

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Thurso Cluny Castle, County of Shroderen, in Lat. _____, Long. _____, Distance from Sea 17 miles.Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground _____ feet.During the MONTH of January 187 2.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.			SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER.				WIND.				RAIN.	CLOUDS.		STUNNED.	THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.								
		9 h. A.M.		9 h. P.M.	Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.			9 A.M.	P.M.		9 h. A.M.														
		Barometer.	Attached Thermometer.	Barometer.	Attached Thermometer.	Max.	Min.	Max.	Min.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.		Force.	No. of hours in which it fell.		Amount in inches.	Velocity (0-10), and Direction.	Amount (0-10), and Species.					Velocity (0-10), and Direction.	Amount (0-10), and Species.	No. 1.	No. 2.	No. 3.	Temperature of Well, at 10 A.M.	Temperature at 10 A.M. and Density.	9 A.M. 9 P.M.
		* 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.
		1	29.081	48	29.375	38	46	28		46	43	41	40	SW	11/10.																High wind all day, a very	1			
		2	29.149	48	29.065	46	43	32		41	39	36	35	SW	SW																High wind throughout	2			
		3	29.158	45	29.062	43	40	26		32	31	38	38	SE	SE																High wind throughout	3			
		4	28.556	45	28.577	40	42	32		38	37	35	33	SW	SW																High wind throughout	4			
		5	28.262	43	28.658	45	38	33		33	32	36	33	SE	SW																High wind throughout	5			
		6	28.708	45	28.763	43	40	30		39	37	34	33	SW	SW																High wind throughout	6			
		7	28.873	39	28.771	40	42	37		33	32	35	35	SE	NE																High wind throughout	7			
		8	28.821	40	28.967	41	37	29		21	20	33	32	W.	NE																High wind throughout	8			
		9	29.277	42	29.625	38	39	25		37	36	27	27	W.	"																High wind throughout	9			
		10	29.642	42	29.417	41	38	22		26	25	36	36	SE	NE																High wind throughout	10			
		11	29.262	43	29.464	42	45	30		28	28	44	40	SE	SE																High wind throughout	11			
		12	29.670	40	29.464	42	41	25		28	28	44	40	SE	SW																High wind throughout	12			
		13	29.310	44	29.410	44	42	39		28	28	44	40	SE	SW																High wind throughout	13			
		14	29.262	43	29.517	41	47	33		28	28	44	40	SE	SW																High wind throughout	14			
		15	29.456	45	29.459	44	41	30		28	28	44	40	SE	SW																High wind throughout	15			
		16	29.549	42	29.262	43	43	32		28	28	44	40	SE	SW																High wind throughout	16			
		17	28.792	44	28.204	42	46	34		28	28	44	40	SE	SW																High wind throughout	17			
		18	27.852	48	28.352	46	49	38		28	28	44	40	SE	SW																High wind throughout	18			
		19	28.605	46	29.007	45	43	34		28	28	44	40	SE	SW																High wind throughout	19			
		20	29.167	41	29.170	40	40	25		28	28	44	40	SE	SW																High wind throughout	20			
		21	29.261	44	29.160	44	40	24		28	28	44	40	SE	SW																High wind throughout	21			
		22	29.286	42	29.115	42	38	24		28	28	44	40	SE	SW																High wind throughout	22			
		23	28.762	43	28.458	43	42	33		28	28	44	40	SE	SW																High wind throughout	23			
		24	28.353	47	28.264	43	42	35		28	28	44	40	SE	SW																High wind throughout	24			
		25	28.608	45	28.915	43	43	29		28	28	44	40	SE	SW																High wind throughout	25			
		26	29.153	46	29.459	44	44	39		28	28	44	40	SE	SW																High wind throughout	26			
		27	29.556	45	29.614	42	43	32		28	28	44	40	SE	SW																High wind throughout	27			
		28	29.680	36	29.112	43	39	22		28	28	44	40	SE	SW																High wind throughout	28			
		29	29.388	45	29.165	42	43	33		28	28	44	40	SE	SW																High wind throughout	29			
		30	29.099	48	29.094	50	52	35		28	28	44	40	SE	SW																High wind throughout	30			
		31	29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																High wind throughout	31			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
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			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
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			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35		28	28	44	40	SE	SW																	High wind throughout			
			29.205	46	28.949	48	42	35																											

BAROMETER, “corrected Mean” at 9 A.M., minus the Correction†† for Temp. (Col. 2), = 29.015
“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = 29.046
Mean at Station, corrected, and at 32°, = 29.031
Correction for height, feet above Mean Sea-level, = 31.2
Mean, reduced to 32°, and Sea-level, 29.343
Highest Reading, corrected for Index error, on the 18th, = 29.680
Lowest Do. Do., on the 18th, = 27.852
Difference, or Monthly Range, = 1.828

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 30th, = 52.0
Lowest in Month, corrected for Index errors, on the 22th, = 21.0
Difference, or Monthly Range, = 31.0
“Corrected Mean” of all the Highest, (Col. 5), = 49.2
“Corrected Mean” of all the Lowest, (Col. 6), = 31.7
Difference, or Mean Daily Range, = 17.5
** Calculated Mean Temperature of Month, = 36.7

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), = 38.0
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 37.0
†† Computed Temperature of Dew-Point, = 35.6
†† Do. Elastic Force of Vapour, = 2.08
†† Do. Weight of Vapour in a Cubic Foot of Air, = _____
†† Relative Humidity, (Saturation = 100), = 91
RAIN fell on 16 Days; Amount in Inches, = 3.32

WIND.		SUMMARY.					
Direction.	N	NE	E	SE	S	SW	W
A.M.	1	12	13	13	1		
P.M.	2	7	13	6	2		
Mean.	0	20	21	13	4	1	

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

Observations made and
Return verified by

Alexandra McDonald

(Signed)

Alexandra McDonald

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

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

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

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

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

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

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *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 surfaces the top of the tube, a *slight tap* is produced. If this is perceived by air it may be removed to the cistern, and got rid of, by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired.

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

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

Position of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as at once to "protect" the Thermometers and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians, Negretti and Zambra's Patent "Marine" 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 attached to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *column of spirit breaks*, it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally. The above remarks apply equally to the Thermometers for registering the greatest heat from the sun's rays, and the least

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus specially vitiate the "Hygrometrical Deductions," Observers are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scale and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which thus 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 heavy weather observation is a matter of much delicacy, and must be made with great care. The bulb must be insulated 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 globe in ordinary circumstances.

The form of "Shanon's Hygrometer" is highly objectionable, also supports the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the 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° 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 24 are those of a series of phenomena commencing at 9 p.m. on the 24, and extending till 9 p.m. on the 25.

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

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

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

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

Snowfalls may, for convenience, be registered in the rain columns, under the following conditions:—when a Snow shower occurs it must be noted in the "Remarks" and the letter S affixed to the depth of water received in 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

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

Observations of the clouds are made at 9 a.m. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," $2, W, \frac{1}{2}$, (for example) will indicate that the upper strata of clouds travel with *eastern* 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 $\frac{2}{3}$, (e.g.) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further observed to that of 2-tenths by lower clouds of the *cumulo-stratus* kind.

Sunshine.—The number of hours in which objects in the sun's rays cast shadows, should be entered in the *prob. or cloud*. 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 flow of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, nothing always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

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

Ozone.—Mention whether Schönbach's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 a.m. and 9 p.m. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 5° 7, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3 on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4"; i.e., that it is *blowing fresh*.

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

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

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

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

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

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

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

(By Order) A. B.

EDINBURGH, 12th November 1872.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

EDINBURGH.

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

MR ALEXANDER BUCHAN,



14 Y
EDINBURGH
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SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *The Gardens, Spring Castle*, County of *Merchiston*, in Lat. _____, Long. _____, Distance from Sea *17* miles.Height of Cistern of the Barometer above Mean Sea-level *280* feet, above Ground _____ feet.During the MONTH of *February* 187*2*.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.		SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M.				HYGROMETER.				WIND.				RAIN.		CLOUDS.		THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.						
		9 h. A.M.	9 h. P.M.	Max. in Shade, 4 feet above Ground.	Min. in Shade, 4 feet above Ground.	Max. in Sun's rays.	Min. on Grass.	9 h. A.M.	9 h. P.M.	9 h. A.M.	9 h. P.M.	Direction.	Force.	Direction.	Force.	Readings of the Hygrometer, No. of hours in which it fell.	No. of hours in which it fell.	9 A.M.	P.M.	9 h. A.M.												
																				No. 1.	No. 2.	No. 3.										
		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.	9 h. A.M.	P.M.	No. 1.	No. 2.	No. 3.	Temperature of Well at depth of feet, No.	Temperature at 1 fathom, and Density.	9 A.M. 9 P.M.							
		inches.		inches.																												
	1	28.840	53	29.049	48	50	40			47	46	45	44	SW	8	SW	8															
	2	28.999	48	29.252	47	47	39			42	39	44	41	SW	8	SW	8															
	3	29.409	46	29.355	46	45	39			42	40	42	40	SW	8	SW	8															
	4	29.252	47	29.477	47	47	37			43	41	41	40	SW	8	SW	8															
	5	29.355	46	29.254	49	43	38			43	42	43	41	SE	8	SW	8															
	6	29.197	49	29.355	46	47	35			44	42	37	36	SW	8	SW	8															
	7	29.532	45	29.622	39	47	26			32	32	29	29	SE	8	SE	8															
	8	29.678	38	29.670	40	39	21			26	25	35	35	SE	8	SE	8															
	9	29.609	44	29.456	45	43	32			41	40	43	42	SE	8	SE	8															
	10	29.405	46	29.443	50	50	40			47	44	45	44	SW	8	SE	8															
	11	29.446	49	29.498	48	48	40			46	45	44	43	SW	8	SE	8															
	12	29.498	48	29.556	45	44	38			44	42	40	39	SE	8	SE	8															
	13	29.548	48	29.598	48	41	37			41	40	40	39	SE	8	SE	8															
	14	29.598	48	29.564	42	40	36			39	38	38	37	SE	8	SE	8															
	15	29.551	47	29.564	43	40	35			40	39	38	38	SE	8	SE	8															
	16	29.452	45	29.320	40	39	34			38	37	36	36	SE	8	SE	8															
	17	29.190	44	29.112	43	40	32			37	36	40	39	SE	8	SW	8															
	18	29.007	45	29.110	44	45	36			37	35	39	37	SE	8	SW	8															
	19	29.076	44	29.215	42	46	30			38	36	37	37	SE	8	SW	8															
	20	29.270	40	29.317	41	44	27			33	32	37	36	SE	8	SE	8															
	21	29.415	42	29.612	43	49	31			39	38	39	38	SW	8	SW	8															
	22	29.628	36	29.433	45	42	25			39	31	42	41	SE	8	SW	8															
	23	29.450	40	29.365	42	54	31			38	37	31	31	SW	8	SE	8															
	24	29.325	38	29.260	44	42	28			38	37	40	39	SE	8	SE	8															
	25	29.265	42	29.322	43	42	38			42	41	40	39	SE	8	SE	8															
	26	29.607	42	29.764	42	43	36			38	36	39	38	SW	8	SW	8															
	27	29.850	40	29.764	42	46	33			38	37	34	33	SW	8	SW	8															
	28	29.594	40	29.215	42	43	31			35	34	40	39	SW	8	SW	8															
	29	28.962	43	29.049	48	56	36			47	44	44	43	SW	8	SW	8															
	30																															
	31																															
Sums.		1115 1/2	1272	833 3/4	1374 1/2	1301	987			1117 1/2	1106	1106	1106																			
Means.		11 03 3	12	11 6	12 1/2	11 1/2	9 8			11 1/2	11 06	11 06	11 06																			
† Total Corrections for Instrumental Errors.																																
‡ Corrections for Diurnal Range.																																
“Corrected Means.”																																
No. of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

