

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens County of Edinburgh, 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 1870.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.	
		9 h. A.M.		P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		P.M.		9 h. A.M.		9 h. P.M.		9 A.M.		P.M.		9 h. A.M.									
		Barometer. * No.	Atmospheric Thermometer.	Barometer. No.	Atmospheric Thermometer.	Max. No.	Min. No.	Max. in Sun-rays No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	No. 1.	No. 2.	No. 3.							
		Inches.	°	Inches.	°																		No. 1.	No. 2.	No. 3.						
	1	29.05	43.2	29.11	44.8	42.0	37.0	38.2	37.2	40.4	39.3	SSW	7	Se												Cloudy with sunshine a.m. dull P.M.	1				
	2	29.25	42.9	29.30	42.0	42.5	34.2	38.9	38.0	37.9	37.2	SW	SW													Do very mild	2				
	3	29.32	45.2	29.35	46.0	46.0	36.2	42.0	40.9	39.2	38.5	SSW	SW													Sunshine a.m. dull P.M. very mild	3				
	4	29.20	45.9	29.23	46.0	46.5	36.0	43.2	40.2	41.9	40.0	SW	SSW													Glimpses of sun a.m. showers of rain P.M.	4				
	5	29.37	43.0	29.30	42.0	42.2	35.2	38.9	37.1	38.2	36.2	SW	SSW													Showers of rain a.m. cloudy with sun P.M.	5				
	6	29.32	42.2	29.07	43.5	41.5	32.0	38.0	36.9	40.9	39.5	SW	SW													Dull throughout, rain at night	6				
	7	28.90	44.9	29.0	45.2	45.0	37.9	42.5	39.9	40.2	38.2	SW	SW													Cloudy bright sun a.m. dull P.M.	7				
	8	28.40	44.2	28.60	43.9	42.0	36.5	39.9	38.0	41.0	38.9	WSW	SW													Dull throughout showers of rain P.M.	8				
	9	29.15	45.9	29.32	41.2	42.2	36.5	40	37.9	35	32.9	W	W													Very Cloudy throughout with sunshine	9				
	10	29.55	40.9	29.65	44.9	37.9	29.2	32.9	30.8	32	30.9	W	W													Sunshine a.m. dull P.M. very cold	10				
	11	29.62	39.2	29.27	40.2	39.5	28	32	32	37.2	34.9	W	SW													Dull throughout snow a.m. rain P.M.	11				
	12	29.22	39.0	29.25	40	37.5	31.9	33.9	32.2	36.5	33.5	W	W													Snow showers with glimpses of sun	12				
	13	29.52	39.0	29.45	40.2	39	32	33.2	32	35	33.9	W	W													Sunshine a.m. dull P.M. cold	13				
	14	28.97	41	28.90	41	41.5	32	36.5	36.2	38.2	37	SE	SW													Very Cloudy with sun a.m. dull P.M. cold	14				
	15	29.35	41.2	29.52	42.5	45.2	33.5	38	36	38.2	37.9	WSW	WSW													Cloudy sunshine a.m. dull P.M. mild	15				
	16	29.90	41	30.00	42.9	41.5	32	36.2	35.9	38.5	38.2	WSW	W													Dull throughout drizzling rain at night, mild	16				
	17	30.25	42.5	30.27	43	45.5	35	38	38	43.5	42.5	WNW	WNW													Foggy a.m. dull P.M. mild	17				
	18	30.30	40.9	30.32	46	47.5	41	43.5	42.9	41	41	SW	WNW													Cloudy sunshine a.m. dull P.M. foggy	18				
	19	30.45	45.5	30.47	44	38.2	34	38.9	32.5	35.2	34.9	SE	SE													Dull throughout, very cold	19				
	20	30.40	40.2	30.32	39.2	35	31.5	33.5	30.2	33	30.2	SE	SE													Do Do	20				
	21	30.25	38	30.15	38	34.5	29.5	31.8	29.2	33	31	SE	WSW													Do Do	21				
	22	30.22	37.9	30.25	40	37.2	27	31	30.5	35.2	34.2	SW	WSW													Do Do	22				
	23	29.32	39.2	30.35	40.2	39.5	30	34.2	33.9	31	31	WSW	SW													Dull throughout clear toward night-fall	23				
	24	30.35	35.9	30.33	37.5	39	24	27	32	26	29	W	SE													Very fine	24				
	25	30.30	37.2	30.27	38.9	37	23	32	31.5	31.5	31.5	WSW	WSW													Frosty air, dull a.m. clear P.M.	25				
	26	30.17	36.2	30.07	35.9	37.9	26	30.2	32	32.9	32.2	WSW	SW													Frosty, sunshine a.m. clear P.M.	26				
	27	30.0	34.9	29.90	38.2	42.2	24	29	29	37	35.2	WSW	WSW													Clear, Cloudy with sun a.m. dull P.M.	27				
	28	29.82	38.5	29.76	39.9	39.9	32	34.9	32.9	35.5	33.9	SW	SW													Cloudy with sun, clear, dull P.M.	28				
	29	29.82	37.5	29.77	38.5	37	26.2	31	29.9	29.9	30	SW	SW													Overcast, sunshine a.m. clear P.M.	29				
	30	29.67	37.5	29.45	40	44.5	20	31	30	37.5	35	S	SE													Overcast, sunshine a.m. windy P.M.	30				
	31	29.25	41.5	29.27	42.2	42.2	33.5	38.2	36.5	41	38.9	SE	SW													Dull throughout	31				
	Sums.	129 15 14			169 13 5			14 11 14 14																							
	Means.	20.66 297			2699 97 68			1106 107 27																							
	† Total Corrections for Instrumental Errors.	29.667496			110.9 499 31.5			35.7 34.6																							
	† Corrections for Diurnal Range.																														
	"Corrected Means."				40.9 31.1			36.2 35.1																							
	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

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† for Temp. (Col. 2), = 29.667 - 0.57 = 29.610

"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = 29.612

Mean at Station, corrected, and at 32°, = 29.612

Correction for height, feet above Mean Sea-level, = 2.09

Mean, reduced to 32°, and Sea-level, = 29.879 821

Highest Reading, corrected for Index error, on the 19th, = 30.450 470

Lowest Do. Do. on the 8th, = 28.400

Difference, or Monthly Range, = 2.050 070

† 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.

†† Edinburgh corrections for both capillarity and Index errors.

‡ The diurnal Range for Scotland is as yet unknown.

††† Practically, though not absolutely a minus correction.

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

‡‡‡ While the diurnal Range is unknown, the Arithmetic Mean of Cols. 9 and 10 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 18th, = 47.5

Lowest in Month, corrected for Index errors, on the 30th, = 19.6

Difference, or Monthly Range, = 27.9

"Corrected Mean" of all the Highest, (Col. 5), = 40.9 = 49.0

"Corrected Mean" of all the Lowest, (Col. 6), = 31.1 = 31.1

Difference, or Mean Daily Range, = 9.8 = 17.9

\*\* Calculated Mean Temperature of Month, = 36.0 = 42.0

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, (Cols. 9 and 11), = 35.7 36.2

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 34.6 35.1

†† Computed Temperature of Dew-Point, = 33.6 33.5

†† Do. Elastic Force of Vapour, = 1.89 1.93

†† Do. Weight of Vapour in a Cubic Foot of Air, = 90

†† Relative Humidity, (Saturation = 100), = 90

RAIN fell on 7 Days; Amount in Inches, = 1.60

WIND.		SUMMARY.									
Direction.		N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.		0	0	1	4	3	9	10	4	0	
P.M.		0	1	2	2	2	12	8	4	0	
Mean.		0	1	2	3	2	10	9	4	0	

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

Observations made and Return verified by \_\_\_\_\_

(Signed) \_\_\_\_\_



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 incompatible, 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 suns, 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. Aikin of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-rod* is 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 they, 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 *aneroid*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *seize* up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upright. Before suspending the Barometer for use, 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 lap* 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 suspended.

The Barometer should be suspended in a good *level*, 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 tipped 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 mercury, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

*Protection of Thermometers.*—The Council of the Society recommend that self-registering Thermometers and Hygrometers be enclosed in a Box painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from nearly local influences. Five 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-sticks, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the publishers, *Self-registering Thermometers*.—Professor Phillips, and Negretti and Zambra's Patent "Maximum" Thermometers, are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be 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 near the top of the tube, and must be dislodged from there 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 reflection 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; for the sun's heat to affect the Minimum Thermometer by diffusion.

*Verification of Thermometers.*—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are *not* graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used, without being *re-tested*. The self-registering, 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 *retailor's 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 he immediately altered by pulling the boxwood frame out of the tin case, and hanging then side by side, so that the frame-worked rep presents 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 tubes, or column of mercury. The readings ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—38°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·3, or 40°·5, according as it indicates a little under, an exact coincidence with, or a little over 40°; or 40°·5, respectively. So also 44°·3, and 40°·8, 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, snow, in winter at least, the extremes may occur at any hour; and it is necessary to refer their comparison to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d. *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.

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

The Council recommend that every observatory be furnished with a Hemispherical Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind, at any particular hour of observation, *Linck'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 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-gauges* may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs it must be noted in the "Remarks," and the letter S affixed to the depth of water received in gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as indicated in every column, the observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for Luke Howard's

nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky *overhead* (i.e., within 30° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *cloud* column, though their appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered on 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," <sup>2</sup> 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 <sup>2</sup> <sup>cr-st.</sup> (i.e.,) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

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

*Underground Thermometers.*—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and consistency, the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames. Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

*Temperature of the Sea.*—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, notwithstanding 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.

*Quesne.*—Mention whether Schumacher's or Mollat'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°·5, as an *zone* entry in the schedule, will indicate that the ozone paper is tinted as "g" on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4 1/2," 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, 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 room 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 importance ought to be given to this column, to the *general* observations, in character, colour, tendency, 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 mists, mists, however, considerable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

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

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

The Council recommend that *yearly* observations be taken;—12, on the 2d of March, 3d of July, 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 writers.

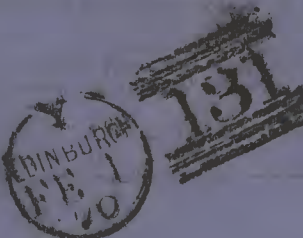
The Council recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable that the Society should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

EDINBURGH.

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

MR ALEXANDER BUCHANAN

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Dec 11 1870

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe, generally.	LABORATORY BIRDS.	First Arrival.	Departure.
Barberry, . . . . .		Apple, . . . . .			Cuckoo, . . . . .		
Bontrée 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, . . . . .		
Mezerion, . . . . .		Strawberry, . . . . .			Rail or Corn Crake, . . . . .		
Mountain Ash or Rowan, . . . . .							
Red Flowering Currant, . . . . .							
Rhododendron Ponticum, . . . . .							
Whin, . . . . .							

