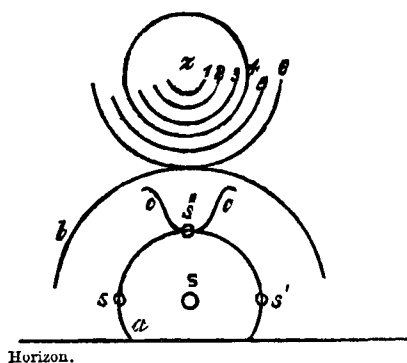
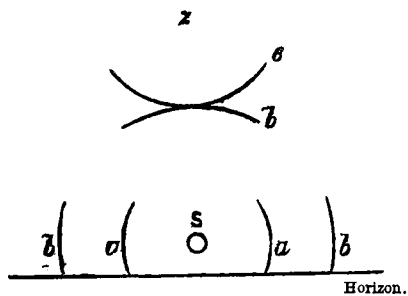


Fig. 1.



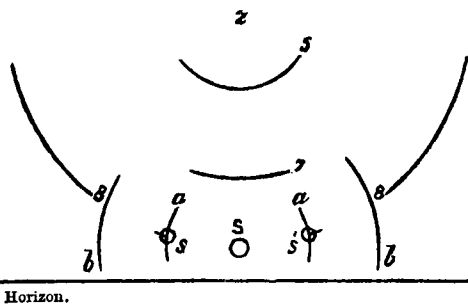
Aberdeen, 2 p.m.

Fig. 2.



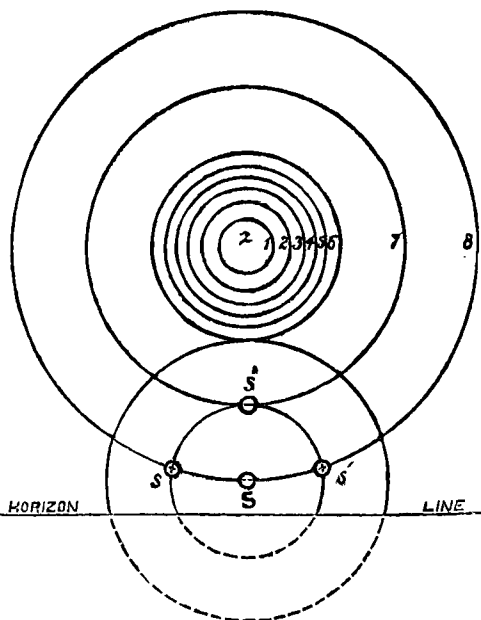
West Hill, Skene, 2 p.m.

Fig. 3.



North Kilmundy, New Machar, 2.30 p.m.

Fig. 4.



The System completed.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

XLIX.]

FEBRUARY, 1870.

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

SOLAR HALOS SEEN IN ABERDEENSHIRE.

SEVERAL of our Aberdeenshire correspondents have favoured us with accounts of the halos and parhelia witnessed by them on January 23rd, 1870.

The display as seen from Aberdeen, about 2 p.m., was singularly complete, and is but faintly indicated by fig. 1, wherein S is the sun (at about 11° above the horizon) s, s', s'' are mock suns, produced by the contact of the primary solar halo A, fig. 1, with the zenithal halos (if the term is admissible as descriptive of circles having the zenith for their common centre), shown more clearly as 7 and 8 in fig. 4, where the rings are carried through the mock suns.

At no one station, or time, was the system seen complete as represented in fig. 4, but the fragments will readily be identified, the lettering being the same in all the figures, viz., Z being the zenith, 1, 2, 3, 4, 5, 6, 7, and 8 circles having the zenith for their centre, A and B two ordinary halos, having, of course, the sun S for their centre, and three mock suns s, s', s'' at the intersection of the zenithal halos, 7 and 8 with the primary halo A.

The horn-like figure c, was only visible for a short time, as it rapidly changed into a segment of 7, as in fig. 3. It was not a mere fancy on the part of the observer, for it is similarly described by two observers. "It had at first the form of the horns usually put on the head of Moses, and then spread out into part of a circle." Another says—"From each side of the mock sun s' there was a prismatic horn-like process proceeding outwards and upwards, and curving more outwards at the extremity. This may have been an optical deception, as one observer considered the appearance as a crescent or part of a small circle, concave upwards."

We think our readers will join us in thanking our northern correspondents, Rev. A. Beverly, Mr. Cruickshank, and others, for enabling us to place upon record so complete a representation of the phenomena.

NEW INSTRUMENTS.

Snell's Aneroid Hygrometer.—During a rain gauge examining tour in the West of England, we were more than once asked what we thought of Snell's Aneroid Hygrometer. Acknowledging profound ignorance of any such instruments, and finding from enquiry that they

were made by a private gentleman residing at Saltash, we made it a point when passing through to call upon him, and found that he had designed the rather ornamental instrument shown in figs. 1 and 2. Its construction is very simple—a piece of whipcord, dipped in some solution (probably salt and water), fastened at one end, is wound two or three times round the axle, on which the recording needle is fixed; it then passes upwards over a pulley, and has a leaden weight attached at the other end to keep the string tight. That it is a new invention so far as Mr. Snell is concerned, we have no doubt, nor do we recollect any of the old cord hygrometers so compact in form. The name certainly requires explanation; aneroid was puzzle enough, the present addition is almost incomprehensible. Not having time to test it ourselves, we submitted it to Mr. Kesteven, who reports as follows:—

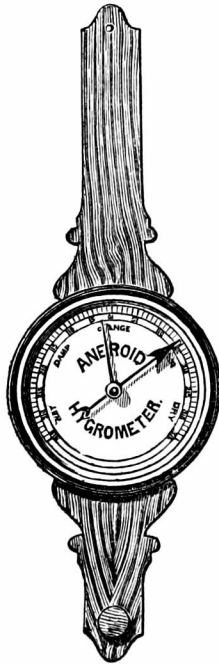


Fig. 1.

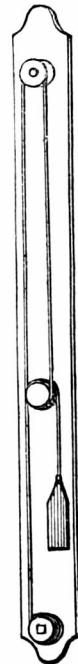


Fig. 2.

"SIR,—Herewith I return you the Snell's Hygrometer, upon which you asked me, some time since, to make observations as to the fulfilment of its professed object—viz., to point out impending changes of weather.

"I have kept it exposed to the air, outside of a window, protected from rain, and have carefully noted its movements.

