

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Ballater, County of Aberdeen, in Lat. 57°12'N, Long. 2°14'W, Distance from Sea 4 1/2 miles.Height of Cistern of the Barometer above Mean Sea-level 660 feet, above Ground 4 feet.During the MONTH of January 1870.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.		SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER.				WIND.				RAINF.	CLOUDS.				SUNSHINE.	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.	Velocity (0-10), and Direction.	Amount, (0-10), and Species.		Velocity (0-10), and Direction.	Amount, (0-10), and Species.	No. 1 inches.						No. 2 inches.	No. 3 inches.	Temperature of Well, at depth of feet, No.	Temperature at surface, and Density.	9 A.M.	9 P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
		"No.	"	"	"	"	"	"	"	"	"	"	"	"	"		"	"	"	"		"	"	"						"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† = 29.063  
for Temp. (Col. 2), = 29.094 - 0.31"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† = 29.074  
for Temp. (Col. 4), = 29.104 - 0.30Mean at Station, corrected, and at 32°, = 29.069  
Correction for height, feet above Mean Sea-level, = 73.5Mean, reduced to 32°, and Sea-level, = 29.804Highest Reading, corrected for Index error, on the 19th, = 29.934Lowest Do. Do., on the 8th, = 27.916Difference, or Monthly Range, = 2.018S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 7th, = 42.5Lowest in Month, corrected for Index errors, on the 24th, = 13.0Difference, or Monthly Range, = 29.5"Corrected Mean" of all the Highest, (Col. 5), = 38.5"Corrected Mean" of all the Lowest, (Col. 6), = 27.1Difference, or Mean Daily Range, = 11.4\* Calculated Mean Temperature of Month, = 22.8

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 11th, =

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

Lowest at Night, Black Bulb, (corrected for Index errors), on the 11th, =

"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), = 34.6

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

†† Computed Temperature of Dew-Point, =

†† Do. Elastic Force of Vapour, =

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

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

RAIN fell on 11 Days; Amount in Inches, = 1.35

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

Mean Velocity in miles per day.	Mean Force.	Mean Variable.	Mean Calm.
1.00	1.07	1.04	1.08

\* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S." and a number to be entered in the Readings; 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 "Hygrometric Deductions" are calculated from Glaisher's Hygrometric Tables, Second Edition only.  
While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."  
Any Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. See over.

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

Observations made and  
Return verified byJ. M. Paterson  
Ballater

(Signed)

J. M. Paterson

1011

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

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

An excellent Barometer is constructed by Mr. A. L. de 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 *bubble* in 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 *exposure*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *seize up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upmost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a *sharp tap* is produced. If this is prevented by an 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 tripped and the cistern-adjustment carefully made. By raising and lowering the eye, it must be brought into the plane of the back and front of the index; usually the lower edge of the venturi, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

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

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

from radiation during night. Their bulbs have a black coating, which may easily be made, or mended, by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "Maximum" should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation.

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

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

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

**Reading of the Thermometer.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.4, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 41½°, and 40¾°, more or less must be registered 40.2 or 40.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's "Max." and "Min." Thermometers the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

**Wind.**—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the 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 especially 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 *Henri's Patent* 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, *Lamb's* Anemometer is also recommended; the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

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

*Snowfalls* may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs it must be noted in the "Remarks;" and the latter 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 to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as registered in every column, the observer cannot be too careful to register *observations only*, and nothing that partakes of the nature of deduction or inference.

*Climate.*—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 (&c., 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 in the *description*, 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 <sup>2</sup>/<sub>10</sub>—st.—will indicate that the higher regions are covered to the "amount" of 1-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 of wooden frames. Mention must be made of the geological formation and general natural condition of the soil in which these Thermometers are placed.

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

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

**Quartz.**—Mention whether Schönböhm's or Meißner's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3xx, as an *extra* entry on the scale 0—6 is 4, &c.; 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, &c. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms as have been buried at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of observations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner 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. 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 *farm day* observations be taken;—viz., on the 21st days of March, June, September, and December.

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

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

Eninburgh, 20th November 1869. (By Order) A. B.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf buds First appear.	In Leaf.	Dissest of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Apperising above Ground.	In Ear or Flower.	First Cut or Harvest.
Alder . . . . .					Barley, . . . . .				
Ash, . . . . .					Bere or Bigg, . . . . .				
Beech, . . . . .					Oats, . . . . .				
Birch, . . . . .					Wheat, . . . . .				
Elm, . . . . .					Beans, . . . . .				
Larch, . . . . .					Poase, . . . . .				
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, . . . . .			Cunlow, . . . . .		
Broom, . . . . .		Cherry, . . . . .			House-Swallow, . . . . .		
Hazel, . . . . .		Cran, . . . . .			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 Ponticium, . . . . .							
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.

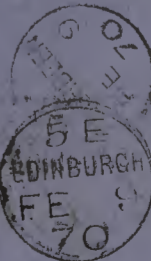
General Post Office Buildings.

Secretary of the Meteorological Society of Scotland.



MR. ALEXANDER BUCHANAN.

BOOK-POST.



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Pallatin, County of Edinburgh, in Lat. 57° 10' N., Long. 2° 12' W., Distance from Sea 43 miles.Height of Cistern of the Barometer above Mean Sea-level 660 feet, above Ground 4 feet.During the MONTH of February 1870.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS.				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 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.									
		No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.		No.	Barometer.	No.	Barometer.	No.	Barometer.	No.					Barometer.		
	1	29.000	41.7	28.726	42.2	40	35			37	35	40	38	SW	2	SW	0.5		12	3.5	10.0	10.0	10.0				Brilliant Aurora to Zenith	1				
	2	28.700	42.3	28.712	42.3	44	38			43	35	43	41	"	3	"	0		4	10.0	10.0	10.0	10.0				" cloudy & fresh breeze P.M. blow. h. off. 2	2				
	3	28.850	43.3	28.900	42.3	43	32			34	33	40.5	38.5	W	0.5	W	0.5		0.7	1.0	10.0	10.0	10.0	10.0				" " & quiet, cold. frosty night	3			
	4	28.850	43.5	28.777	42.5	41.5	36.5			40	38.5	40.5	39.5	E	1	E	2		1.6	2.0	10.0	10.0	10.0	10.0				" cold w. P.M. over: rain. chilly	4			
	5	28.842	44.5	29.050	44.7	42	38			41	39	40.5	39	S	2	SW	1		3.5	8.0	10.0	10.0	10.0	10.0				" cloudy & fresh. cloudy night	5			
	6	28.962	45.5	28.750	45	43	36			39.5	36.5	43	38.5	"	2	"	3		3.5	3.0	10.0	10.0	10.0	10.0				" " & cold wind. very wet black	6			
	7	28.900	45.5	28.978	45	43	39			40	39.7	34.3	33.5	SW	0.5	E	2		1.00	2.5	10.0	10.0	10.0	10.0				" " & very cold. over: snowing	7			
	8	29.000	45	29.150	41	37	30			33	32.5	32		SE	2	SE	1		1.0	over:	2.5	10.0	10.0	10.0	10.0				" over: snowing, drifting. very cold	8		
	9	29.350	41	29.516	40	37.5	24.5			31	29			"	0.5	"	0		"	"	10.0	10.0	10.0	10.0				" " & stormy look. P.M. cloudy & frosty	9			
	10	29.568	40	29.620	39	34	13.5				34			O	N.W.	0.5			0.7	8.0	over:							" calm & very frosty. over: heavy: cold	10			
	11	29.650	39.3	29.800	38.5	33.5	18			29				N.E.	1	N.E.	2		2.4	5.5	3.0	10.0	10.0	10.0	10.0				" cloudy & quiet. cold & cloudy & stormy till	11		
	12	29.850	39.3	29.900	38.3	33	18			34	30.5			E	0.5	"	1		1.1	hazy	3.0	10.0	10.0	10.0	10.0				" " & quiet. cold	12		
	13	29.910	38.5	29.866	38	32.5	22				27			E	2	E	2			over	3.0	10.0	10.0	10.0	10.0				" over: stormy, showing. " & cold	13		
	14	29.850	37.5	29.816	36.5	31.5	22.5			28	30.5			"	2	"	2			"	3.0	10.0	10.0	10.0	10.0				" " & cold P.M. frosty	14		
	15	29.800	36.5	29.700	37	32	18			28	38	36.5		O	N.E.	2				8.0	3.0	10.0	10.0	10.0	10.0				" cloudy & calm very cold. " fresh	15		
	16	29.600	37	29.584	37	37	5.3			37	36.5	30.5	30	E	0.5	E	0.5		0.8	2.0	5.0	2.0	8.0	10.0	10.0				" fresh breeze sub: melting & quiet	16		
	17	29.600	37	29.450	37	37	3.3			33	34.5	33		O	O					over	over:				10.0	10.0				" over: fresh fall of snow. stormy	17	
	18	29.330	38	29.334	38.3	37.5	3.3			36.3	38	36.5	34.5	N.E.	1	E	0.5		2.4	1.0	2.0	5.0	2.0	5.0	10.0	10.0				" cloudy & dull. cold P.M. dull & quiet	18	
	19	29.300	38.3	29.322	40	37	3.2			36	34.5	28.5	27	"	0.5	O			2.0	5.0		O			10.0	10.0				" quiet. bright sunshine. clear frosty	19	
	20	29.132	40.5	29.064	39.5	42.5	2.6			42	38	32		N.W.	2	N.W.	3		2.0	3.0	5.0		O			10.0	10.0				" bright sunshine & milder after	20
	21	28.900	40	28.950	37	32.5	2.2			28				var.	"	2				over:		O				10.0	10.0				" over: very stormy P.M. blow. hard. frosty	21
	22	29.000	37.5	28.826	37.5	33.5	2.2			27.8	31			N.W.	0.5	"	0.5		0.9	2.0	5.0	5.0	5.0	5.0	10.0	10.0				" cloudy & quiet frosty. over: stormy looking	22	
	23	28.662	38.3	28.718	38.5	33	1.6			31				"	2	O			over:		O				10.0	10.0				" over: snowing. very cold P.M. intense frost	23	
	24	28.550	37.5	28.674	36.7	31.3	1.3							"	0.5	O			"						10.0	10.0				" " & quiet P.M. cold	24	
	25	28.700	37.5	28.830	38	31	1.8			27				"	2	N.W.	0.5								10.0	10.0				" " & cold P.M. cloudy & stormy	25	
	26	28.500	37.7	28.710	37	34	1.9							W	1	W	1.5		1.2	2.0	5.0		O			10.0	10.0				" bright sunshine in latterly cold	26
	27	28.800	37	28.572	37	33	1.8				32.5			"	2	N.E.	1.5		6.6	over:	over:				10.0	10.0				" over: stormy look. chilly. over: stormy	27	
	28	28.330	38.7	28.500	39.3	43.5	3.8			43	41.5	44.5	42	SW	2	SW	3		3.9	3.0	5.0	5.0	5.0	5.0	10.0	10.0				" fresh breeze. fog. then milder with	28	
	29																									10.0	10.0					29
	30																									10.0	10.0					30
	31																									10.0	10.0					31
Sums.		815.336	15.8	815.312	16.6	102.117	17.3			101	7.8	75	73						6.32													
Means.		29.126	39.8	29.125	39.5	33.68	26.2			34.7	37.0	35.2	36.2						1.2													
† 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†† = 29.096  
for Temp. (Col. 2), = 29.146... - 0.30...  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† = 29.096  
for Temp. (Col. 4), = 29.145... - 0.24...  
Mean at Station, corrected, and at 32°... = 29.096  
Correction for height, feet above Mean Sea-level... = 738  
Mean, reduced to 32°, and Sea-level... = 29.834  
Highest Reading, corrected for Index error, on the 13 th... = 29.910  
Lowest Do. Do., on the 29 th... = 28.350  
Difference, or Monthly Range... = 1.560

