

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Leafield Cottage, Rubislaw, Aberdeen, in Lat. 57° 8' 6" N, Long. 2° 8' 26" W, Distance from Sea (2.87) 3 miles.
Height of Cistern of the Barometer above Mean Sea-level 195 1/2 feet, above Ground 4 1/2 feet.
During the MONTH of January 187 3.

The Hours of Observation are of Greenwich Time.

TEMPERATURE.	BAROMETER.		SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No. 2237				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.	
	9 h. A.M.		9 h. P.M.		Protected in Shade, in Black Bulb.		Exposed Black Bulb.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.							
	Barometer. No. 236.	Atmospheric Thermometer.	Barometer. No. 236.	Atmospheric Thermometer.	Max. No. 232.	Min. No. 237.	Max. No. 232.	Min. No. 237.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Amount (0-10). and Species.	Amount (0-10). and Species.	Amount (0-10). and Species.	Amount (0-10). and Species.	No. 3 inches.	No. 12 inches.	No. 22 inches.					
1	29.174	44.9	29.222	44.6	44.6	37.0	60.7	32.3	40.0	39.7	41.0	40.0	SW	0.5	SW	1	SW	2	6	0.210								1
2	28.878	45.5	29.026	44.3	44.0	37.8	55.0	30.7	40.0	39.0	39.6	37.6	SW	1	SW	2	SW	3	4	0.065								2
3	28.988	43.8	29.070	44.3	43.9	36.0	56.7	32.0	41.4	40.8	41.0	38.1	SW	2	SW	2	SW	3.5	6	0.113								3
4	29.378	43.0	29.020	43.6	42.5	34.3	42.8	26.4	36.8	35.7	40.2	38.8	SW	1	SW	0.5	SW	2	4	0.235								4
5	29.070	42.5	29.294	41.7	40.8	33.2	63.8	31.4	36.7	35.7	33.7	32.8	SW	1.5	W	0.5	SW	2.5	4	0.087								5
6	29.180	41.7	29.322	45.9	49.9	30.6	52.7	21.7	36.0	35.8	29.4	27.5	SW	0.5	SW	1	SW	2	0	0								6
7	29.466	46.7	29.404	47.6	50.5	44.8	54.0	30.7	47.7	46.8	46.0	44.8	SW	1.5	SW	1.5	SW	3	4	0.010								7
8	29.126	47.6	29.206	47.0	47.2	40.4	63.4	41.3	46.8	43.0	41.8	40.2	SW	2.5	SW	1	SW	4	0	0								8
9	29.184	44.9	29.130	46.0	44.6	34.2	48.9	27.0	37.0	36.7	42.8	42.4	SW	0.5	SW	0.5	SW	1	10	0.115								9
10	29.094	47.2	29.252	48.0	47.6	42.8	62.2	32.7	45.6	44.7	45.3	44.3	SW	1	SW	1	SW	1.5	6	0.090								10
11	29.292	47.2	29.338	47.2	46.7	40.7	60.8	33.8	42.0	41.2	43.1	41.6	SW	0.5	SW	1	SW	1.5	0	0								11
12	29.448	44.7	29.314	44.8	44.0	34.6	51.0	26.1	35.9	34.6	42.0	40.5	SW	0.5	SW	1.5	SW	2	1	0.010								12
13	29.274	45.6	29.278	46.8	48.4	40.5	45.6	28.0	43.0	41.4	46.6	45.6	SW	0.5	SW	0.5	SW	1	0	0								13
14	29.406	47.0	29.472	49.0	54.0	43.2	64.4	33.8	46.2	44.8	46.0	43.2	SW	1.5	SW	1	SW	4	0	0								14
15	29.514	48.0	29.664	47.3	47.0	38.0	56.0	37.2	44.2	40.1	40.0	37.0	SW	0.5	W	0.5	W	1	0	0								15
16	29.828	44.2	29.636	45.3	43.1	33.3	41.9	24.3	34.7	33.0	43.0	42.9	SW	0.5	SE	2.5	SE	3	12	0.585								16
17	29.496	44.4	29.442	44.4	45.6	35.2	55.0	27.4	36.3	35.8	37.0	35.2	SW	1	SW	0.5	SW	2.5	1	0.007								17
18	29.106	42.4	28.464	43.0	42.4	33.6	44.1	28.0	38.6	37.0	39.9	39.2	SW	2.5	SW	0.5	SW	3.5	7	0.260								18
19	28.120	43.3	28.008	41.0	42.7	32.0	60.0	30.1	35.3	33.3	34.0	33.0	SW	1	SW	0.5	SW	1	0	0								19
20	28.012	39.6	28.196	39.5	35.2	28.5	35.0	20.2	30.4	29.3	34.8	32.7	SW	0.5	SW	1.5	SW	2	1	0.010								20
21	28.424	39.8	28.594	40.3	38.5	33.8	39.0	26.8	38.2	36.0	36.0	34.7	SW	2.5	SW	1	SW	3	3	0.070								21
22	28.620	38.6	28.854	39.9	38.0	32.0	58.0	23.4	33.6	32.4	35.5	34.0	SW	0.5	W	1	SW	1.5	1	0.025								22
23	29.092	39.0	29.182	39.3	39.2	31.1	65.5	25.4	34.0	32.5	33.0	32.0	SW	0.5	SW	0.5	SW	1	1	0.013								23
24	29.396	39.4	29.650	39.3	38.7	32.0	70.0	22.9	34.1	33.5	33.0	32.0	SW	0.5	SW	1	SW	1	0	0								24
25	29.684	37.8	29.524	40.0	38.7	28.2	57.8	20.2	31.2	29.9	38.0	36.4	SW	1	SW	2.5	SW	3	9	0.205								25
26	29.434	41.2	29.612	42.2	40.0	36.9	39.6	27.7	39.0	38.6	39.8	39.6	SW	2	SW	2	SW	4	13	0.360								26
27	29.802	43.1	29.898	44.2	43.0	38.8	59.0	37.3	40.5	40.4	40.0	39.2	S	1	SW	0.5	SW	1.5	1	0.005								27
28	29.834	42.0	29.876	42.0	41.0	33.3	56.9	32.9	36.6	35.1	38.0	36.7	S	2	SW	2	SW	3.5	0	0								28
29	29.962	40.3	29.976	41.0	39.0	30.7	39.3	23.8	33.7	32.1	37.0	35.3	SW	0.5	SE	2	SE	2	6	0.065								29
30	30.008	41.4	30.090	42.0	38.9	34.8	41.7	31.3	37.0	36.6	37.9	37.1	SE	1	SE	1	SE	2	6	0.070								30
31	30.160	42.2	30.150	42.2	39.8	35.3	53.2	34.3	37.7	36.4	36.7	35.5	S	1.5	S	1.5	SW	2.5	6	0.085								31
Sums.	1216.13	907.470	1239.1	908.164	1332.0	1098.9	1632.0	901.1	1190.2	1154.9	1232.1	1199.9	340	360	112	269.5	215	92										
Means.	29.222	43.2	29.292	43.7	43.3	35.3	53.3	29.1	38.4	37.2	39.7	38.4	1.10	1.16			7.0	3										
† Total Corrections for Instrumental Errors.	-0.013		-0.013		+0.2	+0.1	0	-0.2	0	0	0	0																
† Corrections for Diurnal Range.																												
"Corrected Means."	29.260	43.2	29.283	43.7	43.1	35.6	53.4	28.9	38.4	37.2	39.7	38.4	1.1	1.2			7.0	3										
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

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.

