SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Mr Gardens Cluny 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 January 1876.

The Hours of Observation are of Greenwich Time.

Days of Month	BAROMETER. 9 h. A.M. Barometer. No. ____	Attached Thermometer	9 h. P.M. Barometer. No. ____	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.	Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Min. on Grass No.	HYGROMETER. No. ____ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H. Cup Anemometer. No. ____ 9 h. A.M.	RAIN. No. of hours in which it fell.	Amount in inches. No.	CLOUDS. 9 A.M. Velocity (0—6), and Direction.	Amount, (0—10), and Species.	P.M. Velocity (0—6), and Direction.	Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	12 inches.	No. 22 inches.	Temperature of Well at depth of feet. No.	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
	inches.	°	inches.	°	°	°	°	°	°	°	°	°																									
1	29.757	31	29.804	32	39	29			32	30	34	33	NW		NW				000		Cicu		Cicu														Generally fine	1
2	29.687	43	29.807	31	41	28			33	33	33	32	NW		NW				000		Cicu		Cicu														Fine	2
3	29.714	42	29.712	43	43	30			30	30	40	39	W		W				000		St		Ni														Fine	3
4	29.806	45	29.851	47	46	30			43	42	47	45	SW		S				0,12		Ni		Ni														Rain all day except 9 A.M.	4
5	29.983	46	29.978	46	46	33			42	42	41	40	S		SE				0,29		Ni		Ni														Showery	5
6	30.161	43	30.172	39	41	33			41	40	34	33	S		S				0,03		St		St														Generally overcast and cold	6
7	30.385	34	30.369	40	37	33			36	33	38	35	SW		SE				0,05		St		Ni														overcast and fine Chilly	7
8	30.280	30	29.851	47	38	29			37	35	31	30	SE		SE				0,02		Ni		Cicu														Cold wind, and hail showers at intervals Ground Speckled with snow by 5h M. about 1in of Snow and hard frost	8
9	29.900	20	30.009	32	35	10			[illegible]		32	30	SW		NW				000		Cicu		Cicu														Frosty & cold	9
10	30.160	26	30.105	36	30	22			33	32	[illegible]		NW		NW				000		Ni		St														Frosty	10
11	30.025	25	29.829	30	31	13			[illegible]		30	29	NW		NW				007		St		St														Frosty,	11
12	29.630	36	29.895	40	38	28			32	32	39	35	W		NW				013		Cu		Cu														Frosty and Changeable	12
13	30.102	37	30.230	36	39	24			34	33	[illegible]		W		NW				000		Ni		St														Frosty and overcast	13
14	30.754	30	30.207	35	33	16			[illegible]		32	31	NW		NW				001		Cist		Cu														Frosty throughout	14
15	30.127	37	29.870	40	40	26			36	36	40	39	NW		NW				000		Ni		St														Frosty all, overcast P.M. and inclined to Sleet	15
16	29.806	45	29.889	42	45	35			41	39	38	35	NW		W				000		St		Cicu														Fine throughout and Spring like	16
17	29.837	43	29.162	43	48	31			36	34	43	41	W		W				000		Cist		Ni														overcast but fine	17
18	29.329	46	28.994	48	47	32			44	40	36	32	SW		W				000		Cist		Ni														high wind during the night very fine all day	18
19	29.869	42	29.002	47	51	27			41	39	45	42	SW		SW				002		St		Ni														Half fine throughout.	19
20	29.007	45	29.420	40	46	29			42	38	32	31	W		NW				000		Cist		St														very fine throughout Slight showers	20
21	29.538	33	29.770	40	35	21			[illegible]		[illegible]		NW		NE				000		Cu		St														Slight frost all day and Ground Sheeted with Snow	21
22	29.701	29	29.720	40	39	14			[illegible]		41	39	NW		NW				000		Cu		Ni														Ground speckled with Snow & frosty	22
23	29.662	43	29.399	48	52	31			40	38	52	47	NW		W				000		St		Ni														Frosty all day. West P.M.	23
24	29.548	48	29.987	43	55	32			42	40	40	37	W		W				000		St		St														high wind all night	24
25	29.667	41	29.550	45	51	32			40	39	40	39	W		W				000		St		Cu														very wet all day	25
26	29.704	46	29.754	46	48	37			40	39	45	42	W		W				000		Cicu		Ci														very fine throughout	26
27	29.701	47	29.743	50	50	40			45	43	47	45	W		SW				021		Cicu		Ni														overcast and very fine.	27
28	29.758	49	29.937	43	50	33			45	43	40	39	SW		SW				000		St		Ni														Very fine	28
29	29.867	41	29.857	47	46	35			41	40	45	42	W		SW				001		Cu		Ni														overcast and very fine	29
30	29.870	40	29.864	42	47	31			43	41	44	43	SW		S				003		Ni		Cu														very fine	30
31	29.867	41	29.788	52	54	41			54	48	49	48	S		S				001		Ni		Cu														very fine	31
Sums.	929.66	1212	923.549	1240	1371	885			1073	979	1095	1053							4.80																			
Means.	29.86	39.1	29.791	40.0	44.2	28.5			34.6	31.6	35.3	34.0																									
† Total Corrections for Instrumental Errors.	796 +.050		799 +.050																																		
‡ Corrections for Diurnal Range.																																					
"Corrected Means."																																					
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30							

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.846 − .028 = 29.818

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.849 − .035 = 29.814

Mean at Station, corrected, and at 32°, = 29.816

Correction for height, feet above Mean Sea-level, = 314

Mean, reduced to 32°, and Sea-level, = 30.130

Highest Reading, corrected for Index error, on the 7 th, = 30.435

Lowest Do. Do., on the 19 th, = 28.914

Difference, or **Monthly Range,** = 1.521

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 24 th, = 55.0

Lowest in Month, corrected for Index errors, on the 9 th, = 10.0

Difference, or **Monthly Range,** = 45.0

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 44.3

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 28.5

Difference, or **Mean Daily Range,** = 15.8

** Calculated **Mean Temperature** of Month, = 36.4

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), =

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

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

‡‡ Do. **Elastic Force of Vapour,** =

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

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

RAIN fell on 13 **Days; Amount in Inches,** = 0.80

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable	Mean Velocity in miles per day.
A.M.	4			2	3	7	10	5		
P.M.	6			3	4	4	8	6		
Mean.	5	0	0	3	3	6	9	5		

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

Observations made and Return verified by _____

(*Signed*) Mary Anne Ogilvie Donald

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation. The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns 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 the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer. Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has 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 is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is 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.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering 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 so as 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 facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down, viz.: as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers. The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers. Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements,—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with Exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers. The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, 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. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer. The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, 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 removed, and altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer. In reading the Thermometer great care must be taken to bring 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 40¼°, and 40¾°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are 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.

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, 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.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Nigretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind. Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction. A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure. The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges. Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Guage should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base us they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

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

Clouds. Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud 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 may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, 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:—Thus, in the column Velocity and Direction,

$$\frac{6,\ S.\ W.}{2,\ W.}$$

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 speed of the former. Again, in the second Cloud column, an entry of

$$\frac{4,\ st.}{2,\ cu\text{-}st,}$$

will indicate that the higher regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo-stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine. The approximate 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 growth of crops and plants generally, depend greatly 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 permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

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 most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. 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. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells. The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone. Mention what Test-Papers are used, Schönbein's or Moffat's, etc. The paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3\frac{N.W.}{4}$, as an Ozone entry in the schedule, will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity. Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks. The Remarks column is unavoidably too narrow. 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 in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons. Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. 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 Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and approved before being used; and they consider it necessary 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, *December* 1874.

Cluny
Jan? 1876—

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK POST.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe, generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry,		Apple,			Cuckoo,		
Bourtree or Elder,		Black Currant,			Curlew,		
Broom,		Cherry,			House-Swallow,		
Hazel,		Gean,			Lapwing,	26th	
Hawthorn,		Gooseberry,			Plover,		
Holly,		Peach,			Sand-Martin,		
Laburnum,		Pear,			Starling,	21st	
Lilac,		Plum,			Swan,		
Mezereon,		Strawberry, [illegible] in flower			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.

[illegible]

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Garden, Cluny Castle, County of Aberdeen, in Lat. _____, Long. _____, Distance from Sea 14 miles.

Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground _____ feet. During the MONTH of February 1876.

The Hours of Observation are of Greenwich Time.

Electricity.	Days of Month.	BAROMETER. 9 h. A.M. Barometer. No.	9 h. A.M. Attached Thermometer	9 h. P.M. Barometer. No.	9 h. P.M. Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max.	Min.	Exposed Black Bulbs. Max. in Sun's rays. No.	Min. on Grass. No.	HYGROMETER. No. 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H.Cup Anemometer. No. 9 h. A.M.	RAIN. No. of hours in which it fell.	Amount in inches. No.	CLOUDS. 9 A.M. Velocity (0—6), and Direction.	Amount, (0—10), and Species.	P.M. Velocity (0—6), and Direction.	Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	12 inches.	No. 22 inches.	Temperature of WELL at depth of feet. No.	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.
		inches.	°	inches.	°	°	°	°	°	°	°	°	°																							
	1	29.791	51	29.402	47	51	40			49	47	47	45	SW		SW				0.05		Cu		Cu										Generally overcast and cool air	1
	2	29.436	34	29.464	42	44	27			33	32	38	36	NW		W				0.05		St		Cu										Cold and rough throughout	2
	3	29.420	40	29.570	40	40	32			39	35	34	30	NW		NW				0.01		Ni		St										Hills covered with snow slightly	3
	4	29.428	37	29.533	35	41	31			34	33	32	31	N		N				0.00		Cu		Cu										very rough day snow showers and frosty strong breeze	4
	5	29.446	30	29.541	32	40	27			30	29	30	29	NW		N				0.00		Cu		Cu										Rough showers throughout.	5
	6	29.533	35	29.538	35	40	23			32	32	30	29	SE		N				0.00		Cu		Cu										Overcast and Cold	6
	7	29.533	35	29.535	34	37	23			27	26	31	30	N		N				0.00		Cu		Cu										Overcast am. Cold and hail showers	7
	8	29.558	35	29.598	37	33	24			31	30	33	32	NW		N				0.07		Cu		Cu										Stormy and cold throughout Ground with snow. by 9. P.M.	8
	9	29.578	37	29.596	36	35	33			32	31	~~00~~	~~00~~	N		N				0.13		Ni		Ni										very stormy 2. or 3 in of snow	9
	10	29.600	27	29.596	30	32	10			~~00~~	~~00~~	~~00~~	~~00~~	NE		N				0.01		Cu		Cu										very stormy about 4 in of snow	10
	11	29.553	37	29.578	37	37	25			32	31	36	34	N		N				0.35		Cu		Ni										heavy snow showers throughout	11
	12	29.530	36	29.593	31	33	17			29	28	~~00~~	~~00~~	NE		NE				0.05		Cu		Cu										snow showers. 5 to 6 inches	12
	13	29.530	36	29.541	32	35	12			29	28	~~00~~	~~00~~	NE		N				0.06		Cu		Cu										heavy snow showers. but air very cold. little or no drifting	13
	14	29.696	30	29.596	38	34	15			32	31	33	32	NE		NE				0.03		Ni		Ni										Showers throughout the day 1 in of snow	14
	15	29.873	38	29.928	37	36	27			37	37	33	33	NW		NW				0.40		Cu		Cu										very strong gale during the night. snow showers till 9 P.M. and snow melting.	15
	16	29.629	39	28.883	35	36	30			38	34	29	29	NW		NW				0.20		Ni		Ni										Changeable dull. frosty P. M.	16
	17	28.880	36	28.506	37	39	32			35	34	36	33	NE		E				0.20		Cu		Cu										Sleety throughout. snow melting	17
	18	28.473	39	28.918	41	40	35			35	34	37	36	E		E				0.05		Cu		Cu										" snow melting. slowly	18
	19	28.873	37	28.881	36	41	30			36	36	31	31	E		NW				0.20		Cu		Cu										" " "	19
	20	29.543	31	29.543	31	00	15			~~00~~	~~00~~	~~00~~	~~00~~	NW		NW				0.01		Cu		Cu										frosty throughout " "	20
	21	29.028	37	29.070	40	39	18			35	35	40	35	NW		NW				0.31		Ni		Ni										drizzling showers dull. overcast and raw cold day.	21
	22	29.013	43	29.065	40	47	32			41	40	39	37	NE		NE				0.38		St		Ni										drizzling rain dull. cold hazy day through out. cold snow melting slowly	22
	23	29.020	40	29.078	37	40	27			43	40	34	32	E		NE				0.12		Ni		Ni										overcast stormy last, drizzling rain at intervals	23
	24	29.278	37	29.178	37	37	31			36	34	37	36	NE		NE				0.00		Ni		Ni										very cold and rough. snow showers. and cold wind. most ungenial throughout	24
	25	29.320	36	29.070	40	39	29			34	33	36	35	NE		NE				0.44		Ni		Ni										Stormy throughout. about 6 in of snow fell during the afternoon	25
	26	29.018	37	28.923	39	34	31			37	36	34	32	NE		NE				0.80		Ni		Ni										foggy throughout. and drizzling rain sleety and disagreeable.	26
	27	29.021	40	28.923	39	39	32			36	34	35	34	E		NE				0.40		Ni		Ni										foggy throughout. and drizzling rain,	27
	28	28.978	37	28.878	37	36	31			35	34	36	35	EE		EE				0.15		Ni		St										changeable, foggy. dull. occasional gleams of sunshine. Mg and snow. genial dull. frosty. with bright sunshine	28
	29	29.065	42	29.167	41	39	32			36	35	~~00~~	~~00~~	EE		EE				0.14		St		Ni										P.M. showery. &c	29
	30																																	This month as a whole has been cold. and ungenial	30
	31																																			31
	Sums.	848.94	14 12 11	1059	13	854.966	16 15 12	1069	10	1104	12	770	10	943	13	879	10	827	9	766	9	4.71														
	Means.	29.7[illegible]	36	29.4[illegible]	36	38.7	26							32.5		30.7		28.5		26.5																
	† Total Corrections for Instrumental Errors.	365 +.050		316 +.050										34.9		33.7		34.7		33.3																
	‡ Corrections for Diurnal Range.																																			
	"Corrected Means."																																			
	No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 0 = _____

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

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

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

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

Highest Reading, corrected for Index error, on the 15 th, = 29.178

Lowest Do. Do., on the 18 th, = 28.473

Difference, or **Monthly Range,** = 1.456

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 1 th, = 51.0

Lowest in Month, corrected for Index errors, on the _____ th, = 10.0

Difference, or **Monthly Range,** = 41.0

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 38.1

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 26.5

Difference, or **Mean Daily Range,** = 11.6

** Calculated **Mean Temperature** of Month, = 32.3

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), = _____

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

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

‡‡ Do. **Elastic Force of Vapour,** = _____

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

‡‡ **Relative Humidity, (Saturation = 100),** = _____

RAIN fell on 24 **Days; Amount in Inches,** = 4.71

WIND. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
SUMMARY. A.M.	7	10	5	1		1		5			
P.M.	14	8	4			1	1	1			
Mean.	10	9	4	1	0	1	1	3			

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

† Embracing corrections for both capillarity and Index Errors.