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 2 th... = 44.0  
Lowest in Month, corrected for Index errors, on the 24 th... = 13.0  
Difference, or Monthly Range... = 31.0  
"Corrected Mean" of all the Highest, (Col. 5)... = 36.8  
"Corrected Mean" of all the Lowest, (Col. 6)... = 26.2  
Difference, or Mean Daily Range... = 10.6  
\*\* Calculated Mean Temperature of Month... = 31.6  
S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th... =  
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun... =  
Lowest at Night, Black Bulb, (corrected for Index errors), on the th... =  
"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass... =  
Difference of above Means or Range ("exposed")... =

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11)... =  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12)... =  
†† Computed Temperature of Dew-Point... =  
†† Do. Elastic Force of Vapour... =  
†† Do. Weight of Vapour in a Cubic Foot of Air... =  
†† Relative Humidity, (Saturation = 100)... =

RAIN fell on 14 Days; Amount in Inches... = 6.32

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

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

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 byJ. W. Patterson  
Pallatin

(Signed)

J. W. Patterson

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

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

**Hours 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.**—If *cellar 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-indices* 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; when steam passes freely through the lid and case of the cistern. When the *index-lens* on this little piston-rod is brought by the adjusting screw, *to point 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 *seize up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upmost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a *slight tap* is produced. If this is prevented by an 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 *triple*, 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 every local influence. The falls forming the sides and doors of the Boxes are arranged so as at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-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-vented by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

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

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

The *Hygrometer* consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *calibrated form* of this apparatus 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 *vacuum-cup* must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the mesh must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer, that the mesh is always *clean and moist*, and the water pine. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 13 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 forms 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 fundamental requirements shall be complied with, as far as possible.

**Mounting of the Thermometers.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index, or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—38°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°. or 40½, respectively. So also 41°·3, and 40½, more or less must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In taking 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 properly taken, being so readily affected by heat from the person of the observer.

**Hours 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 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, &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, 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 *observing* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

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

**Snowfalls may, for convenience**, be registered in the rain columns, under the following conditions:—when a Snow shower occurs it must be noted in the "Remarks," and the letter S 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 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 and Direction," 2, W., (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of  $\frac{2}{2}$ , cu-st., will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

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

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

**Zone.**—Mention whether Schmidt's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 a.m. and 9 p.m. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation in the following manner:—thus 3°W., as an *azimuth* entry in the schedule, will indicate that the zone paper is tinted as "3" on the scale 0 to 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 titles can be given nor hours assigned.

The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, green promontories 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 mists, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms or winds attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

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

**Observations** in connection with the periodic return of the seasons, possess not only great scientific value, but are of considerable interest to the agriculturists. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. 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, 10th November 1859.

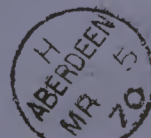
BOOK-POST.

EDINBURGH.

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



76



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

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



1870

The Hours of Observation are of Greenwich Time.

NOTATION USED IN GENERAL REMARKS.			
a.	<i>denotes aurora.</i>	m.	<i>denotes meteor.</i>
ci.	<i>cirrus.</i>	ms.	<i>metecrs.</i>
ci-cu.	<i>cirro-cumulus.</i>	n.	<i>nimbus.</i>
ci-cs.	<i>cirro-stratus.</i>	ra.	<i>rain.</i>
cu.	<i>cumulus.</i>	h. r.	<i>heavy rain.</i>
cu-s.	<i>cumulo-stratus.</i>	c. h. r.	<i>continued heavy rain.</i>
d.	<i>dew.</i>	sc.	<i>stratus.</i>
f.	<i>fog.</i>	scd.	<i>scud.</i>
fr.	<i>frost.</i>	sl.	<i>sleet.</i>
fr.	<i>hoar-frost.</i>	so.	<i>snow.</i>
h.	<i>haze.</i>	so. la.	<i>solar halo.</i>
h. d.	<i>heavy dew.</i>	sq.	<i>squall.</i>
h. l.	<i>halo.</i>	sq. la.	<i>squall.</i>
l.	<i>lightning.</i>	th.	<i>thunder.</i>
l. cl.	<i>light clouds.</i>	t. s.	<i>thunder storm.</i>
l. th.	<i>light showers.</i>	w.	<i>wind.</i>
lu. co.	<i>lunar corona.</i>	g.	<i>gale of wind.</i>
lu. lu.	<i>lunar halo.</i>		

<b>HYGROMETER, Mean</b> (corrected) A.M. and P.M. Reading of <b>Dry Bulb</b> , (Cols. 9 and 11), .....	=	382
<b>Mean</b> (corrected) A.M. and P.M. Reading of <b>Wet Bulb</b> , (Cols. 10 and 12), .....	=	
†† <b>Computed Temperature of Dew-Point</b> , .....	=	
†† <b>Do. Elastic Force of Vapour</b> , .....	=	
†† <b>Do. Weight of Vapour in a Cubic Foot of Air</b> , ...	=	
†† <b>Relative Humidity</b> , (Saturation = 100), .....	=	
<b>RAIN</b> fell on 7 Days; Amount in Inches, .....	=	0.88

WIND.	SUMMARY.											Mean Velocity in miles per day.
	Direction.	N	NE	E	SE	S	SW	W	NW	(alm of Variable.	Mean Force.	
A.M.	J	2	4	1			2	8	7	3	1.03	
P.M.	7	2	3				1	7	2	9	.90	
Mean.	5	2	3	1	0		2	7	4	6	.96	

(Signed) *Imb. Teresa*

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 Taliesin published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

**Hour of Observation.**—The Council recommend that Observations be made precisely at 9 o'clock (Greenwich or Railway Time only) twice a-day for suns, and once (morning or evening) for other instruments, as specified, in the following remarks, or at the top of the schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading at what time it was taken, if not at 9 o'clock.

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

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

An excellent Barometer is constructed by Mr Adie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-inches* are not true inches but so much shorter as to *compensate* the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus, by the 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; when seen passes freely through the lid and case of the cistern. When the *aneroid* 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 *zero-point* setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *aneroid*.

When a Barometer, having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *seize* up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern 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 ventire, 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, Negretti and Zambra's Patent "Maximum" Thermometers are recommended: printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *column* of spirit breaks it may be re-united by striking the instrument repeatedly against the palm of the hand; while 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 printers' ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "Maximum" should be freely exposed to the sun, and the "Minimum" should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation.

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested* form of this apparatus seriously vitiate the "Hygrometrical Deductions" Observers are specially requested to attend to the following conditions:—

The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances. One form of "Mason's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the forementioned requirements shall be complied with, as far as possible.

**Reading of the Thermometer.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read .39-.9. 40-.0. or 40-.1. or under an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 41.2°, 40° 7', 40° 8' must be registered 40° 2', 40° 3', and 40° 3'. Thermometers, the reading of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

**Hour of 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 *7d* are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

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

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

The Council recommend that every observatory be furnished with a *Remans*-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, *John's* Anemometer is also recommended; the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

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

*Snowfalls* may, for convenience, be registered in the rain columns, under the following conditions:—when a Snow shower occurs it must be noted in the "Remarks," and the letter S affixed to the depth of water received in gauges. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as 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 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. 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. A gale, 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. *Underspread* Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its aeration and constant,—the Council commend 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 transpiration 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. (*Zone.*)—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 3  $\frac{1}{2}$  S, as an *exone* entry in the schedule, will indicate that the exone paper is fitted as "3" on the scale, that the wind is from the S.W., and that its force on the scale 0—6 is "4  $\frac{1}{2}$ ," 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 paper Electrometer is necessary to every complete meteorological observatory.

