SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Daylieston, County of Edinburgh, in Lat. 55° 52′ 25″, Long. 3° 21′ 59″, Distance from Sea 3 9/10 miles.

Height of Cistern of the Barometer above Mean Sea-level 128.5 feet, above Ground 3.5 feet. During the MONTH of January 1878.

The Hours of Observation are of Greenwich Time.

Days of Month	BAROMETER. 9 h. A.M. Barometer. * No.—	BAROMETER. 9 h. A.M. Attached Thermometer	BAROMETER. 9 h. P.M. Barometer. No.—	BAROMETER. 9 h. P.M. Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.—	Protected in Shade, 4 feet above Ground. Min. No.—	Exposed Black Bulbs. Max. in Sun's rays No.—	Exposed Black Bulbs. Min. on Grass No.—	HYGROMETER. No.— 9 h. A.M. Dry bulb.	9 h. A.M. Wet bulb.	9 h. P.M. Dry bulb.	9 h. P.M. Wet bulb.	WIND. 9 h. A.M. Direction.	9 h. A.M. Force	9 h. P.M. Direction.	9 h. P.M. Force	Readings of the H.Cup Anemometer. No.— 9 h. A.M.	RAIN. No. of hours in which it fell.	RAIN. Amount in inches. No.—	CLOUDS. 9 A.M. Velocity (0—6), and Direction.	9 A.M. Amount, (0—10), and Species.	5 P.M. Velocity (0—6), and Direction.	5 P.M. Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No.— 3 inches.	12 inches.	No.— 22 inches.	Temperature of WELL at depth of feet. No.—	SEA. Temperature at 1 fathom, and Density,	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month.
	inches.	°	inches.	°	°	°	°	°	°	°	°	°																	°	°	°							
1	30.041	50	29.910	55	42.1	35		22.2	42	40			W	2					.01	12	10			2											Pale obscr	1
2	.182	49	30.124	55	45.6	34.5			38.8	38.8	43	41	S E	1	W	1.5				12	10			10										Very mild	2
3	29.813	54	29.793	58	50.5	42.5		26.5	50	48	45.5	47	W	1.5	W	1			.21	2 W	10	W	10	0										Dark Stormy Day	Black Clouds, Rain at 6 Pm	3
4	30.055	53	30.150	60	51	40.5		38	41.5	40	—		S	2					.01		10			0											Cold	4
5	29.990	52	29.870	60	51	36		29.5	44	43	—		W	1						2 W	10			0											Cold	5
6	.755	52	29.500	59.5	48	40		31	41	39.2			W	2	W	1				3 W	S by E	0	0	3											Showers	6
7	.208	51	29.700	58	47	31		21	38.2	38			W	1.5	N E	2			.03		S by E	0	10	2										Frosty Very cold & Stormy		7
8	30.004	47	30.225	55	48	35		21	37	34			S	2	S E	2			#	2 E	S by E	2 E	10	2										Fine cold & Frosty Morning	Threatening Snow	8
9	30.273	49	.283	57	55	25		20	35	31			W	1.5	S E	2				1 E	10	0	0	2										Fine day	Frost	9
10	.261	42	.405	55	38.5	23		13.5	25	25			W	1	S E	1				0	0	2 E	10	1.5										Very hard Frost, Stillness	Came on after 10 Pm, Li Snow 12 Pm	10
11	.240	45	.482	54	36.5	32		13.5	31	30			W	1.5						1 E	10			2.5										Fall Morning	Frost	11
12	.412	43	.200	54	38	27.2		20	38	36.2			W	1					.09	1 W	10			2.5											Hammer	12
13	.152	49	.103	54	45.5	36.5		28	41	40	42.8	42.8	W	4	W	3			.04	2 W	9 E	1 W	8 E	2										Rainy Shower	2 Pm. 60° Clear Sky	13
14	.000	53	.091	55	45.5	40		40.5	38	42	43	42.2	W	2	W	3			.12	3 S E	9 E	0	10	0										Fine Morning	Freaden Sky — Rain	14
15	.000	52.5	29.962	56	47	39.2		38.8	38.8	38.5	—									Calm	10													Night	& Rain	15
16	29.900	56	30.150	58	51.4	42.5		39.2	47	40	37		W	3	W	2			.05	2 W	2 Bi		10 Bi	3										Clear Frosty Morning		16
17	30.214	53	30.362	57	49.8	36.2		27.2	38	37	32	40.5	W	1	S	1				0	0	0	0	3										Heavy bloodless Sky = Frost		17
18	.324	50	.551	56.5	45.5	28.5		21.8	37	37										Calm	10	Calm	10 Bi	3										Quiet		18
19	.252	53	29.582	55	48.5	38.5		25.5	41.2	39	46.8	44.2	W	1	W	4			.08	2 W	10	1 W	10 Bi	3											Fine day day		19
20	29.922	52	.562	57	48.4	40		28.5	42.8	41.5	46.5	44	W	2.5	W	6			.51	1 S W 4 W	10 Bi Sleet	6 W	10	0											Very Stormy & Rain		20
21	.654	51	.590	57	52.3	41.5		36.2	45	40.3	52.8	52.8	W	2	S	1.5			.62		10		10	0											Snow		21
22	.744	48	520	55	44	25		22.2	26	26.2									.50	0	0			6										Frost Clear	1 in Snow		22
23	.161	46	.123	52	40.7	24		22	35.2	35.2			W	3	W	4			.23 + .25	Snow	10	0	0											Very heavy Snow	Frost day	commencing Snow	23
24	.242	46	.291	48.5	38.1	30		25.4	31.8	28.8	40.2	29.5	W	2	S E	5			.86	0	0		8 E	3										Fine Hard Cold Morning	Snow Snow		24
25	.553	44	.634	53	38	14.5		25.4	20	19	39	35.5	W	1.5	W	3				1 E	2 Bi		21	4										Fine Snow	Frosty Night		25
26	.883	42.5	30.110	53	41.2	30.5		18.5	35	33.5	29.5	29.1	0	0	W	3					10 Bi	Hail		3											Fine Morning day		26
27	.720	48	29.580	55	40.2	26.2		19.8	37	35.8	39	38	S	2	S	4			.21	2 S W	10	1 W	10	0											Rain all day		27
28	.495	42.5	.726	55	41.2	35		21.8	37	36	33	32	W	1.5	W	1				0	9 Bi	0	0	4										Rain day — Frost		28
29	.984	47	30.110	53	41.2	28.8		18.5	37	33.5	29.8	29.1	0	0	W	1				0	0	0	0	3										Frost		29
30	30.200	47	30.380	53	41.4	25.5		14.2			31	31			W	1						0	0	3										Cloudless Sky		30
31	30.470	47	30.552	53	32	25		26.8	28.8	26.5	36	35	W	1						2 Bi	Hazy			2										Fine Frosty day	Hail round 4 — Li Frost & Sleet		31
Sums.	29.205	28.85	29.783		1685	1120	616		759.5	717.0	472.2		19	97										42.8													Sums.
Means.	29.942	49.3	29.961		55.4	43.6	32.0		25.3	37.2	35.7													13.8													Means.
† Total Corrections for Instrumental Errors.	-.012		-.012																																			
‡ Corrections for Diurnal Range.																																						
"Corrected Means."																																						
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30								No. of Column.

