

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. It is well known that the results of different observations; and it is found that differences between the Returns from any two Stations, so very considerable as to render them quite incommensurate, 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.—*Wet-thermometers and Aneroids*, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. No rain-gauge Barometer be used for Meteorological Observations that can be applied with such means of adjustment or compensation as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary, that every Barometer shall have been compared with a *Standard*.

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

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the cistern are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the zero-point of the fixed scale; when passes freely through the lid and case of the cistern. When the *water-line* on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the 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 secured so as to form a tight plug to the cistern. Then screw up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a sharp tap is produced. If this is prevented by air it may be removed to the cistern, and got rid of by inverting the Barometer, (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired.

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

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

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

Self-registering Thermometers.—Professor Phillips's, and Negretti and Zambra's Patent "Maximum" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended. When graduated on the glass stem and affixed to a frame separate from the "Maximum," this Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit decile by high temperature, it will be found in the upper loop, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

The above remarks apply equally to the Thermometers for registering the greatest heat from the Sun's rays and the least from radiation during night. Their bulbs have a black coating, which may easily be made, or printed, by the application of a mixture of lamp black and madder's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "Maximum" should be fixed 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; but the Sun's heat, to affect the alcohol by distillation.

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers are specially requested to attend to the following conditions:—The bulbs must hang down, by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended;—the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulb;—the 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 on the wet cloth in ordinary circumstances.

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

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—38°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·3, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°; or 40°·1, 40°·2, or 40°·3, more or less, must be registered. So also 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "Max." and "Min." Thermometers, the indication of that end of the scale 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 days. In the Society's schedules, the indications registered on the 3rd are those of a series of phenomena commencing at 9 P.M. on the 2nd, and extending till 9 P.M. on the 3rd.

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

Careful observations ought to be made on the changes in the direction of the wind; and during storms, extra observations ought to be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at important Stations, would be likely to give highly interesting and important results. The Council would strongly recommend that every Observatory be furnished with a Hemispherical-Cup Anemometer—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind, at any particular hour of observation, Lind's Anemometer is also recommended: the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

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

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions.—When a snow shower occurs it must be noted in the "Remarks," and the letter S affixed to the depth of water received in gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as 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, rather than the other.

clature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *cloud* column, though their appearance and changes ought to be noted among the "Remarks." The amount of cloud is noted from a scale of 0 to 10; thus, when the sky overhead is half-covered by clouds, 5 is entered as the *observed*, 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," 6, S.W. (for example), will indicate that the upper strata of clouds travel with *average* 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, *cast*, (e.g.) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

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

Temperature of the Sea.—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council, therefore, recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by the tide or 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 Schönbien's or Moffat's papers are used—Moffat's are preferred. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—Thus 3½, as an *cone* entry in the schedule, will indicate that the ozone paper is tinted as 3½ on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4," i.e., that it is *blowing* fresh.

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

Remarks.—The "Remarks" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, difference 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 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 6 A.M. and 9 P.M. ought to be registered, either in two columns otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner, or on the side margin. Additional remarks may be made on the margin.

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

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

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

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

(By Order) A. B.

Edinburgh, 17th July 1861.

BOOK-POST.

EDINBURGH.

10, St Andrew Square,

Secretary of the Meteorological Society of Scotland

Mr ALEXANDER BUCHAN,

76

4 De la Harpe
January 1863

FOREST TREES.		FRUIT TREES.		MICRATORY BIRDS.	
First in	In	First in	In	First in	In
Alder,	Leaf buds	Apple,	Blossom.	Cuckoo,	First in
Aspen,	Leaf buds	Black Currant,	Blossom.	Curlew,	First in
Beech,	Leaf buds	Cherry,	Blossom.	House-Sparrow,	First in
Birch,	Leaf buds	Gooseberry,	Blossom.	Lapwing,	First in
Elm,	Leaf buds	Hawthorn,	Blossom.	Starling,	First in
Larch,	Leaf buds	Hazel,	Blossom.	Sand-Martin,	First in
Oak,	Leaf buds	Black Currant,	Blossom.	Swallow,	First in
Sycamore or Plane,	Leaf buds	Black Currant,	Blossom.	Swallow,	First in

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, etc., whether plentiful or in perfection; and the Agricultural condition of the district generally.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens, County of Midlothian, in Lat. 55° 55' N, Long. 3° 15' W, Distance from Sea 5 miles.

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

The Hours of Observation are of Greenwich Time.

During the MONTH of February, 1865.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				SUNSHINE. Hours.	THERMOMETERS. under Ground.			SEA. Temperature and Direction.	OZONE. 0-10. 9 A.M. 9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. Mention the hour at which Storms began and ended.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
		9 h. A.M.		6 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		6 h. P.M.		9 h. A.M.		6 h. P.M.		Readings of the H-Cup Anemometer.		No. of hours in which it fell.	Amount in inches.	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.	No.	9 h. A.M.			9 h. P.M.	Velocity, (0-10), and Direction.		Amount, (0-10), and Species.	Amount, (0-10), and Species.	No.					3 inches.	No. 12 inches.	No. 24 inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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BAROMETER, "corrected Mean" at 9 A.M., minus the Correction ++ for Temp. (Col. 2), = 29.890
"Corrected Mean" of Barometer at 9 P.M., minus the Correction ++ for Temp. (Col. 4), = 29.890
Mean at Station, corrected, and at 32°, = 29.890
Correction for Height, feet, above Mean Sea-level, = 209
Mean, reduced to 32°, and Sea-level, = 30.099
Highest Reading, corrected for Index error, on the 13th, = 30.420
Lowest Do., Do., on the 1th, = 29.140
Difference, or Monthly Range, = 1.280

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 6th, = 53.0
Lowest in Month, corrected for Index errors, on the 15th, = 20.0
Difference, or Monthly Range, = 33.0
"Corrected Mean" of all the Highest, (Col. 5), = 47.6
"Corrected Mean" of all the Lowest, (Col. 6), = 33.5
Difference, or Mean Daily Range, = 14.1
** Calculated Mean Temperature of Month, = 40.6

S.-R. THERMOMETER, Black Bulb, in Sun, Highest, (corrected for Index Errors), on the 1th, = 53.0
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 47.6
Lowest at Night, Black Bulb, (corrected for Index errors), on the 1th, = 20.0
"Corrected Mean," (Col. 8), of Black Bulb Min. on grass, = 33.5
Difference of above Means or Range ("exposed"), = 14.1

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = 40.6
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 38.7
Computed Temperature of Dew-point, = 36.3
Do. Elastic Force of Vapour, = 2.14
Do. Weight of Vapour in a Cubic Foot of Air, = 8.5
Relative Humidity, (Saturation = 100), = 85

WIND.		SUMMARY.									
Direction.	Force.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.		2	1	0	1	6	13	4	1	0	
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.
† Engraving corrections for both capillary and Index Errors.
‡ The Diurnal Range for Scotland is as yet unknown.
§ Practically, though not absolutely, a mist correction.
|| These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition only.
** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature." Any Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column must be marked as such by the Observer, in each Schedule. See Over.

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and Return verified by

(Signed) Killean Horns

ONE of the objects of immediate importance, that the Scotch 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.

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

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

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

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

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

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes that has not been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are as 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 be *hung down*, by at least an inch free from the scales and frame to which they are attached;—the frame must be such as shall 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 must 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 made 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 a Mason's Hygrometer is highly objectionable. The frame of the Thermometer is enclosed in a tin case, which also supports the water cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the forementioned requirements shall be complied with, as far as possible.

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—38°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·3, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40°·5, respectively. So also 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "Max." and "Min." Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

How of Observing Temperature.—The Hygrometer is read at 9 A.M. and 9 P.M. The self-registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of difference when the self-registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3rd are those of a series of phenomena occurring on the 2nd, and on the 2nd, and extending till 5 P.M. on the 3rd.

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

Careful observations ought to be made on the changes in the direction of the wind; and during storms, extra observations ought to be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results. The Council would strongly recommend that every Observatory be furnished with a Hemispherical-Cup Anemometer, a self-registering instrument which shows the amount of Wind that passes it per day; from which also the Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind, at any particular hour of observation, the Linds 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 observations, 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 date 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 Luke Howard's nomenclature.

clature 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 *near the horizon* (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," 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 $\frac{2}{4}$, S.E., (*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 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 15th, 23rd, and 29th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, noting always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

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

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

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

Remarks.—The "Remarks" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, are given at the foot of the column, which and Southempton, 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 boreales, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been 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 attention to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year, on a selected piece of ground or farm.

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

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

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

(By Order.) A. B.

Printed and Sold by Luke Howard's Son.

BOOK-POST.

EDINBURGH.

10, St Andrew Square,

Secretary of the Meteorological Society of Scotland,

Mr ALEXANDER BUCHAN,

FOREST TREES.		SHRUBS, ETC.		FRUIT.		NEGATORY BIRDS.	
In flower.	In leaf.	In flower.	In leaf.	First in blossom.	First in blossom.	First in blossom.	First in blossom.
Alder.		Apple.		Cuckoo.			
Aspen.		Black Currant.		House-Swallow.			
Beech.		Cherry.		Lapwing.			
Birch.		Gooseberry.		Plover.			
Elm.		Holly.		Sand Martin.			
Larch.		Laburnum.		Starling.			
Maple.		Mountain Ash or Rowan.		Swan.			
Oak.		Myrtle.		Willow.			
Sycamore or Plane.		Rhododendron Ponticum.		Other Birds, naming them.			

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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.



Delivered February 1863

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *Dalkeith Gardens*, County of *Midlothian*, in Lat. _____, Long. _____, Distance from Sea *3* miles.Height of Cistern of the Barometer above Mean Sea-level *190* feet, above Ground *4* feet.

The Hours of Observation are of Greenwich Time.

During the MONTH of *March* 186*3*.