‡ The Diurnal Range for Scotland is as yet unknown.

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

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

** While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature." Any Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. *See over.*

Observations made and Return verified by _____

(Signed) Alexander McDonald

Chivy
Feb: 1876

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK POST.

ABERDEEN H MR 8 76

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation. The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns 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 the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer. Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has 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 is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is 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.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering 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 so as 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 facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down, viz.: as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers. The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers. Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements,—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with Exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers. The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, 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. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer. The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, 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 altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer. In reading the Thermometer great care must be taken to bring 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 40¼°, and 40¾°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are 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.

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, 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.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Nigretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind. Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction. A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure. The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges. Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Guage should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rain-fall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

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

Clouds. Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud 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 may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, 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:—Thus, in the column Velocity and Direction, $\frac{6,\ S.\ W.}{2,\ W.}$ 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 speed of the former. Again, in the second Cloud column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st,}$ will indicate that the higher regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo-stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine. The approximate 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 growth of crops and plants generally, depend greatly 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 permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

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 most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. 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. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells. The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone. Mention what Test-Papers are used, Schönbein's or Moffat's, etc. The paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3\frac{N.W.}{4}$, as an Ozone entry in the schedule, will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity. Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks. The Remarks column is unavoidably too narrow. 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 in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons. Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. 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 Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and approved before being used; and they consider it necessary 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, *December 1874.*

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

Agricultural work much retarded by the extremely wet state of the soil and snow. Potatoes rotting badly in store pits. Turnips fairly plentiful. Straw plentiful. Cattle in our immediate neighbourhood healthy.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *The Gardens Cluny 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 *March* 187*6*.

The Hours of Observation are of Greenwich Time.

Electricity	Days of Month	Barometer 9 h. A.M. (inches)	Attached Thermometer 9 h. A.M. (°)	Barometer 9 h. P.M. (inches)	Attached Thermometer 9 h. P.M. (°)	Self-Registering Thermometers, Protected in Shade, Max.	Min.	Hygrometer 9 h. A.M. Dry bulb	Wet bulb	9 h. P.M. Dry bulb	Wet bulb	Wind 9 h. A.M. Direction	Wind 9 h. P.M. Direction	Rain, Amount in inches	Clouds 9 A.M. Velocity and Direction	Clouds 9 A.M. Amount and Species	Clouds P.M. Velocity and Direction	Clouds P.M. Amount and Species	Sunshine	General Remarks	Days of Month
	1	29.057	45	29.169	43	57	33	40	40	38	35	Sw	Sw	0.01		Ni		Cu		overcast a.m. Fine P.M.	1
	2	28.916	42	28.895	42	51	27	42	40	39	36	Sw	Sw	0.10		Cica		Cica		Fine.	2
	3	28.956	42	28.753	47	55	35	42	40	44	42	Sw	Sw	0.01		Ni		St		dense masses of Cloud a.m. Fine P.M., and strong wind	3
	4	28.555	46	29.164	43	51	33	45	44	35	34	W	S	000		St		Cica		blowing fresh during the night- less strong during the day, and slight rain	4
	5	29.032	47	29.085	44	50	37	46	41	41	39	Sw	Sw	000		St		Ni		Fine throughout	5
	6	29.060	44	28.808	45	50	35	42	38	38	34	W	W	000		Cica		Cu		~~Strong~~ Blowing fresh, and bright sun air cool.	6
	7	29.085	46	28.952	47	49	29	44	42	34	32	W	W	000		St		Cu		Windy throughout and cold frosty air,	7
	8	28.939	42	28.166	42	43	29	39	34	32	31	W	NE	000		St		Cu		Overcast & Chilly	8
X	9	27.816	42	27.732	40	43	29	34	32	34	33	W	N	0.12		Ni		Ni		Slight snow showers (dull leaden ~~very cold day~~ sky. fresh gusts of wind	9
X	10	27.816	42	27.714	43	41	20	37	35	37	36	NW	N	0.40		Ni		Ni		hills covered with snow. Low ground speckled over. Sloppy showers at intervals	10
	11	28.446	40	28.281	36	44	28	34	34	31	30	Nw	N	0.07		Ni		St		overcast and very heavy snow showers a.m., Melting as it fell,	11
	12	28.621	40	28.723	39	44	27	40	39	29	28	N	N	0.04		Ni		St		Snow showers at intervals throughout. and very wintry.	12
	13	28.621	40	28.731	40	57	33	40	39	38	36	N	N	0.04		St		Ni		Showers throughout- Ground slightly covered, most ungenial weather,	13
	14	28.791	32	28.399	39	45	30	31	29	35	33	N	N	0.01		Ni		Ni		Rough cold day throughout Snow showers at intervals, and windy.	14
	15	28.433	35	28.723	39	41	28	33	32	32	31	Nw	N	0.01	Error		Ni	St	St	Fresh wind throughout the night and day and heavy snow showers at intervals and very cold	15
	16	28.174	39	28.886	34	39	27	35	33	31	30	NE	N	0.00			Cu		Cu	overcast and S. showers a.m. bright sun P.M. air Chilly	16
	17	28.861	34	29.478	35	40	22	32	32	30	30	NE	NE	0.01			Cu		Cu	one of the stormiest days of the season, snow and wind very fresh,	17
	18	29.183	35	29.475	37	41	29	29	27	32	31	NE	NE	000			Cu		Cu	most severe S-storm throughout. wind very fresh,	18
	19	29.483	35	29.835	37	34	25	28	27	26	26	NE	NE	000			Cu		Cu	Snow showers, with occasional bursts of sunshine, blowing hard;	19
	20	29.844	31	29.705	35	34	24	27	27	31	31	NE	N	000			Cu		Cu	Slight snow showers at intervals, and Generally overcast	20
	21	29.788	33	29.680	36	35	25	30	30	31	30	NE	N	000			Cu		Cu	a few slight showers of snow, and more genial bursts of sun, also cloud alternately	21
	22	29.883	35	29.833	35	42	25	31	30	31	31	NE	NE	000			Cu		Cu	slight snow showers a.m. dense masses of cloud P.M. snow melting slowly.	22
	23	29.578	37	29.691	32	39	20	30	30	27	27	Nw	Nw	003			Ni		Cu	Generally overcast more genial throughout	23
	24	29.535	34	29.162	43	48	33	34	33	35	34	Nw	Nw	1.16			Ni		Cu	One the best days of month.	24
	25	29.112	43	29.466	42	48	35	43	40	37	37	W	N	0.00			Ni		Ni	Thin rain a.m. Foggy and cold throughout	25
	26	29.664	42	29.273	34	47	33	42	37	35	34	W	E	000			Ni		Cu	cold damp air and hazy	26
	27	29.217	41	29.225	38	45	34	41	38	34	33	E	NE	004			Ni		Ni	overcast and cold, heavy snow showers P.M. ground speckled	27
	28	29.723	39	29.253	37	39	30	39	37	32	31	E	E	0.16			Ni		Ni	overcast up to 11 a.m. afterwards sleety showers most wretched weather, ground saturated	28
	29	29.178	37	28.873	39	36	30	34	33	35	34	E	E	0.04			Ni		Cu	overcast and air more genial a.m. sunshine at intervals P.M.	29
	30	~~29~~ 28.814	42	29.178	47	57	32	40	39	49	48	E	E	0.16			Ni		Cu	Generally overcast more genial throughout.	30
	31	29.270	40	29.257	45	50	33	42	41	47	46	E	NE	000			Ni		Cu	Showery throughout, & Cold	31
	Sums	910.651	1222	899.557	1240	1379	920	1156	1103	1080	1063			2.45							
	Means	29.053	39.4	29.018	40.0	44.4	29.7	37.0	35.3	34	33										
	Total Corrections for Instrumental Errors	+0.50	.4	+0.50		.8				.9	.6										

Column 7 (written vertically): X Y Barometer reading at 6 a.m. was 28.150. att. Thermometer 37 at 9 a.m. Barometer stood at 27.850, after which there was little or no rapid fluctuations; dull leaden sky, wind West. I have not observed any lower readings; there was had, but the 9th & 10th is a very extremely low state of the Barometer.

Columns 25–27 (note beside days 19–24): To day 19th has been a most severe day. snow drifted into unmeasured wreaths, suspending all traffic. Yet we do not think there has been more than 10 in of snow fallen altogether, but the wind was blowing quite a gale;

No. of Column	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

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

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

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

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

Mean, reduced to 32°, and Sea-level, ... = ______

Highest Reading, corrected for Index error, on the ___ th, ... = 29.883

Lowest Do. Do., on the ___ th, ... = 27.714

Difference, or **Monthly Range,** .... = 2.169

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

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 13 th, ... = 57.0

Lowest in Month, corrected for Index errors, on the 3 th, ... = 20.0

Difference, or **Monthly Range,** .... = 37.0

"Corrected **Mean**" **of all the Highest,** (Col. 5), ... = 44.8

"Corrected **Mean**" **of all the Lowest,** (Col. 6), ... = 29.7

Difference, or **Mean Daily Range,** .... = 15.1

** Calculated **Mean Temperature** of Month, ... = 37.2

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** (Cols. 9 and 11), ... = 36.0

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), ... = 34.5

‡‡ Computed **Temperature of Dew-Point,** .... = 32.3

‡‡ Do. **Elastic Force of Vapour,** .... = .184

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

‡‡ **Relative Humidity, (Saturation = 100),** .... = 87

RAIN fell on 18 **Days; Amount in Inches,** .... = 2.45.

WIND. SUMMARY.

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

Observations made and Return verified by ______

(Signed) Alexander McDonald

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns 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 the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has 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 is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is 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.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering 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 so as 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 facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down, viz.: as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument: it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers.

Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements,—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with Exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, 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. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, 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 altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer.

In reading the Thermometer great care must be taken to bring 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 40¼° and 40¾°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are 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.

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, 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.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Nigretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure.

The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Guage should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base us they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rain-fall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls.

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

Clouds.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud 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 may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, 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:—Thus, in the column Velocity and Direction, 6, S. W.

4, st.
——— will indicate that the upper strata of Clouds travel with
2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second

2, cu-st,
Cloud column, an entry of———, 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.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine.

The approximate 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 growth of crops and plants generally, depend greatly 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 permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

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 most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. 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. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc. 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 $3^{N.W.}_{4}$, as an Ozone entry in the schedule, will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks.

The Remarks column is unavoidably too narrow. 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 in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Aurora Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons.

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. 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 Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and approved before being used; and they consider it necessary 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, *December 1874.*

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First appear.	1st Leaf.	Dressed of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Bleed.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

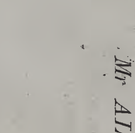
FRUITS.	First in Blossom.	Fruit Ripe, generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

MIGRATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

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.

To
Mr ALEXANDER BUCHAN,
Secretary of the Meteorological Society of Scotland,
EDINBURGH.

BOOK POST.



SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gardens Cluny 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 April 1876.

The Hours of Observation are of Greenwich Time.

Days of Month	Barometer 9h. A.M. (inches)	Attached Thermometer 9h. A.M.	Barometer 9h. P.M. (inches)	Attached Thermometer 9h. P.M.	Self-Reg. Therm. Max.	Self-Reg. Therm. Min.	Black Bulb Max. in Sun's rays	Min. on Grass	Hygrometer 9h. A.M. Dry bulb	9h. A.M. Wet bulb	9h. P.M. Dry bulb	9h. P.M. Wet bulb	Wind 9h. A.M. Direction	Force	Wind 9h. P.M. Direction	Force	H.Cup Anemometer 9h. A.M.	Rain: No. of hours	Rain: Amount in inches	Clouds 9 A.M. Velocity and Direction	Clouds 9 A.M. Amount and Species	Clouds P.M. Velocity and Direction	Clouds P.M. Amount and Species	Sunshine Hours	Under Ground 3 inches	12 inches	22 inches	Well	Sea	Ozone 9 A.M.	Ozone 9 P.M.	General Remarks	Days of Month
1	29.270	40	29.257	45	4 / 37	32			38	37	47	46	SE		SE				000		Ni		Ni									very fine throughout	1
2	29.349	48	29.601	45	58	25			39	38	40	37	SE		SE				000		Ci		Ci									very fine	2
3	29.651	47	29.825	57	60	35			45	44	53	50	SE		SE				000		Cu		Ci									overcast A.M. fine throughout	3
4	29.851	47	29.870	59	60	45			53	47	50	46	S		S				000		Ci		Ci									Slightly overcast and fine	4
5	30.082	55	30.042	50	62	49			57	51	50	47	S		S				000		St		St									very fine	5
6	30.031	54	30.086	43	60	37			60	53	49	47	S		S				000		St		St									very fine	6
7	30.000	57	29.833	45	63	31			49	45	53	49	S		S				000		St		St									Slight haze and very fine	7
8	29.663	57	29.417	36	60	38			55	50	48	45	S		S				001		Cu		Cu									fine	8
9	29.142	48	29.080	34	49	29			55	50	33	32	S		NE				0.12		Cu		Cu									Thunder about 12 P.M. after which the day was cold and raw	9
10	29.049	41	28.886	41	41 (36)	30			3 / 49	3 / 48	32	31	SE		NE				0.07		St		Cu									ground slightly covered with snow and showers at intervals throughout the day	10
11	29.067	44	29.217	35	35	29			37	32	32	31	N		N				0.15		Ni		Cu									about one inch of snow, trees covered over. They look exceedingly pretty but unseasonable	11
12	29.410	39	29.588	37	40	26			35	32	29	28	NW		N				[illegible]		Ni		Ni									2 in. of S. very cold and wintry air. Cold wind & [illegible] P.M. S. showers at intervals throughout	12
13	29.487	40	29.878	37	42	21			38	37	29	29	NW		N				[illegible]		Ni		Cu									severe frost during the night. S. showers very heavy at intervals throughout. The day most wintry	13
14	29.870	37	29.977	36	48	27			40	39	30	29	NW		NW				000		St		Cu									fine generally, but very cold air. Ground covered with S. A.M. Clouds and sunshine afterwards	14
15	29.896	49	29.804	46	48	29			49	45	45	44	N		SW				000		St		Cu									more genial throughout, and drying the soil nicely	15
16	29.813	48	29.812	43	50	34			46	45	36	36	SW		W				000		Ni		St									Generally fine but cold air.	16
17	29.567	41	29.160	44	49	24			43	42	42	41	SE		E				0.47		Ni		St									overcast and showery Cold ungenial day throughout.	17
18	29.065	42	28 / 29.855	46	44	39			42	41	40	40	E		E				0.46		Ni		Ni									overcast and showery air warmer.	18
19	28.755	46	28.763	43	44	38			43	42	42	42	S		E				0.36		Ni		Ni									overcast and showery air more genial	19
20	28.650	48	28.850	48	51	40			49	46	41	41	S		S				0.04		Ni		Ni									Overcast and sultry A.M. 3.4 P.M. South. very heavy thunder shower afterwards	20
21	29.044	50	29.570	40	54	37			52	51	46	45	S		SW				0.00		St		Ni									Changeable sunshine and showers	21
22	29.620	40	29.620	40	46	27			41	40	30	29	NE		N				0.00		Ci-St		Cu									generally fine air cold, a few flakes of snow fell	22
23	29.670	40	29.754	46	47	25			42	41	30	29	SW		N				0.47		Ci		Cu									Cold drying wind throughout	23
24	29.715	42	29.750	46	44	26			3 / 48	1 / 46	44	43	SW		NW				0.16		Ni		Ni									Overcast throughout and showery P.M. cold raw air	24
25	29.517	41	29.606	45	50	37			45	44	40	39	N		NW				0.07		Ni		Ni									generally showery soil saturated. air more genial	25
26	29.596	49	29.679	46	49	34			46	46	42	41	N		N				0.07		Ni		St									Generally overcast and air more genial	26
27	29.601	47	29.492	41	49	33			44 / 50	44 / 49	42	41	N		N				0.01		Cu		Ni									Generally overcast showery at night	27
28	29.352	47	29.656	45	43	37			43	42	40	40	NE		NE				0.14		Cu		Cu									Showery A.M. generally overcast and fresh wind	28
29	29.451	47	29.556	49	50	32			46	45	43	42	N		N				0.01		Cu		Cu									Generally fine	29
30	29.651	47	29.651	47	48	32			47	45	45	44	N		N				0.06		Ni		Ni									passing clouds and bitter cold wind, most wintry weather	30
31																																	31
Sums.	885.085 (13149)	1384 (14)	887.039 (18141)	1335 (14)	1476 (12)	983 (15)			1374 (14)	1324 (12)	1243 (9)	1174 (13)							2.74 (28)														
Means.	29.515 (14)	46.4 (17)	29.5 (16)	44 (11)	49.7 (29)	32.8 (7)			45.8 (16)	44.1 (13)	41.4 (2)	39.4 (28)																					
† Total Corrections for Instrumental Errors.	497 +.050	45.8	539 +.050	43.8		.8			45.6	43.1	40.8	39.5																					
‡ Corrections for Diurnal Range.																																	
"Corrected Means."																																	
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.497 — .045 = 29.452