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

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
1
2
3
4
5
6
Calm
Very light air
Light air
Light breeze
Fresh breeze
Very fresh
Blowing hard
Blowing a gale
Violent gale

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction (†) for Temp. (Col. 2), = 29.222 at 100 ft
for Temp. (Col. 2), = 29.222 at 100 ft
"Corrected Mean" of Barometer at 9 P.M., minus the Correction (†) for Temp. (Col. 4), = 29.243 at 100 ft
Mean at Station, corrected, and at 32°, = 29.232 29.336
Correction for height, 195 1/2 feet above Mean Sea-level, = +0.218 +0.114
Mean, reduced to 32°, and Sea-level, = 29.450 29.450
Highest Reading, corrected for Index error, on the 31st, = 30.147 30.251
Lowest Do. Do. on the 19th, = 27.995 28.100
Difference, or Monthly Range, = 2.152 2.151

* 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.
† The Diurnal Range for Scotland is as yet unknown.
‡ These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition only.
§ While the Diurnal Range is unknown, the Arithmetical Mean of (Cols. 2 and 5) 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.

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 14th, = 34.2
Lowest in Month, corrected for Index errors, on the 25th, = 28.3
Difference, or Monthly Range, = 25.9
"Corrected Mean" of all the Highest, (Col. 5), = 43.6
"Corrected Mean" of all the Lowest, (Col. 6), = 35.6
Difference, or Mean Daily Range, = 7.8
** Calculated Mean Temperature of Month, = 39.5
S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 24th, = 70.0
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 53.4
Lowest at Night, Black Bulb, (corrected for Index errors), on the 20th, = 20.0
"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass, = 28.9
Difference of above Means or Range ("exposed"), = 24.5

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 39.1
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 37.8
† Computed Temperature of Dew-Point, = 36.1
† Do. Elastic Force of Vapour, = 0.213 In.
† Do. Weight of Vapour in a Cubic Foot of Air, = 2.45 grs
† Relative Humidity, (Saturation = 100), = 87.6 90
RAIN fell on 22 Days; Amount in Inches, = 2.695 Rate 11
WIND. SUMMARY.
Direction. N. NE E SE S SW W NW Calm or Variable. Mean Force. Mean Velocity in miles per day.
A.M. 0 0 0 1 3 18 1 5 3 1.10
P.M. 1 0 0 3 1 20 2 4 0 1.16
Mean. 1 0 0 2 2 19 1 4 2 1.13 = 1.28 lbs

N.B.—The Sums to be correctly added and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 3d; those from Other Places, not later if possible than the 5th. This Schedule not to be signed or Fastened and Forwarded by Book Post, prepaid.

Evaporation = 1.275 In.
Observations made and Return verified by { Alex. Bowerly, assessor Sergeant Shumlo
James, Grammar School, Aberdeen

Actual readings at Gram. School, same days shown
Highest 30.267
Lowest 28.117
Mo. range 2.150

N. B. Bar. fell a little in course of night of 19th—20th but certainly not more than 0.040 in.

Greatest daily range 4.6 on the 6th
(Signed) Alex. Bowerly

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS, WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the objects of immediate importance that the Scottish Meteorological Society has proposed to itself, is to secure a *perfect uniformity* in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different Observations; and it is found that differences between the Returns from any 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 persons 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 o'clock (Greenwich or Railway Time only) twice a-day for some, and once (morning or evening for other instruments, as specified, in the following remarks, or at the top 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 at what time it was taken, if not at 9 o'clock.

Barometer.—*Weather glasses* and *Aneroids*, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. No can any Barometer be used for Meteorological Observations that is not supplied with such means of *adjustment* or *compensation* as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a *Standard*.

Two moderate-priced Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted to Meteorological purposes.

An excellent Barometer is constructed by Mr. Alix of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-branches* 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 form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the scale; their coincidence being 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*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *screw up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upmost. 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 when, on inclining the instrument, so that the mercury strikes the top of the tube, a *slaty* cap is produced. If this is prevented by air it may be removed to the cistern, and got rid of by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument should be repaired.

The Barometer should be suspended in a good *light*, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire.

In *taking an Observation*, the attached Thermometer is first noted; the tube must then be gently tapped and the cistern-adjustment carefully made. By raising and lowering the eye, 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 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 greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians *Sgt. Ruggiering*, Thermometers, Professor Phillips, and Negretti and Zambra's Patent "*Maximum*" Thermometers, and recommended; printed directions for their use may be obtained with each instrument. The "*Minimum*" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "*Maximum*." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *column* of spirit breaks, it may be re-ventilated by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

The above remarks apply equally to the Thermometers for registering the greatest heat from the sun's rays, and the least

from radiation during night. Their bulbs have a black coating which may easily be made, or melted, by the application of a mixture of lamp black and printers' 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.

Ventilation 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, and 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. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested* form of this apparatus seriously vitiate the "*Hygrometrical*" Deductions, 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 placed to the side, and a little below the level of the wet bulb;—in no case under the bulb;—the manin must be of medium fineness, and inserted 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 manin 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.

One form of "Mason's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the recommended requirements shall be complied with, as far as possible.

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing 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°.4, 40°.0, or 40°.1; or again, 40°.4, 40°.3, or 40°.6, according as it indicates a little under an exact coincidence with, or a little over 40°, or 40½, respectively. So also 40½, and 40°.7 or 40°.8 respectively. In reading Rutherford's "*Max.*" and "*Min.*" Thermometers, the registered 40° 2 or 40° 3, and 40° 7 or 40° 8 respectively. In the case of the 3d of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d. **Wind.**—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, and always when the wind is feeble, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, etc.

Careful observations ought to be made on the changes in the direction of the wind; and during storms, it is earnestly recommended that extra observations be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results.