BAROMETER, “corrected Mean” at 9 A.M., minus the Correction†† = *29.337*
for Temp. (Col. 2), = *2.03.9* - *0.42*

“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† = *29.358*
for Temp. (Col. 4), = *2.9.4.00* - *0.42*

Mean at Station, corrected, and at 32° = *29.348*
31.0

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

Mean, reduced to 32°, and Sea-level, = *29.658*

Highest Reading, corrected for Index error, on the *27* th, = *29.850*

Lowest Do. Do., on the *1* th, = *28.840*

Difference, or Monthly Range, = *1.010*

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the *29* th, = *56.0*

Lowest in Month, corrected for Index errors, on the *8* th, = *21.0*

Difference, or Monthly Range, = *35.0*

“Corrected Mean” of all the Highest, (Col. 5), = *44.9*

“Corrected Mean” of all the Lowest, (Col. 6), = *33.8*

Difference, or Mean Daily Range, = *11.1*

** Calculated Mean Temperature of Month, = *39.4*

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

“Corrected Mean,” (Col. 7), of Black Bulb, Max. in Sun, = _____

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

“Corrected Mean,” (Col. 8), of Black Bulb, Min. on grass, = _____

Difference of above Means or Range (“exposed”), = _____

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = *39.6*

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = *38.3*

†† Computed Temperature of Dew-Point, = *36.6*

†† Do. Elastic Force of Vapour, = *217*

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

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

RAIN fell on *16* Days; Amount in Inches, = *6.00*

WIND.		SUMMARY.									
Direction.	N	NE	E	SE	S	SW	W	NW	Common Designation.	Mean Force.	Mean Velocity in miles per day.
A.M.											
P.M.											
Mean.	<i>0</i>	<i>1</i>	<i>1</i>	<i>14</i>	<i>0</i>	<i>10</i>	<i>0</i>	<i>3</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.

† Enlarging corrections for both capacity and Index Errors.

‡ The Diurnal Range for Scotland is as yet unknown.

†† “Corrected Means” are calculated from Glaisher’s Hygrometrical Tables, Second Edition only.

‡‡ These “Hygrometrical Deductions” are calculated from the Arithmetical Mean of Cols. 5 and 6 will be entered as the “Calculated Mean Temperature.”

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

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

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

Observations made and
Return verified by

(Signed) *Allyson McDonald*

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Ladsen Cherry Cattle, County of Alberdeen, in Lat. _____, Long. _____, Distance from Sea 17 miles.

Height of Cistern of the Barometer above Mean Sea-level 280 - feet, above Ground _____ feet.

During the MONTH of March 187 2

The Hours of Observation are of Greenwich Time.

[illegible]

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction††)
for Temp. (Col. 2), = 24.410... - .042... = 24.368

"Corrected Mean" of Barometer at 9 p.m., minus the Correction††
for Temp. (Col. 4), = $29.421 - 0.43 = 29.378$

Mean at Station, corrected, and at 32°,..... = 29.373

Correction for height, feet above Mean Sea-level,..... = 319

Mean, reduced to 32°, and Sea-level, 27.003 29.907

Highest Reading, corrected for Index error, on the 10 th,..... = 29.956

Lowest Do. Do., on the 28th,..... = 78.006

Difference, or **Monthly Range**,..... 1020

* 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.

† Entailing corrections for both explanatory and Index Errors.

‡ The Durnal Range for Scotland is as yet unknown.

§ Provisionally, though not absolutely a mine correction.

|| The Hygrometrical Deductions are taken from Glaisher's Hygrometrical Tables, Second Edition only.

¶ While the Durnal Range is unknown, the Arithmetical Mean of Cols. 8 and 9 will be entered as the "Calculated" Mean Temperature.

‡ The Arithmetical Mean of Cols. 10 and 11 will be entered as the "Calculated" Mean Direction on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. See cols.

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the 16th,..... 61.0 =

Lowest in Month, corrected for Index errors, on the 21 th, 22.0 =
Difference or Monthly Range 34.0 =

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

"Corrected Mean" of all the Lowest, (Col. 6), **323** =

Difference, or **Mean Daily Range**, 14.4 =

** Calculated Mean Temperature of Month, 39.5 =

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for

"Connected WE-100" (C-1-7) - 6 W-1, 1 B-14, W-1, C

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

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

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

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

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

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

Do. Elastic Force of Vapour, =

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

RAIN fall on // **RAIN** Amount: 1.1

RE: K 57186	
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WIND.										SUMMARY.	
Direction.	N	NE	E	SE	S	SW	W	NW	Calm or	M	

[illegible]

	1	2	3	4	5	6	7
P.M.	1	2	3	4	5	6	7

	9	0.	2	7	10.	2.	
Mean.	6	7	1	3	2	0	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 3d, those from Other Places, not later if possible than the 6th. This Schedule not to be Gunned or Fastened, and Forwarded by Book Post, prepaid.

Observations made and
Return verified by

(Signed)

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

One of the objects of immediate importance that the Scottish Meteorological Society has proposed to itself, is to secure a *perfect uniformity* in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different observations; and it is found that differences between the Returns from any two Stations, so very considerable as to render them quite 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 scale. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading at what time it was taken, if not at 9 o'clock.

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

Two moderate-priced Barometers have been approved of by the Council: if properly tested and attended to, they are both well adapted to Meteorological purposes. An excellent Barometer is constructed by Mr. A. de London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-heights* are not three 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 *plumb-line* 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 upturned. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument, so that the mercury strikes the top of the tube, a *sharp 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 tipping it; and if this plan fails, the instrument must be replaced in a good *hull*, 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 "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians, *Self-Registering Thermometers*.—Professor Phillips, and Negretti and Zamboni's Patent "Marine" 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 drawbacks, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be re-united by stirring the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

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

Registration of Thermometers.—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are *new* graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scales, and ought never afterwards to be used without being *re-tested*. The self-registering, and especially the "Minimum" Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer (marked by a scratch on the tube) ought to be tested once a year, in snow melting ice. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Society.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "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 mastin 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 mastin is always *clean and moist*, and the water pure. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist 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 Hygrometer.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index, or of a degree, and noted in decimals. Thus the thermometer will be read as 39.9, 40.0, or 40.1; or again, 40.4, 40.9, or 40.6, according as it indicates a little under, an exact coincidence with, or a little over 40° or 40.5° respectively. So also 41.3, and 40.3, more or less must be read as 40.2 or 40.3, and 40.7, or 40.8 respectively. In reading Rutherford's "Hygrometer" and "Hygrometer," the indications of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

The Council recommend that every observatory be furnished with a *Standard 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 unworkable attraction for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauges; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

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

Clouds.—Convenient abbreviations for Luke Howard's

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity 6, S. W." (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, (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 consistency,—the Council recommend that observations in this interesting department be made at 9 A.M., by Thermometers placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and fixed with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames. Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

Temperature of the Sea.—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 1st, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When conveniently extra sea observations might be taken for other and greater depths, noting always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

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

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

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

Remarks.—The "Remarks" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no scales can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognized and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds; the colour of the sky, etc. Remarks ought to be made on the occurrence of mists, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms as have been 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 that 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 selected pieces of ground or farm.

The Council recommend that *year day* observations be taken;—viz., on the 21st days of March, June, September, and December. Full directions for the use of the instruments mentioned above have been printed, and may be had along with them from the makers.

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

Edinburgh, 19th November 1872.

(By Order) A. B.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

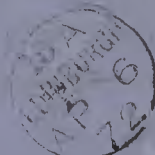
FOREST TREES.	In Flower.	Leaf Buds First appear.	In Leaf.	Divested of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First out or Raised.
Alder,					Barley,				
Ash,					Bere or Bigg,				
Beech,					Oats,				
Birch,					Wheat,				
Elm,					Beans,				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