**Remarks.**—The "Remarks" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, &c. Remarks ought to be made on the occurrence of 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 storms on storms as have been limited at above. When lady 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 unexpedient, or in two ruled off for the purpose, from that needed "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 Agriculturists. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observations ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm.

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

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

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

Enslin, 104, November 1880. (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 Threshed.
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, 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.



March 1880

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Pallater, County of Madan, in Lat. 57° 12' N., Long. 2° 12' W., Distance from Sea 43 miles.Height of Cistern of the Barometer above Mean Sea-level 660 feet, above Ground 4 feet.During the MONTH of April 1870.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.				SEA.	OZONE.	GENERAL REMARKS.		Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																									
		9 h. A.M.		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.		Temperature of WELL at depth of feet. No.		Temperature at 1 fathom, and Drift.	9 A.M. 9 P.M.			As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc.																																																																																																																																																																																																																																																																																																																																																																																																																											
		Barometer, No.	Atmospheric Thermometer	Barometer, No.	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.	No.	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.	Temperature at 1 fathom, and Drift.	9 A.M. 9 P.M.	As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc.																																																																																																																																																																																																																																																																																																																																																																																																																					
																																					No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† = 29.206  
for Temp. (Col. 2), = 29.270 - 0.064 = 29.206  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† = 29.192  
for Temp. (Col. 4), = 29.255 - 0.063 = 29.192  
Mean at Station, corrected, and at 32°, = 29.199  
Correction for height, feet above Mean Sea-level, = 71.4  
Mean, reduced to 32°, and Sea-level, = 29.213  
Highest Reading, corrected for Index error, on the 3 th, = 29.722  
Lowest Do. Do., on the 30 th, = 28.500  
Difference, or Monthly Range, = 1.222

\* 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 *mean* 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 th, = 70.5  
Lowest in Month, corrected for Index errors, on the 4 th, = 28.0  
Difference, or Monthly Range, = 42.5  
"Corrected Mean" of all the Highest, (Col. 5), = 56.0  
"Corrected Mean" of all the Lowest,

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 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 Bells published by the Society, an entire complaisance 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 *impossible 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 Observation, 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 of both well adapted to Meteorological purposes.

An excellent Barometer is constructed by Mr. Altie 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 this, 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 this *water-line* on this little piston-rod is brought, by the adjusting screw, to *join one straight line* with those on the ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this *preliminary setting* must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *remains*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *seize up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upmost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a *slight dip* 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. It is noted: the tube must then be gently tapped and the cistern adjustment carefully made. By raising and lowering the eye, it must be brought into the plane of the back and front of the index—usually the lower edge of the venery, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

**Position of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from nearly local influences. Five laths forming the sides and doors of the Boxes are arranged so as at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-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, *Self-registering Thermometers*. Professor Phillips, and Negretti and Zambra's Patent *Maximum* and *Minimum* Thermometers are recommended: printed directions for their use may be obtained with each instrument. The *Maximum* Thermometer of Rutherford is recommended when graduated on the glass stem, and affixed to a frame separate from the *Maximum*. This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *column* of spirit breaks, it may be re-unioned by striking the instrument repeatedly against the palm of the hand; if 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 renewed, by the application of a mixture of lamp black and primers oil. They are placed in shallow blackened boxes, whose sides protect the bulbs from the sun, and the *Maximum* should be freely exposed to the sky. 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; nor the sun's heat to affect the *Minimum* Thermometer by distillation.

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

**The Hygrometer** consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the Hygrometric Deductions, Observers are specially requested to attend to the following "conditions": The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the mesh must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the mesh is always *clean* and *moist*, and the water pure. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances. One form of "Mason's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the frame and thermometer shall be completely 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 tube, or *column* of mercury. The readings ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—38°.9, 40°0, or 40°1; or again, 40°4, 40°3, or 40°46, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½, respectively. So also 44°, and 44½, more or less must be registered 40°2, or 40°3, and 40°1, or 40°5 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 who takes them.

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

**Wind.**—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the mean direction must be taken; and when it is stationary, and always within the wind's 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 unavoidable situation for instruments used, 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." 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 particles 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." 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  $\frac{2}{2}$ , (*eq.*) will indicate that the higher regions are covered to the "amount" of 4 tenths with *stratus* clouds; and that the sky is further observed to the extent of 2 tenths by lower clouds of the *cumulo-stratus* kind.

**Sunshine.**—The number of hours in which objects in the sun's rays cast shadows, should be entered in the pen or column. **Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that thermometers placed in this interesting department be made at 9 A.M., at 12, and 22 inches, and the stems above ground protected from the sun's rays and fitted with soft iron 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 the wells ought, when practicable, to be taken, and the depth of the well ought, and the water noted.

**Time.**—Mention whether Schombert'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 8 1 1, as an *even* entry in the schedule, will indicate that the zone paper is fitted as 4 3 on the scale 0—6 is "4 3 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 unfortunately so. Some of the most valuable observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, are given at the foot of the column.

Besides special and extraordinary observations, 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, &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 sun, line in view, 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 agriculturists. The Council recommend the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm.

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

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

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

Eninburgh, 10th November 1867.

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

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

APR 1870

BOOK-POST.

APR 1870

APR 1870

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dallator, County of Aberdeen, in Lat. 57° 12' N, Long. 2° 12' W, Distance from Sea 43 miles.Height of Cistern of the Barometer above Mean Sea-level 660 feet, above Ground 4 feet.During the MONTH of May 1870.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.  As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc.  Mention the hour at which Storms, including Thunder and Lightning, began and ended.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.		9 h. A.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
		Barometer.	Atmospheric Thermometer.	Barometer.	Atmospheric Thermometer.	Max.	Min.	Max.	Min.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.			Velocity (0-10).	Amount and Species.	Velocity (0-10).	Amount and Species.	No. 8 inches.	No. 12 inches.	No. 22 inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		* No.		No.		No.	No.	No.	No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.			9 h. A.M.	No.	0-10.	Amount and Species.	0-10.	Amount and Species.	No.					No.	No.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		inches.		inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction  $\dagger\dagger$  for Temp. (Col. 2), = 29.131

"Corrected Mean" of Barometer at 9 P.M., minus the Correction  $\dagger\dagger$  for Temp. (Col. 4), = 29.143

Mean at Station, corrected, and at 32°, = 29.137

Correction for height, feet above Mean Sea-level, = 70.7

Mean, reduced to 32°, and Sea-level, = 29.844

Highest Reading, corrected for Index error, on the 25th, = 29.720

Lowest Do. Do. on the 12th, = 28.300

Difference, or Monthly Range, = 1.420

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 7th, = 70.5

Lowest in Month, corrected for Index errors, on the 3th, = 33.0

Difference, or Monthly Range, = 37.5

"Corrected Mean" of all the Highest, (Col. 5), = 57.8

"Corrected Mean" of all the Lowest, (Col. 6), = 41.8

Difference, or Mean Daily Range, = 16.0

\* Calculated Mean Temperature of Month, = 49.8

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 7th, = 70.5

"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 70.5

Lowest at Night, Black Bulb, (corrected for Index errors), on the 12th, = 33.0

"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass, = 33.0

Difference of above Means or Range ("exposed"), = 37.5

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 50.6

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 46.5

Computed Temperature of Dew-Point, = 42.2

Do. Elastic Force of Vapour, = .269

Do. Weight of Vapour in a Cubic Foot of Air, = 74

Relative Humidity, (Saturation = 100), = 74

RAIN fell on 9 Days; Amount in Inches, = 1.72

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

\* 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 given.

† Enlarging corrections for both capacity and Index Errors.

†† The Diurnal Range for Scotland is as yet unknown.

††† These "Hygrometric Reductions" are calculated from Glaisher's Hygrometric Tables, Second Edition only.

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

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

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

Observations made and  
Return verified byJames M. Paterson  
Dallator

(Signed)

J. M. Paterson

154  
776

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 Returns from different observations; and it is found that differences between the Returns from any two Stations, so very considerably as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those persons who kindly furnish Reports to the Society will by a scrupulous attention to the following Directions secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

**Hour of Observation.**—The Council recommend that Observations be made precisely at 9 o'clock (Greenwich or Railway Time only) twice a-day for some, and once (morning or evening) for other instruments, as specified, in the following remarks, or at the top of the schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading at what time it was taken, if not at 9 o'clock.

**Barometer.**—*Weather glasses and thermids*, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. 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. Ait of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-tubes* are not true inches but so much shorter as to *compensate* the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus, by the aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; the *water-lie* 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 *piston-rod* setting must be made with scrupulous accuracy; 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 right 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 spire above the mercury in the tube is a complete vacuum; this is the case when, on holding the instrument so that the mercury strikes the top of the tube, a *sharp tap* is produced. If this is prevented by an 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 hands and person from affecting the mercury. The use of a lens will greatly facilitate accurate adjustment and reading of the Barometer.

**Protection of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from every local influence. 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 Ruddeford 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 *columns* of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; a portion 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 smeared, 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 rely on an attached scale, *always* repeat, 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 to be compared with the dry bulb of the Hygrometer. This freezing-point of each Thermometer (marked by a screw, 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 keep 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 observed by inspection 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.

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

**Reading of the Thermometer.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 41°, and 40½°, more or less must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Ruddeford'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 1 p.m. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the self-registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 2d are those of a series of phenomena commencing at 9 p.m. on the 2d, and extending till 9 p.m. on the 3d.

**Wind.**—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the above 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.

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 unquestionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass round its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the rain 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 Luke Howard's nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *clouds* column, though their appearances and changes ought to be noted among the "*Remarks*." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is *half covered* by clouds, 5 is entered as the *observation*, and so on.

