SCOTTISH METEOROLOGICAL SOCIETY.

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

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of January 1874.

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	29·70	47	29·20	46	52	39	5		46·5	42	44·5	42	SW		SW																		Overcast-Heavy Rain after 6 P.M.	1
2	29·30	45	29·20	44	41	37			44	41·5	38·2	37	W		W																		Strong Wind Showers.	2
3	29·15	42	29·	40	36	36			36	35·	36	35	W		W																		Overcast-	3
4	29·20	40	29·30	40	38	31			34	32·5	34·5	33	S		S																		"	4
5	29·70	40	29·70	41	41	36			32·5	33	40	38·5	S		S.W.																		Bright-Sun	5
6	29·75	44	29·90	46	47	38			35·	32·5	38·	32·5	W		W																		Overcast-	6
7	29·80	46	29·50	46	46	40			44	46	43	43	W		W																		Blinks of Sun	7
8	29·40	46	29·40	46	50	39			42	41·5	45·	43·5	S.W.		S.W.																		Blks of Sun & Passing Showers	8
9	29·40	46	29·60	43	45	40			32·5	32	38·5	37	SW		S																		Bc. Sun Mid-day	9
10	29·80	44	29·80	43	43	35·			37	35·	35·	34	S		S																		Blinks of Sun	10
11	29·66	43	29·35·	47	42	32			41	38·5	47	45·	S		S.W.																		Passing Showers	11
12	29·40	44	29·55	43	42	38			40	37	37	34	S.W.		W																		Sunshine Mid-day	12
13	29·65	43	29·46	46	48	33			37	35·	47	43·5	W		W																		Sun & Passing Clouds	13
14	29·50	46	29·55	46	47	42			34·5	31·5	43	41	SW		S																		Sun & Blinks of Sun	14
15	29·30	49	29·20	50	51	40		50	38	48	49	48	S		SW																		Slight Showers	15
16	29·10	49	28·95	43	40	36			37	36·5	55·	54	SW		SW																		"	16
17	29·15	39	29·49	39	38	31			32	31	32	31·5	S		S																		Sunshine	17
18	29·05	42	28·90	46	43	30			42	40·5	48	45·	S		W																		Stormy Showers	18
19	29·15	45	29·46	43	41	37			38	35·	32	31	W		W																		Sunshine Cold Wind	19
20	29·05	44	29·25	45	47	29			42	40	43	40	SW		SW																		Blinks of Sun	20
21	29·60	46	29·95	48	49	39			43	41	46	43	SW		SW																		Bright Sun	21
22	30·	47	29·90	47	50	39			45·	43	41	40	SW		W																		" "	22
23	29·75	48	29·60	46	46	40			45·	44	40	39	SW		SW																		Cloudy Slight Showers	23
24	29·85	42	30·10	38	40	36			38	35·	32	31	W		N.W.																		Bc. Sun	24
25	30·10	42	29·95	46	49	29			29	38	46	44	W		W																		Overcast-	25
26	29·80	49	29·95	47	52	43		50	38	48	48	45·5	W		W																		Sunshine	26
27	30·25	46	30·25	49	48	39			42	38	47	46·5	W		W																		"	27
28	30·30	47	30·20	48	51	38			45·	44	46·5	44	S		SW																		Bright Sun	28
29	30·05	48	30·05	49	48	42			44	41	42·5	39	S		SW																		Dull am Sun P.M.	29
30	30·10	44	30·20	45	46	36			39·5	36·5	43	41	W		W																		Bright Sun	30
31	30·25	47	30·25	46	47	41			45·	43·5	44·5	41·5	N		N					1·70													Overcast-	31
Sums.	19·20	150	19·09	152	174	205			2·52	660	582	30																								
Means.	29·619	44·8	29·616	44·9	45·6	36·6			40·1	38·6	41·9	40·1																								
† Total Corrections for Instrumental Errors.						-·4			+·5	+·5	+·5	+·5																								
‡ Corrections for Diurnal Range.																																				
"Corrected Means."						36·2			40·6	39·1	42·4	40·6																								
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), = 29·619 − ·044 = 29·575

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction ++ for Temp. (Col. 4), = ~~29·616 − ·044~~ = ~~29·572~~

Mean at Station, corrected, and at 32°, ... = 29·575

Correction for height, feet above Mean Sea-level, ... = ·209

Mean, reduced to 32°, and Sea-level, ... = 29·784

Highest Reading, corrected for Index error, on the 25th, ... = 30·300

Lowest Do. Do., on the 18th, ... = 29·050

Difference, or **Monthly Range,** ..... 1·250 = ·250

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 18th, ... = 53·0

Lowest in Month, corrected for Index errors, on the 20th, ... = 28·6

Difference, or **Monthly Range,** ..... = 24·4

"Corrected **Mean**" **of all the Highest,** (Col. 5), ... = 45·6

"Corrected **Mean**" **of all the Lowest,** (Col. 6), ... = 36·2

Difference, or **Mean Daily Range,** ..... = 9·4

** Calculated **Mean Temperature** of Month, ... = 40·9

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), ... = ~~41·5~~ 40·6

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), ... = ~~39·0~~ 39·1

‡‡ Computed **Temperature of Dew-Point,** ..... = ~~38·4~~ 37·2

‡‡ Do. **Elastic Force of Vapour,** ..... = ~~·230~~ ·222

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

‡‡ **Relative Humidity, (Saturation** = 100), ... = ~~88~~ 87

RAIN fell on 7 **Days; Amount in Inches,** ..... = 1·70

WIND. Direction.	SUMMARY. N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	0	0	0	0	9	10	12	0	0		
P.M.	0	0	0	0	5	11	14	1	0		
Mean.	0	0	0	0	7	11	13	0	0		