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.533 — .041 = 29.492

Mean at Station, corrected, and at 32°, = 29.472

Correction for height, feet above Mean Sea-level, = .311

Mean, reduced to 32°, and Sea-level, = 29.783

Highest Reading, corrected for Index error, on the 6th, = ~~30.086~~ 30.086

Lowest Do. Do., on the 20th, = ~~28.650~~ 28.650

Difference, or **Monthly Range,** = ~~1.436~~ 1.436

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 7th, = 63.0

Lowest in Month, corrected for Index errors, on the 13th, = 21.0

Difference, or **Monthly Range,** = 42.0

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 49.7

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 32.8

Difference, or **Mean Daily Range,** = 16.9

** Calculated **Mean Temperature** of Month, = 41.3

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), = 43.1

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 41.3

‡‡ Computed **Temperature of Dew-Point,** = 39.1

‡‡ Do. **Elastic Force of Vapour,** = .239

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

‡‡ **Relative Humidity, (Saturation = 100),** = 86

RAIN fell on 17 **Days; Amount in Inches,** = 2.74

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

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

Observations made and Return verified by ______

(Signed) Alexander McDonald

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

One of the chief objects that the Scottish Meteorological Society proposed to itself when the Society was established in 1855, was to secure perfect uniformity in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation. The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns 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 the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer. Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is Fortin's Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has 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 is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is 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.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering 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 so as 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 facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down, viz.: as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers. The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of four feet above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of uniformity of height above ground, and method in protecting the Thermometers, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers. Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements,—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with Exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers. The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, 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. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer. The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, 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 altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer. In reading the Thermometer great care must be taken to bring 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 40¼°, and 40¾°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are 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.

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, 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.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind. Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction. A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called Storm Stations, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to Barometric Gradients, and other points connected with storms.

2. As regards Velocity and Pressure. The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Ballabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges. Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Guage should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rain-fall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

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

Clouds. Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud 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 may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, 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:—Thus, in the column Velocity and Direction, $\frac{6,\ S.W.}{2,\ W.}$ 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 speed of the former. Again, in the second Cloud column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st.}$ will indicate that the higher regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo-stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine. The approximate 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 growth of crops and plants generally, depend greatly 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 permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

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 most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. 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. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells. The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

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

Atmospheric Electricity. Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks. The Remarks column is unavoidably too narrow. 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 in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons. Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. 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 Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and approved before being used; and they consider it necessary 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, December 1874.

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,	12th			
Birch,					Wheat,				
Elm,					Beans,				
Larch,	3rd	3rd			Pease,				
Lime,					Potatoes,				
Oak,					Turnips,				
Sycamore or Plane,		[illegible]			Rye Grass,				

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	First in 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,	last week		Plover,		
Holly,		Peach,			Sand-Martin,		
Laburnum,		Pear,			Starling,		
Lilac,		Plum,			Swan,		
Mezereon,	3rd	Strawberry,	Strawberry first week.		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.

Oats sowing has been completed well the first week of the month. [illegible] considerable breadths were sown during the first [illegible], many have not yet got a [illegible]. Too wet [illegible] remainder of spring [illegible] outdoor operations. Turnips [illegible] almost at a stand. There is plenty of grass [illegible] doing little or nothing in the way of growth, should we not have an immediate change. Stock will suffer badly.

Cluny April 1876.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK POST.

ABERDEEN H MY 2 76

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gardens Cluny 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 May 187 6.

The Hours of Observation are of Greenwich Time.

Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No. ____	Attached Thermometer	9 h. P.M. Barometer. No. ____	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No. ____	Min. No. ____	Exposed Black Bulbs. Max. in Sun's rays No. ____	Min. on Grass No. ____	HYGROMETER. No. ____ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H.Cup Anemometer. No. ____ 9 h. A.M.	RAIN. No. of hours in which it fell.	Amount in inches. No. ____	CLOUDS. 9 A.M. Velocity (0—6), and Direction.	Amount, (0—10), and Species.	P.M. Velocity (0—6), and Direction.	Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. ____ 3 inches.	12 inches.	No. ____ 22 inches.	Temperature of WELL at depth of ____ feet. No.	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.
	inches.	°	inches.	°	°	°	°	°	°	°	°	°																							
1	29.992	50	29.992	50	61	34			53	49	50	49	NE		NE				000		Ci		Cu											Bitter cold day. ground slightly covered with snow, and showers at intervals throughout.	1
2	30.087	52	30.095	49	61	33			52	45	47	46	Sh		Sh				000		Ci		Cu											Fine throughout, and bright sun. air cool. Lunar halo at night.	2
3	29.992	50	30.106	48	60	31			57	46	50	49	Sh		Sh				000		Ci		Cicu											Fine. air chilly and passing Cloud.	3
4	30.045	49	29.950	47	60	32			50	41	48	47	S		E				000		Ci		Ci											Fine throughout and hazy	4
5	30.142	50	30.153	46	61	35			50	48	49	48	S		S				000		Ci		Cicu											very fine throughout, had and Lunar halo	5
6	30.124	57	30.195	49	64	36			57	48	46	45	S		S				000		Ci		Ci											very fine. slight haze.	6
7	30.145	49	30.198	48	62	31			49	41	46	46	SE		SE				000		Ci		Ci											Strong sun. air Chilly, very parching	7
8	30.145	49	30.148	48	61	31			49	48	39	38	S		SE				.		Cu		Cicu											Bright sun. air cool. drying wind. very much appearance of Vegetation.	8
9	30.245	49	30.072	39	62	27			54	46	39	38	SE		Sh				—		Ci		Cicu											Bright sun. air cool. clear sky. chilly at night. very parching	9
10	30.198	48	30.049	40	63	33			48	04	37	36	S		S				—		Ci		Cicu											Bright sun. air cool, slight haze.	10
11	30.069	40	30.045	47	60	28			49	41	41	40	SE		SE				—		Ci		Cicu											Bright sun. air cool and parching Rain wanted badly.	11
12	30.019	40	30.072	39	57	31			48	36	39	36	Sh		SE				—		Cu		Cu											do	12
13	30.048	48	29.937	52	64	36			48	45	47	45	NE		NE				—		Cu		Ni											do	13
14	29.899	48	29.904	46	49	40			47	43	42	40	NW		NE				0.03		Cu		Ni											Generally overcast and very Cold throughout. very severe weather overcast and cold would very unseasonable weather.	14
15	29.876	47	29.904	46	49	40			48	43	41	40	NE		NE				0.01		Ni		Ni												15
16	29.998	48	30.103	46	60	37			48	43	36	34	NE		NE				—		Ni		Ni											Dry parching day	16
17	30.048	49	30.115	49	57	29			48	44	45	42	NE		NE				—		St		Ni											Overcast air Chilly	17
18	30.090	48	30.048	48	54	39			48	43	40	38	NE		NE				—		Cicu		St											Sunny. air cool, and parching	18
19	30.000	47	29.995	49	59	34			49	45	39	38	NE		NE				—		Ni		St											Moderate Throughout	19
20	29.937	52	29.841	51	60	40			50	41	45	42	NE		NE				—		Cicu		St											Fine. air moist and Sunny like	20
21	29.838	52	29.838	54	60	42			59	52	46	44	NE		NE				0.15		Ni		Ni											Generally overcast and	21
22	29.344	54	29.236	53	64	43			54	49	49	43	NE		NE				0.38		Ni		Cu											Sultry air. heavy showers Rain and Thunder.	22
23	29.234	53	29.386	53	60	43			48	42	49	48	NE		NE				0.09		Ni		Ni											Generally overcast and favourable weather.	23
24	29.556	45	29.446	49	60	41			45	42	48	48	NE		NE				0.11		Ni		Ni											overcast and air Chilly	24
25	29.501	47	29.438	52	61	43			45	42	52	46	NE		NE				0.06		Ni		Ni											overcast and showers air Chilly	25
26	29.365	42	29.430	55	55	40			52	49	51	48	NE		NE				0.03		Cu		Cu											Slight drizzling rain. air more genial	26
27	29.483	54	29.525	57	60	48			52	50	55	49	NE		NE				0.01		Ni		Ni											Showery am. Rain PM and Chilly	27
28	29.622	52	29.527	56	64	49			63	57	59	49	NE		NE				0.00		Ni		Cu											Fresh wind. and Genial	28
29	29.620	59	29.659	44	70	60			62	54	56	54	NE		NE				—		St		St											Fine	29
30	29.427	56	29.401	47	75	50			62	54	58	54	NE		NE				—		St		St											Fine throughout slight drizzling rain overcast and Chilly am. windy and bright sun PM.	30
31	29.535	53	29.554	46	70	43			60	49	49	47	NE		NE				—		St		Cu												31
Sums.	924 274		925 057		1420		388 7		1608		1490		1440		1365				0.87																
Means.	29.846 26	49 3/4 29	29.840 26	48 3/4	60 2/3	37.0			51.9 5	48 3/4 18	46 10/31 19.0	44 3/4 12																							
† Total Corrections for Instrumental Errors.	847 +.000	.8	841 +.000	484	.9					45.8	.4																								
‡ Corrections for Diurnal Range.																																			
"Corrected Means."																																			
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30					

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.847 ..... − .057 = 29.790

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.841 ..... − .053 = 29.788

Mean at Station, corrected, and at 32°, ... = 29.789

Correction for height, feet above Mean Sea-level, ... = .305

Mean, reduced to 32°, and Sea-level, ... = 30.094

Highest Reading, corrected for Index error, on the 8 th, ... = 30.298

Lowest Do. Do., on the 23 th, ... = 29.284

Difference, or **Monthly Range,** ..... = 1.014

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 30 th, ... = 75.0

Lowest in Month, corrected for Index errors, on the 13 th, ... = 26.0

Difference, or **Monthly Range,** ..... = 49.0

"Corrected **Mean**" **of all the Highest,** (Col. 5), ... = 60.9

"Corrected **Mean**" **of all the Lowest,** (Col. 6), ... = 37.0

Difference, or **Mean Daily Range,** ..... = 23.9

** Calculated **Mean Temperature** of Month, ... = 48.9

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), ... = 49.1

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), ... = 44.9

‡‡ Computed **Temperature of Dew-Point,** ..... = 40.4

‡‡ Do. **Elastic Force of Vapour,** ..... = .254

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

‡‡ **Relative Humidity,** (**Saturation** = 100), ... = 72

RAIN fell on 9 **Days; Amount in Inches,** ..... = 0.87

WIND. Direction.	SUMMARY. N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.		17		4	6	3		1			
P.M.		19		6	3	3					
Mean.	0	18	0	5	4	3	0	1			

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

Observations made and Return verified by _____

(Signed) Alexander McDonald

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

One of the chief objects that the Scottish Meteorological Society proposed to itself when the Society was established in 1855, was to secure perfect uniformity in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation. The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns 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 the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer. Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is Fortin's Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has 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 is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is 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.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering 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 so as 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 facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down, viz.: as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers. The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of four feet above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of uniformity of height above ground, and method in protecting the Thermometers, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers. Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements,—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with Exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit changes to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers. The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, 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. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer. The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, 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 altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer. In reading the Thermometer great care must be taken to bring 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 40¼°, and 40¾°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are 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.

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, 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.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Nigretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind. Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction. A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called Storm Stations, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to Barometric Gradients, and other points connected with storms.

2. As regards Velocity and Pressure. The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges. Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Guage should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base us they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rain-fall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

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

Clouds. Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud 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 may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, 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:—Thus, in the column Velocity and Direction, $\frac{6,\ S.\ W.}{2,\ W.}$ 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 speed of the former. Again, in the second Cloud column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st,}$ will indicate that the higher regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo-stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine. The approximate 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 growth of crops and plants generally, depend greatly 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 permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

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 most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. 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. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells. The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

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

Atmospheric Electricity. Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks. The Remarks column is unavoidably too narrow. 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 in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons. Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. 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 Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and approved before being used; and they consider it necessary 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, *December 1874.*

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,	4 week	2 week	3 week		Oats,	[illegible] week	[illegible] week		
Birch,			3 week		Wheat,				
Elm,			4 week		Beans,				
Larch,					Pease,				
Lime,					Potatoes,	3 week			
Oak,		4 week			Turnips,	3 week			
Sycamore or Plane,					Rye Grass,				

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe, generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry,		Apple,	3 week		Cuckoo,	1st week	
Bourtree or Elder,		Black Currant,			Curlew,		
Broom,		Cherry,	2 week [illegible]		House-Swallow,		
Hazel,		Gean,	3 week		Lapwing,		
Hawthorn,		Gooseberry,			Plover,		
Holly,		Peach,			Sand-Martin,		
Laburnum,		Pear,			Starling,		
Lilac,		Plum,	Plums [illegible]	[illegible] week	Swan,		
Mezereon,		Strawberry,	4 week		Rail or Corn Crake,	19 May	
Mountain Ash or Rowan,							
Red Flowering Currant,							
Rhododendron Ponticum,							
Whin,	3 week						

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.