"It is extremely sensitive to the slightest changes of atmospheric dryness or moisture, its rise or fall often anticipating changes of the barometer, and of the wet and dry bulb hygrometer. It is so far uniform in its susceptibility, that a pretty accurate scale could, I think,

be constructed, of its indications of the per-centage of moisture, corresponding with the humidity as calculated from the wet and dry bulb. Its inventor, I believe, does not claim for it the scientific precision of thermometric reading, he puts it forward merely as an instrument useful for gardeners. I believe it capable of being rendered more exact than it is. The scale of its index, to be comparable with the per-centage rendering of an ordinary hygrometer, requires re-adjustment. For instance, the mean moisture of the air for sixteen days in December last, afforded by Snell's hygrometer, was .70, while that by the wet and dry bulb was .86, but then the proportional difference was day by day nearly the same; therefore, by a more extensive series of observations, or greater delicacy of mechanism, it may be capable of much closer correspondence.

"The instrument, even as it is, will be found of great use to all those to whom the character of the coming weather is of importance.

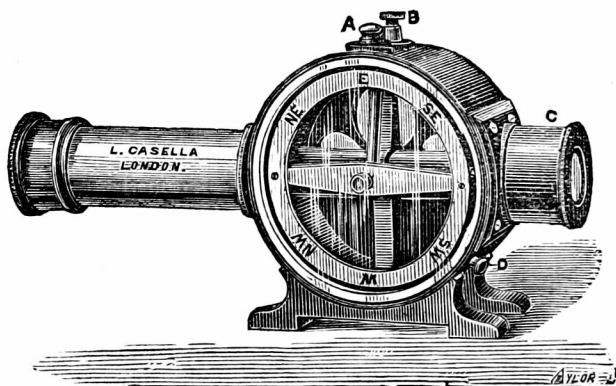
"It must be carefully adjusted in the first instance, and then requires no further interference, but speaks faithfully for itself to the ends it professes to serve.—W. B. KESTEVEN, F.R.C.S."

Browning's Guinea Aneroid.—The title of this instrument indicates its principal characteristic. When a maker, with a character to lose, brings out a new instrument at half the price usually charged second-hand, one feels inclined to think that there must be a mistake somewhere. There is none, however, in the fact, that Mr. Browning is prepared to supply for the sum named, an aneroid at least equal in quality to those sold a few years since at five times the price. It is $3\frac{1}{2}$ ins. diameter, and $1\frac{1}{2}$ in. thick, is equally adapted for travelling, suspension, or standing on a table or mantel, and though, of course, not of the best quality, it is a good serviceable instrument, far superior to many sold at two or three times the price.

Pastorelli's Kew Standard Barometer.—We do not like quoting prices in such notices as the present, but just as we have been already once driven to it, so are we in this case. There is nothing very new in the form of instrument or its mounting, but there is decided novelty in the result of the formula $\frac{q}{p}$, if q represents quality and p price. Seriously, however, we believe that in drawing attention to this instrument, we are benefitting many observers quite as much as the maker, who now offers for three guineas a standard barometer, brass mounted, divided to show hundredths, and guaranteed not to be more than one-hundredth in error at any part of the scale. One chosen, haphazard, from the maker's stock, has been tested by us with most satisfactory results, but what is more, it has, by the courtesy of Dr. Stewart, been rigorously tested in the vacuum chamber at Kew, and is found to be perfectly correct for all ordinary pressures, and from 27 in. to 31 in., never to be more than 0.01 in. in error, thus confirming the maker's guarantee. While, therefore, it will not (is not intended to) compete with first-class standards, it places within the reach of most persons a degree of accuracy, quite sufficient for all ordinary purposes, and,

therefore, we believe its introduction is a decided help to the progress of meteorology.

The Casella-Galton Pocket Altazimuth.—The twin names prefixed to this instrument, lead one to expect (1) superior workmanship, (2) compactness and strength of design, coupled with great accuracy. If any one is competent to decide on the requirements of travellers, it surely is Francis Galton, F.R.S., the talented author of "*The Art of Travel*," and other delightful works. He, jointly with Mr. Casella, has long been striving to give in the smallest possible space, and with the least weight compatible with perfect solidity, the means of accurately measuring angles of altitude and azimuth; the result of their labours is the beautiful little instrument shown in the annexed figure, which



is half size. The dimensions being of some importance, we give the outside measurement of the case, 6 in. \times $3\frac{1}{2}$ in. \times $1\frac{3}{4}$ in., weight (including morroco case) 14 ozs. The fundamental parts of the instrument are a 3-draw telescope of about 10 in. focal length, having a micrometer wire at its focus near the eye end c. The eye piece has a large field, and through it the observer can not only see the object through the telescope, but also the micrometer wire, and the divided edge of the two discs. The disc for azimuth observations is merely a compass ring, divided on its edge as well as lettered on its face. It is two ins. diameter, and divided only to whole degrees, but owing to the power of the eye-piece, and the solidity of the instrument, we find it more accurate than a very fine $3\frac{1}{2}$ in. azimuth compass divided to half degrees. The compass is clamped by pushing forwards the slide a, and is also provided with a steadying pin at d. Angles of elevation are ascertained with equal accuracy by means of a disc heavily weighted in one quadrant, and divided on its edge the same as the compass ring. It is clamped by the pin b. The lower portions are formed as a foot, and the sides of plate glass, and thus this *multum in parvo* instrument forms a very delicate clinometer; but there is no end to the purposes for which it may be used. We do not see how it can be further improved, its accuracy, compactness, and strength are all that can be desired.

RAINFALL AT HOBART TOWN.*

Lat. 42° 53' S. ; Lon. 147° 21' W.