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.		m.	*denotes* meteor.	
ci.	„	cirrus.	ms.	„	meteors.
ci.-cu.	„	cirro-cumulus.	n.	„	nimbus.
ci.-s.	„	cirro-stratus.	r.	„	rain.
cu.	„	cumulus.	h r.	„	heavy rain.
cu.-s.	„	cumulo-stratus.	c. h. r.	„	continued heavy rain.
d.	„	dew.	s.	„	strains.
f.	„	fog.	sc.	„	scud.
fr.	„	frost.	s.	„	sleet.
h.-fr.	„	hoar-frost.	s.	„	snow.
h.	„	haze.	so. ha.	„	solar halo.
h. d.	„	heavy dew.	sq.	„	squall.
hl.	„	hail.	sqs.	„	squalls.
l.	„	lightning.	t.	„	thunder.
li. cl.	„	light clouds.	t. s.	„	thunder storm
li. sh.	„	light showers.	w.	„	wind.
lu. co.	„	lunar corona.	g.	„	gale of wind.
lu. ha.	„	lunar halo.			

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.930 − 0.56 = 29.874

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.949 − 0.072 = 29.877

Mean at Station, corrected, and at 32°, = 29.876

Correction for height, feet above Mean Sea-level, = .141

Mean, reduced to 32°, and Sea-level, = 30.017

Highest Reading, corrected for Index error, on the 31 th, = 30.532

Lowest Do. Do., on the 23 th, = 29.123

Difference, or **Monthly Range,** = 1.409

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 4 th, = 52.3

Lowest in Month, corrected for Index errors, on the 25 th, = 14.5

Difference, or **Monthly Range,** = 37.8

"Corrected **Mean" of all the Highest,** (Col. 5), = 43.6

"Corrected **Mean" of all the Lowest,** (Col. 6), = 32.0

Difference, or **Mean Daily Range,** = 11.6

** Calculated **Mean Temperature** of Month, = 37.8

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, =

"Corrected **Mean,**" (Col. 7), **of Black Bulb, Max. in Sun,** =

Lowest at Night, Black Bulb, (corrected for Index errors), on the 30 th, = 14.5

"Corrected **Mean,**" (Col. 8), **of Black Bulb, Min.** on grass, = 25.3

Difference of above Means or Range ("exposed"), =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** (Cols. 9 and 11), = 37.2