The Council recommend that every observatory be furnished with a Hemispherical Cup Anemometer, a self-registering instrument which shows the amount of Wind that passes it per day; from which also the 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, Lind's Anemometer is also recommended; the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly from unfavourable situation for observation and, partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

Snowfalls may, for convenience, be registered in the rain columns, under the following conditions:—When a snow shower occurs it must 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 indicated 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 Luke Howard's

nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere 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 *cloud* column, though their appearances and changes ought to be noted among the "*Remarks*." The amount of cloud is entered from a scale of 0 to 10; thus, when the *sky overhead* is *half covered* by clouds, 5 is entered as the *observation*, 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:—In the column "*Velocity* 6, S.W." and Direction, "*2. W.*" (for example) 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 (*extreme*) speed of the former. Again, in the second "*Cloud*" column, an entry of $\frac{2}{2}$ (e.g.) 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.

Shadows.—The 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 health of crops and plants greatly depend 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 placed in the earth, their bulbs being sunk to 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. Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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 very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, noting always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottoms of wells ought, when practicable, to be taken, and the depth of the well and of the water noted. **Ozone.**—Mention whether Schloeskin's or McFie's papers are used. The paper is affixed by a pin to a board in the hemispherical box, and the indication 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 8 $\frac{1}{2}$, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "8" on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4" i.e., that it is *blowing fresh*.

Electricity.—Too much importance cannot be attached to electric condition of the atmosphere in connection with terrestrial magnetism, and as a meteorological phenomenon. A proper Electrometer is necessary to every complete meteorological observatory. **Remarks.**—The "*Remarks*" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no rubs can be given nor hours assigned. The use of conjunctions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, 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 characters 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, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purposes, from that headed "*Remarks*." It is intended that observations by the Electrometer should be entered in this manner on the side-margin. Additional remarks may be made on the side-margin. **Observations** in connection with the periodic return of the seasons" possess not only great scientific value, but are of considerable interest to the Agriculturists. The Council would direct the special attention of Observers to the registration of such phenomena, that the published Summaries may fairly represent the whole of Scotland. Observation 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 Council recommend that *tern day* observations be taken;—i.e., on the 1st days of March, June, September, and December.

Full directions for the use of the instruments mentioned above have been printed and may be had along with them from the makers.

The Council recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary, and they consider it desirable 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, 10th November 1869.

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,		
Mezeroon,		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.

Abraham
Jan 1873
General Post Office Buildings,
Secretary of the Meteorological Society of Scotland,
MR ALEXANDER BUCHAN,
76
EDINBURGH.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Leuchfield Cottage, Rutislaw, Aberdeen County of Aberdeen, in Lat. 57° 8' 6" N, Long. 2° 8' 46" W, Distance from Sea (2.87) 3 miles.
Height of Cistern of the Barometer above Mean Sea-level 195½ feet, above Ground 4½ feet.
During the MONTH of February 1873.
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	B. J. BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 8 P.M.				HYGROMETER. No. 2227				WIND.		RAIN.		CLOUDS.		THERMOMETERS under Ground.			SEA.	OZONE.	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.				
	9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.											
	Barometer. No. 236	Attached Thermometer	Barometer. No. 236	Attached Thermometer	Max. No. 233	Min. No. 07	Max. No. 237	Min. No. 234	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	No. 1 inches.						No. 2 inches.	No. 3 inches.	Temperature of Well, at depth of feet. No.	Temperature at 1 fathom, and Depth.
	inches.	°	inches.	°	°	°	°	°	°	°	°	°																		
1	30.068	41.0	29.950	40.3	37.1	32.5	66.5	31.7	35.0	33.4	34.8	32.4	S	1.5	S	2	55E 3	10	0.090								Hail, sleet, snow	1		
2	29.732	39.1	29.692	37.8	35.3	27.4	61.7	26.8	31.9	30.1	29.0	28.9	SE	2	SE	0.5	55E 3.5	14	0.275								snow, hail	2		
3	29.730	37.2	29.946	37.9	34.4	23.0	50.3	13.1	26.4	26.1	33.7	33.2	W	1	W	1	W 1.5	10	0.180								snow	3		
4	30.116	38.4	30.110	39.3	37.3	31.6	50.3	21.0	34.8	33.8	35.6	35.2	W	1	W	0.5	W 2	12	0.143								snow, sleet	4		
5	29.904	39.2	29.808	39.5	37.1	30.0	45.7	31.7	34.4	34.2	31.0	31.8	SE	0.5	SW	0.5	S 1	1	0.005								Fog.	5		
6	29.876	39.3	30.050	40.4	39.9	30.2	62.3	21.6	34.1	33.0	37.0	36.0	W	0.5	W	1	W 1	2	0.030										6	
7	30.182	40.1	30.230	40.7	39.0	31.1	74.8	28.3	36.0	35.6	31.0	30.8	W	1	W	0.5	W 1	0	0										7	
8	30.228	38.0	30.242	38.7	37.7	28.6	74.9	21.1	30.3	28.6	32.0	31.7	W	0.5	W	0.5	W 1	1	0.005									hft.	8	
9	30.230	38.7	30.164	40.6	40.0	31.1	52.6	21.7	34.4	32.8	38.8	38.0	SW	0.5	W	0.5	W 1	3	0.015										9	
10	30.260	40.0	30.368	39.7	40.0	31.2	42.7	28.3	36.2	33.9	33.2	31.0	W	1	W	1	W 2.5	5	0.010									Hail, snow	10	
11	30.184	39.0	29.940	41.0	42.0	32.0	46.3	30.1	35.3	33.0	38.4	36.0	W	1	W	1	W 2.5	3	0.025											11
12	30.100	40.2	30.108	41.9	41.9	35.7	74.0	30.0	37.4	34.8	37.0	35.7	W	1	W	1	W 1.5	1	0.007											12
13	29.964	41.2	29.964	43.7	45.1	35.1	78.0	28.4	40.6	39.4	41.0	39.9	W	1	W	1	W 1.5	4	0.030											13
14	30.014	43.0	30.068	45.0	46.0	38.7	83.7	31.9	40.9	40.2	42.8	40.6	W	0.5	W	1	W 1	0	0											14
15	30.120	43.5	30.162	44.5	44.5	34.0	88.2	26.5	37.0	35.7	35.3	34.8	W	1	SW	0.5	SW 1	0	0											15
16	30.208	42.0	30.204	43.6	45.4	31.1	91.3	21.8	34.0	33.2	34.4	33.3	S	0.5	SW	0.5	S 1	1	0.007									hft.	16	
17	30.244	40.8	30.288	43.3	45.0	29.7	89.2	18.7	34.9	33.7	39.3	37.4	SW	0.5	SW	0.5	SW 1	1	0.010									hft.	17	
18	30.382	41.4	30.412	44.3	45.0	31.6	91.7	20.8	35.3	34.3	37.0	35.3	SW	0.5	W	0.5	W 1	0	0									hft.	18	
19	30.354	40.7	30.270	43.0	43.0	29.0	80.0	19.1	33.2	32.0	37.0	36.0	SW	1	SW	0.5	SW 1	2	0.015									hft.	19	
20	30.344	43.7	30.270	46.0	46.5	36.3	80.8	27.1	42.0	39.8	41.0	40.7	W	0.5	SW	1	SW 1	2	0.010											20
21	29.990	44.0	29.556	45.6	47.0	36.0	91.3	30.2	39.5	38.3	42.7	40.0	SW	1	SW	1	SW 2	8	0.070									hft.	21	
22	29.602	42.1	29.634	39.2	42.8	23.7	81.7	26.5	32.9	32.0	24.8	24.0	W	1	W	1	W 2.5	5	0.110									snow	22	
23	29.570	34.8	29.554	35.0	29.5	21.0	87.4	11.8	23.8	22.7	25.8	25.0	W	1	W	1	W 2.5	6	0.160									snow	23	
24	29.536	35.0	29.668	35.0	30.8	21.3	66.6	17.8	27.2	27.3	21.0	20.6	W	1.5	W	0.5	W 3	2	0.010									snow	24	
25	29.510	33.8	29.022	37.2	36.3	12.6	45.2	2.6	33.8	33.0	35.6	35.4	S	2	SW	1	SSW 3	12	0.200									snow, sleet	25	
26	28.748	38.5	28.804	40.6	38.4	34.1	45.0	31.8	36.8	36.4	37.0	36.6	SE	0.5	W	2	W 2.5	14	0.250									Fog	26	
27	29.158	38.7	29.406	38.7	37.4	30.6	85.2	27.4	33.6	31.6	32.0	30.4	W	2	W	1	W 2	4	0.050									hail, snow	27	
28	29.532	36.6	29.370	37.2	34.8	27.1	65.0	17.1	30.5	30.0	28.7	27.0	W	1	W	0.5	W 1	2	0.010											28
29																														29
30																														30
31																														31
Sums.	837.906	1100	837.430	1139.7	119.2	836.3	1455.4	666.9	962.2	962.2	967.3	934.7	27.0	23.5			125	1717												
Means.	29.912	39.6	29.908	40.7	39.97	29.87	69.84	23.8	34.36	33.18	34.55	33.56	0.96	0.84			4.46	0.061												
† Total Corrections for Instrumental Errors.	-0.013		-0.013		+0.2	+0.1	0	-0.2	0	0	0	0																		
† Corrections for Diurnal Range.																														
† Corrected Means.	29.912	39.6	29.895	40.7	40.2	30.0	69.8	23.6	34.4	33.2	34.5	33.6	0.96	0.84			4.46	0.061												
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