ELECTRICITY.	Days of Month.	BAROMETER.		SELF-REGISTERING THERMOMETERS.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				THERMOMETERS.			SEA.	OZONE.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevailing Diseases, etc. Mention the hour at which Storms began and ended.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		9 h. A.M.		6 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		6 h. P.M.		9 h. A.M.		6 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.	Min.	Max. in Sun's 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 (0-6), and Direction.	Amount (0-10), and Species.	Velocity (0-6), and Direction.	Amount (0-10), and Species.	No.					No.	No.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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BAROMETER, "corrected Mean" at 9 A.M., minus the Correction for Temp. (Col. 2), = *29.617*
"Corrected Mean" of Barometer at 9 P.M., minus the Correction for Temp. (Col. 4), = *29.617*
Mean at Station, corrected, and at 32°, = *29.617*
Correction for Height, feet, above Mean Sea-level, = *209*
Mean, reduced to 32°, and Sea-level, = *29.826*
Highest Reading, corrected for Index error, on the 25th, = *30.240*
Lowest Do., Do., on the 6th, = *29.020*
Difference, or Monthly Range, = *1.190*

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 3th, = *62.5*
Lowest in Month, corrected for Index errors, on the 12th, = *22.0*
Difference, or Monthly Range, = *40.5*
"Corrected Mean" of all the Highest, (Col. 5), = *51.2*
"Corrected Mean" of all the Lowest, (Col. 6), = *36.1*
Difference, or Mean Daily Range, = *15.1*
** Calculated Mean Temperature of Month, = *43.6*

S.-R. THERMOMETER, Black Bulb, in Sun, Highest, (corrected for Index Errors), on the 3th, = *62.5*
"Corrected Mean," (Col. 7), of Black Bulb. Max. in Sun, = *51.2*
Lowest at Night, Black Bulb, (corrected for Index errors), on the 12th, = *22.0*
"Corrected Mean," (Col. 8), of Black Bulb Min. on grass, = *36.1*
Difference of above Means or Range ("exposed"), = *15.1*

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = *43.6*Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = *41.3*II Computed Temperature of Dew-point, = *38.6*II Do. Elastic Force of Vapour, = *23.4*II Do. Weight of Vapour in a Cubic Foot of Air, = *82*II Relative Humidity, (Saturation = 100), = *82*RAIN fell on Days; Amount in Inches, = *0.40*

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

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and
Return verified by

(Signed)

Mr. Thomson

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS.

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

In taking an observation, the attached Thermometer is first noted: the tube is then gently tapped and the cistern adjusted 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.

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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 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 the Thermometers; nor the Sun's heat to affect the alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes that has not been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers 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 *walsted* 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 bulb;—the main 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 by the observer that the main is always *clean* and *moist*, and that the water press. In frosty weather observation is made 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. The 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—35.9, 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 40.8, respectively. So also 40.3, and 40.7 or 40.8 respectively. In reading Rutherford's "*Max*," and "*Min*," Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

Careful observations ought to be made on the changes in the direction of the wind; and during storms, extra observations ought to be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results. The Council would strongly recommend that every Observatory be furnished with a Hemispherical Cup Anemometer, a self-registering instrument which shows the amount of Wind that passes it per day; from which also the Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind, at any particular hour of observation, Lind's Anemometer is also recommended: the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

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

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a snow-shower occurs it must be noted in the "*Remarks*," and the letter S affixed to the depth of water received in gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as 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.

ature 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 *overall* (i.e., within 20° or 30° of the zenith). The strata of clouds that appear at 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 *overall* 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," 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 2 *cast*, (i.e., 4.0) 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 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, 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, noting always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

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

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

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

Remarks.—The "*Remarks*" column is too narrow, but unavoidable. Some of the most valuable observations that can be taken are those for which no rules can be given nor hours assigned. The observations 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 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 purposes, from that headed "*Remarks*." It is intended that observations by the Electrometer should be entered in this manner, or on the side-margin. Additional remarks may be made on the margin.

"*Observations* in connection with the periodic return of the seasons" possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published 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 *long-day* observations be taken;—viz., on the 21st days of March, June, September, and December. For these hourly observations separate schedules will be furnished to observers.

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

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

(By Order.) A. B.

Edinburgh, 17th July 1861.

FOREST TREES.				CROPS.				MIGRATORY BIRDS.			
In flower.	First buds first appear.	In leaf.	Diseste of	Sowing or planting mentioning variety.	Planting or above ground.	In ear or flower.	First Out	First Arrival.	Departure.		
Alder.				Barley.				Cuckoo.			
Beech.				Oats.				Curlew.			
Birch.				Wheat.				House-Swallow.			
Elm.				Beans.				Lapwing.			
Larch.				Pease.				Plover.			
Lime.				Potatoes.				Sand Martin.			
Oak.				Turnips.				Starling.			
Sycamore or Plane.				Rye Grass.				Swan.			

SHRUBS, ETC.				FRUITS.				MIGRATORY BIRDS.			
First in blossom.	First in blossom.	First in blossom.	First in blossom.	First in blossom.	First in blossom.	First in blossom.	First in blossom.	First Arrival.	Departure.		
Barberry.				Apple.				Cuckoo.			
Bouree or Eldar.				Black Currant.				Curlew.			
Broom.				Cherry.				House-Swallow.			
Hawthorn.				Gum.				Lapwing.			
Holly.				Gooseberry.				Plover.			
Laburnum.				Peach.				Sand Martin.			
Lilac.				Pear.				Starling.			
Mountain Ash or Rowan.				Strawberry.				Swan.			
Red Flowering Currant.								Other Birds, naming them.			
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., 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.

Mr ALEXANDER BUCHAN.

Secretary of the Meteorological Society of Scotland.

10, St Andrew Square.

EDINBURGH.

BOOK-POST.

Edinburgh
March 1863

149

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

During the MONTH of April 1863

The Hours of Observation are of Greenwich Time.

BAROMETER,	"corrected Mean" at 9 A.M., <i>minus</i> the Correction ++	=	
	for Temp. (Col. 2), = <i>29.782</i> - <i>0.12</i>	=	<i>29.730</i>
"Corrected Mean" of Barometer at 9 P.M.,	<i>minus</i> the Correction ++	=	
for Temp. (Col. 4), =		=	
Mean at Station, corrected, and at 32°,		=	<i>29.730</i>
Correction for Height,	feet, above Mean Sea-level, =	=	<i>209</i>
Mean, reduced to 32°, and Sea-level,		=	<i>29.939</i>
Highest Reading, corrected for Index error, on the	<i>18</i> th, =	=	<i>30.100</i>
Lowest Do., Do., on the	<i>7</i> th, =	=	<i>29.110</i>
Difference, or Monthly Range,		=	<i>0.990</i>

Each instrument tested at the Office in Edinburgh bears the stamp "S.M.S.," and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.

+ Embracing corrections for both capillarity and Index Errors.

* The Diurnal Range for Scotland is, as yet unknown.

+ Practically, though not absolutely, a minus correction.

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

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

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

N.B.—The Sums to be correctly added, and the Means deducted. Returns from the “Principal Towns” should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and
Return verified by

(Signed)

[illegible]

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 these 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 sun, and once, (morning or evening), for other instruments as specified in the following remarks, on the top of the schedule. It is hoped that the utmost exactness in the time of reading the instruments will be observed. Observers, in some few cases may find this possible; in such instances they are specially requested to mark opposite every reading at what time it was taken, if not at 9 o'clock.

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

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

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with the great convenience of requiring no adjustment of the cistern. Its scale-inches are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the cistern are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the zero-point of the fixed scale; their co-incidence 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 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 within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum: this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a sharp tap is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer, (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired.

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

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

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

Self-registering Thermometers.—Professor Phillips's, and Negretti and Zamboni's Patent "Maximum" Thermometers are recommended; pinned directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rothford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum". This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found in the upper lobe, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes that has not been carefully tested by comparison with a Standard Thermometer. When such Thermometers 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.

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

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°; or 40°·3 respectively. So also 40½°, and 40¾°, more or less, must be read. Rothford's "Max" and "Min" Thermometers, 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.

Heat 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 history. In the Society's schedules, the indications registered on the 3rd are those of a series of phenomena commencing at 9 P.M. on the 2nd, and extending till 9 P.M. on the 3rd.

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

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

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Snow-falls 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 letter S affixed to 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, are given in the following table.

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," 2 W., (for example), will indicate that the upper strata of clouds travel with extreme velocity from S.W., and these 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, 4, 6, 8, 10, will indicate that the higher regions are covered to the 2nd, 4th, 6th, 8th, or 10th with stratus clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the cumulo-stratus kind.

Shadows.—The number of hours in which objects in the sun's rays cast shadows, should be entered in the proper column. **Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy; the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 3, 12, and 25 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames. Mention must be made of the geological formation, and agricultural condition of the soil in which these thermometers are placed.

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

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

Ozone.—Mention whether Schönbein's or Meffert's papers are used.—Meffert's are preferred. The paper is affixed by a pin to a board in the thermometer box, and the indications are registered in the column of the "Remarks." 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 2½; as an ozone entry in the schedule will indicate that the ozone paper is tinted as 2½ on the scale, that the wind is from the N.W., and that its force on the scale 0-6 is 4½; i.e., that it is blowing fresh.

Luminosity.—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 snow-line in winter ought to be recorded.

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

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

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

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

(By Order.) A. B.

EDINBURGH, 17th July 1861.

FOREST TREES.		FRUIT.		MIGRATORY BIRDS.		Other Birds, naming them—	
In flower.	Leaf buds first appear.	In leaf.	Diversified of leaves.	Sorting or mentioning variety.	Planting.	In ear.	First or second.
Alder,.....	Barley,.....	Oats,.....	Wheat,.....	Beans,.....	Peas,.....	Turnips,.....	Rye Grass,.....
Birch,.....	Barley,.....	Oats,.....	Wheat,.....	Beans,.....	Peas,.....	Turnips,.....	Rye Grass,.....
Elm,.....	Barley,.....	Oats,.....	Wheat,.....	Beans,.....	Peas,.....	Turnips,.....	Rye Grass,.....
Larch,.....	Barley,.....	Oats,.....	Wheat,.....	Beans,.....	Peas,.....	Turnips,.....	Rye Grass,.....
Lin,.....	Barley,.....	Oats,.....	Wheat,.....	Beans,.....	Peas,.....	Turnips,.....	Rye Grass,.....
Oak,.....	Barley,.....	Oats,.....	Wheat,.....	Beans,.....	Peas,.....	Turnips,.....	Rye Grass,.....
Sycamore or Plane,.....	Barley,.....	Oats,.....	Wheat,.....	Beans,.....	Peas,.....	Turnips,.....	Rye Grass,.....