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 35.7

‡‡ Computed **Temperature of Dew-Point,** = 33.6

‡‡ Do. **Elastic Force of Vapour,** = .193

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air,** =

‡‡ **Relative Humidity,** (**Saturation** = 100), = 87

RAIN fell on 16 **Days; Amount in Inches,** = 2.72

WIND. SUMMARY. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	2	1	1	·	1	1	17	4	4		
P.M.											
Mean.										1.29	
										1.66	

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.
† Embracing corrections for both capillarity and Index Errors.
‡ The Diurnal Range for Scotland is as yet unknown.
†† *Practically*, though not *absolutely* a *minus* correction.
‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."
Any Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

Observations made and Return verified by _____

(Signed) John Paterson

1161
258
127

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSER

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

The Council recommend that Observations be made precisely at

Hour of Observation.

9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer.

roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Forin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the Index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the readings, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A lens unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz, as 30·365 inches, 28·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the book, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for, if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

The Council c
Th
Protection and Position of Thermometers.
me
Thermometers, and the Dry and Wet Bulb Hygrometers, the frameworks of which are to stand exposure to observation may be made on t
screwed to four stout posts, also painted white, inside and outside, and When convenient, extra Sea (
Returns from two Stations, so very considerable as to render them of Thermometers, either Negretti and Zambra's, or Phillips's, whether Hour of Observation. It is also
quite incomparable, may arise from dissimilarity in the position or sheltered Thermometers, and as regards Maximum and greater depths, nothing else
shelter of instruments, different hours of observation, or even from Thermometers, the Bulbs of the Minimum, will be fixed in the ground exactly commenced at Peterhead
the use of differently constructed instruments. It is therefore hoped, The Thermometer Box is to be placed over a plot of the Thermometers are hung immediately above the Minimum
that those who kindly furnish Reports to the Society will, by a Thermometer. The Thermometer Box is to be placed over a plot of
scrupulous attention to the following Directions, secure for their grass, and in a free
Monthly Returns, an accuracy and value commensurate with the The Thermometers are suspended on cross-laths in the ver to secure.
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Attached Thermometer.

Black-Bulb Thermometers.

Self-Registering Thermometers.

Atmospheric Electricity.

Remarks.

Temperature of Walls.

Grass.

Verification of Standards.

Thermometers as

Reading of the Thermometer.

Underground Thermometers.

Dry and Wet Bulb Hygrometer.

Hour of observing the Temperature.

Temperature of the Sea.

Wind.

1. As regards Direction.

2. As regards Velocity and Pressure.

Rain Gauges.

Clouds.

Snow-falls.

Sunshine.

Observations in connection with the Returns of the Seasons.

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Barometer.

roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Forin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the Index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the readings, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A lens unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz, as 30·365 inches, 28·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the book, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for, if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Attached Thermometer.

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OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe, generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

MIGRATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

EDINBURGH, December 187

(By Order)

A. B.

BOOK POST.

To

M. ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

INCLISTON
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PATHO

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Inglistan, County of Edinburgh, in Lat. 55°56'25" N., Long. 3°21'54" W., Distance from Sea 5 1/2 miles.

Height of Cistern of the Barometer above Mean Sea-level 128.5 feet, above Ground 3.5 feet. During the MONTH of February 1879.

The Hours of Observation are of Greenwich Time.