BAROMETER, "corrected mean" at 9 A.M., minus the Correction††, for Temp. (Col. 2), = 29.882 *at level of school*
"Corrected Mean" of Barometer at 9 P.M., minus the Correction††, for Temp. (Col. 4), = 29.895
Mean at Station, corrected, and at 32°, = 29.872 29.977
Correction for height, 195½ feet above Mean Sea-level, = +0.221 +0.116
Mean, reduced to 32°, and Sea-level, = 30.093 30.093
Highest Reading, corrected for Index error, on the 18 th, = 30.399 30.504
Lowest Do. Do., on the 26 th, = 28.735 28.840
Difference, or Monthly Range, = 1.664 1.664

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 21 th, = 47.2
Lowest in Month, corrected for Index errors, on the 25 th, = 12.7
Difference, or Monthly Range, = 34.5
"Corrected Mean" of all the Highest, (Col. 5), = 40.2
"Corrected Mean" of all the Lowest, (Col. 6), = 30.0
Difference, or Mean Daily Range, = 10.2
Calculated Mean Temperature of Month, = 35.1
S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 18 th, = 91.7
"Corrected Mean" (Col. 7), of Black Bulb, Max. in Sun, = 69.8
Lowest at Night, Black Bulb, (corrected for Index errors), on the 25 th, = 2.4
"Corrected Mean" (Col. 8), of Black Bulb, Min. on grass, = 23.6
Difference of above Means or Range ("exposed"), = 46.2

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 34.34
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 33.4
Computed Temperature of Dew-Point, = 31.87
Do. Elastic Force of Vapour, = 0.179 in.
Do. Weight of Vapour in a Cubic Foot of Air, = 2.1248
Relative Humidity, (Saturation = 100), = 88.5 89
RAIN fell on 24 Days; Amount in Inches, 1.717
WIND. SUMMARY.
Direction. N. NE. E. SE. S. SW. W. NW. Variable. Mean Force. Mean Velocity in miles per day.
A.M. 2 0 0 3 3 4 3 12 1 0.96
P.M. 2 1 0 2 2 8 2 14 0 0.84
Mean 2 1 0 2 2 6 2 13 0 0.90 -0.816

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 3d; those from Other Places, not later if possible than the 6th. This Schedule not to be Gunned or Fastened, and Forwarded by Book Post, prepaid. Evaporation = 0.857 in.

Observations made and Return verified by Alex. Beverley assisted by Mr. Alex. Crundell, 12 Rote St. Aberdeen

Actual readings at 9 a.m. School, same day shown
Highest 30.511
Lowest 28.865
mo. Range 1.656

S. B. The irregularities in the Hygrometer readings on one or two days arose from the water &c being frozen

(Signed) Alex. Beverley
Greatest daily range = 23.7° on the 25 th

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS, WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the objects of immediate importance that the Scottish Meteorological Society has proposed to itself, is to secure a *perfect uniformity* in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different observations; and it is found that differences between the Returns from any 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 persons 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 completeness 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 o'clock (Greenwich or Railway Time only) twice a-day for some, and once (morning or evening) for other instruments, as specified, in the following remarks, or at the top 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 at what time it was taken, if not at 9 o'clock.

Barometer.—*Weather glasses* and *Aneroids*, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with such means of *adjustment* or *compensation* as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a *Standard*.

Two moderate-sized Barometers have been approved of by the Council: if properly tested and attended to, they are both well adapted to Meteorological purposes.

An excellent Barometer is constructed by Mr. Aie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-indices* are not nine 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 form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leaden, and turn by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; and then 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*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *screw up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may 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 when, on inclining the instrument so that the mercury strikes the top of the tube, a *sharp tap* is produced. If this is prevented by air, it may be removed to the cistern, and got rid of by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be rejected.

The Barometer should be suspended in a *good light*, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire.

In taking an *Observation*, the attached Thermometer is first noted; the tube must then be gently tapped, and the cistern adjustment carefully made. By raising and lowering the eye, 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 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 greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians.