Observations of the clouds are made at 9 a.m. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction,"  $\frac{2}{W}$ , (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  $\frac{2}{c}$ , (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 10th or column.

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

**Temperature of the Sea.**—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be plunged, 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.

**Uzone.**—Mention whether Schönbach's or McFitt's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 a.m. and 9 p.m. It is desired that those indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3x, as an *azone* 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 unavoidable so. Some of the most valuable observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, as lists 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 phenomena ought to be noted in this column to prevent diseases, differences in mechanism, 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 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, on the case of crops, to specified sorts reared from year to year on the 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.

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, . . . . .					Peas, . . . . .				
Larch, . . . . .					Potatoes, . . . . .				
Lime, . . . . .					Turnips, . . . . .				
Oak, . . . . .					Rye Grass, . . . . .				
Sycamore or Plane,									

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, . . . . .		Holly, . . . . .			Sand-Martin, . . . . .		
Laburnum, . . . . .		Peau, . . . . .			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.

General Post Office Buildings,  
Secretary of the Meteorological Society of Scotland,  
MR ALEXANDER BUCHAN,



C BALLATER  
JU 8  
70

TO  
JUN 8  
H ABERDEEN

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Ballater, County of Meriden, in Lat. 57° 22', Long 2° 22', Distance from Sea 43 miles.  
Height of Cistern of the Barometer above Mean Sea-level 660 feet, above Ground 4 feet.  
During the MONTH of June 1870.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS.				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.		Readings of the H. Cup Anemometer.		9 A.M.		P.M.		9 h. A.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
		Barometer.	Attached Thermometer.	Barometer.	Attached Thermometer.	Max. No.	Min. No.	Max. No.	Min. on Grass.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	No. —	Amount in inches.	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.	No.	No.									9 h. A.M.							inches.	inches.					inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
		inches.		inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	

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

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

*Hour of Observation.*—The Council recommend that Observations be made precisely at 9 o'clock (Greenwich or Railway Time only) twice a day for suns, and once (morning or evening) for other instruments, as specified, in the following remarks, or at the top of the schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible in such instances, they are specially requested to mark opposite every reading at what time it was taken, if not at 9 o'clock.

*Barometer.*—*Wetther 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 combined mercury can be adjusted to the *zero-point* of the fixed scale; their coincidence being indicated by a light ivory flange, 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 *join one straight line* with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this *preliminary* setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *vernier*.

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

The Barometer should be suspended in a good *lehigh*, 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.

*Reading of 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 every local influence. 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 "Maximum" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer.

When the column of spirit breaks it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

from radiation during night. Their bulbs have a black coating which may easily be made or mended, by the application of a mixture of lamp black and printer's ink. They are placed in shadow 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 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 *hang* the tubes forward by an inch, from any point on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the mesh must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the mesh is always *clean* and *moist*, and the water pure. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

One form of "Mason's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the frame-ventilators 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 31° 9', 31° 0', or 30° 1'; or again, 40° 4', 40° 5', or 40° 6', according as it indicates a little under, an exact coincidence with, or a little over 40°; or 40° 5', respectively. So also 41° 3', and 41° 4', more or less must be registered 40° 2', or 40° 3', and 40° 1', or 40° 0', respectively. In reading Fahrenheit's "F. 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 24 are those of a series of phenomena commencing at 9 p.m. on the 24, and extending till 9 p.m. on the 25.

*Wind.*—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates 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 single, etc.

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

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

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

*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 gauges. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as 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 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 appearance and changes ought to be noted among the "Remarks." The amount of cloud is entered covered by clouds, 5 is entered as the *observation*, and so on, 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." 2, W." (for example,) will indicate that the higher strata of clouds travel with *extreme* velocity from S. W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of 2, <sup>2</sup> cr-st. (*et*) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

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

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

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

*Ones.*—Mention whether Schindler's or Moffat's papers are used. The paper is affected by a pin to a borel 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:—this 9 a.m. is an ozone entry in the schedule, will indicate that the ozone paper is tried as 9 on the scale 0-6 is "4"; i.e., that it is *blowing fresh*.

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

*Remarks.*—The "Remarks" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of meteors, 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 sun-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 margin.

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.

Edinburgh, 20th November 1859.

(By Order) A. B.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First appear.	In Leaf.	Diseased of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First 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, . . . . .				

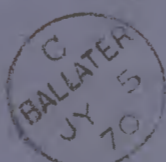
SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe, generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry, . . . . .		Apple, . . . . .			Cuckoo, . . . . .		
Bourtree or Elder, . . . . .		Black Currant, . . . . .			Curlew, . . . . .		
Broom, . . . . .		Cherry, . . . . .			House-Swallow,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



Ballantine  
June 1870

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Ballater, County of Aberdeen, in Lat. 57° 12' N, Long. 2° 27' W, Distance from Sea 43 miles.Height of Cistern of the Barometer above Mean Sea-level 660 feet, above Ground 4 feet.During the MONTH of July 1877.

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 Deposition or Elevation of Barometer, Prevalent Diseases, etc.  Mention the hour at which Storms, including Thunder and Lightning, began and ended.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.		9 h. A.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
		Barometer.	Atta- ched Ther- mometer.	Barometer.	Atta- ched 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.Camp Anemometer. No. —	9 h. A.M.	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.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
		* No.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† for Temp. (Col. 2), = 29.168  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = 29.185  
Mean at Station, corrected, and at 32°, = 29.176  
Correction for height, feet above Mean Sea-level, = 69.2  
Mean, reduced to 32°, and Sea-level, = 29.168  
Highest Reading, corrected for Index error, on the 27 th, = 29.650  
Lowest Do. Do., on the 4 th, = 28.800  
Difference, or Monthly Range, = 0.850

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 24 th, = 85.0  
Lowest in Month, corrected for Index errors, on the 29 th, = 36.0  
Difference, or Monthly Range, = 49.0  
"Corrected Mean" of all the Highest, (Col. 5), = 69.4  
"Corrected Mean" of all the Lowest, (Col. 6), = 49.4  
Difference, or Mean Daily Range, = 20.0  
\*\* Calculated Mean Temperature of Month, = 59.4

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), = 58.7  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 55.4  
†† Computed Temperature of Dew-Point, = 52.5  
†† Do. Elastic Force of Vapour, = 3.95  
†† Do. Weight of Vapour in a Cubic Foot of Air, =  
†† Relative Humidity, (Saturation = 100), = 80  
RAIN fell on 7 Days; Amount in Inches, = 1.55

WIND.		SUMMARY.					
Direction.	N	NE	E	SE	S	SW	W
A.M.							
P.M.							
Mean.							

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

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

Observations made and  
Return verified by

James W. Paterson  
Ballater

(Signed)

Dr. Paterson

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 considerably 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 their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

*Hour of Observation.*—The Council recommend that Observations be made precisely at 9 o'clock (Greenwich or Railway Time only) twice a-day for some, and once (morning or evening) for other instruments, as specified, in the following remarks, or at the top of the schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading at what time it was taken, if not at 9 o'clock.

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

Two moderate-priced Barometers have been approved of by the Council; if properly tested and attended to, they are 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-marks* 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 leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to a little ivory float, 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; 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 *scrub 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 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* of *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 ventricle, 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 glass 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 open to the south. These boxes may be had from the opticians Negretti and Zambra's Patent "Maximum" Thermometers, and 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 Rathford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *column* of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate, and again condense in contact with the body of the liquid. These instruments should be hung by a fine line, and not by a chain. The above remarks apply equally to the Thermometers for

indication 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 linden boxes whose sides protect the bulbs from the wind. The "Minimum" should be freely exposed to the sun, and the "Maximum" should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation.

*Verification of Thermometers.*—No instrument ought to be used for Meteorological purposes 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, if possible. 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 cotton fineness, and fastened at the neck of the bulb by the cotton which also supplies it with water. It must be seen to by the observer that the mesh is always *clean* and *moist*, and the water pure. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be immersed by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

One form of "Glass" Hygrometer is highly objectionable, 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 fore-mentioned requirements shall be complied with, as far as possible.

*Handling of the Thermometer.*—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0 or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40°.5, respectively. So also 41°.3, and 40°.9, more or less must be registered. 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 24 are those of a series of phenomena commencing at 9 P.M. on the 24, and extending till 9 P.M. on the 25.

*Wind.*—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates necessarily, 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-gauge.*—Many causes conspire to produce anomalies 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, 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 particles of the nature of deduction or inference.

*Clouds.*—Convenient abbreviations for James 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 never obliterated; and thus being unable to judge of their amount, we ought not to take them into account in the *cloud* column, though their appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is *half* covered by clouds, 5 is entered as the *observation*, and so on.

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity 6, S. W." (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  $\frac{2}{4}$ , (*sq*) 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 generally depend on the temperature of the soil,—its amount and consistency,—the Council recommend that observations in this interesting department be made at 9 A.M. by thermometers placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars to prevent rain-water being conveyed to the bulbs by the stems or wooden frames.

Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed. *Temperature of the Sea.*—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, noting always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

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

*Glaciers.*—Mention whether Schönbren'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° 4' as an *even* entry in the schedule, will indicate that the ozone paper is turned 4° 3' on the scale, that the wind is from the N.W., and that its force is on the scale 0—6 is "4° 3' 42", 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 Diacrometer 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 a particular colony, 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, and when attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, either also unabbreviated, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Diacrometer should be entered in this manner or on the same 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 *Stannaries* may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reaped from year to year on a selected piece of ground or farm.

The Council recommend that *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 booksellers.

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, 20th November 1866.

BOOK-POST.

EDINBURGH

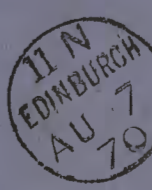
General Post Office Buildings,

Secretary of the Meteorological Society of Scotland.

