

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *Dalkeith Gardens*, County of *Midlothian*, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea *3* miles.  
Height of Cistern of the Barometer above Mean Sea-level *190* feet, above Ground *4* feet. During the MONTH of *January* 187*3*.  
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 Bulb.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.										
		Barometer.	Atmospheric Thermometer.	Barometer.	Atmospheric Thermometer.	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.	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. 1 inches.	No. 2 inches.	No. 3 inches.						Temperature of Water at 1 foot depth, No.	Temperature at 1 foot and Density.	9 A.M., 9 P.M.
		inches.	°	inches.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°						°	°	°
	1	29.27	45.5	29.27	44.8	45.5	36.			41.7	39.5	42.2	39.8	SE																		Mild. Sunshine	1	
	2	28.95	45.	29.05	44.2	45.0	39.			41.0	39.0	39.8	37.0	SE																		Sunshine, cold breeze	2	
	3	29.0	45.8	28.97	46.2	46.	36.			41.2	43.0	40.5	38.8	SE																		Cold breeze, glimpses of sun, heavy drizzle	3	
	4	29.42	44.8	29.10	45.8	42.2	35.8			39.8	36.2	42.0	41.0	SE																		Cloudy, cold winds, slight drizzle	4	
	5	29.20	44.3	29.30	44.0	40.5	36.0			38.0	35.5	35.5	36.8	SE																		Cold winds, glimpses of sun, drizzle	5	
	6	29.31	47.0	29.35	51.0	52.0	35.8			50.3	48.3	51.0	48.0	SE																		Cloudy, high winds	6	
	7	29.55	55.10	29.50	50.8	52.5	48.			50.0	47.0	47.0	44.5	SE																		Strong breeze, bright sunshine	7	
	8	29.23	51.0	29.22	50.8	52.5	48.			47.0	45.0	42.0	40.2	SE																		Drizzle, glimpses of sun, slight drizzle	8	
	9	29.15	46.2	29.10	49.0	48.5	36.0			42.0	41.0	48.0	45.0	SE																		Drizzle, glimpses of sun, slight drizzle	9	
	10	29.16	49.5	29.27	49.5	50.8	45.0			45.2	42.8	48.0	44.5	SE																		Passing clouds, slight drizzle	10	
	11	29.36	48.0	29.40	49.5	50.5	41.5			42.5	41.5	45.2	42.8	SE																		Mild, bright sunshine	11	
	12	29.55	47.5	29.45	47.0	44.0	35.0			37.0	35.5	43.0	41.0	SE																		Sunshine, drizzle, slight drizzle	12	
	13	29.35	49.0	29.40	50.2	50.5	40.0			49.0	46.0	51.0	49.5	SE																		Cloudy, drizzle, slight drizzle	13	
	14	29.51	54.2	29.52	52.5	54.0	44.0			51.0	49.8	49.5	47.0	SE																		Heavy rain, drizzle, slight drizzle	14	
	15	29.60	50.0	29.66	48.2	45.2	42.0			45.3	41.5	41.5	38.1	SE																		Heavy rain, drizzle, slight drizzle	15	
	16	29.81	47.0	29.60	47.0	43.0	37.0			38.3	37.8	43.0	42.0	SE																		Cloudy, drizzle, slight drizzle	16	
	17	29.57	44.0	29.50	46.0	46.0	34.0			37.3	35.5	40.0	37.8	SE																		Rain throughout	17	
	18	29.15	44.0	28.65	46.0	44.0	33.8			41.2	38.2	42.0	41.2	SE																		Glimpses of sun, drizzle, slight drizzle	18	
	19	28.25	44.0	28.08	43.0	40.0	32.0			35.2	32.0	34.3	32.8	SE																		Heavy rain throughout	19	
	20	28.04	39.2	28.02	40.0	35.0	27.0			30.8	29.8	28.0	27.0	SE																		Drizzle, snow, drizzle, slight drizzle	20	
	21	28.57	40.0	28.67	41.0	40.5	24.0			35.2	32.8	36.8	35.0	SE																		Drizzle, snow, drizzle, slight drizzle	21	
	22	28.64	40.5	28.84	39.0	37.0	31.5			33.3	31.8	34.2	33.2	SE																		Clear, frost, drizzle, slight drizzle	22	
	23	29.19	38.8	29.20	38.0	40.0	29.0			32.0	31.0	32.0	31.0	SE																		Cloudy, glimpses of sun	23	
	24	29.42	40.8	29.57	40.0	40.0	31.0			36.0	35.0	33.3	32.8	SE																		Bright sunshine, frosty	24	
	25	29.69	35.0	29.52	41.0	42.0	25.0			29.0	28.0	39.2	35.2	SE																		Cloudy throughout	25	
	26	29.44	43.0	29.55	44.0	43.0	37.8			41.0	39.0	41.8	39.8	SE																		Frosty, drizzle, cloud, frosty	26	
	27	29.50	44.0	29.80	45.0	44.0	38.0			40.0	38.8	42.0	40.8	SE																		Drizzle, rain, drizzle, slight drizzle	27	
	28	29.81	38.8	29.80	40.8	39.0	30.0			32.2	30.0	33.0	30.3	SE																		Cloudy, mild throughout	28	
	29	29.92	33.2	29.90	36.5	32.0	24.0			24.0	24.0	29.8	29.2	SE																		Cold winds, bright sunshine	29	
	30	29.96	38.0	30.0	39.0	36.0	27.0			31.8	31.2	33.5	32.3	SE																		Heavy frost, slight snow	30	
	31	30.18	41.8	30.20	40.8	38.0	32.0			36.2	35.2	36.0	34.0	SE																		Mild, drizzle	31	
	Sums.	919	5126	951	1505	1671	586			288	233	113	226	20																			NOTATION USED IN GENERAL REMARKS.	
	Means.	29.32	44.1	29.30	44.4	43.8	35.1			39.2	37.5	40.4	38.4																				a. denotes aurora. m. denotes meteor. ci. cirrus. cu. cirro-cumulus. cs. cirro-stratus. cu-s. cumulo-stratus. d. dew. f. fog. fr. frost. h. heavy. h. fr. heavy frost. h. d. heavy dew. h. l. hail. l. lightning. li. cl. light clouds. li. sh. light showers. lu. co. lunar corona. lu. lu. lunar halo. ma. mackerel. ni. nimbus. r. rain. h. r. heavy rain. c. h. r. continued heavy rain. s. stratus. sc. squall. sl. sleet. sn. snow. so. lu. solar halo. sq. squall. sqs. squalls. t. thunder. t. s. thunder storm. w. wind. g. gale of wind.	
	† 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†† = *29.280*  
for Temp. (Col. 2), = *29.321* - *0.041* = *29.280*  
“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† = *29.264*  
for Temp. (Col. 4), = *29.307* - *0.043* = *29.264*  
Mean at Station, corrected, and at 32°, = *29.272*  
Correction for height, feet above Mean Sea-level, = *0.09*  
Mean, reduced to 32°, and Sea-level, = *29.489*  
Highest Reading, corrected for Index error, on the 31<sup>st</sup>, = *30.080*  
Lowest Do. Do. on the 20<sup>th</sup>, = *28.040*  
Difference, or Monthly Range, = *2.040*

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 13<sup>th</sup>, = *55.0*  
Lowest in Month, corrected for Index errors, on the 29<sup>th</sup>, = *24.4*  
Difference, or Monthly Range, = *30.6*  
“Corrected Mean” of all the Highest, (Col. 5), = *43.8*  
“Corrected Mean” of all the Lowest, (Col. 6), = *35.5*  
Difference, or Mean Daily Range, = *8.3*  
“Calculated Mean Temperature” of Month, = *39.6*

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the \_\_\_\_\_, = \_\_\_\_\_  
“Corrected Mean,” (Col. 7), of Black Bulb, Max. in Sun, = \_\_\_\_\_  
Lowest at Night, Black Bulb, (corrected for Index errors), on the \_\_\_\_\_, = \_\_\_\_\_  
“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), = *40.3* *39.7*  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = *38.4* *38.0*  
“Computed Temperature of Dew-Point,” = *36.0* *35.8*  
“Do. Elastic Force of Vapour,” = *2.12* *2.10*  
“Do. Weight of Vapour in a Cubic Foot of Air,” = \_\_\_\_\_  
“Relative Humidity, (Saturation = 100),” = *85* *86*  
RAIN fell on \_\_\_\_\_ Days; Amount in Inches, = *2.68*

WIND.		SUMMARY.									
Direction.		N	NE	E	SE	S	SW	W	NW	Calms or Variable.	Mean Force.
A.M.		0	0	2	4	1	10	1	0		
P.M.		0	1	1	4	0	6	7	2	0	
Mean.		0	0	2	4	0	8	4	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 Guessed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

*Malcolm Sturges*

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 *o'clock* every reading at what time it was taken, if not at 9 o'clock.

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

Two moderate-sized Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted to Meteorological purposes. An excellent Barometer is constructed by Mr. A. de London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-bulbs* are not true indices 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; 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 *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 holding the instrument so that the mercury strikes the top of the tube, a *slight tap* is produced. If this is prevented by air it may be removed to the cistern, and got rid of by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails the instrument must be repaired.

The Barometer should be suspended in a good *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 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 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's, and Negretti and Zambra's Patent "*Martini*" 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 demerits, 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-joined by striking the instrument repeatedly against the palm of the hand, which part of the spirit dash by high temperature, it will be found near the top of the tube and must be discoloured from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

from radiation during night. Their bulbs have a black coating, which may easily be made or 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 the face of these Thermometers; nor the sun's heat to affect the *Minimum* Thermometer by distillation.

**Replication 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, intricate repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used, without being *re-tested*. The self-registering, and especially the "*Minimum*" Thermometers ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer (marked by a scratch on the tube) ought to be tested once a year, in snow or melting ice. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested* form of this apparatus seriously vitiate the "*Hygrometrical Deductions*," Observers are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulb;—the manikin 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 manikin 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 putting 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—89.9, 40.0, or 40.1; or again, 40.4, 40.3, or 40.6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40.3°, 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 it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 8d. 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 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 must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

**Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:**—When a Snow shower occurs it must be noted in the "*Remarks*," and the latter S affected 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, 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 from a scale 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." and Direction, 2, W." (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "*Cloud*" column, an entry of  $\frac{2}{2}$ , or-st., will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to 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 Schönbien's or Meissner's papers are used. The paper is annexed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3 $\frac{1}{2}$ , as an ozone entry in the schedule, will indicate that the ozone paper is tinted as 4 $\frac{3}{4}$  on the scale, that the wind is from the N. W., and that its force on the scale 0-6 is "4 $\frac{3}{4}$ ", i.e., that it is *blowing fresh*.

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

**Remarks.**—The "*Remarks*" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, are given at the foot of the column.

Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character of 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, from that headed "*Remarks*." It is intended that observations by the Electrometer should be entered in this manner or on the side-margin. Additional remarks may be made on the margin.

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

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

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

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 attract him satisfaction.

EDINBURGH, 12th November 1892. (By Order) A. B.