The Month has been much opposed to all Agricultural pursuits - the first part being cold and freezing with frost almost every night - [illegible] no consequence - [illegible] 8 [illegible] Hay [illegible] - the Grain [illegible] looking healthy [illegible] the Potatoes [illegible] suffered considerably with frost - [illegible] (or rather the Blossom), Vegetation generally is [illegible] than at this time last year. Cattle generally healthy.

Cherry
May 1876.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK POST.

ABERDEEN JU 8 76

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *Cluny Castle Gardens*, 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* 187*6*.
The Hours of Observation are of Greenwich Time.

Days of Month	Barometer 9 h. A.M. (inches)	Attached Thermometer 9 h. A.M.	Barometer 9 h. P.M. (inches)	Attached Thermometer 9 h. P.M.	S.-R. Therm. Max.	S.-R. Therm. Min.	Hygrometer 9 h. A.M. Dry bulb	9 h. A.M. Wet bulb	9 h. P.M. Dry bulb	9 h. P.M. Wet bulb	Wind 9 h. A.M. Direction	Wind 9 h. P.M. Direction	Rain Amount in inches	Clouds 9 A.M. Amount and Species	Clouds P.M. Amount and Species	Ozone	General Remarks
1	29.427	56	29.316	61	65	50	63	54	43	40	NE	NE	—	Cu	Cu	This week has been very parching & ungenial	Sultry and bright sun. 'I' about 8 PM.
2	29.184	54	29.018	60	55	42	55	49	45	40	NE	NW	0.09	Cicu	Cu		Bright sun and sultry AM.
3	29.076	57	29.071	59	65	44	57	52	43	40	NE	NE	0.03	St	Ni		Cold day. heavy rain. Wind fresh.
4	29.525	57	29.533	54	58	49	48	46	47	43	W	W	0.10	St	Ni		generally fine. ~~strong~~ very fresh breeze. parching
5	29.827	56	29.877	56	70	37	48	44	58	50	W	W	—	Cu	St		very fresh wind and parching
6	29.820	59	29.817	60	60	40	43	37	50	48	SE	E	—	Cu	Cu		very fresh winds and parching
7	29.470	59	29.420	59	62	43	50	46	46	43	SE	SE	—	St	Cu		do do do
8	29.546	49	29.793	50	55	47	49	48	46	45	NW	NW	0.05	St	Ni		air more genial AM. showers PM doing immense good. 9 PM North
9	29.891	51	29.817	60	61	43	51	41	47	46	SE	SE	—	Cu	Cu		Cold Raw day. very adverse to all Vegetation ("more like March than June")
10	29.820	59	29.841	57	70	33	59	54	43	41	SE	SE	0.09	C	Cu		overcast AM. Sunny and air more genial PM.
11	29.312	51	29.724	59	75	37	44	43	45	44	S	S	0.01	Cu	Cu		Sultry AM. air Cooler PM.
12	29.443	50	29.723	58	71	39	50	50	46	44	S	S	—	Cu	Ci		Generally overcast
13	29.817	60	29.877	57	60	50	52	51	47	43	S	S	0.01	Cu	Ci		Bright sun air Chilly
14	29.316	61	29.238	62	60	39	60	51	47	40	SW	SW	—	St	Ci		Bright sun. fresh breeze. very parching. air chilly at night
15	29.318	60	29.366	61	71	44	66	53	49	47	SW	W	0.01	St	St		Generally overcast and fine
16	29.773	58	29.342	51	59	41	50	49	43	41	SW	W	0.03	Ci	St		Bright sun. air mixed and parching
17	29.423	59	29.371	59	75	41	50	41	51	49	SW	S	—	St	St		Generally overcast. slight rain PM.
18	29.420	58	29.368	60	76	40	60	47	50	49	S	S	—	Cu	Ci		very fine throughout
19	29.470	59	29.664	61	77	50	63	51	52	51	S	S	—	Ci	Cu		Bright sun drying ~~air~~ wind. air warm. Chilly at night
20	29.706	64	29.857	63	75	45	69	61	56	53	S	S	0.01	Ni	St		slight haze. fresh wind. very parching. very hot
21	29.854	65	29.717	60	65	47	68	61	53	51	S	S	—	Cu	St		Bright sun. air hazy. 'I' PM. overcast am.
22	29.864	61	29.867	60	68	49	61	56	50	49	S	S	1.00	St	Cu		Continuous rain the rest of day.
23	29.870	59	29.919	64 (~~46~~)	75	39	65	59	58	55	S	S	—	Cu	Cicu		passing clouds and thunder throughout
24	29.856	64	29.793	69	84	39	69	57	65	64	S	S	—	Cu	St		Changeable. passing Clouds & sunshine.
25	29.817	60	29.793	69	68	39	68	54	59	57	S	S	—	St	Cu		Clear blue sky. scorching heat
26	29.814	61	29.764	61	67	41	62	59	56	51	S	S	—	St	Cicu		Grilling heat
27	29.856	64	29.814	61	75	43	56	51	52	51	S	S	—	Cu	Cu		Grilling heat
28	29.870	59	29.872	58	69	41	56	50	54	53	S	S	—	Cu	St		do
29	29.625	57	29.675	57	68	49	54	51	54	53	S	S	—	Cu	St		Generally overcast
30	29.622	58	29.567	60	64	53	55	50	54	54	S	SW	—	Ni	Ni		do
31																	
Sums.	888.072	1645	888.[illegible]	177[illegible]	2023	1294	1680	1516	1509	1405			1.33				
Means.	29.602	54.25	29.599	59.7	67.4	43.1	56.0	50.5	50.3	46.8							
† Total Corrections for Instrumental Errors.	601 +050	.2	599 +.050														
‡ Corrections for Diurnal Range.																	
"Corrected Means."																	

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.601 — .067 = 29.534

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.599 — .082 = 29.517

Mean at Station, corrected, and at 32°, = 29.526

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

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

Highest Reading, corrected for Index error, on the 23th, = 29.969

Lowest Do. Do., on the th, = 29.068

Difference, or **Monthly Range,** = 0.901

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

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 24th, = 84.0

Lowest in Month, corrected for Index errors, on the 10 th, = 33.0

Difference, or **Monthly Range,** = 51.0

"Corrected **Mean" of all the Highest,** (Col. 5), = 67.4

"Corrected **Mean" of all the Lowest,** (Col. 6), = 43.1

Difference, or **Mean Daily Range,** = 24.3

** Calculated **Mean Temperature** of Month, = 55.2

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), = 53.5

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 48.7

‡‡ Computed **Temperature of Dew-Point,** = 44.0

‡‡ Do. **Elastic Force of Vapour,** = .287

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

‡‡ **Relative Humidity, (Saturation = 100),** = 70

RAIN fell on 10 **Days; Amount in Inches,** = 1.33

WIND. Direction.	N.	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	3		4	16	4	2				
P.M.	2	2	1	3	16	2	4				
Mean.	2	2	1	3	16	3	3				

Observations made and Return verified by ______

(Signed) Alexander McDonald

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

One of the chief objects that the Scottish Meteorological Society proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation. The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns 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 the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer. Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is Fortin's Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has 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 is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is 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.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering 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 so as 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 facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down, viz.: as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers. The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers. Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements,—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with Exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers. The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, 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. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer. The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, 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 altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer. In reading the Thermometer great care must be taken to bring 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 $40\frac{1}{2}$°, respectively. So also $40\frac{1}{4}$°, and $40\frac{3}{4}$°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are 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.

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, 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.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Nigretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind. Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction. A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called Storm Stations, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to Barometric Gradients, and other points connected with storms.

2. As regards Velocity and Pressure. The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges. Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Guage should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base us they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

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

Clouds. Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud 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 may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, 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:—Thus, in the column Velocity and Direction, $\frac{6,\ S.W.}{2,\ W.}$ 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 speed of the former. Again, in the second Cloud column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st,}$ will indicate that the higher regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo-stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine. The approximate 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 growth of crops and plants generally, depend greatly 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 permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

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 most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. 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. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells. The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

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

Atmospheric Electricity. Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks. The Remarks column is unavoidably too narrow. 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 in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons. Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. 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 Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and approved before being used; and they consider it necessary 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, *December* 1874.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK POST.

Cluny June 1876 ~~*Aberdeen*~~

ABERDEEN

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	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,		*wk*		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,	*wk*	Gean,			Lapwing,		
Hawthorn,	*1st wk*	Gooseberry,			Plover,		
Holly,		Peach,			Sand-Martin,		
Laburnum,	*3 wk*	Pear,			Starling,		
Lilac,		Plum,			Swan,		
Mezereon,		Strawberry,			Rail or Corn Crake,		
Mountain Ash or Rowan,	*1st wk*						
Red Flowering Currant,							
Rhododendron Ponticum,	*1st wk*						
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.

[illegible]

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gardens Cluny 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 July 1876.

The Hours of Observation are of Greenwich Time.

Days of Month	Barometer 9 h. A.M. (inches)	Attached Thermometer 9 h. A.M. (°)	Barometer 9 h. P.M. (inches)	Attached Thermometer 9 h. P.M. (°)	Self-Registering Thermometers, Max. (°)	Min. (°)	Exposed Black Bulbs: Max. in Sun's rays	Min. on Grass	Hygrometer 9 h. A.M. Dry bulb (°)	Wet bulb (°)	Hygrometer 9 h. P.M. Dry bulb (°)	Wet bulb (°)	Wind 9 h. A.M. Direction	Force	Wind 9 h. P.M. Direction	Force	Rain, Amount in inches	Clouds 9 A.M. Amount and Species	Clouds P.M. Amount and Species	General Remarks
1	29.268	65	29.572	58	67	43			62	58	59	57	W		SW		—	Cicu	Ni	Slight showers. Exceedingly fine
2	29.459	63	29.570	59	68	44			61	59	54	52	S		SW		—	Cicu	Ci	Generally fine
3	29.517	60	29.567	60	71	59			54	52	63	58	SW		SW		—	Cicu	St	overcast and genial
4	29.570	59	29.567	~~60~~ 60	70	53			52	50	59	58	S		SW		—	Cicu	Cu	Strong Sun, slight air, very parching
5	29.378	62	29.570	59	69	46			57	49	54	45	SW		SW		—	Cicu	St	Strong Sun, air parching
6	29.496	49	29.564	61	70	48			64	54	59	48	W		SW		—	Cicu	Cu	Changeable, dark masses of cloud and fresh breeze am, sunny pm,
7	29.430	55	29.318	69	70	45			59	55	55	53	SE		E		0,06	Ni	Cist	generally overcast and warm
8	29.271	59	29.406	64	71	51			61	58	59	58	SE		S		0,06	Ni	Ni	oppressive, and overcast am, ~~to~~ showery pm, genial throughout
9	29.370	60	29.467	60	67	53			56	54	54	48	W		W		0,28	Ni	Ni	Sunshine and cloud alternately and chilly air
10	29.372	57	29.521	59	67	46			60	54	57	53	NW		NW		0,01	Cu	Cu	overcast and chilly
11	29.777	56	29.425	57	60	49			60	50	52	49	NW		W		—	Cu	Ni	Generally overcast
12	29.926	56	29.947	67	77	44			59	51	68	61	SW		SW		—	Cu	St	nice rain during the night. Very fine all day,
13	29.952	65	29.893	69	80	63			55	50	65	60	S		SW		—	St	Cist	Brilliant sun throughout,
14	29.969	68	30.091	69	81	53			75	64	65	62	S		S		—	St	Ni	excessive heat throughout
15	30.105	64	30.197	67	77	60			75	66	60	58	S		SW		—	St	Cu	excessive heat throughout, and parching light breeze.
16	29.949	66	29.830	74	90	45			79	65	70	60	SW		SW		—	Ci	Cicu	× The most intense heat I remember, × clear blue sky, with a speck of Ci cloud
17	29.820	59	29.614	65	67	57			53	57	60	56	S		W		—	Ni	Ni	parching sun, light breeze, burning vegetation fast
18	29.870	59	29.601	66	69	58			62	55	58	53	W		W		0.72	Ni	Ni	Showery up to 2 PM. from 2 PM sunshine and fresh breeze, & cloudy, air cool
19	29.764	61	29.854	65	67	56			59	54	62	57	NW		NW		0.34	Ni	Ni	Generally overcast and drizzling showers, fine growing day
20	29.862	62	29.914	61	67	53			65	56	54	52	S		E		0.01	St	Cicu	fine, overcast throughout
21	29.719	63	29.817	60	67	54			67	54	54	52	S		S		0.01	Cu	Cu	Generally fine
22	29.709	63	29.877	60	67	54			56	54	52	45	S		W		0.83	St	Cicu	sultry am. ~~[illegible]~~ T.S. and lightning very vivid, accompanied with a downpour of rain, continuing from half past one PM until 3 PM. T.S. from NW to SE.
23	29.705	57	29.617	60	65	43			60	55	55	53	S		W		—	Cu	Cu	Very fine
24	29.707	58	29.767	60	65	51			56	52	52	50	N		NW		—	Ni	Cicu	Overcast and genial
25	29.641	51	29.864	61	73	39			60	57	55	53	SW		W		0.01	Ni	Cu	Fine
26	29.770	59	29.650	57	61	46			59	57	53	52	SE		E		—	Ni	Ni	Fine
27	29.151	66	29.120	59	70	49			61	59	59	53	S		S		0.75	Cu	Ni	Generally overcast and very fine
28	29.520	59	29.627	56	67	47			54	50	51	48	SW		NW		0.02	Ni	Cu	Showers and overcast and cool
29	29.367	60	29.317	60	69	39			58	50	52	45	W		S		0.03	Ni	Ni	Generally overcast dry, parching air
30	29.320	59	29.114	61	62	43			62	57	55	53	SW		W		—	Ni	Ni	fresh breeze, air dry, passing clouds
31	29.280	54	29.530	55	61	41			59	52	52	50	NW		N		0.35	Ni	Cu	overcast am, heavy rain pm.
Sums.	17 14 12 / 188 56 / ~~918.413~~	16 / 304 / ~~1854~~	17 12 12 / 1948 / ~~918.508~~	13 / 58 / ~~1858~~	13 / 292 / ~~2142~~	15 / 292 / ~~1533~~			14 / 20 / ~~1880~~	13 / 152 / ~~1702~~	13 / 227 / ~~1773~~	13 / 102 / ~~1656~~					34 / 3.48			
Means.	29.608 / ~~29.626~~	59.8 / ~~59 25/31~~	29.629 / ~~29.629~~	61.9 / ~~59 29/31~~	69.4 / ~~69 3/31~~	49.4 / ~~49 14/31~~			60.6 / ~~60 20/31~~	54.9 / ~~54 28/31~~	57.3 / ~~57 6/31~~	53.3 / ~~53 13/31~~								
Total Corrections for Instrumental Errors.	+.050		+.050																	
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	19	21	23	

(Columns 17 Anemometer, 18 Hours of rain, 20/22 Cloud velocity, 24 Sunshine, 25–27 Thermometers under Ground, 28 Well, 29 Sea, 30 Ozone, and Electricity are blank.)

