SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalmuir Gardens, County of Mid Lothian, in Lat. _____, Long. _____, Distance from Sea 3 miles.

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of January 1866.

The Hours of Observation are of Greenwich Time.

Days	BAROMETER 9 A.M.	BAROMETER 9 P.M.	SELF-REGISTERING THERMOMETERS, Read daily, at 9 P.M. Protected, in shade, 4 feet above Ground. Max.	Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Min. on Grass No.	HYGROMETER. No. 9 h. A.M. Dry bulb	Wet bulb	9 h. P.M. Dry bulb	Wet bulb	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H-Cup Anemometer. No. 9 h. A.M.	9 h. P.M.	RAIN. No. of hours in which it fell.	Amount in inches. No.	CLOUDS. 9 A.M. Velocity, (0—6), and Direction.	Amount, (0—10), and Species.	P.M. Velocity, (0—6), and Direction.	Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS. under Ground. 9 h. A.M. No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at Depth of ___ feet. No. ___	SEA. Temperature at 1 fathom, and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS, As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms began and ended.*	Days of Month.
			°	°	°	°	°	°	°	°															°								
1	28.95	29.19		33			36	35	36	35	W		SW				1														Stormy with showers of Snow	1
2	28.95	29.5		32			37	35	42	40	S		SW																		Wet East Throughout	2
3	29.30	29.35		38			40	365	46	42	SW		W																		Sunshine with passing Clouds	3
				44			48	45	40	395	S		SW																		Overcast with High Wind	4
				32			345	33	335	33	SW		S																		Sunshine, clear & frosty	5
				32			36	34	34	33	S		S																		Do Do Do	6
				32			36	37	42	40	SW		W																		Sunshine with passing Clouds	7
8	28.60	42	28.56	43	43	35	365	35	39	38	NW		NE				1														Rain Am Sunshine PM	8
9	28.46	41	28.46	41	40	33	36	35	39	37	W		W																		Cloudy with slight showers	9
10	28.65	41	29.05	39.5	39	32	33	325	27	26	N		NW																		Clear, but very cold	10
11	29.09	30	29.06	32	36	17	19	165	275	27	SW		SW																		Do Do Do	11
12	29.44	335	29.55	325	31	195	21	20	24	235	SW		SW																		Sunshine Throughout	12
13	28.90	35	29 —	39	47	21	38	365	45	435	S		SW				1														Cloudy with rain	13
14	29.15	45	29.04	46	53	42	49	48	50	48	SSW		SW				1														Do Do	14
15	29.19	43	29.46	44	40	50	41	38	36	36	SW		W				1														Cloudy with Snow & Rain	15
16	29.26	45	29.50	43	41	36	39	385	41	39	S		SW				1														Overcast with rain	16
17	29.60	42	29.53	46	51	34	39	385	51	495	S		W				1														Do Do	17
18	29.53	46	29.29	49	52	46	46	44	49	46	W		S																		Sunshine till 3 PM Overcast	18
19	28.99	46	29.12	46	50	42	445	42	46	39	SW		SW																		Sunshine with passing Clouds	19
20	28.98	46	29.30	45	45	36	415	40	365	38	S		SW																		Overcast Throughout	20
21	29.21	44	29.21	45	45	31	43	41	44	42	W		SW																		Sunshine & Cloudy	21
22	29.30	440	29.30	44	45	38	405	36	43	41	SW		SW																		Sunshine with passing Cl	22
23	30.10	44	30.10	44	46	34	365	37	42	38	SW		W																		Sunshine Throughout	23
24	30.21	45	30.21	46	47	37	45	44	45	43	W		W																		Overcast throughout	24
25	30.15	475	30.20	49	51	41	46	44	465	46	W		W																		Sunshine with passing Clouds	25
26	30.16	50	30.12	50	50	41	46	45	44	42	S		SW																		Cloudy throughout	26
27	29.96	49	29.80	48	47	42	45	42	445	415	SSW		SSW				1														Cloudy with a little Sun	27
28	29.50	48	29.25	48	48	42	49	46	44	42	SSW		SSW				1														Sunshine AM Rain PM	28
29	29.16	44	29.26	44	44	32	35	33	395	37	SW		NW				1														Dull with Showers of Snow & Rain	29
30	29.77	42	29.70	42	35	29	31.5	305	35	33	SSW		SSW																		Overcast throughout	30
31	29.24	432	28.99	45	46	33	415	40	45	445	S		S					1.40													Do Do	31
Sums.	915.38	1512.4	922.0	122	1089	1310	1210	1165	1370	1145																								
Means.	29.303	430					39.2	37.6	44.2	35.7																								
† Total Corrections for Instrumental Errors.	+.060		+.060			-.4	+.5	+.5	+.5	+.5																								
‡ Corrections for Diurnal Range.																																		
"Corrected Means."	29.363					.347	39.7	38.1																										
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	31			

Sans.

1 28.95 29.19
2 28.95 29.5
3 29.30 29.35

Corrections of Barometer received 9th March 1866

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction++ for Temp. (Col. 2), = 29.363 − .038 = 29.325

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

Mean at Station, corrected, and at 32°, = 29.325

Correction for Height, feet, above Mean Sea-level, = 209

Mean, reduced to 32°, and Sea-level, = 29.534

Highest Reading, corrected for Index error, on the 24th, = 30.210

Lowest Do., Do., on the 9th, = 28.460

Difference, or **Monthly Range,** = 1.750

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month** (corrected for Index errors), on the 14th, = 53.0

Lowest in Month, corrected for Index errors, on the 11th, = 16.6

Difference, or **Monthly Range,** = 36.4

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 44.2

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 34.7

Difference, or **Mean Daily Range,** = 9.5

** Calculated **Mean Temperature** of Month, = 39.4

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

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

Lowest at Night, Black Bulb, (corrected for Index errors), on the ___th, = ____

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** = 39.7

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** = 38.1

‡‡ Computed **Temperature of Dew-point,** = 36.0

‡‡ Do. **Elastic Force of Vapour,** = .212

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

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

RAIN fell on 10 **Days; Amount in Inches,** = 1.90

WIND, SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	0	0	0	12	11	6	1	0		
P.M.	0	1	0	0	7	13	8	2	0		
Mean.	0	0	0	0	10	12	7	2	0		

A

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

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 2nd; 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.

Observations made and Return verified by { ____ ____

(Signed) W. Thomson

P

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

BOOK-POST.

Dalkeith
Jan 1866

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 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; 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 adjustible 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 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 black within, 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 at the Society's Office.

Self-Registering Thermometers.—Professor Phillips's, 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 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 lobe, 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 "*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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes, that has not 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 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 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 40¼°, and 40¾°, more or less, must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "*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 *3rd* are those of a series of phenomena commencing at 9 P.M. on the *2nd*, and extending till 9 P.M. on the *3rd*.

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, extra observations ought to 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 would strongly 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.

Snow-falls 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 indeed in every column, the observer cannot be too careful to register *observations* only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for 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 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" $\frac{6, \text{S.W.}}{2, \text{W.}}$, (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 $\frac{4, \text{st.}}{2, \text{cu-st.}}$ (*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.

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 Schönbein's or Moffat's papers are used—Moffat's are preferred. 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 $3^{\text{N.W.}}_{4}$, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—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 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, auroræ boreales, 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, 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 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. For these hourly observations separate schedules will be furnished to observers.

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 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.

EDINBURGH, 9th December 1863.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry, ...		Apple, ...			Cuckoo, ...		
Bourtree or Elder, ...		Black Currant, ...			Curlew, ...		
Broom, ...		Cherry, ...			House-Swallow, ...		
Hazel, ...		Gean, ...			Lapwing, ...		
Hawthorn, ...		Gooseberry, ...			Plover, ...		
Holly, ...		Peach, ...			Sand-Martin, ...		
Laburnum, ...		Pear, ...			Starling, ...		
Lilac, ...		Plum, ...			Swan, ...		
Mezereon, ...		Strawberry, ...			Rail or Corn Crake, ...		
Mountain Ash or Rowan,...					Other Birds, naming them—		
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 Dalkeith Garden's, County of Mid Lothian, in Lat. ______, Long. ______, Distance from Sea 3 miles.

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of Febuary 1866.

The Hours of Observation are of Greenwich Time.

Electricity	Days of Month	Barometer 9 h. A.M. * No. ___ (inches)	Attached Thermometer 9 h. A.M.	Barometer 6 h. P.M. No. ___ (inches)	Attached Thermometer 6 h. P.M.	Self-Registering Thermometers, Read daily, at 9 P.M. — Protected, in Shade, 4 feet above Ground: Max. No. ___	Min. No. ___	Exposed Black Bulbs: Max. in Sun's rays No. ___	Min. on Grass No. ___	Hygrometer No. ___ 9 h. A.M. Dry bulb	9 h. A.M. Wet bulb	6 h. P.M. Dry bulb	6 h. P.M. Wet bulb	Wind 9 h. A.M. Direction	Force	Wind 6 h. P.M. Direction	Force	Readings of the H-Cup Anemometer No. ___ 9 h. A.M.	9 h. P.M.	Rain: No. of hours in which it fell	Rain: Amount in inches No. ___	Clouds 9 A.M.: Velocity, (0—6), and Direction	Amount, (0—10), and Species	Clouds ___ P.M.: Velocity, (0—6), and Direction	Amount, (0—10), and Species	Sunshine Hours	Thermometers under Ground 9 h. A.M. No. ___ 3 inches	No. ___ 12 inches	No. ___ 22 inches	Temperature of WELL at Depth of ___ feet. No. ___	Sea: Temperature at 1 fathom, and Density	Ozone ...... 0—10. 9 A.M.	9 P.M.	General Remarks, As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. Mention the hour at which Storms began and ended.	Days of Month
		inches.	°	inches.	°	°	°	°	°	°	°	°	°														°	°	°	°	°				
	1	28.90	46	28.84	48	50	39.5			44	43	46	44	SSW		SW																		Fine day with passing Clouds	1
	2	29.0	47	29.26	47	47	41			45	43	41	38.5	SW		W																		Sunshine throughout	2
	3	29.12	44.5	29.20	45	48	34			44	41	39	36	SW		N																		Do with passing Clouds showery	3
	4	29.21	44	29.0	46	51	34			42	40	42	39	SW		SW																		High winds with heavy showers of Rain	4
	5	29.40	44	29.16	45	45	37			39	36	45	44	SW		SW																		Do Do Do Do Do	5
	6	29.10	45.5	29.20	46	52	40			43	41	41	39.5	S		SW																		High winds & rain AM Sunshine PM	6
	7	29.0	45	29.10	45	45	35			40	37.5	42	38	SSW		W																		Do & Sunshine AM Cloudy PM	7
	8	29.28	42	29.41	42	43	35			37.5	36	40	37	SW		NW																		Dull with showers of Snow & Rain	8
	9	29.39	41	29.26	42	43	31			38	36	39.5	39	SE		W																		Cloudy with showers of Rain	9
	10	29.15	40.5	28.95	42	43	31			34.5	34	39	37	SSW		S																		Sunshine with passing Clouds	10
	11	28.90	41	28.82	42	45	33			36.5	36	40	39	S		NE																		Overcast throughout	11
	12	29.10	41	29.21	41	40	32			35	31.5	34	31	NE		N																		Sunshine with passing Clouds	12
	13	29.34	38	29.36	40	37	29			32.5	28.5	32	30	SW		W																		Sunshine throughout but cold	13
	14	29.30	36	29.05	37	35	25			~~39~~ 30	28.5	35	33.5	E		E																		Overcast with Snow	14
	15	29.18	38.5	29.30	39	39	31			36	34	35	33	NE		E					Snow													Overcast throughout	15
	16	29.17	40	29.39	40	37	30			36	35.5	36	35	NE		NE																		Rain & Snow throughout	16
	17	29.64	36.5	29.70	36	36	29			31	29	31	29	N		NE																		Sunshine with a few passing clouds	17
	18	29.43	37	29.73	38	37	27			31.5	31	33.5	33	SW		NE																		Sunshine throughout	18
	19	29.68	38	29.71	40	43	29			36.0	34.5	37	37	SW		E																		Slight rain throughout	19
	20	29.68	39	29.91	38	40	32			34.5	34	31	29	W		SW																		Sunshine with passing clouds	20
29.98	~~21~~	30.10	36	~~28~~ 29.98	37	39	24			28.5	28	36	33	SW		S																		Do Do Do Do	21
	22	29.50	40	29.59	43	46	33			41.5	40	40	38	SW		W																		Do Do Do Showers	22
	23	29.0	43	29.30	42	46	35			45	41	38	34	SW		NW																		Sunshine with a few passing clouds	23
	24	29.42	40	29.25	41	47	32			36	34	39	37.5	SW		S																		Do Do Do Do	24
	25	28.88	40	28.80	41	47	34			38	36	38	35	S		SW					Snow 5													Sunshine AM Snow & cloudy PM	25
38.37	~~26~~	29.10	40	29.30	40	43	28.5			36	34	~~37~~ 38	~~38~~ 37	S		NE																		Cloudy with a little Sunshine	26
	27	29.58	40.5	29.64	40.5	37	31			34	31.5	32	31	E		N																		Overcast throughout with a little Snow	27
	28	29.49	39	29.40	39.5	37	29			29.5	29	28	27	NE		N					Rain 2.80													Snow Storm from 6.30 to 10.30 AM	28
	29																																	Overcast PM	29
	30																																		30
	31																																		31
	Sums.	109 / 8.04	4113 / 23.0			413 / 78	312 / 61.0			3135 / 195.0	3123 / 143.5									Rain 12 / Snow 6 = / Total	2.80 / 0.60 / 3.40														
	Means.	29.287	40.8			42.8	32.2			37.0	35.1																								
	† Total Corrections for Instrumental Errors.	+.060								-.5	-.5																								
	‡ Corrections for Diurnal Range.																																		
	"Corrected Means."	29.347								36.5	34.6																								
	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	31			

