

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Elles College, County of Fairfax, in Lat. _____, Long. _____, Distance from Sea _____ miles.
Height of Cistern of the Barometer above Mean Sea-level _____ feet, above Ground _____ feet. During the MONTH of June 1878.
The Hours of Observation are of Greenwich Time.

[illegible]

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

| | | |
|---|---|-------------|
| S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the <u>4th</u> , | = | <u>73.4</u> |
| Lowest in Month, corrected for Index errors, on the <u>3rd</u> | = | <u>40.3</u> |
| Difference, or Monthly Range, | = | <u>33.1</u> |
| " Corrected Mean " of all the Highest, (Col. 5), | = | <u>62.5</u> |
| " Corrected Mean " of all the Lowest, (Col. 6), | = | <u>48.2</u> |
| Difference, or Mean Daily Range, | = | <u>14.3</u> |
| ** Calculated Mean Temperature of Month, | = | <u>55.4</u> |
| | | |
| S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the th, | = | |
| " Corrected Mean, " (Col. 7), of Black Bulb, Max. in Sun, | = | |
| Lowest at Night, Black Bulb, (corrected for Index errors), on the th, ... | = | |
| " Corrected Mean, " (Col. 8), of Black Bulb, Min. on grass, | = | |
| Difference of above Means or Range ("exposed"), | = | |

| | | |
|--|---|------|
| HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb , (Cols. 9 and 11), | = | 54.7 |
| Mean (corrected) A.M. and P.M. Reading of Wet Bulb , (Cols. 10 and 12), | = | 53.8 |
| ‡ Computed Temperature of Dew-Point , | = | 52.9 |
| ‡ Do. Elastic Force of Vapour , | = | 40.3 |
| ‡ Do. Weight of Vapour in a Cubic Foot of Air , ... | = | 4.50 |
| ‡ Relative Humidity , (Saturation = 100), | = | 94 |
| RAIN fell on Days; Amount in Inches , | = | 2.00 |

[illegible]

Observations made and
Return verified by

(Signed)

Greatest Daily Range = 27.1 on 1st

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 who kindly furnish Reports to the Society will by a scrupulous attention to the following Directions secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

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

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

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

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

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

The Barometer should be suspended in a good *light*, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire. In taking an observation, the attached Thermometer is first noted; the tube must then be gently tapped and the cistern-adjustment carefully made. By raising and lowering the eye, it must be brought into the plane of the back and front of the index, usually the lower edge of the vernier, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The 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 may also be made to open to the south.

Self Registering Thermometers.—Professor Philip'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 and should be affixed to a frame separate from the "Maximum." It is recommended that these Thermometers be graduated on the glass stem. The "Minimum" Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *columns* of spirit breaks, it may be 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 upper lobe, and must be

dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally. The above remarks apply equally to the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night. Their bulbs have a black coating, which may easily be made, or mended, by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "Maximum" should be freely exposed to the sun, and the "Minimum" should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by dissipation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers 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.

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

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° 9.4, 40° 0, or 40° 1; or again, 40° 4.4, 40° 5, or 40° 6, according to whether 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 should be taken; and when it is stationary, and always when the wind is feeble, reference may be made 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 recommend that every observatory be furnished with a Hemispherical-Cup Anemometer—a self-registering instrument which shows the amount of Wind that passes in 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 may also be 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 at 9 a.m., and the readings entered in the returns of the day previous.

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

Clouds.—Convenient abbreviations for Luke Howard's nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from

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

Observations of the clouds are made at 9 a.m. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity 6, S. W."

and Direction," 2, W. (for example,) will indicate that the upper strata of clouds travel with *extreme* velocity from S. W., and those in the lower regions from W. with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of 4, st. 2, cu-st. (*e.g.*) will indicate that the higher regions are covered to the "amount" of 4 tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2 tenths by lower clouds of the *cumulo-stratus* kind.

Sunshine.—The number of hours in which objects in the sun's rays cast shadows, should be entered in the proper column. **Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 a.m., by thermometers placed in the earth, their bulbs being sunk, 6 inches of 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 should 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 boats, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, noting always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

Temperature of Wells.—The temperature of the water at the bottoms of wells ought, when practicable, to be taken, and the depth of the well and of the water noted. **Comet.**—Mention whether Schœnbrun's or Molliet's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 a.m. and 9 p.m. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3½, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as 3½ 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 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 should be recorded.

By the use of abbreviations the state of the weather at 9 a.m. and 9 p.m. should be registered, either in two columns, otherwise unoccupied, or in a 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 so that the published Summaries may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year, on a selected piece of ground or farm.

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

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

The Council recommend observers, before purchasing new instruments, to 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. LONDON, November 1874.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

| FOREST TREES. | Plants. | Grasses. |
|------------------------------|-------------------------|----------------------|
| Alder, | Barley, | Rye Grass, |
| Beech, | Bare or Bigg, | Timothy, |
| Birch, | Oats, | Potatoes, |
| Elm, | Wheat, | Pease, |
| Larch, | Beans, | |
| Lime, | | |
| Oak, | | |
| Sycamore or Plane, | | |

| SHRUBS, ETC. | Plants. | Grasses. |
|----------------------------------|--------------------------|-------------------------------|
| Barberry, | Apple, | Rail or Corn Crake, |
| Boutree or Elder, | Black Currant, | |
| Broom, | Cherry, | |
| Hazel, | Gum, | |
| Hawthorn, | Roseberry, | |
| Holly, | Teach, | |
| Laburnum, | Pear, | |
| Lilac, | Plum, | |
| Mezereum, | Strawberry, | |
| Mountain Ash or Rowan, | | |
| Red Flowering Currant, | | |
| Rhododendron Ponticum, | | |
| Whin, | | |

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

BOOK POST.

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EDINBURGH.

Edinburgh 2
June 1875