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

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

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

MR ALEXANDER BUCHAN,



SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Perthshire Cling Castle, County of Aberdeen, in Lat. _____, Long. _____, Distance from Sea 17 miles.
Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground 4 feet. During the MONTH of April 187 2
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.				SUNSHINE. Hours.	THERMOMETERS under Ground.			SEA. Temperature at 1 fathom, and Direction.	OZONE. 0—10.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. Mention the hour at which Storms, including Thunder and Lightning, began and ended.	Days of Month.			
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 A.M.		P.M.			9 h. A.M.									
		Barometer.	Attached Thermometer.	Barometer.	Attached Thermometer.	Max. No.	Min. No.	Max. in Sun's rays	Min. on Grass.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Readings of the H. Cup Anemometer. No. —	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.
		* No.	No.	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.	°	°	°	°	°	°	°	°																				
	1	29.531	42	29.509	44	41	30			57	36	36	35	NW	10																1	
	2	29.245	42	29.557	43	46	30			42	40	36	35	N	10			0.07													2	
	3	29.362	43	29.405	46	44	33			40	39	36	36	W	10			0.06													3	
	4	29.693	44	29.869	40	48	30			41	40	32	31	N	10			0.05													4	
	5	29.099	45	30.084	46	46	25			43	40	37	36	S	10																5	
	6	29.995	48	29.893	50	60	31			51	46	50	45	S	10																6	
	7	29.843	50	29.645	50	55	44			52	48	45	44	SE	10																7	
	8	29.443	50	29.648	48	54	39			50	45	40	39	NW	100																8	
	9	29.893	50	29.746	49	55	37			45	42	42	40	NW	100			0.06													9	
	10	29.563	50	29.530	55	63	36			53	48	52	48	S	100																10	
	11	29.533	54	29.533	54	64	34			54	48	50	46	S	10																11	
	12	29.544	52	29.594	50	65	41			52	48	45	42	S	100																12	
	13	29.755	53	29.738	52	53	39			51	46	46	42	NW	100			0.08													13	
	14	29.735	53	29.730	55	64	40			53	49	50	46	NW	10																14	
	15	29.521	50	29.607	53	60	40			53	48	42	40	W	100																15	
	16	29.449	50	29.458	52	50	36			46	42	38	36	W	100																16	
	17	29.441	51	29.091	57	49	36			42	41	40	39	NE	10			0.13													17	
	18	29.648	48	29.757	48	46	34			40	39	35	34	W	100			0.07													18	
	19	29.698	48	29.548	47	42	31			38	37	36	35	W	100			0.08													19	
	20	29.483	47	29.465	48	41	30			38	37	33	32	SE	10			0.07													20	
	21	29.399	48	29.415	42	44	30			40	39	38	37	W	100			0.08													21	
	22	29.762	43	29.157	45	41	36			40	39	39	38	NE	100			0.08													22	
	23	29.099	48	29.145	46	46	36			40	39	44	43	SE	10			0.50													23	
	24	29.149	48	29.199	48	47	39			46	45	42	41	SE	10																24	
	25	29.147	49	29.244	50	54	30			52	49	43	42	SW	100			0.06													25	
	26	29.368	50	29.441	51	56	37			48	46	45	43	SE	10			0.08													26	
	27	29.535	52	29.498	48	54	34			52	47	46	45	SW	10																27	
	28	29.125	51	29.644	51	58	40			46	45	48	42	SW	100			0.07													28	
	29	29.821	52	29.984	53	61	32			52	48	48	44	SW	100			0.06													29	
	30	29.934	53	29.984	54	62	44			53	50	54	52	SW	100																30	
	31																														31	
Sums.		1518 14	10	1615 15	12	1349 10	10			1382 8	17	1246 12	12					209														
Means.		886 480	106 4	886 225	117 4	1349 103 4	10			1382 150 6	1246 110 5																					
+ Total Corrections for Instrumental Errors.		16 8	26	57 2	49	52 3	35 4			46 3	43 3	42 3	35 3																			
+ Corrections for Diurnal Range.		29.549	48	29.540	49	52 3	35 4			46 3	43 3	42 3	35 3																			
"Corrected Means."																																
No. of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	

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

TABLE FOR ESTIMATING FORCE OF WIND.					
Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.	Estimated Force, 0—6.	Common Designation.
0	Calm	1.5	Light breeze	4	Blowing hard
0.5	Very light air	2	Fresh breeze	5	Blowing a gale
1	Light air	2.5	Very fresh	6	Violent gale

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† for Temp. (Col. 2), = 29.496
"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), = 29.520
Mean at Station, corrected, and at 32°, = 29.508
Correction for height, feet above Mean Sea-level, = 307
Mean, reduced to 32°, and Sea-level, = 29.815
Highest Reading, corrected for Index error, on the 5th, = 30.099
Lowest Do., Do., on the 23th, = 29.099
Difference, or Monthly Range, = 1.000

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 12th, = 62.0
Lowest in Month, corrected for Index errors, on the 5th, = 25.0
Difference, or Monthly Range, = 40.0
"Corrected Mean" of all the Highest, (Col. 5), = 52.3
"Corrected Mean" of all the Lowest, (Col. 6), = 35.1
Difference, or Mean Daily Range, = 17.2
** Calculated Mean Temperature of Month, = 43.7

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 44.2
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 41.9
†† Computed Temperature of Dew-Point, = 39.2
†† Do. Elastic Force of Vapour, = .240
†† Do. Weight of Vapour in a Cubic Foot of Air, = _____
†† Relative Humidity, (Saturation = 100), = 82
RAIN fell on 5 Days; Amount in Inches, = 2.29

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

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

Observations made and
Return verified by

(Signed)

Alfred McDonald

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

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

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

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

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

An excellent barometer is constructed by Mr. A. de 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 *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 *seize* up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern up, or suspended. 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 *venier*, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the barometer.

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

Self-registering Thermometers.—Professor Phillips's, and Negretti and Zambra's Patent "Marine" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Marine" Thermometer of Bartholomew is recommended when graduated on the glass stem and affixed to a frame separate from the "Marine" Thermometer; this Thermometer is liable to be easily remedied by an observer. When the column of spirit breaks it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperatures, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol then evaporates and again condenses 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 and renewed, by the application of a mixture of lamp black and printer's ink. They are placed in station blackened boxes, which slides protect the bulbs from the wind. The "Marine" should rest on a wooden support, a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are not graduated on the stem, but merely on an attached scale, undergoing 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 "Marine" Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer (marked by a scratch on the tube) ought to be tested once a year, in snow or melting ice. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

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

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

Reading of the 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 40.2, and 40.3, more or less must be registered 40.2 or 40.3, and 40.7 or 40.8 respectively. In reading Robertson's "Max." and "Min." Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

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

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

Clouds.—Convenient abbreviations for Luke Howard's

nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *cloud* column, though their appearance and changes ought to be noted among the "Remarks." The amount of cloud is entered from scale of 0 to 10; thus when the sky overhead is *half covered* by clouds, 5 is entered as the *observation*, and so on. Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," 2, W., (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of 4, st., (*eq.*) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

Sunshine.—The number of hours in which objects in the sun's rays cast shadows, should be entered in the proper column. **Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature of the soil—its amount and constancy—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 8, 12, and 22 inches, and the stems above ground, protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames. Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

Ozone.—Mention whether Schönbach's or Mohr's papers are used. The paper is annexed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3+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 0-6 is "4 + 1/2," that it is *blowing fresh*.

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

Remarks.—The "Remarks" column is too narrow, but unfortunately so. Some of the most valuable observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken even when large of, and a list of such as are recognised and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character of colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the concurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and unaccountable falls of snow, hail, or rain, the hour of 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 *ten day* observations be taken;—viz., on the 21st days of March, June, September, and December.

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

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

Edinburgh, 20th November 1859.

(By Order) A. B.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

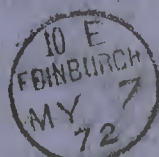
EDINBURGH.

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland,

MR ALEXANDER BUCHAN,

16



Plumy April 1872

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Lodge, Cherry Castle, County of Aberdeen, in Lat. 57° 17', Long. 9° 45', Distance from Sea 17 miles.
Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground feet.
During the MONTH of May 1872.
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No. —				WIND.				RAIN.				CLOUDS.				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, including Thunder and Lightning, began and ended.	Days of Month.	
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		No. of hours in which it fell.	Amount in inches.	Velocity (0—6), and Direction.	Amount (0—10), and Species.	Velocity (0—6), and Direction.	Amount (0—10), and Species.	9 h. A.M.										
		Barometer.	Atmos- phere.	Barometer.	Atmos- phere.	Max.	Min.	Max.	Min.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.							No. 1.	No. 2.		No. 3.							
		* No.	inches.	* No.	inches.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.							No.	No.		No.	No.	No.					No.
	1	29.872	58	29.843	52	60	50			58	57	54	51	SW	SW	SW	SW		0.03	Cast	Cast	Cast	Cast										Generally overcast, and fine	1
	2	29.777	56	29.677	56	66	44			54	51	49	48	SW	SW	SW	SW		0	Cast	Cast	Cast	Cast										Very fine throughout	2
	3	29.572	58	29.131	53	52	34			44	43	45	43	W	W	W	W		0	Cast	Cast	Cast	Cast										Stormy, and wind shifts	3
	4	28.740	52	29.748	49	51	37			43	41	43	42	W	W	W	W		0.07	Cast	Cast	Cast	Cast										Shower, and very heavy rain, after	4
	5	28.944	50	29.092	49	59	39			57	48	45	44	W	W	W	W		0.51	Cast	Cast	Cast	Cast										Generally overcast, and shower after	5
	6	29.053	49	29.099	48	49	40			44	43	43	42	W	W	W	W		0.50	Cast	Cast	Cast	Cast										overcast and shower, generally	6
	7	28.920	49	28.633	45	50	39			45	43	44	43	W	W	W	W		1.15	Cast	Cast	Cast	Cast										overcast, and shower	7
	8	28.942	51	29.294	50	51	36			48	45	47	40	W	W	W	W		0.03	Cast	Cast	Cast	Cast										overcast, and shower, and	8
	9	29.292	51	29.748	48	55	37			52	47	47	40	W	W	W	W		0.03	Cast	Cast	Cast	Cast										at intervals	9
	10	29.957	45	30.000	46	51	36			47	41	40	39	W	W	W	W		0.03	Cast	Cast	Cast	Cast										Several heavy hail showers, and	10
	11	29.957	45	30.000	47	45	33			47	39	42	40	W	W	W	W		0.03	Cast	Cast	Cast	Cast										Rough and showery, hail, and snow	11
	12	29.706	45	29.843	50	49	39			43	42	46	45	W	W	W	W		0.04	Cast	Cast	Cast	Cast										overcast, and shower	12
	13	29.992	50	29.891	51	58	40			49	46	45	44	SE	SE	SE	SE		0.14	Cast	Cast	Cast	Cast										Very fine, and bright sun, and	13
	14	29.788	52	29.724	56	59	43			52	50	50	49	NE	NE	NE	NE		"	Cast	Cast	Cast	Cast										cast, and shower	14
	15	29.641	57	29.580	53	57	44			48	47	47	46	SE	SE	SE	SE		0.83	Cast	Cast	Cast	Cast										drizzle, overcast, and drizzling rain	15
	16	29.496	49	29.496	49	49	40			46	45	43	42	NE	NE	NE	NE		0.17	Cast	Cast	Cast	Cast										but - more - warm	16
	17	29.479	49	29.498	48	48	36			45	43	38	37	W	W	W	W		0.34	Cast	Cast	Cast	Cast										heavy rain during the night, and up to 9 a.m.	17
	18	29.454	46	29.405	46	49	32			43	39	39	37	W	W	W	W		0.04	Cast	Cast	Cast	Cast										afterwards exceedingly fine, and bright sun	18
	19	29.347	42	29.387	45	50	30			46	42	40	38	W	W	W	W		"	Cast	Cast	Cast	Cast										Heavy shower, and	19
	20	29.294	50	29.404	46	54	29			49	44	41	40	SW	SW	SW	SW		"	Cast	Cast	Cast	Cast										about 5 P.M.,	20
	21	29.394	50	29.496	49	55	28			54	49	39	38	SW	SW	SW	SW		0.53	Cast	Cast	Cast	Cast										about 3 P.M., and shower	21
	22	29.496	49	29.493	50	52	33			43	42	43	41	SE	SE	SE	SE		0.16	Cast	Cast	Cast	Cast										Generally fine,	22
	23	29.498	48	29.496	49	50	38			45	43	41	40	NE	NE	NE	NE		0.38	Cast	Cast	Cast	Cast										showers, and shower, and	23
	24	29.654	46	29.746	50	55	33			48	44	49	47	SE	SE	SE	SE		0.27	Cast	Cast	Cast	Cast										very a variable state,	24
	25	29.680	55	29.822	58	65	39			57	53	56	54	SW	SW	SW	SW		0.05	Cast	Cast	Cast	Cast										showers, throughout -	25
	26	29.862	62	29.867	60	74	48			65	58	58	54	SW	SW	SW	SW		1.12	Cast	Cast	Cast	Cast										showers, and shower, and	26
	27	29.915	60	29.994	58	61	48			54	50	49	48	W	W	W	W		"	Cast	Cast	Cast	Cast										showers, and shower, and	27
	28	29.779	60	29.671	59	63	39			56	53	53	50	W	W	W	W		"	Cast	Cast	Cast	Cast										showers, and shower, and	28
	29	29.477	60	29.462	62	65	50			58	54	53	51	W	W	W	W		"	Cast	Cast	Cast	Cast										showers, and shower, and	29
	30	29.522	58	29.535	53	61	44			56	51	46	43	SW	SW	SW	SW		"	Cast	Cast	Cast	Cast										showers, and shower, and	30
	31	29.525	57	29.593	50	60	34			56	50	45	44	SW	SW	SW	SW		"	Cast	Cast	Cast	Cast										showers, and shower, and	31
	Sums.	905.983	13	906.782	13	1598	1683			538	443	442	1352						4.38															
	Means.	29.545	51.5	29.545	51.5	59.8	54.3			49.5	46.5	46.5	43.6																					
	† Total Corrections for Instrumental Errors.																																	
	‡ Corrections for Diurnal Range.																																	
	“Corrected Means.”																																	
	No. of	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			