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29·347 – ·030 = 29·317

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

Mean at Station, corrected, and at 32°, ... = 29·317

Correction for Height, feet, above Mean Sea-level, ... = ·209

Mean, reduced to 32°, and Sea-level, ... = 29·526

Highest Reading, corrected for Index error, on the 21th, ... = 30·100

Lowest Do., Do., on the 25th, ... = 28·~~880~~ 800

Difference, or **Monthly Range,** .... 1·220 = 1·~~220~~ ~~300~~

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month** (corrected for Index errors), on the 6th, ... = 52·0

Lowest in Month, corrected for Index errors, on the 14th, ... = 25·0

Difference, or **Monthly Range,** .... = 27·0

"Corrected **Mean" of all the Highest,** (Col. 5), ... = 42·8

"Corrected **Mean" of all the Lowest,** (Col. 6), ... = 32·2

Difference, or **Mean Daily Range,** .... = 10·6

** Calculated **Mean Temperature** of Month, ... = 37·5

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** .... = 36·5

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** ...... = 34·6

‡‡ Computed **Temperature of Dew-point,** .... = 31·8

‡‡ Do. **Elastic Force of Vapour,** .... = ·181

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

‡‡ **Relative Humidity, (Saturation** = 100), ... = 84

RAIN fell on 12 **Days; Amount in Inches,** ...... = ~~2·80~~ 3·40

WIND. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	4	2	1	7	12	1	0	0		
P.M.	4	5	3	0	3	6	5	2	0		
Mean.	3	4	2	1	5	9	3	1	0		

A

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

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 2nd; 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.

Observations made and Return verified by ______________________

(*Signed*) Wm Morrison

P

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 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; 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 adjustible 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 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 black within, 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 at the Society's Office.

Self-Registering Thermometers.—Professor Phillips's, 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 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 lobe, 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 "*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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes, that has not 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 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 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 $40\frac{1}{2}$°, respectively. So also $40\frac{1}{4}$°, and $40\frac{3}{4}$°, 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 *3rd* are those of a series of phenomena commencing at 9 P.M. on the *2nd*, and extending till 9 P.M. on the *3rd*.

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, extra observations ought to 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 would strongly 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.

Snow-falls 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 indeed in every column, the observer cannot be too careful to register *observations* only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for 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 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," $\frac{6,\ S.W.}{2,\ W.}$, (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 $\frac{4,\ st.}{2,\ cu\text{-}st.}$ (*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.

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 Schönbein's or Moffat's papers are used—Moffat's are preferred. 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 $3^{N.W.}_{\ 4}$, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—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 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, auroræ boreales, 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, 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 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. For these hourly observations separate schedules will be furnished to observers.

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 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.

EDINBURGH, 9th December 1863.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

BOOK-POST.

Dalkeith
Feb. 1866.

DALKEITH 2 MR 66

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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 Cut or Raised.
Alder, ...					Barley, ...				
Ash, ...					Bere or Bigg, ...				
Beech, ...					Oats, ...				
Birch, ...					Wheat, ...				
Elm, ...					Beans, ...				
Larch, ...					Pease, ...				
Lime, ...					Potatoes, ...				
Oak, ...					Turnips, ...				
Sycamore or Plane, ...					Rye Grass, ...				

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry, ...		Apple, ...			Cuckoo, ...		
Bourtree or Elder, ...		Black Currant, ...			Curlew, ...		
Broom, ...		Cherry, ...			House-Swallow, ...		
Hazel, ...		Gean, ...			Lapwing, ...		
Hawthorn, ...		Gooseberry, ...			Plover, ...		
Holly, ...		Peach, ...			Sand-Martin, ...		
Laburnum, ...		Pear, ...			Starling, ...		
Lilac, ...		Plum, ...			Swan, ...		
Mezereon, ...		Strawberry, ...			Rail or Corn Crake, ...		
Mountain Ash or Rowan, ...					Other Birds, naming them—		
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 *Dalkeith Garden's*, County of *Mid Lothian*, in Lat. ______, Long. ______, Distance from Sea *4* miles.

Height of Cistern of the Barometer above Mean Sea-level *190* feet, above Ground *4* feet. During the MONTH of *March* 186*6*.

The Hours of Observation are of Greenwich Time.

Days of Month	Barometer 9 h. A.M. (inches)	Attached Thermometer 9 h. A.M.	Barometer 6 h. P.M. (inches)	Attached Thermometer 6 h. P.M.	Self-Reg. Therm. Max.	Self-Reg. Therm. Min.	Hygrometer 9 h. A.M. Dry bulb	9 h. A.M. Wet bulb	6 h. P.M. Dry bulb	6 h. P.M. Wet bulb	Wind 9 h. A.M. Direction	Wind 6 h. P.M. Direction	Rain, Amount in inches	General Remarks	Days of Month
1	29.57	39 2/5	29.59	39	40	23	28½	27½	31½	31	E	N	Snow ½	Snow through the night Sunshine am Overcast P.M.	1
2	29.55	41 3/5	29.55	41	44	28	33	32	34½	32½	NW	NW		Cloudy with a little Sunshine	2
3	29.42	40 2/5	29.40	42	42	32	37	36½	36½	35	SW	WSW		Do throughout	3
4	29.65	35 3/5	29.69	39	38	28	31	30	29	28½	NE	NW		Fine & clear throughout	4
5	29.60	39	29.35	37 2/5	39	18 2/5	25½	24	34	32	SW	SSW		Sunshine till 4 P.M. Cloudy	5
6	29.05	39 3/5	29.08	39	39	31	33	32	34	33	SE	SE		Overcast Am Small Snow & Rain P.M.	6
7	29. –	40 2/5	29.14	40 2/5	41	26	31	31	33	31	SE	NW	Snow ·3	Snow till 1 P.M. clear P.M.	7
8	29.62	41 3/5	29.80	40	41	30	35	33½	36	34	E	N		Overcast throughout	8
9	30.05	41 1/5	30.20	42	41	30	38½	37	35½	34	S	NE		Sunshine am passing clouds P.M.	9
10	30.32	41	30.27	42	43	26	32½	32	36½	36	SW	SW		Bright Sunshine throughout	10
11	30.16	43	30.07	45 1/5	51	32	43	42	44	43	WSW	WSW		Slightly overcast throughout	11
12	29.50	44 2/5	29.44	46	49	37	39½	38½	39½	37	W	S		Sunshine with passing clouds	12
13	29.64	43	29.55	43	40	32	34½	33	34½	32½	SE	NE		Sunshine throughout	13
14	29.39	47 2/5	29.25	41 1/5	39	25	31½	30½	35	33	S	SW		Do Do	14
15	29.07	39	28.94	40	45	26	33½	32	35	34½	SSW	SE		Sunshine Am Overcast till 4 Rain P.M.	15
16	29.05	42 4/5	29.09	45	43	34	40	39	42	41	S	SE		Overcast with blinks of Sunshine	16
17	29.12	45 2/5	29.11	45 1/5	45	38	42	41	40½	40	E	E		Sunshine with passing clouds	17
18	29.28	45 4/5	29.36	47 3/5	54	39	42½	43½	41½	41	E	E		Sunshine throughout	18
19	29.41	46	29.35	44	43	35	36½	36	37	36	E	NE		Cloudy with Showers of Snow & Rain	19
20	29.48	44 2/5	29.51	43 3/5	43	33	37	36½	37	35	E	E		Cloudy with blinks of Sunshine	20
21	29.54	41 2/5	29.59	41	41	25½	35½	32½	35	34	E	NE		Sunshine with passing clouds Snow 1.30 till 2 p.m.	21
22	29.66	41	29.62	42	41	22	26½	26	34	33	SW	SW	Snow 3½	Bright Sunshine throughout	22
23	29.41	42 2/5	29.09	44	43	27	28½	27	40½	39	SSE	S	½	Overcast throughout	23
24	28.64	43 3/5	28.89	45 2/5	49	34	40½	40	42½	42	E	E		Sunshine with passing clouds	24
25	29.50	46	29.84	47	47	37½	40	40	41½	41	S	S		Overcast but Mild	25
26	29.90	45 1/5	29.80	49	56	34	43	42	48	46½	SE	SE		Do Do Do	26
27	29.75	50	29.86	52½	53	43	49	47	51½	49	SW	SW		Overcast Am bright sunshine P.M.	27
28	29.82	52½	29.83	54	58	45	51½	50	51	49	SW	S		Sunshine Am Rain from 2 till 4, Cloudy	28
29	29.85	53	29.74	56	56	44	52½	51	54½	51	SW	S		Overcast with Blinks of Sunshine	29
30	29.94	53 2/5	29.96	56	51	45	45	43½	45	43½	SW	W	Rain	Sunshine & showers of Rain Am bright P.M.	30
31	29.78	49	29.71	50	51	36	44	41	42½	40	SSW	SSW	1.70	Sunshine with passing Clouds	31
Sums.	14 11 16·66	4 128 117·4		4 134 140·0	4 12 166	14 1 996·4	13 8 1163·0	10 4 1127·5					Snow 8; ·75 2·45		
Means.	29·538	43·8			44·5	32·1	37·5	36·4							
† Total Corrections for Instrumental Errors.	0		0			–·4	–·5	–·5	–·5	–·5					
‡ Corrections for Diurnal Range.															
"Corrected Means."						31·7	37·0	35·9							
No. of Column.	1	2	3	4	5	6	9	10	11	12	13	15	20		

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29·538 – ·038 = 29·500

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

Mean at Station, corrected, and at 32°, = 29·500

Correction for Height, feet, above Mean Sea-level, = ·209

Mean, reduced to 32°, and Sea-level, = 29·709

Highest Reading, corrected for Index error, on the 10 th, = 30·320

Lowest Do., Do., on the 24 th, = 28·640

Difference, or **Monthly Range,** = 1·680

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

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month** (corrected for Index errors), on the 28 th, = 58·0

Lowest in Month, corrected for Index errors, on the 5 th, = 18·0

Difference, or **Monthly Range,** = 40·0

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 44·5

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 31·7

Difference, or **Mean Daily Range,** = 12·8

** Calculated **Mean Temperature** of Month, = 38·1

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** = 37·0

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** = 35·9

‡‡ Computed **Temperature of Dew-point,** = 34·4

‡‡ Do. **Elastic Force of Vapour,** = ·198

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

‡‡ **Relative Humidity, (Saturation** = 100), = 90

RAIN fell on 8 **Days; Amount in Inches,** = 2·45 ?

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	1	8	4	6	9	3	1	0		
P.M.	2	4	4	4	6	6	3	3	0		
Mean.	1	2	6	4	6	7	3	2	0		

A

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 2nd; 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.

Observations made and Return verified by ______

(*Signed*) Wm Thomson

P

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 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; 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 adjustible 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 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 black within, 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 at the Society's Office.

Self-Registering Thermometers.—Professor Phillips's, 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 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 lobe, 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 "*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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes, that has not 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 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 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 40¼°, and 40¾°, more or less, must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "*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 3*rd* are those of a series of phenomena commencing at 9 P.M. on the 2*nd*, and extending till 9 P.M. on the 3*rd*.

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, extra observations ought to 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 would strongly 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.

Snow-falls 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 indeed in every column, the observer cannot be too careful to register *observations* only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for 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 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," $\frac{6.\ S.W.}{2.\ W.}$, (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 $\frac{4.\ st.}{2.\ cu\text{-}st.}$, (*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.

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 Schönbein's or Moffat's papers are used—Moffat's are preferred. 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 $3^{\frac{S.W.}{4}}$, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—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 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, auroræ boreales, 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, 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 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.