YEAR.....	1841	1842	1843	1844	1845	1846	1847	1848	1849
	in.	in.	in.	in.	in.	in.	in.	in.	in.
January.....	·03	1·83	·55	2·01	·58	1·38	·73	1·04	·72
February	3·10	1·05	·11	·34	1·91	2·64	·07	·79	1·02
March	·33	·07	·02	3·22	1·55	2·15	2·67	1·18	2·37
April	1·11	·89	1·96	·92	·24	2·68	1·74	·51	1·46
May	·53	2·09	·10	2·24	·72	·65	1·49	4·38	3·59
June	1·23	4·41	1·91	2·74	4·27	2·29	·56	1·12	2·46
July	1·01	3·46	2·97	2·12	·72	2·20	1·73	2·43	5·99
August	1·32	·99	1·09	1·16	·63	1·53	·60	2·66	2·74
September ...	·82	1·08	·99	7·14	·73	·82	·39	1·84	1·91
October	2·41	1·78	1·47	2·57	1·19	1·61	1·74	1·27	1·41
November.....	1·75	5·84	1·70	1·56	3·75	2·87	2·21	4·04	8·94
December	·31	·11	·56	·23	·39	1·14	·53	2·36	·90
Totals ...	13·95	23·60	13·43	26·25	16·68	21·96	14·46	23·62	33·51

YEAR	1850	1851	1852	1853	1854	1855	1856	1857	1858	1859
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Jan. ...	1·20	2·33	1·46	1·43	·54	·48	·99	2·58	·43	4·61
Feb. ...	1·10	·58	·19	1·43	9·15	·18	·68	·43	4·42	1·70
March..	·29	·73	·31	·80	7·60	1·38	1·63	1·04	2·38	·26
April...	2·19	·18	4·99	1·18	2·72	1·17	5·01	·79	·44	1·43
May ...	·57	·74	1·46	1·28	1·22	3·31	2·42	·19	4·14	1·47
June ...	·70	2·35	·22	·35	·33	1·29	1·15	3·42	1·12	3·80
July ...	·30	1·17	3·14	·67	·33	1·42	1·89	1·00	1·75	2·09
Aug. ...	1·31	1·10	3·47	·87	·23	·69	1·70	1·02	10·16	1·70
Sept. ...	1·67	2·16	3·19	2·91	1·91	2·60	1·79	2·15	1·47	1·39
Oct. ...	·26	·79	1·77	2·59	1·74	1·51	2·22	2·20	·75	1·91
Nov. ...	4·31	4·19	1·41	·53	3·15	1·49	1·31	2·11	4·03	1·70
Dec. ...	·61	1·66	2·01	·48	1·62	2·73	1·94	·21	1·98	1·25
Totals	14·51	17·98	23·62	14·52	30·54	18·25	22·73	17·14	33·07	23·31

YEAR.....	1860	1861	1862	1863	1864	1865	MEANS, 1841 - 65.	
							amount.	per cent.
	in.	in.	in.	in.	in.	in.	in.	
January.....	2·22	2·12	·93	2·39	·71	·63	1·36	6·0
February	·33	4·16	·22	2·40	1·43	2·94	1·69	7·5
March	1·68	·82	1·09	4·87	1·26	1·93	1·66	7·3
April	2·86	2·51	1·88	2·24	2·18	1·23	1·78	7·9
May	1·70	3·31	2·55	2·40	·84	1·88	1·81	8·0
June	1·30	1·58	1·23	·89	3·71	1·20	1·83	8·1
July	·48	1·84	1·11	5·62	4·44	1·60	2·06	9·1
August ...	1·11	·61	·97	3·29	3·68	1·23	1·83	8·1
September ...	1·25	2·02	6·26	1·63	1·25	2·55	2·08	9·2
October.....	3·09	5·04	1·72	3·11	2·63	2·42	1·97	8·7
November...	2·76	·89	2·03	4·23	2·06	2·03	2·84	12·5
December	2·27	3·29	1·73	7·60	3·92	3·43	1·73	7·6
Totals	21·05	28·19	21·72	40·67	28·11	23·07	22·64	100·0

* Result of Twenty-five Years' Meteorological Observations for Hobart Town, &c
By Francis Abbott, F.R.A.S., Hobart Town, 1866,

[We regret our inability to render the above table complete by giving particulars as to the size and position of the instrument, but none are given in the work whence the table is quoted, the reader being referred to a previous publication, which we do not possess. Nor is any light thrown on the matter by reference to the account of the establishment of the observatory given in General Sir E. Sabine's volume of Meteorological and Magnetical Observations at Hobart Town.

We have added a column showing the mean monthly per-centage of the annual fall, which is principally noteworthy for its regularity.—Ed.]

THE CHRISTMAS FROST OF 1869.

WE have to complete the article on the above subject in our last by a few additions, one correction, and the insertion of the following interesting letter. The additions are :—

Min. Temp. in Shade, December, 1869.

Temp. Fah.	Date.	County.	Station.	Observer.
13·0	29	Sussex ...	Uckfield	C. L. Prince, Esq.
14·4	29	Surrey ...	Cobham (Pyports).	G. Dines, Esq.
15·0	29	Durham ..	Gainford	A. Atkinson, Esq.
18·0	29	Essex... ..	High Roding	Rev. E. Maxwell.
21·5	28	Devon ...	Sidmouth	Dr. Mackenzie.
22·0	28	Cheshire..	Pulford Hall	R. Massie, Esq.
23·3	28	Sussex ...	Worthing	W. J. Harris, Esq.

Min. on Grass.

7·6	29	Sussex ...	Uckfield	C. L. Prince, Esq.
17·2	29	„	Worthing	W. J. Harris, Esq.

The correction is, that the min. at Kirkby Lonsdale was 4° above zero, which will be seen to agree very closely with adjacent stations.

To the Editor of the Meteorological Magazine.

SIR,—Had I known that the frost had been so severe in some parts of the country, I would have sent you the following additions to your table of minimum temperature :—

		Whitby.		
Dec.	Ripon	Hawsker	Lighthouses	Wind at time.
26th	25·5	24·3	26·0	N.W.
27th	16·0	28·5	25·0	E.N.E.
28th	15·5	24·0	24·5	W.
29th	14·5	23·0	24·0	S.
30th	36·0	24·0	28·5	S.W.

Hawsker is one mile from the sea, and 340 ft. above it; the light-houses are on the cliff edge, and 200 ft. above the sea.

On this coast the snow was much more remarkable than the frost. From noon on Christmas Day till the evening of the next day, snow fell very thickly, driven by a furious wind, and on Monday morning, nearly all the roads were blocked with drifts 6 ft. deep, which at the end of a month have not yet disappeared. I got as near as I could to one drift, that rose 5 or 6 ft. *above my head*.

It will be seen that the N.E. wind was of a much higher temperature here than at stations inland, after it had parted with its moisture. At 10 p.m. on the 27th, the thermometer was still 35° here, while at Ripon it had fallen to 16° , and at Cockermouth to 9° .