MR ALEXANDER BUCHAN,



70



OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First appear.	In Leaf.	Divested of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First 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, . . . . .		Gann, . . . . .			Lapwing, . . . . .		
Hawthorn, . . . . .		Gooseberry, . . . . .			Plover, . . . . .		
Holly, . . . . .		Peach, . . . . .			Sand-Martin, . . . . .		
Laburnum, . . . . .		Pear, . . . . .			Starling, . . . . .		
Lilac, . . . . .		Plum, . . . . .			Swan, . . . . .		
Mezereon, . . . . .		Strawberry, . . . . .			Rail or Corn Crane, . . . . .		
Mountain Ash or Rowan, . . . . .							
Red Flowering Currant, . . . . .							
Rhododendron Ponticum, . . . . .							
Whin, . . . . .							

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

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Pallat, County of Perth, in Lat. 57° 24' Long. 2° 12' W., Distance from Sea 4.3 miles.  
Height of Cistern of the Barometer above Mean Sea-level 660 feet, above Ground 4 feet. During the MONTH of August 1870  
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No.				WIND.				Readings of the Tl. up Anemometer. No.	No. of hours in which it fell.	Amount in inches.	No.	CLOUDS.				STUNSHINE. Hours.	THERMOMETERS under Ground.			Temperature of WELL, at depth of feet, 30.	SEA. Temperature at 1 fathom, and locality.	OZONE. 0-10.	GENERAL REMARKS.  As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc.  Mention the hour at which Storms, including Thunder and Lightning, began and ended.	Days of Month.
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.						9 A.M.		P.M.			9 h. A.M.							
		Barometer.	Attached Thermometer.	Barometer.	Attached Thermometer.	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 (0-10), and Direction.	Amount (0-10), and Direction.	Velocity (0-10), and Direction.	Amount (0-10), and Direction.		No. 3 inches.	No. 12 inches.	No. 22 inches.					
		* No.	inches.	°	inches.	°	°	°	°	°	°	°	°	°	°	°	°					°	°	°	°		°	°	°					
	1	29.320	68	29.300	68.5	71.5	45.5			60.5	57	55.5	54.5	SW.	2					over:	5-10	4 M. Thunder									Mr. haze on hills, mild. cool.	1		
	2	29.300	68	29.300	69	80	46			69.5	63	60	59	S	0.5	W	1			0.3	0	2 W	10								clear & warm 6 M. light clouds	2		
	3	29.224	68	29.150	69	79	45			50	46	55	53	E	2	E	2			3 E	8	3 E	10								do misty	3		
	4	29.130	68.5	29.050	68.5	71	49.5			60	59	61	56.5	S	2	SW	0.5			3 S	8	2 SW	10								fresh breeze cool & mild	4		
	5	29.000	69	29.100	73	73	57.5			61	58.5	60	57.5	W	2	W	2			3 W	10	0									li showers over: clear & chilly	5		
	6	29.200	71	29.250	71.5	73.5	57.5			64	61	58.5	57.5	SW.	0.5	SW.	0.5			2 SW	10	2 S	10								den fresh breeze & quite mild	6		
	7	29.250	70	29.350	73	72.5	45.5			54	56	60	59.5	E	2	E	1			3 E	10	2 S	10								cloudy & off rain & chilly	7		
	8	29.450	70	29.550	73	75	53			62	61.5	59	56	0		W	0.5			misty	0										close, mist clear & frosty	8		
	9	29.600	71	29.600	73	82	40.5			67	61.5	59	58	W	0.5		2			0.5	0	3 W	5								clear, warm & very close & quiet	9		
	10	29.570	71.5	29.600	74.5	77	45			69	59	56.5	62	0		0.5				0	2	5									bright sunshine dry	10		
	11	29.600	72.5	29.650	74	80.5	45.5			70	64.5	61	59.5	S	2	0				3 S	5	10									fresh breeze & mild cloudy & calm	11		
	12	29.700	70.5	29.750	74	69.5	49.5			64	56	55.5	53.5	E	2	E	2			3 E	10	3 E	10								hazy & dull & bitterly cold wind	12		
	13	29.750	71	29.800	72.5	66	49			59	57.5	55	53	W	2	1				3 W	10	2	5								fresh breeze & off rain	13		
	14	29.750	69	29.730	70	60.5	46			57	53	53.5	52	E	1	W	0.5			2 E	10	2 W	10								li showers very cold & frosty	14		
	15	29.650	68.5	29.600	71	68.5	50			59.5	58	50	55		2	E	0.5			2	5	0									clear & chilly	15		
	16	29.500	68	29.520	70.5	70.5	50.5			61	54.5	57	55	W	0.5	S	0.5			2 W	5	2 S	10								quiet & mild	16		
	17	29.450	69.5	29.400	72.5	73.5	50.5			62.5	57	59	57		1	S	0.5			2 W	5	2 S	10								off rain cloudy & calm	17		
	18	29.300	68.5	29.300	69	71.5	45	61	47	59	58.5	59	57.5	S	2	W	2			3 S	10	3 W	10								li showers cold & W. wind	18		
	19	29.350	67	29.400	67.5	67	47	57.5	47.5	55	53	47.5	45	W	2	2				3 W	10	0									cold	19		
	20	29.430	65.5	29.500	68	65.5	46.5	57.5	46.5	55	48	55	47	SW	0.5	W	0.5			7.2	10	2 W	10								damp & chilly heavy showers	20		
	21	29.516	64.7	29.450	66	65.5	45.5	57	45	55	46	54	46		0					7.4	8	10									gloomy cold M. clear & cold	21		
	22	29.182	64	29.150	67.5	61	45	57	49.5	57	49.5	48	47	S	0.5	E	0.5			11	2 S	10	0								over: sweet	22		
	23	29.100	64.5	29.120	68	61	47	57	53	53	52	52	52	W	1	W	2			0.5	2 W	10	3 W	10								mild & over: sunshine over: sweet	23	
	24	29.100	66.5	29.130	64	61.5	42	57.5	52	49	49			0		0.5				0.5	5	2	10								calm & mild	24		
	25	29.200	64.5	29.150	65	58	47	55	53	49	48	48		W	2	W	2			3 W	10	3 W	10									fresh breeze & chilly	25	
	26	29.250	63	29.300	67.5	61	41	52	50	49	47	47		W	0.5	W	0.5			2 W	10	0										cloudy & off rain	26	
	27	29.250	64	29.100	66.5	59	46	59	56	57	48	48		W	0.5	W	2			0	5 W	5										clear & fine	27	
	28	28.950	65	29.100	69	57	44.5	52	57	49	48	48		W	2	W	0.5			2 W	10	0										over: sweet	28	
	29	29.150	65.5	29.300	62	57	41	46	49	50	48	48		W	1	W	2			1.5	2 W	10	3 W	10								li showers very cold & frosty	29	
	30	29.450	58.5	29.550	59	58	45.5	53	50	47	43	43		E	2	0.5				3 W	10	0										fresh breeze clear & milder	30	
	31	29.350	59	29.200	62	68	42	59	52	58	52	52		W	2	W	2			3 W	10	0										clear & cold	31	
Sum.		910.022		910.490		20.5	14.5	33		51	12.5	15	18							168														
Means.		29.356	67.2	29.371	66.2	66.9	46.9			54	55.5	47.5	45.5																					
+ Total Corrections for Instrumental Errors.										+2		+2																						
+ 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			

NOTATION USED IN GENERAL REMARKS.					
a.	denotes aurora.	m.	denotes meteor.		
ci.	" cirrus.	ms.	" meteors.		
ci-cu.	" cirro-cumulus.	n.	" nimbus.		
ci-s.	" cirro-stratus.	r.	" rain.		
cu.	" cumulus.	h. r.	" heavy rain.		
cu-s.	" cumulo-stratus.	c. h. r.	" continued heavy rain.		
d.	" dew.	s.	" stratus.		
f.	" fog.	sc.	" scud.		
fr.	" frost.	stet.	" steady.		
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.	g.	" gale of wind.		
lu. ha.	" lunar halo.				

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

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† = 29.254  
for Temp. (Col. 2), = 29.356 ... 1.102 ...  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† = 29.265  
for Temp. (Col. 4), = 29.371 ... 1.106 ...  
Mean at Station, corrected, and at 32°, = 29.260  
Correction for height, feet above Mean Sea-level, = 695  
Mean, reduced to 32°, and Sea-level, = 29.955  
Highest Reading, corrected for Index error, on the 13 th, = 29.800  
Lowest Do. Do., on the 26 th, = 28.950  
Difference, or Monthly Range, = 0.850

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 13 th, = 82.0  
Lowest in Month, corrected for Index errors, on the 26 th, = 41.5  
Difference, or Monthly Range, = 40.5  
"Corrected Mean" of all the Highest, (Col. 5), = 66.9  
"Corrected Mean" of all the Lowest, (Col. 6), = 46.9  
Difference, or Mean Daily Range, = 20.0  
\*\* Calculated Mean Temperature of Month, = 56.9

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 13 th, = 82.0  
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 66.9  
Lowest at Night, Black Bulb, (corrected for Index errors), on the 26 th, = 41.5  
"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass, = 46.9  
Difference of above Means or Range ("exposed"), = 20.0

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 57.0  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 54.0  
†† Computed Temperature of Dew-Point, = 51.2  
†† Do. Elastic Force of Vapour, = 377  
†† Do. Weight of Vapour in a Cubic Foot of Air, = 3.77  
†† Relative Humidity, (Saturation = 100), = 81  
RAIN fell on 11 Days; Amount in Inches, = 1.88

WIND.	SUMMARY.									
	Direction.	N	NE	E	SE	S	SW	W	NW	Mean Velocity in miles per day.
A.M.										
P.M.										
Mean.		1	5	5	2	2	2	5	4	1.10

\* Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S." and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.  
† Edinburgh corrections for both capacity and Index Errors.  
†† The Diurnal Range for Scotland is as yet unknown.  
‡† These "Hygrometrical Deductions" are calculated from Gladstone's Hygrometrical Tables, Second Edition 1870.  
‡ While the Diurnal Range is unknown, the Arithmetic Mean of Cols. 9 and 11 will be entered as the "Calculated Mean Temperature."  
Any Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. See over.