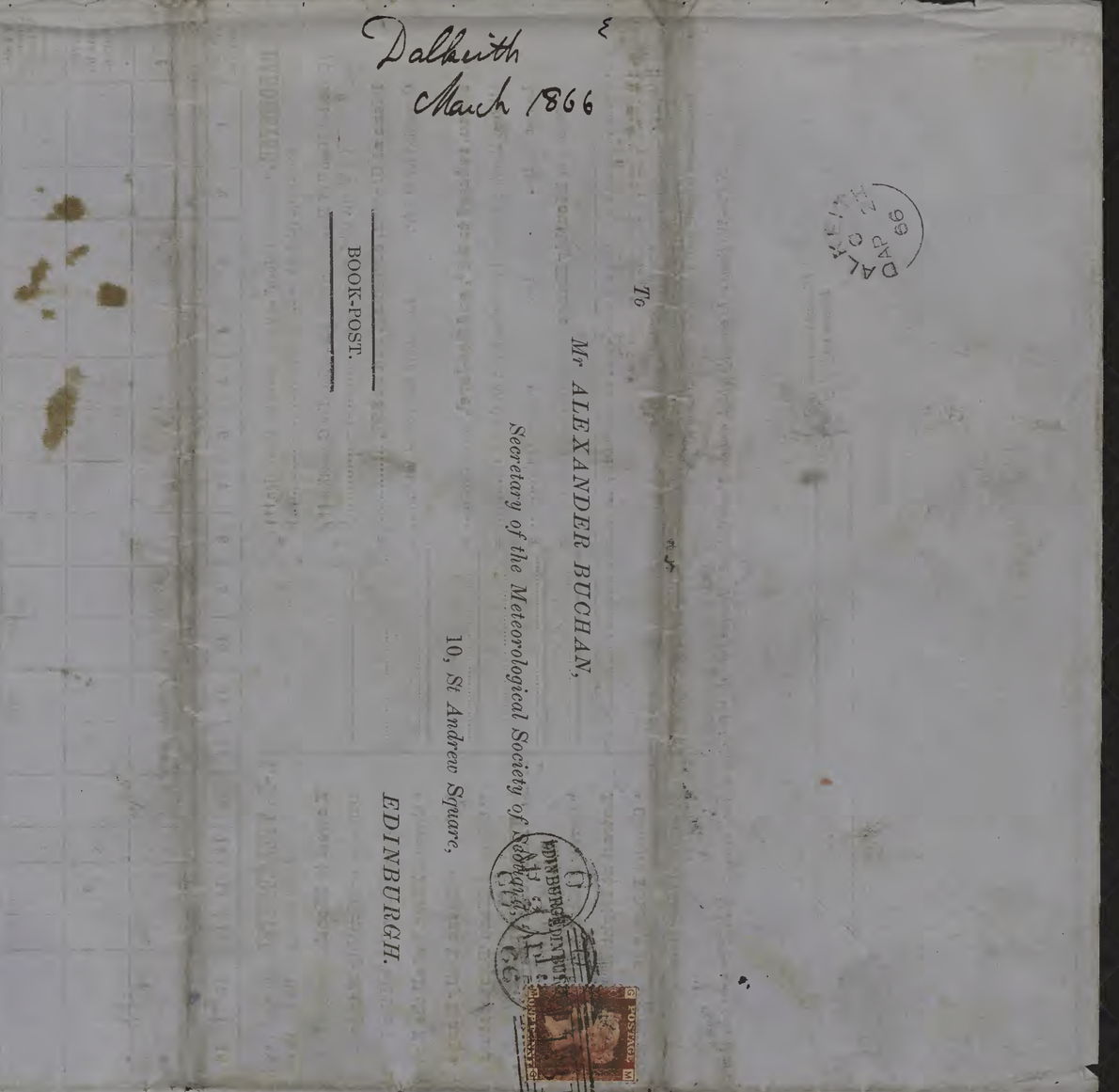
The Council recommend that *term-day* observations be taken;—viz., on the 21st days of March, June, September, and December. For these hourly observations separate schedules will be furnished to observers.

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 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.

EDINBURGH, *9th December* 1863.



OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

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

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

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 Dalkeith Gardens, County of Midlothian, in Lat. ____, Long. ____, Distance from Sea 3. miles.

Height of Cistern of the Barometer above Mean Sea-level 183. feet, above Ground 4 feet. During the MONTH of April 1866.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No.___ (inches)	BAROMETER. 9 h. A.M. Attached Thermometer (°)	BAROMETER. 6 h. P.M. Barometer. No.___ (inches)	BAROMETER. 6 h. P.M. Attached Thermometer (°)	SELF-REGISTERING THERMOMETERS, Read daily, at 9 P.M. Protected, in Shade, 4 feet above Ground. Max. No.___ (°)	Protected. Min. No.___ (°)	Exposed Black Bulbs. Max. in Sun's rays No.___ (°)	Exposed Black Bulbs. Min. on Grass. No.___ (°)	HYGROMETER. No.___ 9 h. A.M. Dry bulb. (°)	9 h. A.M. Wet bulb. (°)	6 h. P.M. Dry bulb. (°)	6 h. P.M. Wet bulb. (°)	WIND. 9 h. A.M. Direction.	9 h. A.M. Force	6 h. P.M. Direction.	6 h. P.M. Force	Readings of the H-Cup Anemometer. No.___ 9 h. A.M.	9 h. P.M.	RAIN. No. of hours in which it fell.	RAIN. Amount in inches. No.___	CLOUDS. 9 A.M. Velocity, (0—6), and Direction.	9 A.M. Amount, (0—10), and Species.	___ P.M. Velocity, (0—6), and Direction.	P.M. Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No.___ 3 inches. (°)	No.___ 12 inches. (°)	No.___ 22 inches. (°)	Temperature of WELL at Depth of ___ feet. No.___ (°)	SEA. Temperature at 1 fathom, and Density. (°)	OZONE. .... 0—10. 9 A.M. 9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms began and ended.*	Days of Month.
	1	29.48	47.5	29.52	48	46	29			40.5	39	38	38	S.E		E																	Overcast with blinks of Sunshine rain P.M.	1
	2	29.54	46	29.69	43.5	41	35			39	38	37	36	S.E		S.E																	Do. with showers of rain hail &c.	2
	3	29.66	44.7	29.58	46	44	34			37	34	40	37	E		W.																	Sunshine with a few passing clouds	3
	4	29.47	43	29.59	46.5	44	31			40	37.5	42	39	S.W.		S.W.																	Do. — Do. — —	4
	5	29.93	45	30.24	47	46	31			39	38	43	39.5	E		E																	Sunshine throughout	5
	6	30.25	45.3	30.26	46	48	32			41.5	39.5	41	39	E		E																	Do. with passing clouds showers P.M. cold winds	6
	7	30.24	47.5	30.03	46	46	35			43.5	42	38	38	E		E																	Overcast A.M. small rain P.M.	7
	8	30.07	46	30.13	49	46	37			39	39	43	41.5	E		E																	Overcast A.M. cloudy P.M.	8
	9	29.7x	47.5	29.96	48.5	47	38			40.5	40	41.5	41	E		E																	Overcast with showers of small rain	9
	10	29.70	47.5	29.68	48	42	39			41	40.5	41	41	E		E.N.E																	Do. — Do. — —	10
	11	29.56	40	29.50	50	52	39			40.5	40	47	45	S.E		E																	Overcast A.M. cloudy P.M.	11
	12	29.55	49	29.54	53	57	41			45	45	51.5	48	E		S.E																	Overcast A.M. Sunshine & cloudy P.M.	12
	13	29.47	53.5	29.47	55	58	44			52	48	47.5	47	S.W.		S.E																	Sunshine & cloudy throughout	13
	14	29.67	53	29.73	55	58	47			49	47	58	53	S.E		S.E																	Sunshine & rain alternate A.M. Sunshine P.M.	14
	15	29.89	53	29.71	55	58	46			47	47	49	47	S.E		S.S.E																	Do. and clouds throughout	15
	16	29.39	44	29.24	55	56	46			49.5	48	48.5	47	S		S.W																	Overcast throughout	16
	17	29.38	53	29.59	55.5	57	44			50	42	50	47	W.		W.																	Do. with blinks of sunshine & rain	17
	18	29.72	53	29.83	52	53	41			44	43	49	45	E		S.E																	Overcast showery	18
	19	29.65	49	29.40	51	52	34.5			41	41	48.5	47	S.E		S.																	Overcast with a little sunshine	19
	20	29.50	50	29.60	52	56	38			46	43	49	45	S.W		W.																	Sunshine with clouds	20
	21	29.90	53	30.05	57	62	35.5			55	52	59	49	S.W.		E																	Sunshine A.M. Sunshine with clouds P.M.	21
	22	30.30	55	30.35	59	65	42			57	52	61	54	S.E		S.E																	Sunshine with clouds	22
	23	30.50	55	30.40	57	63	41			48	45	54	45	S.E		E																	Sunshine throughout	23
	24	30.35	50	30.25	52.5	55	33			44	41	45	43	E		E																	Do. Do.	24
	25	30.20	52	30.10	56	61	32			48	47	58	48.5	E		E																	Sunshine A.M. with clouds P.M.	25
	26	30.05	52	29.95	57	61	33			46	44	60	51	E		E																	Dull 9 A.M. Sunshine P.M.	26
	27	29.80	52	29.60	54	58	37			42	42	50	47	E		E																	Foggy & dull 9 A.M. Sunshine Dull 6 P.M.	27
	28	29.50	53	29.55	52.5	53	39			39	39	44	39	E		E																	Began to rain 8 A.M. Sunshine P.M.	28
	29	29.85	51.5	29.90	51.5	52	34			42	40	40	35	E		N.																	Sunshine and cloudy. Alternate	29
	30	29.85	47	29.75	49.5	51.5	27			41	36	44	37	N.		N.					1.33	~~1.33~~											" " " with cold wind	30
	31																																	31
Sums.		2412	1478.0			1588.5	1115.0			1327.0	1269.5																							
Means.		29.804	49.3			52.9	37.2			44.2	42.3																							
† Total Corrections for Instrumental Errors.							-.4			+.5	+.5	+.5	+.5																					
‡ Corrections for Diurnal Range.																																		
"Corrected Means."							36.8			44.7	42.8																							
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	31		

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.804 – .055 = 29.749

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

Mean at Station, corrected, and at 32°, = 29.749

Correction for Height, feet, above Mean Sea-level, = .209

Mean, reduced to 32°, and Sea-level, = 29.958

Highest Reading, corrected for Index error, on the 23th, = 30.500

Lowest Do., Do., on the 17 th, = 29.380

Difference, or **Monthly Range,** = 1.120

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month** (corrected for Index errors), on the 22th, = 65.0

Lowest in Month, corrected for Index errors, on the 30 th, = 26.6

Difference, or **Monthly Range,** = 38.4

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 52.9

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 36.8

Difference, or **Mean Daily Range,** = 16.1

** Calculated **Mean Temperature** of Month, = 44.8

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** = 44.7

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** = 42.8

‡‡ Computed **Temperature of Dew-point,** = 40.6

‡‡ Do. **Elastic Force of Vapour,** = .253

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

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

RAIN fell on 12 **Days; Amount in Inches,** = 1.33

WIND. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	0	15	8	1	4	1	0	0		
P.M.	2	1	15	5	2	2	3	0	0		
Mean.	2	0	15	6	2	3	2	0	0		

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

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 2nd; 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.

Observations made and Return verified by ____

(*Signed*) Wm Thomson

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 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; 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 adjustible 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 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 black within, 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 at the Society's Office.

Self-Registering Thermometers.—Professor Phillips's, 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 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 lobe, 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 "*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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes, that has not 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 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 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 $40\frac{1}{2}$°, respectively. So also $40\frac{1}{4}$°, and $40\frac{3}{4}$°, 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 *3rd* are those of a series of phenomena commencing at 9 P.M. on the *2nd*, and extending till 9 P.M. on the *3rd*.

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, extra observations ought to 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 would strongly 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.

Snow-falls 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 indeed in every column, the observer cannot be too careful to register *observations* only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for 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 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," $\frac{6,\ S.W.}{2,\ W.}$ (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 $\frac{4,\ st.}{2,\ cu\text{-}st.}$ (*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.

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 Schönbein's or Moffat's papers are used—Moffat's are preferred. 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 $3^{N.W.}_{\ 4}$, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—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 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, auroræ boreales, 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, 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 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. For these hourly observations separate schedules will be furnished to observers.

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 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.

EDINBURGH, 9th December 1863.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

BOOK-POST.

Dalkeith April 1866

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens, County of Midlothian, in Lat. ______, Long. ______, Distance from Sea 3 miles.