BAROMETER, “corrected Mean” at 9 A.M., minus the Correction†† = 29.453
for Temp. (Col. 2), = 29.545 - 0.092 = 29.453
“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† = 29.481
for Temp. (Col. 4), = 29.545 - 0.064 = 29.481
Mean at Station, corrected, and at 32°, = 29.467
Correction for height, feet above Mean Sea-level, = 30.6
Mean, reduced to 32°, and Sea-level, = 29.773
Highest Reading, corrected for Index error, on the 18th, = 30.053
Lowest Do. Do. on the 6th, = 28.053
Difference, or Monthly Range, = 1.000

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 26th, = 74.0
Lowest in Month, corrected for Index errors, on the 21st, = 28.0
Difference, or Monthly Range, = 46.0
“Corrected Mean” of all the Highest, (Col. 5), = 48.9
“Corrected Mean” of all the Lowest, (Col. 6), = 19.2
Difference, or Mean Daily Range, = 29.7
** Calculated Mean Temperature of Month, = 47.0

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 26th, =
“Corrected Mean,” (Col. 7), of Black Bulb, Max. in Sun, =
Lowest at Night, Black Bulb, (corrected for Index errors), on the 21st, =
“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), = 47.5
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 45.2
†† Computed Temperature of Dew-Point, = 42.7
†† Do. Elastic Force of Vapour, = 27.6
†† Do. Weight of Vapour in a Cubic Foot of Air, =
†† Relative Humidity, (Saturation = 100), = 84
RAIN fell on 20 Days; Amount in Inches, = 4.88

WIND.		SUMMARY.							
Direction.		N	NE	E	SE	S	SW	W	NW
A.M.	73								
P.M.	45								
Mean.	54								

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

Observations made and
Return verified by

(Signed)

Alfred McDonald

WITH REMARKS ON THE USE OF INSTRUMENTS

from friction, rubbing, and so forth, which may easily be made, or intended by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the sun and the atmosphere, should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers, nor the sun's heat to affect the Minimum Thermometer by distillation.

Application of Thermometers.—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When sealed Thermometers are not graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be removed 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 zero-point of each Thermometer (marked by a scratch on

The *Thermometer* consists of two Thermometers usually, but not necessarily mounted on one frame. As apparently indicated by deviations from the approved and well-tested form of this apparatus, we seriously criticize the "*Thermometer Definitions*." Observers are especially requested to attend to the following conditions:—

The bulbs must *hang from*, by at least an inch free from the scales and frame to which they are attached;—the frame must be so placed as will bring the tubes forward by an inch from the level to be bored on which it may be suspended; the water-cap must be covered, and placed to the side, and a little below the level of the well bulb;—in no case under the bulbs—the musth 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 dry the observer that the musth is always *clean* and *moist*; and that

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.

The form of "Alison's" trigonometric ring is also a thin case, which is also supported the wafer cap underneath. This arrangement out of the ring is immediately altered by pulling the boxwood frame out of the thin case, and changing them side by side, so that the front-to-back orientation of the ring is reversed. The trigonometric ring is a thin case, and the requirements shall be complied with, as far as possible.

Reading of the Thiemometer—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading should be taken to tenths of a degree, and noted in decimal notation. Thus the Thiemometer will be read $30^{\circ} 40' 0''$ or $40^{\circ} 1' 0''$ or $40^{\circ} 2' 0''$ again, $40^{\circ} 30'$, or $40^{\circ} 45'$, according as it indicates a little more or less than 40° , or $40^{\circ} 30'$, or $40^{\circ} 45'$, respectively. An exact coincidence will, or a little over 40° or $40^{\circ} 30'$ or $40^{\circ} 45'$, or $40^{\circ} 30'$, or $40^{\circ} 45'$, more or less must be indicated, respectively. The Thiemometer, then, indicates $40^{\circ} 2'$ or $40^{\circ} 3'$, and $40^{\circ} 7'$ or $40^{\circ} 8'$ respectively. Registered "Alison's" $40^{\circ} 30'$ and $40^{\circ} 45'$ Thiemometers, then, indicate "Alison's" $40^{\circ} 30'$ and $40^{\circ} 45'$ Thiemometers, then, indicating that end of the index which is next to the surface of the ring.

How of observing Temperature.—The Hygrometer is read at 9 A.M. and 9 P.M. The self-registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the self-registering Thermometers are read since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications comprising a day on the 2d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d. *Wind.*—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the mean direction must be taken; and when it is stationary, any slight variations when the wind is feeble, or prevalence must be made to the contrary when it is strong.

direction of the lower strata of clouds overhead, and to the direction of smoke etc.

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

The Council recommend that every observatory be furnished with a Hemispherical-Cup Anemometer, a self-registering instrument which shows the amount of Wind that passes during the day, from which also the Velocity of the Wind at the time of observation may be ascertained. For indicating the Force or the Wind, at any particular hour of observation, 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.

Anti-causes.—Many causes conspire to produce anomalous

in rain runs. They arise, partly from inmovable situations for observation, and partly from the elective 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 surface of the grass around its mouth. The rain-gauge ought to be placed on grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the journals on the day on which the rain fell.

Shoofly mays, for convenience, be registered in the rain columns, under the following conditions:—When a Shoofly mays 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 it 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.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe, generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry,		Apple,			Cuckoo,	May 14 th	
Bouree or Elder,		Black Currant,			Curlew,		
Broom,		Cherry,			House-Swallow,		
Hazel,		Gean,			Lapwing,		
Hawthorn,		Gooseberry,			Plover,		
Holly,		Peach,			Sand-Martin,		
Laburnum,		Pear,			Starling,		
Lilac,		Plum,			Swan,		
Mezereon,		Strawberry,			Rail or Corn Crake,		
Mountain Ash or Rowan,							
Red Flowering Currant,							
Rhododendron Ponticum,							
Whin,							

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

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

MR ALEXANDER BUCHAN,

General Post Office Buildings,

EDINBURGH.

BOOK-POST.

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*The Cherry
Bloss 1871*

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gardens Army Castle, County of Aberdeen, in Lat. _____, Long. _____, Distance from Sea 17 miles.
Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground _____ feet. During the MONTH of June

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily at 9 P.M.				HYGROMETER.				WIND.				RAIN.		CLOUDS.		THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
		9 h. A.M.		9 h. P.M.		Max. No.	Min. No.	Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.		9 h. A.M.					Temperature of Well, at depth of feet, No.	Temperature at 1 fathom, and Density.	Ozone at 9 A.M. 9 P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		Barometer. * No.	Attached Thermometer.	Barometer. No.	Attached Thermometer.			Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Velocity (0-10), and Direction.	Amount (0-10), and Species.			Velocity (0-10), and Direction.	Amount (0-10), and Species.	No. 1 inches.	No. 2 inches.	No. 3 inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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BAROMETER, "corrected Mean " at 9 A.M., minus the Correction††		
for Temp. (Col. 2),	= 29.459... - 0.78	= 29.381
"Corrected Mean" of Barometer at 9 P.M., minus the Correction††		
for Temp. (Col. 4),	= 29.466... - 0.40	= 29.386
Mean at Station, corrected, and at 32°,.....		= 29.384
(Correction for height, feet above Mean Sea-level,.....)		= 30
Mean, reduced to 32°, and Sea-level,.....		= 29.685
Highest Reading, corrected for Index error, on the 16 th,.....		= 29.935
Lowest Do. Do., on the 10 th,.....		= 29.026
Difference, or Monthly Range,		= 0.909

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the <u>18</u> th,.....	=	<u>76.0</u>
Lowest in Month, corrected for Index errors, on the <u>1</u> th,	=	<u>35.0</u>
Difference, or Monthly Range,	=	<u>41.0</u>
"Corrected Mean " of all the Highest, (Col. 5);	=	<u>63.7</u> 79.4
"Corrected Mean " of all the Lowest, (Col. 6),	=	<u>45.9</u> 13.7
Difference, or Mean Daily Range,	=	<u>17.8</u> 55.4
** Calculated Mean Temperature of Month,	=	<u>54.8</u> 64.3
 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),	=	55.2
Mean (corrected) A.M. and P.M. Reading of Wet Bulb , (Cols. 10 and 12),	=	52.9
‡ Computed Temperature of Dew-Point ,	=	50.7
‡ Do. Elastic Force of Vapour ,	=	370
‡ Do. Weight of Vapour in a Cubic Foot of Air , ...	=	
‡ Relative Humidity , (Saturation = 100),	=	85
RAIN fell on // Days ; Amount in Inches,	=	1.53

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		11	10	4		4			
P.M.				10	11	4	1	3	1		
Mean.	0	1	0	10	11	4	1	3	1		

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

Emending corrections for both capability and index errors.