SHRUBS, ETC.	FRUIT.	MIGRATORY BIRDS.	Other Birds, naming them—
First in blossom.	First in blossom.	First in blossom.	First in blossom.
Barberry,.....	Apple,.....	Cuckoo,.....	Swallow,.....
Broom,.....	Black Currant,.....	Curlew,.....	Swallow,.....
Hazel,.....	Cherry,.....	House-Swallow,.....	Swallow,.....
Hawthorn,.....	Gooseberry,.....	Plover,.....	Swallow,.....
Holly,.....	Gooseberry,.....	Plover,.....	Swallow,.....
Laburnum,.....	Pear,.....	Swallow,.....	Swallow,.....
Lilac,.....	Plum,.....	Swallow,.....	Swallow,.....
Mountain Ash or Rowan,.....	Strawberry,.....	Swallow,.....	Swallow,.....
Rhododendron Ponticum,.....	Strawberry,.....	Swallow,.....	Swallow,.....
Whin,.....	Strawberry,.....	Swallow,.....	Swallow,.....

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.

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

BOOK-POST.

Dalkeith
April 1863

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Edinburgh, County of Midlothian, in Lat. _____, Long. _____, Distance from Sea 3 miles.Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet.

The Hours of Observation are of Greenwich Time.

During the MONTH of May 1863.

ELECTRICITY.	Days of Month.	BAROMETER.		SELF-REGISTERING THERMOMETERS.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				SUNSHINE.	THERMOMETERS.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
		9 h. A.M.		6 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		6 h. P.M.		9 h. A.M.		6 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 No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	No.	Amount in which it fell.	Amount in inches.	Velocity (0-10), and Direction.		Amount (0-10), and Species.	Velocity (0-10), and Direction.	Amount (0-10), and Species.					No. 3 inches.	No. 12 inches.	No. 22 inches.	Temperature of WELL at Depth of feet. No.	Temperature at 1 fathom, and Depth.	0 A.M. 9 P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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BAROMETER, "corrected Mean" at 9 A.M., minus the Correction \ddagger for Temp. (Col. 2) = 29.800
"Corrected Mean" of Barometer at 9 P.M., minus the Correction \ddagger for Temp. (Col. 4) = 29.800
Mean at Station, corrected, and at 32°, = 29.800
Correction for Height, feet, above Mean Sea-level, = 2.09
Mean, reduced to 32°, and Sea-level, = 30.009
Highest Reading, corrected for Index error, on the 21 th, = 30.210
Lowest Do., Do., on the 13 th, = 29.200
Difference, or Monthly Range, = 1.010

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 31 th, = 69.0
Lowest in Month, corrected for Index errors, on the 28 th, = 33.5
Difference, or Monthly Range, = 35.5
"Corrected Mean" of all the Highest, (Col. 5), = 60.3
"Corrected Mean" of all the Lowest, (Col. 6), = 41.0
Difference, or Mean Daily Range, = 19.3
** Calculated Mean Temperature of Month, = 50.8

S.-R. THERMOMETER, Black Bulb, in Sun, Highest, (corrected, for Index Errors), on the 31 th, = 69.0
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 60.3
Lowest at Night, Black Bulb, (corrected for Index errors), on the 28 th, = 33.5
"Corrected Mean," (Col. 8), of Black Bulb Min. on grass, = 41.0
Difference of above Means or Range ("exposed"), = 19.3

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = 52.2
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 49.2
†† Computed Temperature of Dew-point, = 46.1
†† Do. Elastic Force of Vapour, = 3.13
†† Do. Weight of Vapour in a Cubic Foot of Air, = 80
†† Relative Humidity, (Saturation = 100), = 80
RAIN fell on Days; Amount in Inches, = 0.87

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

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

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and
Return verified by

(Signed)

W. Thomson

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Edinburgh, County of Midlothian, in Lat. _____, Long. _____, Distance from Sea 3 miles.Height of Cistern of the Barometer above Mean Sea-level 191 feet, above Ground 4 feet.

The Hours of Observation are of Greenwich Time.

During the MONTH of June 1863.

ELECTRICITY.	Days of Month.	BAROMETER.		SELF-REGISTERING THERMOMETERS.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				SUNSHINE.	THERMOMETERS.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
		9 h. A.M.		6 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		6 h. P.M.		9 h. A.M.		6 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 No.	Min. on Grass No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Readings of the H-Cup Anemometer.	No. of hours in which it fell.	Amount in inches.	Velocity, (0-5), and Direction.		Amount, (0-10), and Species.	Amount, (0-10), and Species.	No. 1 inches.					No. 2 inches.	No. 3 inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction ++ for Temp. (Col. 2), = 29.638
"Corrected Mean" of Barometer at 9 P.M., minus the Correction ++ for Temp. (Col. 4), = 29.638
Mean at Station, corrected, and at 32°, = 29.638
Correction for Height, feet, above Mean Sea-level, = 20.9
Mean, reduced to 32°, and Sea-level, = 29.847
Highest Reading, corrected for Index error, on the 1 th, = 30.020
Lowest Do., Do., on the 7 th, = 29.230
Difference, or Monthly Range, = 0.890

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index error), on the 2 th, = 72.0
Lowest in Month, corrected for Index error, on the 7 th, = 40.0
Difference, or Monthly Range, = 32.0
"Corrected Mean" of all the Highest, (Col. 5), = 65.4
"Corrected Mean" of all the Lowest, (Col. 6), = 46.2
Difference, or Mean Daily Range, = 19.2
** Calculated Mean Temperature of Month, = 55.8

S.-R. THERMOMETER, Black Bulb, in Sun, Highest, (corrected, for Index Error), on the th, = 72.0
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 72.0
Lowest at Night, Black Bulb, (corrected for Index error), on the th, = 40.0
"Corrected Mean," (Col. 8), of Black Bulb Min. on grass, = 40.0
Difference of above Means or Range ("exposed"), = 32.0

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = 58.1
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 54.9

Computed Temperature of Dew-point, = 52.0

Do. Elastic Force of Vapour, = 389

Do. Weight of Vapour in a Cubic Foot of Air, = 80

Relative Humidity, (Saturation = 100), = 80

RAIN fell on Days; Amount in Inches, = 2.62

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	6	5	1	0	9	6	2						
P.M.	0	4	3	4	2	10	5	2						
Mean.	0	5	4	2	1	10	6	2						

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and Return verified by

(Signed)

Wm. Thomson

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens, County of Midlothian, in Lat. _____, Long. _____, Distance from Sea 5 miles.

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

During the MONTH of July 1865.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				THERMOMETERS.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		9 h. A.M.		6 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		6 h. P.M.		9 h. A.M.		6 h. P.M.		Readings of the H-Cup Anemometer.		No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.		9 h. A.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
		No.	Barometer.	No.	Barometer.	No.	Max.	No.	Min.	No.	Max.	No.	Min.	No.	Max.	No.	Min.	No.	Max.			No.	Max.	No.	Max.	No.					Max.	No.	Max.	No.	Max.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
		inches.	Barometer.	inches.	Barometer.	No.	No.	No.	No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	9 h. A.M.	9 h. P.M.			No.	No.	Velocity, (0-10), and Direction.	Amount, (0-10), and Species.	Velocity, (0-10), and Direction.					Amount, (0-10), and Species.	No.	3 inches.	No.	12 inches.	No.	22 inches.	Temperature of WELL at Depth of feet. No.	Temperature at station, and Rainfall.	0-10.	9 A.M. 9 P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
1		30.05	61	29.93	64	68	41			62.5	58.5	65	61	SW	5																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction ++ for Temp. (Col. 2), = 29.933
"Corrected Mean" of Barometer at 9 P.M., minus the Correction ++ for Temp. (Col. 4), = 29.933
Mean at Station, corrected, and at 32°, = 29.933
Correction for Height, feet, above Mean Sea-level, = 209
Mean, reduced to 32°, and Sea-level, = 30.142
Highest Reading, corrected for Index error, on the 12th, = 30.370
Lowest Do., Do., on the 22th, = 29.470
Difference, or Monthly Range, = 0.900

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 9th, = 87.0
Lowest in Month, corrected for Index errors, on the 22th, = 34.0
Difference, or Monthly Range, = 47.0
"Corrected Mean" of all the Highest, (Col. 5), = 69.8
"Corrected Mean" of all the Lowest, (Col. 6), = 46.9
Difference, or Mean Daily Range, = 22.9
** Calculated Mean Temperature of Month, = 58.4

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, = 60.3
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 55.6
Computed Temperature of Dew-point, = 51.5
Do. Elastic Force of Vapour, = 3.81
Do. Weight of Vapour in a Cubic Foot of Air, = _____
Relative Humidity, (Saturation = 100), = 72
RAIN fell on 4 Days; Amount in Inches, = 0.70

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

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and Return verified by _____

(Signed) W. Thomson

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS.

WITH REMARKS ON THE USE OF INSTRUMENTS.

Oxre of the objects of immediate importance that the Society Meteorological Society has proposed to itself, is to secure *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 considerable 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 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, as may be best adapted to the convenience of the observer, 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 to every reading at what time it was taken, if not at 9 o'clock.

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

Two moderate-priced Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted for 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. *His scale-rod* is not too long, but so much shorter 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 action 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 co-incidence being indicated by a little ivory float, whose end passes freely through the lid and case of the cistern. When the *index-tube* on this little piston-rod is brought, by the adjusting screw, to form one straight line with these on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In making an observation, this *principle* here will vitiate the readings from the *zenith*.

When a Barometer having adjustable scales has to be removed from its fastenings, the ivory peg must be screwed on 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 upnearest. Before suspending the Barometer for use, it must be ascertained whether the space which, 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 glass of mercury by tightening the ivory peg), and gently tapping it, as 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 sun's direct rays, nor the heat of a fire.

In *taking an Observation*, the attached Thermometer is first inserted into the tube must then be gently tapped and the instrument carefully made. By raising and lowering the eye, it must be brought into the plane of the back and front of the thermometer, 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 immediately; so as to prevent loss from the observer's hands and fingers, and to insure an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside, and black within, and fixed 4 feet above grass in an exposed position, free from all 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-rails, 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 made to open to the south. These Boxes may be had at the Society's Office.

Self-Registering Thermometers.—Professor Phillips's, and Neill's, and Zambra's Patent "*Maximum*" Thermometers are recommended; plain 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 made in two denagements, both of which must be guarded against, and may be easily remedied by an observer. When the thermometer of spirit breaks, it may be repaired by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found in the lower bulb, and must be dislodged from thence by heating that pole, and over a lamp; the alcohol will evaporate and again condense in contact with the body of the tube. This instrument must be turned perfectly horizontal; the bulb end should incline slightly upwards, rather than the other.