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

Observations made and Return verified by _____

(Signed) Malcolm [illegible] Dunn

6

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

The above remarks apply equally to the Thermometers for registering the greatest heat from the sun's rays, and the least from radiation during night. Their bulbs have a black coating, which may easily be made, or mended, by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulb from the wind. The "*Maximum*" should rest on wooden supports as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner;—In the column "Velocity and Direction,"

6, S. W.
2, W.
———,(for example,) will indicate that the *upper* strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of

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

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

Underground Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk 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. Mention should be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

Ozone.—Mention whether Schönbein's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $\frac{3}{S.W.}$, 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"; *i.e.*, that it is *blowing fresh*.

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

Remarks.—The "*Remarks*" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken 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 and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter should be recorded.

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

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

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

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

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

(By Order) A. B.

EDINBURGH, *November 1872.*

Observations.—Observations of the clouds are made at 9 A.M. and at sunset, the greater or less obscuration of the sky *overhead* (*i. e.*, within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *clouds* column, though their appearances and changes should be noted among the "*Remarks*." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky *overhead* is free from clouds it is entered 0, when *half covered* by clouds, 5 and so on.

Observations of the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner;—In the column "Velocity and Direction,"

6, S. W.
2, W.
———,(for example,) will indicate that the *upper* strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of

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

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

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

(By Order) A. B.

EDINBURGH, *November 1872.*

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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,				

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,		

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.

BOOK POST.

M. ALEXANDER BUCHAN,
Secretary of the Meteorological Society of Scotland,
EDINBURGH.

To

Dalkeith
Jan. 1874.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens Dalkeith County of Edinburgh, in Lat. ____, Long. ____, Distance from Sea 3 miles.

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of February 1874.

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.Oup 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	30·25	46	30·20	46	46	37			43·5	41	46·5	45	SW		SW																					Overcast	1
2	30·05	46	30	45	47	38			44	42	45	43·5	S		SW																					Overcast	2
3	30·25	46	30·30	42	47	39	47 AB		48	41	35	34	S		S																					Bright Sun	3
4	30·40	44	30·35	44	48	34			40	38·5	37·5	37	SW		S																					" "	4
5	31·25	41	30·30	44	46	32			36	34	36	34	S		S																					" "	5
6	30·20	42	30·10	41	43	31			34	33	33	32	S		S																					" "	6
7	30	41	29·70	47	48	30			37·5	35·5	48	46	SW		W																					Dull	7
8	30·05	41	30·10	39	41	33			35·5	34·5	38	28	SW		S																					Bright Sun	8
9	30·10	39	30·20	37	34	27			32	29	31	30	N		NW																					Bleaks & Sun	9
10	30·35	38	30·20	34	36	29			33	31	28	28	NW		NW																					Bright Sun	10
11	31·05	32	29·90	36	41	20			25	25	32	31	NE		NE																					" "	11
12	29·75	37	29·50	40	37	28·5			31·5	31·5	32	31	S		SW																					Dull	12
13	29·45	41	29·55	45	48	29			39	38	44	42	S		SW																					Showery & Bleaks of Sun	13
14	29·10	47	29·05	48	51	41			46	44	45	43	SW		S.W.																					Bright am Dull PM	14
15	29·05	47	29·10	48	49	38			48·5	46	34	33	S		S																					Slight Showers	15
16	29·15	44	29·05	44	50	34			41	38·5	40	39	SW		SW																					Bright Showers	16
17	28·90	45	29·05	42	45	38			39·5	38	34	33	SW		S																					Bleaks & Sun	17
18	29·30	39	29·55	40	43	30			35	33·5	35	33·5	S		S																					Bright Sun	18
19	29·75	40	29·90	40	46	30			36	34	35	34	S		S																					" "	19
20	29·85	41	29·90	45	45	29			38	37	43	42	S		S																					Dull	20
21	29·55	48	29·65	45	53	40			47	45	40·5	40	S		S																					Bright Sun	21
22	29·65	48	29·60	46	45	39			~~48~~	~~46~~	39	38	S		S																					Foggy am Dull PM	22
23	29·65	41	29·70	42	58	30			38	36	36	35	S		S																					Bright Sun	23
24	29·75	46	29·75	45	50	35			42·5	41	40	39	SE		SE																					Cloudy Glimpses of Sun	24
25	29·60	45	29·25	42	39	33			35	32·5	37	35	E		NE																					Dull Very Cold East Wind	25
26	28·80	44	28·70	45	44	34			40	38·5	40	39	NE		E																					Heavy Rain Hail & Sleet	26
27	28·80	44	29·20	46	49·5	37·5			40	38·5	43	45	SE		SE																					Sun am Overcast PM	27
28	29·65	43	29·60	44	50	34			42	39	40	39	S		S				1.																	Sun Very fine	28
29																																						29
30																																						30
31																																						31
Sums.	19·70	76	19·45	69	15·95	90·0			38·8	36·9	37·8	36·8																										
Means.	29·704	42·7	29·695	42·4	45·7	33·2			38·8	36·9	37·8	36·8																										
† Total Corrections for Instrumental Errors.						−·4			+·5	+·5																												
‡ Corrections for Diurnal Range.																																						
"Corrected Means."						32·8			39·3	37·4																												
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), = 29·704 − ·038 = 29·666