Height of Cistern of the Barometer above Mean Sea-level 183 feet, above Ground ______ feet. During the MONTH of May 1866.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No. ___	9 h. A.M. Attached Thermometer	6 h. P.M. Barometer. No. ___	6 h. P.M. Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read daily, at 9 P.M. Protected, in Shade, 4 feet above Ground. Max. No. ___	Min. No. ___	Exposed Black Bulbs. Max. in Sun's rays No. ___	Min. on Grass. No. ___	HYGROMETER. No. ___ 9 h. A.M. Dry bulb.	9 h. A.M. Wet bulb.	6 h. P.M. Dry bulb.	6 h. P.M. Wet bulb.	WIND. 9 h. A.M. Direction.	Force	6 h. P.M. Direction.	Force	Readings of the H-Cup Anemometer. No. ___ 9 h. A.M.	9 h. P.M.	RAIN. No. of hours in which it fell.	Amount in inches. No. ___	CLOUDS. 9 A.M. Velocity, (0—6), and Direction.	9 A.M. Amount, (0—10), and Species.	___ P.M. Velocity, (0—6), and Direction.	P.M. Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. ___ 3 inches.	No. ___ 12 inches.	No. ___ 22 inches.	Temperature of WELL at Depth of ___ feet. No. ___	SEA. Temperature at 1 fathom, and Density.	OZONE. 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS, As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. Mention the hour at which Storms began and ended.	Days of Month.
		inches.	°	inches.	°	°	°	°	°	°	°	°	°														°	°	°	°	°				
	1	29.70	48	29.65	49	46.5	29			41	37.5	39	35.5	N.E		N.E																		A cloudy chilly cold day showers of hail	1
	2	29.50	47.5	29.45	48.5	48	33.5			40	37	41	38	N.E		N.E																		Do " Do showers of hail	2
	3	29.40	47	29.40	48	50	33.5			42.5	40	41	41	N.W		N.W																		Sunshine changeable showery	3
	4	29.55	49	29.60	53	56	33			45	41.5	55	45	S.W		S.W																		Bright sunshine passing clouds	4
	5	29.70	55	29.80	55.5	58	39			49	45	58	49	S.W		S.W																		Do passing clouds	5
	6	30.05	52	30.05	57	60	36.5			49	44	58	49	S.W		S																		Do " Do "	6
	7	30.05	55	29.95	58	62	41			54	48	56	49	S.W		S.W																		Do " Do "	7
	8	29.75	56.5	29.55	58	60	47			53	50	53	50	S.W		S.W																		Dull & showery throughout	8
	9	29.45	57	29.45	57	59	46			51	47	51	47	S.W		S.W																		Sunshine changeable showers	9
	10	29.64	55	29.68	57.7	60.5	42.3			51.5	46	58	50	S.W		S.W																		Bright sunshine some clouds & showers	10
	11	29.28	54	29.22	53	57.5	43			45.7	44	45.5	46	S.E		S.E																		Rain A.M. Bright sunshine P.M.	11
48:46	12	29.58	51.5	29.75	53	54	39			45	42	48	46	E		E																		Rain in the night Overcast A.M. sunshine P.M.	12
	13	29.93	52	29.98	53	52	39			41	41	47	43	N.E		N.E																		Overcast throughout	13
	14	30.08	52	30.12	52	52	38			45	43	45	45.5	N.E		N.E																		Do " Do "	14
	15	30.25	51	30.28	53.3	52.5	39			45.5	40	49	42	N.E		N.E																		Overcast A.M a little sunshine P.M.	15
	16	30.27	50.7	30.15	56	60	31.5			46	41	58	51	N.E		N.E																		Bright sunshine throughout	16
	17	30.10	54	30.07	59	65	39			55	49	61	51	S		S																		Dull with a little bright sunshine	17
47	18	30.	56	29.97	59	67.5	40			55.5	50	52	47	S.W		S.W																		Sunshine with passing clouds	18
58	19	30.05	58	30.05	65	72	40			58	51	58	50	S.W		S.W																		Do " Do "	19
	20	30.20	58	30.23	63	71.5	40			62	50	68	53.5	E		E																		Bright sunshine throughout	20
	21	30.38	57	30.40	63	67	42			58	48	54	48.5	S.E		S.E																		Do " Do "	21
	22	30.10	60	30.28	64	71	35			51	48	65	50.5	E		S.E																		Sunshine with a cold wind	22
	23	30.08	62	29.98	64	71.5	40			59.5	58.5	62	49	S.		S.E																		Do " Do "	23
	24	29.98	61	29.95	63	65	43			53	49	57.5	49	E		E																		Bright sunshine a few passing clouds	24
	25	29.95	58	29.88	61.5	65	36			50	46	60	49	E		E																		Sunshine throughout	25
	26	29.73	57	29.63	66	72.5	37			55	48.5	70	53	E		E																		Bright sunshine throughout	26
	27	29.55	60	29.53	63	65	45			56	48	53	49	S		S.W																		Cloudy A.M. Overcast P.M.	27
	28	29.63	57	29.60	57	64	38.5			53	41	53	49	S.W		S.W																		Blinks of sunshine	28
	29	29.64	55	29.75	57	57.5	37			48	42	48	41	S.W		S.																		Showery a shower of hail 1 P.M.	29
	30	29.80	56	29.78	58	60	35			57.5	45	54	47	S.W		S.																		Blinks of sunshine	30
	31	29.87	56	29.80	57	62	38.3			55	41	51	46	S.E		N.E						1.17													Cloudy with little sunshine	31
	Sums.	14 12 26.24	14 2 1690.2			11 4 1884.5	15 3 1195.1			13 3 1556.7	13 1402.0																								
	Means.	29.846	54.5			60.8	38.6			50.2	45.2																								
	† Total Corrections for Instrumental Errors.						-.4			+.5	+.5	+.5	+.5																						
	‡ Corrections for Diurnal Range.																																		
	"Corrected Means."						38.2			50.7	45.7																								
	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	31			

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.846 – .069 = 29.777

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

Mean at Station, corrected, and at 32°, = 29.777

Correction for Height, feet, above Mean Sea-level, = .209

Mean, reduced to 32°, and Sea-level, = 29.986

Highest Reading, corrected for Index error, on the 21 th, = 30.~~400~~ 380

Lowest Do., Do., on the 11 th, = 29.280

Difference, or **Monthly Range,** = 1.100

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

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month** (corrected for Index errors), on the 26 th, = 72.5

Lowest in Month, corrected for Index errors, on the 1 th, = 28.6

Difference, or **Monthly Range,** = 43.9

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 60.8

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 38.2

Difference, or **Mean Daily Range,** = 22.6

** Calculated **Mean Temperature** of Month, = 49.5

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** = 50.7

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** = 45.7

‡‡ Computed **Temperature of Dew-point,** = 40.5

‡‡ Do. **Elastic Force of Vapour,** = .253

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

‡‡ **Relative Humidity, (Saturation** = 100), = 69

RAIN fell on 6 **Days; Amount in Inches,** = 1.17

WIND. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	0	6	6	3	3	12	0	1	•		
P.M.	0	7	5	4	4	10	0	1	0		
Mean.	0	6	6	4	3	11	0	1	0		

A

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 2nd; 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.

Observations made and Return verified by ______

(Signed) Wm Thomson

P

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 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; 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 adjustible 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 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 black within, 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 at the Society's Office.

Self-Registering Thermometers.—Professor Phillips's, 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 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 lobe, 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes, that has not 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 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 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 40¼°, and 40¾°, more or less, must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "*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 *3rd* are those of a series of phenomena commencing at 9 P.M. on the *2nd*, and extending till 9 P.M. on the *3rd*.

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, extra observations ought to 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 would strongly 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.

Snow-falls 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 indeed in every column, the observer cannot be too careful to register *observations* only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for 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 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," $\frac{6, \text{S.W.}}{2, \text{W.}}$ (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 $\frac{4, \text{st.}}{2, \text{cu-st.}}$ (*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.

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 Schönbein's or Moffat's papers are used.—Moffat's are preferred. 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 $3\frac{\text{N.W.}}{4}$, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—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 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, auroræ boreales, 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, 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 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. For these hourly observations separate schedules will be furnished to observers.

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 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.

EDINBURGH, *9th December* 1863.

Dalkeith 3 May 1866

DALKEITH JU 4 66

EDINBURGH 110 JU 4 66

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To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, *St Andrew Square,*

EDINBURGH.

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BOOK-POST.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry, ...		Apple, ...			Cuckoo, ...		
Bourtree or Elder, ...		Black Currant, ...			Curlew, ...		
Broom, ...		Cherry, ...			House-Swallow, ...		
Hazel, ...		Gean, ...			Lapwing, ...		
Hawthorn, ...		Gooseberry, ...			Plover, ...		
Holly, ...		Peach, ...			Sand-Martin, ...		
Laburnum, ...		Pear, ...			Starling, ...		
Lilac, ...		Plum, ...			Swan, ...		
Mezereon, ...		Strawberry, ...			Rail or Corn Crake, ...		
Mountain Ash or Rowan,...					Other Birds, naming them—		
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 Dalkeith Gardens, County of Midlothian, in Lat. ______, Long. ______, Distance from Sea 3 miles.

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground ______ feet. During the MONTH of June 1866.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No. ___ inches.	9 h. A.M. Attached Thermometer °	6 h. P.M. Barometer. No. ___ inches.	6 h. P.M. Attached Thermometer °	SELF-REGISTERING THERMOMETERS, Read daily, at 9 P.M. Protected, in Shade, 4 feet above Ground. Max. No. ___ °	Min. No. ___ °	Exposed Black Bulbs. Max. in Sun's rays No. ___ °	Min. on Grass. No. ___ °	HYGROMETER. No. ___ 9 h. A.M. Dry bulb. °	9 h. A.M. Wet bulb. °	6 h. P.M. Dry bulb. °	6 h. P.M. Wet bulb. °	WIND. 9 h. A.M. Direction.	Force	6 h. P.M. Direction.	Force	Readings of the H-Cup Anemometer. No. ___ 9 h. A.M.	9 h. P.M.	RAIN. No. of hours in which it fell.	Amount in inches. No. ___	CLOUDS. 9 A.M. Velocity, (0—6), and Direction.	Amount, (0—10), and Species.	___ P.M. Velocity, (0—6), and Direction.	Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. ___ 3 inches. °	No. ___ 12 inches. °	No. ___ 22 inches. °	Temperature of WELL at Depth of ___ feet. No. ___ °	SEA. Temperature at 1 fathom, and Density. °	OZONE. 0—10. 9 A.M. 9 P.M.	GENERAL REMARKS, As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms began and ended.*	Days of Month.
	1	29.87	56.5	29.85	55	55	44			49	43	46	46	N.E		N.E																	Overcast A.M. Showery P.M.	1
	2	29.85	53	29.83	54	54	45			46	46	50	50	N.E		N.E																	Small rain & showers A.M. Overcast P.M.	2
	3	29.93	54	29.90	55	54.3	47			49	49	50	50	N.E		N.E																	Dull and foggy throughout	3
	4	29.88	55.4	29.80	61	65	49			53	53	54	53.7	N.E		E																	Overcast with a little sunshine	4
	5	29.70	56	29.78	63	54.7	46			53	52	65	58	E		S.E																	Dull foggy A.M. Sunshine & cloudy P.M.	5
	6	29.82	61	29.80	62	70	47			62	57	58	57	S.E		S.E																	Changeable thunder shower P.M.	6
	7	29.87	60.3	29.82	61.4	64	47			58	55	57	57	S.E		S																	Dull rain from 10 A.M. till 4 P.M.	7
61	8	30·	62	30.05	66	74	57			61	56	~~71~~ 61	57	S.		S.W																	Cloudy A.M. Bright Sunshine P.M.	8
	9	30.12	62	30·	64	70.3	47			61	56	57	57	S		S																	Cloudy rain from 2 P.M.	9
	10	29.83	65	29.75	66	72	57			63	57	57	55	S.W		N.W																	Sunshine heavy rain P.M.	10
	11	29.75	61	29.70	63	65.2	50			57	52	56	54	S.W		S.W																	Blinks of sunshine, passing showers	11
	12	29.50	62	29.50	63	65	49			56	53	59	52	S.E		E																	Bright sunshine, passing clouds	12
	13	29.60	60.5	29.65	63	67	47			57	52	60	55	S.W		S.W																	Do " Do "	13
	14	29.73	60	29.75	63	67	42			59	55	62	55	W		S.W																	Cloudy a little sunshine	14
	15	29.65	61	29.65	64	67	52			55	57	64	50	S.W		S.W																	Bright sunshine passing clouds	15
	16	29.40	56	29.20	59	65	52			50	49	55	49	S.W		S.W																	Overcast and rain A.M. Blinks of sun P.M.	16
	17	29.40	57	29.48	60	62	42			52	45	59	43	S.W		W																	Bright sunshine A.M. Cloudy P.M.	17
	18	29.40	55	29.30	60	63	37			48	41	56	45	N.E		N.E																	Do throughout	18
	19	29.43	56	29.35	59	64	34			53	46	54	52	E		N.W																	Bright sunshine A.M. gentle showers P.M.	19
	20	29.80	56	29.70	61.5	70	37			55	50	60	55	E		S.E																	Overcast and showery	20
	21	29.57	62	29.65	60	70	54.5			61.5	55	64	55	S		S																	Blinks of sunshine	21
	22	29.70	64	29.80	68	75	52			64.3	56	68	58	S.W		S.W																	Bright sunshine, Cloudy P.M.	22
	23	29.98	67	30.03	72	79	52			67	60	76	61	S.W		S																	very hot, and bright	23
	24	30.10	68	30.15	75	82	49			67	59	80	64	S.		S																	Do " Do "	24
	25	30.10	67	30.05	73	80	52			59	57	75	64	E		N.E																	Foggy A.M. sunshine throughout P.M.	25
30·03 AM	26	30 ~~.88~~ .03	64	29.98	75	80	54			68	63	74	66	E		E																	Hot and sultry	26
	27	29.90	72	29.85	76	83	60			73	64	73	66	E		S																	Very warm a few clouds & a slight breeze	27
	28	30.05	69	30·	65	66	53.7			56	53	57	54	N.E		N.E																	Dull and overcast throughout	28
	29	29.98	63	29.87	67	67	54			56.5	55	62	57	N.E		N.E																	Overcast A.M. Sunshine P.M.	29
	30	29.65	66	29.45	67	77	52			71	64	57	57	S		W						1.15												Bright and windy began to rain 3 P.M.	30
	31																																	31
	Sums.	178 ~~23.88~~ 23.61	12 1 36.7			12 1 2052.5	13 1 1459.2			45 1 1745.3	13 1606																							
	Means.	29.7~~96~~ 87	61.2			68.4	48.6			58.0	53.5																							
	† Total Corrections for Instrumental Errors.						−·4			+·5	+·5	+·5	+·5																					
	‡ Corrections for Diurnal Range.																																	
	"Corrected Means."					68.4	48.2			58.5	54.0																							
	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	31		

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction †† for Temp. (Col. 2), = 29.7~~96~~ 87 − .087 = 29 ~~709~~ 700

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

Mean at Station, corrected, and at 32°, = 29. ~~709~~ 700

Correction for Height, feet, above Mean Sea-level, = 209

Mean, reduced to 32°, and Sea-level, = 29. ~~978~~ 909

Highest Reading, corrected for Index error, on the 24th, = 30.150

Lowest Do., Do., on the 16th, = 29.200

Difference, or **Monthly Range,** = 0.950

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month** (corrected for Index errors), on the 27th, = 83.0

Lowest in Month, corrected for Index errors, on the 19th, = 33.6

Difference, or **Monthly Range,** = 49.4

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 68.4

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 48.2

Difference, or **Mean Daily Range,** = 20.2

** Calculated **Mean Temperature** of Month, = 58.3

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** = 58.5

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** = 54.0

‡‡ Computed **Temperature of Dew-point,** = 50.0

‡‡ Do. **Elastic Force of Vapour,** = .360

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

‡‡ **Relative Humidity, (Saturation = 100),** = 74

RAIN fell on 11 **Days; Amount in Inches,** = 1.15

WIND. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	0	7	6	3	5	8	1	0			
P.M.	0	7	3	3	6	7	2	2			
Mean.	0	7	4	3	6	7	2	1	0		

A

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

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 2nd; 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.