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



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens, County of Edinburgh, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea 3 miles.Height of Cistem of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet.During the MONTH of February 1870.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.				SEA.	OZONE.	GENERAL REMARKS.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 A.M.		P.M.		9 h. A.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
		Barometer.	Attached Thermometer.	Barometer.	Attached Thermometer.	Max.	Min.	Max. in Sun-rays.	Min. on Grass.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	No. of hours in which it fell.	Amount in inches.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	Velocity (0-6), and Direction.	Amount (0-10), and Species.	No.	No.	No.	Temperature of Well at depth of feet, No.					Temperature and Density.	9 A.M. 9 P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
		* No.		No.		No.	No.	No.	No.															3 inches.	12 inches.	22 inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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	1	29.55	42.2	29.32	44	44.2	34.5			38	36.2	41.2	38.9	S	8	S	8														I all throughout, windy, drizzling rain at night	1																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
	2	29.27	43.3	29.25	46.5	47.5	38			43.9	42.2	43.5	42.9	S	8	S	8														Dull throughout rain at intervals very much	2																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
	3	29.42	44	29.42	45.2	45.2	36.2			38.5	38.9	37.5	36.5	S		S															Bleak, rain a.m. glimpse of sun P.M.	3																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
	4	29.40	43.2	29.27	45	44.2	35.2			38.2	36.5	42.9	40.9	S	10	S	10														Bright sun a.m. dull P.M. drizzling rain at night	4																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
	5	29.42	45.9	29.57	44.2	44.2	36.5			42	40.5	38.2	37.2	S	10	WS	10														Dull a.m. sunshine with passing clouds P.M.	5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
	6	29.55	43.2	29.25	45.2	45.2	36.6			40.2	35.5	43.9	41.5	S	8	SS	8															Dull throughout, high wind towards night fresh	6																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	7	29.47	45.5	29.42	44	45.5	39.9			41.5	39.9	38.9	37.5	S		SS																Very dull, showers of rain at intervals, windy	7																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	8	29.47	44.2	29.45	40	38.2	33.2			36.2	35	35.2	32.5	SS		SS																Very cloudy, snow showers, Very cold	8																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	9	29.87	41.2	30.0	37.2	45.5	38.9			38.5	31	31.2	29	SS		SS																Bright sun with passing clouds very cold	9																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
	10	30.12	35.2	30.07	37.2	34.8	24			26.5	28	34	32.5	SS		SS																	Trace throughout snow showers P.M. cold	10																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	11	30.20	35.7	30.22	39.9	37.5	30			32.5	32	36.2	32.5	SS		SS																	Snow showers, cloudy with sun P.M. cold 4 p.m. 3 1/4 inches	11																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
	12	30.40	38.5	30.35	37.2	33.2	30.2			30.9	29.9	30.5	29.9	SS		SS																		Very dull throughout snow showers P.M. cold	12																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
	13	30.37	37.5	30.35	35.2	31.2	25.5			28	28.9	28.5	27.5	SS		SS																		Heavy showers of snow throughout	13																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
	14	30.35	35.2	30.30	37.2	33	24.5			32.5	32.5	33	32.5	SS		SS																		Dull throughout, showers frequent very cold	14																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
	15	30.32	38	30.35	40.2	39.2	28			35	34.5	37.2	36.2	SS		SS																		Densely bleared, showers frequent at intervals	15																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
	16	30.15	41	30.05	40.5	39.2	34.2			36.5	36.5	36	36	SS		SS																		Cloudy throughout, rain showers cold	16																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
	17	30.10	41	30.05	41	38.2	32			34.9	32.2	36.5	35	SS		SS																			Dull throughout, with showers of rain	17																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	18	29.90	40	29.82	41.2	39.5	32			37.2	32.2	38.5	36.2	SS		SS																			Very cloudy throughout	18																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	19	29.87	41.5	29.85	42.2	41.5	33.2			38.9	33.2	36.2	33.5	SS		SS																			Sunshine with passing clouds a.m. dull P.M.	19																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	20	29.77	42	29.57	44	46.2	30			40.2	37.5	42.9	39.9	SS		SS																			Bright sun a.m. cloudy P.M. windy	20																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	21	29.50	42	29.42	40	45	32			33.9	30.5	31	31	SS		SS																			Dull throughout, and cold wind	21																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	22	29.60	39.2	29.50	39	38.5	25			30.2	27	33	32.2	SS		SS																			Bright sun a.m. dull P.M. cold wind	22																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	23	29.17	41	29.22	38.9	40.2	31.5			32.9	32.2	32	32	SS		SS																				Bright sun a.m. dull P.M. cold wind	23																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
	24	29.0	40.9	29.20	38	35	29.2	SAB		31	32	27	27	SS		SS																				Snow showers throughout cold	24																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
	25	29.22	39.9	29.12	40	37.2	18	SAB		30	30	32	32	SS		SS																				Heavy fall general a.m. clear P.M. S.W. 5 1/4 inches	25																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
	26	29.85	38.9	29.23	39	40	27.2			30	30	32	32	SS		SS																				Dull throughout snow showers S.W. 6 1/4 inches	26																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
	27	29.32	41.5	29.15	41.2	38.2	22.2			35	33.2	33.9	33.9	SS		SS																				Bright sun a.m. snow showers throughout S.W. 1 1/4 inches	27																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
	28	28.90	44	29.10	44.9	47.2	32			44.9	42.5	43.9	40.2	SS		SS																					Dull, snow showers, rain at night S.W. 1 1/4 inches	28																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
	29																																					Heavy showers of rain a.m. bright sun P.M. S.W. 4 1/4 inches	29																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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BAROMETER, “corrected Mean” at 9 A.M., minus the Correction†† = 29.638  
for Temp. (Col. 2), = 29.638 — 0.033 = 29.638  
“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† = 29.638  
for Temp. (Col. 4), = 29.638 — 0.033 = 29.638  
Mean at Station, corrected, and at 32°, = 29.638  
Correction for height, feet above Mean Sea-level, = 2.209  
Mean, reduced to 32°, and Sea-level, = 29.829 8 45  
Highest Reading, corrected for Index error, on the 12 th, = 30.400  
Lowest Do. Do. on the 28 th, = 28.900  
Difference, or Monthly Range, = 1.500

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 2 th, = 47.5  
Lowest in Month, corrected for Index errors, on the 25 th, = 17.6  
Difference, or Monthly Range, = 29.9  
“Corrected Mean” of all the Highest, (Col. 5), = 40.6  
“Corrected Mean” of all the Lowest, (Col. 6), = 30.3  
Difference, or Mean Daily Range, = 10.3  
\*\* Calculated Mean Temperature of Month, = 35.4

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, (Cols. 9 and 11), = 36.0  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 34.6  
†† Computed Temperature of Dew-Point, = 32.5  
†† Do. Elastic Force of Vapour, = 1.86  
†† Do. Weight of Vapour in a Cubic Foot of Air, =         
†† Relative Humidity, (Saturation = 100), = 87  
RAIN fell on 20 Days; Amount in Inches, = 4.30

WIND.		SUMMARY.					
Direction.	N	NE	E	SE	S	SW	W
A.M.	0	1	10	2	3	4	6
P.M.	0	6	8	0	2	4	7
Mean.	0	4	9	1	2	4	6

\* Each instrument tested at the Office in Edinburgh bears the stamp “S.M.S.” and a number to be entered in the Reading; or the Number and Initials of the Maker may be here given.  
† Tabulating corrections for both regularity and Index Errors.  
†† The Diurnal Range for Scotland is as yet unknown.  
‡† *Provisionally*, though not *absolutely* a *minus* correction.  
‡‡ These “Hygrometric Deductions” are calculated from Glashier’s Hygrometric 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 page.

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

Observations made and  
Return verified by

(Signed)

*Mr. 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.

**How of Observation.**—The Council recommend that Observations be made precisely at 9 A.M. (Greenwich or Railway Time only) twice a-day for some, and once (morning or evening) for other instruments, as proposed, 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 the addition 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 exactitude being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *water-line* on this little piston coincides with the ivory frame, the screw, *to form one straight line* with those of 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 *register*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be secured so as to form a tight plug to the cistern. Then *seize* up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern 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 mercury, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

**Protection of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from nearby local influences. The laths forming the sides and doors of the boxes are arranged so as at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These boxes may be had from the opticians, *Self-registering Thermometers*.—Professors Phillips, and Negretti and Zamboni's Patent "Minimum" Thermometers, are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rathford is recommended when graduated on the glass stem of the thermometer.

This Thermometer is fitted to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *column* of spirit breaks, it may be re-ventilated by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

from radiation during night. Their bulbs have a black coating, which may easily be made, or 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 are not *not* graduated on the stem, but merely on an attached scale, a rule is required, they are very liable to be moved from their position on the scale, and ought never after-wards 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 "Hygrometric Deductions" Observers are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the bulb must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the mesh is always *clean* and *moist*, and the water-pipe must be made with great care. The bulb must be delicately 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 "Glass" Hygrometer is highly objectionable. The frame of the Thermometer 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—38°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½, respectively. So also 41½, and 40½, more or less must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Rathford's "Max" and "Min" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

**Wind.**—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the main 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 wind, or of clouds overhead, and to the direction of smoke, &c.

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

The Council recommend that every observatory be furnished with a Hemispherical Cup Anemometer;—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the Velocity of the Wind and the force 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, unscientific.

**Rain-gauges.** Many causes conspire to produce anomalies in rain returns. They arise, partly from unfavorable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the read dial, 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 attached to the depth of water received in open places where no drift is observed, and registered in addition to, as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as indicated in every column, the observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

*Clouds.*—Convenient abbreviations for Luke Howard's

nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *clouds* column, though their appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered on 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,"  $\frac{2}{6}$  S.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 (i.e., *extreme*) speed of the former. Again, in the second "Cloud" column, an entry of  $\frac{2}{2}$  east, (*i.e.*) 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 *prob* or 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 24 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 Morf'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° W., as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as 4° 3° on the scale 0 to 6 is "4° 3°," i.e., that it is *slightly fresh*.

**Magnetic.**—Too much importance cannot be attached to the 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, &c. "Remarks" ought to be made on the occurrence of meteors; aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been limited at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the sun-line in winter ought to be recorded.

By the use of observations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered either in two columns, otherwise unoccupied, or in two ruled off for the purposes, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner, or on the side-marginal. Additional remarks may be made on the margin. **Observation** in connection with the periodic return of the seasons," possess not only great scientific value, but are of considerable interest to the Agriculturists. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm.

The Council recommend that *from day* observations be taken;—viz., on the 2d of March, 1st of June, September, and December.

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

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

EDINBURGH. (By Order) A. B.

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

MR ALEXANDER BUCHAN,

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Delivered February 1870

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, . . . . .					Bero or Bigg, . . . . .				
Beech, . . . . .					Oats, . . . . .				
Birch, . . . . .					Wheat, . . . . .				
Elm, . . . . .					Beans, . . . . .				
Larch, . . . . .					Pease, . . . . .				
Lime, . . . . .					Potatoes, . . . . .				
Oak, . . . . .					Turnips, . . . . .				
Sycamore or Plane, . . . . .					Rye Grass, . . . . .				

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

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



# SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens, County of Edinburgh, 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 March 1878.

The Hours of Observation are of Greenwich Time.

<b>BAROMETER,</b> “corrected Mean” at 9 A.M., <i>minus</i> the Correction ††)	=	29.826
for Temp. (Col. 2), = .29.868..... — .042.....}		
“Corrected Mean” of Barometer at 9 P.M., <i>minus</i> the Correction ††)	=	
for Temp. (Col. 4), = ..... — .....		
<b>Mean at Station, corrected, and at 32°,.....</b>	=	29.826
Correction for height, feet above Mean Sea-level,.....	=	209
<b>Mean, reduced to 32°, and Sea-level,.....</b>	=	30.035
Highest Reading, corrected for Index error, on the 6 <sup>th</sup> ,.....	=	30.370
Lowest Do. Do., on the 1 <sup>th</sup> ,.....	=	29.050
Difference, or <b>Monthly Range,</b> .....	=	1.320

<b>S.-R. THERMETER</b> , (in shade, etc.), <b>Highest in Month</b> , (corrected for Index Errors), on the <del>30</del> <sup>32</sup> th, .....	=	52.9
<b>Lowest in Month</b> , corrected for Index errors, on the <del>30</del> <sup>32</sup> th, .....	=	25.0
Difference, or <b>Monthly Range</b> , .....	=	27.9
"Corrected <b>Mean</b> " of all the <b>Highest</b> , (Col. 5), .....	=	46.3
"Corrected <b>Mean</b> " of all the <b>Lowest</b> , (Col. 6), .....	=	33.2
Difference, or <b>Mean Daily Range</b> , .....	=	13.1
<b>** Calculated Mean Temperature</b> of Month, .....	=	39.8

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<b>S.-R. THERMETER</b> , <b>Black Bulb in Sun</b> , <b>Highest</b> , (corrected for Index Errors), on the th, .....	=	
"Corrected <b>Mean</b> ," (Col. 7), of <b>Black Bulb. Max. in Sun</b> , .....	=	
<b>Lowest at Night</b> , Black Bulb, (corrected for Index errors), on the th, ...	=	
"Corrected <b>Mean</b> ," (Col. 8), of <b>Black Bulb. Min.</b> on grass, .....	=	
Difference of above Means or Range ("exposed"), .....	=	

<b>HYGROMETER, Mean</b> (corrected) A.M. and P.M. Reading of <b>Dry Bulb</b> , (Cols. 9 and 11), .....	=	39.9
<b>Mean</b> (corrected) A.M. and P.M. Reading of <b>Wet Bulb</b> , (Cols. 10 and 12), .....	=	37.4
‡ Computed <b>Temperature of Dew-Point</b> , .....	=	<del>32.3</del> 34.2
‡ Do. <b>Elastic Force of Vapour</b> , .....	=	1.98
‡ Do. <b>Weight of Vapour in a Cubic Foot of Air</b> , ... =		
‡ <b>Relative Humidity</b> , (Saturation = 100), .....	=	80
<b>RAIN</b> fell on 7 Days; Amount in Inches, .....	=	1.70

WIND.		SUMMARY.									
Direction.	N	NE	E	SE	S	SW	W	NW	Gale or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	3	3	6	2	8	7	1			
P.M.	2	0	10	2	0	13	2	2			
Mean.	2	2	6	4	1	10	4	2			

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 Master may be here given.

Any necessary corrections for both capability and Index Errors.

The Diurnal Range for Scotland is as yet unknown.

*Practically*, though not *absolutely* a *mere correction*.

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

When the Hygrometrical Deduction is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."

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

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

Observations made and  
Return verified by

(Signed)

Mr. Thomas



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 incompatible, 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 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.**—*Waller glass* and *aneroid*, 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. Aldie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-rod* is 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* of the fixed scale; when steam passes freely through the lid and case of the cistern. When the *index-tape* on this little piston-rod is brought by the adjusting screws, to form *one straight line* with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this *preliminary setting* must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *zenith*.

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

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 eastern 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 venturi, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

**Protection of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The lids 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-baths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians *Self-registering Thermometers*.—Professor Phillips, and Negretti and Zamboni's Patent "Minimum" Thermometers are recommended: printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Kewford 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 near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

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

**Protection 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 specially 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 Scale 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 this 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 Thermometers.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read 38°·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 44½, and 44½, more or less must be read 44°·2, or 40°·3, and 40°·1, or 40°·5, respectively. In reading Fahrenheit'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 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 extreme may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the case of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

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

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

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

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

**Snowfalls may, for convenience,** be registered in the rain columns; under the following conditions:—When a snow shower occurs it must be noted in the "Remarks," and the latter attached to the depth of water received in gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as indicated in every column, the observer cannot be too careful to register *observations only*; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for Lake Howard's

nomenclature of clouds will 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 condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity," 6, S.W., (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of  $\frac{2}{2}$ , (e.g.) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

**Sunshine.**—The number of hours in which objects in the sun's rays cast shadows, should be entered in the *peg* or column. **Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and consistency,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames. Attention 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 conveniently, 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.

**Crops.**—Merrifon whether Schimper's or Milford'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 8 A.M. as an *even* entry in the schedule, will indicate that the ozone paper is injured as 8 on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4" & "2," 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 Dictrometer 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 differences ought to be given in this column to prevalent diseases, differences in climate, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, &c. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the 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, though that headed "Remarks." It is intended that observations by the Dictrometer should be entered in this manner on the side-margin. Additional remarks may be made on the side-margin.

"Observations in connection with the periodic return of the seasons," possess not only great scientific value, but are of considerable interest to the 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 reaped from year to year on a selected piece of ground or farm.