Days of Month.	BAROMETER. 9 h. A.M. Barometer. No. 6	BAROMETER. 9 h. A.M. Attached Thermometer	BAROMETER. 9 h. P.M. Barometer. No. 6	BAROMETER. 9 h. P.M. Attached Thermometer	SELF-REGISTERING THERMOMETERS. Read Daily, at 9 A.M. Protected in Shade, 4 feet above Ground. Max. No.	Protected in Shade, 4 feet above Ground. Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Exposed Black Bulbs. Min. on Grass No.	HYGROMETER. No. —— 9 h. A.M. Dry bulb.	9 h. A.M. Wet bulb.	9 h. P.M. Dry bulb.	9 h. P.M. Wet bulb.	WIND. 9 h. A.M. Direction.	9 h. A.M. Force	9 h. P.M. Direction.	9 h. P.M. Force	Readings of the H.Cup Anemometer. No. —— 9 h. A.M.	RAIN. No. of hours in which it fell.	RAIN. Amount in inches. No. —
	inches.	°	inches.	°	°	°	°	°	°	°	°	°							
1	30.442	47	30.400	55	40.8	25.8		16.4	53.3	46.2			W	1.5					
2	.345	47	.350	54	42	27.5		16.5	51.5	51.5	51	52	W	1	W	1.5			
3	.400	48	.422	51	43	26.2		16.2	51	53.5	50.8	46.5	W	.5	W	.5			
4	.371	50	.400	55	42.8	34.5		31.6	40.2	38.6	39.8	37.5	W	2	W	2			
5	.381	50	.420	56	40.8	36		29	38.1	36.2	40	38	W	2	W	1			
6	.340	50			44	31		29	40.1	37	39	37	W	3					
7	.320	52	.400	58				20	44	42	46.2	45	W	3	W	2			
8	.493	54	.365	58	41.8	41.5		29.8	40.8	44	38.8	37.5	W	2	W	2			
9	.170	51	.000	51	51	29.6		21.5	37.5	36	39.1	37	W	1	W	1.5			
10	29.861	53	29.871	55	42	35.4		29.8	39.5	38	37	36.4	NW	1	NW	.5			
11	.954	51.5	30.051	55	44.5	30.5		22.5	41.8	41.8	38.2	38	NW	1	E	.5			
12	30.114	47	.014	52	39	35.5		20.1	40.2	39.2	38	37	N	.5	N	1			
13	29.854	50	29.863	54	40.2	21		22.5	42.8	41.2	38.8	38	E	2	E	3.5		.75	24
14	.922	54			40	34		29.5	40	39.5			E	3				.29	
15	30	52	29.722	57	41.5	34		27.1	46.4	43	42	40.5	NE	1	E	1			
16	29.781	55	29.805	58	49.8	29.2		28	47.5	45	51.5	49.5	S	2	SW	5		.16	
17	29.791	55	29.644	59	52.1	45.5		33.8	50.8	48	52.5	49.5	W	4	SW	4		.18	5
18	.664	56	30.050	59	56	40.2		30	44	41.8	45	41	W	4	W	4		.05	5
19	30.262	55	.000	57.5	56	35.5		21.5	38.8	38.2	45.5	41.8	C	0	W	2			
20	29.824	54			48.6	37.8		28.6	48.4	46			W	2				.07	15
21	30.303	55	30.410	61	55.4	40.8		31.8	50	49.5			W	3					
22	.423	55.5	.380	59	52.5	44.1		36.2	47.5	46			W	2.5					
23	.200	55			48.8	41.6		34	46	44			W	1.5					
24	.051	52	29.960	57	49.2	36		26.5	44.2	42.2			W	2					
25	29.846	51			48.2	36.6		28	39	37			W	2.5					
26	840	52																.07	
27	550	54																.10	
28	560	57	29.502	60														.24	
29																			
30																			
31																			
Sums.	1812.5 1800	81 80	852 1585	12 14.5	1167 1616	1088 776			1337	1190 290	1125 74 23	953 1200	933 507		3 500		3 330	3	1.15
Means.	30.064	52.4	30.076	56.9	46.7	34.9			26.5	41.2	39.5	40.7	39.2		2.0		2.1		
† Total Corrections for Instrumental Errors.																			
‡ Corrections for Diurnal Range.	-.002																		
"Corrected Means."	.3																		
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

Days of Month.	CLOUDS. 9 A.M. Velocity (0—6), and Direction.	9 A.M. Amount, (0—10), and Species.	9 P.M. Velocity (0—6), and Direction.	9 P.M. Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of feet. No.	SEA. Temperature at 1 fathom, and Density,	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month.
					Hours.	°	°	°	°	°				
1	5W	10cu			2								H.R. Frosh	1
2	0	0	0	0	5					Fair			Hard	2
3	0	5ci	—	10c	3			Frost					do Frosh	3
4	2W	10cu		10c	0		Fine	Frosh Morning					Cold day	4
5	2W	9cu		10c	0		Fine	day Morning					do	5
6			0	0	2								Fine day Cold day	6
7				10H	3								do do	7
8	1W	10cu	5	0	3		Fine	Hoing Morning					Very fine day	8
9	1W	10c	2W	10c	0								Cold day	9
10	1W	10c	1c	10cu	3								Fine day	10
11		10H	1E	10cu	3		Some	Fog					Very Fine day	11
12		2ci	2HE	9cu	2								Frost	12
13	7S	2HE	10c		0		Snow	Day Storms		Rain				13
14	.29		10c		1					Leaden Sky				14
15		2HE	8cu	2W	3					Storms				15
16	.16		10c	5cu	0					Rain & Snow				16
17	.18	5W	10c	5cu	4		Storms						Fine day Morning	17
18	.05	5W	5c	0	2			do					Cloudless do	18
19				8cu	4		Dull	Morning		Fine			Fine Morning day	19
20	.07	1SW	8cu		0								Frost	20
21		3W	10c		0								Fine Dull day	21
22		5W	9c		0								Fine	22
23		2W	10c										do	23
24		2W	1cu										do	24
25		0	0				Fine	clear	Morning	bi	in	H.R.		25
26														26
27														27
28														28
29														29
30														30
31														31