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction†† for Temp. (Col. 2), = 29.608 — .082 = 29.526

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction†† for Temp. (Col. 4), = 29.629 — .089 = 29.540

Mean at Station, corrected, and at 32°, = 29.436

Correction for height, feet above Mean Sea-level, = 299

Mean, reduced to 32°, and Sea-level, = 29.735

Highest Reading, corrected for Index error, on the 15 th, = ~~30.969~~ 30.247

Lowest Do. Do., on the 30 th, = ~~29.105~~ 29.165

Difference, or **Monthly Range,** = .1082

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 16 th, = 90.0

Lowest in Month, corrected for Index errors, on the 25 th, = 39.0

Difference, or **Monthly Range,** = 51.0

"Corrected **Mean" of all the Highest,** (Col. 5), = 69.4

"Corrected **Mean" of all the Lowest,** (Col. 6), = 49.4

Difference, or **Mean Daily Range,** = 20.0

** Calculated **Mean Temperature** of Month, = 59.0

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), = 59.0

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 54.1

‡‡ Computed **Temperature of Dew-Point,** = 49.7

‡‡ Do. **Elastic Force of Vapour,** = .357

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

‡‡ **Relative Humidity, (Saturation = 100),** = 72

RAIN fell on 14 **Days; Amount in Inches,** = 3.48

WIND. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1			3	11	6	5	5			
P.M.	1		3		5	10	8	4			
Mean.	1	0	2	1	8	8	6	5			

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

Observations made and Return verified by ______

(Signed) Alexander McDonald

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns 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 the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has 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 is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is 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.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering 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 so as 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 facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down, viz.: as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers.

Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements,—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with Exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, 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. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, 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 altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer.

In reading the Thermometer great care must be taken to bring 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 40¼°, and 40⅝°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are 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.

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, 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.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Nigretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure.

The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Guage should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base us they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls.

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

Clouds.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud 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 may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, 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:—Thus, in the column Velocity and Direction, 6, S. W.

——— will indicate that the upper strata of Clouds travel with
2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second

4, st.

Cloud column, an entry of ———, will indicate that the higher
2, cu-st,

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.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine.

The approximate 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 growth of crops and plants generally, depend greatly 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 permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

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 most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. 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. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc. The paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{\frac{N.W.}{4}}$, as an Ozone entry in the schedule, will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks.

The Remarks column is unavoidably too narrow. 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 in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons.

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. 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 Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

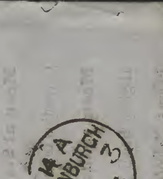
The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and approved before being used; and they consider it necessary that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, *December 1874.*

To
Mr ALEXANDER BUCHAN,
Secretary of the Meteorological Society of Scotland,
EDINBURGH.

BOOK POST.



OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First appear.	First in Blossom.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	In Flower.	Leaf First appear.	First in Blossom.
Barberry,			
Bourtree or Elder,			
Broom,			
Hazel,			
Hawthorn,			
Holly,			
Laburnum,			
Lilac,			
Mezereon,			
Mountain Ash or Rowan,			
Red Flowering Currant,			
Rhododendron Ponticum,			
Whin,			

FRUITS.	First in Blossom.	Fruit Ripe, generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

MIGRATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

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

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gardens & Cluny Castle Aberdeen 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 August 1876.

The Hours of Observation are of Greenwich Time.

Days of Month	Barometer 9 h. A.M. (inches)	Attached Thermometer 9 A.M.	Barometer 9 h. P.M. (inches)	Attached Thermometer 9 P.M.	Self-Reg. Therm. Max.	Self-Reg. Therm. Min.	Hygrometer 9 A.M. Dry bulb	9 A.M. Wet bulb	9 P.M. Dry bulb	9 P.M. Wet bulb	Wind 9 A.M. Direction	Wind 9 P.M. Direction	Rain Amount in inches	Clouds 9 A.M. Amount and Species	Clouds P.M. Amount and Species	General Remarks
1	29.310	45	29.530	55	61	42	59	52	49	47	NW	W	0.35	Cu	Ni	Generally overcast and fine
2	29.627	56	28.857	59	59	49	62	55	56	51	S	NW	0.30	Ni	St	overcast Very fresh wind air Chilly. Rainy P.M.
3	28.823	56	29.443	50	66	50	54	52	55	49	SE	SE	—	Ni	Ni	fresh wind and showers A.M. air at rest P.M.
4	29.417	60	29.770	59	67	54	63	53	53	52	SW	SW	—	Cu	St	sunny and very fresh breeze generally fine
5	29.570	59	29.620	59	65	43	63	52	57	55	NW	NW	—	Ni	Ni	Generally fine passing Clouds and sunshine alternately
6	29.422	58	29.617	60	65	39	62	57	59	55	SW	SW	—	Cu	Cu	Generally overcast light breeze
7	29.517	60	29.659	63	70	46	60	55	59	56	NW	NW	—	Cu	Cu	Generally fine.
8	29.804	65	29.606	64	75	44	70	60	61	57	NW	S	—	Cu	Cu	Very fine throughout
9	29.464	61	29.695	55	71	47	71	63	48	46	S	SE	—	Cu	Cu	fine
10	29.896	68	29.827	60	79	45	64	52	59	49	S	S	—	St	St	Bright sun throughout & fine
11	29.917	63	29.915	60	82	48	69	58	57	54	S	S	—	St	St	Sultry and fine
12	29.895	59	29.854	65	74	42	71	62	58	56	S	W	—	St	Cicu	Sultry
13	29.609	63	29.809	63	75	42	70	68	56	54	S	S	—	St	Cicu	Parching sun throughout
14	29.664	61	29.864	64	86	42	71	69	~~75~~ 57	55	S	W	—	St	Cu	Grilling sun and slight haze,
15	29.706	64	29.643	69	70	43	70	65	56	53	S	S	—	Cicu	Cicu	parching sun fresh breeze rain much wanted.
16	29.764	62	29.577	60	79	41	70	66	62	60	S	S	—	—	Cicu	parching sun. dense fogs nightly
17	29.872	58	29.840	60	75	42	70	63	50	48	S	S	—	St	Cicu	overcast dull Bright sun P.M.
18	29.862	62	29.862	62	75	40	68	57	58	57	S	S	—	Cu	Cicu	Parching throughout
19	29.617	60	29.714	61	78	54	73	63	51	50	W	SE	—	St	—	do do do
20	29.714	61	29.812	62	78	45	64	62	54	53	S	SE	—	Cu	—	do do do
21	29.562	62	29.454	60	66	47	69	62	56	54	S	SE	0.05	Cu	Cu	Bright sun A.M. overcast P.M. Thunder about 4 P.M. and slight showers.
22	29.462	58	29.533	54	68	43	56	43	58	45	S	S	0.01	St	St	air Cool. slight showers. fresh breeze and passing Clouds.
23	29.383	54	29.543	50	67	40	52	52	59	44	SW	SW	—	St	CiSt	Blowing hard. air Cold. sunshine & shade alternately
24	29.491	51	29.585	53	60	45	57	47	47	46	W	NW	0.05	CiSt	Cu	Blowing hard. showers at intervals and cold.
25	29.580	55	29.220	59	57	45	52	47	48	45	NW	NW	—	Ni	Ni	fresh breeze A.M. changeable P.M. sunshine showers & shade & cold
26	29.150	56	29.036	53	57	44	55	47	53	49	NW	SW	0.09	Ni	Cu	showery and blowing fresh
27	29.327	55	29.611	51	61	44	55	51	47	45	NW	W	—	Cu	Ni	Generally fine air Cool
28	29.193	50	29.342	51	63	44	55	51	43	42	W	NW	0.02	Ni	Cicu	showery A.M. and Cool and overcast P.M.
29	29.193	50	29.285	53	68	46	49	47	47	45	N	NW	—	Ni	Cicu	Fine throughout
30	29.186	53	29.139	52	63	40	49	48	50	49	SE	NW	—	Ni	Cicu	overcast & fine
31	28.855	56	28.931	55	57	48	52	49	50	46	SE	NE	0.05	Cu	Cicu	generally overcast fresh breeze slight showers P.M.
Sums	906.082	1751	905.823	1801	2145	1484	1923	1738	1689	1578			0.92			
Means	29.519 +050	58.1	29.543 +050		68.9	44.6	62.1	55.7								
† Total Corrections for Instrumental Errors																
‡ Corrections for Diurnal Range																
"Corrected Means."																
No. of Column	1	2	3	4	5	6	9	10	11	12	13	15	19	21	23	

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

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

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

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

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

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

Highest Reading, corrected for Index error, on the 11 th, = 29.967

Lowest Do. Do., on the 3 th, = 28.875

Difference, or **Monthly Range,** = 1.092

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

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 14 th, = 86.0

Lowest in Month, corrected for Index errors, on the 6 th, = 39.0

Difference, or **Monthly Range,** = 47.0

"Corrected **Mean" of all the Highest,** (Col. 5), = 68.9

"Corrected **Mean" of all the Lowest,** (Col. 6), = 44.6

Difference, or **Mean Daily Range,** = 24.3

** Calculated **Mean Temperature** of Month, = 56.8

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** (Cols. 9 and 11), = 58.0

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 53.5

‡‡ Computed **Temperature of Dew-Point,** = 49.4

‡‡ Do. **Elastic Force of Vapour,** = .365

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

‡‡ **Relative Humidity, (Saturation = 100),** = 74

RAIN fell on 8 **Days; Amount in Inches,** = 0.92

WIND. Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1			4	15	3	2	6			
P.M.		1	1	3	10	2	5	9			
Mean.	1	0	1	3	12	3	4	7			

Observations made and Return verified by ____________

(Signed) Alexander McDonald

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns 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 the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has 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 is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is 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.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering 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 so as 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 facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down, viz.: as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers.

Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements,—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with Exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, 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. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, 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 altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer.

In reading the Thermometer great care must be taken to bring 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 40¼°, and 40⅞°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are 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.

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, 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.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Nigretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure.

The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Guage should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base us they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls.

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

Clouds.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud 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 may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, 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:—Thus, in the column Velocity and Direction, 6, S. W.

———— will indicate that the upper strata of Clouds travel with
2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second

4, st.

Cloud column, an entry of———, will indicate that the higher
2, cu-st,

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.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine.

The approximate 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 growth of crops and plants generally, depend greatly 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 permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

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 most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. 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. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc.

Ozone.

The paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{\frac{N.W.}{S.}}$, 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, or blowing fresh.

Atmospheric Electricity.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks.

The Remarks column is unavoidably too narrow. 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 in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons.

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. 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 Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and approved before being used; and they consider it necessary 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, *December 1874.*

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First Appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Pontieum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe, generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Peas,				
Potatoes,				
Turnips,				
Rye Grass,				

MIGRATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

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.

To
Mr ALEXANDER BUCHAN,
Secretary of the Meteorological Society of Scotland,
EDINBURGH.

BOOK POST.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gardens, Murray Lands, County of Aberdeen, in Lat. _____, Long. _____, Distance from Sea 4 miles.

Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground _____ feet. During the MONTH of September 1876.

The Hours of Observation are of Greenwich Time.

Days of Month.	BAROMETER. 9 h. A.M. * No.	Attached Thermometer	9 h. P.M. Barometer. No.	Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.	Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Min. on Grass No.	HYGROMETER. No. ___ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H.Cup Anemometer. No. ___ 9 h. A.M.	RAIN. No. of hours in which it fell.	Amount in inches. No. ___	CLOUDS. 9 A.M. Velocity (0—6), and Direction.	Amount, (0—10), and Species.	___ P.M. Velocity (0—6), and Direction.	Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No. 3 inches.	12 inches.	No. 22 inches.	Temperature of WELL at depth of ___ feet. No. ___	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.
	inches.	°	inches.	°	°	°	°	°	°	°	°	°												°	°	°	°				Generally overcast and Slight	
1	29.234	54	29.407	45	57	46			53	49	50	48	NE		NE				0.00		Ni		Ni							Showers. Fresh breeze	1
2	29.236	53	29.573	48	55	38			49	45	40	39	NE		NE				0.04		Ni		Ni							Generally overcast. Very fresh breeze and chilly	2
3	29.579	46	29.598	48	59	29			55	47	41	40	E		E				0.10		Ni		Ni							Generally overcast slight Showers PM. Windy AM	3
4	29.392	57	29.186	53	58	51			49	47	50	49	E		E				0.65		Ni		Ni							Showery throughout fresh breeze and	4
5	28.782	55	28.929	56	66	45			55	54	51	47	E		E						Ni		St							Showery and fresh breeze	5
6	28.877	57	29.088	56	65	48			57	53	51	49	SW		W				0.08		St		Ni							Generally overcast and drizzling rain	6
7	29.136	53	29.186	53	55	44			53	48	47	46	W		SW				0.23		Ni		Ni							overcast throughout,	7
8	29.392	57	29.259	54	62	32			47	45	49	48	NW		W				0.06		Ni		St							Showery	8
9	29.392	54	29.384	54	56	44			52	51	49	47	NW		NE				0.01		Ni		Ni							Showery	9
10	29.344	50	29.443	50	53	44			50	48	46	44	NW		NE				0.01		Ni		Ni							Showers. Very fresh winds and raw day	10
11	29.643	50	29.473	48	52	42			50	47	45	43	E		NE				0.07		Ni		Ni							Very fresh wind drizzling showers	11
12	29.448	50	29.466	51	52	41			50	49	50	49	W		NW				0.01		Ni		Cu							Blowing a gale AM. Blowing hard midday at intervals	12
13	29.441	51	29.463	52	51	45			51	45	48	46	W		W				0.05		Ni		Cu							Blowing a gale PM, and Showery. Cold raw day	13
14	29.438	52	29.483	54	55	54			52	51	55	51	W		NW				0.01		Ni		Ni							Blowing fresh and Showery	14
15	29.435	53	29.427	56	57	45			53	51	54	52	NW		NW				0.16		Ni		Ni							overcast & Showery	15
16	29.342	51	29.430	55	58	47			51	50	58	56	W		NW				0.06		Ni		Ni							overcast Showers	16
17	29.435	53	29.334	53	65	46			51	48	47	46	SW		W				0.01		Ni		Ni							Changeable. but Generally overcast	17
18	29.780	55	29.588	52	56	40			54	48	47	44	SW		SW				—		Cu		Ni							Stagnant warm air and overcast	18
19	29.992	50	29.952	52	56	43			49	46	47	44	SE		SE				—		St		Ni							overcast AM. very fine PM.	19
20	29.435	53	30.006	45	57	43			51	50	47	45	E		E				0.10		Ni		Cu							Very fine throughout the most part of month	20
21	29.680	55	29.597	56	62	46			55	54	54	53	E		E				—		Ni		Cu							Very fine throughout	21
22	29.475	57	29.471	59	62	52			53	52	55	54	E		E				0.03		Cu		Cu							Showery AM. fine PM.	22
23	29.430	57	29.402	57	62	47			55	54	53	52	E		E				—		Ni		Ni							Generally overcast. AM. Fresh breeze PM.	23
24	29.620	55	29.579	56	56	54			55	54	46	44	NE		E				0.50		Ni		Ni							Generally overcast. AM. fine PM. air stagnant	24
25	29.478	50	29.525	57	55	45			55	53	54	52	E		E				0.16		Ni		Ni							Fine PM. air stagnant AM. showery PM. very bad weather for harvest operations	25
26	29.294	50	29.515	57	55	50			50	49	52	51	NW		NE				0.07		Ni		Ni							showery AM. Foggy PM.	26
27	29.294	50	29.452	56	54	45			50	48	47	46	E		E				0.19		Ni		Cu							Showery, AM. Fair and overcast PM. Stagnant air.	27
28	29.339	52	29.438	52	53	35			50	45	48	46	NE		E				—		Cu		Cu							overcast throughout, and most adverse for all outdoor work	28
29	29.326	51	29.201	53	50	35			48	47	36	35	W		W				0.01		Ni		Ni							overcast AM. Fine PM. Fair AM.	29
30	29.554	46	29.556	45	47	34			46	44	42	40	SW		S				0.01											Generally Fine	30
31																																					31
Sums.	881.968	1569	892.741	1584	1686	1314			1551	1472	1462	1407							2.62																			
Means.	29.409	52.6	29.430	52.8	56.2	43.7			51.6	49.1	48.6	46.8																									
† 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							