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, . . . . .		
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, &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,



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Wulkeith, County of Spittal, in Lat. 57° 10' N, Long. 3° 10' W, Distance from Sea 3 miles.  
Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 17 feet.  
During the MONTH of February 1872.  
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.	Amount in inches.	9 A.M.		P.M.		9 h. A.M.							Temperature of Wet Bulb, at 5 feet, No.	Temperature and Density.	0-10.	9 A.M. 9 P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		Barometer. No.	Attached Thermometer.	Barometer. No.	Attached Thermometer.	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.			Readings of the H. Cup Anemometer No.	9 h. A.M.	Velocity (0-5), and Direction.	Amount (0-10), and Species.	Velocity (0-5), and Direction.	Amount (0-10), and Species.	No. 1 inches.									No. 2 inches.	No. 3 inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
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BAROMETER, "corrected Mean" at 9 A.M., minus the Correction++ for Temp. (Col. 2), = 29.956 9 22  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction++ for Temp. (Col. 4), = 29.922  
Mean at Station, corrected, and at 32°, = 29.922  
Correction for height, feet above Mean Sea-level, = 20.9  
Mean, reduced to 32°, and Sea-level, = 30.131  
Highest Reading, corrected for Index error, on the th, = 30.450  
Lowest Do. Do. on the th, = 28.700  
Difference, or Monthly Range, = 1.750

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 20th, = 50.0  
Lowest in Month, corrected for Index errors, on the 24th, = 18.6  
Difference, or Monthly Range, = 31.4  
"Corrected Mean" of all the Highest, (Col. 5), = 40.9  
"Corrected Mean" of all the Lowest, (Col. 6), = 30.1  
Difference, or Mean Daily Range, = 10.8  
\*\* Calculated Mean Temperature of Month, = 35.5  
S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, = 50.0  
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 40.9  
Lowest at Night, Black Bulb, (corrected for Index errors), on the th, = 18.6  
"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass, = 30.1  
Difference of above Means or Range ("exposed"), = 10.8

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 34.9 35.4  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 33.5 34.0  
# Computed Temperature of Dew-Point, = 31.2 31.8  
# Do. Elastic Force of Vapour, = 7.5 180  
# Do. Weight of Vapour in a Cubic Foot of Air, = 86 87  
# Relative Humidity, (Saturation = 100), = 86 87  
RAIN fell on 6 Days; Amount in Inches, = 1.20

WIND.		SUMMARY.					
Direction.	N	NE	E	SE	S	SW	W
A.M.	0	2	3	4	0	4	8
P.M.	0	1	2	3	1	6	7
Mean.	0	2	2	4	0	5	7

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 Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

Malcolm Gunn

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 Tribes published by the Society, an entire comparability 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. Aick 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, sitting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; their concave being indicated by a little ivory hook, whose stem passes freely through the lid and case of the cistern. When the *scale-line* on this little piston-rod is brought by the adjusting screw, to *form one straight line* with those on its own face, 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 *verrier*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *screw up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upmost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a *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 verrier, 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 the 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 doors of the boxes are arranged so as 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 have 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, 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; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be displaced 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 mounted, 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 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 facing-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 laid on iron, 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 *calibrated 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 a cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water-pure. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances. One form of "Mason's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the front-mounted 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° and 40¾° more or less must be registered 40° 3', 40° 3½', 40° 7', or 40° 8' respectively. In reading Rutherford's "Max." and "Min." Thermometers, the indication of that end of the tube 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 or 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 placed 12 feet at least above surrounding objects. When it oscillates incessantly, and always when the wind is feeble, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, &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, wind-mills, or anemometers, are also recommended; the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

*Atmospheres.*—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 depth 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 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 6, S. W."

and Direction," 2, W. (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S. W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of  $\frac{2}{4}$ , (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.

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

*Ozone.*—Mention whether Schönbain's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 8½%, as an ozone entry, in the schedule, will indicate that the ozone power is fitted as 8½% on the scale 0—6 is "4"; i.e., that it is *between*  $\frac{1}{2}$  and 1.

*Electricity.*—Too much importance cannot be attached to electro 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 very narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no rules can be given nor homogenized. 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 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 column or on the side-marginal. Additional remarks may be made on the margin.

*Observations in connection with the periodic return of the seasons.* possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds; and in the case of crops, to specified sorts reared from year to year on 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 1870.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Last Date First appear.	In Leaf.	Directed of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Out or Raked.
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,  
36/10/70  
3  
76

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Waukeith Gardens, County of Midlothian, in Lat. 55° 55' N, Long. 2° 10' 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 March 1873.  
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.		Projected in Shade, & at above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		Readings of the H. Cup Anemometer No. _____		No. of hours in which it fell.		Amount in inches.		9 A.M.		P.M.					9 h. A.M.			
		Barometer.	Attach- ed Ther- mometer	Barometer.	Attach- ed Ther- mometer	Max. No.	Min. No.	Max. in Sun's rays.	Min. on Grass.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Velocity (0-6), and Direction.	Amount (0-10), and Species.	Velocity (0-6), and Direction.	Amount (0-10), and Species.	Hours.	No. _____ 3 inches.	No. _____ 12 inches.	No. _____ 22 inches.	Temperature of WELL at depth of feet. No. _____					Temperature at 1 fathom, and Density,	9 A.M. 9 P.M.		
		inches.	°	inches.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°					°	°	°	
	1	29.15	38	29.1	40.2	36.5	35			35	32	36.2	34.5	SW		SE													Cloudy glimpses of Sun	1				
	2	29.25	42	29.50	43	45	37			39.6	37	40	38	SW		W													Bright sunshine	2				
	3	29.55	45	29.40	45	43	35			42.5	40	39	38	SW		SW													Rain Am. foggy P.M.	3				
	4	29.40	47	29.50	49	53	37			45	43.5	46	44	W		W													Bright sunshine passing clouds	4				
	5	29.80	46	29.90	47	50	34			40	39	42	40	W		SE													Bright sunshine	5				
	6	29.70	45	29.45	46.5	43	32			40	37	42.5	40.5	SW		SW													Bright sunshine	6				
	7	29.15	43	29	46	37	35			37	37	34.5	34	SE		SE														cloudy slight E. of rain	7			
	8	29.15	45	29.25	47	47	32.5			41.5	39	41	40	W		W														Heavy rain throughout	8			
	9	29.20	45	29.15	48	47	36			41.2	39	42.5	41	W		SW														Bright sunshine	9			
	10	28.95	44	28.95	45	43	33			37	35	37.5	36	SE		SE														Bright sun Am. passing clouds P.M.	10			
	11	28.90	45	29.15	44	43	33			36.2	34.5	38	36.5	SE		SE														Bright sunshine Am. slight E. of rain P.M.	11			
	12	29.25	41	29.10	42	42	32			35	32	37	34	SE		SE														Bright sunshine Am. passing clouds P.M.	12			
	13	29.35	41	29.45	42	44	27			35	32	38	36	SE		SE														Bright sunshine throughout	13			
	14	29.70	41	29.85	42	41	30			36.5	35	37	35	SE		SE														Bright sunshine throughout	14			
	15	30	42	30.05	42	42	29			35	33	36	34	SE		SE															SW & S. glimpses of sun	15		
	16	29.95	42	29.85	41	37	32			35	32	34.5	34	SE		SE															Bright sunshine passing clouds	16		
	17	29.80	42.5	29.85	42	39	32			37	36.5	37	36	SE		SE															cloudy slight showers of snow	17		
	18	29.95	43	29.90	43	41	35			38	37.5	40.5	39	SE		SW															Rain Am. overcast P.M.	18		
	19	29.95	45	30.05	44	45	35			44	43	40	36	SE		SE															Overcast	19		
	20	30.05	44	30.05	43	40	33			37.5	36.5	39.5	36.5	SE		SE															Bright sunshine passing clouds	20		
	21	30.10	45	30	45	40	35			39	36	39	37	SE		SE															Overcast - cold winds	21		
	22	29.95	44.5	29.95	46	40	38			39	38.5	39	38	SE		SE															D. 80°	22		
	23	29.95	45	29.95	46	44	37			38.5	37.5	40.5	37	SE		SE															Cloudy glimpses of sun	23		
	24	30	45	30	46	43	34			40	39	41	39	SE		SE															Overcast	24		
	25	30.05	46	30	48	47	37			41	40	45	42	SE		SE															Overcast	25		
	26	30.05	45	30	48	44	34			37	37	39.2	39	SE		SE															Overcast - very mild	26		
	27	30	46	29.90	54	60	35			38	38	54	53	SE		SE															Overcast Am. foggy P.M.	27		
	28	29.85	47	29.80	53	58	33			47	44.2	50	47	SW		SE															Foggy Am. Bright sunshine P.M.	28		
	29	29.90	47	29.85	47	42	35			36	36	40	40	SE		SE															Bright sunshine	29		
	30	29.85	44	29.70	46	42	34			37.5	37	40.2	40	SE		SE															Foggy throughout	30		
	31	29.60	49	29.55	51	56	37			48	47	52	45	SW		SW																Bright - sunshine	31	
	Sums.	1599	9144	1363	5711	5711	3713			3774	3655	3953	3652																					
	Means.	29.66	44.2	29.64	45.7	44	33.6			39.0	37.2	40.5	38.7																					
	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†† for Temp. (Col. 2), = 29.661 — .041 = 29.620  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = 29.644 — .045 = 29.599  
Mean at Station, corrected, and at 32°, = 29.620  
Correction for height, feet above Mean Sea-level, = .209  
Mean, reduced to 32°, and Sea-level, = 29.829  
Highest Reading, corrected for Index error, on the 21<sup>st</sup>, = 30.100  
Lowest Do. Do., on the 11<sup>th</sup>, = 28.900  
Difference, or Monthly Range, = 1.200

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 27<sup>th</sup>, = 60.0  
Lowest in Month, corrected for Index errors, on the 13<sup>th</sup>, = 26.6  
Difference, or Monthly Range, = 33.4  
"Corrected Mean" of all the Highest, (Col. 5), = 44.3  
"Corrected Mean" of all the Lowest, (Col. 6), = 33.2  
Difference, or Mean Daily Range, = 11.1  
\*\* Calculated Mean Temperature of Month, = 38.8

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 27 th, = 60.0  
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 44.3  
Lowest at Night, Black Bulb, (corrected for Index errors), on the 13 th, = 26.6  
"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass, = 33.2  
Difference of above Means or Range ("exposed"), = 11.1

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 40.2 39.5  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 38.6 37.7  
†† Computed Temperature of Dew-Point, = 36.5 35.2  
†† Do. Elastic Force of Vapour, = .216 .207  
†† Do. Weight of Vapour in a Cubic Foot of Air, = .87 .86  
†† Relative Humidity, (Saturation = 100), = 87 86  
RAIN fell on / Days; Amount in Inches, = 1.50

WIND.		SUMMARY.					
Direction.	N	NE	E	SE	S	SW	W
A.M.	0	4	8	2	5	4	4
P.M.	1	3	3	1	0	5	3
Mean.	0	4	2	1	5	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)

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 very considerable differences from any two Stations, so very considerable as to render them quite incommensurable, 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 *Anemoids*, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with such means of *adjustment or compensation* as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer should 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 recommended by Mr. Adie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-inches* are not true inches but so much shorter as to *compensate* the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; their coincidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *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 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 *lytle*, 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 ought to 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 Zamboni'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 earth breaks, it may be re-united by stirring 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 top 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* 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, 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 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 so on to 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 "*Mason's*" Hygrometer 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°. Under an exact coincidence with, or a little over 40° or 40½°, 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*, are rapidly taken, being so readily affected by heat from the face of the observer.

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

**Wind.**—A wind-vane ought to be elevated 12 feet above surrounding objects. When it indicates incessant, or almost incessant, direction, it 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.

Caution 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-gauge.**—Many causes conspire to produce anomalies in rain returns. They arise, partly, from an ununiform 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.

**Snowfall.** 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 Ltice 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 *fully covered* by clouds, 9 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  $\frac{2}{2}$ , (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 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 fixed 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 at ways 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 barometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind, at the time of observation, in the following manner:—thus 3½, as an ozone entry in the "*Remarks*," will indicate that the ozone paper is tinted as "3," that the wind is from the N. W., and that its force is "½," that it is *blowing fresh*.