The above remarks apply usually 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 *Wæzmann* should be freely exposed to the Sun, and the *Wüthrich* should rest on wooden supports a few inches from the surface of the ground. The *Wüthrich* Thermometer is not so well adapted to cover either of these Thermometers, nor the Sun-glass, as to cover either of these Thermometers, nor the Sun-glass, by its partial exposure to the sun.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes that has not been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers 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 to be used, without being *re-tested*. The Self-governing, 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-measured Theriometer may be used, on land, on board any observatory from the Arctic to the Antarctic.

The *Hygrometer* consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight elevations 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 gratings and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any point on which it may be suspended;—the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the 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, evaporation 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 "Glaeson'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 case, and hanging them side by side, so that the frame mentioned

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, in 40°C .; or, in this the Thermometer will be read— $39^{\circ}\cdot 0$, $40^{\circ}\cdot 0$, $40^{\circ}\cdot 1$; or again, $40^{\circ}\cdot 4$, $40^{\circ}\cdot 5$, or $40^{\circ}\cdot 6$, according as it indicates a little more, an exact coincidence with, or a little over 40° , or $40^{\circ}\cdot 1$, respectively. So also $40^{\circ}\cdot 1$ and $40^{\circ}\cdot 5$ more or less, must be registered $40^{\circ}\cdot 2$ or $40^{\circ}\cdot 3$, and $40^{\circ}\cdot 4$ or $40^{\circ}\cdot 8$ respectively. In reading Rutherford's "*Hot*," and "*Hot*," Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings must be thermometers; especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person

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

Wind.—A wind-vane ought to be elevated 12 feet at least, above surrounding objects. When it oscillates incessantly, the mean direction must be taken; and when it is stationary, and always in the same position, the true direction must be made to the direction of the lower strata of clouds overhead, and to the direction of the lower strata of clouds beneath, if they be visible.

Careful observations ought to be made on the changes in the direction of the wind; and during storms, extra observations should be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results. The Council would strongly recommend that every Observatory be furnished with a Hemispherical Cup Anemometer—this 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, the Cup Anemometer is also recommended: the method of *Exhibiting 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 of 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 should be read daily, and the readings entered in the returns.

Snow-falls on which the rain fell, be registered in the rain column, for convenience. When a snow shower occurs, under the following conditions:—When a snow shower occurs it must be noted in the Remarks, and the letter S must be written in the Remarks column, and the depth of snow must be measured in some open place where no drift has accumulated, and registered in addition to, as a check upon, the observations of the run-gauge. For wind, rain, and snow, as in every column, the observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Remarks.—Convenient abbreviations for Luke Howard's names—

centure 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-manometer, though their appearances and changes ought to be noted among the *phenakia*. The amount of cloud is entered from 0 to 10; thus, when the sky overhead is *half covered* by

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 "Variety" ⁶, S.W., (for example), will indicate that the "Wind and Direction" ², W., (for example), will indicate that the "velocity" ³ 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" ⁴, column, an entry of $\frac{2}{3}$ _{at} ^{at} will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further extended to the extent of 2-tenths by lower clouds of the *cirrus*-*stratus* kind.

Shading.—The number of rays 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., 12 noon, 3 P.M., and 6 P.M., in the following manner:—Four thermometers placed in the earth, their bulbs being sunk to 3, 6, 9, 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 from the surface being conveyed to the bulbs by the stems or wooden frames.

The natural condition of the soil in which these thermometers are placed, should be entered in the proper column.

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 land, 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, and at or near the time of high water; on the 1st, 15th, 21st, and 29th of each month; the thermometer ought to be sunk to exactly six feet (one fathom); and after ten minutes have elapsed, the water to be drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, noting always the temperature of the air, and the hour of observation: and continuing to observe for particular depths.

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

Ozone.—Mention whether Schönbien's or Mofett's papers are used. Mofett's are preferred. The paper is affixed by a pin to board in the thermometer box, and the indication registered at 8 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation in the following manner:—thus $3\frac{1}{2}$, as *ozone* entry in the schedule, will indicate that the *ozone* paper, as noted 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* $\frac{1}{2}$ gals.

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 *Janenka's* column is too narrow, but unavoidably so. Some of the most valuable observations that can be made 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 is given in this column to prevalent diseases, differences of 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 onset of wind attaining their maximum, as well as such notes as storms as have been limited at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the line in winter, ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. or 9 P.M. may only to be registered, either in two columns otherwise unoccupied, or in two lined off for the purpose, from that time to the time of day when the observations are made. The section entitled "Remarks" is intended that observations by the meteorologist should be entered in this manner; or on the side-line of the *Observations* in connection with the periodic return of the seasons. Additional remarks may be made on the margin. The *Observations* possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct 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 birks; and, in the case of crops, to specified sorts reared from year to year in a selected piece of ground or farm.

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

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

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

ABSTINATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In flower.	In first buds appear.	In leaf.	Divided of leaves.	CROPS mentioning variety.	Sowing or planting.	Appearing above ground.	In bar or flower.	First cut
Alder,					Barley,				
Ash,					Bere or Bigg,				
Beech,					Oats,				
Birch,					Wheat,				
Elm,					Beans,				
Larch,					Pears,				
Lime,					Potatoes,				
Oak,					Tunip,				
Sycamore or Plane,					Rye Grass,				

SHRUBS, ETC.	Plt in Bloom.	FRUIT.	First in Bloom.	First in Fruiting.	Other Birds, naming them.	First Arrival.	Departure.
Barberry,	3	Apple,			Cuckoo,		
Bource or Pidge,		Black Cherry,			Catbird,		
Broom,		Cherry,			House-Swallow,		
Hazel,		Cean,			Lapwing,		
Hawthorn,		Gooseberry,			Flower,		
Holly,		Peach,			Sand-Martin,		
Laburnum,		Pear,			Starling,		
Lilac,		Plum,			Swan,		
Mezereum,		Strawberry,			Rail or Corn Crane,		
Mountain Ash or Rowan,							
Red Flowering Currant,							
Rhododendron Ponticum,							
Whin,							

Epizootic disease prevails amongst cattle, or in perfection; whether any have suffered from blight, disease, etc. Whether turnips, fruits, etc., whether plentiful, or in perfection; and the Agricultural condition of the district generally.

BOOK-POST.

EDINBURGH.

10, *St Andrew Square,*

Secretary of the Meteorological Society of Scotland

Mr ALEXANDER BUCHAN,

 $T_{\mathcal{G}}$

W D Alkwith Esq
July 1863

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens, County of Midlothian, in Lat. _____, Long. _____, Distance from Sea 3 miles.Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet.During the MONTH of August 1863.

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 began and ended.	Days of Month.							
		9 h. A.M.		6 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		6 h. P.M.		9 h. A.M.		6 h. P.M.		9 A.M.		P.M.		9 h. A.M.															
		Barometer. " No. _____	Attach- ed Ther- mometer.	Barometer. " No. _____	Attach- ed Ther- mometer.	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, (0-6), and Direction.	Amount, (0-10), and Species.	Velocity, (0-6), and Direction.	Amount, (0-10), and Species.	No. _____ 3 inches.	No. _____ 12 inches.	No. _____ 22 inches.													
		inches.	"	inches.	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"					"						
1		30.02	61	29.95	67	75	44			63	56.5	65	75.5	E	SE											Fine Constant Sunshine throughout	1										
2		29.93	63	29.85	68	75	47			63	58	65	60	SE	SE											do do do	2										
3		29.78	65	29.73	69	69	54			65	62	63	60	SE	SE											Fine with passing clouds all day	3										
4		29.65	65	29.63	68	72	52			63	59	65	57	SE	SE											do do do	4										
5		29.59	64	29.56	67	69.5	46			63	58.5	61	59	SE	SE											Slight showers and passing clouds	5										
6		29.55	64	29.62	68	73	49			64	59	66	59	SE	SE											Fine with passing clouds throughout	6										
7		29.67	65	29.70	69	75	58			64	63	66	64	SE	SE											Gale and showers throughout	7										
8		29.62	68.5	29.59	69	71	59			68.5	64	66	61	SE	SE											Passing clouds, showers and high wind	8										
9		29.76	63.5	29.85	67	69	51			61	56	63	58.5	SE	SE											Passing clouds and drizzle throughout	9										
10		29.82	64.5	29.77	67	70.5	51			63	59	64	59.5	SE	SE											Fine and mild with passing clouds	10										
11		29.71	62.5	29.80	64	64	50			54	52	58	51.5	SE	SE											do do do	11										
12		29.90	59	29.88	63	66.5	40.5			56.5	51	60	54	SE	SE											do do do	12										
13		29.87	58.5	29.90	62	66	40			54.5	51	61	53.5	SE	SE											Constant Sunshine throughout	13										
14		29.95	58.5	29.79	62	66	39			58.5	54	60	57	SE	SE											Overcast and like rain all day	14										
15		29.41	62	29.34	67	74	53			64	62	64	61	SE	SE											Passing clouds and high wind	15										
16		29.38	63	29.38	65	69	55			61	59	59	57	SE	SE											Slight showers and passing clouds	16										
17		29.63	60.5	29.57	63	64.5	43			57.5	54.5	60	56	SE	SE											Slightly overcast throughout	17										
18		29.50	59	29.64	62	64	47			57.5	54	58.5	55.5	SE	SE											do do do	18										
19		29.60	59	29.61	61.5	62.5	45			57	53.5	56	54	SE	SE											Overcast A.M. passing clouds and drizzle P.M.	19										
20		29.80	57	29.90	60	64	39			52.5	47	59	52.5	SE	SE											Fine with constant sunshine throughout	20										
21		29.97	55	29.93	58	61	36			53	51	57.5	55.5	SE	SE											Gale and like rain throughout	21										
22		29.86	59	29.86	63	70	48			61.5	60	62	57	SE	SE											Showery A.M. and passing clouds P.M.	22										
23		29.67	59	29.60	62.5	69	45			59.5	57	62	57.5	SE	SE											Fine and mild with passing clouds	23										
24		29.56	58.5	29.48	60.5	69	45			59	54	53.5	52	SE	SE											Mild A.M. Showers P.M.	24										
25		29.39	57	29.24	61.5	69.5	40.5			57	54	60	54.5	SE	SE											Fine mild day with passing clouds	25										
26		29.25	57.5	29.32	60.5	63	45			53	52	56	52	SE	SE											Gale and rainy A.M. and passing clouds P.M.	26										
27		29.28	56	29.33	57	62.5	44			51.5	51	61	50.5	SE	SE											Gale and rainy throughout	27										
28		29.50	53	29.52	53	50	43			48.5	48	48.5	48.5	SE	SE											do do do	28										
29		29.41	55	29.32	58	61	46			57.5	55	54.5	51	SE	SE											Fine and mild with passing clouds	29										
30		29.72	53.5	29.74	58	65	38			56	52.5	56	55	SE	SE											Bright sun A.M. Gale and showers P.M.	30										
31		29.71	56	29.70	57	52.5	45.5			53	57.5	51.5	51.5	SE	SE											Gale and rainy throughout	31										
	Sums.	42.40	175	40.10	141	212.5	1435.5			515.6	133	132	144																								
	Means.	29.658	601			66.8	46.4			58.7	53.5																										
	† Total Corrections for Instrumental Errors.	+0.60		+0.60						+1	-2	+1	-2																								
	† Corrections for Diurnal Range.																																				
	"Corrected Means."	29.718								58.8	53.3																										
	No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31					
																																NOTATION USED IN GENERAL REMARKS.					
a. denotes aurora. m. denotes meteor.																																					
ci. " cirrus. ms. " meteors.																																					
ci-cu. " cirro-cumulus. n. " nimbus.																																					
ci-s. " cirro-stratus. r. " rain.																																					
cu. " cumulus. h. r. " heavy rain.																																					
cu-s. " cumulo-stratus. c. h. r. " continued heavy rain.																																					
d. " dew. s. " stratus.																																					
f. " fog. sc. " sleet.																																					
fr. " frost. sh. " snow.																																					
h. " haze. so. ha. " solar halo.																																					
h. d. " heavy dew. sq. " squall.																																					
hl. " hail. sqs. " squalls.																																					
l. " lightning. t. " thunder.																																					
l. cl. " light clouds. t.-s. " thunder-storm.																																					
l. sh. " light showers. w. " wind.																																					
lu. co. " lunar corona. g. " gale of wind.																																					
lu. ha. " lunar halo.																																					
TABLE FOR ESTIMATING FORCE OF WIND.																																					
Estimated Force, 0-6. Common Designation. Estimated Force, 0-6. Common Designation. Estimated Force, 0-6. Common Designation.																																					
0 Calm 1.5 Light breeze 4 Blowing hard																																					
0.5 Very light air 2 Fresh breeze 5 Blowing a gale																																					
1 Light air 3 Very fresh 6 Violent gale																																					