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

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

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

Examiner, *John N. Walker* 1852. (By Order) A. B.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Birds First appear.	In Leaf.	Divested of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Apperching above Ground.	In Ear or Thresh.	First Cut or Baled.
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, . . . . .			Stirling, . . . . .		
Lilac, . . . . .		Plum, . . . . .			Swan, . . . . .		
Mezerion, . . . . .		Strawberry, . . . . .			Rail or Corn Crane, . . . . .		
Mountain Ash or Rowan, . . . . .							
Red Flowering Currant, . . . . .							
Rhododendron Ponticum, . . . . .							
Whin, . . . . .							

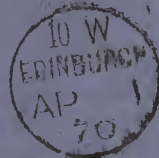
Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, &c., whether plentiful, or in perfection; whether any have suffered from blight, disease, &c. Whether Epizootic disease prevails among cattle; and the Agricultural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

EDINBURGH.

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland.

MR ALEXANDER BUCHAN.



March 1870



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *Dalkeith Gardens*, County of *Edinburgh*, 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 *April* 187*0*.  
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No.				WIND.				Rain. No. of hours in which it fell.	CLOUDS.				THERMOMETERS under Ground.	SEA.	OZONE.	GENERAL REMARKS.  As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depressure or Elevation of Barometer, Prevalent Diseases, etc.  Mention the hour at which Storms, including Thunder and Lightning, began and ended.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		9 h. A.M.		6 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.			9 A.M.		P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
		Barometer.	Atmospheric Thermometer.	Barometer.	Atmospheric Thermometer.	Max. in Shade.	Min. in Shade.	Max. in Sun-rays.	Min. on Grass.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.		Velocity (0-10), and Direction.	Amount (0-10), and Species.	Velocity (0-6), and Direction.	Amount (0-10), and Species.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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BAROMETER, “corrected Mean” at 9 A.M., minus the Correction†† for Temp. (Col. 2), = *29.811*

“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = \_\_\_\_\_

Mean at Station, corrected, and at 32°, = *29.871*

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

Mean, reduced to 32°, and Sea-level, = *30.020*

Highest Reading, corrected for Index error, on the 16 th, = *30.300*

Lowest Do. Do., on the 30 th, = *29.150*

Difference, or Monthly Range, = *1.150*

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 18 th, = *75.2*

Lowest in Month, corrected for Index errors, on the 9 th, = *30.8*

Difference, or Monthly Range, = *44.4*

“Corrected Mean” of all the Highest, (Col. 5), = *57.7*

“Corrected Mean” of all the Lowest, (Col. 6), = *39.2*

Difference, or Mean Daily Range, = *18.5*

Calculated Mean Temperature of Month, = *48.4*

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, (Cols. 9 and 11), = *49.1*

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols.

10 and 12), = *44.6*

† Computed Temperature of Dew-Point, = *39.8*

† Do. Elastic Force of Vapour, = *24.6*

† Do. Weight of Vapour in a Cubic Foot of Air, = \_\_\_\_\_

† Relative Humidity, (Saturation = 100), = *70*

RAIN fell on 4 Days; Amount in Inches, = *0.20*

WIND.		SUMMARY.									
Direction.		N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.		1	0	0	1	2	17	7	2		
P.M.		2	0	2	0	2	14	10	0		
Mean.		2	0	1	0	2	16	8	1	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.  
† Entrenching correction for both capillary and index errors.  
‡ The Diurnal Range for Scotland is as yet unknown.  
†† These “Hygrometrical Deductions” are calculated from Glaisher’s Hygrometrical Tables, Second Edition 1870.  
‡‡ While the Diurnal Range is unknown, the Arithmetic Mean of Cols. 9 and 11 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 3d; those from Other Places, not later if possible than the 6th. This Schedule not to be Gimmied or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

*W. 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.

**Barometre.**—*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. Not can any Barometre 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 Barometre 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 Barometre is constructed by Mr. Aldie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-ticks* 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 Barometre, the sides of the *cistern* are of ebonite, 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; the coincidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *mercury-line* on this little float is brought, by the adjusting screw, *to form one straight line* with those on its ivory frame, 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 *verner*.

When a Barometre, 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 *set 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 Barometre 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 *slump* *tap* is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometre (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 Barometre 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 verner, which must be exactly 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 hand and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometre.

**Protection of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as at once to "protect" the Thermometers and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to *open* to the south. These Boxes may be had from the opticians, *Self-Registering Thermometers*.—Professor Phillips's, and Negretti and Zamboni's Patent "Marine" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Marine" Thermometer of Rudenford is recommended when graduated on the glass scale and annexed to a frame separate from the "Marine." 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 near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

from radiation during night. Their bulbs have a black coating, which may easily be made, or mended, by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes whose sides protect the bulbs from the wind. The "Marine" should be freely exposed to the sun, and the "Marine" should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation.

**Verification of Thermometers.**—No instrument ought to be used for Meteorological purposes till it has been *carefully tested* by comparison with a *Standard Thermometer*. When such Thermometers are *not graduated* on the stem, but merely on an attached scale, 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 "Hygrometric Deductions," Observers are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs—the mesh must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the mesh is always *clean* and *moist*, and 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 40½°, 40.7, or 40.8 respectively. In reading Rudenford's "Marine" and "Marine" 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 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

**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, &c.

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

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

**Rain-gauges.**—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge, but in all cases the gauge does not sink in the ground till its edges are on a level with the level of 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/fall 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 place. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as indicated in every column, the observer cannot be too careful to register *observations only*; and nothing that partakes of the nature of deduction or inference.

*Clouds.*—Convenient abbreviations for Luke Howard's

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," 2 W, (for example,) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with *moderate* the (extreme) speed of the former. Again, in the second "Cloud column, an entry of 2, cr-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 observed to the extent of 2 tenths by lower clouds of the *cumulo-stratus* kind.

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

**Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and consistency,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and the stems above ground protected from the sun's rays and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames. Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

**Ozone.**—Mention whether 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 those indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3xx, 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 + 2x, 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 observation 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 of colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky etc. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometre, 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 Barometre should be entered in this manner on the side margin. Additional remarks may be made on the margin.

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

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

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

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

EDINBURGH, 10th November 1859. (By Order) A. B.

BOOK-POST.

EDINBURGH.

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

MR ALEXANDER BUCHAN,

To

EDINBURGH  
MY 2  
70

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, . . . . .		
Bouretree or Elder, . . . . .		Black Currant, . . . . .			Curlew, . . . . .		
Broom, . . . . .		Cherry, . . . . .			House-Swallow, . . . . .		
Hazel, . . . . .		Gean, . . . . .			Lapwing, . . . . .		
Raw thorn, . . . . .		Gooseberry, . . . . .			Plover, . . . . .		
Holly, . . . . .		Peach, . . . . .			Sand-Martin, . . . . .		
Laburnum, . . . . .		Pear, . . . . .			Starling, . . . . .		
Lilac, . . . . .		Plum, . . . . .			Swan, . . . . .		
Mezerion, . . . . .		Strawberry, . . . . .			Rail or Corn Crane, . . . . .		
Mountain Ash or Rowan, . . . . .							
Red Flowering Currant, . . . . .							
Rhododendron Ponticum, . . . . .							
Whin, . . . . .							

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



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkuth 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 May  
The Hours of Observation are of Greenwich Time.

[illegible]

<b>BAROMETER,</b> "corrected Mean" at 9 A.M., <i>minus</i> the Correction ++		
for Temp. (Col. 2), =	29.775	— .076 } = 29.699
<b>"Corrected Mean" of Barometer at 9 P.M., <i>minus</i> the Correction ++</b>		
for Temp. (Col. 4), =	.....	} =
<b>Mean at Station, corrected, and at 32°,</b>		= 29.699
(Correction for height, feet above Mean Sea-level,		= 209
<b>Mean, reduced to 32°, and Sea-level,</b>		= 29.908
Highest Reading, corrected for Index error, on the 26 th,		= 30.250
Lowest Do. Do., on the 12 th,		= 28.850
Difference, or <b>Monthly Range,</b>		= 1.400

<b>S.-R. THERMOMETER</b> , (in shade, etc.), <b>Highest in Month</b> , (corrected for Index Errors), on the 27 <sup>th</sup> .....	=	71.5
<b>Lowest in Month</b> , corrected for Index errors, on the 4 <sup>th</sup> , .....	=	30.5
Difference, or <b>Monthly Range</b> , .....	=	41.0
"Corrected <b>Mean</b> " of all the <b>Highest</b> , (Col. 5), .....	=	61.1
"Corrected <b>Mean</b> " of all the <b>Lowest</b> , (Col. 6), .....	=	43.1
Difference, or <b>Mean Daily Range</b> , .....	=	18.0
** Calculated <b>Mean Temperature</b> of Month, .....	=	52.1

<b>S.-R. THERMOMETER</b> , <b>Black Bulb in Sun</b> , <b>Highest</b> , (corrected for Index Errors), on the 1 <sup>st</sup> .....	=	71.5
"Corrected <b>Mean</b> ," (Col. 7), of <b>Black Bulb. Max. in Sun</b> ,.....	=	61.1
<b>Lowest at Night</b> , <b>Black Bulb</b> , (corrected for Index errors), on the 1 <sup>st</sup> , .....	=	30.5
"Corrected <b>Mean</b> ," (Col. 8), of <b>Black Bulb. Min.</b> on grass, .....	=	43.1
Difference of above Means or Range ("exposed"), .....	=	18.0

**HYGROMETER, Mean** (corrected) A.M. and P.M. Reading of **Dry Bulb**, (Cols. 9 and 11), ..... = 53.9

**Mean** (corrected) A.M. and P.M. Reading of **Wet Bulb**, (Cols. 10 and 12), ..... = 48.6

‡ Computed **Temperature of Dew-Point**, ..... = 43.4

‡ Do. **Elastic Force of Vapour**, ..... = 281

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

‡ **Relative Humidity**, (Saturation = 100), ..... = 68

**RAIN** fell on 10 Days; Amount in Inches, ..... = 0.67

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

Observations made and  
Return verified by

(Signed)



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

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

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-studies* are an inch and a half longer than the *scale-studies* of the other Barometers, 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 *flexible* 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 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 *register*.

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 *sever* 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 upturned. 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 top* is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory peg) and gently tapping it; and if this plan fails, the instrument must be 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 perpendicularly, 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 venturi, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

**Protection of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from nearly local influences. The laths forming the sides and floors 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 open to the south. These boxes may be had from the opticians, Messrs. Negretti and Zambra's Patent "Maximum" Thermometers, and recommended: printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *column* of spirit breaks it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperatures, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

from radiation during night. Their bulbs have a black coating which may easily be made, or made, by the application of a mixture of lamp black and primer's ink. They are placed in shallow louvered boxes, whose sides protect the bulbs from the wind. The "Minimum" should be freely exposed to the sun, and the "Maximum" 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 until it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are not *calibrated* 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 Society.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *re-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 the thus formed expanation 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 is not to 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 Thermometers.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index, or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—30°.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°.5, respectively. So also 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 taken rapidly taken, being so really 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, it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 24 are those of a series of phenomena commencing at 9 P.M. on the 24, and extending till 9 P.M. on the 3d.

**Wind.**—A wind-frame 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 may be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, etc.

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

The Council recommend that every observatory be furnished with a Hemispherical Cup Anemometer;—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind, at any particular hour of observation, *Drifts* and *Anemometers* may be used; the method of *judging* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

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

**Snowfalls may, for convenience, be registered in the rain columns, under the following conditions:**—When a Snow shower occurs it must be noted in the "Remarks," and the letter S affixed to the depth of water received in gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as indicated in every column, the observer cannot be too careful to register *alterations* 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 6, S. W." (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S. W., and those in the lower regions from W., with one-third the (extreme) speed of the former. Again, in the second "Cloud" column, an entry of  $\frac{2}{4}$  (e.g.) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

**Shadows.**—The number of hours in which objects in the sun's rays cast shadows, should be entered in the proj or column *Underspread Thermometer*.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and consistency,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames. Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

**Temperature of the Sea.**—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by the flow 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 Schumbe's or Mollat'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<sup>xx</sup>, as an ozone entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale 0—6 is "4"; i.e., that it is *bleaching* freely.

**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, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain; the height 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 observations, 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 by the side-marginal. Additional remarks may be made on the margin of 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 agriculturists. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds; and in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm.

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

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

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

(By Order) A. B.

EDINBURGH, 1892.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

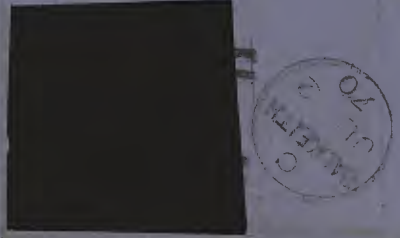
FOREST TREES.	In Flower.	Leaf Buds First appear.	In Leaf.	Divested of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Appearing above ground.	In Ear or Flower.	First cut or Raised.
Alder, . . . . .					Barley, . . . . .				
Ash, . . . . .					Bere or Bigg, . . . . .				
Beech, . . . . .					Oats, . . . . .				
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 Arrived.	Departure.
Barberry, . . . . .		Apple, . . . . .			Cuckoo, . . . . .		
Bouretree or Elder, . . . . .		Black Currant, . . . . .			Curllew, . . . . .		
Broom, . . . . .		Cherry, . . . . .			House-Swallow, . . . . .		
Hazel, . . . . .		Gean, . . . . .			Lapwing, . . . . .		
Hawthorn, . . . . .		Gooseberry, . . . . .			Plover, . . . . .		
Holly, . . . . .		Peach, . . . . .			Sand-Martin, . . . . .		
Laburnum, . . . . .		Pear, . . . . .			Starling, . . . . .		
Lilac, . . . . .		Plum, . . . . .			Swain, . . . . .		
Mezereum, . . . . .		Strawberry, . . . . .			Rail or Corn Crane,		
Mountain Ash or Rowan, . . . . .							
Red Flowering Currant, . . . . .							
Rhododendron Ponticum, . . . . .							
Whin, . . . . .							