Too much importance cannot be attached to the detection of the atmosphere in connection with terrestrial and as a meteorological phenomenon. A proper is necessary to every complete meteorological

The "*Remarks*" column is too narrow, but must be used. Some of the most valuable observations that can be made for which no rules can be given nor hours assigned, contractions ought, therefore, to be taken every advantage of a list of such as are recognised and in use at Greenwich and other observatories, are given at the foot of the column. Rain 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 mists, mists, mists, 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 neat off for the purpose, from that headed "*Remarks*." It is intended that observations by the Plethrometer 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 specific sorts reared from year to year on one 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 the should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, 20th November 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.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry, . . . . .		Apple, . . . . .			Cuckoo, . . . . .		
Boutree or Elder, . . . . .		Black Currant, . . . . .			Curlew, . . . . .		
Broom, . . . . .		Cherry, . . . . .			House-Swallow, . . . . .		
Hazel, . . . . .		Gean, . . . . .			Lapwing, . . . . .		
Hawthorn, . . . . .		Gooseberry, . . . . .			Plover, . . . . .		
Holly, . . . . .		Peach, . . . . .			Sand-Martin, . . . . .		
Laburnum, . . . . .		Pear, . . . . .			Starling, . . . . .		
Lilac, . . . . .		Plum, . . . . .			Swan, . . . . .		
Mezereon, . . . . .		Strawberry, . . . . .			Rail or Corn Crane, . . . . .		
Mountain Ash or Rowan, . . . . .							
Red Flowering Currant, . . . . .							
Rhododendron Ponticum, . . . . .							
Whin, . . . . .							

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

EDINBURGH.

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland,

MR ALEXANDER BUCHAN,



16

Macneil  
Mar. 1878

# SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Walkeith 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 April

The Hours of Observation are of Greenwich Time.

[illegible]

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction $\left\{ \begin{array}{l} \text{th} \\ \text{for Temp. (Col. 2),} \end{array} \right.$	=	29.849
"Corrected Mean" of Barometer at 9 P.M., minus the Correction $\left\{ \begin{array}{l} \text{th} \\ \text{for Temp. (Col. 4),} \end{array} \right.$	=	
Mean at Station, corrected, and at 32°,.....	=	29.849
Correction for height, feet above Mean Sea-level,.....	=	+209
Mean, reduced to 32°, and Sea-level,.....	=	30.058
Highest Reading, corrected for Index error, on the 10 th,.....	=	30.300
Lowest Do. Do., on the 6 th,.....	=	29.450
Difference, or Monthly Range,.....	=	0.850

<b>S.-R. THERMOMETER,</b> (in shade, etc.), <b>Highest in Month,</b> (corrected for Index Errors), on the <u>21</u> th,.....	=	<u>65.0</u>
<b>Lowest in Month,</b> corrected for Index errors, on the <u>24</u> th, .....	=	<u>29.6</u>
Difference, or <b>Monthly Range,</b> .....	=	<u>35.4</u>
"Corrected <b>Mean</b> " of all the <b>Highest,</b> (Col. 5); .....	=	<u>53.4</u>
"Corrected <b>Mean</b> " of all the <b>Lowest,</b> (Col. 6), .....	=	<u>36.9</u>
Difference, or <b>Mean Daily Range,</b> .....	=	<u>16.5</u>
** Calculated <b>Mean Temperature</b> of Month, .....	=	<u>45.2</u>
<hr/>		
<b>S.-R. THERMOMETER, Black Bulb in Sun, 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), .....	=	46.8
<b>Mean</b> (corrected) A.M. and P.M. Reading of <b>Wet Bulb</b> , (Cols. 10 and 12), .....	=	43.7
## Computed <b>Temperature of Dew-Point</b> , .....	=	38.9
## Do. <b>Elastic Force of Vapour</b> , .....	=	2.37
## Do. <b>Weight of Vapour in a Cubic Foot of Air</b> , ...	=	
## <b>Relative Humidity</b> , (Saturation = 100), .....	=	75
<b>RAIN</b> fell on <b>Days</b> ; <b>Amount in Inches</b> , .....	=	75

WIND.		SUMMARY.									
Direction.	N	NE	E	SE	S	SW	W	NW	(Caln or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	2	6	6	1	4	3	2	0		
P.M.	0	7	4	9	1	1	4	4	0		
Mean.	0	7	5	8	1	2	4	3	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. 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 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, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the cistern are of leaden, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the zero-point of the fixed scale; their coincidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then screw up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upright. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument, so that the mercury strikes the top of the tube, a sharp tap is produced. If this is prevented by air, it may be removed to the cistern, and got rid of, by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory 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-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" Thermometers of Kithleyford is recommended when graduated on the glass seen 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 remedied by stirring the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be discoloured from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

from radiation during night. Their bulbs have a black coating which may easily be made, or moved, 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. Show 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 Society.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus, especially 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 mastin must be of cotton, which thus supplies it with water. It must be seen to by the observer that the mastin 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 earth in ordinary circumstances.

The form of "Shaw'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 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° 5, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40½, and 40½, more or less must be registered 40° 2 or 40° 3, and 40° 7 or 40° 8 respectively. In reading Kithleyford'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, shies in winter at least, their occurrence to their proper meteorological use. 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 1st, and extending till 9 P.M. on the 3d. Wind.—A wind-gauge 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 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-gauges; 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 S affixed to the depth of water received in place where no drift of the snow must be measured in some open space 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, is 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 cloud column, though their appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is 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 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 4, 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 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 waters. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, nothing always the temperature of the air, and the bottom 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 Schindler's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3½, as an ozone entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4" i.e., that it is blowing fresh.

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

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

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

"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 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, 11th November 1852.

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,

Edinburgh  
April 1873

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *Dalkeith, Midlothian, County of Edinburghshire*, in Lat. *55° 57' N* Long. *3° 16' 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 *May* 187*3*.  
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No. _____				WIND.				CLOUDS.				THERMOMETERS under Ground.				SEA.	OZONE.	GENERAL REMARKS.	Days of Month.		
	9 h. A.M.		9 h. P.M.		Protected in Shade, at least 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.		P.M.							
	Barometer, No. _____	Atmospheric Thermometer, No. _____	Barometer, No. _____	Atmospheric Thermometer, No. _____	Max. in Sun's rays No. _____	Min. on Grass. No. _____	Dry bulb. No. _____	Wet bulb. No. _____	Dry bulb. No. _____	Wet bulb. No. _____	Direction. No. _____	Force. No. _____	Direction. No. _____	Force. No. _____	Velocity (0-10), and Direction.	Amount (0-10), and Species.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	No. _____ 3 inches.	No. _____ 12 inches.	No. _____ 22 inches.	Temperature of WELL, at depth of feet, No. _____	Temperature at 1 fathom, and Density.	9 A.M. 9 P.M.						
	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____	Thermometer, No. _____					Thermometer, No. _____	
1	29.85	58	29.90	54	62	40	35.5	41	34.5	48	N	11													Sunshine. Passing Clouds	1				
2	29.65	53	29.55	56	56	46	34	46	50	46	N	11													Cloudy Glimpses of Sun	2				
3	29.50	53	29.60	53	54	42	44	45	45	42	N	11													do	3				
4	29.55	49	29.45	51	52	30	47	40	49	43	N	11													Cloudy am. Bright Sunshine P.M.	4				
5	29.30	49	29.20	50	44.5	35	44	41	44.5	44	SE	SE													Cloudy (am.) Heavy Rain (P.M.)	5				
6	29.25	46	29.30	48	44	31	39	38	42.5	42	SE	11													Heavy Rain all day	6				
7	29.30	52	29.26	55	52	40	49.5	45	49	45	11	SE													Calim Glimpses of Sun	7				
8	29.30	53	29.36	50	55	43	47	44.5	45	40	SE	SE													Sunshine (am.) Showery (P.M.)	8				
9	29.65	52	29.80	52	53	39	45.5	45.5	43	43.5	SE	11													Bright Sunshine throughout	9				
10	29.90	53	29.90	55	59	40	51.5	41	50	46	SE	11													Passing Clouds & Sunshine	10				
11	29.80	58	29.85	58	61	54	53	52.5	60	50.5	SE	11													Cloudy (am.) Sunshine (P.M.)	11				
12	30.00	56	30.05	56	60	45	53	54.5	57	56	SE	11													Bright Sunshine all day	12				
13	30.15	52	30.20	52	60	35	49.5	49	43	43.5	E	SE													do	13				
14	30.10	52	30.05	53	56	36	46.5	45	46.5	43.5	E	E													Overcast (am.) Sunshine (P.M.)	14				
15	29.99	49	29.99	47	45	38	41.5	40	40	37	E	E													Overcast. Showery	15				
16	29.98	48	29.80	46	38	36	40	42.5	39	36	E	E													Full very cold East Wind	16				
17	29.70	46	29.70	45	41	33	38	38	36	38.5	E	E													Rain throughout	17				
18	29.70	46	29.75	46	45	34	39	38	37	37.5	E	E													Detached Clouds	18				
19	29.51	47	30	48	52	30	44	40	42.5	40	E	E													Overcast (am.) Overcast & Showery P.M.	19				
20	29.05	52	29.75	52	55	32	52	45	47.5	47	SE	11													Bright Sunshine	20				
21	29.75	56	29.80	56	62	42	57	56.5	50.5	50	SE	11													Drizzling Rain am. Overcast P.M.	21				
22	29.65	56	29.70	57	58	52	52	52.5	50	48	SE	11													Rain (am.) Overcast P.M.	22				
23	29.35	56	29.60	56	55	44	48.5	47.5	46	42	SE	11													Bright Sunshine	23				
24	29.80	56	29.85	59	58	42	53.5	47	45	42.5	11	11													do	24				
25	30.05	57	29.95	58	62	40	52	42.5	49	49	SE	11													Overcast (am.) B.S. Sunshine P.M.	25				
26	29.75	57	29.60	58	62	40	51	51.5	48	48	SE	11													do	26				
27	29.70	58	29.95	54	55	40	49	46.5	45	44	N	11													Bright Sunshine all day	27				
28	29.30	57	29.40	57	62	42	52	46.5	48	44	SE	11													do	28				
29	29.30	57	29.50	56	64	42	52.5	49.5	49	53	SE	11													do	29				
30	30.40	56	30.30	55	61	45	52	47.5	46	45	E	E													do	30				
31	30.30	57	30.30	60	67	32	52	50	49	47	E	E													Blue Sky	31				
Sums.	167.5	9	17.5	10	615.0	310	167.5	107.5	143.5	143.5																				
Means.	29.74	53.0	29.77	55.3	55.2	39.8	48.7	45.4	46.4	45.3																				
† 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†† for Temp. (Col. 2), = *29.679*  
“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = *29.679*  
Mean at Station, corrected, and at 32°, = *29.679*  
Correction for height, feet above Mean Sea-level, = *209*  
Mean, reduced to 32°, and Sea-level, = *29.885*  
Highest Reading, corrected for Index error, on the 30 th, = *30.400*  
Lowest Do. Do. on the 5 th, = *29.200*  
Difference, or Monthly Range, = *1.200*

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 29 th, = *64.0*  
Lowest in Month, corrected for Index errors, on the 4 th, = *29.6*  
Difference, or Monthly Range, = *34.4*  
“Corrected Mean” of all the Highest, (Col. 5), = *53.2*  
“Corrected Mean” of all the Lowest, (Col. 6), = *39.4*  
Difference, or Mean Daily Range, = *13.8*  
\*\* Calculated Mean Temperature of Month, = *47.3*  
S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, = *64.0*  
“Corrected Mean,” (Col. 7), of Black Bulb, Max. in Sun, = *64.0*  
Lowest at Night, Black Bulb, (corrected for Index errors), on the th, = *29.6*  
“Corrected Mean,” (Col. 8), of Black Bulb, Min. on grass, = *29.6*  
Difference of above Means or Range (“exposed”), = *34.4*

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = *44.9*  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = *44.8*  
†† Computed Temperature of Dew-Point, = *42.5*  
†† Do. Elastic Force of Vapour, = *2.72*  
†† Do. Weight of Vapour in a Cubic Foot of Air, = *2.72*  
†† Relative Humidity, (Saturation = 100), = *88*  
RAIN fell on 8 Days; Amount in Inches, = *1.65*

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

Malcolm Lum

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.*—*Wetther glasses* and *Anemoids*, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any barometer be used for Meteorological Observations 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 constructed by Mr. Aick of London, the use of which is attended with the great convenience of requiring no *adjustment* of the cistern. Its *scale-anchors* are not true quints 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; whose coincidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *index-line* on this little piston-rod is brought by the adjusting screw, to form one *straight line* with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this *preliminary setting* must be made with scrupulous accuracy, *as a slight error here will vitiate the readings from the vernier.*

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *screw* up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern unperforated. 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 tilting the ivory peg), and gently tapping it; and if this plan fails, the instrument must be replaced.