Self-Registering Thermometers.—Professor Phillips, and Negretti and Zambra's Patent "*Maximum*" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "*Minimum*" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "*Maximum*." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *column* of spirit breaks, it may be renewed by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be discoloured from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

The above remarks apply equally to the Thermometers for registering the greatest heat from the sun's rays, and the least

from radiation during night. Their bulbs have a black coating which may easily be made, or mercuried, by the application of a mixture of lamp black 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.

Vitification 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, and especially the "*Maximum*," 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. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Society.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "*Hygrometrical Deductions*," 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 placed to the side, and a little below the level of the wet bulb,—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.

One form of "*Mason's*" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the recommended requirements shall be complied with as far as possible.

Reading of the Thermometers.—Great care must be taken to avoid the effects of refraction, by bringing 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,—59.9, 40.0, or 40.1; or again, 40.4, 40.5, or 40.6, according as it indicates a *little under*, an exact coincidence with, or a *little over* 40°, or 40½°, respectively. So also 40½°, and 40.7, or 40.8 respectively. In reading Rutherford's "*Max*," and "*Min*," Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

Hour of observation.—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 2d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Wind.—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the mean direction must be taken, and when it is stationary, and always when the wind is feeble, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, etc.

Careful observations ought to be made on the changes in the direction of the wind; and during storms, it is earnestly recommended that extra observations be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results.

The Council recommend that every observatory be furnished with a Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the 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, Lind's Anemometer is also recommended; the method of *Defining* Wind Force by such tables as that given in the schedule is to say the least, unsatisfactory.

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly from unfavorable situation for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

Snowfalls may, for convenience, be registered in the rain columns; under the following conditions:—When a Snow shower occurs it must 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 indicated 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 Lake Howard's

nomenclature of clouds will, food on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e., within 20° or 30° of the zenith). The *form* of clouds that appear near the horizon are viewed obliquely, thus being unable to judge of their amount, we ought not to take them into account in the *clouds* column, though their apertures and changes ought to be noted among the "*Remarks*," the amount of cloud is entered from a scale of 0 to 10; thus, the sky overhead is *half covered* by clouds, 5 is entered as *observation*, and so on.

Observations of the clouds made at 9 A.M. and at sunset, as illustrating the condition and trends of the upper and lower regions of the atmosphere. Entries in the schedule are to be made in the following manner:—In the column "*Velocity* 6, S. W. 2 W. (for example) will indicate that the and Direction," 2 W. (for example) will indicate that the

upper strata of clouds travel in *extreme* velocity from S.W., and those in the lower region from W., with one-third the (extreme) speed of the former, gaining in the second "*Cloud*" column, an entry of 4, S. (it will indicate that the higher

regions are covered to the "*amount*" of 4 tenths with *strife* clouds; and that the sky is *freely* observed to the extent of 2 tenths by lower clouds of the *middle-strata* kind.

Shadows.—The number of rain in which objects in the sun's rays cast shadows, should be entered in the proper column.

Underground Thermometers.As the germination and health of crops and plants greatly depend 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 placed in the ear their bulbs being sunk to 3, 12, and 22 inches, and the stem-pipe ground protected from the sun's rays, and fitted with slung tin collars, to prevent rain-water being conveyed to the bulb by the stems or wooden frames. Mention must be made of the *glacial* formation and general natural condition of the soil in which these Thermometers are placed.

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 very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus from the ends of piers and rocks round the coast where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. No convenient extra sea observations might be taken for other greater depths, noting always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottoms of wells ought, when accessible, to be taken, and the depth of the well and of the water noted.

Ozone.—Mention whether Southey's or Mollat's papers are used. The paper is affixed by pin to a board in the thermometer box, and the indicator registered at 9 A.M. and 9 P.M. It is desired that these indicators be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3 $\frac{1}{2}$, as an ozone entry in the schedule, will indicate that an ozone paper is tinted as 4 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4 3," i.e., as it is blowing fresh.

Electricity.Too much importance cannot be attached to electric condition of the atmosphere in connection with terrestrial magnetism, and as a meteorological phenomenon. A proper Electrometer is necessary to very complete meteorological observation.

Remarks.—The "*Remarks*" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no rubric has been given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, 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, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purpose, from that headed "*Remarks*." It is intended that observations by the Electrometer should be entered in this manner on the side margin. Additional remarks may be made on the margin.

Observations in connection with the periodic return of the seasons," possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; 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 selected pieces of ground or firm.

The Council recommend that *year day* observations be taken;—viz., on the 21st days of March, June, September, and December.

Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the makers.

The Council recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable 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, 19th November 1880.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First appear.	In Leaf.	Dyed out of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Out 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,		
Bouretree or Elder,		Black Currant,			Curlow,		
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 Crane,		
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.

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland,

MR ALEXANDER BUCHAN,



INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS, WITH REMARKS ON THE USE OF INSTRUMENTS.

One of the objects of immediate importance that the Scottish Meteorological Society has proposed to itself, is to secure a *perfect uniformity* in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different observations; and it is found that differences between the Returns from any 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 persons 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 o'clock (Greenwich or Railway Time only) twice a-day for some, and once (morning or evening) for other instruments, as specified in the following remarks, or at the top of the scale. 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 at what time it was taken, if not at 9 o'clock.

Barometer.—*Weather glasses* and *Anemoids*, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with such means of *adjustment* or *compensation* as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a *Standard*.

Two moderate-priced Barometers have been approved of by the Council: if properly tested and attended to, they are both well adapted to Meteorological purposes.

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with 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 form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; then, compasses being 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, and is brought by the adjusting screw, *to form one straight line* with those of the 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*.

When a Barometer, having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *seize up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upmost. 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 when, on inclining the instrument so that the mercury strikes the top of the tube, a *slight tap* is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired.

The Barometer should be suspended in a good *ladle*, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire.

In taking an Observation. the attached Thermometer is first noted; the tube must then be gently tapped and the cistern-adjustment carefully made. By raising and lowering the eye, 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 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 greatly facilitate an accurate adjustment and reading of the Barometer.

Adjustment of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians.

Self-registering Thermometers.—Professor Phillips, and Negretti and Zambetti's Patent "Maxima" Thermometers are recommended: printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maxima." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *columns* of spirit breaks, it may be re-ventilated by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

The above remarks apply equally to the Thermometers for registering the greatest heat from the sun's rays, and the least

from radiation during night. Their bulbs have a black coating, which may easily be made or mended, by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "Maxima" 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.

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, and 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. For comparison of Thermometers a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested* form of this apparatus seriously vitiate the "Hygrometrical Deductions" 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 supported; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulb;—the mouth 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 mouth 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. One form of "Mason's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the forementioned requirements shall be complied with, as far as possible.

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing 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, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½, respectively. So also 41½, and 40½, more or less must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "Max" and "Min" Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so 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 2d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

Wind.—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the mean direction must be taken; and when it is stationary, and always when the wind is feeble, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, etc.