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

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

MR ALEXANDER BUCHAN,



80  
EDINBURGH  
JULY 20



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens, County of Midlothian, in Lat. 55° 55' N, Long. 3° 15' W, 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 June 1870.  
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer. Prevalent Diseases, etc.  Mention the hour at which Storms, including Thunder and Lightning, began and ended.	Days of Month.			
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.		9 h. A.M.									
		Barometer. No.	Atmospheric Thermometer	Barometer. No.	Atmospheric Thermometer	Max. No.	Min. No.	Max. in Sun-rays No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.			Velocity (0-10), and Species.	Amount (0-10), and Species.	Velocity (0-10), and Species.	Amount (0-10), and Species.	No. 3 inches.	No. 12 inches.	No. 22 inches.							
		inches.	°	inches.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°					°		
	1	29.45	59	29.60	65	64	48.5			53	50.9	61	55	S.W.	4	W															Showerly A.M. Sunshine with passing clouds P.M.	1	
	2	29.82	61	29.85	67	67	47			56.2	52	62.9	56.5	N.W.	5	S.E.															Dull & cloudy A.M. Sunshine P.M.	2	
	3	29.95	58	30.03	61.5	60	48.2			52.9	49.7	59.9	56.3	E																	Dull throughout with rain at intervals	3	
	4	30.17	59	30.35	66.2	70.5	50			54	53.3	67.9	61	S.E.																	Rainy A.M. bright Sunshine P.M.	4	
	5	30.45	64	30.45	68	72	49.5			64.4	59	67	60	S.S.E.																	Bright sun all day	5	
	6	30.45	67	30.43	68.9	77.5	49			69.9	63	64	59.2	S.S.W.																	Bright sun all day very mild	6	
	7	30.45	65	30.35	66	67	54			62	57.2	60.9	58	E																	Dull A.M. Sunshine with passing clouds P.M.	7	
	8	30.10	65	29.87	64.5	70.5	50			63	59	57	54	N																	Cloudy with glimpses of bright sun	8	
	9	29.67	60	29.57	63.2	61.9	45			53	46	56.7	49	N.W.																	Sunshine with passing clouds & showers P.M.	9	
	10	29.45	55	29.42	60.2	58	43.5			48.9	44.8	53.2	48.9	W																	Rainy A.M. Sunshine with passing clouds & a hail shower P.M.	10	
	11	29.38	57	29.60	60	57.5	46.5			51	46.5	55	46	W																	Sunshine with passing clouds & heavy showers	11	
	12	29.85	57	29.80	58	59	44			55	47	53.8	52.9	N.E.																	Sunshine A.M. Drizzling rain P.M.	12	
	13	29.85	62	29.85	66	66.5	52			60.2	58	62.5	56	N																	Overcast A.M. Sunshine P.M.	13	
	14	29.85	63.9	29.90	66	68	52			61.9	56.3	61	56	N																	Cloudy with glimpses of sun	14	
	15	29.92	63.5	29.90	64	67	49			61	56	57.8	56	S.W.																	Sunshine with clouds A.M. Showers P.M.	15	
	16	29.80	64	29.80	64.5	66	53.5			63.5	58.9	60	53.5	S.W.																	Dull with showers	16	
	17	29.75	62	29.70	66	67.5	51			58.9	55	64	57	N.W.																	Overcast & heavy A.M. Bright sun P.M.	17	
	18	29.70	59.8	29.85	67	67.9	45			56.2	54	63.2	53.5	S.W.																	Cloudy with showers A.M. Bright sun P.M.	18	
	19	29.95	62	29.82	65	66.5	48			58.5	54	61	57.2	N																	Dull A.M. sun with clouds & showers P.M.	19	
	20	29.92	61	30.05	65	64	57			57.9	53	62	55	S.W.																	Slightly overcast A.M. Bright sun P.M.	20	
	21	30.12	68.8	30.10	72.5	76.5	53			67.8	62.2	71.5	63.9	S.W.																	Bright sun with passing clouds	21	
	22	30.10	66	30.15	66.1	73	53			61.2	54.5	58.5	50.7	S.W.																	Do Do	22	
	23	30.05	61	30.00	64	62.5	45			56	49	57	49	W																	Bright sun with passing clouds & misty	23	
	24	29.80	61.8	29.75	59	59.9	44.5			57	50.5	53	50.1	N																	Showerly with glimpses of sun & thunder at intervals	24	
	25	29.90	58	29.90	61.5	62.5	44.5			53.5	47.8	56.5	50.2	N.W.																	Dull throughout	25	
	26	29.72	61.8	29.65	59	61	49			57	52.5	52.9	51.3	N.W.																	Dull A.M. rain & heavy fall of rain after 12 n.	26	
	27	29.80	59	29.90	61.9	58	49			55	52	56	51.5	N.W.																	Dull with showers, turning fine	27	
	28	29.95	58	29.92	64.9	68	45			54	48	62	55	N.W.																	Fine throughout	28	
	29	29.92	62.8	29.90	65	71	48			60	54.9	60.9	56.2	N																	Fine throughout	29	
	30	29.87	60	29.82	64.9	62.5	49			55	49.9	57.8	50.8	N																	Cloudy A.M. Rainy P.M.	30	
	31																																
Sums.		19 10 6 14.6				6 15 8 15.3				118 5 16.9																							
		27.1 6 43.2				173 2 25.7				2399 9 7.5																							
Means.		29.905 61.4				65.8 48.6				58.0 53.2																							
+ Total Corrections for Instrumental Errors.						-4				+5 +5 +5 +5																							
+ Corrections for Diurnal Range.																																	
"Corrected Means."						118.2				58.5 53.7																							
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		

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction ++  
for Temp. (Col. 2), = 29.817  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction ++  
for Temp. (Col. 4), = 29.817  
Mean at Station, corrected, and at 32°, = 29.817  
Correction for height, feet above Mean Sea-level, = 2.09  
Mean, reduced to 32°, and Sea-level, = 30.026  
Highest Reading, corrected for Index error, on the 5 th, = 30.450  
Lowest Do. Do., on the 11 th, = 29.380  
Difference, or Monthly Range, = 1.070

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 6 th, = 77.5  
Lowest in Month, corrected for Index errors, on the 18 th, = 43.1  
Difference, or Monthly Range, = 34.4  
"Corrected Mean" of all the Highest, (Col. 5), = 65.8  
"Corrected Mean" of all the Lowest, (Col. 6), = 48.2  
Difference, or Mean Daily Range, = 17.6  
"Calculated Mean Temperature of Month, = 57.0

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, (Cols. 9 and 11), = 58.5  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 53.7  
# Computed Temperature of Dew-Point, = 49.4  
# Do. Elastic Force of Vapour, = 35.4  
# Do. Weight of Vapour in a Cubic Foot of Air, =         
# Relative Humidity, (Saturation = 100), = 72  
RAIN fell on 11 Days; Amount in Inches, = 1.00

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	2	1	2	7	10	7			
P.M.		2	1	3	2	5	3	10	4			
Mean.		1	1	2	2	4	5	10	5	1		

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

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 *thermols*, 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. Acland of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-rod* is 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 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 *some* up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a *slight tap* is produced. If this is prevented by air, it may be removed to the cistern, and got rid of, by inserting 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 inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-balls, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians.

*Self-registering Thermometers.*—Professor Phillips, and Negretti and Zambra's Patent "Maximum" Thermometers are recommended: printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be re-unioned by striking the instrument repeatedly against the palm of the hand; if any part of the spirit distils by high temperature, it will be found just the top of the tube, and must be dislodged from there 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.

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested* form of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers are specially requested to attend to the following conditions:—The bulbs must *long down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the mesh must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the mesh is always *clean* and *moist*, and the water pine. 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 thus the Thermometer will be read 39° 9', 40° 0', or 40° 1'; or again, 40, 40.5, or 40.6, according as it indicates a little under, an exact coincidence with, or a little over 40° or 40.5° respectively. So also 44.5, and 40.6, more or less must be registered 40.2 or 40.3, and 40.7 or 40.8 respectively. In reading Katherford'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 note their occurrence to their proper meteorological day. In the Society's schedules, the indications registered at 9 P.M. are those of a series of phenomena commencing at 9 P.M. on the 24, and extending till 9 P.M. on the 3d.

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

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

The Council recommend that every observatory be furnished with a Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of the Wind 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-gauge.*—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 should be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

*Snowfalls* may, for convenience, be registered in the rain column, 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 appearance and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the *sky overhead* is *half covered* by clouds, 5 is entered as the *observation*, and so on.

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," 2, W., (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (extreme) speed of the former. Again, in the second "Cloud" column, an entry of 2, 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 coasts, 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 Schönborn's or Mollat'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<sup>xx</sup>, 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 observatory is necessary to every complete meteorological observatory.

*Remarks.*—The "Remarks" column is too narrow, but unavoidable so. Some of the most valuable observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow hail, or rain, the hour of storms of wind attaining their maximum, as well as such spots on storms as have been limited at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner on the side 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 *ten day* observations be taken;—viz., on the 21st days of March, June, September, and December. Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the makers.

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

DONNING, 10th November 1893.

(By Order) A. B.

BOOK-POST.

EDINBURGH.

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland,

MR ALEXANDER BUCHAN,

To

Delivered June 1890

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Last 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, . . . . .					Bore or Bigg, . . . . .				
Beech, . . . . .					Oats, . . . . .				
Birch, . . . . .					Wheat, . . . . .				
Elm, . . . . .					Beans, . . . . .				
Larch, . . . . .					Pease, . . . . .				
Lime, . . . . .					Potatoes, . . . . .				
Oak, . . . . .					Turnips, . . . . .				
Sycamore or Plane,					Rye Grass, . . . . .				