It must be borne in mind that, as a general rule, the further a wind travels over land in winter in our latitudes, the colder it becomes. Hence the great cold which the N.E. wind brought to the south and west coasts, and the much higher temperature on the north-east coast, where the wind had just passed over the comparatively warm surface of the sea. Hence too, the high temperature at Llandudno, where the only land winds are S.E. and S. Conversely, the S.W. wind is colder here in winter than at most places. This may be seen by the temperature given in the above table for the 30th ult. Another fact which throws light on sea coast temperatures is, that the influence of the sea, both in summer and winter, is comparatively little felt when the wind is not blowing from the sea. The sea coast in fact (unless sheltered on the land side) may be considered to have two distinct climates, according as the wind is from the land or sea.

I must not make this letter long, but will only add that great extremes of cold are necessarily local in their character. I have observed the thermometer not unfrequently 3° or 4° higher at the top of my father's garden at Ripon, than it was at the bottom, only 50 yards distant. When a clear sky and a perfectly still air after a dry Polar wind occur, in an inland valley or plain, the frost will be severe, especially if the heat from the earth is intercepted by snow, but seldom under other conditions. In any case, I believe a rise of 300 or 400 ft. into the air would inevitably reveal a much higher temperature.—I am, Sir, your obedient servant,

F. W. STOW.

Hawsker, January 22nd.

P.S.—Since I wrote the above we have experienced a severe frost. On Thursday, the 27th, the lowest temperature of the air was 20° , and on four nights it was between 16° and 17° on the grass. The sky was cloudless from 10 a.m. on Tuesday till Sunday night, except a few hours on Saturday and Sunday mornings. The wind was S. and S.W. till Sunday, when it veered to S.E. at 0.40 a.m.

SEA SPRAY IN RAIN WATER.

To the Editor of the Meteorological Magazine.

SIR,—I observe in the last number of the *Meteorological Magazine* a letter from Mr. J. G. Wood, dated from Chepstow, respecting the amount of salt in rain water. I cannot help thinking there must be some error in the experiment he tried. Last year I evaporated the whole of the rain water collected in my gauge, which amounted to 932 cube inches down to about a cubic inch, and then sent it to Professor Voelcker to be analysed for salt, not having the means at command to do so myself. The quantity he found was 0.5 grain to a gallon—this gives 76lbs. 8oz. of salt to an acre. This year I have done the same, and early in January I purpose having it analysed in the same way. I have tested the rain for salt, and found it in rain from the west and

south-west, but none in that from the east. I am situated 18 miles west of Chepstow and feel the south-westerly gales first. As regards the leaves being blighted with the salt, I am rather disposed to think that the violence of the wind twists the stem of each leaf, and thus causes the leaf to wither, as I have frequently observed one side of a tree or hedge to lose all its leaves, while the other side remains fresh and green, in very exposed situations.—Your obedient servant,

F. J. MITCHELL.

Llanfrechfa Grange, Caerleon, Mon., Dec. 18th, 1869.

SENSITIVE BAROMETERS.

To the Editor of the Meteorological Magazine.

SIR,—There are many passing variations of atmospherical pressure that are not, and cannot be, recorded by either the aneroid, mercurial, or water barometer. I allude to the slight variations constantly occurring, especially during stormy weather, and which would, I think, be exceedingly interesting to notice, if they could be rendered visible, and the waves mapped as they roll along. I was drawn to the consideration of this matter the other night by noticing the effect produced upon one of "Leon Clerc's Benzoline Lamps," or rather upon the flame proceeding from the lamp, during the opening and shutting of the door of my study. The door opens inwards, and if opened sharply the flame of the said lamp instantly shortens in height for a part of a second, and when the door is closed suddenly, the contrary effect transpires. This is not owing to any draught of air, for the flame will remain perpendicular whilst shortening and lengthening, but evidently takes place in and through altered pressure of air. Whilst I am writing, the night is boisterous, and the little lamp flame slightly elongates and shortens at times as the gale sweeps by, evidently indicating, in its quiet way, the variation of pressure. Seen through a good magnifying glass, the alterations are more perceptible. It is in fact a very sensitive barometer in its way. Can it be made still more sensitive? Perhaps some of your numerous readers may think the matter too trivial, but facts are not trifles. I remain, yours faithfully,

A. R. L.

Hengoed, Oswestry, December 13th, 1869.

TRUE TIME, AND HOW TO KEEP IT.

To the Editor of the Meteorological Magazine.

SIR,—One of your correspondents writes about the difficulty of getting a moderately cheap clock to keep good time.

I have had for some years a kind of clock I can recommend, made by Joyce, of Whitchurch, Shropshire. It is in a neat case with glass front, and strikes the hours. It has a wooden pendulum, with a heavy brass bob, price £15; might be a little cheaper in a plainer case; if with compensating pendulum and mercurial weight, which would make it as good as most watchmaker's regulators, it would be £18.

I have also a turret clock by same maker, with Denison's escapement, that goes as well as any clock can be expected to do, and the two will go together for MONTHS, striking almost to the second together. The regulating is done by putting a small weight on the top of the pendulum bob; a small piece of lead as big as a sixpence will increase the rate a few seconds a week, and it can be regulated to a nicety that way.—Your obedient servant,

WHITEHALL DOD.

Llanerch, St. Asaph, January 22nd, 1870.

To the Editor of the Meteorological Magazine.

SIR,—Approximate time may be independently found and kept in the following simple manner:—

On a common drawing board draw a number of concentric circles, about an inch apart, the exterior one being as large as possible. In the centre erect a stiff straight wire, as nearly perpendicular as possible (which may be done with a common square). The length of the wire should be about one-half the radius of the largest circle. Level the board in full sunlight, two or three hours before noon, and as the end of the shadow of the wire in shortening exactly touches the circles, make a small mark at the point of contact. Do the same in the afternoon, without disturbing the board, and then on each of one, two, or three circles, there will be two points. Join these by a straight line which bisect. The straight line drawn through these points of bisection and the foot of the wire will be in the meridian.

The simplest way to take advantage of this meridian line for the determination of time, is to note with a common watch the times of marking the points on the circles, and the mean of such times is the time by the watch at apparent noon, or in astronomical language, Oh. Om. Os. apparent time.—I am, &c.,

G. L. TUPMAN.

Malta, 16th January, 1870.

SNOW AND DECIMALS.

To the Editor of the Meteorological Magazine.

SIR,—17 inches being one-twelfth of two inches of snow, because, I suppose, it is nearer *that* than .16 inches—the decimal being really a recurren. In the case of four inches of snow, is the decimal .33 or .34 inches, a recurren again making its appearance?

How did you arrive at this measurement?—Yours, &c., H.B.C.
Huddersfield.