The Diurnal Range for Scotland is as yet unknown.

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

For the *Diurnal Range*, see *Table* from (Glaisher's) *Hydrographical Tables*, Second Edition *only*.

While the Diurnal Range is unknown, the Arithmetical Mean of (Col's 5 and 6) will be entered as the "Calculated Mean Temperature."

Any Observations not taken in strict accordance with the instructions on the other side, or noted at the Top of each column, will be marked as such by the observer, in each Schedule. See *over*.

Observations made and
Return verified by

(Signed)

(Signed) Alfred McDonald

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 situation 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 Public's guidance, the Society, an entire complicity 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. Aikin of London, the use of which is attended with the great convenience of requiring no *adjustment* of the cistern. Its *scale-inches* are not too inclining 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 *join one straight line* with those of the ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this *preliminary* setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *verrier*.

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

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

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

Provision of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white, the outside and inside, 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-sticks, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians, Self-registering Thermometers.—Professor Phillips, and Negretti and Zamboni's Patent "Maximum" Thermometers are recommended: printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by a 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 top of the tube, and must be discoloured from chance by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *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, by a fine frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water trap 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 frame-outed 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° 2, or 40° 3, and 40° 7, or 40° 8 respectively. In reading Rutherford's "Min." and "Max." 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 as fully taken, being so readily affected by heat from the person of the observer.

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

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

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

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

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

Snowfalls may, for convenience, be registered in the rain columns, under the following conditions:—When a snow shower occurs it must be noted in the "Remarks," and the extent 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 not noting that particles of the nature of deduction or inference.

nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus being unable to judge of their amount, we ought not to take them into account in the clouds column, though their appearance and changes ought to be noted among the "Remarks." The amount of cloud is ordered from a scale of 0 to 10, thus, when the sky overhead is *half covered* by clouds, 5 is entered as the *observation*, and so on. Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," 2, W., (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (extreme) speed of the former. Again, in the second "Cloud" column, an entry of 2, cu-st., (i.e.,) 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 covered, and placed to the side, and a little below the level of 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 20th of each month, the thermometer ought to be 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 Schönbach's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 8½, as an ozone entry in the schedule, will indicate that the ozone 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" & "4," that it is *blowing fresh*.

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

Remarks.—The "Remarks" column is too narrow, but unfortunately so. Some of the most valuable observations that can be taken are those for which no rubric 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 *icebergs*, *aurora borealis*, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of onsets 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 *year day* observations be taken;—viz., on the 21st days of March, June, September, and December.

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

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

(By Order) A. B.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

Edinburgh 28th July 1892
General Post Office Buildings,
Secretary of the Meteorological Society of Scotland,
MR ALEXANDER BUCHAN,
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EDINBURGH.
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Observations taken at Chungking Garden, County of Shenkeen, in Lat. _____, Long. _____, Distance from Sea _____ miles.
Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground 4 feet. During the MONTH of July
The Hours of Observation are of Greenwich Time.

BAROMETER, "corrected Mean " at 9 A.M., <i>minus</i> the Correction +†		
for Temp. (Col. 2),	<u>29.633... - 0.84</u>	= 29.547
"Corrected Mean " of Barometer at 9 P.M., <i>minus</i> the Correction +†		
for Temp. (Col. 4),	<u>29.642... - 0.47</u>	= 29.559
Mean at Station, corrected, and at 32°,.....		= 29.553
Correction for height,	feet above Mean Sea-level,.....	= 299
Mean, reduced to 32°, and Sea-level,.....		= 29.852
Highest Reading, corrected for Index error, on the } th,.....		= 29.881
Lowest Do. Do., on the th,.....		= 29.231
Difference, or Monthly Range,		= 0.650

S.-R. THERMOMETER , (in shade, etc.), Highest in Month , (corrected for Index Errors), on the 5 th	=	80.0
Lowest in Month , corrected for Index errors, on the 18 th	=	38.0
Difference, or Monthly Range ,	=	42.0
"Corrected Mean" of all the Highest , (Col. 5),	=	66.4
"Corrected Mean" of all the Lowest , (Col. 6),	=	47.3
Difference, or Mean Daily Range ,	=	16.9
** Calculated Mean Temperature of Month,	=	58.0
<hr/>		
S.-R. THERMOMETER , Black Bulb in Sun , Highest , (corrected for Index Errors), on the th.....	=	
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun ,	=	
Lowest at Night , Black Bulb , (corrected for Index errors), on the th, ... =		
"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass,	=	
Difference of above Means or Range ("exposed"),	=	

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb , (Cols. 9 and 11),	=	58.8
Mean (corrected) A.M. and P.M. Reading of Wet Bulb , (Cols. 10 and 12),	=	56.2
## Computed Temperature of Dew-Point ,	=	53.9
## Do. Elastic Force of Vapour ,	=	416
## Do. Weight of Vapour in a Cubic Foot of Air , ...	=	
## Relative Humidity , (Saturation = 100),	=	83
RAIN fell on / o Days; Amount in Inches,	=	1.25

Observations made and
Return verified by

(Signed

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

One of the objects of immediate importance that the Scottish Meteorological Society has proposed to itself, is to secure a *perfect uniformity* in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Results from different Returns; 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 days, 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 copiously 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-ticks* are not true inches but so much shorter as to *compensate* the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; their coincidence being indicated by a little ivory 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 *verifier*.

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 an inch of the top of the tube, and take down the instrument, if any then be critical with the cistern upmost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on lifting 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 *level*, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire. In taking an *Observation*, the attached Thermometer is first noted; the tube must then be gently tapped and the cistern-adjustment carefully made. By raising and lowering the eye, it must be brought into the plane of the back and front of the index—usually the lower edge of the vernier, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested* form of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the mudlin must be of medium fineness, and inserted at the neck of the bulb by the cotton, which also supplies it with water. It must be seen by the observer that the mudlin is always *clean and moist*, and the water pure. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances. One form of "Mason's" Hygrometer is highly objectionable. The frame of the water-cup underneath. This arrangement must be immediately altered by putting the boxwood frame out of the tin case, and hanging them side by side, so that the frame-wood 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 40.2°, and 40.3°, more or less must be registered 40.2 or 40.3, and 40.7 or 40.8 respectively. In reading Rutherford's *"Glass"* 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 Thermometer 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; the 24 hours readings. It is not a matter of indifference when the self-registering Thermometers are read, in winter at least, the extremes may occur at any hour; and it is necessary to read them occasionally to their proper meteorological day. In the Society's schedules, the indications registered on the 24 are those of a series of phenomena commencing at 9 p.m. on the 24, and extending till 9 p.m. on the 30. **Wind.**—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the main direction must be taken; and when it is stationary, and always when the wind is feeble, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, etc.

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

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

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

Snowfalls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs it must be noted in the "Remarks," and the letter S affixed to the depth of water received in 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 windy, rainy, and snowy, 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 Linze 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 extent 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 appearance and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10, thus, when the *sky overhead* is *half covered* by clouds, 5 is entered as the observation, and so on. Observations of the clouds are made at 9 a.m. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity 6, S. W." (for example) will indicate that the *upper* strata of clouds travel with *extreme* velocity from S. W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of $\frac{2}{2}$ (e.g.) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

Sunshine.—The number of hours in which objects in the sun's rays cast shadows, should be entered in the pro. or column. **Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature of the soil—its amount and constancy—the Council recommend that thermometers placed in 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 pin 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 a very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When conveniently, extra sea observations might be taken for other and greater depths, noting always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

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

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

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

Remarks.—The "Remarks" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no 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 variation of dress, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of mists, mists, mists, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been 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.

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

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

(By Order) A. B. Bannerman, 19th November 1892.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

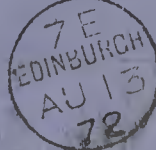
Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural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

EDINBURGH.

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland,

MR ALEXANDER BUCHAN,



SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Kilpatrick Ferry, Argyll, County of Argyll, in Lat. 57° 17', Long. 8° 17', Distance from Sea 17 miles.
Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground 4 feet.
During the MONTH of August 1872.
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS Head Daily, at 9 P.M.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.		OZONE.		GENERAL REMARKS.		Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		Readings of the H. Cup Anemometer. No. —	No. of hours in which it fell.	9 A.M.		P.M.		9 h. A.M.			Temperature of Well at depth of feet. No. —	Temperature and Direction.	0—10.		As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. Mention the hour at which Storms, including Thunder and Lightning, began and ended.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
		Barometer. No. —	Attached Thermometer. No. —	Barometer. No. —	Attached Thermometer. No. —	Max. No. —	Min. No. —	Max. in Sun's rays No. —	Min. on Grass. No. —	Dry bulb. No. —	Wet bulb. No. —	Dry bulb. No. —	Wet bulb. No. —	Direction. No. —	Force. No. —	Direction. No. —	Force. No. —			Velocity (0—10), and Direction. No. —	Amount (0—10), and Species. No. —	Velocity (0—10), and Direction. No. —	Amount (0—10), and Species. No. —	No. 3 inches. No. —	No. 12 inches. No. —	No. 22 inches. No. —			9 A.M. No. —	9 P.M. No. —																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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BAROMETER, "corrected Mean" at 9 A.M., minus the Correction $\frac{1}{1000}$ for Temp. (Col. 2), = 29.564
"Corrected Mean" of Barometer at 9 P.M., minus the Correction $\frac{1}{1000}$ for Temp. (Col. 4), = 29.571
Mean at Station, corrected, and at 32°, = 29.568
Correction for height, feet above Mean Sea-level, = 3.01
Mean, reduced to 32°, and Sea-level, = 29.569
Highest Reading, corrected for Index error, on the 19 th, = 30.015
Lowest Do. Do., on the 1 th, = 29.171
Difference, or Monthly Range, = 0.844

S.R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 19 th, = 74.0
Lowest in Month, corrected for Index errors, on the 4 th, = 38.0
Difference, or Monthly Range, = 36.0
"Corrected Mean" of all the Highest, (Col. 5), = 62.7
"Corrected Mean" of all the Lowest, (Col. 6), = 44.8
Difference, or Mean Daily Range, = 17.9
Calculated Mean Temperature of Month, = 53.5
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), = 55.3
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 53.3
Computed Temperature of Dew-Point, = 51.3
Do. Elastic Force of Vapour, = 0.377
Do. Weight of Vapour in a Cubic Foot of Air, =
Relative Humidity, (Saturation = 100), = 87
RAIN fell on 18 Days; Amount in Inches, = 3.75

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

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

Observations made and
Return verified by

(Signed)

Alfred Donald

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

Hour of Observation.—The Council recommend that Observations be made precisely at 9 o'clock (Greenwich or Railway Time only) twice a-day for some, and once (narrowing or evening) for other instruments, as specified in the following remarks; or at the top of the solenoid. It is hoped that the instruments will be punctually 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 make up the 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 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; then 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 *practically* setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *exterior*.