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction †† for Temp. (Col. 2) = 29.634
"Corrected Mean" of Barometer at 9 P.M., minus the Correction †† for Temp. (Col. 4) = _____
Mean at Station, corrected, and at 32°, = 29.634
Correction for Height, feet, above Mean Sea-level, = 20.9
Mean, reduced to 32°, and Sea-level, = 29.843
Highest Reading, corrected for Index error, on the 1 th, = 30.020
Lowest Do., Do., on the 25 th, = 29.240
Difference, or Monthly Range, = 0.780

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

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 1 th, = 75.0
Lowest in Month, corrected for Index errors, on the 21 th, = 36.0
Difference, or Monthly Range, = 39.0
"Corrected Mean" of all the Highest, (Col. 5), = 68.8
"Corrected Mean" of all the Lowest, (Col. 6), = 46.4
Difference, or Mean Daily Range, = 20.4
** Calculated Mean Temperature of Month, = 56.6

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, = 58.8Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 55.3†† Computed Temperature of Dew-point, = 52.2†† Do. Elastic Force of Vapour, = 391

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

†† Relative Humidity, (Saturation = 100), = 79RAIN fell on Days: Amount in Inches, = 4.32

WIND.	SUMMARY.									
	Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.
A.M.		0	4	0	3	0	18	4	2	0
P.M.										
Mean.										

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and
Return verified by

(Signed)

Mr. Thompson

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

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

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with the great convenience of requiring no *adjustment* of the cistern. Its *scale-tube* is not true inches, but so much shorter as to *compensate* the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather; and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; their co-incidence 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-red is brought, by the adjusting screw, to *form one straight line* with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this *preliminary* setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *venier*.

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

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

In *taking an Observation*, the attached Thermometer is first noted: the tube must then be gently tapped and the cistern-adjustment carefully made. By raising and lowering the eye, it must be brought into the plane of the book 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 face from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

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

Self-registering Thermometers.—Professor Phillips's, and Negretti and Zambra's Patent "Maximum" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found in the upper lobe, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. This instrument must be hung perfectly horizontal: the bulb should incline slightly downwards, rather than the other way.

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 primer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "Maximum" should be freely exposed to the Sun, and the "Minimum" should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the Sun's heat, to affect the alcohol by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes that has not been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers 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 State, and ought never afterwards to be used, without being *re-tested*. Of 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 bulb;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer, that the muslin is always *clean and moist*, and the water-pure. In frosty weather observation is a matter of much delicacy and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

One form of "Maximum" Hygrometer is highly objectionable, the frame of "Mason's" Hygrometer is enclosed in a tin case, which also supports the water cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the 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 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 40½°, and 40¾°, more or less, must be registered 40·2 or 40·3, and 40·7 or 40·8 respectively. In reading Rutherford's "Max." and "Min." Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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 *hour*. In the Society's schedules, the indications registered on the 3rd and 4th are those of a series of phenomena commencing at 9 P.M. on the 2nd, and extending till 9 P.M. on the 3rd.

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

Careful observations ought to be made on the changes in the direction of the wind; and during storms, exact observations ought to be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results. The Council would strongly recommend that every Observatory be furnished with a Hemispherical-Cup Anemometer, a self-registering instrument which shows the amount of Wind that passes it per day; from which also the velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind, at any particular hour of observation, Lind's Anemometer is also recommended: the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

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

Snow-falls may, for convenience, be registered in the rain columns under the following conditions.—When a snow shower occurs it must be noted in the "Remarks," and the letter S affixed to the depth of water received in gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as 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 deduction or inference.

clature 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 8 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," 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 4 st. (e.g.) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

Sunshine.—The number of hours in which objects in the sun's rays cast shadows, should be entered in the proper column. **Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature and 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 rivers entering. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, noting always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottoms of wells ought, when practicable, to be taken, and the depth of the well and of the water noted. **Ozone.**—Mention whether Schönbien's or Moffat's papers are used—Moffat's are preferred. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—"I was 3½", as an ozone entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "1," 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 influence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, &c. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been limited at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns otherwise unoccupied, or in two ruled off for the purposes, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner, or on the side-margin. Additional remarks may be made on the margin. **Observations** in connection with the periodic return of the seasons possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published 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 *weekly* observations be taken;—viz. on the 21st days of March, June, September, and December. For these hourly observations separate schedules will be furnished to observers. Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the makers.

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

(By Order) A. B.

Edinburgh, 17th July 1861.

BOOK-POST.

Mr. ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	In Leaf.	In Leaf Buds.	First in Blossom.	CROPS mounting or above ground.	Sowing or above ground.	In Ear or above ground.	First Harvest.	First Depature.	MIGRATORY BIRDS.									
										First Arrival.	First Depature.	First Arrival.	First Depature.	First Arrival.	First Depature.	First Arrival.	First Depature.	First Arrival.	First Depature.
Alder.					Barley.					Chickadee.		Curlew.		House-Swallow.		Lapwing.		Plover.	
Aspen.					Bare or Bigg.					Swallow.		Starling.		Swallow.		Swallow.		Swallow.	
Birch.					Oats.					Swallow.		Swallow.		Swallow.		Swallow.		Swallow.	
Elm.					Wheat.					Swallow.		Swallow.		Swallow.		Swallow.		Swallow.	
Larch.					Peas.					Swallow.		Swallow.		Swallow.		Swallow.		Swallow.	
Oak.					Turnips.					Swallow.		Swallow.		Swallow.		Swallow.		Swallow.	
Sycamore or Plane.					Rye Grass.					Swallow.		Swallow.		Swallow.		Swallow.		Swallow.	

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 Epidemic disease prevails among Cattle; and the Agricultural condition of the district generally.

Edinburgh
August 1863.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *Calveith Gardens*, County of *Mid Lothian*, in Lat. _____, Long. _____, Distance from Sea *3* miles.Height of Cistern of the Barometer above Mean Sea-level *190* feet, above Ground *4* feet.During the MONTH of *September* 186*3*.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.		SELF-REGISTERING THERMOMETERS.		HYGROMETER.		WIND.		RAIN.		CLOUDS.		THERMOMETERS.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.					
		9 h. A.M.		6 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		6 h. P.M.		9 h. A.M.		6 h. P.M.					9 h. A.M.		6 h. P.M.		
		No.	Barometer.	Barometer.	Barometer.	Max.	Min.	Max.	Min.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.					Force.	9 h. A.M.	9 h. P.M.	9 h. A.M.	9 h. P.M.
	1	29.73	55	29.61	57	60.5	40.5	56	53.5	54.5	57.5	SW	SW							1					
	2	29.58	57	29.40	59	62.5	40	57.5	53.5	55	50.5	SW	SW							2					
	3	29.53	56.5	29.40	59	64	44	57	55	54.5	54.5	SW	SW							3					
	4	29.46	55.5	29.40	58	59	40	53	52	56.5	56.5	SW	SW							4					
	5	29.41	55	29.40	57	61	39	53	56	53.5	51	SW	SW							5					
	6	29.52	52.5	29.48	56	59	41	52	47	53	46	SW	SW							6					
	7	29.45	55	29.49	55	54	43	52	49	51	46.5	SW	SW							7					
	8	29.52	53	29.50	56.5	59	42.5	53	48.5	52.5	51	SW	SW							8					
	9	29.50	54	29.57	57	61	44	54	52	52.5	48.5	SW	SW							9					
	10	29.70	53.5	29.80	56	61	40	51.5	48	52	50	SW	SW							10					
	11	29.95	51.5	29.95	55.5	59	35	51.5	47	53	51	SW	SW							11					
	12	29.87	55	29.85	57.5	60.5	44	54	56	55	51.5	SW	SW							12					
	13	29.90	54.5	29.97	57.5	60	44	54	51	55	50.5	SW	SW							13					
	14	30.05	56.5	29.98	58.5	60	48	57.5	53	54.5	51	SW	SW							14					
	15	29.77	57.5	29.71	58	62.5	48	56	54	53	48	SW	SW							15					
	16	29.65	55	29.72	54	56.5	42	52	50	52	47.5	SW	SW							16					
	17	29.77	54	29.75	57.5	61.5	43	52.5	50	54	52	SW	SW							17					
	18	29.67	57.5	29.68	60	62.5	49	58	55	57	55	SW	SW							18					
	19	29.18	59	29.11	56	55	48	56	54	48	45	SW	SW							19					
	20	29.50	52.5	29.50	54.5	57	40	51.5	48	49	47	SW	SW							20					
	21	29.80	53	29.70	53.5	56	42.5	50	47.5	48	45.5	SW	SW							21					
	22	29.59	49.5	29.72	52.5	53	38	46	45	47.5	46	SW	SW							22					
	23	29.96	50.5	29.62	53.5	53	38.5	48	47	49	48	SW	SW							23					
	24	29.18	51	29.26	52	54	36	50	49	48	47.5	SW	SW							24					
	25	29.40	52	29.52	54	56	36	51.5	49	50	48	SW	SW							25					
	26	29.70	51	29.77	53.5	55.5	38	49.5	42	49.5	47	SW	SW							26					
	27	29.49	53	29.38	56	59	41	53.5	50.5	51	49	SW	SW							27					
	28	29.40	50.5	29.42	52	53	36.5	46	44	46	43.5	SW	SW							28					
	29	29.56	50.5	29.54	52	55	36.5	50	47	51	48	SW	SW							29					
	30	29.63	52.5	29.37	53.5	54	42	52	49	50.5	47.5	SW	SW							30					
	31																			31					
Sums.		1475	1435			512.4	412.3	83.5	53.5																
Means.		29.487	53.8			58.1	41.3	52.8	50.2																
Corrections for Instrumental Errors.		+0.60	+0.60					+1	-2	+1	-2														
Corrections for Diurnal Range.																									
Corrected Means.		29.541						52.9	50.0																