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

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



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith 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 July 1870.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No. 1.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.  As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc.  Mention the hour at which Storms, including Thunder and Lightning, began and ended.		Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Balls.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
		Barometer, * No.	Atmos- phere.	Barometer, No.	Atmos- phere.	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Velocity (0-10), and Species.	Amount (0-10), and Species.	Velocity (0-10), and Species.	Amount (0-10), and Species.	No. 1. inches.	No. 2. inches.	No. 3. inches.	No. 4. inches.	No. 5. inches.						No. 6. inches.	No. 7. inches.	No. 8. inches.	No. 9. inches.	No. 10. inches.	No. 11. inches.	No. 12. inches.	No. 13. inches.	No. 14. inches.	No. 15. inches.	No. 16. inches.	No. 17. inches.	No. 18. inches.	No. 19. inches.	No. 20. inches.	No. 21. inches.	No. 22. inches.	No. 23. inches.	No. 24. inches.	No. 25. inches.	No. 26. inches.	No. 27. inches.	No. 28. inches.	No. 29. inches.	No. 30. inches.	No. 31. inches.	No. 32. inches.	No. 33. inches.	No. 34. inches.	No. 35. inches.	No. 36. inches.	No. 37. inches.	No. 38. inches.	No. 39. inches.	No. 40. inches.	No. 41. inches.	No. 42. inches.	No. 43. inches.	No. 44. inches.	No. 45. inches.	No. 46. inches.	No. 47. inches.	No. 48. inches.	No. 49. inches.	No. 50. inches.	No. 51. inches.	No. 52. inches.	No. 53. inches.	No. 54. inches.	No. 55. inches.	No. 56. inches.	No. 57. inches.	No. 58. inches.	No. 59. inches.	No. 60. inches.	No. 61. inches.	No. 62. inches.	No. 63. inches.	No. 64. inches.	No. 65. inches.	No. 66. inches.	No. 67. inches.	No. 68. inches.	No. 69. inches.	No. 70. inches.	No. 71. inches.	No. 72. inches.	No. 73. inches.	No. 74. inches.	No. 75. inches.	No. 76. inches.	No. 77. inches.	No. 78. inches.	No. 79. inches.	No. 80. inches.	No. 81. inches.	No. 82. inches.	No. 83. inches.	No. 84. inches.	No. 85. inches.	No. 86. inches.	No. 87. inches.	No. 88. inches.	No. 89. inches.	No. 90. inches.	No. 91. inches.	No. 92. inches.	No. 93. inches.	No. 94. inches.	No. 95. inches.	No. 96. inches.	No. 97. inches.	No. 98. inches.	No. 99. inches.	No. 100. inches.	No. 101. inches.	No. 102. inches.	No. 103. inches.	No. 104. inches.	No. 105. inches.	No. 106. inches.	No. 107. inches.	No. 108. inches.	No. 109. inches.	No. 110. inches.	No. 111. inches.	No. 112. inches.	No. 113. inches.	No. 114. inches.	No. 115. inches.	No. 116. inches.	No. 117. inches.	No. 118. inches.	No. 119. inches.	No. 120. inches.	No. 121. inches.	No. 122. inches.	No. 123. inches.	No. 124. inches.	No. 125. inches.	No. 126. inches.	No. 127. inches.	No. 128. inches.	No. 129. inches.	No. 130. inches.	No. 131. inches.	No. 132. inches.	No. 133. inches.	No. 134. inches.	No. 135. inches.	No. 136. inches.	No. 137. inches.	No. 138. inches.	No. 139. inches.	No. 140. inches.	No. 141. inches.	No. 142. inches.	No. 143. inches.	No. 144. inches.	No. 145. inches.	No. 146. inches.	No. 147. inches.	No. 148. inches.	No. 149. inches.	No. 150. inches.	No. 151. inches.	No. 152. inches.	No. 153. inches.	No. 154. inches.	No. 155. inches.	No. 156. inches.	No. 157. inches.	No. 158. inches.	No. 159. inches.	No. 160. inches.	No. 161. inches.	No. 162. inches.	No. 163. inches.	No. 164. inches.	No. 165. inches.	No. 166. inches.	No. 167. inches.	No. 168. inches.	No. 169. inches.	No. 170. inches.	No. 171. inches.	No. 172. inches.	No. 173. inches.	No. 174. inches.	No. 175. inches.	No. 176. inches.	No. 177. inches.	No. 178. inches.	No. 179. inches.	No. 180. inches.	No. 181. inches.	No. 182. inches.	No. 183. inches.	No. 184. inches.	No. 185. inches.	No. 186. inches.	No. 187. inches.	No. 188. inches.	No. 189. inches.	No. 190. inches.	No. 191. inches.	No. 192. inches.	No. 193. inches.	No. 194. inches.	No. 195. inches.	No. 196. inches.	No. 197. inches.	No. 198. inches.	No. 199. inches.	No. 200. inches.	No. 201. inches.	No. 202. inches.	No. 203. inches.	No. 204. inches.	No. 205. inches.	No. 206. inches.	No. 207. inches.	No. 208. inches.	No. 209. inches.	No. 210. inches.	No. 211. inches.	No. 212. inches.	No. 213. inches.	No. 214. inches.	No. 215. inches.	No. 216. inches.	No. 217. inches.	No. 218. inches.	No. 219. inches.	No. 220. inches.	No. 221. inches.	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No. 280. inches.	No. 281. inches.	No. 282. inches.	No. 283. inches.	No. 284. inches.	No. 285. inches.	No. 286. inches.	No. 287. inches.	No. 288. inches.	No. 289. inches.	No. 290. inches.	No. 291. inches.	No. 292. inches.	No. 293. inches.	No. 294. inches.	No. 295. inches.	No. 296. inches.	No. 297. inches.	No. 298. inches.	No. 299. inches.	No. 300. inches.	No. 301. inches.	No. 302. inches.	No. 303. inches.	No. 304. inches.	No. 305. inches.	No. 306. inches.	No. 307. inches.	No. 308. inches.	No. 309. inches.	No. 310. inches.	No. 311. inches.	No. 312. inches.	No. 313. inches.	No. 314. inches.	No. 315. inches.	No. 316. inches.	No. 317. inches.	No. 318. inches.	No. 319. inches.	No. 320. inches.	No. 321. inches.	No. 322. inches.	No. 323. inches.	No. 324. inches.	No. 325. inches.	No. 326. inches.	No. 327. inches.	No. 328. inches.	No. 329. inches.	No. 330. inches.	No. 331. inches.	No. 332. inches.	No. 333. inches.	No. 334. inches.	No. 335. inches.	No. 336. inches.	No. 337. inches.	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No. 570. inches.	No. 571. inches.	No. 572. inches.	No. 573. inches.	No. 574. inches.	No. 575. inches.	No. 576. inches.	No. 577. inches.	No. 578. inches.	No. 579. inches.	No. 580. inches.	No. 581. inches.	No. 582. inches.	No. 583. inches.	No. 584. inches.	No. 585. inches.	No. 586. inches.	No. 587. inches.	No. 588. inches.	No. 589. inches.	No. 590. inches.	No. 591. inches.	No. 592. inches.	No. 593. inches.	No. 594. inches.	No. 595. inches.	No. 596. inches.	No. 597. inches.	No. 598. inches.	No. 599. inches.	No. 600. inches.	No. 601. inches.	No. 602. inches.	No. 603. inches.	No. 604. inches.	No. 605. inches.	No. 606. inches.	No. 607. inches.	No. 608. inches.	No. 609. inches.	No. 610. inches.	No. 611. inches.	No. 612. inches.	No. 613. inches.	No. 614. inches.	No. 615. inches.	No. 616. inches.	No. 617. inches.	No. 618. inches.	No. 619. inches.	No. 620. inches.	No. 621. inches.	No. 622. inches.	No. 623. inches.	No. 624. inches.	No. 625. inches.	No. 626. inches.	No. 627. inches.	No. 628. inches.	No. 629. inches.	No. 630. inches.	No. 631. inches.	No. 632. inches.	No. 633. inches.	No. 634. inches.	No. 635. inches.	No. 636. inches.	No. 637. inches.	No. 638. inches.	No. 639. inches.	No. 640. inches.	No. 641. inches.	No. 642. inches.	No. 643. inches.	No. 644. inches.	No. 645. inches.	No. 646. inches.	No. 647. inches.	No. 648. inches.	No. 649. inches.	No. 650. inches.	No. 651. inches.	No. 652. inches.	No. 653. inches.	No. 654. inches.	No. 655. inches.	No. 656. inches.	No. 657. inches.	No. 658. inches.	No. 659. inches.	No. 660. inches.	No. 661. inches.	No. 662. inches.	No. 663. inches.	No. 664. inches.	No. 665. inches.	No. 666. inches.	No. 667. inches.	No. 668. inches.	No. 669. inches.	No. 670. inches.	No. 671. inches.	No. 672. inches.	No. 673. inches.	No. 674. inches.	No. 675. inches.	No. 676. inches.	No. 677. inches.	No. 678. inches.	No. 679. inches.	No. 680. inches.	No. 681. inches.	No. 682. inches.	No. 683. inches.	No. 684. inches.	No. 685. inches.	No. 686. inches.	No. 687. inches.	No. 688. inches.	No. 689. inches.	No. 690. inches.	No. 691. inches.	No. 692. inches.	No. 693. inches.	No. 694. inches.	No. 695. inches.	No. 696. inches.	No. 697. inches.	No. 698. inches.	No. 699. inches.	No. 700. inches.	No. 701. inches.	No. 702. inches.	No. 703. inches.	No. 704. inches.	No. 705. inches.	No. 706. inches.	No. 707. inches.	No. 708. inches.	No. 709. inches.	No. 710. inches.	No. 711. inches.	No. 712. inches.	No. 713. inches.	No. 714. inches.	No. 715. inches.	No. 716. inches.	No. 717. inches.	No. 718. inches.	No. 719. inches.	No. 720. inches.	No. 721. inches.	No. 722. inches.	No. 723. inches.	No. 724. inches.	No. 725. inches.	No. 726. inches.	No. 727. inches.	No. 728. inches.	No. 729. inches.	No. 730. inches.	No. 731. inches.	No. 732. inches.	No. 733. inches.	No. 734. inches.	No. 735. inches.	No. 736. inches.	No. 737. inches.	No. 738. inches.	No. 739. inches.	No. 740. inches.	No. 741. inches.	No. 742. inches.	No. 743. inches.	No. 744. inches.	No. 745. inches.	No. 746. inches.	No. 747. inches.	No. 748. inches.	No. 749. inches.	No. 750. inches.	No. 751. inches.	No. 752. inches.	No. 753. inches.	No. 754. inches.	No. 755. inches.	No. 756. inches.	No. 757. inches.	No. 758. inches.	No. 759. inches.	No. 760. inches.	No. 761. inches.	No. 762. inches.	No. 763. inches.	No. 764. inches.	No. 765. inches.	No. 766. inches.	No. 767. inches.	No. 768. inches.	No. 769. inches.	No. 770. inches.	No. 771. inches.	No. 772. inches.	No. 773. inches.	No. 774. inches.	No. 775. inches.	No. 776. inches.	No. 777. inches.	No. 778. inches.	No. 779. inches.	No. 780. inches.	No. 781. inches.	No. 782. inches.	No. 783. inches.	No. 784. inches.	No. 785. inches.	No. 786. inches.	No. 787. inches.	No. 788. inches.	No. 7

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† for Temp. (Col. 2), = 29.737"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = 29.737Mean at Station, corrected, and at 32°, = 29.737Correction for height, feet above Mean Sea-level, = 20.9Mean, reduced to 32°, and Sea-level, = 29.946Highest Reading, corrected for Index error, on the 28 th, = 30.200Lowest Do. Do., on the 4 th, = 29.400Difference, or Monthly Range, = 0.800S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 24 th, = 87.0Lowest in Month, corrected for Index errors, on the 28 th, = 42.1Difference, or Monthly Range, = 44.9"Corrected Mean" of all the Highest, (Col. 5), = 69.6"Corrected Mean" of all the Lowest, (Col. 6), = 57.7Difference, or Mean Daily Range, = 11.9\* Calculated Mean Temperature of Month, = 60.6

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, (Cols. 9 and 11), = 61.5Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 57.1†† Computed Temperature of Dew-Point, = 53.3†† Do. Elastic Force of Vapour, = 40%

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

†† Relative Humidity, (Saturation = 100), = 75RAIN fell on 9 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	2	6	4	6	10	1				
P.M.	0	4	4	2	1	5	11	4			
Mean.	1	3	5	2	2	6	10	2	0		

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

Observations made and Return verified by

(Signed)

Mr. Adonis



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. A. de la Roche, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-tubes* 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 hair, whose stem passes freely through the lid and case of the cistern. When the *balance* on this little piston-rod is brought, by the adjusting screw, *so form one an equilibrium* with those on its ivory frame, the scale is graduated. In taking an observation, this *slight* setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *vernier*.

When a Barometer, having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *seize* up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upmost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on holding the instrument so that the mercury strikes the top of the tube, a *sharp lap* 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 hand and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

**Position of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the boxes are arranged so as at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These boxes may be had from the opticians *Self-registering Thermometer*,—Professor Phillips's, and Kegereth and Zamboni Patent *Maximum* Thermometers, and recommended; printed directions for their use may be obtained with each instrument. The "*Minimum*" Thermometer of Kutherford 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 near the top of the tube and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

from radiation during night. Their bulbs have a black coating which may easily be made, or melted, by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "*Maximum*" should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation.

**Verification of Thermometers.**—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are *not* graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used without being *re-tested*. The self-registering, and especially the "*Maximum*" Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer (marked by a scratch on the tube) ought to be tested once a year, in snow or melting ice. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological 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 20 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 putting 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 Thermometers.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—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 40½°, 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 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. They are not a matter of indifference when the self-registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

**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, &c.

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

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

**Rain-gauges.**—Many causes conspire to produce anomalies in rain returns. They arise, partly from unfavorable situation for rain returns, and partly from the defective nature of the instruments used. It is indeed, difficult to obtain an unexceptionably 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 surface of grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

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

*Clouds.*—Convenient abbreviations for Luke Howard's

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "*Velocity* 6, S. W. 2, W. (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S. W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "*Cloud*" column, an entry of  $\frac{2}{4}$  (i.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 toward the coast, where it is not influenced by heat of river water. At or near the time of high water, on the 3th, 15th, and 29th 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 bottom 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 Moffit'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"x, 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 Electricometer 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, &c. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, either headed "*Remarks*," or in two ruled off for the purpose, from that headed "*Remarks*." It is intended that observations by the Electricometer 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 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.

DUNDEE, 12th November 1893.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe, generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry, . . . . .		Apple, . . . . .			Cuckoo, . . . . .		
Bourtree or Elder, . . . . .		Black Currant, . . . . .			Curlew, . . . . .		
Broom, . . . . .		Cherry, . . . . .			House-Swallow, . . . . .		
Hazel, . . . . .		Gann, . . . . .			Lapwing, . . . . .		
Flawthorn, . . . . .		Gooseberry, . . . . .			Plover, . . . . .		
Holly, . . . . .		Peach, . . . . .			Sand-Martin, . . . . .		
Laurum, . . . . .		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.

EDINBURGH.