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

Observations made and  
Return verified by

J. W. Paterson  
Pallat

(Signed)

J. W. Paterson

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 imposed 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 Reports from different observers; and it is found that differences between the returns 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 labours 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 signs of *upliftment or compression* 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 by, 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-marks* 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 *baric-line* on this little piston-rod is brought by the adjusting screw, to form one straight line with those on its ivory frame, the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *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 cistern. Then *sew up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upmost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a *slight tap* is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer (once 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 attending the mercury and reading of the Barometer.

**Evolution 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 floors of the Boxes are arranged so as at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and 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, *Self-registering Thermometers*—Professors Phillips, and Negretti and Zambra's Patent "Maximum" Thermometers are recommended: printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; when near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

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

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

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

One form of "Jackson's" Hygrometer is highly objectionable, also supports the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the frame would 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—31.0, 31.0, 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 4½°, and 40½°, more or less must be read. 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 read their exposures to their proper meteorological day. In the Society's schedules, the indications registered on the 24 are those of a series of phenomena commencing at 9 P.M. on the 24, and extending till 9 P.M. on the 25.

**Wind.**—A white-rose ought to be elevated 12 feet at least above surrounding objects. When it inclines necessarily, the 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.

**Atmospheres.** Many causes conspire to produce anomalies in rain returns. They arise, partly from unvaryable 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 gauges 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 column, under the following conditions:—**When a Snow shower occurs it must be noted in the "Remarks," and the letter S affixed to the depth of water received in gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as indicated in every column, the observer cannot be too careful to register observations only; and nothing that particles 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 (&c., 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 4, st., (*etc.*) will indicate that the higher regions are covered to the "amount" of 4 tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

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

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

**Ice.**—Mention whether Schumacher's or Mollat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3½", as an *ice* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale 0—6 is "4" i. e., that it is *floating* freely.

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

**Remarks.**—The "Remarks" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no notices 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 revelations of differences in direction, 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-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 Agriculturists. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm.

The Council recommend that *term day* observations be taken;—viz., on the 21st days of March, June, September, and December. Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the makers. The Council recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable that the Meteorologist have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

Eninburgh, 20th November 1869.

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

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

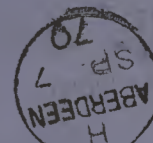
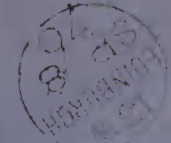
EDINBURGH.

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



MR ALEXANDER BUCHAN.

76



Ballater  
Aug 1870

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *Pallat*, County of *Aberdeen*, in Lat. *57° 12' N.*, Long. *2° 12' W.*, Distance from Sea *4.3* miles.Height of Cistern of the Barometer above Mean Sea-level *660* feet, above Ground *4* feet.During the MONTH of *September* 187*0*.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No. _____				WIND.				RAIN.				CLOUDS.				THERMOMETERS under Ground.				SEA.	OZONE.	GENERAL REMARKS.  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.		Temperature of Air, Soil, and Water, No. _____		0-10.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		Barometer.	Attached Thermometer.	Barometer.	Attached Thermometer.	Max. No.	Min. No.	Max. in Sun rays.	Min. on Grass.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	No. of hours in which it fell.	Amount in inches.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	No. _____ inches.	No. _____ inches.	No. _____ inches.	No. _____ feet.	No. _____ feet.	No. _____ feet.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
		inches.	"	inches.	"	No.	No.	No.	No.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"					"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† for Temp. (Col. 2), = *29.160*  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = *29.174*  
Mean at Station, corrected, and at 32°, = *29.167*  
Correction for height, feet above Mean Sea-level, = *70.3*  
Mean, reduced to 32°, and Sea-level, = *29.870*  
Highest Reading, corrected for Index error, on the 30 th, = *29.850*  
Lowest Do. Do. on the 9 th, = *28.200*  
Difference, or Monthly Range, = *1.650*

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 23 th, = *62.5*  
Lowest in Month, corrected for Index errors, on the 15 th, = *30.0*  
Difference, or Monthly Range, = *32.5*  
"Corrected Mean" of all the Highest, (Col. 5), = *61.6*  
"Corrected Mean" of all the Lowest, (Col. 6), = *41.9*  
Difference, or Mean Daily Range, = *19.7*  
\*\* Calculated Mean Temperature of Month, = *52.8*

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), = *51.5*  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = *48.7*  
†† Computed Temperature of Dew-Point, = *44.8*  
†† Do. Elastic Force of Vapour, = *310*  
†† Do. Weight of Vapour in a Cubic Foot of Air, =  
†† Relative Humidity, (Saturation = 100), = *81*  
RAIN fell on 9 Days; Amount in Inches, = *2.26*

WIND.
-------



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Ballalish, County of Aberdeen, in Lat. 57°42'N, Long. 2°42'W, Distance from Sea 1.3 miles.Height of Cistern of the Barometer above Mean Sea-level 660 feet, above Ground 11 feet.During the MONTH of October 1870.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				STUNSHINE. Hours.	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. Sun-rays.		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. No.	Min. No.	Max. in Sun-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 Direction.	Velocity (0-10), and Direction.	Amount (0-10), and Direction.		No. 1. inches.	No. 2. inches.	No. 3. inches.						
		* No.		No.		No.	No.	No.	No.																								
		inches.		inches.																													
	1	29.90050		29.90055		68.5	35			44.42	49.548	W	2		0					misty	0									Am. fresh breeze. clear frosty	1		
	2	29.85055		29.90060		70	29			40.38	44.839	W	0.5		0.5					0.2W	scat									" clear bright sunshiny sharp fall	2		
	3	29.85054		29.91460		66	28			42.40	46.536	W	1		0					2W	scat	0								" 5.4 fine. cold mist	3		
	4	29.85054		29.83858		63.5	28			41.38	40.539	W	0.5		W	2				2W	8-3W	scat								" chilly occ. sunshiny cold	4		
	5	29.75053		29.65054		49	29			39.38	46.545	E	2		W	2				misty 2W	10									" heavy & dull. very damp	5		
	6	29.42254		29.30054		49.5	39			45.543	45.544	W	0.5		0					10	2E	scat	5							" cold sharp air. mild calm	6		
	7	29.20053		29.20053		47.5	39			43.42	44.538	W	2		E	2				3	10	3E	10							" fresh breeze cold & very cold	7		
	8	28.75050		28.55050		46	32			35.38	35.334	W	0.5		2					15	2	5	3							" very cold & damp. clear frosty	8		
	9	28.45049		28.55049		47	33			38.38	38.536	W	2		1					30	3	10	2							" overcast. cold. thick. fair	9		
	10	28.75048		28.90050		46	34			39.37	41.538	W	2		0.5					30	2	10	2							" sharp wind, wet. quiet	10		
	11	28.95048		29.50057		51.5	33			45.342	40.39	W	0.5		W	1				0.5	2W	5-4	2W	5						" cloudy & quiet. frosty	11		
	12	28.80049		28.42050		47	35			42.41	44.43	E	2		3.5					72	2	10	5.5							" overcast. mild	12		
	13	28.70051		29.15051		48.5	40			47.545	44.539	E	3		0					10	4E	scat	5							" blowing hard occ. sharp cold	13		
	14	29.25048		29.25051		50	27			34.531	37.532	W	1		1					0	0	0								" clear frosty bright sunshine	14		
	15	29.10047		28.85050		51	26			40.539	47.448	W	0.5		W	2				50	2W	8-3W	scat							" 5.4 fine. fresh breeze	15		
	16	28.30050		28.10051		55.2	44.5			30	47.547	45	W	0.5		W	3			12	2	10	4							" heavy rain during night. cold	16		
	17	28.25051		28.65050		48.5	38.5			47.548	47.485	W	2		2					3	W	8-3	5							" chilly. clear & cold	17		
	18	28.95048		28.76850		48	32			44.418	46.546	W	1		W	0.5				112	2	5-4	2W	10							" cold wind. raining	18	
	19	28.40050		28.29257		51.5	41			49.547	45.42	W	1		3					37	4	5	0								" heavy rain sunshiny occ. sharp	19	
	20	28.35051		28.90051		48.5	37			44.44	48.546	W	0.5		W	2				22	2	10	3								" overcast. cold in cloudy	20	
	21	29.10051		29.00052		53	34.5			41.540	44.23	W	0.5		W	0.5				0.5	5	scat	W	10							" clear frosty fine & calm	21	
	22	28.85052		28.56853		56.5	37			52.567	39.38	W	0.5		1					61	2	W	5-4	2							" mild & quiet. clear & cold	22	
	23	27.95052		27.77054		63	37.5			47.546	46.547	E	2		3.5					24	3	6	10								" overcast. cold. thick	23	
	24	27.85051		28.10054		49.5	43.5			47.458	48.47	W	0		W	2				5	scat	3W	8								" cloudy & damp. fresh breeze	24	
	25	28.35053		28.55052		49.5	32			44.548	43.537	W	3		0					4	W	5	0								" very cold. wind. clear frosty	25	
	26	28.47050		28.53050		47.5	35			44.543	38.37	W	2		0					3	W	5	0								" cloudy chilly	26	
	27	28.35048		28.75049		49	34.5			38.368	44.543	W	0.5		W	0.5				2	5	2W	10								" clear cold. gloomy & rain	27	
	28	28.90048		29.15050		50	29.5			43.542	38.37	W	1		0					0.4	2	scat	0								" dull & very cold. clear frosty	28	
	29	29.00048		28.93050		48	32			41.398	43.541	W	2		W	2				3	W	10	2W	10							" cloudy & damp. chilly & thick	29	
	30	28.85048		28.65050		48	31			42.41	38.37	W	3		2					4	W	5	3								" very cold wind. cloudy & wet	30	
	31	28.51649		28.50051		47	36.5			43.543	45.545	W	2		3.5					0	0	0									" clear cold. raining	31	
	Sums.	595.338	134	596.220	1670	1602.5	063			970	135	164	130		360				4.75														
	Means.	26.558	50.5	28.875	52.2	51.7	34.3			43.2	41.4	42.6	41.1		136				1.46														
	+ 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++ = 28.831  
for Temp. (Col. 2), = 28.808 - 0.027  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction++ = 28.816  
for Temp. (Col. 4), = 28.878 - 0.062  
Mean at Station, corrected, and at 32°, = 28.824  
Correction for height, feet above Mean Sea-level, = 7.15  
Mean, reduced to 32°, and Sea-level, = 28.539  
Highest Reading, corrected for Index error, on the 3 th, = 29.914  
Lowest Do. Do. on the 16 th, = 27.770  
Difference, or Monthly Range, = 2.144