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† for Temp. (Col. 2), = *29.475*

"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = *29.475*

Mean at Station, corrected, and at 32°, = *29.475*

Correction for Height, feet, above Mean Sea-level, = *20.9*

Mean, reduced to 32°, and Sea-level, = *29.684*

Highest Reading, corrected for Index error, on the *14* th, = *30.050*

Lowest Do., Do., on the *22* th, = *28.580*

Difference, or Monthly Range, = *1.470*

S-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the *3* th, = *64.0*

Lowest in Month, corrected for Index errors, on the *11* th, = *35.0*

Difference, or Monthly Range, = *29.0*

"Corrected Mean" of all the Highest, (Col. 5), = *55.1*

"Corrected Mean" of all the Lowest, (Col. 6), = *41.3*

Difference, or Mean Daily Range, = *13.8*

** Calculated Mean Temperature of Month, = *49.7*

S-R. THERMOMETER, Black Bulb, in Sun, Highest, (corrected for Index Errors), on the *3* th, = *64.0*

"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = *64.0*

Lowest at Night, Black Bulb, (corrected for Index errors), on the *11* th, = *35.0*

"Corrected Mean," (Col. 8), of Black Bulb Min. on grass, = *35.0*

Difference of above Means or Range ("exposed"), = *29.0*

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = *52.9*

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = *50.0*

Computed Temperature of Dew-point, = *47.1*

Do. Elastic Force of Vapour, = *3.211*

Do. Weight of Vapour in a Cubic Foot of Air, = *0.013*

Relative Humidity, (Saturation = 100), = *81*

RAIN fell on Days; Amount in Inches, = *3.13*

WIND.		SUMMARY.									
Direction.		N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.		0	1	1	0	3	14	8	3	0	
P.M.											
Mean.											

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and Return verified by

M. Morrison

(Signed)

M. Morrison

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

An excellent Barometer is constructed by Mr. Aie of London, the use of which is attended with the great convenience of requiring no adjustment of the cistern. Its *scale-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 co-incidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *index-line* on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the scale is graduated. In taking an observation, this *preliminary* setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *vernier*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *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 uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum: this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a *sharp top* is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer; care being taken to prevent the loss of mercury by tightening the ivory pegs, and gently tapping it; and if this plan fails, the instrument must be repaired.

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

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

Self-registering Thermometers.—Professor Phillips's, and Negretti and Zambra's Patent *"Maximum"* Thermometers are recommended; printed directions for their use may be obtained with each instrument. The *"Minimum"* Thermometer of 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 divides by high temperature, it will be found in the upper lobe, and must be isolated from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus seriously vitiate the *"Hygrometrical Deductions"* Observations 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, little below the level of the wet bulb,—in no case under the bulb;—the mesh must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the mesh is always *clean and moist*, and the 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 evaporation.

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—38°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40°·5, respectively. So also 40½° and 40¾° more or less, must be registered. 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading *Rutherford's "Max."* and *"Min."* Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

Careful observations ought to be made on the changes in the direction of the wind; and during storms, extra observations ought to be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results. The Council would strongly recommend that every Observatory be furnished with a Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind, at any particular hour of observation, Lind's Anemometer is also recommended: the method of *Zeroing* 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 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.

Snow-falls 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 partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for Luke Howard's nomen-

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

Observations of the clouds are made at 9 a.m. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," 2, W., (for example,) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (extreme) speed of the former. Again, in the second "Cloud" column, an entry of 2, W., (e.g.) will indicate that the higher rays cast shadows, should be entered in the proper column.

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

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

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

Omnia.—Mention whether Schindler's or Moffet's papers are used—Moffet's are preferred. The paper is affixed to 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 ¼, as an example entry in the schedule, will indicate that the ozone paper is tinted as ¼ on the scale, that the wind is from the N.W., and that its force on the scale 0-6 is ¼; i.e., that it is blowing fresh.

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

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

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

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

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

(By Order,) A. B.

EDINBURGH, 17th July 1861.

BOOK-POST.

10, St Andrew Square,

EDINBURGH.

Secretary of the Meteorological Society of Scotland,

Mr ALEXANDER BUCHAN,

To

Edinburgh
Sept. 1. 1863

FOREST TREES.		CROPS		MIGRATORY BIRDS.	
In flower.	In leaf.	Planted or sown.	Harvested or reaped.	First seen.	Departure.
Alder,	Barley,	Barley,	Barley,	Chickadee,	Chickadee,
Aspen,	Beech,	Beech,	Beech,	Cuckoo,	Cuckoo,
Birch,	Birch,	Birch,	Birch,	Goldfinch,	Goldfinch,
Elm,	Elm,	Elm,	Elm,	House-Sparrow,	House-Sparrow,
Larch,	Larch,	Larch,	Larch,	Jackdaw,	Jackdaw,
Linnet,	Linnet,	Linnet,	Linnet,	Magpie,	Magpie,
Oak,	Oak,	Oak,	Oak,	Partridge,	Partridge,
Sycamore or Plane,	Sycamore or Plane,	Sycamore or Plane,	Sycamore or Plane,	Robin,	Robin,

FRUIT TREES.		FRUIT TREES.		FRUIT TREES.	
In flower.	In leaf.	Planted or sown.	Harvested or reaped.	First seen.	Departure.
Apple,	Apple,	Apple,	Apple,	Blackbird,	Blackbird,
Berry,	Berry,	Berry,	Berry,	Cherry,	Cherry,
Bramble,	Bramble,	Bramble,	Bramble,	Currant,	Currant,
Burnthorn,	Burnthorn,	Burnthorn,	Burnthorn,	Gooseberry,	Gooseberry,
Hawthorn,	Hawthorn,	Hawthorn,	Hawthorn,	Lapwing,	Lapwing,
Holly,	Holly,	Holly,	Holly,	Plover,	Plover,
Laburnum,	Laburnum,	Laburnum,	Laburnum,	Sand-Martin,	Sand-Martin,
Malva,	Malva,	Malva,	Malva,	Starling,	Starling,
Mezereum,	Mezereum,	Mezereum,	Mezereum,	Swallow,	Swallow,
Mountain Ash or Rowan,	Mountain Ash or Rowan,	Mountain Ash or Rowan,	Mountain Ash or Rowan,	Thrush,	Thrush,
Rhododendron Ponticum,	Rhododendron Ponticum,	Rhododendron Ponticum,	Rhododendron Ponticum,	Wren,	Wren,
White,	White,	White,	White,	Yellow Warbler,	Yellow Warbler,

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 the good season prevails among Cattle; and the Agricultural condition of the district generally.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Salisbury Gardens, County of West Lothian, in Lat. 55° 55' N, Long. 3° 10' W, Distance from Sea 3 miles.

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

During the MONTH of October 1863

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.		SELF-REGISTERING THERMOMETERS.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				THERMOMETERS.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
		9 h. A.M.		6 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		6 h. P.M.		9 h. A.M.		4 h. P.M.		Readings of the H-Cup Anemometer.		9 A.M.		P.M.		9 h. A.M.					Temperature of WELL at Depth of feet No.	Temperature at 1 fathom, and Depth.	9 A.M. 9 P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
		Barometer. No.	Attached Thermometer.	Barometer. No.	Attached Thermometer.	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	No. of hours in which it fell.	Amount in inches.	Velocity, (0-10), and Direction.	Amount, (0-10), and Species.	Velocity, (0-10), and Direction.	Amount, (0-10), and Species.	SUNSHINE. Hours.								No. 3 inches.	No. 12 inches.	No. 22 inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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BAROMETER, "corrected Mean" at 9 A.M., minus the Correction++ = 29.514
for Temp. (Col. 2), = 29.573 - .059 }
"Corrected Mean" of Barometer at 9 P.M., minus the Correction++ = 29.573
for Temp. (Col. 4), = 29.573 - .059 }
Mean at Station, corrected, and at 32°, = 29.574
Correction for Height, feet, above Mean Sea-level, = 20.9
Mean, reduced to 32°, and Sea-level, = 29.723
Highest Reading, corrected for Index error, on the 23th, = 30.060
Lowest Do., Do., on the 29th, = 28.440
Difference, or Monthly Range, = 1.620

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 7th, = 63.0
Lowest in Month, corrected for Index errors, on the 6th, = 26.5
Difference, or Monthly Range, = 36.5
"Corrected Mean" of all the Highest, (Col. 5), = 54.2
"Corrected Mean" of all the Lowest, (Col. 6), = 38.5
Difference, or Mean Daily Range, = 15.7
** Calculated Mean Temperature of Month, = 46.4

S.-R. THERMOMETER, Black Bulb, in Sun, Highest, (corrected, for Index Errors), on the 7th, = 63.0
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 54.2
Lowest, Black Bulb, (corrected for Index errors), on the 6th, = 26.5
"Corrected Mean," (Col. 8), of Black Bulb Min. on grass, = 38.5
Difference of above Means or Range ("exposed"), = 15.7

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = 48.1
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 46.7
Computed Temperature of Dew-point, = 45.2
Do. Elastic Force of Vapour, = 3.01
Do. Weight of Vapour in a Cubic Foot of Air, = 90
Relative Humidity, (Saturation = 100), = 90
RAIN fell on Days; Amount in Inches, = 1.85

WIND.		SUMMARY.									
Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	0	1	2	6	5	10	6	1	0		
P.M.	0	5	2	2	9	11	1	0			
Mean.	0	3	2	4	7	10	4	1	0		

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and Return verified by

(Signed) W. Thomson

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS.