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland,

MR ALEXANDER BUCHAN,



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dulkeith 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 August 1870.  
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.		SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.  As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc.  Mention the hour at which Storms, including Thunder and Lightning, began and ended.	Days of Month.			
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 A.M.		P.M.		9 h. A.M.									
		Barometer. No.	Atmospheric Thermometer.	Barometer. No.	Atmospheric Thermometer.	Max. in Shade.	Min. on Grass.	Max. in Sun-rays.	Min. on Grass.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Velocity (0-5).	Amount (0-10).	Velocity (0-5).	Amount (0-10).	No. 3 inches.	No. 12 inches.	No. 22 inches.							
		inches.	°	inches.	°	No.	No.	No.	No.	°	°	°	°																		
	1	29.85	62	29.85	66	69.5	54	58	57	62	60	E	1/2												Slightly overcast A.M. but a fine day	1					
	2	29.82	63.5	29.80	69.8	74	56	60	58.9	67	62	S.E.	1/2												Hazy but a fine day throughout	2					
	3	29.75	62	29.70	68	70	53	56.3	55.9	65.5	61	N.E.	1/2												Foggy in the morning, remainder fine	3					
	4	29.60	63	29.57	65	67	51	61	59	63	60	N	1/2												Dull & hazy throughout	4					
	5	29.55	67	29.55	72	75.5	57.9	66	61.5	72	61	S	3/4												Fine day throughout	5					
	6	29.75	66	29.74	71	75	53	67	60	70	60	S.W.	3/4												Do - Do - Do	6					
	7	29.75	68	29.75	72	77.5	51	70	61	70.8	61	S.E.	1/2												Fine day bright sun throughout	7					
	8	29.95	65	30.00	69	72	48	64	60.8	67.2	63.9	E	1/2												Dull with slight shower A.M. sun with partial clearing	8					
	9	30.15	64.5	30.10	71.8	76.5	49	60	58.5	72	60	E	1/2												Fine day bright sun throughout	9					
	10	30.10	65.5	30.10	71	78	48	69	59	71.2	59	S.E.	1/2												Do - Do - Do	10					
	11	30.13	66.5	30.13	71	81.5	49	71.2	61.2	70	63	S.E.	1/2												Do - Do - Do	11					
	12	30.20	65	30.20	68.5	72.5	52.8	63	60	66	61	E	1/2												Do - Do - Do	12					
	13	30.28	65	30.25	68	71	55.9	60	57.4	63.8	55.5	E	1/2												Fine day throughout	13					
	14	30.25	60	30.23	64	65	46	56.2	52	60	53	N	1/2												Do - Do - Do	14					
	15	30.17	61	30.10	65.5	66	53	58.8	52	63	56	E	1/2												Overcast A.M. Sunshine P.M.	15					
	16	30.03	62	29.98	69	77.2	45	66	57	69.2	60	S.E.	3/4												Fine day throughout	16					
	17	30.00	63.8	29.90	71	76.5	52	62	57	71.8	61.2	E	1/2												Sunshine A.M. Sun with passing clouds P.M.	17					
	18	29.80	62.8	29.78	60	73	52.5	58	55.8	53	52	E	1/2												Dull A.M. - Rain P.M.	18					
	19	29.85	58	29.88	61	65.5	42.8	58	51	58	51	S.E.	1/2												Sunshine A.M. Cloudy with showers P.M.	19					
	20	29.95	58	30.00	59	61.5	46.9	57	50	53	52	N	1/2												Sun with passing clouds A.M. Showery P.M.	20					
	21	30.08	57.5	30.02	60.5	62	45	54	49.5	60	57	N.W.	1/2												Dull A.M. Sunshine P.M.	21					
	22	29.77	57	29.62	59	59	46.8	54	50	57	53	N	1/2												Rain, towards the day - evening fine	22					
	23	29.65	57	29.66	62	63	43.7	57	54.8	60.8	54.5	S	1/2												Dull most of the day, Sunshine towards evening	23					
	24	29.65	57	29.68	60	64.2	47.5	59	52.8	58	54	N	1/2												Showery with glimpses of bright sun	24					
	25	29.75	58	29.74	59	62	46	56.5	51	54.5	46.2	N.W.	1/2												Sunshine A.M. Dull P.M.	25					
	26	29.80	56	29.78	62	66.5	46	56.5	50	63.7	52	N	1/2												Fine throughout - bright sun	26					
	27	29.78	58	29.65	69	65	46.5	55.8	52	54.8	50.2	N.E.	1/2												Fine A.M. Dull P.M.	27					
	28	29.40	56.8	29.52	55	56	48	53	57	50	49	N.E.	1/2												Dull A.M. Heavy rain P.M.	28					
	29	29.70	53.5	29.77	56	60	42	53	47.5	52	48.5	N.W.	1/2												Sunshine, passing clouds & showers at intervals	29					
	30	30.00	55.8	30.08	61	63.5	43.5	51.2	47	62	52.5	N.W.	1/2												Fine day throughout	30					
	31	30.00	56.5	29.85	61	65	46	53	51.9	59	55.5	N	1/2												Sun with passing clouds & fall of wind	31					
Sums.		926.5	118.4	926.0	118.0	1317.8		1376.3	167.9	1845.3	173.4																				
Means.		29.887	61.1	29.839	65.0	72.5		59.6	54.8	62.0	56.1																				
Total Corrections for Instrumental Errors.						-4		+5	+5	+5	+5																				
Corrected Means.						69.1	45.6			60.1	55.3																				
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

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction  $\ddagger$  = 29.799  
for Temp. (Col. 2), = 29.887..... - 0.888...  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction  $\ddagger$  =  
for Temp. (Col. 4), = .....  
Mean at Station, corrected, and at 32°, = 29.799  
Correction for height, feet above Mean Sea-level, = 209  
Mean, reduced to 32°, and Sea-level, = 30.008  
Highest Reading, corrected for Index error, on the 1<sup>st</sup> th, = 30.280  
Lowest Do. Do., on the 2<sup>nd</sup> th, = 29.400  
Difference, or Monthly Range, = 0.880

\* 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.  
† Enabling corrections for both capillarity and Index Errors.  
‡ The Diurnal Range for Scotland is as yet unknown.  
§ Practically, though not absolutely a minute correction.  
|| These "Hygrometrical Deductions" are calculated from the Diurnal Range of Col. 8, and will be entered as the "Calculated Mean Temperature." While the Diurnal Range is unknown, the Arithmetical Mean of Col. 8, and 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 11<sup>th</sup>, = 81.5  
Lowest in Month, corrected for Index errors, on the 29<sup>th</sup>, = 41.6  
Difference, or Monthly Range, = 39.9  
"Corrected Mean" of all the Highest, (Col. 5), = 69.1  
"Corrected Mean" of all the Lowest, (Col. 6), = 48.6  
Difference, or Mean Daily Range, = 20.5  
\*\* Calculated Mean Temperature of Month, = 58.8

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 11<sup>th</sup>, =  
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, =  
Lowest at Night, Black Bulb, (corrected for Index errors), on the 11<sup>th</sup>, =  
"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), = 60.1  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 55.3  
† Computed Temperature of Dew-Point, = 51.1  
† Do. Elastic Force of Vapour, = 376  
† Do. Weight of Vapour in a Cubic Foot of Air, =  
† Relative Humidity, (Saturation = 100), = 72  
RAIN fell on 8 Days; Amount in Inches, = 0.95

WIND.		SUMMARY.									
Direction.		N	NE	E	SE	S	SW	W	NW	Chn or Variable.	Mean Force.
A.M.		5	3	8	6	2	1	3	4		
P.M.		6	8	5	1	0	3	4	5		
Mean.		6	5	6	4	1	2	3	4		

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

Observations made and  
Return verified by

(Signed)

Wm. Thomson

AL



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

One of the objects of immediate importance to 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 fall 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. Aile of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-rod* and are not true inches but so much shorter as to *compensate* for 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; and their coincidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *index-line* on this little piston-rod is brought, by the adjusting screw, to *form one straight line* with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this *preliminary* setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *zenith*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *screw up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern open. Before suspending the Barometer for use, it must be ascertained whether the spire 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 inserting 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 accurate adjustment and reading of the Barometer.

*Protection of Thermometers.*—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The lids 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-balls, in the centre of the Box, and free the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians.

*Self-registering Thermometers.*—Professor Phillips, and Negretti and Zambra's Patent "Marinum" 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 scale 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 near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

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

*Registration of Thermometers.*—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are *not graduated* on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used, without being *re-tested*. The self-registering, and specially 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 mesh must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the mesh is always *clean* and *moist*, and 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 mentioned requirements shall be complied with, as far as possible.

*Reading of the Thermometers.*—Great care must be taken to avoid the effects of refraction by bringing the eye exactly opposite the tip of the scales 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° respectively. So also 40°·2, 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, in the case of those of a series of phenomena commencing at 9 P.M., on the 2d, and extending till 9 P.M. on the 3d.

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

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

The Council recommend that every observatory be furnished with a Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind, at any particular hour of observation, Lind's Anemometer is also recommended; the method of *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 unavoidable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unequivocal position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

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

*Clouds.*—Convenient abbreviations for Luke Howard's

nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less observation 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," 2 W. (for example), will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of 2, cu-st. (*cu.*) 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 5, 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.

*Notes.*—Mention whether Schomburgk's or Moritz'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<sup>W</sup>, as an *entry* in the schedule, will indicate that the zone 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 notes 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, green 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 concurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain. The hour of storms of wind attaining their maximum, as well as such notes on storms as have been limited at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

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

*Observations* in connection with the periodical 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.

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

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

(By Order) A. B.

DUNDEE, 19th November 1879.

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, . . . . .					Bore 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.	AVIARY.	First Arrival.	Departure.
Barberry, . . . . .		Apple, . . . . .			Cuckoo, . . . . .		
Bouree 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, . . . . .		
Mezerion, . . . . .		Strawberry, . . . . .			Rail or Corn Crane, . . . . .		
Mountain Ash or Rowan, . . . . .							
Red Flowering Currant, . . . . .							
Rhododendron Ponticum, . . . . .							
Whin, . . . . .							

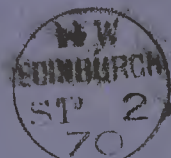
Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural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

EDINBURGH.

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

MR ALEXANDER BUCHAN,

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## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens County of Hill, 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 1870.  
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER.				WIND.				RAIN.				CLOUDS.				THERMOMETERS under Ground.				SEA.	OZONE.	GENERAL REMARKS.  As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc.  Mention the hour at which Storms, including Thunder and Lightning, began and ended.	Days of Month.		
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.											
		Barometer.	Attach- ed Ther- mometer.	Barometer.	Attach- ed Ther- mometer.	Max.	Min.	Max. in Sun's rays.	Min. on Grass.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Readings of the H. Cup Anemometer No. —	No. of hours in which it fell.	Amount in inches.	Velocity (0—10), and Direction.	Amount (0—10), and Species.	Velocity (0—10), and Direction.	Amount (0—10), and Species.	SUNSHINE.  Hours.	No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of Well at depth of feet, No.					Temperature of Air, Surface, and Dew- point.	0—10.  9 A.M. 9 P.M.
		inches.	°	inches.	°	°	°	°	°	°	°	°	°	°					9 h. A.M.																
	1	29.60	58	29.40	62	55	53			53	52	59	56	11																		Dull and threatening squalls.	1		
	2	29.13	59	29.12	62	65	51			57	51.8	58	53.5	51																		Sunshine with passing clouds.	2		
	3	29.29	58	29.46	58	60	45			56	50	53	45	7																		Fine with light wind.	3		
	4	29.60	55	29.50	61	64.2	42.5			53	49	50	52	8																		Fine with light high wind.	4		
	5	29.23	61	29.16	62	65	53.5			62.8	53.5	57	55	8																		Sunshine with occasional clouds.	5		
	6	29.28	51	29.20	62	64	46			56	52.8	59	53	8																		Fine throughout.	6		
	7	29.10	56	29.12	60	63.5	44			54.8	51.5	53.5	51.5	8																		Sunshine with dull weather.	7		
	8	29.40	56	29.45	58	61.5	41.8			53	43.5	54	48	11																		Fine throughout.	8		
	9	28.90	56	28.81	57	62	41			52.8	51	51	46	8																			Shower.	9	
	10	29.18	57	29.62	57	57	43			53.5	47	52	47	8																			Dull throughout.	10	
	11	29.75	53	29.70	57	60	42			50	45	54	47	11																			Shower.	11	
	12	29.65	57	29.90	57	60	45			54	52	50	43	8																			Fine but shower.	12	
	13	29.80	57	29.75	57	53	48			55	53	53	50	8																			Sunshine with passing clouds.	13	
	14	29.75	57	29.90	58	50	45			53	46	53	46	11																			Fine throughout.	14	
	15	30.20	51	30.30	57	53.6	43.5			53	48	54	50	11																			Fine throughout.	15	
	16	30.26	59	30.35	62	59	49			55	53.5	59	57	11																				Dull throughout.	16
	17	30.20	63	30.20	61	67	53.5			58	56	56	55	11																				Dull and threatening rain.	17
	18	30.20	57	30.19	59	62	45			56	57	56	51.8	8																				Fine throughout.	18
	19	30.15	57	30.10	63	66.5	42.5			57	52	59	56	8																				Sunshine with dull weather.	19
	20	30.10	61	30.11	63	69	53			62.5	57	59	53	8																				Dull with occasional showers.	20
	21	30.16	61	30.16	64	68	48			59	53	59	57	11																				Fine but shower.	21
	22	30.14	63	30.13	64	69	46			59	56	60	58	8																				Dull throughout.	22
	23	30.20	57	30.20	63	67	46			61	56	61	56	11																				Fine throughout.	23
	24	30.17	60	30.16	65	68	44			55	56	57	54	11																				Fine throughout.	24
	25	30.17	60	30.16	61	71	46			55	54	56	55	11																				Fine throughout.	25
	26	30.06	57	30.05	63	70	45			56	54	61	57	11																				Fine with occasional clouds.	26
	27	30.25	59	30.23	61	60	51			56	53	55	53	8																				Dull throughout.	27
	28	30.23	57	30.22	67	62	47			57	50	57	50	11																				Sunshine with slight haze.	28
	29	30.20	56	30.28	61	71	40			57	56	57	55	11																				Fine with slight haze.	29
	30	30.35	57	30.37	60	67	45			58	58	56	64	11																				Fine with haze & shower.	30
	31																																		
Sun.		25.17	23.90	25.19	12.3	11.2	20.31			18.03	7.41	19.88	13.5																						
Means.		29.839	68.0	29.849	64.9	63.8	46.8			56.0	52.5	56.5	52.4																						
† Total Corrections for Instrumental Errors.																																			
‡ Corrections for Diurnal Range.																																			
“Corrected Means.”						63.8	46.4			56.5	53.0																								
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				

BAROMETER, “corrected Mean” at 9 A.M., minus the Correction†† = 29.760  
for Temp. (Col. 2), = 29.839 - 0.079  
“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† = 29.760  
for Temp. (Col. 4), = 29.849 - 0.089  
Mean at Station, corrected, and at 32° = 29.760  
Correction for height, feet above Mean Sea-level, = 0.209  
Mean, reduced to 32°, and Sea-level, = 29.969  
Highest Reading, corrected for Index error, on the 30 th, = 30.390  
Lowest Do. Do., on the 9 th, = 28.870  
Difference, or Monthly Range, = 1.520

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 30 th, = 71.0  
Lowest in Month, corrected for Index errors, on the 30 th, = 39.6  
Difference, or Monthly Range, = 31.4  
“Corrected Mean” of all the Highest, (Col. 5), = 63.8  
“Corrected Mean” of all the Lowest, (Col. 6), = 46.4  
Difference, or Mean Daily Range, = 17.4  
“Calculated Mean Temperature of Month, = 55.1

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 30 th, = 71.0  
“Corrected Mean,” (Col. 7), of Black Bulb, Max. in Sun, = 63.8  
Lowest at Night, Black Bulb, (corrected for Index errors), on the 9 th, = 39.6  
“Corrected Mean,” (Col. 8), of Black Bulb, Min. on grass, = 46.4  
Difference of above Means or Range (“exposed”), = 17.4

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 56.5  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 53.0  
†† Computed Temperature of Dew-Point, = 49.8  
†† Do. Elastic Force of Vapour, = 3.58  
†† Do. Weight of Vapour in a Cubic Foot of Air, = 78  
†† Relative Humidity, (Saturation = 100), = 78  
RAIN fell on 4 Days; Amount in Inches, = 1.10

WIND.		SUMMARY.									
Direction.		N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.		0	1	0	4	8	7	7	3		
P.M.		0	2	0	2	8	11	7	0		
Mean.		0	2	0	3	8	9	7	1	0	

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

Observations made and  
Return verified by

(Signed)

*Mr. Thomas*

*CP*



## WITH REMARKS ON THE USE OF INSTRUMENTS

from radiation during night. The dark bulbs have a black coating which may easily be made, or mercuried by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "*Macimum*" should be freely exposed to the sun, and the "*Minimum*" should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the *Minimum* Thermometer by distillation.