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 2 th, = 70.0  
Lowest in Month, corrected for Index errors, on the 15 th, = 26.0  
Difference, or Monthly Range, = 44.0  
"Corrected Mean" of all the Highest, (Col. 5), = 51.7  
"Corrected Mean" of all the Lowest, (Col. 6), = 34.3  
Difference, or Mean Daily Range, = 17.4  
\* Calculated Mean Temperature of Month, = 43.0

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 43.1  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 41.2  
Computed Temperature of Dew-Point, = 38.9  
Do. Elastic Force of Vapour, = 2.37  
Do. Weight of Vapour in a Cubic Foot of Air, =  
Relative Humidity, (Saturation = 100), = 85  
RAIN fell on 15 Days; Amount in Inches, = 4.75

WIND.		SUMMARY.									
Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.		1	7	1			16	3	3	1.36	
P.M.		1	4	2		1	8	7	8	1.16	
Mean.	0	1	5	2	0	1	12	5	5	1.26	

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

James Paterson  
Ballalish

(Signed)

James Paterson

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 Returns 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 active comparableness among the several Returns, without which the Society's Reports must inevitably fall in achieving one of the main objects of Meteorological Observation.

*Hour of Observation.*—The Council recommend that Observations be made, precisely at 9 o'clock (Greenwich or Railway Time only) twice a-day for some, and once (morning or evening) for other instruments, as specified in the following remarks, or at the top of the schedule. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading at what time it was taken, if not at 9 o'clock.

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

Two modern-optical 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-ticks* are not true inches but so much shorter as to *compensate* the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; their coincidence being indicated by a little ivory hair, whose stem passes freely through the lid and case of the cistern. When the *index-line* on this little piston-rod is brought, by the adjusting screw, to *join 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 *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 rejected.

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

In taking an *Observation*, the attached Thermometer is first noted: the tube must then be gently tapped and the *observed* 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 multiplicity of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians, Messrs. *Reid and Zambra's Patent "Mercurium"* Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "*Mercurium*" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the *Measuring*. This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *column* of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be 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 melted, by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides present the bulbs from the wind. The "*Mercurium*" 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 "*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 or melting ice. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Society.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "*Hygrometric*" Deductions, Observers are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the 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 water-cup indelibly. This arrangement must also impurities the water-cup indelibly. 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 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—89.5, 40.0, or 40.1; or 40.4, 40.3, or 40.0; or 40.7, or 40.8 respectively. In reading Rutherford's "*Mercurium*" and "*Mercurium*" Thermometers, the index, an exact coincidence with, or a little over 40, or 40.5, respectively. So also 41.5, and 40.5, more or less must be registered 40.2 or 40.3, and 40.7 or 40.8 respectively. In reading Rutherford's "*Mercurium*" and "*Mercurium*" Thermometers, the index, an exact coincidence with, or a little over 40, or 40.5, respectively. So also 41.5, and 40.5, more or less must be registered 40.2 or 40.3, and 40.7 or 40.8 respectively.

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

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

Cloud 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.

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

*Snowfalls* may, for convenience, be registered in the rain columns, under the following conditions:—When a snow shower occurs it must be noted in the "*Remarks*," and the latter S annexed 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 Late 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 greatest 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." "*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  $\frac{2}{4}$ , (*eg.*) 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.

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

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

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

*Zeon.*—Mention whether Schumann's or Meffert'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  $\frac{3}{4}$ , as an *zeon* entry in the schedule, will indicate that the ozone paper is tinted as " $\frac{3}{4}$ " on the scale, that the wind is from the N.W., and that its force is on the scale 0—6 is " $\frac{4}{4}$ " 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 Electro-meter is necessary to every complete meteorological observatory.

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

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purpose, from that headed "*Remarks*." It is intended that observations by the Electro-meter 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 *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 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, 20th November 1870. (By Order) A. B.

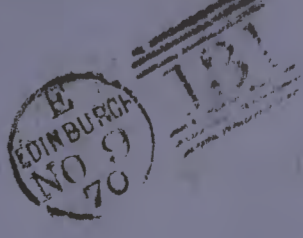
Fuller  
Feb 1870

76

BOOK-POST.

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

MR ALEXANDER BUCHAN



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, . . . . .		
Mezeron, . . . . .		Strawberry, . . . . .			Rail or Corn Crake, . . . . .		
Mountain Ash or Rowan, . . . . .							
Red Flowering Currant, . . . . .							
Rhododendron Ponticum, . . . . .							
Whin, . . . . .							

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

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Pallatow, County of Albion, in Lat 57° 12' N, Long 2° 12' W, Distance from Sea 43 miles.  
Height of Cistern of the Barometer above Mean Sea-level 660 feet, above Ground 40 feet.

During the MONTH of November 1870.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.		OZONE.		GENERAL REMARKS.		Days of Month.			
		9 h. A.M.		9 h. P.M.		Protected in Shade, if not 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.C. Anemometer. No.	No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.		STUNSHINE. Hours.	9 h. A.M.			Temperature of Wet Bulb, at 1 inch and Depth.	Temperature of Surface and Dew-Point.	9 A.M. 9 P.M.	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.				
		Barometer, * No.	Atmospheric Thermometer No.	Barometer, No.	Atmospheric Thermometer No.	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass, No.	Dry bulb, No.	Wet bulb, No.	Dry bulb, No.	Wet bulb, No.	Direction.	Force.	Direction.	Force.				9 h. A.M.	9 A.M. Velocity (0-10), and Direction.	Amount (0-10), and Species.	9 A.M. Velocity (0-10), and Direction.		Amount (0-10), and Species.	No. 8 inches.	No. 12 inches.						No. 22 inches.		
		inches.	°	inches.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°		
	1	29.700	49	29.724	51	52	38.5			41.5	40	38.5	38	W	0.5	W	2			2	W	5	cast	3	W	5	cast							A.M. bitterly cold. M. clear & cool.	1	
	2	29.600	50	29.570	52	51	35			47.5	46	49	48.5	u	1	u	0.5			2	u	5	cast	2	u	5	cast							" clear & fine. cont. " " " " " " " "	2	
	3	29.650	51	29.750	52	50.5	41			42	41.5	43	42.5	0	u	0.5				5	cast	2	u	5	u								" clear & cold, fine, cold wind.	3		
	4	29.780	51	29.750	50	50.5	42			42	41	41.5	41	W	2	0				3	W	10	cast	5	u								" cloudy & dull. quit.	4		
	5	29.800	47.5	29.600	49	49.5	33			33.5	33	48	41.5	u	0.5	W	0.5							5	u								" clear & frosty. cont. " " " " " " " "	5		
	6	29.418	50	29.350	50	47.5	35			44.5	41.5	38	37.5	u	2	0				2	W	10	cast											" cloudy & off & rain. clear & frosty.	6	
	7	29.300	47.5	29.200	48	43	30			38.5	33	34.5	33.0	u	1	0				2	u	5	cast											" very cold. fine. do.	7	
	8	29.350	46	29.333	46	41.5	28			37.5	36.5	31	39	SE	0.5	0				2	SE	10	cast	10	cast									" very cold. fine. do.	8	
	9	29.200	45	29.100	45	37.5	24.5			36.5	35.5	34	33.5	E	2	SW	3			1	SE	10	cast											" snowing very frosty. blow. heavy.	9	
	10	28.950	44	29.050	49	37.5	28			34.3	33.5	33.5	33	u	3	SE	4			6	4	10	u	SE	10	cast	10	PM	thunder	lightning			" very cold. sun. dripping with hail.	10		
	11	29.000	44	28.800	43.5	36	31.5			36	34	35	32	SW	2	SE	3			4	3	W	10	cast	8	W	10	u							" snowing. do.	11
	12	28.650	42	28.600	45	40.5	25			30	29	40	38	u	0.5	W	2			0	8	2	W	10	cast	4	SE	u						" cloudy & quit. - thawing.	12	
	13	28.500	44	28.300	44.5	41	29			38	36	31	30	u	1	0				2	u	10	u											" do & cold. clear & frosty.	13	
	14	28.300	43.5	28.350	43	35	25.5			33	32	29.5	29	SE	2	0				0	3	SE	10	u	5	cast									" over. & stormy. cont. " " " " " " " "	14
	15	28.250	43.5	28.450	45	38.5	28			38	36.5	37	35.5	u	2	SW	0.5			2	3	u	5	u	2	SE	10	u							" fresh breeze. cold. raining.	15
	16	28.450	43	28.500	45	39	25			37	35	38	36	W	0.5	W	0.5			0	5	2	W	5	u	2	W	10	cast						" cloudy & off & rain. quit & heavy.	16
	17	28.650	43	28.750	45	40	35			38	36	38	37	u	2	u	2			2	3	u	10	u	2	u	10	u							" gloomy. " cloudy with.	17
	18	28.800	44	28.550	43	39	24.5			37.5	35.5	29.5	29	u	0.5	0				0	5	2	W	u										" do. clear & frosty.	18	
	19	28.350	43.5	28.450	45	38	28.5			37	35.5	38	36.5	u	0.5	W	0.5			1	SE	2	W	8	cast										" cloudy with. cont. " " " " " " " "	19
	20	28.400	43	28.450	45	41.5	31			32.5	32	42	40	SW	2	3				3	SE	10	u	10	u										" very cold. wind. lishowers.	20
	21	28.412	45	28.300	46	44	35			41.5	40	41	41.5	SE	0.5	3	2			100	2	SE	10	u	10	u									" cloudy & off & rain. heavy rain.	21
	22	28.350	43.5	28.300	44	42.5	28.5			32	31	31.5	30	0	W	0.5																			" very frosty. cont. & " " " " " " " "	22
	23	28.250	42	28.450	42	38.5	24.5			26.5	26	33.5	33	0	0	0																			" snow on ground. frosty.	23
	24	28.400	42	28.300	43.5	41.5	26.5			32	31.5	43.5	23	W	0.5	W	2			2	W	5	cast	3	W	10	cast								" clear & frosty. -	24
	25	28.250	45.5	28.550	45	46.5	40			44.5	41.5	42	38	u	0.5	u	4			2	u	10	u	5	u									" mild & quit. - blowing & light.	25	
	26	29.000	44	29.250	45	46.5	28			34.5	33.5	20.5	20	0	0	0																			" do. clear & frosty.	26
	27	29.450	42	29.500	41	33	22					29.5	29	W	2	0				3	W	5	cast												" very cold. frosty. do.	27
	28	29.550	41	29.550	42.5	36.5	23			33.5	32.5	34	33.5	u	0.5	W	2			2	u	5	cast	3	W	10	cast								" do. cloudy. cold.	28
	29	29.650	42	29.650	43	36.5	28.5			33.5	33	32	32	0	u	0.5				0	2	u	10	u											" clear & frosty. very cold.	29
	30	29.750	43	29.800	42	39.5	30			35	34.5	35	34	SW	0.5	u	2			6	SE	10	cast	3	u	10	u								" dull & cold. soft.	30
	31																																			
Sums		866	140	140	140	122	140			137	106	136	135		5	31				294																NOTATION USED IN GENERAL REMARKS.
Means		28.470	44.5	28.479	44.5	41.7	30.2			36.6	33.4	36.6	35.8		0.98	1.08																			a. denotes aurora.	
Total Corrections for Instrumental Errors.										+2	+2																								ci. " cirrus.	
Total Corrections for Diurnal Range.																																				ci-cu " cirro-cumulus.
Corrected Means.										36.8	36.8																								ci-s. " cirro-stratus.	
No. of Columns.		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			cu. " cumulus.		
																																				cu-s. " cumulo-stratus.
																																				d. " dew.
																																				f. " fog.
																																				h-fr. " hoar-frost.
																																				h. " haze.
																																				h-d. " heavy dew.
																																				h-l. " hail.
																																				li. cl. " lightning.
																																				li. sh. " light showers.
																																				lu. co. " lunar corona.
																																				lu. ha. " lunar halo.
																			</																	