When a Barometer having adjustable surfaces has to be removed from its fastenings the ivory pegs must be screwed so as to form a tight plug to the cistern. Then *screen 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 tilting 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 venturi, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above ground 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-sticks, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians, Messrs. James Watson & Co., Glasgow, or from the Society's Depot, 10, Regent Street, London. Professor Phillips, and Messrs. Lamb and Lamb's Patent "Maximum" Thermometers are recommended: printed directions for their use may be obtained with each instrument. The "Maximum" Thermometer of Rutherford is recommended when graduated on the glass stem, and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand, when part of the top of the tube, and must be disclosed 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 are freely exposed to the sun, wind, and "Minimum" should be freely exposed to the sun, and the "Maximum" should rest on wooden supports a few inches from the surface of the grass in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by distillation.

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

The Hygrometer consists of two Thermometers usually, but not necessarily mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus seriously vitiate the "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-pipe. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

One form of "Mason's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the frame on which the Thermometers will be read—89°·0, 40°·0, or 40°·1; or, again, 40°·2, 40°·3, or 40°·4, according as it indicates a little under, an exact coincidence with, or a little over 40°; or 40°·5, 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 on the 2d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d.

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

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

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

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

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

Clouds.—Convenient abbreviations for Luke Howard's

nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the cloud column, though their appearances and changes ought to be noted amongst 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 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 (average) 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-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 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 Schlotheim's or Moffat's papers are used. The paper is affected by a pin to a board in the thermometer box, and the indication is 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+3, as an ozone entry in the schedule, will indicate that the ozone paper is fixed as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0-6 is "4" + "2", that 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.

Humidity.—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 as have been limited at above. When lofty hills are in the vicinity of an observatory, the height of clouds and of the sun line in winter ought to be recorded.

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

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

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

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

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

(By Order) A. B.

EDINBURGH, 21st November 1872.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

EDINBURGH

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

72

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EDINBURGH
SP 9
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1872

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Highland Plains, Ariz., County of Apache, in Lat. _____, Long. _____, Distance from Sea 17 miles.
Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground _____ feet. During the MONTH of September
The Hours of Observation are of Greenwich Time.

[illegible]

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction \uparrow)	=	29.271
for Temp. (Col. 2), = 29.331 - .060		
"Corrected Mean" of Barometer at 9 P.M., minus the Correction \uparrow)	=	29.292
for Temp. (Col. 4), = 29.357 - .065		
Mean at Station, corrected, and at 32°,.....	=	29.282
		304
Correction for height, feet above Mean Sea-level,.....	=	
Mean, reduced to 32°, and Sea-level,.....	=	29.586
Highest Reading, corrected for Index error, on the 14th,.....	=	29.827
Lowest Do. Do., on the 18th,.....	=	28.843
Difference, or Monthly Range,	=	1.084

S.-R. THERMETER , (in shade, etc.), Highest in Month , (corrected for Index Errors), on the 6 th	=	70.0
Lowest in Month , corrected for Index errors, on the 2 th ,	=	27.0
Difference, or Monthly Range ,	=	43.0
"Corrected Mean " of all the Highest , (Col. 5),	=	57.6
"Corrected Mean " of all the Lowest , (Col. 6),	=	40.9
Difference, or Mean Daily Range ,	=	16.7
** Calculated Mean Temperature of Month,	=	49.3

S.-R. THERMETER , Black Bulb in Sun , Highest , (corrected for Index Errors), on the 1 th	=	70.0
"Corrected Mean ," (Col. 7), of Black Bulb, Max. in Sun	=	57.6
Lowest at Night , Black Bulb, (corrected for Index errors), on the 1 th , ...	=	27.0
"Corrected Mean ," (Col. 8), of Black Bulb, Min. on grass.	=	40.9
Difference of above Means or Range ("exposed"),	=	16.7

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb , (Cols. 9 and 11),	=	50.2
Mean (corrected) A.M. and P.M. Reading of Wet Bulb , (Cols. 10 and 12),	=	48.6
## Computed Temperature of Dew-Point ,	=	46.9
## Do. Elastic Force of Vapour ,	=	32.2
## Do. Weight of Vapour in a Cubic Foot of Air , ...	=	
## Relative Humidity , (Saturation = 100),	=	89
RAIN fell on <i>41</i> Days; Amount in Inches,	=	5.31

WIND.		SUMMARY.									
Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.		8		2	3	10		6			
P.M.	1	11		2	2	7		7			
Mean.	1	10	0	2	2	8	0	7			

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

Observations made and
Return verified by.

(Signed) _____

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

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

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

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

Two moderate-sized Barometers have been approved by the Council; it is 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* indicates are 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, 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-disk* 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 *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 *slight lap* is produced. If this is prevented by air it may be removed to the cistern, and got rid of, by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails the instrument must be repaired.

The Barometer should be suspended in a good *lymph*, 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 nearby local influences. The lids 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 from the opticians.

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *calibrated form* of this apparatus 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 bulb must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the mesh is always *clean* and *moist*, and the water 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 "Masson'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 site of the tube to tenths of a degree, and noted in decimals. The Thermometer will be read 39° 9, 40° 0, or 40° 1; or 40° 4, 40° 5, or 40° 6, according as it indicates a little under, an exact coincidence with, or a little over 40°. A little under, 40° 2, or 40° 3, and 40° 7, or 40° 8 respectively. In reading Fahrenheit's "Max" and "Min" Thermometers, the indication of that each 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 occurrences to their proper meteorological day. In the Society's schedules, the indications registered on the 24 are those of a series of phenomena commencing at 9 P.M. on the 24, and extending till 9 P.M. on the 30.

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

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

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

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

Snowfalls may, for convenience, be registered in the rain columns, under the following conditions:—When a Snow shower occurs it must be noted in the "Remarks," and the letter S affixed to the depth of water received in 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 on 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," $\frac{2}{W}$, (for example) will indicate that the

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

regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

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

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

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. 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 3⁵⁰, as an ozone entry in the schedule, will indicate that the ozone paper is tinted as 4³⁰ on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4³⁰," 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 must not be so. Some of the most valuable observations that can be taken are those for which no table can be given nor hours assigned. The use of exclamation marks, therefore, to be taken over advantage, of, and a list of such as are recognized and in use at Greenwich and Southampton, are given at the foot of the column.

Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of mists, aurora borealis, remarkable depressions and elevations of the barometrical height, 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 *ten day* observations be taken;—viz., on the 21st days of March, June, September, and December.

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

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

Durham, 19th November 1872.

(By Order) A. B.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

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

MIR ALEXANDER BUCHAN.

16

1872

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *St. Andrew's Church, Leith*, County of *Aberdeen*, in Lat. _____, Long. _____, Distance from Sea *17* miles.
Height of Cistern of the Barometer above Mean Sea-level *40* feet, above Ground *7* feet. During the MONTH of *October* 187*2*.
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.		
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulb.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		Readings of the H. Cup Anemometer.		No. of hours in which it fell.		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.	9 h. A.M.	No. of hours in which it fell.	Amount in inches.	Velocity (0-10).	Amount (0-10).	Velocity (0-10).	Amount (0-10).	No. 8 inches.	No. 12 inches.					No. 22 inches.	
	1	29.992	57	28.895	50	59	40		52	57	50	49	SE						0.21		Ca	Vi							Showering A.M. Fine P.M.	1		
	2	28.882	55	28.832	55	59	42		54	52	50	48	SW						0.05		Ca	Ca							Changeable	2		
	3	28.835	54	28.744	50	52	38		48	47	40	39	NE								Vi	Ca							Fine	3		
	4	29.319	48	29.706	49	40	37		42	40	38	37	SW								Ca	Ca							Fine	4		
	5	29.069	40	29.920	40	50	28		40	38	31	30	SW								Ca	Ca							Fine	5		
	6	29.848	48	29.643	50	59	26		48	44	51	48	SW								Ca	Ca							Shower	6		
	7	29.635	53	29.593	50	52	36		53	52	40	39	SW						0.33		Vi	Ca							overcast. A.M. Fine P.M.	7		
	8	29.418	48	29.344	50	59	36		49	48	46	45	SW								Ca	Ca							Fine	8		
	9	29.144	50	29.107	45	60	32		45	44	35	34	SW								Ca	Ca							Fine	9		
	10	29.173	39	29.062	43	53	34		35	34	40	39	SW								Ca	Ca							very fine throughout	10		
	11	29.005	46	29.035	42	47	35		41	40	40	39	NE								Vi	Vi							Apple wind and heavy rain.	11		
	12	29.160	44	29.167	41	49	36		45	43	42	41	SW						0.50		Vi	Ca							Wind & showers	12		
	13	29.155	46	29.038	48	49	39		45	44	39	38	SW						0.03		Vi	Ca							Changeable	13		
	14	29.719	44	29.532	46	51	29		38	37	32	35	SW								Ca	Ca							Showering	14		
	15	29.520	40	29.129	49	52	25		37	36	41	40	SW						0.16		Ca	Ca							Fine	15		
	16	29.099	48	29.149	48	48	36		35	33	37	36	SW								Ca	Ca							overcast. A.M. Fine P.M.	16		
	17	29.572	39	29.622	49	54	28		36	36	37	36	SW								Ca	Ca							Fine	17		
	18	29.664	42	29.564	50	58	28		44	43	50	49	SW								Ca	Ca							very fine	18		
	19	29.389	52	29.389	53	53	49		50	49	58	48	SW						0.35		Vi	Ca							overcast and showers	19		
	20	29.438	52	29.638	52	60	40		50	48	46	45	SW								Ca	Ca							Fine	20		
	21	29.347	49	28.897	49	46	39		45	44	43	42	SW						0.12		Vi	Vi							occasional showers	21		
	22	29.949	48	29.899	48	48	39		44	43	43	42	NE						0.69		Vi	Vi							showing throughout	22		
	23	29.917	49	28.947	49	50	40		46	44	46	45	SW						0.06		Ca	Ca							partial generally and showering	23		
	24	28.845	50	28.944	50	50	41		46	45	43	42	SW								Vi	Vi							Fine	24		
	25	28.839	52	29.944	50	53	42		49	48	46	45	SW						0.61		Vi	Ca							overcast and showering	25		
	26	28.841	51	29.142	51	56	43		49	48	47	46	SW						0.09		Vi	Vi							Changeable	26		
	27	29.094	51	29.344	50	50	42		47	46	46	45	SW						0.77		Vi	Vi							changeable rain during night	27		
	28	29.262	53	29.440	44	53	30		46	45	45	44	SW						0.50		Ca	Ca							Changeable	28		
	29	29.244	50	29.244	48	55	31		49	48	46	45	SW								Ca	Ca							Fine	29		
	30	28.813	43	28.743	51	48	37		42	40	39	38	SW								Ca	Ca							Wind	30		
	31	28.745	50	28.847	49	48	38		45	42	44	42	SW								Ca	Ca								high wind & fine	31	
Sums.		1515.16	12	1516.5	11	13	15																									
Means.		28.855	23	28.85	25.9	54	110.2		139.5	136.2	138	136.0							4.57													
† Total Correction for Instrumental Errors.		29.257	A75	29.276		52.2358																										
‡ Corrections for Diurnal Range.																																
“Corrected Means.”																																
No. of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	