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

In taking an *Observation*, the attached Thermometer is first noted; the tube must then be gently tapped and the cistern-*adjustment* carefully made. By raising and lowering the eye, it must be brought into the plane of the back and front of the index,—usually the lower edge of the vernier, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

*Protection of Thermometers.*—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians, *Sgt. Hagley's Thermometers*, Professor Phillips, and Negretti and Zambra's Patent "Mercurium" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Mercurium" Thermometer of Kithleyford is recommended when graduated on the glass from and affixed to a frame separate from the "Mercurium." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by a simple operation. 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 discoloured from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid.

These instruments should be hung horizontally. The above remarks apply equally to the Thermometers for registering the greatest heat from the sun's rays, and the least

from radiation during night. Their bulbs have a black coating, which may easily be made, or 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 "Mercurium" 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, microscopes 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 "Mercurium" 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 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 fact, 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 "Thermometer" 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 the side to its side, so that the aforementioned 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 top 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, or 44½, more or less must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Kithleyford's "Max." and "Min." Thermometers, the indication of that end of the index which is next to the surface of the mercury observed 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 a.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 in the same direction, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of snags, 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, 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 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 close out grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

*Snow-falls.*—*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 inches. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as indicated in every column, the observer cannot be too careful to register *observations only*; and nothing that partakes of the nature of deduction or inference.

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

Observations of the clouds are made at 9 a.m. and at sunset, as illustrating the condition and 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  $\frac{2}{4}$  (or  $\frac{1}{2}$ ) 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 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 5, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with joping tin collars, to prevent transpiration being conveyed to the buds 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.*—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 oil 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.

*Quartz.*—Mention whether bell-shaped or of Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 a.m. and 9 p.m. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation in the following manner:—thus 3xw, as an ozone entry in the schedule, will indicate that the ozone appears as "3" on the scale, but 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 on the scale.

*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 must be taken as those for which no more can be given nor hours assigned. The use of contractions ought, however, 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 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 threatening the maximum, as well as such notes on storms as have been farther 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 abbreviation the state of the weather at 9 a.m. and 9 p.m. ought to be registered, either in two columns, either wise unabbreviated, or in two parts 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; particular species of birds; and, in the case of crops, to special sorts reared from year to year on a selected piece of ground farm.

The Council recommend *at least* *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 desirable that he should have full power to reject any instrument which, on being presented for comparison, does not afford satisfaction.

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

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



MR ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland

Handwritten signature and date: May 1873

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Edinburgh, County of Edinburghshire, in Lat. 55° 57', Long. 3° 10', 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 1873.  
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 Depressions 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. —	Attached Ther- mometer	Barometer. No. —	Attached Ther- mometer	Max. No.	Min. No.	Max. in Sun 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 Wet Bulb, No. —	Temperature of Air, and Density.	9 A.M. 9 P.M.
		inches.	"	inches.	"	"	"	No. —	No. —	"	"	"	"	"	"	"	"	9 h. A.M.	"	"	"	"	"	"	"	"	"					"	"	"	"
	1	30.30	61	30.30	66	57	40	SAB	57	57	58.5	58	E																	B. clear	1				
	2	30.40	57	30.20	61	62	41			58.5	51.5	57	50	E																Overcast am. Bright Sunshine	2				
	3	30.60	60	29.85	65	62	43			60.5	52	50	49.8	E																Rain am. & Shift of Sun	3				
	4	29.80	69	29.80	69	60	48			60	49	58.5	52	NE																Bright Sunshine	4				
	5	29.80	62	29.99	63	63	41	SAB	57	57	58	52	N	NE																Bright Sunshine	5				
	6	30.20	60	30.20	63	60	42			50	42	51.5	49	NE																	Overcast am. Bright Sunshine	6			
	7	30.40	60	31.10	58	62	43			50	49	53	49	NE																	Bright Sun am. Overcast P.M.	7			
	8	30.20	62	29.80	61	71	45			50	48	54	49.5	NE																	Very Bright Sun throughout.	8			
	9	29.80	62	29.60	62	61	49			55.5	51.5	61	60	N																	Sunshine. Overcast P.M.	9			
	10	29.30	62	29.55	65	66	52			48.5	47.5	60	49.5	NE																	Rain till 8 p.m. until 5 p.m. after	10			
	11	29.40	61	29.45	63	64	43			52	50	61	48	S																	Windy & Bright Sunshine	11			
	12	29.45	62	29.55	65	64	42			59.5	54	65	53.8	SE																	Sunshine & overcast P.M.	12			
	13	29.60	58	29.50	58	58	47			58.5	52	58.5	58	E																	Drizzling rain all day	13			
	14	29.55	65	29.70	63	67	45			57	57.5	60	47.5	SE																	Bright Sunshine	14			
	15	29.70	63	29.70	62	65	41	SAB	56	55.5	54	55	54	SE																	"	15			
	16	29.75	63	29.75	64	71	49			60	60	55	54	SE																	"	16			
	17	29.95	62	29.80	60	68	46			59	60	48	48	N																	Sunshine am. Overcast P.M.	17			
	18	29.85	60	29.90	66	72	46			58.5	52	61.5	56	NE																	Passing Clouds am. pass overcast	18			
	19	29.85	65	29.95	67	70	56			62.5	52	59.5	54	S																	Overcast very sultry	19			
	20	30.00	68	29.85	67	74	51	60 AB	64	56.5	61	56	56	SE																	Bright Sunshine	20			
	21	30.00	66	29.85	63	70	51			51	60	60	56	SE																		"	21		
	22	29.75	67	29.75	65	62	51	SAB	62.5	60	54	54	54	S																		Overcast & passing showers	22		
	23	29.80	64	29.80	61	68	43			57	52	52	60	SE																		Bright Sunshine am. Overcast P.M.	23		
	24	29.55	62	29.60	63	62	49			59	55	50	58	S																		Passing Clouds & Showers	24		
	25	29.60	65	29.65	60	50	58			62	59	54	46	S																		Showers am. Sunshine P.M.	25		
	26	29.90	63	29.85	62	67	45			57	56	56	52	S																		Rain am. Showers P.M.	26		
	27	29.70	62	29.65	63	66	45			56.5	56.5	58	57	S																		Overcast & Showers	27		
	28	29.70	63	29.60	62	65	40			57	55.5	62	54	SE																		"	28		
	29	29.85	62	29.80	61	68	42			57	64	64	52	S																		Overcast	29		
	30	29.80	60	29.85	60	63	47			58	52	52	54.5	SE																		Overcast am. Bright Sun	30		
	31																																		
Sums.		1646.9	61			1114.18				173.5	103.5																								
Means.		29.832	62.0			61.8	46.0			56.2	53.7																								
+ Total Corrections for Instru- mental Errors.																																			
+ Corre- ctions for Diurnal Range.																																			
"Corrected Means."		29.832				45.6				56.7	54.2																								
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  $\uparrow$  for Temp. (Col. 2), = 29.743  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction  $\uparrow$  for Temp. (Col. 4), = 29.743  
Mean at Station, corrected, and at 32°, = 29.743  
Correction for height, feet above Mean Sea-level, = 2.09  
Mean, reduced to 32°, and Sea-level, = 29.952  
Highest Reading, corrected for Index error, on the 2<sup>nd</sup> th, = 30.400  
Lowest Do. Do., on the 10<sup>th</sup> th, = 29.300  
Difference, or Monthly Range, = 1.100

\* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S." and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.  
† Enveloping corrections for both capillarity and Index Errors.  
‡ The Diurnal Range for Scotland is as yet unknown.  
§ "Provisionally" though not absolute a minus correction.  
|| These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition only.  
¶ While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 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 20<sup>th</sup> th, = 74.0  
Lowest in Month, corrected for Index errors, on the 1<sup>st</sup> th, = 39.6  
Difference, or Monthly Range, = 34.4  
"Corrected Mean" of all the Highest, (Col. 5), = 64.8  
"Corrected Mean" of all the Lowest, (Col. 6), = 45.6  
Difference, or Mean Daily Range, = 19.2  
\*\* Calculated Mean Temperature of Month, = 55.2

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 1<sup>st</sup> th, = 74.0  
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 64.8  
Lowest at Night, Black Bulb, (corrected for Index errors), on the 1<sup>st</sup> th, = 39.6  
"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass, = 45.6  
Difference of above Means or Range ("exposed"), = 19.2

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 56.7  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 54.2  
# Computed Temperature of Dew-Point, = 51.9  
# Do. Elastic Force of Vapour, = 3.87  
# Do. Weight of Vapour in a Cubic Foot of Air, = 5.84  
# Relative Humidity, (Saturation = 100), = 84  
RAIN fell on 8 Days; Amount in Inches, = 0.60

WIND.		SUMMARY.									
Direction.		N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.		2	4	4	1	8	9	1	1		
P.M.		1	3	5	1	12	6	1	1		
Mean.		2	4	4	1	10	7	1	1	0	

N.B.—The Sums to be correctly added and the Means deducted. 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 Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