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

Hour of Observation.—The Council recommend that Observations be made precisely at 9 o'clock (Greenwich or Railway Time only), twice a-day for some, and once, (in 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 the scale means of *adjusted or compensated* 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-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 co-incidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *index-line* on this little piston-rod is brought, by the adjusting screw, to form one *straight line* with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this *preliminary* setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *vernier*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *screw up* the *vernier* to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum: this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a *slight tap* is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer, (care being taken to prevent the loss of mercury by tightening the ivory pegs), and gently tapping it; and if this plan fails, the instrument must be *gained*. The Barometer should be suspended in a good *light*, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the Sun's direct rays nor the heat of a fire.

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

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

Self-registering Thermometers.—Professor Phillips's, and Negretti and Zambra's Patent "*Maximum*," Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "*Minimum*," Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "*Maximum*," This Thermometer is liable to two damage-ants, both of which must be guarded against, and may be easily remedied by an observer. When the "*columns*" of spirit breaks, it may be repaired by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by light, touched from thence by heating the upper lobe, and must be discoloured from thence by heating the part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. This instrument must be hung perfectly horizontal: the bulb end should incline slightly downwards, rather than the other.

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

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes that has not been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are not graduated on the stem, but merely on an attached scale, undergoing repairs, they are very liable to be moved from their position on the Scales, and ought never afterwards to be used, without being *re-tested*. The self-registering, and especially the "*Minimum*," Thermometers, ought frequently to be compared with a 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 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.

O 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, 38°·9, 40°·0, or 40°·1; or, again, 40°·4, 40°·6, or 40°·8, according as it indicates a little under, an exact coincidence with, or a little over 40°; or 40°·5, respectively. So also 40½, and 40¾, more or less, must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8, respectively. In reading Rutherford's "*Max.*" and "*Min.*" Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

Hour of Observing Temperature.—The Hygrometer is read at 9 a.m. and 9 p.m. The self-registering Thermometers are read at 6 a.m. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the self-registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3rd are those of a series of phenomena commencing at 9 p.m. on the 2nd, and extending till 9 a.m. on the 3rd.

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

Careful observations ought to be made on the changes in the direction of the wind; and during storms, extra observations ought to be made at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, would be likely to give highly interesting and important results. The Council would strongly recommend that every Observatory be furnished with a *Highland-Cup Anemometer*—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind, at any particular hour of observation, Lind's Anemometer is also recommended: the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

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

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

Clouds.—Convenient abbreviations for Lake Howard's notation of deduction or inference.

clature 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 *obscuratio*, and so on.

Observations of the clouds are made at 9 a.m. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "*Velocity and Direction*," 2 W., (for example), will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "*Cloud*" column, an entry of 2, 4, 6, 8, 10, 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.

Standard.—The number of hours in which objects in the sun's rays cast shadows should be entered in the proper column. **Underground Thermometers.**—At the examination 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., 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 must be taken for other and greater depths, noting always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottoms of wells ought, when practicable, to be taken, and the depth of the well and of the water noted. **Crops.**—Mention whether Schöner's or Moffat's papers are used—Moffat's are preferred. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 a.m. and 9 p.m. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3 p.m., as an entry in the schedule, will indicate that the ozone paper is tried as "43" on the scale, that a wind is from the N.W., and that its force on the scale 0—6 is "4." i.e., that it is *flowing 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 have been given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary derivations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and action between the lower and upper strata of clouds, the color of the sky, etc. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the site of the weather at 9 a.m. and 9 p.m. ought to be registered, either in two columns otherwise unoccupied, or in two ruled off for the purposes, from that headed "*Remarks*." It is intended that observations by the Electrometer should be entered in his 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. Observers ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified soil or soil.

The Council recommend that *weekly* observations be taken;—viz., on the 21st days of March, 1st, September, and December, for these hourly observations separate schedules will be furnished to observers. Full directions for the use of the instruments mentioned above have been printed, and may be had orig with them from the makers. The Council have agreed to recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider desirable that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

By Order, A. B.

Edinburgh, 17th July 1861.

FOREST TREES.		SHRUBS, ETC.		FRUITS.		MIGRATORY BIRDS.		First Departure.	
In	First in	In	First in	First in	First in	First in	First in	First in	First in
Alder.	March.	Black Currant.	April.	Apple.	May.	Cuckoo.	June.	First in	First in
Ash.	March.	Broom.	April.	Black Currant.	May.	Curlew.	June.	First in	First in
Beech.	March.	Burnt or Elder.	April.	Cherry.	May.	House-Swallow.	June.	First in	First in
Birch.	March.	Cherry.	May.	Gooseberry.	June.	Lapwing.	June.	First in	First in
Elm.	March.	Holly.	May.	Hawthorn.	June.	Plover.	June.	First in	First in
Larch.	March.	Hazel.	May.	Peach.	June.	Sand-Martin.	June.	First in	First in
Plane.	March.	Mountain Ash or Rowan.	June.	Plum.	June.	Starling.	June.	First in	First in
Oak.	March.	Myrtle.	June.	Strawberry.	June.	Swan.	June.	First in	First in
Sycamore or Plane.	March.	Red Flowering Currant.	June.	Turnip.	June.	Other Birds, naming them.	June.	First in	First in
		White.	June.	Turnip.	June.		June.	First in	First in

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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 any have suffered from blight, disease, etc. Whether

Epizootic disease prevails among Cattle; and the Agricultural condition of the district generally.

Mr. ALEXANDER BUCHAN.

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

BOOK-POST.

W. A. Buchan
October 1863

T9

SCOTTISH METEOROLOGICAL SOCIETY.

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

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

The Hours of Observation are of Greenwich Time.

During the MONTH of November 1863

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				SUNSHINE. Hours.	THERMOMETERS. under Ground.			SEA. Temperature at 1 fathom, and Density.	OZONE. 0-10. 9 A.M. 9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. Mention the hour at which Storms began and ended.	Days of Month.				
		9 h. A.M.		6 h. P.M.		Protected, in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		6 h. P.M.		9 h. A.M.		6 h. P.M.		Readings of the H-Cup Anemometer.		No. of hours in which it fell.	Amount in inches.	9 A.M.			P.M.		9 h. A.M.								
		Barometer.	Attached Thermometer.	Barometer.	Attached Thermometer.	Max. No.	Min. No.	Max. No.	Min. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	No.	No.			Velocity, (0-6), and Direction.	Amount, (0-10), and Species.		Velocity, (0-6), and Direction.	Amount, (0-10), and Species.	No.					No.	No.		
		No.	inches.	No.	inches.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.		No.	No.	No.					No.	No.	No.	No.
		inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.		inches.	inches.	inches.					inches.	inches.	inches.	inches.
	1	29.13	43	29.10	44	48	30			38	37	37	36	S	14															Bright sunshine throughout	1				
	2	28.93	41.5	29.30	43	46.5	25			41	40	40.5	37	S	8															Stormy and wet. A.M. Dull P.M.	2				
	3	29.37	40.5	29.18	43	44.5	29			36	34.5	45	44	S	1															Passing clouds A.M. Dull slight rain P.M.	3				
	4	29.30	48	29.57	49	52.5	40			50	47	45	42	W	14															Sunshine with passing clouds, stormy	4				
	5	29.84	45	29.93	45	45	33.5			41.5	38.5	38.5	36	W	18															Calms dull day	5				
	6	30.27	38.5	30.18	40	40	21			28.5	28	32	32	SW	1																Bright sunshine throughout	6			
	7	29.98	39	29.92	41	42	28.5			35.5	35	37.5	37	S	1																Dull A.M. overcast P.M.	7			
	8	29.69	42	29.92	43	43	33			39.5	39	40	39.5	SE	1																Heavy rain during the night. Rain P.M.	8			
	9	30.18	42.5	29.96	44.5	43	31.5			37	36	32.5	32	SE	14																Thunder P.M.	9			
	10	29.44	43	29.37	43.5	46	27			41.5	40	39	37.5	W	1																Sunshine throughout	10			
	11	29.13	41	29.31	41.5	44	30			37	35.5	35.5	34.5	W	14																Sunshine with passing A.M. Dull P.M.	11			
	12	29.68	40	29.81	40	42	27.5			37.5	34.5	36.5	34	SW	1																Sunshine throughout	12			
	13	29.72	44.5	29.80	49.5	54	32			57	49.5	53.5	50	W	14																Sunshine A.M. overcast P.M.	13			
	14	29.80	50	29.83	57.5	56	46			50.5	49.5	53	51	SW	14																Dull throughout	14			
	15	29.87	52	29.78	52.5	54	44			50	47.5	50.5	48	W	14																	Bright sunshine A.M. Dull P.M.	15		
	16	29.67	53	29.77	53	54.5	43.5			52	51	48	47	W	14																	Sunshine A.M. with passing clouds P.M.	16		
	17	29.71	52	29.70	51	50.5	42			46.5	46	47.5	47	SE	1																	Dull A.M. Rainy P.M.	17		
	18	29.80	51.5	29.72	51.5	53	43			49.5	48	50.5	47.5	S	14																	Rainy A.M. Sunshine with passing clouds	18		
	19	29.80	52	29.82	52	54	46			51.5	49	50.5	48.5	S	14																	Very mild day but overcast	19		
	20	29.77	49.5	29.70	52	54	37			46.5	42	52	50	S	14																	Dull day high wind during the night	20		
	21	29.40	52	28.99	52.5	54	46.5			52.5	50	51	49.5	S	1																	Very bright autumn day heavy shower	21		
	22	29.41	49	29.30	49	48	39			44.5	42	46	43.5	SW	14																	(Overcast with slight showers)	22		
	23	29.47	47.5	29.49	49	49.5	35			46	44.5	46	44.5	SW	1																	Sunshine with passing clouds, stormy	23		
	24	29.53	49	29.59	48	49	36			46	45.5	40	39.5	S	1																	Very fine. Storm of the night. A.M. Dull P.M.	24		
	25	29.52	48.5	29.67	52	51.5	31			53	50	53.5	50	S	14																	Bright sunshine A.M. overcast P.M.	25		
	26	29.92	51.5	29.97	54	58	42			55	53	52.5	51	S	1																	Rainy A.M. Sunshine with passing clouds	26		
	27	29.98	51.5	29.98	52.5	54	44.5			57	48	50.5	48	S	14																	Dull throughout. Stormy	27		
	28	30.00	48	30.03	49	48	33			58.5	38	45	44	S	1																	Very mild Dull day	28		
	29	30.10	47	30.07	45	48.5	27.5			34.5	33.5	34.5	35	S	1																	Dull & stormy with occasional winds	29		
	30	29.97	42.5	29.48	47	42.5	39			35	34	37.5	36	SE	1																	Sunshine with passing clouds	30		
	31																																Sunshine throughout	31	
																																	Bright Sunshine		
	Sums.	1711	444			444	312			147	155																								
		211.09	207.0			263.0	156.0			138.1	57.60																								
	Means.	29.670	46.5			48.8	35.2			44.0	42.2																								
	† Total Corrections for Instrumental Errors.	+0.60	+1.60							+1	-2	+1	-2																						
	† Corrections for Diurnal Range.																																		
	"Corrected Means."	29.730								44.1	42.0																								
	No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31			