Observations made and Return verified by { ______

(Signed) Wm Thomson

P

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 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; 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 adjustible 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 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 black within, 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 at the Society's Office.

Self-Registering Thermometers.—Professor Phillips's, 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 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 lobe, 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 "*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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes, that has not 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 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 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 40¼°, and 40¾°, more or less, must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "*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 *3rd* are those of a series of phenomena commencing at 9 P.M. on the *2nd*, and extending till 9 P.M. on the *3rd*.

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, extra observations ought to 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 would strongly 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.

Snow-falls 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 indeed in every column, the observer cannot be too careful to register *observations* only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for 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 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," $\frac{6,\ S.W.}{2,\ W.}$, (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 $\frac{4,\ st.}{2,\ cu\text{-}st.}$, (*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.

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 Schönbein's or Moffat's papers are used—Moffat's are preferred. 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 $3^{N.W.}_{4}$, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—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 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, auroræ boreales, 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, 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 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. For these hourly observations separate schedules will be furnished to observers.

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 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.

Edinburgh, 9*th December* 1863.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, *St Andrew Square,*

EDINBURGH.

BOOK-POST.

Dalkeith
June 1866.

EDINBURGH JY 3 66

DALKEITH JY 66

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry,		Apple,			Cuckoo,		
Bourtree or Elder,		Black Currant,			Curlew,		
Broom,		Cherry,			House-Swallow,		
Hazel,		Gean,			Lapwing,		
Hawthorn,		Gooseberry,			Plover,		
Holly,		Peach,			Sand-Martin,		
Laburnum,		Pear,			Starling,		
Lilac,		Plum,			Swan,		
Mezereon,		Strawberry,			Rail or Corn Crake,		
Mountain Ash or Rowan,					Other Birds, naming them—		
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 Dalkeith Gardens County of Midlothian, in Lat. ______, Long. ______, Distance from Sea 3 miles.

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of July 1866.

The Hours of Observation are of Greenwich Time.

Only the columns that carry entries are shown below. The printed form also has these columns, all left empty: Electricity; the Exposed Black Bulbs (Max. in Sun's rays, Min. on Grass); Wind Force; H-Cup Anemometer readings; Rain (No. of hours in which it fell); Clouds; Sunshine; Thermometers under Ground; Temperature of Well; Sea; Ozone.

Days of Month	Barometer 9 h. A.M. (inches)	Attached Thermometer 9 h. A.M.	Barometer 6 h. P.M. (inches)	Attached Thermometer 6 h. P.M.	Self-Reg. Therm. Max.	Self-Reg. Therm. Min.	Hygrometer 9 h. A.M. Dry bulb	Hygrometer 9 h. A.M. Wet bulb	Hygrometer 6 h. P.M. Dry bulb	Hygrometer 6 h. P.M. Wet bulb	Wind 9 h. A.M. Direction	Wind 6 h. P.M. Direction	Rain Amount in inches	General Remarks	Days of Month
1	29.35	64	29.23	64	69	47	55	52	62	57	S.W.	S.W.		Sunshine with passing clouds	1
2	29.10	61	29.5	62	64	44	55	50	61	50	W.	W.		Sunshine with passing clouds	2
3	29.05	60	29.03	62	64	42.5	57	50	62	53	W.	S.W.		Cloudy slight showers	3
4	29.15	58	29.23	62	66	42	57	53	60	50	S	E		Cloudy A.M. heavy rain P.M.	4
5	29.30	57	29.40	61	64	47	48	48	56	52.7	E	N.E.		Rain during the night heavy rain A.M. Dry P.M.	5
6	29.53	58	29.60	60	65	45.5	54	48	55	50	N.E.	N.E.		Fine with blinks of sunshine	6
7	29.75	59	29.80	61	67	44	56	50	56	52.3	S.W.	S		Overcast a little sunshine	7
8	29.73	61	29.80	69	69	53	59	57	63	60	S.W.	W.		Overcast & dull throughout	8
9	29.80	64	29.90	67	70	58	64	58	63	59	S.W.	S.W.		Sunshine with passing clouds	9
10	30.05	65	30.10	67	72	56	64	59.5	60	59.7	S.W.	W.		Sunshine with passing clouds	10
11	30.15	64	30.13	73	78	56	66	60	73	64	W.	S.W.		Bright sunshine throughout	11
12	30.10	73	30.05	80	84	57	74	67	83	69	S.W.	S.W.		Do. close and very warm	12
13	29.95	70	29.95	72	80	59	68	64	69	69	S.W.	S.W.		Do. heavy thunder and rain 2.30 P.M.	13
14	29.95	69	29.98	68	75	56	68	62	62	61	S	W.		Cloudy A.M. heavy rain P.M.	14
15	30.10	65	30.10	70	73	57	62.5	59	67	63	W.	W.		Sunshine with passing clouds	15
16	30.10	64	30.08	65	76	55	58	57	62	59	E	E		Overcast throughout	16
17	30.05	63	29.98	66	70	52	60	56	62	57	E	E		Dull & cloudy A.M. bright & fine P.M.	17
18	29.95	63	29.90	70	73	49	62	58	67	52	E	E		Sunshine with passing clouds	18
19	29.90	61.5	29.95	64	69	46	57	52	58	52	N.E.	N.E.		Bright and very fine throughout	19
20	29.95	60	29.95	68	74	43	58	53	65	57	E	E		Do Do Do	20
21	30.03	60	30.05	66	71	46	58	53	63	56	E	E		" " "	21
22	30.07	62	30.05	67	70	57	61	56	65	59	E	E		" " "	22
23	30	62	30	63	71	49	60	55	62	55	E	E		Dull till 10 A.M. clear and bright	23
24	30.05	61	30.10	66	72	52	58	54	65	57.5	N.E.	N.E.		Dull A.M. bright dry & warm	24
25	30.15	60	30.10	61.5	72	52	65	58	61	58	N	N.E.		Dull & mild	25
26	30	60	29.95	59	63	49	55.5	55	51	57	S.W.	N.E.		Dull A.M. heavy rain from 2 P.M.	26
27	29.85	58	29.67	59	55.5	49	53	51	53.5	53	N.E.	N.E.		A gentle rain with lighter showers	27
28	29.67	58	29.63	59	58	50	51	50	53	52	N.E.	E		Overcast & showery	28
50 49 29	29.53	57	29.60	56	55	49	51.5	51.5	~~51~~ 50	~~50~~ 48	N.E.	N.E.		Rain through the night heavy showers throughout	29
30	29.70	56	29.70	55	57	45	51	50	47	47	E	N.E.		Showery A.M. heavy rain P.M.	30
31	29.75	56	29.80	60	61.3	49	51	48	56	51	N.E.	N.E.	3.65	Drying wind sunshine	31
Sums.	1210 24.71	6 11 4 75			12 2127.8	16 1 1547.0	171 ~~1800.5~~ 14 1817.5	141 ~~1709.0~~ 131 1697.0							
Means.	29.797	61.5			68.6	49.9	58.6	54.8							
† Total Corrections for Instrumental Errors.						−.4	+.5	+.5	+.5	+.5					
‡ Corrections for Diurnal Range.															
"Corrected Means."						49.5	59.1	55.3							
No. of Column.	1	2	3	4	5	6	9	10	11	12	13	15	20		

Columns 3 and 4 and columns 11 and 12 are struck through with a diagonal line in the Sums to "Corrected Means" rows.

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.797 – .087 = 29.710

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

Mean at Station, corrected, and at 32°, = 29.710

Correction for Height, feet, above Mean Sea-level, = .209

Mean [redacted]°, **and Sea-level,** = 29.919

Highes[redacted]for Index error, on the 25th, = 30.150

Lowes[redacted]Do., on the 3th, = 29.030

Differe[redacted]ange, = 1.120

* Each in[redacted]Edinburgh bears the stamp "S.M.S.;" and a number to be entered in the Heading; or the Numb[redacted]e here given.
† Embrac[redacted]and Index Errors.
‡ The Di[redacted]known.
†† *Practica*[redacted]rection.
‡‡ These "[redacted]" are calculated from Glaisher's Hygrometrical Tables, Second Edition *only*.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature." Any Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the Observer, in each Schedule. *See Over.*

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month** (corrected for Index errors), on the 12 th, = 84.0

Lowest in Month, corrected for Index errors, on the 4 th, = 41.6

Difference, or **Monthly Range,** = 42.4

"Corrected **Mean" of all the Highest,** (Col. 5), = 68.6

"Corrected **Mean" of all the Lowest,** (Col. 6), = 49.5

Difference, or **Mean Daily Range,** = 19.1

** Calculated **Mean Temperature** of Month, = 59.0

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** = 59.1

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** = 55.3

‡‡ Computed **Temperature of Dew-point,** = 51.9

‡‡ Do. **Elastic Force of Vapour,** = .387

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

‡‡ **Relative Humidity, (Saturation** = 100), = 77

RAIN fell on 10 **Days; Amount in Inches,** = 3.65

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	7	9	0	2	8	4	0	0		
P.M.	0	10	9	0	1	6	5	0	0		
Mean.	1	8	9	0	2	7	4	0	0		

A

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 2nd; 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.

Observations made and Return verified by ______

(*Signed*) Wm Thomson

P

To [redacted]

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

~~10, St Andrew Square,~~

EDINBURGH.

BOOK-POST.

24

Dalkeith
July 1866

DALKEITH AU 2 66

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 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; 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 adjustible 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 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 black within, 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 at the Society's Office.

Self-Registering Thermometers.—Professor Phillips's, 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 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 lobe, 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 "*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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes, that has not 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 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 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 40¼°, and 40¾°, more or less, must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "*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 *3rd* are those of a series of phenomena commencing at 9 P.M. on the *2nd*, and extending till 9 P.M. on the *3rd*.

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, extra observations ought to 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 would strongly 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.

Snow-falls 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 indeed in every column, the observer cannot be too careful to register *observations* only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for 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 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," $\frac{6,\ \text{S.W.}}{2,\ \text{W.}}$ (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 $\frac{4,\ \text{st.}}{2,\ \text{cu-st.}}$ (*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.

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 Schönbein's or Moffat's papers are used—Moffat's are preferred. 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 $3^{\text{N.W.}}_{4}$, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—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 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, auroræ boreales, 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, 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 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. For these hourly observations separate schedules will be furnished to observers.

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 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.

EDINBURGH, 9th December 1863.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry,...........		Apple,...........			Cuckoo,...........		
Bourtree or Elder,........		Black Currant,........			Curlew,...........		
Broom,...........		Cherry,...........			House-Swallow,.......		
Hazel,...........		Gean,...........			Lapwing,...........		
Hawthorn,...........		Gooseberry,...........			Plover,...........		
Holly,...........		Peach,...........			Sand-Martin,...........		
Laburnum,...........		Pear,...........			Starling,...........		
Lilac,...........		Plum,...........			Swan,...........		
Mezereon,...........		Strawberry,...........			Rail or Corn Crake, ...		
Mountain Ash or Rowan,...					Other Birds, naming them—		
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 Dalkeith Gardens, County of Midlothian, in Lat. ______, Long. ______, Distance from Sea 3 miles.

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of August 1866.

The Hours of Observation are of Greenwich Time.