[We do not think that the measurement of the depth of snow or its reduction to water equivalent is ever sufficiently accurate to give a second place of decimals, but the answer to the question becomes obvious by carrying on the recurren. .17 most closely represents .16'6, and .33 most nearly .33'3. We do not know what the writers on arithmetic from Cocker to Colenso say on this matter, but as many persons stumble when reducing the number of decimal places, we venture to "lay down the law," and to illustrate it by examples:—

I.—If the last figure is less than 5 it is thrown off, and the previous figure remains unchanged, e.g., .164=.16.

II.—If the last figure is more than 5 it is thrown off, and the previous figure raised by one, *e.g.*, $\cdot 168 = \cdot 17$.

III.—If the last figure is a 5 it is thrown off, and *generally* the previous figure is raised, *e.g.*, $\cdot 155 = \cdot 16$; if the column contains only fives and noughts, the figures preceding the fives must be alternately thrown up and down.

Case I.	Case II.	Case III.	Case IV.
$1\cdot672 = 1\cdot67$	$1\cdot696 = 1\cdot70$	$1\cdot832 = 1\cdot83$	$9\cdot555 = 9\cdot56$
$1\cdot858 = 1\cdot86$	$1\cdot749 = 1\cdot75$	$1\cdot751 = 1\cdot75$	$1\cdot368 = 1\cdot37$
$1\cdot988 = 1\cdot99$	$1\cdot858 = 1\cdot86$	$2\cdot943 = 2\cdot94$	$1\cdot756 = 1\cdot75$
$2\cdot143 = 2\cdot14$	$1\cdot750 = 1\cdot75$	$3\cdot664 = 3\cdot66$	$1\cdot925 = 1\cdot93$
$2\cdot207 = 2\cdot21$	$1\cdot987 = 1\cdot99$	$3\cdot880 = 3\cdot88$	$1\cdot878 = 1\cdot88$
<hr/>	<hr/>	<hr/>	<hr/>
$9\cdot868 = 9\cdot87$	$9\cdot040 = 9\cdot05$	$14\cdot070 = 14\cdot06$	$16\cdot482 = 16\cdot50$

In case I., the rules above given produce a correct result, the sum of the reduced values $9\cdot87$ agreeing with that of the unreduced ones. In case II. there is an unusual proportion of high values among the terminal figures, and we, therefore, find the sum of the reduced values too high; in such a case the lowest terminal must be thrown off, and the previous figure *not* raised, even though contrary to rule II., and to what appears common sense. In case II. $1\cdot696$ must be represented by $1\cdot69$.

Case III. is the reverse of case II.: there is an excess of low values, and the highest of them must be thrown up, so that $3\cdot664$ becomes $3\cdot67$.

Case IV. illustrates the frequent necessity for disregarding rule III., for the fives there being thrown up give $16\cdot50$ instead of $16\cdot48$.

H. B. C.'s last question is best answered by reference to *Meteorological Magazine*, vol. II., p. 27.—Ed.]

DIRECTION OF THE WIND AT LINTON PARK, MAIDSTONE, AS TAKEN AT NOON EACH DAY FOR THE LAST TWENTY YEARS.

THE following table denotes the number of days the wind blew from the eight cardinal points, or what appeared to be the nearest approach to these points, together with the rainfall and number of rainy and frosty days during great part of that time, from which it will be seen that the past year has been a wet one, whether in consequence of the greater prevalence of south-westerly winds or not is difficult to say, but with the exception of 1861 this theory might be set up as a valid one. Traditionally, the S.W. wind is a moist one in this district, but I must leave the further deduction to be made by those who have studied such matters for a similar lapse of years. Certainly the direction of the wind has not received that attention amongst other meteorological matters which its importance deserves, however much nautical men may have studied it. That I hope the future numbers of your very useful *Meteorological Magazine* will report observations from other quarters, so as to place the matter in the same position you have

done with the rainfall—namely, to tell us in what districts of the kingdom there is a prevalence of certain winds and *vice versa*, and possibly some idea may be worked out, connecting the rainfall with the winds, and other matters bearing thereon.

The following table shows the number of days the wind was in the direction indicated at noon each day.

Year.	E.	S.E.	S.	S.W.	W.	N.W.	N.	N.E.	Not ascertained.	Total Rainfall.	No. of Rainy Days.	No. of Frosty Days.
1850 ...	17	36	21	60	76	38	40	74	3	in.		
1851 ...	14	28	29	53	47	55	59	76	4			
1852 ...	36	32	46	93	40	22	25	69	3			
1853 ...	34	27	25	76	59	36	36	68	4			
1854 ...	32	17	29	100	62	41	36	47	1			
1855 ...	21	32	23	63	36	48	25	115	2	20·84	160	114
1856 ...	14	44	34	99	29	42	28	72	4	27·79	169	89
1857 ...	14	47	37	81	37	38	21	86	4	24·33	137	
1858 ...	16	71	16	73	24	58	19	87	1	16·33	116	93
1859 ...	8	53	21	125	11	59	9	78	1	29·55	151	93
1860 ...	13	27	64	88	29	49	42	54	...	33·66	216	93
1861 ...	12	28	66	110	34	21	45	47	2	24·01	158	85
1862 ...	8	24	77	95	33	18	73	37	...	26·93	195	67
1863 ...	12	31	82	118	29	25	36	31	1	22·75	169	64
1864 ...	30	40	65	66	26	28	35	71	5	21·25	156	96
1865 ...	28	45	59	74	36	29	35	55	4	35·18	172	80
1866 ...	16	32	54	89	71	31	35	31	6	30·82	179	66
1867 ...	13	24	80	72	46	27	59	42	2	26·71	176	94
1868 ...	7	16	73	88	46	27	53	54	2	25·19	137	62
1869 ..	8	23	71	79	46	28	53	54	3	29·09	162	76
Average...	17	34	49	85	41	36	38	62	3	26·30	164	77

J. ROBSON.

REVIEWS.

First Annual Report of the Bournemouth Meteorological Society.
Bournemouth : Sydenham's Library. 8vo, 41 pages.