Careful observations ought to be made on the changes in the direction of the wind; and during storms, it is earnestly recommended that extra observations be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results.

The Council recommend that every observatory be furnished with a Hemispherical Cup Anemometer;—a self-registering instrument which shows the Amount of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind, at any particular hour of observation, Lind's Anemometer is also recommended; the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation, and partly from the deleterious nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

Snowfalls may, for convenience, be registered in the rain columns, under the following conditions:—when a Snow shower occurs it must 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 indicated 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 Luke Howard's nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere 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 ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is *half covered* by clouds, 5 is entered as the *observation*, and so on. Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and extents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," 2, W., (for example) 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 (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of $\frac{2}{2}$, cu-st., (*eq.*) 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.

Sunshine.—The 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 health of crops and plants greatly depend on the temperature of the soil,—its amount and consistency,—the Council recommend that observations in this interesting department be made at 9 A.M., by Thermometers placed in the earth, their bulbs being sunk to 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. Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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 very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, nothing always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottoms of wells ought, when practicable, to be taken, and the depth of the well and of the water noted.

Ozone.—Mention whether Schloibach's or Meiffert's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication 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 3½, 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—6 is "4" + ½, that is *blowing fresh*.

Electricity.—Too much importance cannot be attached to electric condition of the atmosphere in connection with terrestrial magnetism, and as a meteorological phenomenon. A paper Electrometer is necessary to every complete meteorological observatory.

Remarks.—The "Remarks" column is too narrow, but unfortunately so. 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 recognised and in use at Greenwich and Southampton, 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, aurora borealis, remarkable depressions and elevations of the barometrical thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purposes, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner or on the side-margin. Additional remarks may be made on the margin.

Observations in connection with the periodic return of the seasons" possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Schedules may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of bulbs; and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm.

The Council recommend that *term* day observations be taken;—viz., on the 21st days of March, June, September, and December.

Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the makers.

The Council recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

EDINBURGH

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland,

MR ALEXANDER BUCHAN,

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Mar. 1873

EDINBURGH

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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.	CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Out 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,		
Bountree 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.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *Seaford Cottage, Whitehill, Aberdeen*, County of *Aberdeen*, in Lat. *57° 8' 8" N*, Long. *2° 28' 46" W*, Distance from Sea *2.87* miles.
Height of Cistern of the Barometer above Mean Sea-level *195½* feet, above Ground *4½* feet.

During the MONTH of *April* 187 *3*.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	B.V. BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No. 2237				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.	OZONE.	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.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs. 92m.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		Barometer. No. 236	Attached Thermometer	Barometer. No. 236	Attached Thermometer	Max. No. 123	Min. No. 123	Max. No. 123	Min. No. 123	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force (0-6).	Direction.	Force (0-6).	9 h. A.M. No. 236	9 h. P.M. No. 236	9 h. A.M. No. 236	9 h. P.M. No. 236	No. 1 inches.	No. 2 inches.	No. 3 inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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NOTATION USED IN GENERAL REMARKS.

a.	denotes aurora.	m.	denotes meteor.
ci.	cirrus.	ms.	mesoceros.
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.	sn.	snow.
h. fr.	hoar-frost.	slet.	sleet.
h. d.	haze.	so. h.	solar halo.
h. l.	heavy dew.	sq.	squall.
h. l.	hail.	sq.	squall.
li. cl.	light clouds.	t.	thunder.
li. sh.	light showers.	t. s.	thunder storm.
li. co.	lunar corona.	w.	wind.
li. h.	lunar halo.	g.	gale of wind.

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†† = 29.822
for Temp. (Col. 2), = 29.873, minus the Correction†† = 29.830
“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† = 29.830
for Temp. (Col. 4), = 29.885, minus the Correction†† = 29.830
Mean at Station, corrected, and at 32°, = 29.826 29.929
Correction for height, 195½ feet above Mean Sea-level, = +0.217 +0.114
Mean, reduced to 32°, and Sea-level, = 30.043 30.043
Highest Reading, corrected for Index error, on the 9 th, = 30.325 30.418
Lowest Do. Do. on the 6 th, = 29.365 29.469
Difference, or Monthly Range, = 0.960 0.959

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 30 th, = 57.5
Lowest in Month, corrected for Index errors, on the 24 th, = 31.8
Difference, or Monthly Range, = 25.7
“Corrected Mean” of all the Highest, (Col. 5), = 49.3
“Corrected Mean” of all the Lowest, (Col. 6), = 38.2
Difference, or Mean Daily Range, = 11.1
** Calculated Mean Temperature of Month, = 43.8

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 29 th, = 117.0
“Corrected Mean,” (Col. 7), of Black Bulb, Max. in Sun, = 97.9
Lowest at Night, Black Bulb, (corrected for Index errors), on the 21 th, = 20.5
“Corrected Mean,” (Col. 8), of Black Bulb, Min. on grass, = 32.3
Difference of above Means or Range (“exposed”), = 65.6

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry

Bulb, (Cols. 9 and 11), = 43.4
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 41.7
Computed Temperature of Dew-Point, = 39.7
Do. Elastic Force of Vapour, = 0.245 in.
Do. Weight of Vapour in a Cubic Foot of Air, = 2.80 grs
Relative Humidity, (Saturation = 100), = 87.8 87

RAIN fell on 21 Days; Amount in Inches, = 1.019
Rat. 1.019

WIND.		SUMMARY.			
Direction.		N	NE	E	SE
A.M.		9	5	0	3
P.M.		6	2	0	6
Mean.		8	3	0	4
		8	4	0	4
		4	2	4	0
		8	0	8	0

N.B.—The Sums to be correctly added and the Means deduced. Returns from the “Principal Towns” should be in Edinburgh not later than the 3d; those from Other Places, not later if possible than the 6th. This Schedule not to be Gunned or Fastened, and Forwarded by Book Post, prepaid.
Evaporation = 2.019 inches.

Observations made and Return verified by { Alexander Beverley, assisted by Serjeant Spruce, Sanitor, Grammar School, Aberdeen

(Signed) Alex. Beverley

* Same days and hours, actual readings at Grammar School

Highest 30.493
Lowest 29.469
Range 0.972

Greatest daily range = 17.6 on the 8th = 17.6
= 17.6 on the 14th

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS, WITH REMARKS ON THE USE OF INSTRUMENTS.

One of the objects of immediate importance that the Scottish Meteorological Society has proposed to itself, is to secure a *perfect uniformity* in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different observations; and it is found that differences between the Returns from any 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, &c. It is therefore hoped, that those persons who kindly furnish Reports to the Society will by 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 o'clock (Greenwich or Railway Time only) twice a-day for some, and once (morning or evening) for other instruments, as specified, in the following remarks, or at the top 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 at what time it was taken, if not at 9 o'clock.