Malcolm Lum

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# SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *Balllith Gardens Balllith* County of *Edinburghshire*, 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* 187*3*.  
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS.				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.	Atmospheric.	Barometer.	Atmospheric.	Max.	Min.	Max.	Min.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.		Velocity (0-6).	Amount (0-10).	Velocity (0-6).	Amount (0-10).	No. 1.	No. 2.	No. 3.						
		inches.		inches.																											
	1	29.90	63	29.80	63	62	45			63.5	60	58	58.5	SW	SM												Bright Sunshine	1			
	2	29.80	61	29.75	64	72	50			59	55	60	57	SW	S												overcast am Bright Sunshine P.M.	2			
	3	29.60	65	29.55	62	61	58			63	59	58	56	S	S												overcast	3			
	4	29.45	64	29.65	60	68	43			60	54	53.5	49.5	SE	S												Bright Sunshine	4			
	5	29.65	62	29.60	62	72	42			65	57	60.5	48	SW	SW												"	5			
	6	29.50	65	29.75	64	67	42			60.5	52	56.5	53.5	SW	SW												"	6			
	7	29.85	66	29.85	66	74	50			62	55	60	56	SW	SW												"	7			
	8	29.80	65	29.85	66	68	58			60	54	60	55	SW	SW												"	8			
	9	29.50	64	29.65	62	64	54			56.5	52.5	55	52	S	SW												Heavy rain am Sunshine P.M.	9			
	10	29.65	64	29.65	62	66	57			57.5	53.5	56	54.5	S	S												Passing Clouds	10			
	11	Omitted																										B.E. Sunshine am overcast P.M.	11		
	12	29.50	63	29.45	63	61	52			57	53	56.5	50	SW	SW													Passing Showers	12		
	13	29.40	64	29.35	62	64	47			58.5	53.5	56.5	52.5	SW	W													sun & passing showers	13		
	14	29.36	62	29.45	63	68	46			58.5	52.5	55.2	50	SW	SW													Bright Sunshine	14		
	15	29.45	61	29.42	62	65	45			55	50.5	53	52	SW	W													overcast am Showers with Sun P.M.	15		
	16	29.85	62	29.05	62	67	49			57.5	52.5	50	47	S	S													sun & passing showers	16		
	17	29.70	64	29.55	61	67	45			56.5	53	58	55.5	S	S													overcast am Showers P.M.	17		
	18	29.50	65	29.75	61	63	53			62.5	57.5	52.5	53	S	SW													Heavy rain am passing clouds with Sun	18		
	19	29.75	62	29.70	60	62	47			57	51.5	56.5	50.5	SW	SW													Cloudy with drizzle rain	19		
	20	29.70	65	29.95	68	75	44			65	63.5	65	61.5	S	SW													Rain am B.E. Sunshine P.M.	20		
	21	29.45	70	29.95	68	82	60			60.5	58.5	64.5	63	SW	SW													Very B.E. Sun	21		
	22	29.90	76	29.85	76	89	58			79	70	69	65.5	S	S													ditto	22		
	23	29.75	73	29.80	71	75	61			68.5	65	58	55	SE	SW													overcast am B.E. Sunshine P.M.	23		
	24	29.80	68	29.80	67	73	48			60.5	58.5	62.5	58	SW	SE													Bright Sun am overcast P.M.	24		
	25	29.75	70	29.80	68	67	59			66.5	66	57	57	S	S													overcast am rain from 4 to 6 P.M.	25		
	26	29.80	68	29.80	67	62	55			60	54.5	60	58	W	W													overcast & passing clouds	26		
	27	29.75	67	29.75	65	69	49			61	60	60	58	S	SW													Thunder Showers	27		
	28	29.75	66	29.85	68	68	47			62	61.5	58	53	SW	W													Bright Sunshine	28		
	29	29.85	61	29.80	60	61	45			56	53.5	59	57.5	S	SW													Passing Showers	29		
	30	29.75	63	29.70	61	62	50			63	62.5	58	55	S	SW													overcast am Passing Showers P.M.	30		
	31	29.55	62	29.80	62	68	53			57.5	58	57	54	SW	W													Rain am Showers with Sun P.M.	31		
	Sums.	20.51151		21.82117	242	16				29.02185	236	0.420																			
	Means.	29.68465		29.72763	968	505				61.0	57.3	57.9	54.7																		
	+ 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

Heavy Thunder storm commencing 9 P.M. on the 22 & abating 6.30 on the 23 accompanied with very much electricity

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

TABLE FOR ESTIMATING FORCE OF WIND.					
Estimated Force, 0-1.	Common Designation.	Estimated Force, 2-6.	Common Designation.	Estimated Force, 7-10.	Common Designation.
0	Calm	1.5	Light breeze	4	Blowing hard
0.5	Very light air	2	Fresh breeze	5	Blowing a gale
1	Light air	3	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction for Temp. (Col. 2),  $29.587 - 0.075 = 29.512$   
"Corrected Mean" of Barometer at 9 P.M., minus the Correction for Temp. (Col. 4),  $29.633 - 0.075 = 29.558$   
Mean at Station, corrected, and at 32°,  $29.587$   
Correction for height, feet above Mean Sea-level,  $209$   
Mean, reduced to 32°, and Sea-level,  $29.796$   
Highest Reading, corrected for Index error, on the 16th,  $30.050$   
Lowest Do. Do., on the 13th,  $29.350$   
Difference, or Monthly Range,  $0.700$

S.R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 22th,  $89.0$   
Lowest in Month, corrected for Index errors, on the 5th,  $41.6$   
Difference, or Monthly Range,  $47.4$   
"Corrected Mean" of all the Highest, (Col. 5),  $68.4$   
"Corrected Mean" of all the Lowest, (Col. 6),  $50.1$   
Difference, or Mean Daily Range,  $18.3$   
\*\* Calculated Mean Temperature of Month,  $59.2$   
S.R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 11th,  $89.0$   
"Corrected Mean" (Col. 7), of Black Bulb, Max. in Sun,  $89.0$   
Lowest at Night, Black Bulb, (corrected for Index errors), on the 11th,  $41.6$   
"Corrected Mean" (Col. 8), of Black Bulb, Min. on grass,  $50.1$   
Difference of above Means or Range ("exposed"),  $38.9$

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11),  $61.5$   
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12),  $57.8$   
Computed Temperature of Dew-Point,  $54.6$   
Do. Elastic Force of Vapour,  $4.77$   
Do. Weight of Vapour in a Cubic Foot of Air,  $7.8$   
Relative Humidity, (Saturation = 100),  $78$   
RAIN fell on Days; Amount in Inches,  $2.30$

WIND.											
SUMMARY.											
Direction.	N	NE	E	SE	S	SW	W	NW	Calms or Variables.	Mean Force.	Mean Velocity in miles per day.
A.M.	0	0	0	2	12	15	1	0	0		
P.M.	0	0	0	1	8	16	5	0	0		
Mean.	0	0	0	1	10	16	3	0	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 Gummed or Fastened, and Forwarded by Book Post, prepaid.

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

(Signed) *Nicolson Dunn*

*C*

WITH REMARKS ON THE USE OF INSTRUMENTS.

from radiation during night. Their bulbs have a black coating which has been made or mediated 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 "*Mazman*" should be freely exposed to the sun, and the "*Mimumin*" 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 Mimumin 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, midday 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-reading, and especially the "*Mimumin*" Thermometers ought frequently to be compared with the dry bulb of the Hygrometer. The

The *Higrometer* 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 Delinquencies." Observers are specially urged to attend to the following conditions—

The bulks must *hang down* 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 bulks,—the mshin 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

One form of "Alaskan" hygrometer is highly objectionable. The frame of the thermometer is enclosed in a tin case, which also supports the thermometer 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 aforementioned requirements shall be complied with, as far as possible.

*Reading of the Tiernometer.*—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 should be taken to tenths of a degree, and noted in decimals; thus the Tiernometer will be read—39.9°, 40.0°, or 40.1°; or

again,  $40^{\circ}$ – $40.5^{\circ}$ , or  $40^{\circ}$ – $40.6^{\circ}$ , according as it indicates a little under, an exact coincidence with, or a little over  $40^{\circ}$  or  $40.5^{\circ}$ , respectively. So also  $40.5^{\circ}$  and  $40.6^{\circ}$ , more or less must be registered  $40.5^{\circ}$  or  $40.6^{\circ}$ , and  $40.7^{\circ}$  or  $40.8^{\circ}$  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

*Hour of Observing Temperature*—The Hygrometers are 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, inasmuch as, in winter at least, the extremes may occur at any hour; and

*Wind*.—A wind-rune ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the wind direction must be taken; and when it is stationary, the direction 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. Special 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 the day, and at every hour of the night. 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 fur-

erished with Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it in any 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.

*Latin-gauges*—Many causes conspire to produce anomalies in rain returns. They arise partly from unfavourable situation or 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 coarse grass around its mouth. The rain-gauge ought to be used daily, and the readings entered in the returns on the day

*Snowfall* may, for convenience, be registered in the rain columns, under the following conditions:—When a Show shower occurs it must be noted in the “Remnants,” and the letter S attributed to the depth of water received in gauge. The depth of snow must be measured in some open place where no drift has accumulated, and the result noted in the “Remnants,” as observed, and registered in addition to, as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as in every column the observer cannot be too careful to fill in every space.

*Clouds*.—Convenient abbreviations for Luise Howard's  
*signet observations* only; and nothing that parades of the  
 figure of deduction or inference.

BOOK POST.

EDINBURGH

NB URGH.

[illegible][illegible]

PERIODICAL REVIEW		Sowing
CROPS, showing variety.		Planting
Wheat, . . . . .		
Barley, . . . . .		
Oats, . . . . .		
Rye, . . . . .		
Triticum, . . . . .		
Maize, . . . . .		
Peas, . . . . .		
Beans, . . . . .		
Turnips, . . . . .		
Grass, . . . . .		

Leaf.	Divested of Leaves.	ment.
		Barley
		Bore
		Oats,
		Wheat
		Beans
		Pease
		Potatoes
		Turneps
		Rye

[illegible]

BEST TREES.	In Flower
y.	
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.	
b,	
.	
t.	
.	
b,	
.	
.	
more or Plane,	
SHRUBS, ETC.	

O.
FO
Alder
Ash,
Beech
Birch
Elm,
Larch
Lime,
Oak,
Sycam
Barbe

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.
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SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry, . . . . .		Apple, . . . . .			Cuckoo, . . . . .		
Boutree or Elder, . . . . .		Black Currant, . . . . .			Chirlew, . . . . .		
Broom, . . . . .		Cherry, . . . . .			House-Swallow, . . . . .		
Hazel, . . . . .		Geay, . . . . .			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, . . . . .							

3

# SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *Edinburgh Gardens & Park* County of *Edinburghshire* 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* 187*9*.  
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.		No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.		9 h. A.M.									
		Barometer.	Attached Thermometer	Barometer.	Attached Thermometer	Max. No.	Min. No.	Max. in Shade.	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 (0-10), and Direction.	Amount (0-10), and Species.	No. 8 inches.	No. 12 inches.	No. 22 inches.							
		* No.		No.		No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.			No.	No.	No.	No.	No.	No.	No.					No.	No.	
	1	29.85	62	29.95	60	64	52			58.5	58.5	58.5	51.5	SW	0																Bright Sunshine	1	
	2	29.95	63	29.85	63	66	51			59	58.5	58.5	53.5	SW	0																Overcast throughout	2	
	3	29.85	63	29.90	64	65	50			59	58	58	54	SW	0																Bright Sunshine	3	
	4	29.75	61	29.70	60	65	51			56.5	54	58	51	SW	0																Overcast	4	
	5	29.75	62	29.60	61	63	51			58.5	58	56.5	54	W	0																"	5	
	6	29.65	60	29.75	60	66	51			63.5	58.5	58.5	56	SW	0																Overcast (am) Bk Sun (PM)	6	
	7	29.80	65	29.80	67	69	52			62.5	58	60	60	SW	0																Passing Clouds	7	
	8	29.70	64	29.75	61	64	51			57.5	51	58	52.5	SW	0																Firm (am) Sunshine (P.M.)	8	
	9	29.65	59	29.75	61	60	45			58	54.5	58.5	50	W	0																Passing Showers	9	
	10	29.80	60	29.85	60	64	46			56.5	49.5	52	50	SW	0																Bright Sunshine	10	
	11	29.80	60	29.75	59	63	40			54.5	48.5	53.5	52	SW	0																Overcast & Rain	11	
	12	29.75	62	29.60	60	66	52			58	59.5	58.5	58	SW	0																Overcast & Showers	12	
	13	29.50	63	29.60	60	65	52			60	58.5	60	57.5	SW	0																Full (am) Sunshine (PM)	13	
	14	29.75	62	29.85	64	65	52			61.5	60	56	54	SW	0																Bright Sunshine	14	
	15	29.95	63	29.85	63	70	48			63	58	59	56	SW	0																	"	15
	16	29.55	65	29.49	59	68	52			63.5	60	52	49	SE	0																	Heavy Showers	16
	17	29.85	62	29.70	61	60	48			58	57	54	56	SW	0																	Overcast	17
	18	29.55	60	29.50	60	65	51			55.5	54	55	54	SW	0																	Overcast with Bk of Sun	18
	19	29.45	59	29.55	59	56	52			55.5	53.5	53.5	49	SW	0																	Overcast (am) Heavy Showers (PM)	19
	20	29.50	57	29.55	58	54	42			55.5	52	54.5	52	SE	0																	Bright Sunshine	20
	21	29.50	57	29.60	58	58	49			57.5	57	52.5	52	SE	0																	Heavy Rain all day	21
	22	29.60	60	29.65	59	65	48			58.5	56.5	55	53.5	SW	0																	Sunshine with Passing Showers	22
	23	29.75	60	29.80	60	66	46			62	58.5	58.5	52	SW	0																	Bright Sunshine	23
	24	29.99	58	29.80	58	57	50			54.5	52	54.5	50	NE	0																	Dull throughout	24
	25	29.90	58	29.90	68	57	52			55	54.5	52	51.5	SE	0																	Dull rain after 6 P.M.	25
	26	29.70	63	29.65	68	70	54			62	59	58.5	54	SE	0																	Overcast & Passing Clouds	26
	27	29.50	63	29.40	65	65	54			59.5	56	56	53	SW	0																	Sun with Passing Showers	27
	28	29.25	63	29.25	60	68	54			62	56	54.5	52	SW	0																	Bright Sun	28
	29	29.20	58	29.20	59	64	48			54	58.5	54	52	SW	0																	"	29
	30	29.35	59	29.60	57	62	49			59	58.5	50	49	SW	0																	"	30
	31	29.67	57	29.38	58	63	43			57	57.5	55	54.5	SW	0																	Overcast rain from 4 P.M. to 6 P.M.	31
	Sums.	20.71	33			110	296			244.5	133.5																						
	Means.	29.68	61.1			63.6	49.6			57.9	55.0																						
	† Total Corrections for Instrumental Errors.																																
	‡ Corrections for Diurnal Range.																																
	"Corrected Means."					49.2				54.5	53.5																						
	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		