WE do not know the present population of Bournemouth, but well recollect, a few years since, spending a weary time trying to find it on a county map, on which it was not even marked, and now it has become known through the length and breadth of the land, nay it even has a meteorological society to itself. We need hardly say that we rejoice at such a state of things, and we hope that the zeal of the founders and present members will meet with no check. Two papers read before the society are printed *in extenso*, and the titles of five others are given. We hope in future short abstracts of all will be given, and as many *in extenso* as the secretaries think expedient and the funds of the society will permit. The first paper is on the meteorology of 1868, by Dr. Compton ; a clear and well-arranged article. One column, however, which would be of much interest if correct, seems to us self-evidently fallacious. The temperature of the sea is an element of high importance in meteorology, medico-climatology, and even as a matter of pleasure in bathing. A table gives the "mean temperature

of the sea" in each month and for the year, and from it we learn that in July the mean temperature of the sea was $70^{\circ}\cdot 1$, being 5° hotter than the air; in August $68^{\circ}\cdot 5$, being 7° hotter than the air, and so on, the sea being always hotter than the air, and the yearly mean temperature of the sea being $57^{\circ}\cdot 2$ or $5^{\circ}\cdot 6$ hotter than the air. It is most desirable that the temperature of the sea should be regularly and carefully recorded, but though to our knowledge no careful observations have been made in the Channel, we have no doubt that when they are made, these observations will be proved to be nearly 10° too hot in the summer. Not a word is said as to *how* the observations are taken, or of what the *mean* consists, but we have little doubt that the temperature has been taken too near the shore; it is, to those unused to the subject, surprising how very much the temperature of the sea is raised by running over sands exposed to a noon-day sun. If the values given are correct, we pity the summer residents of Bournemouth, for they can have no reviving sea-breeze to waft refreshment, and as for a "dip in the briny" at $70^{\circ}\cdot 1$, we decline it with thanks. The second article is an able one, "On the Climate of Bournemouth," by the Rev. P. H. Newnham, which commences by stating in detail the localities and conditions under which the observations upon which it is based were made, the corrections applied, and every successive step up to the final inferences drawn.

We congratulate the Society on the progress it has already made; we wish it every success, and if its members will set carefully to work at the sea temperature, and show that the values assigned are correct, or that our objections to them are valid, in either case, (no matter which) they will contribute to progress, because they will give well ascertained, and indisputable facts.

The Rainfall on the St. Mary Church Road, Torquay, during the five years ending December 31st, 1868. By W. PENGELLY, Esq., F.R.S. 8vo, 14 pages.

The Rainfall in Devonshire during 1868. By W. PENGELLY, Esq., F.R.S., F.G.S., &c. [Reprinted from the "Transactions of the Devonshire Association for the Advancement of Science, Literature, and Art, 1869." 8vo, 13 pages.]

Two of the capital little monographs in which Mr. Pengelly gives the condensed result of much honest and careful work. Any one who wishes to know how to discuss rain records should obtain the first of these two pamphlets, or still better both of them. We have room only for one extract from the former, but it is one in which we fully concur.

"The mild character of the winter 1868-9 was, of course, noted by everyone. As is common when anything unusual occurs in our meteorological phenomena, the Gulf Stream was supposed to be out of order, and the blame was laid on it. It may be doubted, however, whether, in order to explain the high temperature, it is necessary to do more than to recognize the direct and indirect thermal effects of the protracted heavy rainfall already alluded to.

"1st. Such a rainfall implies the prevalence of wet, that is south-westerly, that is hot winds,

"2nd. It implies an atmosphere super-saturated with aqueous vapour, which, it is well known, greatly retards the loss of radiant heat by the earth.

"3rd. The conversion of water from the vaporous to the liquid state is necessarily attended with the passage of heat from the so-called *latent* to the *sensible* condition. In other words, being no longer employed in doing the work of keeping water in the form of vapour, the heat performs that of raising the temperature of the air.

"4th. Between November 19, 1868, and January 31, 1869, there fell in the Torquay district no less than 1890 tons of rain on every acre of ground. Taking this as the average for the county, and supposing the mean height of the rain clouds to have been no more than 772 yards—estimates both probably below the truth—the caloric into which the motion of the rain of Devonshire would be converted on being destroyed as motion, during the period specified, would be sufficient to raise the temperature of 4·5 millions of tons of water from the freezing to the boiling point.

"5th. But for the condition of the atmosphere, which renders such a rainfall possible, the surface of the earth, in all probability, would have been frozen, and the heat of the sun would have been largely expended in thawing; not having this work to perform, it helped to raise the temperature of the atmosphere beyond that which is usual at that period of the year. With a machinery so multiform and efficient at hand, it does not seem needful to be for ever supposing that the Gulf Stream is guilty of some irregularity of conduct."

Similar in its excellent aim and completeness to the papers by the same author, which we have had the pleasure of describing on previous occasions, it will be sufficient to note the appearance of the second pamphlet mentioned above, and to make one extract. Mr. Pengelly bases his papers exclusively on the returns published in *British Rain-fall*, but works them up in a way peculiarly his own—*e. g.*, in order to compare the rainfall of Devon with other counties, he averages every element in the general tables of the publication above referred to, and among the results is the "mean acreage per gauge for each county"—on which column he makes the following remarks:—

"The average number of acres in each county represented by every gauge in 1868 is shown in the fourth column, and was obtained, of course, by dividing the total average [acreage?] of the county by the number of gauges it contains. It appears that this number is least in the case of Middlesex, where there is one gauge for every 7,466 acres; that it is greatest in that of Radnorshire, where every gauge represents 153,993 acres, or upwards of twenty times the Middlesex mean; that in the entire kingdom as a whole, there is one gauge for every 37,029 acres; that in 32 counties this acreage is exceeded; that the counties of Cumberland, Westmoreland, Carnarvon, are amongst the 20 in which this average area is not reached; and that 21 counties surpass Devonshire in the relative number of its rain gauges.

"That Middlesex should be thickly studded with stations at which the rainfall is observed is by no means surprising, but it is eminently creditable to the meteorologists of the three mountainous and thinly peopled districts that have just been named, that for every fourteen gauges in the kingdom generally, there should, on an equal area, be 21 in Carnarvonshire, 24 in Cumberland, and upwards of 28 in Westmoreland.

"It should be remarked too, that in Cumberland there are 11 gauges upwards of 1,000 feet above the sea, three above 2,000 feet, and one as much as 3,200 feet; that in Westmoreland there are five at an elevation exceeding 1,000 feet; and that though only one of the Carnarvonshire series attains this altitude, the returns made from every gauge in the county are, in every respect, complete; they contain full information as to height above the sea level and above the ground, the total rainfall, and the number of wet days. It may also be remarked that of the 14 gauges in this model county, 11 are superintended by Major Mathew, who also has gauges in Merionethshire and in Anglesea."