Barometer.—Weather glasses and aneroids, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with such means of *adjustment or compensation* as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a *Standard*.

Two moderate-sized Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted to Meteorological purposes. An excellent Barometer constructed by Mr. Adie of London, the use of which is attended with the great convenience of requiring no *adjustment* of the cistern. Its *scale-bulbs* are so constructed that so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of lead, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; their coincidence being 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 *zenith*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *screw up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may 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 when, on inclining the instrument so that the mercury strikes the top of the tube, a *slight top* is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be replaced in its original position. The Barometer should be suspended in a good *light*, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire.

In taking an *Observation*, the attached Thermometer is first noted; the tube must then be gently tapped and the cistern-adjustment carefully made. By raising and lowering the eye, 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 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 greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from nearby local influences. The laths forming the sides and doors of the Boxes are arranged so as to once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians, *Self-registering Thermometers*.—Professor Phillips's, and Negretti and Zambra's Patent "Meteorium" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Meteorium" Thermometer of Rathfriland is recommended when graduated on the glass scale and affixed to a frame separate from the "Meteorium". This Thermometer is liable to two disadvantages, both of which must be guarded against, and may be easily remedied by an observer. When the *columns* of spirit breaks, it may be re-acted by striking the instrument repeatedly against the palm of the hand, when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate, and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

The above remarks apply equally to the Thermometers for registering the greatest heat from the sun's rays, and the least

from radiation during night. Their bulbs have a black coating, which may easily be made, or melted, by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "Meteorium" 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.

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, underpins 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 and especially the "Meteorium" 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. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "Hygrometric" Deductions, 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 placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs—the mesh 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 mesh is always *clean and moist*, and by the water pump. 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 copious evaporation will proceed as from the moist cloth in ordinary circumstances.

One form of "Thason's" Hygrometer is highly objectionable, the frame of the Thermometers is enclosed in a tin case, which also supports the water-cup underneath. This arrangement must be immediately altered by putting the boxwood frame out of the tin case, and hanging them side by side, so that the *functional* requirements shall be complied with, as far as possible.

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing 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°·4, 40°·0, or 40°·1; or again, 40°·4, 40°·5, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½, respectively. So also 40½, and 40¾, more or less must be registered 40·2 or 40·3, and 40·7 or 40·8 respectively. In reading Rathfriland's "Meteor" and "Meteorium" Thermometers, the reading of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

Hour of observation 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 24 are those of a series of phenomena commencing at 9 P.M. on the 24, and extending till 9 P.M. on the 25.

Wind.—A wind-vane ought to be elevated 12 feet, at least above surrounding objects. When it oscillates frequently, the mean direction must be taken; and when it is stationary, and always when the wind is feeble, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, &c.

Careful observations ought to be made on the changes in the direction of the wind; and during storms, it is extremely recommended that extra observations be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results.

The Council recommend that every observatory be furnished with a Hemispherical-Cup Anemometer—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the 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, Lind's Anemometer is also recommended; the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from defective situation for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unquestionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

Snow-gauges.—For convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs it must be noted in the "Remarks"; and the latter S column must be measured in some open place where no drift of the snow must be measured in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as indicated 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 Luke Howard's nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere 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 *cloud* column, though their appearances and changes ought to be noted among the "Remarks". The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is *half covered* by clouds, 5 is entered as the *observation*, 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:—In the column "Velocity and Direction," 2, W., (for example) 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 (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of 2, *ci-st.*, (*ci-g.*) 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.

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

Underground Thermometers.—As the temperature and health of crops and plants greatly depend 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 placed in the earth, their bulbs being sunk to 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. Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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 very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 11th, 15th, and 20th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, nothing always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottoms of wells ought, when practicable, to be taken, and the depth of the well and of the water noted.

Ozone.—Mention whether Scholbein's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication 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 3½, 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 0-6 is "4"; i.e., that it is *blowing fresh*.

Electricity.—Too much importance cannot be attached to electric condition of the atmosphere in connection with terrestrial magnetism, and as a meteorological phenomenon. A proper Electrometer is necessary to every complete meteorological observatory.

Remarks.—The "Remarks" column is too narrow, but unavoidably so. 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 recognized and in use at Greenwich and Southampton, 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, &c. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometrical thunder storms, and remarkable falls of snow, hail, or rain, the hour of on storms as have been limited at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner on the side-margins. Additional remarks may be made on the margin.

"Observations" in connection with the periodic return of the seasons, possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specific sorts reared from year to year on a selected piece of ground or farm.

The Council recommend that *every day* observations be taken—viz., on the 21st days of March, June, September, and December. Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the makers.

The Council recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

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 or Rained.
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 Crane,		
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.

EDINBURGH

General Post Office Buildings,
Secretary of the Meteorological Society of Scotland,



MR ALEXANDER BUCHAN,

Alexander
April 1873

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Seafield Cottage, Rubishaw, Aberdeen, County of Aberdeen, in Lat. 57° 8' 46" N, Long. 2° 8' 46" W, Distance from Sea 287 1/3 miles.Height of Cistern of the Barometer above Mean Sea-level 195 1/2 feet, above Ground 4 1/2 feet.During the MONTH of May 1873.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER, <i>N.Y.</i> No. 2237				WIND.				RAIN.		CLOUDS.				THERMOMETERS. under Ground.			SEA.	OZONE.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. <i>Mention the hour at which Storms began and ended.</i>	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs, on Sun's rays.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		No. of hours in which it fell.	Amount in inches.	A.M.		P.M.		9 h. A.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		Barometer. No. 236	Attach- ed Ther- mometer	Barometer. No. 236	Attach- ed Ther- mometer	Max. No. 236	Min. No. 236	Max. in Sun's rays No. 236	Min. on Grass. No. 236	Dry bulb. No. 236	Wet bulb. No. 236	Dry bulb. No. 236	Wet bulb. No. 236	Direc- tion.	Force No. 236	Direc- tion.	Force No. 236			No. of hours in which it fell.	Amount in inches.	Velocity, (0-10), and Direc- tion.	Amount, (0-10), and Direc- tion.	Velocity, (0-10), and Direc- tion.	Amount, (0-10), and Direc- tion.	No. 8 inches.					No. 12 inches.	No. 22 inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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BAROMETER, "corrected Mean" at 9 A.M., minus the Correction $\frac{1}{100}$ for Temp. (Col. 2), = 29.693 *allow*
"Corrected Mean" of Barometer at 9 P.M., minus the Correction $\frac{1}{100}$ for Temp. (Col. 4), = 29.713 *Gran. Sel.*
Mean at Station, corrected, and at 32°, = 29.703 29.806
Correction for height, 195 1/2 feet, above Mean Sea-level, = +0.215 + 0.112
Mean, reduced to 32°, and Sea-level, = 29.918 29.918
Highest Reading, corrected for Index error, on the 29 th, = 30.257 30.360
Lowest Do., Do., on the 6 th, = 29.297 29.400
Difference, or Monthly Range, = 0.960 0.960