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.	m.	*denotes* meteor.
ci.	" cirrus.	ms.	" meteors.
ci.-cu.	" cirro-cumulus.	n.	" nimbus.
ci.-s.	" cirro-stratus.	r.	" rain.
cu.	" cumulus.	h. r.	" heavy rain.
cu.-s.	" cumulo-stratus.	c. h. r.	" continued heavy rain.
d.	" dew.	s.	" stratus.
f.	" fog.	sc.	" scud.
fr.	" frost.	s.	" sleet.
h.-fr.	" hoar-frost.	s.	" snow.
h.	" haze.	so.ha.	" solar halo.
h. d.	" heavy dew.	sq.	" squall.
hl.	" hail.	sqs.	" squalls.
l.	" lightning.	t.	" thunder.
li. cl.	" light clouds.	t. s.	" thunder storm
li. sh.	" light showers.	w.	" wind.
lu. co.	" lunar corona.	g.	" gale of wind.
lu. ha.	" lunar halo.		

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 30.052 − .064 = 29.988

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = ... − ..... = ...

Mean at Station, corrected, and at 32°, ... = 29.988

Correction for height, feet above Mean Sea-level, ... = .140

Mean, reduced to 32°, and Sea-level, ... = 30.128

Highest Reading, corrected for Index error, on the 1 th, ... = 30.442

Lowest Do. Do., on the 28 th, ... = 29.502

Difference, or **Monthly Range,** ..... = 0.940

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 18 th, ... = 56.0

Lowest in Month, corrected for Index errors, on the 13 th, ... = 21.0

Difference, or **Monthly Range,** ..... = 35.0

"Corrected **Mean**" **of all the Highest,** (Col. 5), ... = 46.7

"Corrected **Mean**" **of all the Lowest,** (Col. 6), ... = 34.9

Difference, or **Mean Daily Range,** ..... = 11.8

** Calculated **Mean Temperature** of Month, ... = 40.8

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, ... =

"Corrected **Mean,**" (Col. 7), **of Black Bulb, Max. in Sun,** ..... = 16.2

Lowest at Night, Black Bulb, (corrected for Index errors), on the th, ... = 16.2

"Corrected **Mean,**" (Col. 8), **of Black Bulb, Min.** on grass, ... = 26.5

Difference of above Means or Range ("exposed"), ... =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** (Cols. 9 and 11), ... = 41.0

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), ... = 39.3

‡‡ Computed **Temperature of Dew-Point,** ..... = 37.2

‡‡ Do. **Elastic Force of Vapour,** ..... = .221

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air,** ... =

‡‡ **Relative Humidity, (Saturation = 100),** ..... = 86

RAIN fell on 9 **Days; Amount in Inches,** ..... = 1.15

WIND. Direction.	SUMMARY. N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1		2		2		17	2	1		
P.M.			2		1	3	9	1			
Mean.	1	0	2	0	1	2	13	2	0		

4.00

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.

† Embracing corrections for both capillarity and Index Errors.

‡ The Diurnal Range for Scotland is as yet unknown.

‡‡ *Practically*, though not *absolutely a minus* correction.

‡‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.

†† While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."

** Any Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

Observations made and Return verified by .....

(*Signed*) John Tatum

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

One of the chief objects that the Scottish Meteorological Society proposed to itself when the Society was established in 1855, was to secure perfect uniformity in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation. The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer. Weather-Glasses and Aneroids, though well-suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is Fortin's Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted; the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz., as 30·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for, if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers. The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of four feet above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of uniformity of height above ground, and method in protecting the Thermometers, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers. Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principal of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers. The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, have a black coating, which may easily be made, or mended, by the application of a mixture of lampblack and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The Maximum should be freely exposed to the sun, and the Minimum should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer. The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer. In reading the Thermometer great care must be taken to bring the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, 40°.6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40¼°, and 40¾°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

Hour of observing Temperature. The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Verification of Thermometers. No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a Standard Thermometer. When such Thermometers as are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind. Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction. A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called Storm Stations, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to Barometric Gradients, and other points connected with storms.