JANUARY, 1870.

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 39°	
		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 screen
I.	Camden Town	1.38	— .57	.24	13	17		51.7	8	21.2	28	13	18	
II.	Maidstone (Linton Park)	1.66	— .40	.30	8	21		50.0	15	21.0	27	...	...
	Selborne (The Wakes)	2.00	— 1.27	.32	7	14		49.0	3, 16	14.0	28	15	17	
III.	Hitchen	1.17	— .97	.18	13	19		54.0	7	19.0	27	74	...	
	Banbury	1.33	— .76	.17	8, 13	18		49.0	4, 17	15.0	28	18	...	
IV.	Bury St. Edmunds (Culford) .....	.89	— .98	.14	5	12		50.0	7	17.0	27	11	18	
V.	Bridport	1.74	— 1.45	.36	11	12		54.0	16	19.0	28	13	...	
"	Barnstaple	3.19	— .33	.53	7	19		52.0	2	24.0	29	...	...
"	Bodmin	4.35	— .84	1.03	30	18		55.0	16	25.0	23	7	15	
VI.	Cirencester	2.45	— .55	.73	8	13		...	...	...	...	...	...
"	Shifnall (Haughton Hall)	1.50	— .40	.21	13	17		48.0	7, 16	18.0	26+	19	...	
"	Tenbury (Orleton)	2.33	— .20	.30	13	19		51.3	77	17.5	28	16	21	
VII.	Leicester (Wigston)	1.63	— .35	.41	14	12		50.0	+	20.0	25	16	...	
"	Boston	1.25	— .56	.21	3, 6	19		48.7	1	23.2	28	8	24	
"	Grimsby (Killingholme)	1.26	...	.23	14	19		48.0	4, 8	24.0	27	7	...	
"	Derby	1.43	— .36	.26	8, 13	21		51.0	7	21.0	27+	11	...	
VIII.	Manchester	3.13	+	.61	.55	14	18	51.8	2	22.0	26§	12	21	
IX.	York	1.68	+	.10	.30	6	19	50.0	2	19.0	27	9	...	
"	Skipton (Arnccliffe)	6.24	+	.60	1.09	6	15	...	...	...	...	...	...
X.	North Shields	1.60	— .51	.29	7	18		48.8	4	22.7	27	12	...	
	Borrowdale (Seathwaite) .....	...	...	...	...	...		...	...	...	...	...	...
XI.	Cardiff (Town Hall)	3.18	...	.62	8	17		...	...	...	...	...	...
"	Haverfordwest	4.28	— .77	.88	30	12		52.5	16	23.0	25	12	19	
"	Rhayader (Cefnfaes)	4.49	— .03	1.00	7	13		49.0	...	19.0	...	10	...	
"	Llandudno	2.80	+	.26	.42	18	15	52.3	16	28.0	26	8	...	
XII.	Dumfries	3.28	— 1.32	.58	13	17		47.0	4, 7	19.0	27	16	...	
	Hawick (Silverbut Hall)	2.58	...	.49	6	17		...	...	...	...	...	...
XIV.	Ayr (Auchendrane House)	3.54	— .98	1.05	13	16		53.0	31	21.0	24||	12	19	
XV.	Castle Toward	3.99	— 2.30	.67	7	17		49.0	17	23.0	25	19	24	
XVI.	Leven (Nookton)	2.21	— .66	.61	13	11		45.0	7	19.0	27	16	31	
"	Stirling (Deanston)	3.94	— .78	.69	7	19		44.8	4, 30	18.3	27	23	...	
	Logierait	2.40	...	.54	13	11		...	...	...	...	...	...
XVII.	Ballater	1.35	...	.25	3	11		42.5	7	13.0	24	20	...	
XVIII.	Aberdeen	1.51	...	.37	13	18		43.8	4, 7	22.9	27	18	29	
	Inverness (Culloden) .....	...	...	...	...	...		...	...	...	...	...	...
"	Portree	4.94	— 8.15	.85	30	20		...	...	...	...	...	...
"	Loch Broom	4.42	...	1.96	12	17		...	...	...	...	...	...
XIX.	Helmsdale	2.96	...	.98	12	13		...	...	...	...	...	...
"	Sandwick	2.31	— .98	.75	11	18		45.0	17	30.8	11	3	19	
XX.	Cork	4.76	...	1.19	30	17		...	...	...	...	...	...
"	Waterford	4.75	— .11	.91	30	21		41.0	17*	25.0	10	12	...	
"	Killaloe	5.76	+	.90	1.07	7	18	52.0	16	26.0	25	8	...	
XXI.	Portarlinton	2.83	— 1.18	.46	30	21		51.0	16	24.0	24	7	...	
	Monkstown	2.53	— .86	1.10	30	16		...	...	...	...	...	...
XXII.	Galway	4.11	...	.63	6, 13	17		50.0	17*	24.0	24	7	...	
	Bunninadden (Doo Castle)	3.31	...	.76	30	19		52.0	16	21.0	25	11	...	
XXIII.	Bawnboy (Owendoon)	4.43	...	.97	13	17		52.0	16	23.0	25	15	18	
"	Waringstown	3.15	...	.79	30	17		51.0	16	23.0	24	13	21	
"	Strabane (Leckpatrick)	3.66	...	.78	30	15		52.0	17	17.0	25	21	27	

* And 18. + And 27, 28. † And 28, 29. § And 27. || And 25.

+ 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.—High wind on 8th, and steady frost from 24th to 30th inclusive, otherwise the month a mild and dry one for January. Bar. mostly high after the 15th. Winds various, and, contrary to usual custom, were S. and S.E. the greater part of the last week, when it was frosty; scarcely any S during the month; only 10 days on which the wind blew from the N. or compounds of N.

SELBORNE.—T with violent wind on 7th; high wind with H at 3 a.m. on 8th; TS at 5 a.m. on 12th; white frosts with fog 26th to 30th inclusive.

BANBURY.—High wind on 6th and 7th; slight S on 11th, 18th, 19th, 20th, 21st, 24th, and 25th.

CULFORD.—High wind on 7th and 8th; wind S. and S.W. up to 15th; the remainder of the month S. and S.E. No S has fallen here during the month.

BRIDPORT.—Very heavy S.W. gale on 7th and 8th. L on the 12th; gale on the night of 30th. Frost not severe enough for skating, as the thaw came in early morning of 28th.