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

TABLE FOR ESTIMATING FORCE OF WIND.					
Estimated Force, 0-6.	Common Designation.	Estimated Force, 0-6.	Common Designation.	Estimated Force, 0-6.	Common Designation.
0	Calm	1.5	Light breeze	4	Blowing hard
0.5	Very light air	2	Fresh breeze	5	Blowing a gale
1	Light air	3	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† for Temp. (Col. 2), = *29.582*  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = \_\_\_\_\_  
Mean at Station, corrected, and at 32°, = *29.582*  
Correction for height, feet above Mean Sea-level, = *2.09*  
Mean, reduced to 32°, and Sea-level, = *29.791*  
Highest Reading, corrected for Index error, on the *24* th, = *29.990*  
Lowest Do. Do., on the *29* th, = *29.200*  
Difference, or Monthly Range, = *0.790*

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the *26* th, = *70.0*  
Lowest in Month, corrected for Index errors, on the *11* th, = *39.6*  
Difference, or Monthly Range, = *30.4*  
"Corrected Mean" of all the Highest, (Col. 5), = *63.6*  
"Corrected Mean" of all the Lowest, (Col. 6), = *49.2*  
Difference, or Mean Daily Range, = *14.4*  
\*\* Calculated Mean Temperature of Month, = *56.4*  
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), = *58.4*  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = *55.5*  
†† Computed Temperature of Dew-Point, = *52.9*  
†† Do. Elastic Force of Vapour, = *40.2*  
†† Do. Weight of Vapour in a Cubic Foot of Air, = \_\_\_\_\_  
†† Relative Humidity, (Saturation = 100), = *82*  
RAIN fell on *11* Days; Amount in Inches, = *3.90*

WIND.		SUMMARY.										
Direction.		N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.		0	1	3	2	9	12	3	1	0		
P.M.		0	0	4	2	7	13	5	0	0		
Mean.		0	0	4	2	8	12	4	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 Gammed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and Return verified by

(Signed)

*Malcolm Gunn*

*C*

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 comprehensiveness among the several Stations, 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. Adie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-inches* are not true inches but so much shorter as to *compensate* the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; their coincidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *float-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 *venier*.

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 neck of 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 *slight tap* is produced. If this is perceived, 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 *venier*, 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-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 Negretti and Zambra's Patent "Thermometer" and "Hygrometer" and "Self-registering Thermometer." Professor Phillips's are recommended; painted directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and attached 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; if the part of the spirit distils by light 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 printers' ink. They are placed in shadow louvered 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 the bulb of these Thermometers; not 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 two bulbs;—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 immersed by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as fast as the moist cloth in ordinary circumstances.

One form of "Theson'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 frame of the Thermometer, and hanging them side by side, so that the 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 40°·1, respectively. So also 40°·2, and 40°·3, or 40°·7, or 40°·8 respectively. In reading Rutherford's "Max" and "Min." Thermometers, the reading 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "Max" and "Min." Thermometers, the indication of the 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 commencing 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 34.

**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 in the same place, 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 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, 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.

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

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

Clouds.—Convenient abbreviations for Luise Howard's

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," 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.* (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 consistency,—the Council recommend that observations in this interesting department be made at 9 A.M., 9 P.M., and 12 M., and the stems above ground protected from the sun's rays, 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.

**Comet.**—Mention whether Schœben'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 *arrow* entry in the schedule, will indicate that the zone in paper is tinted as 4°·3° on the scale, that the wind is from the N.W., and that its force on the scale 0-6 is "4 : 1 : 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 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 hour of 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.

Bathe 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 a small 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 *tem* day observations be taken;—viz., on the 21st days of March, June, September, and December.

Fall 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, 16th November 1853.

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, . . . . .		Crossberry, . . . . .			Plover, . . . . .		
Holly, . . . . .		Peach, . . . . .			Sand-Martin, . . . . .		
Laburnum, . . . . .		Pear, . . . . .			Starling, . . . . .		
Lilac, . . . . .		Plum, . . . . .			Swan, . . . . .		
Mezercon, . . . . .		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,

Admitted Aug. 1873

BOOK-POST.

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Walmcote Gardens, County of Edinburghshire, in Lat. 55° 57', Long. 3° 10' 1/2, 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 1873.

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.		9 h. P.M.										
		Barometer.	Attached Thermometer.	Barometer.	Attached Thermometer.	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 Direction.	Amount (0-10), and Species.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	No.	No.	No.	No.	No.	No.							
		* No.																																
SAB	1	29.49	61	29.49	59	64	53			55	50	54	52.5	S		S														Bright Sun. am Overcast. P.M.	1			
	2	29.60	37	29.65	58	61	48			52	52	56	53.5	E		E														Passing Showers	2			
	3	29.85	38	29.90	66	55	48			53	53.5	52.5	52	N.E.		N.E.														Passing Showers	3			
	4	30.00	56	29.90	66	54	47			59	56.5	54.5	52	S.E.		S														Bright Sun. am Overcast. P.M.	4			
	5	30.00	55	29.95	55	55	46			51.5	52	57	56	N		S															Shower all day	5		
	6	29.85	53	29.65	54	57	43			49	45	45	44	N.E.		N.E.															Sunshine am Overcast. P.M.	6		
	7	29.55	51	29.60	56	55	36			50.5	47	45	44	S.W.		S.W.															" " " "	7		
	8	29.60	52	29.49	53	62	35			52.5	49	50	47	S.W.		S.W.															" " " "	8		
	9	29.35	54	29.20	53	57	39			50	44	51.5	50	S.W.		S.W.															Overcast. am Rain P.M.	9		
	10	29.15	56	29.25	56	61	49			54.5	52	51.5	48	S.W.		S.W.															Sun am Overcast. P.M.	10		
	11	29.30	55	29.40	55	59	46			55	51	52.5	50	S.W.		S.W.															Sun & Passing Showers	11		
	12	29.45	56	29.65	56	61	47			55	52.5	50	48	S.W.		S.W.															" " " "	12		
	13	29.70	55	29.55	55	61	43			64	51	55.5	50	N.E.		N.E.															Sun & overcast	13		
	14	29.45	55	29.15	54	53	47			50	49.5	48.5	48	N.E.		N.E.																Dull Rain from 11 am to 7 p.m.	14	
	15	29.15	52	29.30	52	57	42			48.5	47	48	46	N.E.		N.E.																Heavy Showers am Sunshine P.M.	15	
	16	29.55	53	29.35	53	59	45			51.5	48	56	57	N.E.		S																Overcast throughout	16	
	17	29.25	53	29.30	52	62	42			57	50.5	48.5	45	S.W.		S.W.																Rain am Fair & Dull P.M.	17	
	18	29.55	55	29.45	51	52	43			51.5	48	48.5	48	S.W.		S.W.																Showerly strong gale Thunder	18	
	19	29.75	52	29.65	55	59	45			53.5	53	49	48	N		S.W.																Sun am Overcast & Rain P.M.	19	
	20	29.55	57	29.65	56	66	48			54.5	57	54.5	52	S		S																B.M. Sunshine strong wind	20	
	21	30.10	55	30.35	51	58	42			62	57	46	45	S		S																	Bright Sun	21
	22	30.30	52	30.20	54	55	38			52.5	52	51	49	S		S																	Overcast & Showery	22
	23	30.20	54	30.20	53	61	47			56.5	53	48.5	46	S		S																	Bright Sunshine	23
	24	30.15	53	30.10	56	69	41			57.5	51.5	48.5	47	S.W.		S.W.																	B.M. Sunshine	24
	25	30.05	55	30.00	57	65	46			55.5	52.5	53.5	51	S.W.		S																	" " " "	25
	26	30.00	58	29.80	57	67	47			58.5	54	52.5	51	S		S																	" " " "	26
	27	29.70	60	29.60	63	72	50			64.5	58.5	59	56	N		N																	" " " "	27
	28	29.75	59	29.99	56	57	45			57.5	51	45	41	N		N																	" " " "	28
	29	30.00	51	29.99	50	55	38			50	46	44	42	S		S.W.																	B.M. Sun. am Overcast. P.M.	29
	30	29.90	52	29.70	51	50	40			45.5	43	47.5	46	S.W.		S.W.																	Overcast am Rain P.M.	30
	31																																	31
Sums.		21.09	145	20.51	162	275	125			1135	270	94	265																					
Means.		29.703	54.8	29.645	55.4	59.5	44.2			53.85	49.5	48.8																						
+ Total Corrections for Instru- mental Errors.																																		
+ Corre- ctions for Diurnal Range.																																		
"Cor- rected 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 ++ for Temp. (Col. 2), = 29.633  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction ++ for Temp. (Col. 4), = 29.612  
Mean at Station, corrected, and at 32°, = 29.622  
Correction for height, feet above Mean Sea-level, = 2.09  
Mean, reduced to 32°, and Sea-level, = 29.842  
Highest Reading, corrected for Index error, on the 21th, = 30.350  
Lowest Do. Do., on the 10th, = 29.150  
Difference, or Monthly Range, = 1.200

\* 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.  
† Estimating corrections for both capillarity and Index Errors.  
‡ The Diurnal Range for Scotland is as yet unknown.  
§ Practically, though not absolutely a minus correction.  
|| These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition only.  
¶ While the Diurnal Range is unknown, the Arithmetical Mean of (Cols. 5 and 6) will be entered as the "Calculated Mean Temperature."  
‡ Any Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. See over.

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 27th, = 72.0  
Lowest in Month, corrected for Index errors, on the 8th, = 34.6  
Difference, or Monthly Range, = 37.4  
"Corrected Mean" of all the Highest, (Col. 5), = 59.5  
"Corrected Mean" of all the Lowest, (Col. 6), = 43.8  
Difference, or Mean Daily Range, = 15.7  
\*\* Calculated Mean Temperature of Month, = 51.6

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 11th, = 72.0  
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 72.0  
Lowest at Night, Black Bulb, (corrected for Index errors), on the 11th, = 34.6  
"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass, = 34.6  
Difference of above Means or Range ("exposed"), = 37.4

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 52.4  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 50.4  
†† Computed Temperature of Dew-Point, = 48.6  
†† Do. Elastic Force of Vapour, = 3.37  
†† Do. Weight of Vapour in a Cubic Foot of Air, = 3.41  
†† Relative Humidity, (Saturation = 100), = 85  
RAIN fell on // Days; Amount in Inches, = 3.10

WIND.		SUMMARY.			
Direction.		N	NE	E	SE
A.M.		2	5	1	1
P.M.		2	5	1	0
Mean.		2	5	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 Gimmied or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

Malcolm Smith

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 dissimilarities 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 (nominally 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 new compensated 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 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 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 screw up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a *slight 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 exactly made. By raising the back and front of the index, the lower edge of the reading, 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, Messrs. Rogers and Sons, 15, Abchurch Lane, London, E.C. 4.