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

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

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

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

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

Mean, reduced to 32°, and Sea-level, ... = _____

Highest Reading, corrected for Index error, on the 20 th, ... = 30.006

Lowest Do. Do., on the 5 th, ... = 28.782

Difference, or **Monthly Range,** ..... = 1.224

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 5 th, ... = 66.0

Lowest in Month, corrected for Index errors, on the 3 th, ... = 29.8

Difference, or **Monthly Range,** ..... = 3.7

"Corrected **Mean" of all the Highest,** (Col. 5), ... = 56.2

"Corrected **Mean" of all the Lowest,** (Col. 6), ... = 43.7

Difference, or **Mean Daily Range,** ..... = 12.5

** Calculated **Mean Temperature** of Month, ... = 49.9

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), ... = 50.1

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), ... = 48.0

‡‡ Computed **Temperature of Dew-Point,** ..... = 45.8

‡‡ Do. **Elastic Force of Vapour,** ..... = .306

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

‡‡ **Relative Humidity, (Saturation = 100),** ..... = 85

RAIN fell on 23 **Days; Amount in Inches,** ..... = 2.62

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

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

† Embracing corrections for both capillarity and Index Errors.

‡ The Diurnal Range for Scotland is as yet unknown.

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

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

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

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

Observations made and Return verified by _____

(Signed) Alexander McDonald

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation. The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns 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 the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer. Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has 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 is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is 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.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering 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 so as 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 facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down, viz.: as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers. The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers. Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements,—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with Exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers. The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, 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. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer. The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, 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 altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer. In reading the Thermometer great care must be taken to bring 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 $40\frac{1}{2}$°, respectively. So also $40\frac{1}{4}$°, and $40\frac{3}{4}$°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are 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.

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, 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.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Nigretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind. Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction. A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure. The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges. Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Guage should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

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

Clouds. Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud 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 may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, 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:—Thus, in the column Velocity and Direction, $\frac{6,\ S.\ W.}{2,\ W.}$ 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 speed of the former. Again, in the second Cloud column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st,}$ will indicate that the higher regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo-stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine. The approximate 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 growth of crops and plants generally, depend greatly 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 permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

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 most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. 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. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells. The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

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

Atmospheric Electricity. Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks. The Remarks column is unavoidably too narrow. 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 in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons. Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. 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 Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and approved before being used; and they consider it necessary 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, *December* 1874.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

Everything late as generally is the very unsuitable state of the weather ... but the month ... has been most adverse for all harvest operations, turnips have made great strides during the month. Potatoes are doing well. District generally healthy.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK POST.

Ehrry
Sept. 1876.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gardens Cluny 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 October 187 6

The Hours of Observation are of Greenwich Time.

Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No.___ (inches.)	BAROMETER. 9 h. A.M. Attached Thermometer (°)	BAROMETER. 9 h. P.M. Barometer. No.___ (inches.)	BAROMETER. 9 h. P.M. Attached Thermometer (°)	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.___ (°)	Min. No.___ (°)	Exposed Black Bulbs. Max. in Sun's rays No.___ (°)	Min. on Grass. No.___ (°)	HYGROMETER. No.___ 9 h. A.M. Dry bulb. (°)	Wet bulb. (°)	9 h. P.M. Dry bulb. (°)	Wet bulb. (°)	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H.Cup Anemometer. No.___ 9 h. A.M.	RAIN. No. of hours in which it fell.	Amount in inches. No.___	CLOUDS. 9 A.M. Velocity (0—6), and Direction.	Amount, (0—10), and Species.	___ P.M. Velocity (0—6), and Direction.	Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No.___ 3 inches. (°)	12 inches. (°)	No.___ 22 inches. (°)	Temperature of WELL at depth of ___ feet. No. (°)	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.
1	29.555	47	29.804	46	49	26			40	36	40	39	W		W				001	Ni		Ni									Generally fine	1
2	29.986	45	29.851	47	46	37			42	41	42	40	W		W				.04	Ni		Ni									Overcast - Wet - Generally fair	2
3	29.844	50	29.848	48	51	25			51	50	46	45	NW		NW				0.09	Ni		Ni									Showery and unfavourable	3
4	29.594	54	29.588	52	60	43			53	52	59	49	SW		SW				0.18	Ni		Ni									Fine all, Overcast + Fine	4
5	29.595	46	29.334	54	59	48			45	44	47	46	SW		SW				0.06	Ni		Ni									Generally fair in Stagnant	5
6	29.450	57	29.487	57	61	45			58	55	55	53	W		W				0.10	St		St									Generally overcast - slight Showers	6
7	29.625	57	29.570	59	64	53			52	48	58	54	W		SW				—	Ni		Cu									Generally fine Clear Sky and Light Airs	7
8	29.381	55	29.405	55	63	45			59	52	52	51	W		W				0.12	Cu		Cu									Generally fine All dense Clouds P.M.	8
9	28.792	55	28.875	58	57	50			44	42	55	52	W		W				0.18	Cu		Cu									Showery am Fair and windy Night P.M.	9
10	28.800	48	28.785	58	54	36			47	46	49	45	W		W				0.17	Cu		St									Generally Fair, Many Fair at Night	10
11	28.947	49	28.985	57	59	40			51	50	47	46	NW		NW				0.24	Ni		Ni									Blowing hard and Showery	11
12	28.797	49	29.192	57	58	40			47	46	48	45	NW		NW				0.01	Ni		Ni									Generally Fine Overcast - Fine,	12
13	29.154	54	29.463	50	50	45			48	48	44	42	Sh		SW				—	Ni		Ni									Showery throughout	13
14	29.284	54	29.339	52	55	31			50	49	43	41	Sh		SW				0.06	Ni		Cu									Fair Generally	14
15	29.480	58	29.342	51	57	36			53	52	51	49	SW		SW				0.03	St		Cu									Fine throughout	15
16	29.591	51	29.352	50	53	46			53	52	50	49	SW		SW				0.04	Ni		Cu									Generally fine Blowing a fair breeze during night	16
17	29.589	52	29.331	55	54	50			54	51	49	47	S		S				0.60	Cu		Cu									Generally, overcast and drizzling showers, cloud stagnant air,	17
18	29.940	51	29.229	55	54	40			40	40	39	38	S		SW				0.20	St		St									Generally overcast and stagnant air	18
19	29.788	52	29.485	56	52	51			39	38	34	33	SW		SW				0.15	St		Cu									Drizzling showers throughout	19
20	29.872	48	29.793	53	47	46			35	34	35	34	W		W				0.01	Ni		Ni									Overcast throughout	20
21	29.956	45	30.011	50	49	45			39	39	38	35	W		W				0.09	Ni		Ni									Generally overcast	21
22	29.961	43	30.098	43	48	41			34	33	32	31	SW		SW				0.05	St		Ni									Overcast + Fine	22
23	29.966	48	30.052	48	48	40			40	39	31	31	W		W				0.18	Cu		Ni									Generally overcast	23
24	29.896	49	29.817	45	49	41			41	40	34	33	SW		SW				—	Cu		Cu									Generally overcast	24
25	29.956	45	29.845	41	58	31			42	41	39	38	NW		NW				—	Cu		Cu									Fine throughout.	25
26	29.872	41	29.772	34	52	29			34	33	31	31	W		W				—	St		St									Fine. light air	26
27	29.868	38	29.811	39	49	32			34	33	35	33	W		W				—	St		St									Very fine light air	27
28	29.862	43	29.706	44	57	32			44	43	40	39	W		W				—	St		—									Fine	28
29	29.643	56	29.659	47	55	38			51	47	44	41	S		SW				—	Cu		Cu									Snow showers and very fresh wind	29
30	29.767	41	29.870	40	46	33			38	37	36	34	NW		NW				—	Cu		Cu									Slight. Snow showers and fresh	30
31	29.917	41	29.867	41	40	32			38	35	38	36	NW		NW				—	Ni		Ni									Slight. Snow showers, at intervals	31
Sums.	916.108		916.677		1524				1399	1326	1329	1262							2.58																		
Means.	29.552		29.570		49.5	5.24			45.1	43.4	43.2	41.4																									
† 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							

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

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

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

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

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

Mean, reduced to 32°, and Sea-level, ... = _____

Highest Reading, corrected for Index error, on the 22 th, ... = 30.098

Lowest Do. Do., on the 12 th, ... = 28.297

Difference, or **Monthly Range,** ..... = 1.801

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 7 th, ... = 64.0

Lowest in Month, corrected for Index errors, on the 1 th, ... = 26.0

Difference, or **Monthly Range,** ..... = 38.0

"Corrected **Mean**" **of all the Highest,** (Col. 5), ... = 52.4

"Corrected **Mean**" **of all the Lowest,** (Col. 6), ... = 39.9

Difference, or **Mean Daily Range,** ..... = 12.5

** Calculated **Mean Temperature** of Month, ... = 46.1

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

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

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

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

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

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

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

‡‡ Computed **Temperature of Dew-Point,** ..... = _____

‡‡ Do. **Elastic Force of Vapour,** ..... = _____

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

‡‡ **Relative Humidity, (Saturation = 100),** ..... = _____

RAIN fell on 21 **Days; Amount in Inches,** ..... = 2.58

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	3	1	7	4	3	5	7	1	0		
P.M.	3	1	9	2	2	4	8	2			
Mean.	3	1	8	3	3	4	7	2			

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

Observations made and Return verified by _____

(*Signed*) Alexander McDonald

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns 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 the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has 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 is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is 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.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering 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 so as 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 facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down, viz.: as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers.

Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements,—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with Exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, 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. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, 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 altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer.

In reading the Thermometer great care must be taken to bring 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 40¼°, and 40¾°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are 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.

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, 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.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Nigretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure.

The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Guage should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base us they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rain-fall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls.

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

Clouds.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud 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 may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, 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:—Thus, in the column Velocity and Direction, 6, S. W.

——— will indicate that the upper strata of Clouds travel with 2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second 4, st.

Cloud column, an entry of———, will indicate that the higher 2, cu-st,

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.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine.

The approximate 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 growth of crops and plants generally, depend greatly 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 permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

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 most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. 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. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc. 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 $3^{N.W.}_{4}$, as an Ozone entry in the schedule, will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is 4, or blowing fresh.

Atmospheric Electricity.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks.

The Remarks column is unavoidably too narrow. 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 in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons.

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. 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 Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and approved before being used; and they consider it necessary 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, *December 1874.*

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First appear.	In Leaf.	Divested of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Pease,				
Potatoes,				
Turnips,				
Rye Grass,				

MIGRATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

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.

To
Mr ALEXANDER BUCHAN,
Secretary of the Meteorological Society of Scotland,
EDINBURGH.

BOOK POST.

Oct. 1876

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gardens Kemnay 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 November 187 6.

The Hours of Observation are of Greenwich Time.

Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No.___	BAROMETER. 9 h. A.M. Attached Thermometer	BAROMETER. 9 h. P.M. Barometer. No.___	BAROMETER. 9 h. P.M. Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.	Min. No.	Exposed Black Bulbs. Max. in Sun's rays No.	Exposed Black Bulbs. Min. on Grass. No.	HYGROMETER. No.___ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H.Cup Anemometer. No.___ 9 h. A.M.	RAIN. No. of hours in which it fell.	Amount in inches. No.___
	inches.	°	inches.	°	°	°	°	°	°	°	°	°							
1	30.016	41	29.892	41	45	33			39	37	46	43	W		NW				—
2	29.864	42	29.671	49	50	42			47	44	49	46	S		SE				—
3	29.668	50	29.791	57	56	44			50	47	48	44	S		S				0.06
4	30.00	47	30.057	47	46	40			44	45	45	46	SW		NW				0.18
5	29.901	47	29.893	50	52	41			45	44	47	48	S		NW				0.08
6	30. 29.068	46	30. 29.008	44	47	37			45	44	40	30	E		SE				—
7	29.997	39	30.027	37	43	26			35	34	31	20	NW		NW				—
8	30.007	35	29.982	35	34	21			35	34	31	29	NW		NW				—
9	29.930	37	29.972	39	35	25			000	000	000	000	NW		NW				60
10	29.920	38	29.820	40	30	9			000	000	000	000	NW		SW				—
11	29.692	41	29.564	42	30	15			000	000	000	000	NW		SW				—
12	29.451	47	29.407	45	35 21	35			40	39	41	38	E		SW				—
13	29.479	46	29.514	42	41 37	41			41	37	40	39	E		E				0.80
14	29.512	43	29.207	45	44	35			43	40	45	44	E		NE				0.15
15	29.046	50	29.194	50	52	42			52	52	50	48	NE		E				1.20
16	29.287	43	29.164	52	50	26			39	38	50	49	NE		E				000
17	29.261	53	29.198	48	50	36			39	38	50	49	NW		E				0.42
18	29.571	49	29.441	51	48	36			47	46	49	48	SE		E				0.11
19	29.241	57	29.305	46	50	35			44	43	38	37	NE		SE				1.00
20	29.399	48	29.646	49	47	34			45	43	46	45	SE		S				—
21	29.806	45	29.854	46	47	38			37	37	43	42	SW		NW				0.03
22	29.798	48	29.748	48	46	37			44	42	44	42	SE		S				0.02
23	29.751	47	29.712	43	45	38			41	39	41	38	SW		S				—
24	29.656	45	29.606	45	45	36			41	39	43	39	SW		S				—
25	29.420	44	29.062	43	43	26			41	39	39	38	SE		NW				0.06
26	29.017	41	29.107	45	42	25			36	36	000	000	SW		SW				0.38
27	29.035	40	29.017	41	35	31			000	000	35	34	S		SW				—
28	28.980	44	29.078	41	38	29			39	38	31	37	NW		NW				0.09
29	29.000 30.5	37	29.170	40	40	26			33	32	26	34	SE		NW				0.30
30	29.866	36	29.375	38	38	28			000	000	34	33	S		SW				—
31																			
Sums.	885.9 16	13 13 11	885.615	13 14 12	1285	11 12			1042	997	1132	1060							5.48 5
Means.	29.554	43.9	29.554	44.4	43.4	32.2			41.7	40.3	42.0	40.0							
† Total Corrections for Instrumental Errors.	29.551																		
‡ 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