2. As regards Velocity and Pressure. The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Bullingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges. Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls. Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs, it should be noted in the 'Remarks,' and the letter S affixed to the depth of water received in Gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the Rain-Gauge. For wind, rain, and snow, as indeed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Clouds. Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.*, within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, and so on.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction,

$\frac{6,\ S.\ W.}{2,\ W.}$ will indicate that the upper strata of Clouds travel with extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second Cloud column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st.}$, will indicate that the higher regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo-stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine. The approximate number of Hours in which objects in the sun's rays cast shadows, should be entered in the proper column.

Underground Thermometers. As the germination and growth of crops and plants generally, depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

Temperature of the Sea. A knowledge of the Temperature of the Sea is not only in itself, but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where [illegible] cannot be taken daily, the observation may be m[illegible]th, and 25th of each month. When convenient, ex[illegible]s might be taken for other and greater depths, n[illegible]perature of the Air, and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells. The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, the depth of the Well and of the water being noted.

Ozone. Mention what Test-Papers are used, Schönbein or Moffat's, etc. The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3\frac{N.W.}{4}$, as an Ozone entry in the schedule, will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity. Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks. The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions, ought, therefore, to be taken every advantage of, and a list of such as are in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunderstorms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending; as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons. Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

Edinburgh, *December* 1877.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe, generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

MIGRATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK POST.

RATHO 14 JUL 79 INGLISTON

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Inglistun, County of Edinburgh, in Lat. 55°56'25" N., Long. 3°21'59" W., Distance from Sea 3 9/16 miles.

Height of Cistern of the Barometer above Mean Sea-level 128.5 feet, above Ground 3.5 feet. During the MONTH of March 1878.

The Hours of Observation are of Greenwich Time.

Days of Month	BAROMETER. 9 h. A.M. Barometer. * No.	BAROMETER. 9 h. A.M. Attached Thermometer	BAROMETER. 9 h. P.M. Barometer. No.	BAROMETER. 9 h. P.M. Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 A.M. Protected in Shade, 4 feet above Ground. Max. No.	Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Min. on Grass No.	HYGROMETER. No. ——. 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H.Cup Anemometer. No. —— 9 h. A.M.	RAIN. No. of hours in which it fell.	Amount in inches. No.	CLOUDS. 9 A.M. Velocity (0—6), and Direction.	Amount (0—10), and Species.	9 P.M. Velocity (0—6), and Direction.	Amount (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	12 inches.	No. 22 inches.	Temperature of WELL at depth of —— feet. No.	SEA. Temperature at 1 fathom, and Density,	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms, including Thunder and Lightning, began and ended.*	Days of Month
	inches.	°	inches.	°	°	°	°	°	°	°	°	°													°	°	°	°	°						
1	29.311	56	29.321	62	54	45		35.5	49	47.2			W	2				.02	2 W	10 C			0						Dull		Damp Cor		1
2	.614	57	.955	62	52.2	45.2		34	45.5	45.8			W	5.5					2 W	1 Cu									Fine		Evening		2
3	30.124	57	30.140	61	51	44.5		36.2	48.2	46.2			W	5.	W	2			2 W	10 C		10 C	0						Fine		day clear		3
4	.105	59	29.984	60	55.5	47		39.9	50.5	48			W	5				.30	2 W	10 C											Gale Wind		4
5	.020	54	.921	60	51.2	48		42	45.2	44.2			W	5				.15	3 W	5 C			0						Very	Stormy	~~Fine afternoon~~		5
6	29.500	55	.812	60	47	35		32	51	48			W	5	W	1.5			6 W	10 C	0	0	3								Fine afternoon		6
7	.650	57	—		52.1	38		30.5	51	50			W	4				.34	6 W	5 Cu	0	0	0								Cir above, Mist=0		7
8	.812	47	30.080	55.5	54.3	34		28	40	38			W	2					0	0			6								Fine		8
9	30.013	51	29.790	56	47	24.5		20	38.5	31	37.2	37	W	.5	W	.5		.01	0	10 Cu	0	10 C	0						Frost & Clear		Fine day		9
10	29.810	54	.813	57	43.5	31.2		30.5	47	45.5	47	46	W	2	W	1			2 W	10 Cu 10 Ci	2 W	10 C	5						Fine	Evening	Storms		10
11			.993	58	50	42.5			43.2	46	40	39	W	1	W	1			2 W	10 Cu	2 W	8 Cu								Fine	Dry day		11
12	30.231	52			50	29		25	38	34.8	38.5	35.5	W	1	W	1.5			1 W	1 Ci		10 Ci	8								Splendid day Lunar Halo		12
13	.510	58							50	39.5	6	2	C	0							0	0											13
14	.482	49	30.400	55	47	27.5		22.5	38.1	35.5	41.5	41.5	W	1.5	W	0				10 C	0	0	0						Clear		Frost Hr Fr		14
15	.442	50			45	25		20.5	35	33.5			0	0																			15
16																																			16
17																		.03																	17
18																																			18
19																																			19
20			30.213	61							45.5	46						.09				10 C	5							Thrt Recvr				20
21																																			21
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26																																			26
27	29.775	49			43.6	34		19.5	36.4	33			1	2					0	0															27
28			29.600	55																															28
29	29.603	47			42.2	25		14.4	37.5	33			1	2					0	0			8						Clear Frost		Very bold		29
30	29.500	50	29.474	55	44.8	33.8		16	37.5	34.2			1	2	1	1		.02	2	10 C	2	10 C	8						Frost, Dull		Fine cold day		30
31	.230	51	.020	56	45	27		20	34	33			1	1	1	1			2	4 Cu	0	0	0								Severe bold day		31
Sums.	15738	55	12574	35	1578	840		1145	1424	99	617	485				45		12					115													Sums.
Means.	29.874	53.0	29.838	58.2	48.8	34.6		26.7	42.4	40.0	38.6	36.9				2.4		1.1																	Means.
† Total Corrections for Instrumental Errors.																																			† Total Corrections for Instrumental Errors.
‡ Corrections for Diurnal Range.																																			‡ Corrections for Diurnal Range.
"Corrected Means."																																			"Corrected Means."
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					No. of Column.