*Verification of Thermometers.*—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are not graduated on the stem, but merely on an attached scale, 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, which frequently have to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer (marked by a scratch on

The *Hygrometer* consists of two *Thermometers* usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and well-established of this apparatus seriously vitiate the *Hygrometrical Deductions*,<sup>1</sup> 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-glass 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 instrument must be medium fineness, and fastened at the neck of the water-glass by cotton, which also supplies it with water;—the observer that the *muslin* is always *the same* must be seen to by the same person;—the *water-glass* must be a matter of much delicacy, and must be made of the best material;—The bulb must be

One form of "Alston's" Hygrometer is slightly adjustable. The frame of the Thermometers is enclosed in a tin case, which also supports the writer pen 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 readings 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 40½, and 40¾, more or less must be registered. Bartholin's "Mæz" and "Mæz" Thermometers, the former of which read of the index which is next to the surface

indications, and even the use of the mercury or alcohol is alone novel. 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 5 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 relate their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the *6d* are those of a series of phenomena commencing at 9 p.m. on the *2d*, and extending till 9 p.m. on the *3d*.

*Wind.*—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the mean direction must be taken; and when it is stationary, and

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

The Council recommend that every observatory be furnished with a copy of the *Instructions* and *Regulations* relating to the

ing instrument which shows the amount of Wind that passes to the instrument in a given time. The instrument is a vertical tube, and is inserted into the atmosphere at a certain angle, and is graduated to show the Force of the Wind at the time 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, Linde'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 unfavorable situation for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexpected 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 surface of the ground. The rain-gauge ought to be so placed that grass around its mouth, or the surface of the ground close to it, is not disturbed by the passage of the day.

read daily, and the readings entered in the columns on the left. On such a rain gauge, for convenience, he registered in the rain column the amount of rain that fell, and in the snow column the amount of snow that fell. 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 place. Where no drift the snow must be measured in some open place where no drift is accumulated. In addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow as observed, and registered in the columns on the right, the "Remarks" column is reserved for such observations only; and nothing that pertains to the

*Clouds*.—Convenient abbreviations for Luke Howard's nature of deduction or inference.

noninteracting cloudlets within a cloud. The amount of cloud in the atmosphere ought to be estimated from the greater or less concentration of the *sky overcloud* (46), within 20° or 30° of the horizon (47). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge the thickness, we ought not to take them into account in the total amount, though their appearance and changes ought to be noted among the *20° Runners*. The amount of cloud is everywhere on a scale of 0 to 10; thus, when the *sky overcloud* is *halved* by clouds, 5 is entered as the *observation*, and so on. *Overcloud* sections 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»,  $\frac{2}{2} \text{ W}$ , (for example), will indicate that the upper strata of clouds travel with *extreme* velocity from S.W. to N.W. and those in the lower regions with *moderate* velocity from S.W. to N.W. Again, in the second «Cloud» column, an entry of  $\frac{2}{2} \text{ ci-st.}$  (*cg*) will indicate that the highest regions are covered to the «amount» of 4 tenths with *stratocumulus* clouds; and that the sky is further observed to the extent of

*2-terre* by power clods of the *gambusia* kind. Similarly.—The number of hours in which objects in the sun's rays cast shadows, should be entered in the project 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 4 a.m., by the 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 iron collars, to prevent frost-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 a very important branch of meteorology, but it is also, 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 ensides of piers and rocks round the coast, where it is not influenced by the water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be plunged, drawn up, fixed (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 nature and the depth of observation. And

The temperature of the air, and the temperature of the water at different depths, were measured by means of thermometers fitted up especially for the purpose. The temperature of the water at the bottom of wells ought, when practicable, to be taken, and the depth of the well and of the water noted.

*Comez*.—Mention whether Schönbach's or Meißner'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 N.W., as an *example*, entry in the schedule will indicate that the *N.W.* paper is blown at 3 on the scale; that the wind that is from the *N.E.*, and that its force on the scale —0–6—is “ $\frac{1}{2}$ ” “ $\frac{1}{2}$ ”; that it is blowing fresh.

*Electricity*.—Too much importance cannot be attached to the

*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 forms adapted. 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 comets, the colour of the sky etc. *Remarks* ought to be made on the occurrence of meteors, aurora borealis, and light.

phenomena, remarkable falls of snow, hail, or rain, the force of storms, and other atmospheric phenomena, as well as such indications of wind attaining their maximum, as well as such indications of storms as have been limited at maximum, when they thus 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 barometers, 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 barometer should be entered in this manner or on the side.

*Observations* in connection with the periodic return of the seasons,<sup>2</sup> possess not only great scientific value, but are of considerable interest to the Agriculturist. The Campbell would direct the principal portion of Observers to the vegetation of each

phenomena; that the published Stimulants 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 recommends that *term day* observations be taken;—viz., on the 21st days of March, June, September, and December.

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

(By Order) A. B.

1

[illegible]

PERIODICAL RETURN	Sowing or Planting.	ab
CROPS, sowing variety.		
Y, . . . . .		
or Bigg, . . . . .		
ft, . . . . .		
g, . . . . .		
es, . . . . .		
ps, . . . . .		
Grass, . . . . .		

In flower.	Leaf buds first appear.	In Leaf.	Divested of Leaves.	mentioned.
				Barley
				Bere
				Oats,
				Whea
				Beans
				Pease
				Potato
				Turni
				Rye

OBSERVATIONS	
FOREST TREES.	FRUIT.
lder, . . . . .	
h, . . . . .	
ech, . . . . .	
rch, . . . . .	
m, . . . . .	
rch, . . . . .	
me, . . . . .	
rk, . . . . .	
eamore, or Plane,	

Al
As
Be
Bi
El
La
Li
Oa
Sy

24

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



Observations taken at Dalkeith 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 October,  
The Hours of Observation are of Greenwich Time.

**HYGROMETER, Mean** (corrected) A.M. and P.M. Reading of **Dry Bulb**, (Cols. 9 and 11), ..... = 47.6

**Mean** (corrected) A.M. and P.M. Reading of **Wet Bulb**, (Cols. 10 and 12), ..... = 45.7

‡ Computed **Temperature of Dew-Point**, ..... = 43.6

‡ **Do. Elastic Force of Vapour**, ..... = 2.84

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

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

**RAIN** fell on 10 Days; Amount in Inches, ..... = 1.40

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

Observations made and  
Return verified by



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 *thermids*, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Not can any Barometer be used for Meteorological Observations that is not supplied with such means of *adjustment* or *compensation* as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a *Standard*.

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

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-indent* 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 the aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; its convenience 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 of the ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this *preliminary setting* must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *zenith*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be severed so as to form a tight plug to the cistern. Then *score up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upmost. Before suspending the Barometer for use, the tube is a complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a *slight top* is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be 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 venery, 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 hand and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

**Protection of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the officers, Messrs. Negretti and Zambra & Paton, "Metamum," Thermometers of which each instrument. The "Metamum" Thermometer of Ruthford is recommended when graduated on the glass stem and affixed to a frame separate from the "Metamum." 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-vented by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

from radiation during night. Their bulbs have a black coating, which may easily be made, or mended, by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "Metamum" should be freely exposed to the sun, and the "Minimum" should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation.

**Verification of Thermometers.**—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are not *calibrated* 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 *relaxed 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 scale 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 observed, by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as if "Mason's" Hygrometer is highly objectionable. One form of "Mason's" Hygrometer is highly objectionable, also supports the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and bringing them side by side, so that the frame should avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index, or *column* of mercury. The readings 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 40½°, and 40¾°, more or less must be registered 40° 2 or 40° 3, and 40° 7 or 40° 8 respectively. In reading Ruthford'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 note their occurrence so that proper meteorological *day*. In the Society's schedules the indications registered on the 24 are those of a series of phenomena commencing at 9 P.M. on the 24, and extending till 9 P.M. on the 3d.

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

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

The Council recommend that every observatory be furnished with a Henshaw's 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 *calculating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

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

**Snowfalls** may, for convenience, be registered in the rain columns, under the following conditions:—when a Snow shower occurs it must be noted in the "Remarks," and the letter S annexed to the depth of water received in gauges. 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 Laite 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 6, S. 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  $\frac{1}{2}$ , (e.g.) will indicate that the higher regions are covered to the "amount" of 4 tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2 tenths by lower clouds of the *cumulo-stratus* kind.

**Sunshine.**—The number of hours in which objects in the sun's rays cast shadows, should be entered in the paper column. **Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and consistency,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames. Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

**Temperature of the Sea.**—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, 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.**—Meteorologist Schönbien's or Modir'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+ 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 is  $4 \frac{1}{2}$ , that it is *blewing 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 even 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 direction, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the force of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When *foggy mists* 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; no particular species of birches, 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 *ten day* observations be taken;—viz., on the 21st days of March, June, September, and December. Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the makers. The Council recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

Edinburgh, 10th November 1882.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

SHRUBS, &c.	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, . . . . .		
Mezerion, . . . . .		Strawberry, . . . . .			Rail or Corn Crane, . . . . .		
Mountain Ash or Rowan, . . . . .							
Red Flowering Currant, . . . . .							
Rhododendron Ponticum, . . . . .							
Whin, . . . . .							

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

EDINBURGH

General Post Office Buildings,  
Secretary of the Meteorological

MR ALEXANDER BUCHAN,

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20 NOV 1882



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *Dalkeith Gardens*, County of *West 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 *November* 187*0*.  
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.				SEA.	OZONE.	GENERAL REMARKS.	Days of Month.			
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		No. of hours in which it fell.		9 A.M.		P.M.		9 h. A.M.		9 h. P.M.								
		Barometer. No.	Atmospheric Thermometer.	Barometer. No.	Atmospheric Thermometer.	Max. No.	Min. No.	Max. in Sun-rays No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Readings of the H.Cup Anemometer. No.	9 h. A.M.	No. of hours in which it fell.	Amount in inches.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	No. of inches.	No. of inches.					No. of inches.	9 A.M.	9 P.M.
		inches.	°	inches.	°																													
	1	30.28	50	30.34	49	53.5	39.5			44	42.5	41.8	40.5	W	SW																	1		
	2	30.28	44	30.23	50	51	30.5			40.5	39.5	48	45.5	SW	SW																	2		
	3	30.28	51	30.32	51	54.5	46			50	47.5	47	44.5	SW	SW																	3		
	4	30.38	51.5	30.34	48	49	42			45	42.5	41	40	SW	W																	4		
	5	30.35	45	30.28	48	49	32			40	38	44	42	SW	SW																	5		
	6	30.05	49.5	29.95	48.5	51.5	38.5			46	52.5	43	41	SW	SW																	6		
	7	29.85	43.5	29.84	42.5	44.5	35			38	37.5	34.5	34.5	SW	SW																	7		
	8	29.95	37	29.93	41.5	46	27			31.5	30.5	38	37	SW	W																	8		
	9	29.80	38	29.73	40	40.5	27.5			33.5	31.2	35	32.5	SW	W																	9		
	10	29.54	39	29.60	40.5	40	29.5			34	32	36.8	35	SE	SE																	10		
	11	29.58	41	29.45	40	40	31			36.5	34.8	35.2	32.3	SE	SE																	11		
	12	29.20	38	29.13	41	40.5	30			32	30.2	40.8	40	SW	SE																	12		
	13	29.10	42	29.00	42	45	37			40	35.5	38	36	W	SE																	13		
	14	28.90	42	28.90	40	41	34.5			38.5	35.5	33	33	W	SE																	14		
	15	28.83	41.5	28.95	43	41	30			36	35.5	38.5	36.5	W	SE																	15		
	16	29.07	42	29.13	39	43.5	34			39	36.3	33.5	32.3	SW	SW																	16		
	17	29.27	40	29.27	42.5	43.5	31.2			36	36.8	40	38.3	W	W																	17		
	18	29.40	41.8	29.25	39.7	44	33.5			37.5	35.8	38.8	33.7	W	SW																	18		
	19	28.98	41.5	29.02	43	44	31			39.5	37	41	38.8	SW	SW																		19	
	20	29.02	42	29.05	44	43.8	34			40	37.8	43.5	42.2	SW	W																	20		
	21	28.99	46	28.92	44.8	46.5	40.5			45	42.8	41	39.5	SW	SW																		21	
	22	28.98	39.5	28.85	36	40	31.5			35.5	34.5	31	31	SW	SW																		22	
	23	28.81	39.5	28.95	41.8	40.5	28.5			31.5	35	38.5	38.5	W	W																		23	
	24	28.90	43	28.89	47	42.5	33			41.9	40.5	47.2	45.5	W	W																		24	
	25	28.88	47	29.22	46.8	43.3	42.5			45.8	43.2	42.3	40	SW	W																		25	
	26	29.65	43	29.80	43.2	43.5	36.5			58	56.5	55	34	SW	W																		26	
	27	30.03	40	30.09	42	39.5	28			33	31.5	37	36.5	SE	SE																		27	
	28	30.13	38	30.13	39	40.3	30.3			37.5	36.2	31.8	31.5	W	W																		28	
	29	30.18	37.2	30.23	41.3	39.5	28			32.5	32.5	39.5	38	SE	SE																		29	
	30	30.38	43.5	30.40	43	43.5	38.5			41.3	38.7	40	37.5	W	W																		30	
	31																																	31
Sums.		29 1574 4124	19 1411	4 116	4128	3137				81163	1213	813	7312																					
Means.		17-05 768	17 22	981	1419	1110				2452	20912	73	52272																					
† Total Corrections for Instrumental Errors.																																		
† Corrections for Diurnal Range.																																		
“Corrected Means.”																																		
No. of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			