Days of Month.	CLOUDS. 9 A.M. Velocity (0—6), and Direction.	9 A.M. Amount, (0—10), and Species.	— P.M. Velocity (0—6), and Direction.	— P.M. Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No.___ 3 inches.	12 inches.	No.___ 22 inches.	Temperature of WELL at depth of ___ feet. No.___	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.
					Hours.	°	°	°	°	°				
1		St		Ni									Generaley fine. Light breeze	1
2		Ni		AcCu									Mild genial day throughout	2
3		Ni		Cu									Fine all day drizzling showers at night	3
4		Cu		Ni									Generally overcast	4
5		Cu		Ni									Generally overcast & showers,	5
6		Ni		—									Overcast	6
7		Cu		—									Hail and Snow Showers.	7
8		Cu		Cu									Snow showers. depths about 2, in.	8
9		Cu		—		Unusually severe so early							Severe Snow Storm, 3. to 4 in	9
10		Cu		Cu									Severe frost throughout.	10
11		Cu		Cu									Frosty throughout.	11
12		St		Cu									Inclined to frost. and blowing Hard	12
13		Ni		Cu									Fresh breeze. Snow melting fast	13
14		Ni		Ni									Showery, and ~~Violent~~ Blowing a gale at night	14
15		Ni		Cu									Generaley overcast	15
16		Ni		Cu									Dense Fog A.M. Rain P.M. Meteors	16
17		Ni		Cu									Showery	17
18		Ni		—									Fine all day. heavy rain at night	18
19		Ni		Ni									Blowing hard. Very Brilliant Meteors	19
20		Cu		Cu									Fine. But overcast	20
21		Ni		Ni									overcast and fine. Blowing hard during night.	21
22		Cicu		Ni									Generally overcast, Blowing hard during night.	22
23		Cu		Cu									Generally overcast an Chiley	23
24		Cu		Cu									Overcast	24
25		Ni		Ni									Generaley fine	25
26		St		—									Generally overcast	26
27		Cu		Cicu									Overcast	27
28		Ni		Ni									Sleety showers. hills speckled with Snow	28
29		St		—									Generaley fine	29
30		Cicu		Ni									Generaley fine	30
31														31

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction ++ for Temp. (Col. 2), = 29.551 — 0.040 = 29.511

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction ++ for Temp. (Col. 4), = 29.554 — 0.042 = 29.512

Mean at Station, corrected, and at 32°, = 29.512

Correction for height, feet above Mean Sea-level, = 314

Mean, reduced to 32°, and Sea-level, = 29.826

Highest Reading, corrected for Index error, on the 4 th, = 30.057

Lowest Do. Do., on the 28 th, = 28.980

Difference, or **Monthly Range,** = 1.071

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 3 th, = 56.0

Lowest in Month, corrected for Index errors, on the 10 th, = 09.0

Difference, or **Monthly Range,** = 47.0

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 43.4

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 32.2

Difference, or **Mean Daily Range,** = 11.2

** Calculated **Mean Temperature** of Month, = 37.8

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

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

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

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

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

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

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

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

‡ Do. **Elastic Force of Vapour,** = ____

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

‡ **Relative Humidity, (Saturation = 100),** = ____

RAIN fell on 16 **Days; Amount in Inches,** = 5.48

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

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

Observations made and Return verified by _____

(Signed) Alexander Mc Donald

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

ONE of the chief objects that the SCOTTISH METEOROLOGICAL SOCIETY proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation.

The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns 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 the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer.

Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is FORTIN'S Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has 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 is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is 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.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering 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 so as 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 facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down, viz: as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers.

The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers.

Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements,—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with Exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers.

The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, 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. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer.

The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, 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 altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer.

In reading the Thermometer great care must be taken to bring 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 40¼°, and 40¾°, more or less must be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are 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.

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, 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.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Nigretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind.

Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction.

A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure.

The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges.

Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Guage should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base us they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rain-fall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

Snow-falls.

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

Clouds.

Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud 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 may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, 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:—Thus, in the column Velocity and Direction, 6, S. W.

——— will indicate that the upper strata of Clouds travel with 2, W.

extreme velocity from S.W., and those in the lower regions from W., with one-third the speed of the former. Again, in the second 4, st.

Cloud column, an entry of———, will indicate that the higher 2, cu-st,

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.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine.

The approximate 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 growth of crops and plants generally, depend greatly 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 permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

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 most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. 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. It is also very desirable that observations on the daily Maxima and Minima by Thermometers continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Peterhead and Liverpool.

Temperature of Wells.

The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone.

Mention what Test-Papers are used, Schönbein's or Moffat's, etc. 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 date and direction of the wind at the time of observation, in the following manner:—thus $3^{N.W.}_{*}$, 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, or blowing fresh.

Atmospheric Electricity.

Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks.

The Remarks column is unavoidably too narrow. 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 in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons.

Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. 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 Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and approved before being used; and they consider it necessary 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, *December 1874.*

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First appear.	In Leaf.	Directed of Leaves.
Alder,				
Ash,				
Beech,				
Birch,				
Elm,				
Larch,				
Lime,				
Oak,				
Sycamore or Plane,				

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Elder,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	
Red Flowering Currant,	
Rhododendron Ponticum,	
Whin,	

FRUITS.	First in Blossom.	Fruit Ripe, generally.
Apple,		
Black Currant,		
Cherry,		
Gean,		
Gooseberry,		
Peach,		
Pear,		
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Raised.
Barley,				
Bere or Bigg,				
Oats,				
Wheat,				
Beans,				
Peas,				
Potatoes,				
Turnips,				
Rye Grass,				

MIGRATORY BIRDS.	First Arrival.	Departure.
Cuckoo,		
Curlew,		
House-Swallow,		
Lapwing,		
Plover,		
Sand-Martin,		
Starling,		
Swan,		
Rail or Corn Crake,		

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.

The Gardeners Chron. 1876

76

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK POST.

ABERDEEN ADIE 7 6

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gardens of Kinmy 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 December 1876.

The Hours of Observation are of Greenwich Time.

Days of Month.	BAROMETER. 9 h. A.M. Barometer. * No.___	BAROMETER. 9 h. A.M. Attached Thermometer	BAROMETER. 9 h. P.M. Barometer. No.___	BAROMETER. 9 h. P.M. Attached Thermometer	SELF-REGISTERING THERMOMETERS, Read Daily, at 9 P.M. Protected in Shade, 4 feet above Ground. Max. No.___	Min. No.___	Exposed Black Bulbs. Max. in Sun's rays No.___	Min. on Grass. No.___	HYGROMETER. No.___ 9 h. A.M. Dry bulb.	Wet bulb.	9 h. P.M. Dry bulb.	Wet bulb.	WIND. 9 h. A.M. Direction.	Force	9 h. P.M. Direction.	Force	Readings of the H.Cup Anemometer. No.___ 9 h. A.M.	RAIN. No. of hours in which it fell.	Amount in inches. No.___	CLOUDS. 9 A.M. Velocity (0—6), and Direction.	Amount, (0—10), and Species.	___ P.M. Velocity (0—6), and Direction.	Amount, (0—10), and Species.	SUNSHINE. Hours.	THERMOMETERS under Ground. 9 h. A.M. No.___ 3 inches.	12 inches.	No.___ 22 inches.	Temperature of WELL at depth of ___ feet. No.___	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.
	inches.	°	inches.	°	°	°	°	°	°	°	°	°																						
1	29.160	44	29.019	45	45	37			43	42	44	43	Nelt		NW			0.87		Ni		Ni									Generally Showery ~~heavy hail at night~~	1
2	29.173	39	29.215	42	44	35			40	39	41	38	NW		NE			0.77		Ni		Ni									Showery blowing fresh.	2
3	28.962	43	28.450	48	47	34			42	41	44	44	E		E			1.33		Ni		Ni									Blowing a gale and heavy rain	3
4	28.401	48	28.214	49	49	41			48	48	48	47	E		E			1.78		Ni		Ni									Blowing a gale and rain. low ground flooded	4
5	28.204	47	28.351	48	47	38			47	46	48	47	E		S			0.72		Cu		Ni									Generally fair all day heavy rain at night & fresh breeze	5
6	28.204	47	28.354	47	46	37			46	45	47	46	W		S			0.23		Ni		Cu									Showery all day rather heavy at night	6
7	28.719	47	29.040	42	41	32			46	43	34	33	SW		SW			0.00		Cu		Cu									Showery.	7
8	29.065	42	29.417	41	39	38			33	32	~~46~~	~~43~~	SW		SW			—		St		Cu									Generally fair and inclined to frost	8
9	29.514	42	29.621	45	46	~~34~~ 45			40	40	~~46~~	~~43~~	E		SW			—		St		Cu									Fine	9
10	29.664	42	29.635	40	47	27			~~00~~	~~00~~	34	33	S		SW			—		St		Cu									very fine	10
11	29.528	36	29.367	41	42	25			~~00~~	~~00~~	40	40	SE		S			0.05		St		Cu									Overcast dull. Fine P.M. air cool	11
12	29.057	45	29.135	40	46	30			46	45	34	34	S		S			0.09		Ni		—									Overcast and drizzling showers	12
13	29.373	39	29.436	34	35	26			~~00~~	~~00~~	~~00~~	~~00~~	NE		SW			—		Cu		—									Overcast and drizzling showers	13
14	29.472	39	29.572	42	41	39			39	39	43	41	SE		S			—		Cu		Cu									Overcast throughout	14
15	29.656	45	29.609	44	42	40			38	31	42	39	E		CE			0.12		Ni		Ni									Overcast ~~and showery~~	15
16	29.475	38	29.622	43	42	40			39	39	42	41	SE		SE			0.28		Ni		Ni									Rough showers.	16
17	29.010	44	29.412	43	42	37			41	40	40	34	E		E			0.70		Ni		Ni									Overcast and showery	17
18	29.312	43	29.170	40	40	33			40	39	36	34	NE		E			0.15		Ni		Ni									Rough cold showery day Soil saturated,	18
19	29.027	37	28.977	37	36	32			34	34	35	34	NE		NE			1.09	3	Cu		Ni									Overcast and showers	19
20	28.871	40	28.978	39	36	29			37	36	~~00~~	~~00~~	SE		SE			0.37		Ni		Cu									Excessively rough cold Rainy day,	20
21	28.928	37	28.378	37	33	26			~~00~~	~~00~~	~~00~~	~~00~~	NE		NE			—		Cu		Cu									Blowing ~~a gale~~ Hard. Hail and Snow Throughout Lightning and	21
22	28.723	39	28.871	40	39	38			38	36	37	34	NE		E			0.74		Ni		Ni									Fierce storm drifting and snowing	22
23	28.975	39	29.128	37	37	31			35	34	35	34	E		NE			0.50		Cu		Cu									and blowing a gale,	23
24	29.378	37	29.628	37	36	28			34	33	34	33	E		NE			—		Cu		Cu									Very stormy up until 2 P.M. Sleet and rain	24
25	29.778	37	29.880	36	33	25			~~00~~	~~00~~	~~00~~	~~00~~	NE		NE			—		Cu		Cu									Fair. 7 P.M. Thunder 7 P.M. & Lightning	25
26	29.870	40	29.620	40	35	26			36	34	26	35	NE		NE			0.38		Cu		Ni									Heavy ~~sh~~ snowshowers at intervals throughout frosty	26
27	29.170	40	28.878	37	36	30			37	36	35	35	NE		E			1.35	5	Ni		Ni									Snow showers at intervals frosty	27
28	28.967	41	28.921	40	44	30			42	40	38	37	SE		SE			0.50		Cu		Cu									Snow drifting severely.	28
29	29.083	35	29.230	36	41	28			35	34	32	30	NE		NW			0.22		Cu		Cu									Snow melting. every place in a wretched state with sloughy water	29
30	29.075	38	28.618	41	35	29			35	35	34	34	SE		SE			0.86		Ni		Cu									generally overcast and showers. very heavy rain at night	30
31	28.518	41	28.571	40	42	30			42	42	38	38	E		NE			0.10		Ni		Cu									generally overcast showery and foggy.	31
Sums.	922.310		902.752		1271				1043	1003	1100	1006						12.20																
Means.	29.752	41.0	29.121	41.0	41.0	32.5			33.7	32.4	35.5	32.5																						
† Total Corrections for Instrumental Errors.	29.107		29.121			32.1			39.7	38.6	38.7	37.8																						
‡ Corrections for Diurnal Range.																																		
"Corrected Means."																																		
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

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

BAROMETER, "corrected Mean" at 9 A.M., *minus* the Correction †† for Temp. (Col. 2), = 29.107 − 033 = 29·074

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.121 − 033 = 29·088

Mean at Station, corrected, and at 32°, = 29.081

Correction for height, feet above Mean Sea-level, = 314

Mean, reduced to 32°, and Sea-level, = 29 395

Highest Reading, corrected for Index error, on the 25 th, = 29.880

Lowest Do. Do., on the 6 th, = 28·204

Difference, or **Monthly Range,** = 1·676

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 4 th, = 49·0

Lowest in Month, corrected for Index errors, on the 11 th, = 25·0

Difference, or **Monthly Range,** = 24·0

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 40·8

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 32·1

Difference, or **Mean Daily Range,** = 0·87

** Calculated **Mean Temperature** of Month, = 36·4

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), =

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

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

‡‡ Do. **Elastic Force of Vapour,** =

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

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

RAIN fell on 22 **Days; Amount in Inches,** = 12.20

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

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

Observations made and Return verified by _____

(Signed) Thomas McDonald

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

One of the chief objects that the Scottish Meteorological Society proposed to itself when the Society was established in 1855, was to secure PERFECT UNIFORMITY in the system of observation pursued at all its stations. Uniformity in the observations is absolutely necessary to justify the publication of Monthly Results from different observations, it being found that differences between the Returns from two Stations, so very considerable as to render them quite incomparable, may arise from dissimilarity in the position or shelter of instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore hoped, that those who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fail in achieving one of the main objects of Meteorological Observation.

Hour of Observation. The Council recommend that Observations be made precisely at 9 A.M. and 9 P.M. (Greenwich or Railway Time only), as specified in the following remarks, or at the top of the columns 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 the time at which it was taken, if not at 9 A.M. or 9 P.M.

Barometer. Weather-Glasses and Aneroids, though well suited to indicate roughly variations of atmospheric pressure, are not fitted for scientific purposes. No Barometer should be used for Meteorological Observation that is not supplied with some means of adjustment or compensation which will secure that the height of the mercury in the tube is accurately measured from the fluctuating surface of the mercury in the cistern.