Electricity	Days of Month	Barometer 9 h. A.M. (inches)	Attached Thermometer 9 h. A.M.	Barometer 6½ h. P.M. (inches)	Attached Thermometer 6½ h. P.M.	Self-registering Thermometers (read daily at 9½ P.M.), Shade Max.	Shade Min.	Black Bulb Max. in Sun's rays	Min. on Grass	Hygrometer 9 h. A.M. Dry bulb	9 h. A.M. Wet bulb	6½ h. P.M. Dry bulb	6½ h. P.M. Wet bulb	Wind 9 h. A.M. Direction	Force	Wind 6½ h. P.M. Direction	Force	Rain Amount in inches	General Remarks	Days of Month
	1	29.75	57	29.60	63	71	42			55	51	60	56	E		S.E			Fine but changeable	1
	2	29.43	61	29.55	57	63	57			56	56	57	53	S.E		S.E			Damp small rain throughout	2
	3	29.43	61	29.35	61	64	51.5			58	55	57	52	S		S.W			Sunshine with passing clouds & wind	3
	4	29.10	58	29.25	61	61	48.5			55	55	59	53	S		S.W			High wind showery	4
	5	29.45	56	29.57	60	65	46.5			53	47	56	50	W		S.W			Sunshine with clouds windy	5
	6	29.40	55	29.65	59	62	55			54	50	57	57	S.W		S.W			Dull rain with heavy showers	6
	7	28.90	57	28.93	59	63.5	46			59	55	55	52	S.W		S.W			Blinks of sunshine showery	7
	8	29.30	57	29.20	58	63	46			57	52	51.5	51.5	S.W		S.W			Fine A.M rain P.M	8
50; 49 ~~48~~	9	29.23	56	29.35	59	65.5	47			~~51~~ 50	~~51~~ 49	56	52.5	W		S.W			Sunshine with clouds showery	9
	10	29.47	57	29.73	58	65	45			55	53.5	55	52.5	W		W			Do " Do	10
	11	29.40	56	29.85	60	65	48			51	49	58	55	N		W			Sunshine passing clouds	11
	12	29.63	59	29.60	60	67	49			56	52	56	55	S.W		S			Overcast with showers mild	12
	13	29.77	60	29.70	62	64	48			57.5	56	61	58	S		S			Overcast mild, showers P.M	13
	14	29.58	59	29.70	65	70	57			55.5	55.5	63	59	S.W		W			Rain through the night—cloudy A.M [illegible]	14
	15	29.75	60	29.67	60	70	49			55	55	55.5	57	S.W		W			Blinks of sunshine mild and fine	15
	16	29.40	52	29.27	57	69	44.5			46	45	56	57	S.W		W			Heavy showers, sunshine	16
	17	29.57	56	29.63	59	63	45			53	50	55	55	W		S.W			Fine A.M heavy showers P.M	17
	18	29.73	56	29.65	58	65	42			53	49	55	52	W		S.W			Sunshine cloudy changeable	18
	19	29.60	60.5	29.65	64	69	52			60	57	64	65	S.W		W			Do " A.M sultry [illegible]	19
	20	29.67	59	29.75	63	70	57.5			56.5	56	60	58	W		S.E			A little sunshine very fine	20
	21	29.85	60	29.87	62	66	53			56	55	59	57	E		E			Dull but fine	21
	22	29.70	60	29.90	61	64	50			54	53	57	55	E		E			Dull A.M sunshine P.M	22
	23	29.93	58	29.88	63	71	45			57	56	61	59	E		E			Cloudy warm very fine	23
	24	29.85	62	29.85	64	70	52			60.5	59	60	59	E		E			Overcast with a little sunsh[ine]	24
	25	29.83	61	29.77	63	69	47			60	58	60	60	S.E		E			Dull. rain very mild	25
	26	29.75	63	29.70	66	71.5	56			63	58	68	61	S		S			Bright sunshine throughout	26
	27	29.50	61	29.50	65	70	55			57	57	61	55	S		S.E			Rain A.M bright and fine P.M	27
	28	29.55	60	29.50	60	64	47			54	53	55	52	E		E			Dull and cloudy A.M rain P.M	28
	29	29.50	61	29.45	60	57	52			53	53	52	52	E		E			Rain throughout	29
	30	29.50	57	29.55	61	65	45			52	52	60	55	E		S.W			Bright and fine	30
	31	29.67	57	29.60	61	68	43			55	53	59	55	W		S.W		2.25	Bright slight showers, thund[er]	31
	Sums.	17.84	~~473~~ 268.5	~~17.55~~	33	1885	1470.5			1630	1640									
	Means.	29.575	58.7		61.1	66.1	48.7			53.3	53.4									
	† Total Corrections for Instrumental Errors.						-.4			+.5	+.5	+.5	+.5							
	‡ Corrections for Diurnal Range.																			
	"Corrected Means."						48.3			55.8	53.9									
	No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	20		

NOTATION USED IN GENERAL REMARKS.

a. denotes aurora. ci. " cirrus. ci.-cu. " cirro-cumulus. ci.-s. " cirro-stratus. cu. " cumulus. cu.-s. " cumulo-stratus. d. " dew. f. " fog. fr. " frost. h.-fr. " hoar-frost. h. " haze. h. d. " heavy dew. hl. " hail. l. " lightning. li. cl. " light clouds. li. sh. " light showers. lu. co. " lunar corona. lu. ha. " 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. ha. " solar halo. sq. " squall. sqs. " squalls. 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	Calm	1·5	Light breeze	4	Blowing hard
0·5	Very light air	2·	Fresh breeze	5	Blowing a gale
1·	Light air	3·	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.575 – .079 = 29.496

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

Mean at Station, corrected, and at 32°, = 29.496

Correction for Height, feet, above Mean Sea-level, = 209

Mean, reduced to 32°, and Sea-level, = 29.705

Highest Reading, corrected for Index error, on the 23 th, = 29.930

Lowest Do., Do., on the 7 th, = 28.900

Difference, or **Monthly Range,** = 1.030

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month** (corrected for Index errors), on the 26 th, = 71.5

Lowest in Month, corrected for Index errors, on the 1 th, = 41.6

Difference, or **Monthly Range,** = 29.9

"Corrected **Mean**" of all the **Highest,** (Col. 5), = 66.1

"Corrected **Mean**" of all the **Lowest,** (Col. 6), = 48.3

Difference, or **Mean Daily Range,** = 17.8

** Calculated **Mean Temperature** of Month, = 57.2

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** = 55.8

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** = 53.9

‡‡ Computed **Temperature of Dew-point,** = 52.1

‡‡ Do. **Elastic Force of Vapour,** = .392

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

‡‡ **Relative Humidity, (Saturation** = 100), = 88

RAIN fell on 13 **Days; Amount in Inches,** 2.26 = 2.25

WIND. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	0	8	2	5	8	7	0			
P.M.	0	1	7	3	3	8	6	3			
Mean.	1	0	8	2	4	8	6	2	0		

A

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

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 2nd; 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.

Observations made and Return verified by ____________

(*Signed*) Wm Thomson

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 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; 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 adjustible 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 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 black within, 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 at the Society's Office.

Self-Registering Thermometers.—Professor Phillips's, 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 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 lobe, 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 "*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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes, that has not 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 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 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 40¼°, and 40¾°, more or less, must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "*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 *3rd* are those of a series of phenomena commencing at 9 P.M. on the *2nd*, and extending till 9 P.M. on the *3rd*.

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, extra observations ought to 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 would strongly 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.

Snow-falls 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 indeed in every column, the observer cannot be too careful to register *observations* only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for 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 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," $\frac{6.\ S.W.}{2.\ W.}$, (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 $\frac{4.\ st.}{2.\ cu\text{-}st.}$, (*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.

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 Schönbein's or Moffat's papers are used—Moffat's are preferred. 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 $3^{s.w.}_{4}$, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—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 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, auroræ boreales, 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, 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 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. For these hourly observations separate schedules will be furnished to observers.

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 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.

EDINBURGH, *9th December* 1863.

Dalkeith
August 1866

To

MR ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

BOOK-POST.

Dalkeith
August 1866

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OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe (generally.)
Barberry,		Apple,		
Bourtree or Elder,		Black Currant,		
Broom,		Cherry,		
Hazel,		Gean,		
Hawthorn,		Gooseberry,		
Holly,		Peach,		
Laburnum,		Pear,		
Lilac,		Plum,		
Mezereon,		Strawberry,		
Mountain Ash or Rowan,				
Red Flowering Currant,				
Rhododendron Ponticum,				
Whin,				

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

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

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 Dalkeith Gardens, County of Midlothian, in Lat. ______, Long. ______, Distance from Sea 3 miles.

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of September 1866.

The Hours of Observation are of Greenwich Time.

Electricity	Days of Month	Barometer 9 h. A.M. (inches)	Attached Thermometer 9 h. A.M.	Barometer 6 h. P.M. (inches)	Attached Thermometer 6 h. P.M.	Self-Registering Thermometers, Max.	Min.	Exposed Black Bulbs, Max. in Sun's rays	Min. on Grass	Hygrometer 9 h. A.M. Dry bulb	Wet bulb	Hygrometer 6 h. P.M. Dry bulb	Wet bulb	Wind 9 h. A.M. Direction	Force	Wind 6 h. P.M. Direction	Force	H-Cup Anemometer 9 h. A.M.	9 h. P.M.	Rain, No. of hours	Amount in inches	Clouds 9 A.M. Velocity and Direction	Amount and Species	Clouds P.M. Velocity and Direction	Amount and Species	Sunshine Hours	Thermometers under Ground 3 inches	12 inches	22 inches	Temperature of Well	Sea	Ozone 9 A.M.	9 P.M.	General Remarks	Days of Month
	1	29.55	57	29.50	60	63	47			56	53	55	50	S.W		S.W																		Rain through the night. Bright A.M. [illegible]	1
	2	29.27	57	29.35	57	59	45			52	50	52.5	50	S.W		S.W																		Heavy showers. Bright sunshine	2
	3	29.50	55	29.57	57	61	44			50.5	48	52	48	S.W		W																		Sunshine with passing clouds fine	3
	4	29.55	55	29.35	58	63	42			52	49.5	51	51	S.W		E																		Bright and fine A.M. began to rain [illegible]	4
	5	29.10	58	29.07	60	64	49			56	55	57	55	S.W		S																		Overcast throughout mild	5
	6	29.35	56	29.33	58	63	42			52	49	55	51	S.W		E																		Bright sunshine fine	6
	7	29.35	56	29.53	58	62	48.5			50	49	53	52	E		E																		Dull with a little sunshine	7
	8	29.65	57	29.70	59	61	47			54	53	54	53	E		E																		Do " Do "	8
	9	29.65	56	29.47	59	66	40			54	52	55	52	E		S.E																		Blinks of sunshine windy	9
	10	29.25	60	29.25	63	70.5	52			58	57	61	56.5	S.E		S.E																		Bright sunshine with a few clouds	10
	11	29.03	59	29.35	62	63.5	54			55	53.5	56	55	S		S.W																		Cloudy but fine	11
	12	29.71	55	29.62	58	62	43			50	49	52	50	E		S																		Dull with a few blinks of sun	12
	13	29.50	59	29.45	59	58	47			51.5	51	54	52.5	S.W		S.W																		Rain from 6 to 7 A.M. Changeable	13
	14	29.	57	29.05	57	61	48			54	52	50	48	S.W		W																		Fine and rain alternate. Windy	14
	15	29.54	55	29.30	57	60.5	46			49.5	48	50.5	47	S.W		S																		Bright sunshine windy	15
	16	29.15	53	29.20	56	57	41.5			49	49	49.5	49	S.W		W																		Cloudy. A.M. Bright P.M.	16
	17	29.45	53.5	29.57	56	54	34			49	46	50	49	S.W		S.W																		Very fine Bright sunshine	17
	18	29.70	54	29.46	56	57.5	40.5			50	49	52	51.5	S.W		S.E																		Fine A.M. overcast windy showers P.M.	18
	19	29.37	55.5	29.43	57.5	61	44			53	50.5	53	51	S.W		S.W																		Do A.M. Stormy with showers	19
	20	29.53	55	29.19	58	61	47			52	50	53.5	52	S.W		S.W																		Do A.M. cloudy and rain P.M.	20
	21	29.11	54	28.38	52.5	57	41			49	46	46.5	45	S.W		S.W																		Sunshine A.M. Overcast stormy P.M.	21
	22	28.98	53	29.03	54	56	41			48.5	47.2	47.5	46	S.W		S.W																		Sunshine cloudy fine	22
	23	29.25	57.5	29.34	54	60	32.5			45.5	45	48.5	49	S		S																		Bright sunshine slight shower hail	23
	24	29.45	50	29.53	54	60	33			48.5	47	52	50	S		S																		Extra fine Bright sunshine	24
	25	29.57	53	29.55	56	58	37.5			54	50	53	53	S		S																		Overcast high winds	25
	26	29.63	55	29.67	56	64	44			55	52	54	51	S		S																		Sunshine cloudy fine	26
	27	29.75	55	29.75	57	62	42			53	51	52	52	S		S																		Dull but fine	27
	28	29.83	50	29.85	54	56	38			45	41	48	48	S		S.E																		Overcast A.M. rain P.M.	28
	29	29.70	52	29.80	58	62	44			53	51	53	53	E		E																		Heavy rain through the night. Overcast	29
	30	30.03	54	30.10	57	61	44			52	52	54	52	S.E		S.E					2.35													Overcast and rain A.M. a little [illegible]	30
	31																																		31
	Sums	13.26	153.5			29.0	98.5			51.0	1495.7																								
	Means	29.442	55.1			61.0	43.3			51.7	49.8																								
	Total Corrections for Instrumental Errors	~~.06~~					−.4			+.5	+.5	+.5	+.5																						
	Corrections for Diurnal Range																																		
	"Corrected Means."						42.9			52.2	50.3																								
	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	29	30		31		

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction†† for Temp. (Col. 2), = 29.4422 − .070 = 29.372

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

Mean at Station, corrected, and at 32°, = 29.372

Correction for Height, feet, above Mean Sea-level, = .209

Mean, reduced to 32°, and Sea-level, = 29.581

Highest Reading, corrected for Index error, on the 30 th, = 30.100

Lowest Do., Do., on the 22 th, = 28.980

Difference, or **Monthly Range,** = 1.130

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month** (corrected for Index errors), on the 10 th, = 70.5

Lowest in Month, corrected for Index errors, on the 23 th, = 32.1

Difference, or **Monthly Range,** = 38.4

"Corrected **Mean**" of all the **Highest,** (Col. 5), 61.0 = ~~60.7~~

"Corrected **Mean**" of all the **Lowest,** (Col. 6), 42.9 = ~~42.9~~

Difference, or **Mean Daily Range,** 18.1 = ~~26.8~~

** Calculated **Mean Temperature** of Month, 52.0 =

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** = 52.2

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** = 50.3

‡‡ Computed **Temperature of Dew-point,** = 48.4

‡‡ Do. **Elastic Force of Vapour,** = .340

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

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

RAIN fell on 13 **Days; Amount in Inches,** = 2.35

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	5	2	7	16	0	0			
P.M.	0	1	5	4	8	9	3	0			
Mean.	0	0	5	3	8	12	2	0	0		

A

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

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 2nd; 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.