BAROMETER, “corrected Mean” at 9 A.M., minus the Correction†† = *29.532*  
for Temp. (Col. 2), = *29.568* - *0.036* = *29.532*  
“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† = *29.536*  
for Temp. (Col. 4), = *29.574* - *0.038* = *29.536*  
Mean at Station, corrected, and at 32°, = *29.532*  
Correction for height, feet above Mean Sea-level, = *+ 209*  
Mean, reduced to 32°, and Sea-level, *29.741* = *29.741*  
Highest Reading, corrected for Index error, on the 30 th, = *30.400*  
Lowest Do. Do., on the 23 th, = *28.810*  
Difference, or Monthly Range, = *1.590*

S-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 3 th, = *54.5*

Lowest in Month, corrected for Index errors, on the th, = *26.6*  
Difference, or Monthly Range, = *27.9*  
“Corrected Mean” of all the Highest, (Col. 5), = *44.7*  
“Corrected Mean” of all the Lowest, (Col. 6), = *33.0*  
Difference, or Mean Daily Range, = *11.7*  
\*\* Calculated Mean Temperature of Month, = *38.8*

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, (Cols. 9 and 11), = *39.80*

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = *37.87*  
†† Computed Temperature of Dew-Point, = *36.0*  
†† Do. Elastic Force of Vapour, = *27.2*  
†† Do. Weight of Vapour in a Cubic Foot of Air, =  
†† Relative Humidity, (Saturation = 100), = *90*  
RAIN fell on Days; Amount in Inches, = *0.50*

WIND.	SUMMARY.									
	Direction.	N	NE	E	SE	S	SW	W	NW	Calms or Variable.
A.M.		1	1	0	1	4	1	3	3	
P.M.		3	1	0	2	4	1	3	4	
Mean.		2	1	0	1	4	1	3	4	

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

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

An excellent Barometer constructed by Mr. Ald of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-sticks* 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 *under-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 inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The falls 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-sticks, in the centre of the Box, and the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians.

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

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

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

**Application 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 "*Hygrometric Deductions*," Observers are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any point on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the mesh must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the mesh is always *clean* and *moist*, and 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 Thermometers.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading might 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 44½°, and 40.7, or 40.8 respectively. In reading Rutherford's "*Therm.*" and "*Therm.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

**Wind.**—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the mean direction must be taken, and when it is steady, and always when the wind is feeble, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, etc. Careful observations ought to be made on the changes in the direction of the wind; and during storms, it is earnestly recommended that extra observations be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results.

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

**Range-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 round its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

**Snowfalls** may, for convenience, be registered in the rain columns, under the following conditions:—when a Snow shower occurs it must be noted in the "*Remarks*," and the letter S affixed to the depth of water received in gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as indicated in every column, the observer cannot be too careful to register *observations* only; and nothing that pertains 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* 6, S. W. 7, W. 8, W. 9, W. 10, W. 11, W. 12, W. 13, W. 14, W. 15, W. 16, W. 17, W. 18, W. 19, W. 20, W. 21, W. 22, W. 23, W. 24, W. 25, W. 26, W. 27, W. 28, W. 29, W. 30, W. 31, W. 32, W. 33, W. 34, W. 35, W. 36, W. 37, W. 38, W. 39, W. 40, W. 41, W. 42, W. 43, W. 44, W. 45, W. 46, W. 47, W. 48, W. 49, W. 50, W. 51, W. 52, W. 53, W. 54, W. 55, W. 56, W. 57, W. 58, W. 59, W. 60, W. 61, W. 62, W. 63, W. 64, W. 65, W. 66, W. 67, W. 68, W. 69, W. 70, W. 71, W. 72, W. 73, W. 74, W. 75, W. 76, W. 77, W. 78, W. 79, W. 80, W. 81, W. 82, W. 83, W. 84, W. 85, W. 86, W. 87, W. 88, W. 89, W. 90, W. 91, W. 92, W. 93, W. 94, W. 95, W. 96, W. 97, W. 98, W. 99, W. 100, W. 101, W. 102, W. 103, W. 104, W. 105, W. 106, W. 107, W. 108, W. 109, W. 110, W. 111, W. 112, W. 113, W. 114, W. 115, W. 116, W. 117, W. 118, W. 119, W. 120, W. 121, W. 122, W. 123, W. 124, W. 125, W. 126, W. 127, W. 128, W. 129, W. 130, W. 131, W. 132, W. 133, W. 134, W. 135, W. 136, W. 137, W. 138, W. 139, W. 140, W. 141, W. 142, W. 143, 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W. 894, W. 895, W. 896, W. 897, W. 898, W. 899, W. 900, W. 901, W. 902, W. 903, W. 904, W. 905, W. 906, W. 907, W. 908, W. 909, W. 910, W. 911, W. 912, W. 913, W. 914, W. 915, W. 916, W. 917, W. 918, W. 919, W. 920, W. 921, W. 922, W. 923, W. 924, W. 925, W. 926, W. 927, W. 928, W. 929, W. 930, W. 931, W. 932, W. 933, W. 934, W. 935, W. 936, W. 937, W. 938, W. 939, W. 940, W. 941, W. 942, W. 943, W. 944, W. 945, W. 946, W. 947, W. 948, W. 949, W. 950, W. 951, W. 952, W. 953, W. 954, W. 955, W. 956, W. 957, W. 958, W. 959, W. 960, W. 961, W. 962, W. 963, W. 964, W. 965, W. 966, W. 967, W. 968, W. 969, W. 970, W. 971, W. 972, W. 973, W. 974, W. 975, W. 976, W. 977, W. 978, W. 979, W. 980, W. 981, W. 982, W. 983, W. 984, W. 985, W. 986, W. 987, W. 988, W. 989, W. 990, W. 991, W. 992, W. 993, W. 994, W. 995, W. 996, W. 997, W. 998, W. 999, W. 1000, W. 1001, W. 1002, W. 1003, W. 1004, W. 1005, W. 1006, W. 1007, W. 1008, W. 1009, W. 1010, W. 1011, W. 1012, W. 1013, W. 1014, W. 1015, W. 1016, W. 1017, W. 1018, W. 1019, W. 1020, W. 1021, W. 1022, W. 1023, W. 1024, W. 1025, W. 1026, W. 1027, W. 1028, W. 1029, W. 1030, W. 1031, W. 1032, W. 1033, W. 1034, W. 1035, W. 1036, W. 1037, W. 1038, W. 1039, W. 1040, W. 1041, W. 1042, W. 1043, W. 1044, W. 1045, W. 1046, W. 1047, W. 1048, W. 1049, W. 1050, W. 1051, W. 1052, W. 1053, W. 1054, W. 1055, W. 1056, W. 1057, W. 1058, W. 1059, W. 1060, W. 1061, W. 1062, W. 1063, W. 1064, W. 1065, W. 1066, W. 1067, W. 1068, W. 1069, W. 1070, W. 1071, W. 1072, W. 1073, W. 1074, W. 1075, W. 1076, W. 1077, W. 1078, W. 1079, W. 1080, W. 1081, W. 1082, W. 1083, W. 1084, W. 1085, W. 1086, W. 1087, W. 1088, W. 1089, W. 1090, W. 1091, W. 1092, W. 1093, W. 1094, W. 1095, W. 1096, W. 1097, W. 1098, W. 1099, W. 1100, W. 1101, W. 1102, W. 1103, W. 1104, W. 1105, W. 1106, W. 1107, W. 1108, W. 1109, W. 1110, W. 1111, W. 1112, W. 1113, W. 1114, W. 1115, W. 1116, W. 1117, W. 1118, W. 1119, W. 1120, W. 1121, W. 1122, W. 1123, W. 1124, W. 1125, W. 1126, W. 1127, W. 1128, W. 1129, W. 1130, W. 1131, W. 1132, W. 1133, W. 1134, W. 1135, W. 1136, W. 1137, W. 1138, W. 1139, W. 1140, W. 1141, W. 1142, W. 1143, W. 1144, W. 1145, W. 1146, W. 1147, W. 1148, W. 1149, W. 1150, W. 1151, W. 1152, W. 1153, W. 1154, W. 1155, W. 1156, W. 1157, W. 1158, W. 1159, W. 1160, W. 1161, W. 1162, W. 1163, W. 1164, W. 1165, W. 1166, W. 1167, W. 1168, W.



# SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Wallycith 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 December 1870

The Hours of Observation are of Greenwich Time.

[illegible]

**BAROMETER**, "corrected Mean" at 9 A.M., minus the Correction ++  
for Temp. (Col. 2), =  $29.448 - .028 = 29.42$

"Corrected Mean" of Barometer at 9 P.M., minus the Correction  $\uparrow$ )  
for Temp. (Col. 4), = ~~29.760~~ - ~~0.028~~ = 29.732

Mean at Station, corrected, and at 32°,..... = 29.751

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

Mean, reduced to 32°, and Sea-level,..... = 29.960

Highest Reading, corrected for Index error, on the th,..... = 30.52

Lowest Do. Do., on the th,..... = 28.6

Difference, or **Monthly Range**,..... = 1.9

- \* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.S." and a number to be entered in the Heading; or the Number and Initials of the Maker may be given.
- \* Enabling corrections for the capillary and index errors.
- \* The Barred Range for Scotland is as yet unknown.
- \* *Precaution, though not absolutely a necess correction.*
- \* These "Hymetrical Calculations" are extracted from Olafsen's Hymetrical Tables, Second Edition *only*.
- \* These "Hymetrical Calculations" are extracted from Olafsen's Hymetrical Tables, Second Edition *only*.
- \* While the Barred Range is unknown, the Arithmetic 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 19<sup>th</sup>, ..... = 23

**Lowest in Month**, corrected for Index errors, on the 23<sup>rd</sup>, ..... = 12.57

Difference, or **Monthly Range**, ..... = 39.59

"Corrected Mean" of all the Highest, (Col. 5), ..... = 38.3

"Corrected Mean" of all the Lowest, (Col. 6). ..... = 29.3

Difference, or **Mean Daily Range**, ..... = 9.0

\*\* Calculated Mean Temperature of Month, ..... = 33.8

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, (Cols. 9 and 11), .....** =

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12)..... = 34.0 35.7

†† Computed **Temperature of Dew-Point,** ..... = 34.2 27.0

Do. Elastic Force of Vapour, ..... = 300 18.2

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

Relative Humidity, (Saturation = 100), ..... = 92 to 99

AIN fell on 8 Days; Amount in Inches, ..... = 1.40

<b>WIND.</b>	SUMMARY.
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WIND.	SUMMARY.										Mean Force.	Mean Velocity in miles per day.
	Direction.	N	N E	E	S E	S	S W	W	N W	Calm or Variable.		
A.M.	1	6	2	5	1	10	1	5				
P.M.	1	7	2	3	3	7	2	6				
Mean.	1	6	2	4	2	8	2	6	0			

Observations made and  
Return verified by

(Signed)



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. Not 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; if their coincidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *water-line* on this little piston-rod is brought, by the adjusting screw, to *form one straight line* with those on its ivory frame the scale is graduated. In taking an observation, *as preliminary setting* must be made with scrupulous accuracy; *as a slight error* here will vitiate the readings from the *vertical*.

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 *sew up* the tube, 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 *slump top* is produced. If this is prevented by air it may be removed to the cistern, and got rid of by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be 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 venturi, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

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

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

from radiation during night. Their bulbs have a black coating which may easily be made, or mended, by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the sun, and the "*Minimum*" should rest on woolen supports a few inches from the surface of the glass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation.

**Verification of Thermometers.**—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are *not* graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scales, 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 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 *wet*; 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 immersed in immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed, as from the moist cloth in ordinary circumstances. One form of "Mason's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the recommended requirements shall be complied with, as far as possible.

**Reading of the Thermometer.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·3, 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°½, respectively. So also 40½, and 40¾, more or less must be registered 40·2 or 40·3, and 40·7 or 40·8 respectively. In reading 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.

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

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

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

The Council recommend that every observatory be furnished with a Hemispherical Cup anemometer—a self-registering instrument which also 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, Juntz'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 falls.

*Snowfalls* may, for convenience, be registered in the rain columns, under the following conditions:—when a snow shower occurs it must be noted in the "Remarks." The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as registered *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* (2*e*), within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *cloud's* 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,"  $\frac{2}{2} W$ , (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of  $\frac{2}{4} \text{ cir-st.}$  (*eq*) will indicate that the higher regions are covered to the "amount" of 4 tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2 tenths by lower clouds of the *cumulo-stratus* kind.

**Sunshine.**—The number of hours in which objects in the sun's rays cast shadows, should be entered in the proper column. *Underground Thermometers.*—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 A.M., by 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, 13th, and 25th of each month, the thermometer ought to be sunk, exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, nothing always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

**Temperature of Wells.**—The temperature of the water at the bottoms of wells ought, when practicable, to be taken; and the depth of the well and of the water noted. *Ozone.*—Mention whether Schönbach's or Moffet'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 8  $\frac{1}{2}$ , 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  $\frac{1}{2}$ " *etc.*, 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 *barometrical* differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, diurnal storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

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

*Observations* in connection with the periodic return of the seasons, possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; than 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 special sorts reared from year to year on a selected piece of ground or farm.

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

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

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

(By Order) A. B.

EDINBURGH, 19th November 1883.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

EDINBURGH.

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland,

MR ALEXANDER BUCHAN,