The Barometer in which the error arising from the fluctuating surface of the mercury in the cistern is entirely got rid of is Fortin's Barometer, the arrangement consisting in applying pressure by means of a screw to the bottom of the cistern, which is made of flexible leather, thus raising or depressing the surface till it just meets the ivory point which forms the zero point of the fixed scale.

The Barometer originally constructed by Mr Adie of London, and usually called the Board of Trade Barometer, has 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 is an excellent Barometer for ordinary Observers, inasmuch as it entirely eliminates the error of observation likely to arise in not a few cases in setting the instrument to the zero point of the fixed scale when the light is not good. To show the accuracy with which these Barometers are made, it may be stated, that one was compared, during a whole year, with the Society's Standard Barometer, particular care being given to make the comparison when atmospheric pressure was rising or falling very rapidly, with the result that none of the readings differed from those of the Standard more than 0·003 inch.

A modification of Fortin's Barometer is used at a number of the Society's Stations, by which the coincidence of the zero point with the surface of the mercury is 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.

It is absolutely necessary that the Barometer which is to be used, shall have been compared with a Standard Barometer.

The Barometer should be suspended in as good a light as can be secured, and to facilitate the reading, a piece of white paper may be put behind the tube. It must be hung truly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire, and must not be hung against a wall heated by a flue. The object being to secure that the whole instrument, including the brass fittings, the contained mercury, and the attached Thermometer, shall be, when read, at one uniform temperature, it is evident that the best position is that which is least liable to sudden changes of temperature.

In taking an Observation, the Attached Thermometer is first noted: the tube must then be gently tapped, and the cistern-adjustment carefully made. The eye, by raising and lowering 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 so as 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 facilitate an accurate adjustment and reading of the Barometer. A mistake not unfrequently made by those beginning to observe, consisting in setting the edge of the vernier to the level of the clear surface of the mercury which is in direct contact with the glass tube, must be carefully avoided.

The errors most frequently made in reading the Barometer are errors of 1·000 inch, 0·500 inch, and 0·050 inch; that is to say, instead of 29·365 inches, either of the following is sometimes set down, viz.: as 30·365 inches, 28·365 inches, 29·865 inches, or 29·815 inches. Experience having shown that even the very best Observers make these mistakes, particular attention is directed to the matter.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must first be screwed so as to form a tight plug to the cistern, thus preventing the escape of the mercury. Then screw up the mercury not quite to the top of the tube, but to within a quarter of an inch of it, and take down the instrument; it should then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case if, on inclining the instrument, a sharp tap is produced when the mercury strikes the top of the tube. If a dull tap is heard, there is air in the tube, which must be got rid of.

As Barometers are liable to be deranged by the introduction of air into their tubes, on removal from place to place, or in being roughly handled, it may be useful to Observers to know how the air may be expelled. First close up the cistern by screwing the ivory peg tight, so as to prevent the escape of mercury; then screw up the mercury to about half an inch from the top of the tube; and having slowly inverted the instrument, place the top of it on a yielding substance, such as the boot, and gently tap on the cistern with the palm of the hand, so as to induce the air to ascend through the column to the cistern, whence it may escape. Since there is the weight of two atmospheres—the pressure of the mercury in the Barometer, and the air outside—pressing on any air that may be inside the tube, it is usually a tedious operation to get it wholly expelled. After repeated trials, however, it is generally accomplished; and the clear metallic sound of the mercury, when gently struck against the top of the glass tube, will show when the whole of the air has been expelled. On hanging up the Barometer, care must be taken to screw down the mercury in the tube before unfastening the float of the cistern, for if this be not attended to, the mercury will flow out, and the instrument be seriously damaged.

Protection and Position of Thermometers. The Council of the Society recommend that the Self-Registering Thermometers, and the Dry and Wet Bulb Hygrometer, be kept in Stevenson's Louvre-boarded Box for Thermometers, painted white inside and outside, and screwed to four stout posts, also painted white, firmly fixed in the ground. The posts must be of such a length that when the Thermometers are hung in position the Bulbs of the Minimum Thermometer, and of the Dry and Wet Bulb Thermometers, will be exactly at the same height of FOUR FEET above the ground, the Maximum Thermometer being hung immediately above the Minimum Thermometer. The Thermometer Box is to be placed over a plot of grass, and in a free open space to which the sun's rays have free access during as much of the day as surrounding conditions enable the Observer to secure. The Thermometers are suspended on cross-laths in the centre of the Box, and face the door, which should open to the north.

The Council regard the question of UNIFORMITY OF HEIGHT ABOVE GROUND, AND METHOD IN PROTECTING THE THERMOMETERS, as vital in every system of Meteorological Observation, since without it Observations made at different Stations are incomparable, thus rendering it impossible to compare the Climates of places with each other as regards their most important features.

Self-Registering Thermometers. Professor Phillip's, and Negretti and Zambra's Maximum Thermometers, and Rutherford's Minimum Thermometer are recommended. It is recommended that these Thermometers be graduated on the glass stem. The Minimum Thermometer is liable to two derangements,—viz., the column of spirit breaking, and part of the spirit distilling by high temperature and lodging at the top of the tube. This derangement is of occasional occurrence with Protected Thermometers, but of frequent occurrence with Exposed Thermometers. Hence a systematic examination of Minimum Thermometers ought to be a regular part of the work carried on by each Observer.

Fortunately, Spirit Thermometers may be easily set right by any one, when the column of spirit chances to separate. Let the Thermometer be taken in the hand by the end farthest from the bulb, raised above the head, and then forcibly swung down towards the feet; the object being, on the principle of centrifugal force, to send down the detached portion of spirit till it unites with the column. A few throws, or swinging strokes, will generally be sufficient for the purpose; after which the Thermometer should be placed in a slanting position, to allow the rest of the spirit still adhering to the sides of the tube to drain down to the column. But another method must be adopted, if the portion of spirit in the top of the tube be small. Heat should be applied slowly and cautiously to the top end of the tube where the detached portion of spirit is, which, being turned into vapour by the heat, will condense on the surface of the unbroken column of spirit. Care must be taken that the heat is not applied too quickly; for if this be done, the tube will break and the instrument be destroyed. The best way to apply the requisite amount of heat, is by bringing the end of the tube slowly down towards a minute flame from a gas-burner; or if gas be not at hand, a piece of heated metal will serve instead.

Black-Bulb Thermometers. The bulbs of the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night, 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. Black-bulbs enclosed in 'glass jackets' may also be used, being indeed preferable to the above. It must, however, be added, that the whole subject of the observation of Solar and Terrestrial Radiation is not yet in a sufficiently advanced state to warrant the exclusive recommendation of any one of these methods.

Dry and Wet Bulb Hygrometer. The Hygrometer in use at the Society's Stations consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved form of this apparatus seriously vitiate the Hygrometrical Observations, 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 altogether placed to the side, and a little below the level of the wet bulb, but in no case under the bulbs; the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the Observer that the muslin is always clean and moist, and the water pure. In frosty weather, observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

Reading of the Thermometer. In reading the Thermometer great care must be taken to bring the eye exactly opposite the top of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—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 40¼°, and 40¾°, are to be registered 40°.2, or 40°.3, and 40°.7 or 40°.8 respectively. In reading Rutherford's Minimum Thermometer, the indication of that end of the index which is next the surface of the spirit is alone noted. On opening the Thermometer Box, the Dry and Wet Bulb Thermometers are to be first, and rapidly, read, inasmuch as they are 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.

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, 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.

In selecting instruments, the following points require attention:—The divisions of the vernier of Barometers in reference to their scales, and the perfect freedom of the Barometer from air; the correct numbering of the scale of every instrument; the rejection of Thermometers, the frameworks of which are not likely to stand exposure to the weather, as shown in the past by repeated and annoying breakages of Thermometers of similar construction; and as regards Maximum Thermometers, either Negretti and Zambra's, or Phillip's, whether they will act at the highest temperatures they may be required to register. By the laws of the Society, Members and Observers have a right to have their instruments compared by the Secretary, and to advise with him regarding the purchase of instruments.

Wind. Very great care should be bestowed on the Observations of the Wind, the accuracy of which, both as regards Direction and Force, is so essential towards the right discussion of many of the more important problems of the science.

1. As regards Direction. A Wind-Vane ought to be elevated at least 12 feet above surrounding objects. When it oscillates incessantly, the mean direction should be taken. In all cases, but especially when the Vane is stationary, and when the wind is feeble, reference may be made to the direction of smoke, etc., in well-exposed situations. Careful observations are recommended to be made on the changes in the direction of the wind; and during storms, extra observations at every hour of Greenwich time. Such a system of simultaneous observation, pursued at different Stations, is likely to give highly valuable and important results, particularly in connection with the system of thickly-planted Stations over a limited district round Edinburgh called STORM STATIONS, in the course of being established by the Society for the systematic investigation of the relation of the force of the wind to BAROMETRIC GRADIENTS, and other points connected with storms.

2. As regards Velocity and Pressure. The Council would recommend the Hemispherical-Cup Anemometer,—a self-registering instrument which shows the amount of Wind that passes it per day; from which also the mean Velocity of the Wind at the time of observation may be ascertained. For indicating the Force of the Wind at any particular hour of observation, the Pressure Anemometers recently brought under the notice of the Society by Mr T. Stevenson, the Honorary Secretary, and Mr R. Ballingall, the Society's Observer at Eallabus, are recommended as likely to secure uniformity in making observations on the Force of the Wind.

Rain Gauges. Many causes conspire to produce anomalies in Rain Returns, arising partly from the difficulty of obtaining a perfectly unobjectionable situation for observation, and partly from the defective nature of the instruments used. The Rain-Gauge should not be placed on a slope or terrace, but on a level piece of ground, in as open a situation as the Observer can secure for it. As it is often difficult to obtain a position as free and unobstructed by surrounding objects as is desirable, care should be taken to place it at some distance from shrubs, trees, buildings, or other obstructions, at least as many feet from their base as they are in height. The more important directions, towards which it is most desirable to have a free exposure, are in the order of their importance, S.W., N.E., S.E., S., and W. The rim of the Gauge must be perfectly level, and fixed so that it will remain level in all weathers, and be at a height of one foot above ground, over grass. In such gauges as Fleming's, which are furnished with a measuring rod attached to a float, the rod ought to be fixed down, and the float rise to its height only at the time the instrument is read, it being found that a stem projecting above the rim of the gauge seriously interferes with the proper measurement of the Rainfall. When a measuring glass is used, care should be taken to hold it quite perpendicular. The Rain Gauge ought to be read daily at 9 A.M., and the reading entered in the Returns of the previous day. If the Gauge is read once a month, the reading is to be made on the first of the month, and the amount entered for the previous month.

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

Clouds. Convenient abbreviations for the nomenclature of Clouds will be found on the other side. The amount of Cloud 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 may be noted among the Remarks. The amount of Cloud is entered from a scale of 0 to 10; thus, when the sky overhead is free from Clouds it is entered 0, when half covered by Clouds, 5, wholly covered, 10, 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:—Thus, in the column Velocity and Direction, $\frac{6, \text{S.W.}}{2, \text{W.}}$ 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 speed of the former. Again, in the second Cloud column, an entry of $\frac{4, \text{st.}}{2, \text{cu-st,}}$ will indicate that the higher regions are covered to the amount of 4-tenths with stratus Clouds; and that the sky is further obscured to the extent of 2-tenths by lower Clouds of the cumulo-stratus kind.

Remarks on peculiar Clouds, accompanied with drawings, will assist materially in the development of a more exact nomenclature of Clouds, as well as throw light on the electrical, and other of the more obscure phenomena of Meteorology.

Sunshine. The approximate 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 growth of crops and plants generally, depend greatly 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 permanently fixed in the soil, their bulbs being sunk to depths of 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain water being conveyed to the bulbs by the stems or wooden frames.

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 most important branch of Meteorology. The Council therefore recommend that the Temperature of the Sea be carefully taken by a properly constructed apparatus, from boats, or if this be impracticable, from the ends of piers and rocks round the coast, where it is not influenced by that of river water, and as little influenced as possible by currents sweeping along the coast, and thus acquiring the temperature of the land, either greatly heated by the sun or cooled by nocturnal radiation. At or near the time of high water, in cases where the observations cannot be taken daily, the observation may be made on the 5th, 15th, and 25th of each month. 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. It is also very desirable that observations on the daily Maxima and Minima by Thermometers, continuously immersed, be instituted at points along the coast, by the method proposed by Mr T. Stevenson, and already commenced at Portobello and Liverpool.

Temperature of Wells. The Temperature of the water at the bottom of Wells ought, when practicable, to be taken, both the depth of the Well and of the water being noted.

Ozone. Mention what Test-Papers are used, Schönbein's or Moffat's, etc. The paper is affixed by a pin to a board in the Thermometer Box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3\frac{\text{N.W.}}{4}$, as an Ozone entry in the schedule, will indicate that the Ozone paper is tinted as 3 on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is 4, or blowing fresh.

Atmospheric Electricity. Too much importance cannot be attached to the electric condition of the atmosphere in connection with terrestrial magnetism, barometrical, thermometrical, and meteorological phenomena generally. A proper Electrometer is, in truth, necessary to every complete meteorological observatory.

Remarks. The Remarks column is unavoidably too narrow. 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 in general use are given at the foot of the column. Besides special and extraordinary Observations, great prominence ought to be given in this column to Prevalent Diseases, differences in character, colour, velocity, and direction between the Lower and Upper Strata of Clouds, the Colour of the Sky, etc. Remarks ought to be made on the occurrence of Meteors, Auroræ Boreales, remarkable depressions, elevations, and fluctuations of the Barometer, Thunder-Storms, and remarkable falls of Snow, Hail, or Rain, the Hour of Storms of Wind commencing, attaining their maximum, and ending, as well as such notes on Storms as have been hinted at above. When lofty hills are in the vicinity of a Station, the Height of Clouds and of the Snow-line in winter should be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. should be registered, either in two columns, otherwise unoccupied, or ruled off for the purpose, from the column of "Remarks."

Observations in connection with the Periodic Return of the Seasons. Observations in connection with the Periodic Return of the Seasons, possess not only great scientific value, but are of considerable importance in connection with Agriculture, Horticulture, and Natural History. The Council would direct the special attention of Observers to the registration of such phenomena, so that the published Summaries may fairly represent the whole of Scotland. 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 Annual Table, published yearly in the Society's Journal, will indicate the species of plants and animals to which special attention is more particularly directed.

The Council recommend Observers, before purchasing new instruments, and in repairing old ones, to communicate with the Meteorological Secretary, in order that every instrument may be examined and approved before being used; and they consider it necessary 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, *December* 1874.

Dec. 1876

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK POST.

ABERDEEN H JA 4 77

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

This month has been remarkable for ~~the~~ severe gales and the large amount of ~~snow~~ Rain ~~fallen~~, and snow fall. All outdoor work has been suspended owing to the saturated state of the soil.— and stormy weather together, Cattle are generally healthy. Straw and turnips are being rapidly eaten up, Straw in places will be sadly wanted shortly, fortunately turnips are plentiful, Potatoes are keeping well in pits,