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction $\frac{1}{4}$ for Temp. (Col. 2), = 29.730..... - 0.146..... = 29.684
"Corrected Mean" of Barometer at 9 P.M., minus the Correction $\frac{1}{4}$ for Temp. (Col. 4), =
Mean at Station, corrected, and at 32°, = 29.684
Correction for Height, feet, above Mean Sea-level, = 2.09
Mean, reduced to 32°, and Sea-level, = 29.893
Highest Reading, corrected for Index error, on the 6 th, = 30.270
Lowest Do., Do., on the 2 th, = 28.630
Difference, or Monthly Range, = 1.340

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 26 th, = 58.0
Lowest in Month, corrected for Index errors, on the 6 th, = 21.0
Difference, or Monthly Range, = 37.0
"Corrected Mean" of all the Highest, (Col. 5), = 48.8
"Corrected Mean" of all the Lowest, (Col. 6), = 35.2
Difference, or Mean Daily Range, = 13.6
** Calculated Mean Temperature of Month, = 42.0

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = 44.1
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 42.0
† Computed Temperature of Dew-point, = 39.5
† Do. Elastic Force of Vapour, = 2.43
† Do. Weight of Vapour in a Cubic Foot of Air, =
† Relative Humidity, (Saturation = 100), = 83
RAIN fell on Days; Amount in Inches, = 1.28

WIND.		SUMMARY.									
Direction.		N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.		1	2	0	2	13	6	5	1	0	
P.M.		0	1	0	0	13	7	6	3	0	
Mean.		0	2	0	1	13	6	6	2	0	

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

N.B.—The Sums to be correctly added, and the Means deduced. Returns from the "Principal Towns" should be in Edinburgh not later than the 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and Return verified by

(Signed) Mr. Morrison

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 time involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

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

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

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

An excellent Barometer 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 Royal Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus by the aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; their co-incidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern, and is secured by a screw, to form one *straight line* with those on its ivory frame; the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this *preliminary* setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *vernier*.

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

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

In taking an *Observation*, the attached Thermometer is first noted: the tube must then be gently tapped and the cistern-adjustment carefully made. By raising and lowering the eye, it must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and face from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer. **Protection of Thermometers.** The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside, and black within, and fixed 4 feet above grass in an exposed position, free from merely local influences. The lids 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 at the Society's Office.

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

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

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

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

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index, or column, of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°·9, 40°·0, or 40°·1; or again, 40°·4, 40°·5, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½, respectively. So also 40½, and 40¾, more or less, must be registered 40°·5, 40°·3, and 40°·4, 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 a.m. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the self-registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 3rd are those of a series of phenomena commencing at 9 p.m. on the 2nd, and extending till 9 p.m. on the 3rd.

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

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

The Council would strongly recommend that every Observatory be furnished with a Hæmiphspherical-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, the *United States* Anemometer is also recommended: the method of *Estimating* Wind Force by such tables as that given in the schedule is, to say the least, unsatisfactory.

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

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When a snow shower occurs it must be noted in the "*Remarks*," and the letter S affixed to the depth of water received in gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as 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 nomen-

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

Observations of the clouds are made at 9 a.m. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "*Velocity*" and "*Direction*," 2, W., (for example,) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "*Cloud*" column, an entry of 2, east., (*e.g.*) will indicate that the higher regions are covered to the "*amount*" of 4-fifths with *stratus* clouds; and that the sky is further obscured to the extent of 2-fifths 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., 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames. Mention must be made of the geological formation, and agricultural condition of the soil in which these thermometers are placed.

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

Temperature of Wells.—The temperature of the water at the bottoms of wells ought, when practicable, to be taken, and the depth of the well and of the water noted. **Ozone.**—Mention whether Schönbien's or Mofat's papers are used—Mofat's are preferred. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 a.m. and 9 p.m. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3 p.m., as an ozone entry in the schedule, will indicate that the ozone paper is tinted as 4, 3, on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4," 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, 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 of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

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

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

(By Order.) A. B.

EDINBURGH, 17th July 1861.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In flower.	First appearance.	In leaf.	Diseased of	CROPS.	Sowing or planting.	In ear or raised.	First Cut										
Alder,					Barley,													
Beech,					Bare or Bigg,													
Birch,					Oats,													
Elm,					Wheat,													
Larch,					Beans,													
Maple,					Potatoes,													
Oak,					Turnips,													
Sycamore or Plane,					Rye Grass,													

SHRUBS, ETC.	First in Blossom.	First in Blossom.	Fruit ripe generally.	First Appearance.										
Burberry,					Cuckoo,									
Bourtree or Elder,					Curtlew,									
Broom,					Horse-Swallow,									
Hazel,					Lapwing,									
Hawthorn,					Plover,									
Holly,					Sand-Martin,									
Laburnum,					Starling,									
Myrtle,					Swall,									
Myrtle,					Rail or Corn Crake,									
Mountain Ash or Rowan,					Other Birds, naming them,									
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, Kraits, 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.

Mr. ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

BOOK-POST.

Edinburgh, 1863.

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

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

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scales* 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 sites 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 co-incidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *index-line* on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this *preliminary* setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *vernier*.

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

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

In *taking an Observation*, the attached Thermometer is first noticed: the tube must then be gently tapped and the cistern-adjustment carefully made. By raising and lowering the eye, it must be brought into the plane of the back and front of the index—usually the lower edge of the *vernier*, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer. **Protection of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside, and black within, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as to once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had at the Society's Office.

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

The above remarks apply equally to the Thermometers for registering the greatest heat from the Sun's rays and the least from radiation during night. Their bulbs have a black coating, which may easily be made, or mended, by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "*Maximum*," whose sides protect the bulbs from the wind. The "*Minimum*," should rest freely exposed to the Sun, and the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the Sun's heat, to affect the alcohol by dissipation.

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

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

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

Reading of the 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 read—38°·3, 40°·0, or 40°·1; or again, 40°·4, 40°·3, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½, respectively. So also 40½, and 40¾, more or less, must be registered 40·2 or 40·3, and 40·7 or 40·8 respectively. In reading Rutherford's "*Max.*" and "*Min.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

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

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

Clouds.—Convenient abbreviations for Luke Howard's nomen-

clature 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 90° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *cloud* column, though their appearance and changes ought to be noted among the "*Remarks*." The amount of cloud is entered 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 *average* 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, *cast.*, (*e.g.*) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

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

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

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

Ozone.—Mention whether Schönbien's or Moffat's papers are used—Moffat's are preferred. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3°, as an ozone entry in the schedule, will indicate that the ozone paper is tinted as "3°" on the scale, that the wind is from the N.W., and that its force on the scale 0—9 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, &c. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been limited at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

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

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

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

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

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

(By Order,) A. B.

Edinburgh, 17th July 1861.

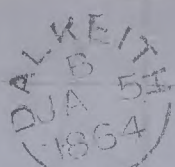
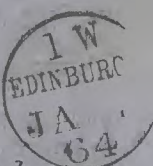
BOOK-POST.

10, St Andrew Square,

EDINBURGH.

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,



FOREST TREES.		CROPS.		MIGRATORY BIRDS.	
In Flower.	In Leaf.	Planted or sown in the month.	First cut or raised.	First in Blossom.	First in Fruit ripe generally.
Alder,	Barley,	Bare or Bogs,	Oats,	Wheat,	Beans,
Asch,	Barley,	Bare or Bogs,	Oats,	Wheat,	Beans,
Beech,	Barley,	Bare or Bogs,	Oats,	Wheat,	Beans,
Birch,	Barley,	Bare or Bogs,	Oats,	Wheat,	Beans,
Blm,	Barley,	Bare or Bogs,	Oats,	Wheat,	Beans,
Larch,	Barley,	Bare or Bogs,	Oats,	Wheat,	Beans,
Line,	Barley,	Bare or Bogs,	Oats,	Wheat,	Beans,
Oak,	Barley,	Bare or Bogs,	Oats,	Wheat,	Beans,
Sycamore or Plane,	Barley,	Bare or Bogs,	Oats,	Wheat,	Beans,
FRUITS.		CROPS.		MIGRATORY BIRDS.	
First in Blossom.	First in Fruit ripe generally.	Planted or sown in the month.	First cut or raised.	First in Blossom.	First in Fruit ripe generally.
Apple,	Cuckoo,	House-Swallow,	Lapwing,	Plover,	Sand-Martin,
Black Currant,	Cherry,	Gooseberry,	Holly,	Hawthorn,	Hazel,
Broom,	Cherry,	Gooseberry,	Holly,	Hawthorn,	Hazel,
Bouffree or Elder,	Cherry,	Gooseberry,	Holly,	Hawthorn,	Hazel,
Barberry,	Cherry,	Gooseberry,	Holly,	Hawthorn,	Hazel,
Strawberry,	Plum,	Swan,	Rail or Corn Cuckoo,	Other Birds, naming them—	Wren,
Mountain Ash or Rowan,	Plum,	Swan,	Rail or Corn Cuckoo,	Other Birds, naming them—	Wren,
Red Flowering Currant,	Plum,	Swan,	Rail or Corn Cuckoo,	Other Birds, naming them—	Wren,
Rhododendron Ponticum,	Plum,	Swan,	Rail or Corn Cuckoo,	Other Birds, naming them—	Wren,
Whin,	Plum,	Swan,	Rail or Corn Cuckoo,	Other Birds, naming them—	Wren,

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

Walker
Dec. 1863.

T6