Observations made and Return verified by ______

(*Signed*) Wm Thomson

P

DALKEITH OC 2 66

7 0 EDINBURGH OC 2 66

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Dalkeith Sept 1866.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

BOOK-POST.

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 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; 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 adjustible 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 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 black within, 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 at the Society's Office.

Self-Registering Thermometers.—Professor Phillips's, 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 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 lobe, 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 "*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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes, that has not 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 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 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 $40\frac{1}{2}$°, respectively. So also $40\frac{1}{4}$°, and $40\frac{3}{4}$°, 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 *3rd* are those of a series of phenomena commencing at 9 P.M. on the *2nd*, and extending till 9 P.M. on the *3rd*.

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, extra observations ought to 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 would strongly 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.

Snow-falls 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 indeed in every column, the observer cannot be too careful to register *observations* only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for 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 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," $\frac{6,\ S.W.}{2,\ W.}$, (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 $\frac{4,\ st.}{2,\ cu\text{-}st.}$, (*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.

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 Schönbein's or Moffat's papers are used—Moffat's are preferred. 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 $3\frac{N.W.}{4}$, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—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 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, auroræ boreales, 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, 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 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. For these hourly observations separate schedules will be furnished to observers.

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 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.

EDINBURGH, *9th December* 1863.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry, ...		Apple,......................			Cuckoo, ...		
Bourtree or Elder,........		Black Currant, ...			Curlew,....................		
Broom,......................		Cherry, ...			House-Swallow, ...		
Hazel, ...		Gean, ...			Lapwing, ...		
Hawthorn, ...		Gooseberry, ...			Plover,.....................		
Holly, ...		Peach,......................			Sand-Martin,............		
Laburnum,.................		Pear, ...			Starling,..................		
Lilac, ...		Plum,.......................			Swan,......................		
Mezereon, ...		Strawberry, ...			Rail or Corn Crake, ...		
Mountain Ash or Rowan,...					Other Birds, naming them—		
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 *Dalkeith Gardens*, County of *Midlothian*, in Lat. ______, Long. ______, Distance from Sea *3* miles.

Height of Cistern of the Barometer above Mean Sea-level *190* feet, above Ground *4* feet. During the MONTH of *October* 186*6*.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No. ___ (inches)	BAROMETER. 9 h. A.M. Attached Thermometer (°)	BAROMETER. *6* h. P.M. Barometer. No. ___ (inches)	BAROMETER. *6* h. P.M. Attached Thermometer (°)	SELF-REGISTERING THERMOMETERS, Read daily, at *6* P.M. Protected, in Shade, 4 feet above Ground. Max. No. ___ (°)	Min. No. ___ (°)	Exposed Black Bulbs. Max. in Sun's rays No. ___ (°)	Min. on Grass. No. ___ (°)	HYGROMETER. No. ___ 9 h. A.M. Dry bulb. (°)	9 h. A.M. Wet bulb. (°)	*6* h. P.M. Dry bulb. (°)	*6* h. P.M. Wet bulb. (°)	WIND. 9 h. A.M. Direction.	Force	*6* h. P.M. Direction.	Force	Readings of the H-Cup Anemometer. No. ___ 9 h. A.M.	9 h. P.M.	RAIN. No. of hours in which it fell.	Amount in inches. No. ___	CLOUDS. 9 A.M. Velocity, (0—6), and Direction.	Amount, (0—10), and Species.	___ P.M. Velocity, (0—6), and Direction.	Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. ___ 3 inches. (°)	No. ___ 12 inches. (°)	No. ___ 22 inches. (°)	Temperature of WELL at Depth of ___ feet. No. ___ (°)	SEA. Temperature at 1 fathom, and Density. (°)	OZONE. ...... 0—10. 9 A.M.	9 P.M.	GENERAL REMARKS, As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. *Mention the hour at which Storms began and ended.*	Days of Month.
	1	30·15	55	30·07	56	57	44			50	50	53	53	E.		E.																		Overcast throughout	1
	2	30·03	55	30·05	56	55	47			50	50	52	50	E.		E.																		Overcast. with small rain	2
	3	30·03	56	30·	58	60	48			53	53	56	54	E.		E.																		Overcast throughout	3
	4	30·05	57	30·07	56	58	47			52	52	57	57	E.		E.																		Thick fog A.M. Dull P.M.	4
	5	30·25	56	30·35	58	62	47			52	52	52	52	N.E.		N.																		Dull and damp throughout	5
	6	30·45	56	30·40	56	58	47·5			51	51	50	50	N.		N.																		Dull but fine	6
	7	30·35	56	30·33	57	60	41·5			53	51	50	50	S.E.		S.																		Sunshine throughout	7
	8	30·35	52	30·30	53	58	37·5			46	45	50	49	S.		S.W.																		Bright sunshine Passing clouds	8
	9	30·25	52	30·15	58	62	35			45	45	47	47	W.		N.																		Overcast throughout	9
	10	30·10	53	30·10	54	55	42			47	46	48	48	S.W.		S.																		Sunshine. cloudy fine	10
	11	30·07	52	30·03	53	54	47·5			46	45	50	50	S.		S.																		Dull and mild	11
	12	29·93	53	29·85	52	53	43			48	47·5	45	45	S.W.		S.																		Overcast cold	12
	13	29·70	52	29·75	52	53·5	40			49	48	45	45	S.W.		S.W.																		Overcast showers of small rain	13
	14	29·93	49	29·95	50	48	32			48	48	41·5	41·5	S.W.		S.W.																		Sunshine throughout	14
	15	30·07	49	29·95	50	52	33			44	44	43	42	S.W.		S.W.																		Do " Do. "	15
	16	30·05	48	30·10	49	53	33			41	41	47	46	S.W.		S.																		Do " Cloudy fine	16
	17	29·93	49	29·85	50	54·5	33			42	41	47	45	S.		S.																		Sunshine cold winds	17
	18	29·80	57	29·73	53	55	43			48	47·5	49·5	48	S.		S.																		High wind through the night. windy rain	18
	19	29·76	55	29·70	58	64	48·5			53	53	57	56	S.		S.																		Do Sunshine A.M. Dull P.M.	19
	20	30·03	56	30·05	57	62	45			53	52	54	52	W.		S.																		Bright throughout. very fine	20
	21	29·85	58	29·87	57	60	48			54	56	56	55	S.S.E.		S.S.E.																		Dull with a little sunshine fine	21
	22	29·75	57	29·85	57	57·5	46			52	52	50	48	S.		S.																		Small rain A.M. Dull P.M.	22
	23	29·87	52	29·83	56	58	40			46	45	50	49	S.		S.																		Overcast throughout	23
	24	29·57	50·5	29·50	53	53·5	43			48·5	48·5	46	45	S.W.		S.W.																		Rain A.M. Overcast P.M.	24
	25	29·60	47	29·73	50	53	32·5			38	38	35	35	S.W.		S.W.																		Fair throughout slight hoar	25
	26	29·85	46	29·80	47	52	27			36	36	43	42	S.W.		S.W.																		Sunshine fine but cold	26
	27	29·73	50·5	29·70	53	55	39·5			47	49	57	50	S.W.		S.W.																		Overcast. A.M. rain P.M.	27
	28	29·84	56	30·10	50	54	40			44	42	41	41	W.		S.W.																		Sunshine throughout	28
	29	29·88	49	29·73	51	54·5	37			45·5	44	47·5	46·3	W.		W.																		Overcast stormy	29
	30	29·30	53	29·70	47	55	38			57·5	57·5	40·5	40·5	W.		W.																		High wind through the night showery	30
	31	29·83	49	29·64	50	48	34			42	42	46	46	W.		W.				0·85														Fair A.M. a gentle rain P.M.	31
Sums.		1512 / 29·37	16 / 80·6			13 3 2 / 1733·5	143 / 1259·5			141 / 1485	13 / 1474																								
Means.		29·947	52·6			55·9	40·6			47·9	47·5																								
† Total Corrections for Instrumental Errors.							-·4			+·5	+·5	+·5	+·5																						
‡ Corrections for Diurnal Range.																																			
"Corrected Means."							40·2			48·4	48·0																								
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	31			

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29·947 – ·064 = 29·883

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

Mean at Station, corrected, and at 32°, ... = 29·883

Correction for Height, feet, above Mean Sea-level, ... = ·209

Mean, reduced to 32°, and Sea-level, ... = 30·092

Highest Reading, corrected for Index error, on the 6 th, ... = 30·450

Lowest Do., Do., on the 30 th, ... = 29·300

Difference, or **Monthly Range,** .... = 1·150

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month** (corrected for Index errors), on the 19 th, ... = 64·0

Lowest in Month, corrected for Index errors, on the 26 th, ... = 26·6

Difference, or **Monthly Range,** .... = 37·4

"Corrected **Mean**" of all the **Highest,** (Col. 5), ... = 55·9

"Corrected **Mean**" of all the **Lowest,** (Col. 6), ... = 40·2

Difference, or **Mean Daily Range,** .... = 15·7

** Calculated **Mean Temperature** of Month, ... = 48·0

S.-R. THERMOMET[illegible] **Bulb, in Sun, Highest,** (corrected, for Index [illegible] .... =

"Corrected [illegible] **lack Bulb, Max. in Sun,** .... =

Lowest a[illegible] cted for Index errors), on the th, =

"Corrected **Mea**[illegible] **lack Bulb Min.** on grass, ... =

Difference of above Mean[illegible] ("exposed"), ... =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** .... = 48·4

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** .... = 48·0

‡‡ Computed **Temperature of Dew-point,** .... =

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

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

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

RAIN fell on Days; **Amount in Inches,** .... = 0·85

WIND. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	1	4	1	8	10	6	0	0		
P.M.	4	0	4	0	11	9	3	0	0		
Mean.	2	0	4	1	10	10	4	0	0		

A

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

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 2nd; 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.

Observations made and Return verified by ____________

(*Signed*) Wm Thomson

P

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 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; 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 adjustible 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 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 black within, 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 at the Society's Office.

Self-Registering Thermometers.—Professor Phillips's, 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 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 lobe, 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 "*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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes, that has not 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 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 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 40¼°, and 40⅜°, 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 3*rd* are those of a series of phenomena commencing at 9 P.M. on the 2*nd*, and extending till 9 P.M. on the 3*rd*.

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, extra observations ought to 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 would strongly 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.

Snow-falls 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 indeed in every column, the observer cannot be too careful to register *observations* only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for 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 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," $\frac{6.\ S.W.}{2.\ W.}$, (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 $\frac{4.\ st.}{2.\ cu\text{-}st.}$, (*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.

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 Schönbein's or Moffat's papers are used—Moffat's are preferred. 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 $3^{S.W.}_{2}$, 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 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, auroræ borealeæ, 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, 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 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. For these hourly observations separate schedules will be furnished to observers.

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 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.

EDINBURGH, 9*th December* 1863.

Dalkeith
Oct 1866

To
Mr ALEXANDER BUCHAN,
Secretary of the Meteorological Society of Scotland,
10, St Andrew Square,
EDINBURGH.

BOOK-POST.

DALKEITH C DNO 16 66

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

FRUITS.	First in Blossom.	Fruit Ripe generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
[illegible]wberry,		

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

MIGRATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Quail or Corn Crake,		
Other Birds [illegible]aming them—		

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, diseases, etc. Whether Epizootic disease prevails among Cattle; and the Agricultural condition of the district generally.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens, County of Midlothian, in Lat. ______, Long. ______, Distance from Sea 3 miles.

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of November 1866.

The Hours of Observation are of Greenwich Time.