BAROMETER, “corrected Mean” at 9 A.M., minus the Correction†† = *29.240*
for Temp. (Col. 2), = *29.289* - *0.049* = *29.240*
“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† = *29.224*
for Temp. (Col. 4), = *29.276* - *0.052* = *29.224*
Mean at Station, corrected, and at 32°, = *29.232*
Correction for height, feet above Mean Sea-level, = *307*
Mean, reduced to 32°, and Sea-level, = *29.539*
Highest Reading, corrected for Index error, on the 22th, = *30.064*
Lowest Do. Do. on the 30th, = *28.743*
Difference, or Monthly Range, = *1.326*

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 20th, = *60.0*
Lowest in Month, corrected for Index errors, on the 10th, = *24.0*
Difference, or Monthly Range, = *36.0*
“Corrected Mean” of all the Highest, (Col. 5), = *52.2* = *49*
“Corrected Mean” of all the Lowest, (Col. 6), = *35.8* = *30*
Difference, or Mean Daily Range, = *16.4* = *14*
** Calculated Mean Temperature of Month, = *44.0*

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = *43.8*
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = *42.4*
†† Computed Temperature of Dew-Point, = *40.8*
†† Do. Elastic Force of Vapour, = *2.55*
†† Do. Weight of Vapour in a Cubic Foot of Air, = _____
†† Relative Humidity, (Saturation = 100), = *89*
RAIN fell on *4* Days; Amount in Inches, = *4.057*

WIND.		SUMMARY.				
Direction.		N	NE	E	SE	S
A.M.		1	4	8	12	6
P.M.		3	6	13	9	
Mean.		1	3	7	10	8

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

Observations made and
Return verified by

(Signed)

John Macdonald

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

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

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

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

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

An excellent Barometer is constructed by Mr. A. de la Roche, 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 condensation being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the float rises on this little piston-valve is brought, by the adjusting screw of *zero*, one screw, these on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *aneroid*.

When a Barometer, having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then screw up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a 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 ground 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. Thermometers are suspended on cross-laths in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the old-fashioned Self-registering Thermometers.—Professor Phillips, and Negretti and Zamboni's Patent "Maximum" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Ruthenford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be re-united by stirring the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus seriously vitiate the "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 Thermometers.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read 38.9° , 40.0° , or 40.1° ; or again, 40.4 , 40.5 , or 40.6 , according as it indicates a little under an exact coincidence with, or a little over 40° , or 40.5° respectively. So also 40.1° and 40.2° , more or less must be registered 40.2 or 40.3 , 40.7 or 40.8 respectively. In reading Ruthenford's "Max" and "Min" Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

Hour of observing Temperature.—The Thermometer is read at 9 A.M. and 9 P.M. The self-registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the self-registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 24 are those of a series of phenomena commencing at 9 P.M. on the 24, and extending till 9 P.M. on the 25.

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

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

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

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," $\frac{2}{W}$, (for example,) will indicate that the upper strata of clouds travel with extreme velocity from S.W., and those in the lower regions from W., with one-third the (extreme) speed of the former. Again, in the second "Cloud" column, an entry of $\frac{2}{4}$, (i.e.,) will indicate that the higher regions are covered to the "amount" of 4-tenths with stratus clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the cumulo-stratus kind.

Sunshine.—The number of hours in which objects in the sun's rays cast shadows, should be entered in the proper column. Underground Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and 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 bottom of the well and of the water noted. Ozon.—Mention whether Schloffen's or Moritz's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation in the following manner:—thus 3^{xx} , as an ozone entry in the schedule, will indicate that the ozone paper is turned 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 Barometer is necessary to every complete meteorological observatory.

Remarks.—The "Remarks" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no notes can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, 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 nebulæ, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms as have been limited at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner on the side-margins. Additional remarks may be made on the margin. Observations in connection with the periodic return of the seasons" possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Schedules 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 *yearly* day observations be taken;—viz., on the 1st days of March, June, September, and December.

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

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

(By Order) A. B.

Edinburgh, 19th November 1859.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

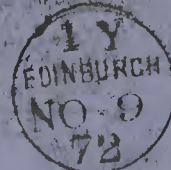
Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural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

EDINBURGH.

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland,

MR ALEXANDER BUCHAN,



SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Glenny Castle Gardens, County of Aberdeen, in Lat. _____, Long. _____, Distance from Sea 17 miles.
Height of Cistern of the Barometer above Mean Sea-level 380 feet, above Ground _____ feet.
During the MONTH of November 1872.
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETER.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.								
		No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.	No.	Barometer.					
	1	29.049	48	29.798	49	49	36	42	40	41	41	SW	SE					Ni	Ni								5 mi. all day. But very heavy rain during the night. Burns and snowing at intervals and fogs at intervals.	1		
	2	29.598	49	29.945	46	43	38	41	41	42	41	SE	SW	1.97				Ni	Ca								Shower all day	2		
	3	29.698	48	29.606	45	42	30	42	41	31	30	SW	SW	2.37				Ca	Ca								Shower all day	3		
	4	29.485	34	29.452	46	53	23	31	31	43	43	NE	NE					Ca	Ni								Shower all day	4		
	5	28.997	49	28.843	50	59	39	44	42	42	41	SW	SW	1.50				Ca	Ca								Shower all day	5		
	6	29.746	49	28.777	57	63	39	45	46	57	48	SW	SW					Ca	Ca								Shower all day	6		
	7	29.237	53	29.394	50	53	40	46	42	44	42	SW	SW					Ca	Ca								Shower all day	7		
	8	29.536	45	29.546	49	50	38	40	41	40	39	SW	SW					Ca	Ca								Shower all day	8		
	9	29.504	46	29.470	47	49	30	42	40	31	30	NE	NE					Ca	Ca								Shower all day	9		
	10	29.534	44	29.701	47	40	24	36	35	35	35	NE	NE	1.10				Ni	Ni								Shower all day	10		
	11	29.704	46	29.854	46	42	31	37	37	39	38	NE	NE	0.23				Ni	Ni								Shower all day	11		
	12	30.008	44	30.119	40	42	25	37	36	28	28	NE	NE	0.13				Ni	Ni								Shower all day	12		
	13	30.116	41	30.024	38	35	25	35	35	32	32	NE	NE					Ni	Ni								Shower all day	13		
	14	29.924	39	29.922	39	35	27	34	34	34	34	NE	NE	0.30				Ni	Ni								Shower all day	14		
	15	29.972	39	29.870	40	40	35	35	35	34	34	NE	NE	0.12				Ni	Ni								Shower all day	15		
	16	29.567	41	29.570	40	40	30	40	39	36	35	NE	NE	0.12				Ni	Ni								Shower all day	16		
	17	29.536	45	29.370	40	44	31	36	35	33	32	NE	NE	0.12				Ni	Ni								Shower all day	17		
	18	29.170	40	29.167	41	40	28	35	35	32	32	NE	NE					Ca	Ca								Shower all day	18		
	19	29.120	40	28.916	42	42	29	33	33	41	40	NE	NE	0.15				Ca	Ca								Shower all day	19		
	20	28.763	43	28.810	44	45	37	40	39	39	38	NE	NE	0.22				Ca	Ca								Shower all day	20		
	21	29.057	45	29.062	43	46	34	43	42	38	37	NE	NE					Ca	Ca								Shower all day	21		
	22	29.105	46	28.760	44	45	38	40	38	40	39	NE	NE	0.13				Ca	Ca								Shower all day	22		
	23	28.610	44	28.553	46	49	35	42	42	42	42	SW	SW	0.19				Ni	Ni								Shower all day	23		
	24	28.548	49	28.703	47	49	35	49	46	40	40	NE	NE	0.34				Ca	Ca								Shower all day	24		
	25	28.853	47	28.653	46	45	36	41	41	39	39	SW	SW	0.25				Ni	Ni								Shower all day	25		
	26	28.508	45	28.558	45	44	32	41	41	40	39	SW	SW	0.19				Ni	Ca								Shower all day	26		
	27	28.955	46	29.420	40	44	28	42	41	31	31	NE	NE	0.05				Ni	Ca								Shower all day	27		
	28	29.365	42	29.270	40	33	21	27	27	27	27	SW	SW					Ca	Ca								Shower all day	28		
	29	29.123	39	28.863	43	42	21	25	25	42	41	NE	NE	0.30				Ca	Ni								Shower all day	29		
	30	28.656	45	28.663	43	45	38	43	40	40	39	NE	NE					Ni	Ca								Shower all day	30		
	31																											Shower all day	31	

Sums.		Means.	
154.15	13.10	16.14	12.11
890.44	13.10	858.66	13.22
710.9	13	133	14
29.444	44	29.186	44
237	4	29.186	44

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction for Temp. (Col. 2), = 29.495	
"Corrected Mean" of Barometer at 9 P.M., minus the Correction for Temp. (Col. 4), = 29.144	
Mean at Station, corrected, and at 32°, = 29.170	
Correction for height, feet above Mean Sea-level, = 311	
Mean, reduced to 32°, and Sea-level, = 29.481	
Highest Reading, corrected for Index error, on the 12th, = 30.110	
Lowest Do. Do. on the 26th, = 28.508	
Difference, or Monthly Range, = 1.602	

S.R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 6th, = 63.0	
Lowest in Month, corrected for Index errors, on the 28th, = 21.0	
Difference, or Monthly Range, = 42.0	
"Corrected Mean" of all the Highest, (Col. 5), = 44.9	
"Corrected Mean" of all the Lowest, (Col. 6), = 31.9	
Difference, or Mean Daily Range, = 13.0	
* Calculated Mean Temperature of Month, = 38.4	

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, = 44.9	
Lowest at Night, Black Bulb, (corrected for Index errors), on the 28th, = 21.0	
"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass, = 31.9	
Difference of above Means or Range ("exposed"), = 13.0	

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 38.4	
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 37.5	
# Computed Temperature of Dew-Point, = 36.3	
# Do. Elastic Force of Vapour, = 2.14	
# Do. Weight of Vapour in a Cubic Foot of Air, = 93	
# Relative Humidity, (Saturation = 100), = 93	
RAIN fall on 8 Days; Amount in Inches, = 7.06	

WIND.		SUMMARY.	
Direction.	N N E S S W W N W	Mean Force.	Mean Velocity in miles per day.
A.M.	3 3 8 3 8 5		
P.M.	3 10 1 7 9		
Mean.	2 3 0 9 2 7 0 7		

* 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.
† Entering corrections for both capillarity and Index Errors.
‡ The Diurnal Range for Scotland is as yet unknown.
§ Practically, though not absolutely a minus correction.
|| These "Hygrometric Deductions" are calculated from Glashier's Hygrometric Tables, Second Edition only.
¶ While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 9 and 10 will be entered as the "Calculated Mean Temperature."
Any Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. See over.