BODMIN.—A very heavy gale on 7th from S. to W.N.W. Average temp. for the month 40°·8; average bar. 29·98; max. diff. between wet and dry bulbs 9° on the 24th.

CIRENCESTER.—A violent gale from S.W. on 8th; a moderate winter month, without S, wind or hard frost during the prevalence of the N. and E. winds, which lasted a fortnight; a great amount of uniform cloud throughout, so that only four or five days were bright, the moon at full not dissipating the clouds; no exciting causes have disturbed the general sleep of winter in plants.

SHIFFNAL.—A most variable month; R daily, with one exception, till the 16th. From the 19th frosts with occasional sleet, the last week quite severe. Ther. down to 18° on 26th, 27th, and 28th, and the ice 3½ inches thick. Bronchial attacks most prevalent; much illness, especially among the poor. TS with H and R from the N. about 2 p.m. on 4th; R with stormy wind on 6th, 7th and 8th; fog with high bar. on 16th, 17th, 18th. Woodcocks partially distributed, in some few places very plentiful, in others scarce.

WIGSTON.—There have been about the average of frosty nights for this month.

KILLINGHOLME.—Bar. low, 28·700 at 1 p.m. on 8th, but high and steady from the 17th to 26th. Frost from 25th to the 30th; splendid aurora on 3rd, and aurora like rays of cirri in N. at 11 a.m. on 18th. A queen wasp killed on the 2nd. Small birds singing feebly on 3rd; aconites began to flower on 22nd. A cold but seasonable month; the steady frosts of the latter part have kept vegetation backward without injuring it.

DERBY.—Aurora visible from 8 p.m. to 9 p.m. on 3rd.

MANCHESTER.—Aurora on 2nd and 8th.

NORTH SHIELDS.—Fine aurora on 8th; L on 20th.

W A L E S.

HAVERFORDWEST.—The first fortnight constant R; very stormy at times; tremendous gale from the S.W. to N.W. on 7th and 8th. Lowest reading of bar. (corrected) 8 a.m. on 8th, 28·760; from the 18th to the end fine and frosty, except the last two days, which were very cold and wet, and accompanied by a tremendous gale from the S.E.

CEFNFAES.—The month generally fine; the last two weeks more or less of frost. Wind during this time N. and N.E. The violence of the wind between 2 and 5 o'clock on the morning of the 8th was terrific. Only slight covering of S on the low grounds, drifts on the hills, where it remains. Bar. above 29° from 14th to 29th.

LLANDUDNO.—Heavy H between 11 and 12 a.m. on 10th; H again on following day; from 9 to 10 a.m. nearly dark, although neither haze nor thunder cloud. The common violet has been gathered during December and January; in several gardens here, the géant des batailles rose flowered through the winter. In spite of frost, H, and a little S, the yellow calceolarias are as bright and green in the open ground as those in any conservatory, though in an exposed bed. Honey suckle in leaf on the 1st. S on the distant hills from the 10th to the end of the month.

SCOTLAND.

DUMFRIES.—For the first 8 days the weather was showery, and occasionally stormy; no R fell on the 9th or 10th; from that time to the 18th the weather very variable, two or three changes every 24 hours; from 19th to 30th frosty; thaw on the 31st.

SILVERBUT HALL.—The weather has been very changeable throughout the month, but there were no boisterous winds. Broccoli and cabbage plants have suffered a good deal.

AUCHENDRANE.—Bar., bar. range, amount of cloud, and humidity, have all been more or less above the mean for January, while the ther., force of wind, rainfall and evaporation have all been below the mean. The temp. being low, a high humidity failed to produce a heavy rainfall. Previous to the 16th bar. low and ther. high, afterwards bar. high and ther. low. No gales from the N.E., but several from the S.W., particularly on 30th and 31st, with great rise of temp., and slight fall of R; weather seasonable; river still full.

CASTLE TOWARD.—Wet and very changeable, with several frosty nights up to the 17th. Dry with white frost and fog to the 29th; fine and breezy to the 31st, clearing away the fog. Mail boat two hours behind from Greenock to Dunoon on 24th, when there was a close fog. Seventeen wet days, with little more than half the usual fall; 14 dry days, and only 34 hours sunshine. The month has been remarkable for low temperature, white frosts, fog, and a damp atmosphere.

DEANSTON.—This month began wet and foggy, but mild; on the 11th some S and wind; more S on 12th, 13th, and 14th, and to the depth of 4 inches. From 17th to 28th exceedingly calm; some fogs and frosty; thaw without R on 28th; nights frosty.

LOGIERAIT.—A month of very severe weather; have had little intermission of frost since the close of October; heavy fall of S on 13th, which has mostly disappeared; but February opens with the appearance of continued frost, notwithstanding that the last day of January had a rainfall of .16.

BALLATER.—Severe cold weather throughout; remarkably little S, but a continuance of hard frosts, preventing all out-door work; both rainfall and temp. below the mean of January.

ABERDEEN.—Bar. above the average of last 13 years; rainfall, temp., and pressure of wind all below the average. The month was comparatively dry, with frequent, though seldom severe, frosts. Hoar frost very frequent, especially towards the end of the month; very little S. Auroræ on 7 nights; solar halos and mock suns on 23rd; splendid auroral arch on 29th.

PORTREE.—The finest and driest month of January on record in these islands; the oldest inhabitant has not seen the like of it.

LOCHBROOM.—This month began beautifully, and continued fine until the 9th, 10th, and 11th, which were stormy; but the 12th was a terrific day, not to be forgotten here for a long time; from that date to the end, January has continued the finest month we could desire. Field operations are far in advance, and the soil is in excellent condition.

SANDWICK.—January has been much drier, and half a degree colder than the mean of last 43 years. The latter half of the month was particularly fine and dry, only .09 in. of R having fallen during the last 14 days; auroræ on 7 nights. Snowdrops in flower on the 28th.

IRELAND.

DOO CASTLE.—Some severe frosts during the month.

OWENDON.—First half of the month wet, with only one fine day; second half fine, with only two wet days, that is, the 30th and 31st.

WARINGSTOWN.—First fortnight wet and cold, but the end of the month frosty and very dry up to the 30th; ground drier than usual at this season, and consequently very favourable to farming operations.

LECKPATRICK.—Cold month, the greater portion of the R fell in the first fortnight, only .03 having fallen between the 15th and 30th. The number of night frosts is remarkable; since 1st of October last, out of 123 nights, there has been frost on the grass on 83 nights.