## NOTATION USED IN GENERAL REMARKS.

a.	denotes aurora.	m.	denotes meteor.
ci.	cirrus.	ms.	meteors.
ci-cu.	cirro-cumulus.	n.	nimbus.
ci-s.	cirro-stratus.	r.	rain.
cu.	cumulus.	h. r.	heavy rain.
cu-s.	cumulo-stratus.	c. h. r.	continued heavy rain.
d.	dew.	s.	stratus.
f.	fog.	sc.	scud.
fr.	frost.	sl.	sleet.
h-fr.	hoar-frost.	sn.	snow.
h.	haze.	so. h.	solar halo.
h-d.	heavy dew.	sq.	squall.
h-l.	halo.	sqa.	squalls.
l.	lightning.	t.	thunder.
h. cl.	light clouds.	t. s.	thunder storm.
h. ch.	light showers.	w.	wind.
lu. co.	lunar corona.	g.	gale of wind.
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), = 28.928

"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = 28.935

Mean at Station, corrected, and at 32°, = 28.932

Correction for height, feet above Mean Sea-level, = 72.5

Mean, reduced to 32°, and Sea-level, = 29.657

Highest Reading, corrected for Index error, on the 5<sup>th</sup>, = 29.800

Lowest Do. Do., on the 15<sup>th</sup>, = 28.250

Difference, or Monthly Range, = 1.550

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the / th, = 52.0

Lowest in Month, corrected for Index errors, on the 27<sup>th</sup>, = 22.0

Difference, or Monthly Range, = 30.0

"Corrected Mean" of all the Highest, (Col. 5), = 41.7

"Corrected Mean" of all the Lowest, (Col. 6), = 30.2

Difference, or Mean Daily Range, = 11.5

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

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 36.8

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 35.6

†† Computed Temperature of Dew-Point, = 34.2

†† Do. Elastic Force of Vapour, = 1.96

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

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

RAIN fell on / 0 Days; Amount in Inches, = 2.94

WIND.		SUMMARY.									
Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day
A.M.	2	2	2	1	1	2	13	1	8	0.98	
P.M.		1		1	1	1	18	1	10	1.03	
Mean.	1	2	1	1	1	8	14	1	8	1.00	

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 Stations. Returns from any two Stations, so very considerably 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 *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 *calibration* 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. Altie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-tubules* 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 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 *baro-blue* on this little piston-rod is brought, by the adjusting screw, to *four one-fourth 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 *remains*.

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. It may then be carried with the necessary 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 upperside. Before suspending the Barometer for use, it must be ascertained whether the spare 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 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 venetian, 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 Thermometer.**—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 north 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 "*Maximum*" Thermometers are recommended: printed directions for their use may be obtained with each instrument. The "*Minimum*" Thermometer of Ruthenford 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 a skilful hand. When the *column* of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the hung horizontally. 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, *microscope* repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used, without being *re-tested*. The self-registering, and especially the "*Maximum*" Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer (marked by a scratch on the tube) ought to be tested once a year, in snow or melting ice. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

**The Hygrometer** consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "*Hygrometrical Deductions*," Observers are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the muffle 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 muffle 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 the Hygrometer is highly objectionable, also supports the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the forementioned requirements shall be complied with, as far as possible.

**Reading of the Thermometer.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—38°·9, 40°·0, or 40°·1; or, under, 40°·4, 40°·3, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 41°·1, and 40½°, more or less must be read. Ruthenford'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 scrupulously 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 24 are those of a series of phenomena commencing at 9 P.M. on the 24, and extending till 9 P.M. on the 25.

**Wind.**—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates 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 observations, etc.

Careful observations ought to be made on the changes in the direction of the wind; and during storms, it is especially 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 values as that given in the schedule is, to say the least, unsatisfactory.

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

**Snowfalls may, for convenience,** be registered in the rain columns, under the following conditions:—when a snow shower occurs it must be noted in the "*Remarks*," and the 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 *deductions only*; and nothing that partakes of the nature of observation or inference.

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

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "*Velocity*" 6, S. W., 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, east, (*eq*) will indicate that the higher regions are covered to the "*amount*" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

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

**Temperature of the Sea.**—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water on the 20th, 15th, and 20th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, 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. **Uzone.**—Mention whether Schœnbein'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>sw</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 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 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 at Southampton, are given at the foot of the column. Besides special and extraordinary observations, great differences ought to be given in this column to prevalent diseases, differences in climate, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been limited at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purpose, from that headed "*Remarks*." It is intended that observations by the Electrometer should be entered in this manner 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 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 *seven day observations* be taken;—on the 21st, 28th, 5th, 12th, 19th, 26th, 3rd, 10th, 17th, 24th, and 31st.

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

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

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

General Post Office Buildings,  
Secretary of the Meteorological Society of Scotland,  
MR ALEXANDER BUCHAN,



Height of Cistern of the Barometer above Mean Sea-level 65.6 feet, above Ground 4 feet.

During the MONTH of January 1870

The Hours of Observation are of Greenwich Time.

<b>BAROMETER,</b> "corrected Mean" at 9 A.M., <i>minus</i> the Correction <sup>++</sup>	=	29.122
for Temp. (Col. 2), = 29.146... - 0.245		
 "Corrected Mean" of Barometer at 9 P.M., <i>minus</i> the Correction <sup>++</sup>	=	29.135
for Temp. (Col. 4), = 29.161... - 0.265		
 <b>Mean at Station, corrected, and at 32°,</b> .....	=	29.128
 Correction for height,                      feet above Mean Sea-level,.....	=	738
 <b>Mean, reduced to 32°, and Sea-level,</b> .....	=	29.866
 Highest Reading, corrected for Index error, on the / th,.....	=	29.900
 Lowest      Do.                      Do,                      on the 14 th,.....	=	28.000
 Difference, or <b>Monthly Range,</b> .....	=	1.900

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 Officer may be here given.

Emphasizing correctness for both clarity and Error Errors.

The Diurnal Range for Scotland is as yet unknown.

Practically, though not absolutely a minus correction.

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

While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 4, 5, and 6 will be entered as the "Calculated Mean Temperature."

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

Observations made and  
Return verified by

04