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

Observations made and
Return verified by

(Signed)

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

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

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

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

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

An excellent Barometer is constructed by Mr. A. de la Rive, 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; 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 flanges, 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 *reverse* up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when on inclining the instrument so that the mercury strikes the top of the tube, a *slight tap* is produced. If this is prevented by air, it may be removed to the cistern, and got rid of, by 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 index, 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 any 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 fixed the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These boxes may be had from the opticians.

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *retarded 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 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 "Masson'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, which is immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the forementioned requirements shall be complied with, as far as possible.

Reading of the Thermometers.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite to 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°.1; or 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 24 are those of a series of phenomena commencing at 9 P.M. on the 24, and extending till 9 P.M. on the 3d.

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

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

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

Atmospheric Pressure. 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.

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

Clouds.—Convenient abbreviations for Luke Howard's

nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the cloud column, though their appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is half covered by clouds, 5 is entered as the *observation*, and so on. Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity 6, S. W." 2, W." (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of 2, on-st. (i.e.g.) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

Sunshine.—The number of hours in which objects in the sun's rays cast shadows, should be entered in the proper column. **Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature of the soil—as amount and consistency—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems of 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 Schönböhm's or Mohr's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3%, as an ozone entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force 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 forms assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognized and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

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

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

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

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

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

EDINBURGH. (By Order) A. B.

EDINBURGH, 19th November 1892.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

EDINBURGH.
General Post Office Buildings,
Secretary of the Meteorological Society of Scotland,
MR ALEXANDER BUCHAN,
1892-
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EDINBURGH
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SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *The Gardens, Hemy Castle*, County of *Aberdeen*, in Lat. _____, Long. _____, Distance from Sea *17* miles.
Height of Cistern of the Barometer above Mean Sea-level *380* feet, above Ground _____ feet. During the MONTH of *December* 187 *2*

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No. —				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. Mention the hour at which Storms, including Thunder and Lightning, began and ended.	Days of Month.								
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Balls. Sun's rays Grass.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		Readings of the H. C. P. Anemometer. No. —		No. of hours in which it fell.		Amount in inches. No. —		9 A.M.		1 P.M.					9 h. A.M.			Temperature of air at surface of water. No. —	Temperature at depth of 5 fathoms. No. —	Temperature at depth of 10 fathoms. No. —	9 A.M. 9 P.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.	Velocity (0—10).	Amount (0—10), and Direction.	Velocity (0—10).	Amount (0—10), and Direction.	No. 1.	No. 2.	No. 3.														
		* No.	inches.	°	inches.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°					°	°	°					°
	1	28.600	44	29.315	42	45	39			46	44	42	41	SE	18	SE	18			0.38													1					
	2	29.315	412	29.270	40	43	36			42	41	40	39	SE	18	SE	18			0.24													2					
	3	29.412	43	29.470	40	46	32			39	38	34	34	NE	14	NE	14																3					
	4	29.620	40	29.620	40	36	24			34	33	24	24	NE	10	NE	10			0.07													4					
	5	29.483	35	28.521	40	38	15			15	15	38	38	SE	18	SE	18																5					
	6	28.533	42	28.571	40	47	37			43	42	43	42	SW	10	SW	10			0.04													6					
	7	28.716	39	28.674	44	44	38			40	39	42	39	E	8	E	8			0.14													7					
	8	28.716	42	28.598	39	42	23			41	38	29	29	SW	10	SW	10																8					
	9	28.521	40	28.571	40	37	21			37	35	35	34	NE	11	NE	11																9					
	10	28.768	41	28.926	38	38	28			36	36	35	34	NE	11	NE	11																10					
	11	29.220	40	29.373	39	36	27			35	33	28	27	NE	10	NE	10																11					
	12	29.575	38	29.470	40	34	22			30	29	34	33	NE	10	NE	10																12					
	13	29.323	39	29.330	36	35	16			23	23	16	16	NE	10	NE	10																	13				
	14	29.380	36	29.588	32	32	14			18	18	19	19	SE	11	SE	11																	14				
	15	29.580	36	29.530	30	32	18			30	30	30	30	SE	18	SE	18																	15				
	16	29.520	40	29.462	43	38	28			37	37	37	35	SE	18	SE	18																	16				
	17	29.365	42	29.462	43	38	30			55	34	34	34	NE	18	NE	18			0.57														17				
	18	29.574	42	29.462	43	39	30			36	36	39	38	SE	18	SE	18			0.50														18				
	19	29.572	43	29.574	42	40	39			41	40	40	39	SE	8	E	8			0.64														19				
	20	29.572	45	29.467	41	39	35			39	38	39	38	SE	18	SE	18			0.30														20				
	21	29.470	40	29.520	40	39	34			39	38	38	37	SE	18	SE	18			0.60														21				
	22	29.667	41	29.372	43	43	34			38	38	43	42	SE	18	SE	18			0.40														22				
	23	28.947	49	28.880	48	49	37			49	47	44	43	SW	10	SW	10			0.50														23				
	24	28.853	47	28.533	47	48	34			46	44	45	44	SW	10	SW	10																	24				
	25	28.450	48	28.453	47	48	39			44	43	44	42	SE	18	SE	18			0.27														25				
	26	28.905	46	28.994	50	50	32			38	37	49	48	SE	18	SE	18																	26				
	27	29.042	51	29.097	49	50	39			51	49	42	41	SE	18	SE	18																	27				
	28	29.147	49	29.147	49	49	34			48	47	40	38	SW	10	SW	10																	28				
	29	29.144	50	29.549	48	42	34			40	38	24	24	SW	10	SW	10																	29				
	30	29.520	40	29.320	44	39	34			32	31	38	37	SW	10	SW	10																	30				
	31	29.079	45	29.007	45	44	41			46	40	40	43	SW	10	SW	10			0.09														31				
Sums.		1511.9	11	1515.9	11	17	500			1161	1141	1129	1092							4.45																		
Means.		825.822	133	804.243	129	129	900			1161	1141	1129	1092							4.17																		
† Total Corrections for Instrumental Errors.		53.59	75	52.45	68	4	17																															
† Corrections for Diurnal Range.		29.173	42.4	29.169	42.2																																	
"Corrected Means."																																						
No. of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30							

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† = *29.138*
for Temp. (Col. 2), = *29.173* - *0.035*
"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† = *29.134*
for Temp. (Col. 4), = *29.169* - *0.035*
Mean at Station, corrected, and at 32°, = *29.136*
Correction for height, feet above Mean Sea-level, = *313*
Mean, reduced to 32°, and Sea-level, = *29.449*
Highest Reading, corrected for Index error, on the 22 th, = *29.667*
Lowest Do. Do., on the 23 th, = *28.450*
Difference, or Monthly Range, = *1.217*

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 26 th, = *50.0*
Lowest in Month, corrected for Index errors, on the 14 th, = *14.0*
Difference, or Monthly Range, = *36.0*
"Corrected Mean" of all the Highest, (Col. 5), = *41.3*
"Corrected Mean" of all the Lowest, (Col. 6), = *29.7*
Difference, or Mean Daily Range, = *11.6*
** Calculated Mean Temperature of Month, = *35.5*

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), = *37.0*
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = *36.0*
†† Computed Temperature of Dew-Point, = *34.6*
†† Do. Elastic Force of Vapour, = *.200*
†† Do. Weight of Vapour in a Cubic Foot of Air, ... =
†† Relative Humidity, (Saturation = 100), = *91*
RAIN fell on *4* Days; Amount in Inches, = *4.74*

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

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

Observations made and
Return verified by

(Signed)

Alfred McLeod

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 incomparably, 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 redacting 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 times so punctually in the time of reading the instruments will be observed. Observers, in some key-gases, may find this impossible; in such instances, they are specially requested to mark opposite every reading at what time it was taken, if not at 9 o'clock.

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

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

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

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then screw up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern 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 at once to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians, Self-registering Thermometers.—Professor Phillips, and Negretti and Zamboni's Patent "Maximum" Thermometers are recommended; printed directions for their use may be obtained from each instrument. The "Maximum" Thermometer of Rudolph is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two arrangements, 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-ruled by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be discoloured from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus occasionally vitiate the "Hygrometrical Deductions," Observers are specially requested to attend to the following directions: The bulb 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-pipe. 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, 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 readings ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39.9, 40.0, or 40.1; or again, 40.4, 40.5, or 40.6, according as it indicates a little under, an exact coincidence with, or a little over 40°, respectively. So also 40.3, and 40.7, or 40.8 respectively. In reading Ruthven'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 bulb, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

Path-gauges.—Many causes conspire to produce anomalies in rain returns. They arise partly from unfavourable situation for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass 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, by far the commonest, be registered in the rain columns, under the following conditions:—When Snow above occurs it must be noted in the "Remarks," and the latter should be annexed to the depth of water received in gauges. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as indicated in every column, the observer cannot be too careful to register observations only; and nothing that partakes of the nature of deduction or inference.

Clouds.—Convenient abbreviations for Luke Howard's

nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less observation of the sky overhead (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the cloud column, though their appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is half covered by clouds, 5 is entered as the observation, and so on. Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity 6, S. W., 2 W., (for example) will indicate that the upper strata of clouds travel with extreme velocity from S.W., and those in the lower regions from W., with one-third the (extreme) speed of the former. Again, in the second "Cloud" column, an entry of 2, cumuli, (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 in 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 Scotchlin's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3x, as an ozone entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4"; i.e., that it is blowing fresh.

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

Remarks.—The "Remarks" column is too narrow but unfortunately so. Some of the most valuable observations that can be taken are those for which no rules can be given or hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognized and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, &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-margins. Additional remarks may be made on the margin.

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

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

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

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

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

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

Dec 1 1859
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