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 21st th, = 63.5
Lowest in Month, corrected for Index errors, on the 19 th, = 33.4
Difference, or Monthly Range, = 30.1
"Corrected Mean" of all the Highest, (Col. 5), = 52.3
"Corrected Mean" of all the Lowest, (Col. 6), = 40.9
Difference, or Mean Daily Range, = 11.4
** Calculated Mean Temperature of Month, = 46.6
S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected, for Index errors), on the 21st th, = 140.3
"Corrected Mean" (Col. 7), of Black Bulb, Max. in Sun, = 112.0
Lowest at Night, Black Bulb, (corrected for Index errors), on the 19 th, = 19.0
"Corrected Mean" (Col. 8), of Black Bulb Min. on grass, = 32.3
Difference of above Means or Range ("exposed"), = 79.7

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 46.3
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 43.8
†† Computed Temperature of Dew-Point, = 40.9
†† Do. Elastic Force of Vapour, = 0.257 *in.*
†† Do. Weight of Vapour in a Cubic Foot of Air, = 3.01 *grs*
†† Relative Humidity, (Saturation = 100), = 82.8
RAIN fell on 24 Days; Amount in Inches, = 2.691 *See B.*
2.63

WIND.	SUMMARY.									
	Direction	N	NE	E	SE	S	SW	W	NW	Calculated Force.
A.M.	4	3	1	7	3	3	0	8	0	1.23
P.M.	2	1	3	5	3	3	1	10	1	0.94
Mean.	3	2	2	6	3	3	0	9	1	1.08

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 3rd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Evaporation = 2.711 InchesObservations made and Return verified by Alex. Beverly, assisted by Mr. Alex. Cruickshank and Sergt. Spruce, Gram. School(Signed) Alex. Beverly

Greatest

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS.

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the objects of immediate importance that the "Scottish Meteorological Society" has proposed to itself, is to secure a perfect uniformity in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different observations; and it is found that differences between the Returns from any 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 persons 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 o'clock (Greenwich or Railway Time only) twice a-day for some, and once (morning or evening) for other instruments, as specified, in the following remarks, or at the top 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 at what time it was taken, if not at 9 o'clock.

Barometer.—Weather glasses and Aneroids, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with such means of *adjustment or compensation* as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a *Standard*.

Two minute-pieced Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted to Meteorological purposes.

An excellent Barometer is constructed by Mr. Aikin of London, the use of which is attended with the great convenience of requiring no *adjustment* of the cistern. Its *scale-tubes* are not two 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 form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus, by the aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; their coincidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When screws, 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*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *serve up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upright. 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 when, on inclining the instrument so that the mercury strikes the top of the tube, a *sharp tap* is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory pegs, and gently tapping it; and if this plan fails, the instrument must be repaired).

The Barometer should be suspended in a good *light*, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire.

In taking an *Observation*, the attached Thermometer is first noted; the tube must then be gently tapped and the cistern-adjustment carefully made. By raising and lowering the eye, it must be brought into the plane of the vernier, which must be index,—usually the lower edge of the back, which must be carefully adjusted 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 greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box painted white outside, and black within, and fixed 4 feet above grass in an exposed position, free from nearly local influences. The bars forming the sides and doors of the Boxes are arranged so as to open to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-baths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had at the Society's Office.

Self Registering Thermometers.—Professor Phillips's, and Negretti and Zamboni's Patent "Macrumin" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Macrumin" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Macrumin." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *column* of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found in the upper tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

The above remarks apply equally to the Thermometers for

registering the greatest heat from the sun's rays, and the least, from radiation during night. Their bulbs have a black coating, 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 appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is *half covered* by clouds, 5 is entered as the *observation*, 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;—In the column "Velocity" and Direction," (for example,) will indicate that the higher strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former.

Again, in the second "Cloud" column, an entry of $\frac{2}{4}$ enst., (e.g.) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further observed to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

Sunshine.—The 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 health of crops and plants greatly depend 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 placed in the earth, their bulbs being sunk to 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. Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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 very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, noting always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottoms of wells ought, when practicable, to be taken, and the depth of the well and of the water noted.

Ozone.—Mention whether Schönbach's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication 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 S.E., as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "33," on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4"; i. e., that it is *blowing fresh*.

Electricity.—Too much importance cannot be attached to electric condition of the atmosphere in connection with terrestrial magnetism, and as a meteorological phenomenon. A proper observatory is necessary to every complete meteorological observatory.

Remarks.—The "Remarks" column is too narrow, but unavoidably so. 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 recognised and in use at Greenwich and Southampton, 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 on remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, either was unoccupied, or in two ruled off for the purposes, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner on the side-margin. Additional remarks may be made on the margin.

Observations in connection with the periodic return of the seasons, possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation 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 Council recommend that *term day* observations be taken;—viz., on the 21st days of March, June, September, and December.

Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the publishers.

The Council have agreed to recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable 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.

Eninburgh, 9th December 1865.

BOOK-POST.

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In flower.	In leaf.	Deciduous of leaves.	Chops, mentioning variety.	Soaking or planting.	Appearing above ground.	In flower or leaves.	Root cut.
Alder,								
Beech,								
Birch,								
Elm,								
Larch,								
Lime,								
Oak,								
Sycamore or Plane,								

FRUIT.	First in Blossom.	First in Fruit.	First in Ripeness.	First in Generality.
Apple,				
Black Currant,				
Cherry,				
Gean,				
Hawthorn,				
Holly,				
Laburnum,				
Lilac,				
Mezereum,				
Mountain Ash or Hovan,				
Red Flowering Currant,				
Rhododendron Ponticum,				
Whin,				

SHRUBS, ETC.	First in Blossom.	First in Fruit.	First in Ripeness.	First in Generality.
Barberry,				
Bourtee or Elder,				
Black Currant,				
Cherry,				
Gean,				
Hawthorn,				
Holly,				
Laburnum,				
Lilac,				
Mezereum,				
Mountain Ash or Hovan,				
Red Flowering Currant,				
Rhododendron Ponticum,				
Whin,				

NIGHTBLOOMING BIRDS.	First in Blossom.	First in Fruit.	First in Ripeness.	First in Generality.
Cuckoo,				
House-Swallow,				
Lapwing,				
Plover,				
Sand-Martin,				
Starling,				
Swan,				
Rail or Corn Crane,				

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 Hay, Potatoes, disease prevails among cattle; and the Agricultural condition of the district generally.

RECEIVED
JUN 4 1873

Mr. Alexander Buchan
May 1873