**Self-registering Thermometers.**—Professor Phillips, and Messrs. Rogers and Sons, 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 reunited 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 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 dissipation.

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

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

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

**Reading of the Thermometer.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading of 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 40½, and 40¾, more or less must be registered 40° 2, or 40° 3, and 40° 7, or 40° 8 respectively. In reading Anderson's "Max" and "Min." Thermometers, the indication of thin edge 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 as 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 read their occurrence by 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-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 *Measuring Wind Force* by steel tables as that given in the schedule is, to say the least, unsatisfactory.

**Mean-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 unfavourable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

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

**Clouds.**—Convenient abbreviations for Luke Howard's nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *cloud* column, though their appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is *half covered* by clouds, 5 is entered as the *observation*, and so on. Observations of the clouds are made at 9 a.m. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity 9, 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.

**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. 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 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 of Mr. Schönbem'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>25</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 Electrometer is necessary to every complete meteorological observatory.

**Remarks.**—The "Remarks" column is too narrow, but unfortunately so. Some of the most valuable observations that can be taken are those for which no rule exists, observations assumed to be the use of contractions ought, therefore, to be taken every advantage of, and a list of such as may be registered, and in two at Greenwich, and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great importance ought to be given in this column to observations of great difference in character, colour, velocity, and direction of the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of mists, fog, or fumes, remarkable depressions and elevations of the barometer, thunder, storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 a.m. and 9 p.m. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the magnifying glass may be made on the periphery of the seasons, possess not only great scientific value, but are of considerable interest to the agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs, to particular species of birds, and in the case of crops, to specified sorts reaped from year to year on a selected piece of ground of  $\frac{1}{2}$  or 1 acre. 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, 17th November 1892.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Last Budd First appear.	In Leaf.	Diverged 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, &c.	First in Blossom.	Fruit Ripe, generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry,			Cuckoo,		
Bourtree or Elder,			Curlew,		
Broom,			House-Swallow,		
Hazel,			Lapwing,		
Hawthorn,			Plover,		
Holly,			Sand-Martin,		
Laburnum,			Starling,		
Lilac,			Swan,		
Mezerion,			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,  
10, South Street,  
Edinburgh.

# SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Vallehall, Goudrie, Dalkeith County of Edinburghshire, 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 1873.  
 The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.		SELF-REGISTERING THERMOMETERS.		HYGROMETER.		WIND.		RAIN.		CLOUDS.		THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.					
		9 h. A.M.		6 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bells.		9 h. A.M.		6 h. P.M.		9 h. A.M.		6 h. P.M.					9 h. A.M.		6 h. P.M.		
		Barometer.	Attached Ther- mometer.	Barometer.	Attached Ther- mometer.	Max. No.	Min. No.	Max. No.	Min. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.					Force.	9 h. A.M.	6 h. P.M.	9 h. A.M.	6 h. P.M.
		No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.					No.	No.	No.	No.	No.
		Inches.		Inches.																					
	1	29.60	54	29.60	50	53	45	50	50.5	48.5	47	S								Continued Heavy Rain	1				
	2	29.70	56	29.70	54	53	45	51.5	51.5	47.5	47.5	S								" do	2				
	3	29.70	54	29.60	54	53	47	50	49.5	50	50	S								" do	3				
	4	29.90	54	29.85	52	56	44	49.5	45	40	39	S								Bright Sunshine	4				
	5	29.70	52	29.85	50	54	58	50.5	47	43	41	SW								Shower and B.S. Sunshine	5				
	6	29.75	50	29.20	53	55	41	47.5	43	34	32	SW								Rain	6				
	7	29.50	50	29.45	50	54	41	47	44	40	40	W								Breeze - Thunder Shower	7				
	8	29.45	46	29.45	46	50	38	43	41	35	35	W								Bright Sun	8				
	9	29.50	44	29.10	52	57	33	40	39.5	38.5	34	S								Light Showers	9				
	10	29.10	53	29.05	54	57	31	53	52	51	47	W								" do	10				
	11	29.25	53	29.30	52	53	46	51	47.5	45	44	W								Bright Sun	11				
	12	29.50	51	29.45	48	51	40	46.5	45.5	41.5	41	SW								" do	12				
	13	29.45	48	29.35	46	52	36	45	44	41	40	S								" do	13				
	14	29.50	48	29.45	44	50	37	45	41.5	42.5	41	S								" do	14				
	15	29.50	46	29.65	47	50	37	44.5	42	39.5	39	S								" do	15				
	16	29.70	48	29.65	51	56	35	47.5	45	50	48	SW								Breeze	16				
	17	29.80	52	29.70	52	55	36	50	48.5	51	51.5	SW								Breeze	17				
	18	29.65	53	29.90	50	56.5	49	53	51.5	44.5	43	SW								Blinks of Sun	18				
	19	30.00	50	29.65	50	55	40	48.5	45	47	44	SW								Sunshine	19				
	20	29.45	48	29.60	45	46	38	41.5	38	37	35	W								B.S. Sunshine	20				
	21	29.30	40	29.00	46	49	35	43	41.5	45	42.5	S								" do Cold Wind	21				
	22	28.70	47	28.60	45	46	41	44.5	41	36.5	36	W								Breeze - am Heavy Rain	22				
	23	28.70	42	28.70	40	46	33	40	38	33	34	W								Heavy Showers	23				
	24	29.60	42	29.25	42	48	31.5	38.5	36	32.5	32	W								Bright Sun	24				
	25	29.45	42	29.55	43	48	29	34.5	34	36.5	35	S								" do	25				
	26	29.85	44	30.00	43	46	31	35	31.5	32	31.5	S								" do	26				
	27	30.00	40	30.40	43	47	28	39	36	40	38	S								" do	27				
	28	30.35	44	30.05	45	51	37	44.5	41.5	42	43	SW								" do	28				
	29	29.99	47	29.80	48	52	39	47.5	44	44	43	SW								Bright Sun am Breeze - P.M.	29				
	30	29.65	49	29.60	48	50	42	46	44	42.5	41	S								Breeze	30				
	31	29.25	46	29.90	46	48	34	42.5	40.5	40	39.5	SW								Breeze	31				
		16.94	252	16.40	249	46.62	25	169.5	99.5	55.5	54.5														
		29.54	64.8	29.52	48	51.5	38.8	45.5	43	42.8	41.8														

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† for Temp. (Col. 2), = 29.49 4  
 "Corrected Mean" of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = 29.47 4  
 Mean at Station, corrected, and at 32°, = 29.47 4  
 Correction for height, feet above Mean Sea-level, = 2.09  
 Mean, reduced to 32°, and Sea-level, 29.70 3  
 Highest Reading, corrected for Index error, on the 27th, = 30.40 0  
 Lowest Do. Do. on the 22th, = 28.60 0  
 Difference, or Monthly Range, = 1.80 0

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 9th, = 57.0  
 Lowest in Month, corrected for Index errors, on the 27th, = 27.6  
 Difference, or Monthly Range, = 29.4  
 "Corrected Mean" of all the Highest, (Col. 5), = 51.5  
 "Corrected Mean" of all the Lowest, (Col. 6), = 38.1  
 Difference, or Mean Daily Range, = 13.4  
 \* Calculated Mean Temperature of Month, = 44.8

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 44.6 46.0  
 Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 43.0 43.7  
 †† Computed Temperature of Dew-Point, = 41.1 41.1  
 †† Do. Elastic Force of Vapour, = 2.58-259  
 †† Do. Weight of Vapour in a Cubic Foot of Air, = \_\_\_\_\_  
 †† Relative Humidity, (Saturation = 100), = 88 84  
 RAIN fell on 10 Days; Amount in Inches, = 3.70

WIND.	SUMMARY.										Mean Force.	Mean Velocity in miles per day.
	Direction.	N	NE	E	SE	S	SW	W	NW	Caln or Variable.		
A.M.		3	0	0	0	10	9	9	0	0		
P.M.		2	0	0	0	8	11	9	1	0		
Mean.		2	0	0	0	9	10	9	0	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 Gummed or Fastened, and Forwarded by Book Post, prepaid.

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

(Signed) Malcolm Sumner

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## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Belmont Gardens Belmont County of Edinburghshire, 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 1873.

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.		9 A.M.		P.M.		9 h. A.M.									
		Barometer. No.	Attached Thermometer.	Barometer. No.	Attached Thermometer.	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.	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.	No. 3 inches.	No. 12 inches.					No. 22 inches.
		inches.	°	inches.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°					°
1	1	28.40	46	28.75	43	43	38			42	40	36	35	N	S														Strong gale Showers	1	
2	2	28.95	43	29.10	42	46	32.5			40	38	38	37	S	S														Bl. Sunshine	2	
3	3	29.20	40	29.25	39	50	30			33.5	33	33	32.5	S	S														do	3	
4	4	29.30	41	29.35	39	49	32			39.5	38	32	32	S	S														do	4	
5	5	29.35	41	29.30	38	48	28			37.5	37	46	45	S	S														do	5	
6	6	29.30	47	29.35	47	48	43			46	45.5	43	42	S	1.E														Overcast -	6	
7	7	29.60	47	29.90	46	47	40			44	43.5	46.5	44	1.E	1.E														Heavy Rain	7	
8	8	30.00	45	30.05	46	44	37			40	38	37	37	1.E	1.E														do	8	
9	9	30.20	46	30.15	44	47	32			44	43	40	39	1.E	1.E														Overcast am Showers	9	
10	10	30.25	45	30.15	45	44	37			42.5	39.5	42	40	1.E	1.E														Blinds of Sun & Passing Showers	10	
11	11	30.25	45	30.15	45	45	38			44	41.5	34	34	E	S														Overcast -	11	
12	12	30.11	40	29.95	43	44	27			31	30.5	40	39.5	S	S.E														do	12	
13	13	30.25	45	29.85	48	44	38			43	41.5	41	40	S.E	1.E														Overcast - & Blinds of Sun	13	
14	14	29.95	40	30.15	43	45	35			42	41.5	41	41	1.E	1.E														Overcast - Rain	14	
15	15	30.25	45	30.20	41	46	38			42	40	42	41.5	E	E														Overcast - Showers	15	
16	16	30.30	42	30.30	41	35	28			29.5	29	35.5	33	S	S														Bl. Sun	16	
17	17	30.35	42	30.25	40	36	31			32.5	32	30	29.5	N	N														Foggy	17	
18	18	30.25	41	30.15	42	45	28			34	33	37	36	N	N														Overcast - Sunshine Midday	18	
19	19	30.10	41	29.95	43	43	34			37	36.5	40	39	N	N														Overcast -	19	
20	20	29.95	43	29.75	44	45	38			41.5	39.5	33	36	S.W	S.W														do	20	
21	21	29.55	42	29.05	48	51	36			42	40	31	48.5	S.W	S.W														do	21	
22	22	29.05	48	29.25	48	51.5	45			47.5	47.5	46	46	E	E														Overcast - Strong gale	22	
23	23	29.20	49	29.40	47	48	44			46.5	46	42.5	42	E	E														Bl. Sunshine	23	
24	24	29.45	47	29.60	47	47	39			44.5	43	41.5	39	E	E														do & Passing Showers	24	
25	25	29.85	46	29.70	47	48	37			42.1	40	40.5	40	S.W	S.W														Sunshine	25	
26	26	29.35	50	28.85	53	55	39			52.5	50	52	50	E	E														do	26	
27	27	29.40	47	28.85	47	52.5	44			45	43	45	41	E	E														Passing Clouds	27	
28	28	29.60	47	29.50	52	54	39			43	41.5	52	49.5	S.W	S.W														Rain on Cloudy P.M.	28	
29	29	29.20	49	29.00	48	54	37			44	43.5	43.5	44	S	S														Overcast - Showers	29	
30	30	29.65	46	29.95	46	44	35			37.5	37	37.5	37	S.W	S.W														Shower	30	
31	31																													Bright	31
Sums.		19.75	144	19.20	139	2010	1795			30.0	29.20	143	29.0																	NOTATION USED IN GENERAL REMARKS.	
Means.		29.65	84.47	29.64	40	44.6	46.7	36.0		41.0	39.7	40.5	39.7																	a. denotes aurora. m. denotes meteor. ci. " cirrus. ma. " meteors. ci-cu. " cirro-cumulus. n. " nimbus. cu. " cumulus. r. " rain. cu-s. " cumulo-stratus. c. h. r. " continued heavy rain. d. " dew. s. " squall. f. " fog. sc. " squall. fr. " frost. sl. " sleet. h. fr. " hoar-frost. sn. " snow. h. " haze. so. h. " solar halo. h. d. " heavy dew. sq. " squall. hl. " hail. sqs. " squalls. l. " lightning. t. " thunder. li. cl. " light clouds. t. s. " thunder storm. li. sh. " light showers. w. " wind. lu. co. " lunar corona. w. " wind. lu. ha. " lunar halo. g. " gale of wind.	
+ Total Corrections for Instrumental Errors.		-4						+5 +5 +5 +5																							
+ Corrections for Diurnal Range.		35.6						41.5 40.2 44.0 40.2																							
** Corrected Means.		35.6						41.5 40.2 44.0 40.2																							
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  $\uparrow$  for Temp. (Col. 2), = 29.658 - 0.044 = 29.614