NOTATION USED IN GENERAL REMARKS.

a.	*denotes* aurora.		m.	*denotes* meteor.	
ci.	"	cirrus.	ms.	"	meteors.
ci.-cu.	"	cirro-cumulus.	n.	"	nimbus.
ci.-s.	"	cirro-stratus.	r.	"	rain.
cu.	"	cumulus.	h r.	"	heavy rain.
cu.-s.	"	cumulo-stratus.	c. h. r.	"	continued heavy rain.
d.	"	dew.	s.	"	stratus.
f.	"	fog.	sc.	"	scud.
fr.	"	frost.	s.	"	sleet.
h.-fr.	"	hoar-frost.	s.	"	snow.
h.	"	haze.	so.ha.	"	solar halo.
h. d.	"	heavy dew.	sq.	"	squall.
hl.	"	hail.	sqs.	"	squalls.
l.	"	lightning.	t.	"	thunder.
li. cl.	"	light clouds.	t. s.	"	thunder storm
li. sh.	"	light showers.	w.	"	wind.
lu. co.	"	lunar corona.	g.	"	gale of wind.
lu. ha.	"	lunar halo.			

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0—6.	Common Designation.	Estimated Force 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction†† for Temp. (Col. 2), = ... — ..... = _____

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction†† for Temp. (Col. 4), = ... — ..... = _____

Mean at Station, corrected, and at 32°, ... = _____

Correction for height, _____ feet above Mean Sea-level, ... = _____

Mean, reduced to 32°, and Sea-level, ... = _____

Highest Reading, corrected for Index error, on the 13 th, ... = 30.510

Lowest Do. Do., on the 31 th, ... = 29.020

Difference, or **Monthly Range**, ... = 1.490

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the 8 th, ... = 54.3

Lowest in Month, corrected for Index errors, on the 9 th, ... = 24.5

Difference, or **Monthly Range**, ... = 29.8

"Corrected **Mean**" **of all the Highest**, (Col. 5), ... = 48.8

"Corrected **Mean**" **of all the Lowest**, (Col. 6), ... = 34.6

Difference, or **Mean Daily Range**, ... = 14.2

** Calculated **Mean Temperature** of Month, ... = 41.7

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, ... = _____

"Corrected **Mean**," (Col. 7), **of Black Bulb, Max. in Sun**, ... = _____

Lowest at Night, Black Bulb, (corrected for Index errors), on the th, ... = _____

"Corrected **Mean**," (Col. 8), **of Black Bulb, Min.** on grass, ... = _____

Difference of above Means or Range ("exposed"), ... = _____

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb**, (Cols. 9 and 11), ... = _____

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), ... = _____

‡‡ Computed **Temperature of Dew-Point**, ... = _____

‡‡ Do. **Elastic Force of Vapour**, ... = _____

‡‡ Do. **Weight of Vapour in a Cubic Foot of Air**, ... = _____

‡‡ **Relative Humidity**, (**Saturation** = 100), ... = _____

RAIN fell on 8 **Days; Amount in Inches**, ... = 0.72

WIND. Direction.	SUMMARY. N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	5		1				6	6	1		
P.M.	4						2	3	1		
Mean.	5	0	0	0	0	0	3	5	1		

* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.