Days of Month	Barometer 9 h. A.M. (inches)	Attached Ther. 9 h. A.M.	Barometer 6 h. P.M. (inches)	Attached Ther. 6 h. P.M.	Self-Reg. Therm. Max.	Self-Reg. Therm. Min.	Hygrometer 9 h. A.M. Dry bulb	9 h. A.M. Wet bulb	6 h. P.M. Dry bulb	6 h. P.M. Wet bulb	Wind 9 h. A.M. Direction	Wind 6 h. P.M. Direction	Rain Amount in inches	General Remarks
1	29.53	53	29.57	54	56	44	51	50	47	46	W.	W.		Bright sunshine fine
2	29.60	51	29.58	50	49.	40	45	45	45	45	S.	S.		Rain throughout
3	29.62	48	29.65	47	47	34.5	41.5	41.5	41	40.5	S.	N.		Overcast throughout
4	29.53	49	29.58	49.	50	36	45	44	45	44	W.	S.W.		Sunshine passing clouds
5	29.55	50	29.50	51	56	39.	46	45	46	44	S.W.	W.		High wind cloudy
6	29.54	49	29.75	48	49.	39	44	44	42.5	42	W.	W.		Do " Do "
7	29.37	57	29.70	50	54	38	52	49	43	42	W.	W.		Very stormy throughout cloudy
8	29.20	57	29.34	49.	54	38.5	50.5	50.5	41	39	W.	W.		High wind with showers
9	29.55	47	29.50	47	47.	34	42	39.	37	37	N.W.	N.		A little sunshine cold
10	29.94	43	29.70	45	44	27	32	30	38	38	S.W	S.E		Clear frosty a little sunshine
11	29.29	48	29.42	47	50	39	47	45	43	43	S.	W.		Fine sunshine high wind P.M.
12	29.56	47.5	29.40	48	50	40	43	43	43	43	S.W.	W.		Fresh passing clouds. m.s.
13	29.20	47	29.29	47	46	37	41	40	38.5	38.5	W.	W.		Slight showers m.s. a little sunshine
14	29.57	45	29.80	44	45.5	33.5	38	36	37	36.5	W.	W.		Cold wind cloudy m.s.
15	29.75	44	29.20	47	46	27.5	40	39.5	46	46	W.	W.		Overcast rain most part of the day
16	29.20	46	29.45	44	47.	38	37	37	35	35	N.E	N.		Heavy rain throughout
17	29.97	37	29.94	40	37	22	25	26	34	32	S.	S.W.		Hard frost clear sunshine cloudy
18	29.50	42	29.62	41	41	30	37	37	32	32	W.	N.W.		Dull and showery A.M. clear cold
19	29.80	37.5	29.84	37.5	36	26	30	30	32	30.5	N.W	N.W		Dull very cold wind frost
20	30.03	38	30.	39.	36	24	30	30	32	30	N.W	N.		Sharp frost Do "
21	29.90	41	29.93	44	46	30	38	38	42	42	W.	N.W.		Fresh sunshine fine
22	29.97	44	29.88	44	46	34	41.5	41	39	39	S.W.	W.		Sunshine mild and fine
23	29.47	45	29.40	44	45	34	40.5	40.5	36.5	36.5	S.W.	W.		Sunshine passing clouds.
24	29.67	42	29.40	46	44.5	29	34	34	34	34	S.W.	S.W.		Frost, cloudy, rain, Dull
25	29.15	43	29.35	44	46	23	35	35	37	37	W.	N.W.		Sunshine cloudy but fine
26	29.80	42	29.65	44	45	31	34	34	45	44	N.W.	N.W.		Slight frost, changeable rain
27	29.73	44	29.93	46	47.5	37	39.	38.5	41	40	W.	W.		Cloudy mild and fine
28	30.	45	30.05	47.	47.5	38	43	43	43	43	W.	W.		Overcast with a little sunshine
29	30.	41	29.97	45	46	22.5	30	30	42	42	S.W.	S.W.		Sharp frost sunshine cloudy
30	29.85	45	29.85	43	43	30	41	40	32	32	S.W.	S.E.	1.89	Cold wind a little sunshine
31														
Sums.	15 10 / 18.84	14 / 1368			15 / 1397	13 / 988.5	10 / 1193	11 / 1175.5						
Means.	29.628	45.6			46.6	32.9	39.8	39.2						
† Total Corrections for Instrumental Errors.						-.4	+.5	+.5	+.5	+.5				
‡ Corrections for Diurnal Range.														
"Corrected Means."						32.5	40.3	39.7						

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M. minus the Correction †† for Temp. (Col. 2), = 29.628 − .045 = 29.583

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

Mean at Station, corrected, and at 32°, ... = 29.583

Correction for Height, feet, above Mean Sea-level, ... = .209

Mean, reduced to 32°, and Sea-level, ... = 29.792

Highest Reading, corrected for Index error, on the 28th, ... = 30.005

Lowest Do., Do., on the 8th, ... = 29.200

Difference, or **Monthly Range**, ... = 0.805

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month** (corrected for Index errors), on the 1 th, ... = 56.0

Lowest in Month, corrected for Index errors, on the 17 th, ... = 21.6

Difference, or **Monthly Range,** .... = 34.4

"Corrected **Mean**" of all the Highest, (Col. 5), ... = 46.6

"Corrected **Mean**" of all the Lowest, (Col. 6), ... = 32.5

Difference, or **Mean Daily Range,** .... = 14.1

** Calculated **Mean Temperature** of Month, ... = 39.6

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** .... = 40.3

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** .... = 39.7

‡‡ Computed **Temperature of Dew-point,** .... = 39.0

‡‡ Do. **Elastic Force of Vapour,** .... = .237

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

‡‡ **Relative Humidity, (Saturation** = 100), ... = 95

RAIN fell on 7 **Days; Amount in Inches,** .... = 1.89

WIND. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	0	1	0	0	4	8	13	4	0		
P.M.	4	0	0	2	1	4	14	5	0		
Mean.	2	1	0	1	2	6	14	4	0		

A

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

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 2nd; 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.

Observations made and Return verified by ________________

(Signed) Wm Morrison

P

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 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; 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 adjustible 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 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 black within, 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 at the Society's Office.

Self-Registering Thermometers.—Professor Phillips's, 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 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 lobe, 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 "*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 alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes, that has not 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 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 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 $40\frac{1}{2}$°, respectively. So also $40\frac{1}{4}$°, and $40\frac{3}{4}$°, 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 *3rd* are those of a series of phenomena commencing at 9 P.M. on the *2nd*, and extending till 9 P.M. on the *3rd*.

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, extra observations ought to 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 would strongly 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.

Snow-falls 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 indeed in every column, the observer cannot be too careful to register *observations* only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for 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 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," $\frac{6,\ S.W.}{2,\ W.}$, (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 $\frac{4,\ st.}{2,\ cu\text{-}st.}$, (*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.

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 Schönbein's or Moffat's papers are used—Moffat's are preferred. 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 $3^{N.W.}_{4}$, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—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 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, auroræ boreales, 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, 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 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. For these hourly observations separate schedules will be furnished to observers.

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 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.

Edinburgh, *9th December* 1863.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

Dalkeith
Nov. 18[illegible]

EDINBURGH DE 5 66

DALKEITH B DE [illegible] 66

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, *St Andrew Square,*

EDINBURGH.

BOOK-POST.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens, County of Midlothian, in Lat.____, Long.____, Distance from Sea 3 miles.

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of December 1866.

The Hours of Observation are of Greenwich Time.

Days of Month	Barometer 9 h. A.M. (inches)	Attached Thermometer 9 h. A.M.	Barometer 6 h. P.M.	Attached Thermometer 6 h. P.M.	Self-Registering Thermometers, Protected in Shade, Max.	Min.	Hygrometer 9 h. A.M. Dry bulb	Wet bulb	Hygrometer 6 h. P.M. Dry bulb	Wet bulb	Wind 9 h. A.M. Direction	Wind 6 h. P.M. Direction	Rain, Amount in inches	General Remarks	Days of Month
1	29·77	41	29·60	41	37	24	32	32	33	33	S.E.	N.E.		Dull and cold. Overcast P.M.	1
2	29·60	41	29·45	41	34	30·5	31	31	32	32	N.E.	S.W.		Overcast throughout	2
3	29·12	48	29·17	45	52	29	43	43	42	41	S.W.	S.W.		High wind and rain throughout	3
4	29·15	44	29·05	47	53	36·5	41	41	48	48	S.	S.		Rain A.M. High wind P.M.	4
5	29·37	46	29·47	45	50	35	40·5	40·5	37	37	S.	S.		Showers of rain sunshine changeable	5
6	29·37	45	29·25	44	39	33	34	34	35	35	S.	S.		Dull and cold with showers of rain	6
7	28·63	45	29·30	44	45	30	42	42	36	35	S.W.	S.W.		Stormy and heavy rain	7
8	29·98	41	30·15	39	38	26	30	30	28	28	S.W.	S.W.		Frost. a little sunshine	8
9	29·75	42	29·45	45	45	25	40	40	45	44	S.W.	S.W.		Cloudy very heavy rain, wind	9
10	29·98	45	30·	43	48	34	41	39	37	36	N.W.	N.W.		Stormy through the night. sunshine	10
11	30·15	41	30·03	40	36	25	30	29	32	32	S.E.	N.E.		Dull cold and frosty	11
12	29·50	41	29·40	44	45	28	35	35	44	44	N.W.	N.W.		Bar. very unsteady. Small rain A.M. sunshine	12
13	29·12	45	29·05	43	45	34	39	39	39	39	S.W.	S.W.		Rain through the night. sunshine showers	13
14	28·97	43	29·03	44	45	32·5	40	40	37·5	37	S.W.	S.W.		Sunshine changeable. showery.	14
15	29·13	43	29·07	45	44	34	40	39·5	39	39	W.	W.		Dull with showers of small rain	15
16	29·25	44	29·58	44	43	32	40	40	34	34	W.	S.		Rain A.M. Clear sunshine frost P.M.	16
17	29·70	45	29·73	49	53	31	45	44·5	52	50	S.W.	S.W.		Overcast very mild	17
18	29·75	52	29·60	52	55	50	52	50·3	50·5	49	S.W.	S.W.		High wind mild and fine	18
19	29·80	46	30·	47	53	37	38	37·5	41	40	W.	W.		Stormy through the night. cold but fine	19
20	30·12	47	30·05	47	47	38	42	41	44	43	S.W.	W.		Sunshine passing clouds fine	20
21	29·87	49	30·05	50	51	40	48	46	46	44	S.W.	S.W.		Do " Do "	21
22	30·23	45	30·13	46	45	30	33	32	41	39·5	S.W.	W.		Slight frost. sunshine changeable	22
23	29·95	47	30·	49	53	39	44	43	46	44	W.	W.		Mild and fine. with passing clouds	23
24	30·03	48	29·97	48	53	39·5	44	43	43	43	S.W.	S.		Do. A.M. Dull and rain P.M.	24
25	29·80	48	29·67	50	50·5	41	45	43	46	45	S.	S.	[illegible]	Overcast throughout. Mild	25
26	29·56	47	29·05	46	46	34·5	38·5	38·5	41	41	W.	W.		Blinks of sunshine showery A.M. Heavy rain P.M.	26
27	29·48	45	29·42	43	47·5	34	37	36	43	42	W.	W.		Rain through the night. High wind and A. rain	27
28	29·52	46	29·52	50	50	37·5	45	45	47	45·5	W.	N.W.		Wind Overcast A.M. Clear and fine P.M.	28
29	29·20	49	29·	48	57·5	35	47	47	38	38	W.	W.		Rain A.M. Heavy showers P.M.	29
30	28·70	43	28·87	43	44	32	35	35	35	35	W.	S.E.		Changeable cold wind a little rain	30
31	29·28	42	29·46	41	32	27	30·5	30	29	29	N.E.	N.E.	2/12	A slight fall of snow. Hazy, showers of snow	31
Sums.	16 13 9 17·12146				121 1424·5	13 3 1034·0	101 1222·5	11 2 1206·8							
Means.	29·552	44·7			46·0	33·4	39·4	38·9							
† Total Corrections for Instrumental Errors.						-·4	+·5	+·5	+·5	+·5					
‡ Corrections for Diurnal Range.															
"Corrected Means."						33·0	39·9	39·4							
No. of Column.	1	2	3	4	5	6	9	10	11	12	13	15	19		

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29·552 — 044 = 29·508

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

Mean at Station, corrected, and at 32°, = 29·508

Correction for height, feet, above Mean Sea-level, = 209

Mean, reduced to 32°, and Sea-level, = 29·717

Highest Reading, corrected for Index error, on the 22 th, = 30·230

Lowest Do., Do., on the 7 th, = 28·630

Difference, or **Monthly Range,** = 1·600

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

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 18 th, = 55·0

Lowest in Month, corrected for Index errors, on the 1 th, = 24·0

Difference, or **Monthly Range,** = 31·0

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 46·0

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 33·0

Difference, or **Mean Daily Range,** = 13·0

** Calculated **Mean Temperature** of Month, = 39·5

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** (Cols. 9 and 11), = 39·9

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 39·4

‡‡ Computed **Temperature of Dew-Point,** = 38·4

‡‡ Do. **Elastic Force of Vapour,** = ·235

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

‡‡ **Relative Humidity,** (**Saturation** = 100), = 96

RAIN fell on 14 **Days; Amount in Inches,** = 2·50? 2·12

WIND. Direction	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	0	2	0	2	4	13	9	2	0		
P.M.	0	3	0	1	6	10	8	3	0		
Mean.	0	2	0	2	5	11	8	3	0		

A

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.

Observations made and Return verified by

(*Signed*) Wm Thomson

P

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 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; 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 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 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 black within, 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 at the Society's Office.

Self Registering Thermometers.—Professor Phillips's, 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 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 lobe, 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 "*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.

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 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 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 40¼°, and 40¾°, more or less must be registered 40°.2 or 40°.3 and 40°.7 or 40°.8 respectively. In reading Rutherford's "*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 *3rd* are those of a series of phenomena commencing at 9 P.M. on the *2nd*, and extending till 9 P.M. on the *3rd*.

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, extra observations ought to 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 would strongly 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.

Snow-falls 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-guage. For wind, rain, and snow, as indeed in every column, the observer cannot be too careful to register *observations* only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for 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 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," $\frac{6,\ \text{S.W.}}{2,\ \text{W.}}$, (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 $\frac{4,\ \text{st.}}{2,\ \text{cu-st.}}$, (*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.

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 Schönbein'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 $3^{\text{N.W.}}_{4}$, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—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 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, auroræ boreales, 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 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 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 makers.

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.

EDINBURGH, *9th December* 1865.

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

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

BOOK-POST.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

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Dec 1866

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