"Corrected Mean" of Barometer at 9 P.M., minus the Correction  $\uparrow$  for Temp. (Col. 4), = 29.596 - 0.044 = 29.552

Mean at Station, corrected, and at 32°, = 29.614

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

Mean, reduced to 32°, and Sea-level, = 29.823

Highest Reading, corrected for Index error, on the 17th, = 30.350

Lowest Do. Do., on the 1st, = 28.400

Difference, or Monthly Range, = 1.950

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 26th, = 55.0

Lowest in Month, corrected for Index errors, on the 12th, = 26.6

Difference, or Monthly Range, = 28.4

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

"Corrected Mean" of all the Lowest, (Col. 6), = 35.6

Difference, or Mean Daily Range, = 11.1

\*\* Calculated Mean Temperature of Month, = 41.2

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 1st, =

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

Lowest at Night, Black Bulb, (corrected for Index errors), on the 1st, =

"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), = 41.25

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 40.2

Computed Temperature of Dew-Point, = 38.86

Do. Elastic Force of Vapour, = 2.374

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

Relative Humidity, (Saturation = 100), = 98.0

RAIN fell on // Days; Amount in Inches, = 2.50

WIND.	SUMMARY.										Mean Force.	Mean Velocity in miles per day.
	Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.		
A.M.		1	4	2	1	7	4	9	1	0		
P.M.		0	7	1	1	7	2	11	1	0		
Mean.		0	6	1	1	7	3	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 Gimmied or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

Malcolm Smith



# SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Valleikirk Gardens, Dalkeith 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.

The Hours of Observation are of Greenwich Time.

During the MONTH of December 1873.

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 Winds, 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.	Atta- ched Ther- mometer	Barometer.	Atta- ched Ther- mometer	Max.	Min.	Max.	Min.	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.	No.	No.								
		No.	No.	No.	No.	No.	No.	No.	No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	9 h. A.M.	No. of hours in which it fell.	Amount in inches.	Direction.	Amount (0-10), and Species.	Direction.	Amount (0-10), and Species.	No.	No.					No.	
		29.90	49	29.90	52	54	36			38	37.5	52	51	SW	SW												Shower	1				
		30.20	50	30.15	51	50	36			35	34	50	49	SW	S												Dull Forecast	2				
		30.15	51	30.25	52	51	46			47	46	50	49	S	S												"	3				
		30.25	52	30.25	51	52	46			42	39	51	49.5	S	N												"	4				
		29.95	52	29.95	48	51	45			50	50	41	40.5	S	S												"	5				
		30.30	47	29.90	40	41	31			52.5	32	34	33	S	S												Sunshine	6				
		30.18	46	30.00	47	50	30			45	44	47	44	N	N												"	7				
		30.15	49	30.05	49	51	45			48.5	45.5	46	44	SW	N												Sunshine mid-day	8				
		30.15	50	30.10	50	50	45			48	45	48	45	S	N												Dull	9				
		30.25	50	30.30	50	50.5	43			45.5	43	38.5	39.5	SW	SW												Sunshine am Forecast-P.M.	10				
		30.15	43	30.30	44	43.5	32			36	35	37	36	SW	SW												Dull Light fog	11				
		30.35	44	30.30	45	45	31			36.5	35	42.5	43.5	SW	SW												Bluffs of Sun Forecast	12				
		30.30	45	30.30	48	48	41			46.5	45	46	45.5	S	S												Bluffs of Sun	13				
		30.20	48	29.90	46	43	41			42.5	42	45	41	SW	SW												Dull	14				
		29.65	48	29.30	48	48	41			45.5	44	46.5	44	S	SW												Bluffs of Sun	15				
		29.25	50	29.65	50	49	44			48	43.5	46.5	42.5	N	SW												ditto	16				
		29.85	49	29.70	51	52	42			44.5	43	52.5	50	SW	SW												Dull & Forecast	17				
		29.85	50	29.80	49	47	41			44	43	43	41	SW	SW												Bright Sun	18				
		29.65	45	29.50	45	45	35			39	37.5	41	40	S	S												Bluffs of Sun	19				
		29.50	46	29.49	46	45	36			41	39	44.5	41	S	N												Light Showers	20				
		29.60	49	29.45	50	50	41			49.5	46.5	47.5	41.5	N	N												Rain	21				
		29.45	46	29.55	45	42	38			40	38	39	37	N	N												Hail Showers & Snow	22				
		29.60	47	29.40	50	51	36			46	44	51.5	49	N	N												Light Showers	23				
		30.	45	29.90	42	45	30			31.5	31	40	39	S	SW												Bright Sun	24				
		29.85	45	29.75	50	51	38			39	38.5	49	47	SW	SW												Sun am Forecast-P.M.	25				
		29.70	50	29.55	43	48	45			47.5	45.5	36	35	SW	S												Shower	26				
		29.60	41	29.80	40	38	30			32	31	20	29.5	S	S												Bright Sun	27				
		29.95	42	29.80	41	35	28			33	32.5	35	34	S	S												Shower of Snow am Haze P.M.	28				
		29.60	42	29.50	42	41	31			39	37.5	37	35	SW	SW												Bluffs of Sun	29				
		29.25	44	28.95	46	46	34			44.5	42	45	43	SW	SW												Shower	30				
		29.	46	29.30	45	44	42			43.5	41	41	39	SW	S												Forecast	31				
Sums.		26.75	224	25.09	216	216	244			58.5	10.5	130	56.0																			
Means.		29.863	47.2	29.809	47.0	47.0	37.9			41.9	40.3	43.6	41.3																			
+ 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	31

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction++ = 29.814  
for Temp. (Col. 2), = 29.814  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction++ = 29.814  
for Temp. (Col. 4), = 29.814  
Mean at Station, corrected, and at 32° = 29.787  
Correction for height, feet above Mean Sea-level = 30.023  
Mean, reduced to 32°, and Sea-level = 29.787  
Highest Reading, corrected for Index error, on the 12th = 30.350  
Lowest Do. Do. on the 31st = 28.950  
Difference, or Monthly Range = 1.400

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 1th = 54.0  
Lowest in Month, corrected for Index errors, on the 28th = 27.6  
Difference, or Monthly Range, = 26.4  
"Corrected Mean" of all the Highest, (Col. 5), = 47.0  
"Corrected Mean" of all the Lowest, (Col. 6), = 37.5  
Difference, or Mean Daily Range, = 9.5  
Calculated Mean Temperature of Month, = 42.2  
S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 1th = 54.0  
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 47.0  
Lowest at Night, Black Bulb, (corrected for Index errors), on the 31st = 27.6  
"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass, = 37.5  
Difference of above Means or Range ("exposed"), = 9.5

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 43.2  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 40.8  
Computed Temperature of Dew-Point, = 39.7  
Do. Elastic Force of Vapour, = 2.45  
Do. Weight of Vapour in a Cubic Foot of Air, = 2.37  
Relative Humidity, (Saturation = 100), = 88  
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	0	0	12	14	5	0	0	
P.M.		0	0	0	0	10	13	8	0	0	
Mean.		0	0	0	0	11	14	6	0	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 Grammed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and Return verified by

(Signed)

Malcolm Gunn

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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 model-verified Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted to Meteorological purposes by Mr. A. de London, an excellent Barometer constructed by Mr. A. de London, the use of which is attended with the great convenience of requiring no adjustment of the cistern. Its *scale-bulbs* are not true indices but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; their coincidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *index-line* on this little piston-rod is brought, by the adjusting screw, to *form one straight line* with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this *preliminary* setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *vernier*.

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

**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 to "protect" the Thermometers and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians.

**Self-registering Thermometers.**—Professor Phillips, and Negretti and Zambra's Patent "Maximum" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be re-united by stirring the instrument, especially 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 station. Snow must not be allowed to cover either of these Thermometers; not 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 "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 "Hygrometric Calculations," Observers are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulb;—the 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 wetter pure. In frosty weather observation is a matter of much delicacy and must be made with great care. The bulb must be protected 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 "Maximum" 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, 40.2, 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 40½°, more or less must be respectively 40.2 or 40.3, and 40.7 or 40.8 respectively. In reading Rutherford's "Max." and "Min." Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

**Snowfall.** 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 gauges. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition as, as a check upon the indications of the rain-gauge. For wind, rain, and snow, as indicated in every column, the observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for Luke Howard's

nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *cloud* column, though their appearance 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 6, S. W."

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  $\frac{2}{2}$  (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 proper column.

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

**Temperature of the Sea.**—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by heat 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 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>rd</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 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 attention, 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 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 on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

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

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

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

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

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, 19th November 1852. (By Order) A. B.

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, . . . . .			May 11		Barley, . . . . .				
Ash, . . . . .	May 4				Bere or Bigg, . . . . .				
Beech, . . . . .					Oats, . . . . .				
Birch, . . . . .					Wheat, . . . . .				
Elm, . . . . .	April 26				Beans, . . . . .				
Larch, . . . . .	April 12				Pease, . . . . .				
Lime, . . . . .					Potatoes, . . . . .				
Oak, . . . . .			May 1		Turnips, . . . . .				
Sycamore or Plane, May 15					Rye Grass, . . . . .				

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry, . . . . .		Apple, . . . . .	May 20		Cuckoo, . . . . .		
Bouretree or Elder, . . . . .	June 28	Black Currant, . . . . .			Curlew, . . . . .		
Broom, . . . . .	May 18	Cherry, . . . . .			House-Swallow, . . . . .		
Hazel, . . . . .		Gean, . . . . .			Lapwing, . . . . .		
Hawthorn, . . . . .	May 28	Gooseberry, . . . . .			Plover, . . . . .		
Holly, . . . . .	May 18	Peach, . . . . .			Sand-Martin, . . . . .		
Laburnum, . . . . .	May	Pear, . . . . .	May 12		Starling, . . . . .		
Lilac, . . . . .	May 24	Plum, . . . . .			Swan, . . . . .		
Mezeron, . . . . .		Strawberry, . . . . .	May 26		Rail or Corn Crake, . . . . .		
Mountain Ash or Rowan, June 20							
Red Flowering Currant, April 28							
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,



Delivered  
Dec 1852.