† Embracing corrections for both capillarity and Index Errors.

‡ The Diurnal Range for Scotland is as yet unknown.

‡‡ *Practically*, though not *absolutely* a *minus* correction.

†† These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.

†† While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."

Any Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

Observations made and Return verified by _____

(*Signed*) John Fatmore

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERV[illegible],

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation. The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns of the Schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer. Weather-Glasses and Aneroids, though well-suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering it, must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted so as to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down—viz., as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for, if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers. The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers. Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principal of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for, if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers. The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, have a black coating, which may easily be made, or mended, by the application of a mixture of lampblack and painter's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The Maximum should be freely exposed to the sun, and the Minimum should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer. The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by at least an inch free from the scales and frame to which they are attached; the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer. In reading the Thermometer great care must be taken to bring the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, 40°.6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40¼°, and 40¾°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are readily affected by heat from the person of the Observer.

Hour of observing Temperature. The Hygrometer is read at 9 A.M. and 9 P.M. The Self-Registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the Self-Registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Verification of Thermometers. No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a Standard Thermometer. When such Thermometers are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being re-tested. The Self-Registering, especially the Minimum Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer, marked by a scratch on the tube, ought to be tested once a year, in snow or melting ice.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind. Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction. A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure. The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges. Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls. Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs, it should be noted in the 'Remarks,' and the letter S affixed to the depth of water received in Gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the Rain-Gauge. For wind, rain, and snow, as indeed in every column, the Observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Clouds. Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud ought to be estimated from the greater or less obscuration of the sky overhead (*i.e.*, within 20° or 30° of the zenith). The strata of Clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the Clouds' column, though their appearance and changes may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, and so on.

Observations of the Clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—Thus, in the column Velocity and Direction, $\frac{6,\ S.W.}{2,\ W.}$ will indicate that the upper strata of Clouds travel with extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second Cloud column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st.}$, will indicate that the higher regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo-stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine. The approximate number of Hours in which objects in the sun's rays cast shadows, should be entered in the proper column.

Underground Thermometers. As the germination and growth of crops and plants generally, depend greatly on the temperature of the soil,—its amount and constancy,—the Council recommend that Observations in this interesting department be made at 9 A.M., by Thermometers permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

Temperature of the Sea. A knowledge of the Temperature of the Sea is not only in itself, but in its relations to that of our island, a most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where th[illegible] taken daily, the observation may be ma[illegible]h of each month. When convenient, ex[illegible] Observations might be taken for other and greater depths, noting always the Temperature of the Air, and the Hour of Observation. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells. The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone. Mention what Test-Papers are used, Schönbein's or Moffat's, etc. The Paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{\frac{N.W.}{4}}$, as an Ozone entry in the schedule, will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity. Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks. The Remarks column is unavoidably too narrow. Some of the most valuable Observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions, ought, therefore, to be taken every advantage of, and a list of such as are in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons. Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm. The Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and improved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December* 1877.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First appear.	In Leaf.	Divested of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Alder,					Barley,				
Ash,					Bere or Bigg,				
Beech,					Oats,				
Birch,					Wheat,				
Elm,					Beans,				
Larch,					Pease,				
Lime,					Potatoes,				
Oak,					Turnips,				
Sycamore or Plane,					Rye Grass,				

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe, generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry,		Apple,			Cuckoo,		
Bourtree or Elder,		Black Currant,			Curlew,		
Broom,		Cherry,			House-Swallow,		
Hazel,		Gean,			Lapwing,		
Hawthorn,		Gooseberry,			Plover,		
Holly,		Peach,			Sand-Martin,		
Laburnum,		Pear,			Starling,		
Lilac,		Plum,			Swan,		
Mezereon,		Strawberry,			Rail or Corn Crake,		
Mountain Ash or Rowan,							
Red Flowering Currant,							
Rhododendron Ponticum,							
Whin,							

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural condition of the district generally.

Inglistone

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK POST.

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