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction ‡‡ for Temp. (Col. 4), = 29·695 − ·038 = 29·657

Mean at Station, corrected, and at 32°, = 29·666

Correction for height, feet above Mean Sea-level, = ·209

Mean, reduced to 32°, and Sea-level, = 29·875

Highest Reading, corrected for Index error, on the 4 th, = 30·400

Lowest Do. Do., on the 26 th, = 28·700

Difference, or **Monthly Range,** = 1·700

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 23 th, 58·0 = 58·0

Lowest in Month, corrected for Index errors, on the 11 th, 19·6 = 20·0

Difference, or **Monthly Range,** 38·4 = 38·0

"Corrected **Mean" of all the Highest,** (Col. 5), 45·7 = 45·7

"Corrected **Mean" of all the Lowest,** (Col. 6), 32·8 = 33·2

Difference, or **Mean Daily Range,** 12·9 = 12·5

** Calculated **Mean Temperature** of Month, 39·2 = 39·4

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** (Cols. 9 and 11), = 38·4 39·3

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 36·9 37·4

‡‡ Computed **Temperature of Dew-Point,** = 34·8 34·9

‡‡ Do. **Elastic Force of Vapour,** = ·203 ·204

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

‡‡ **Relative Humidity, (Saturation** = 100), = 88 85

RAIN fell on 4 **Days; Amount in Inches,** = 1·00 1·00

WIND. Direction.	SUMMARY. N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	1	1	3	14	7	0	1	0		
P.M.	0	2	1	2	14	6	1	2	0		
Mean.	0	2	1	3	14	6	0	2	0		

A

* 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) Malcolm Dunn

6

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers, are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb,—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather 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.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with or, a little over 40°, or 40½°, respectively. So also 40½°, and 40¾°, more or less must be registered 40°.2 or 40°.3 and 40°.7 or 40°.8 respectively. In reading Rutherford's "*Max.*" and "*Min.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily at 9 A.M., and the readings entered in the returns of the day previous.

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

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner;—In the column "Velocity and Direction," $\frac{6,\ S.\ W.}{2,\ W.}$, (for example,) will indicate that the *upper* strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st,}$, (*e.g.*) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-*tenths* by lower clouds of the *cumulo-stratus* kind.

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

Underground Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk 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. Mention should be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

Ozone.—Mention whether Schönbein's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $\frac{2}{4}$ 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": *i.e.*, that it is *blowing fresh*.

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

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

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

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

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

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

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

(By Order) A. B.

EDINBURGH, *November 1873.*

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,				

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

SHRUBS, ETC.	First in Blossom.
Barberry,	
Bourtree or Eller,	
Broom,	
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	
Lilac,	
Mezereon,	
Mountain Ash or Rowan,	28
Red Flowering Currant,	
Rhododendron Ponticum,	1
Whin,	

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.

Dalkeith
Feb. 1874

To

MR ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK POST.

SCOTTISH METEOROLOGICAL SOCIETY.

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

Height of Cistern of the Barometer above Mean Sea-level *190* feet, above Ground *4* feet. During the MONTH of *March* 187*4*.

The Hours of Observation are of Greenwich Time.

Columns 13–30 are printed but left blank except column 19: 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.).

Electricity	Days of Month	Barometer 9 h. A.M. * No.__ (inches)	Attached Thermometer (°)	Barometer 9 h. P.M. No.__ (inches)	Attached Thermometer (°)	Self-Registering Thermometers, 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 (°)	Rain, Amount in inches	General Remarks (Mention the hour at which Storms, including Thunder and Lightning, began and ended)	Days of Month
	1	29·65	45	29·95	47	51	37			42	41·5	43	42		Blinkes of Sun	1
	2	30·15	48	33·30	49	53	37			46	44	47	45		" "	2
	3	30·30	48	30·25	50	53	39			48	45	42	41		" "	3
	4	30·25	49	30·20	48	53	38			45	43·5	44	42		" "	4
	5	30·25	50	30·50	48	49	42			47	45·5	41·5	40		Rain throught	5
5 AB	6	30·60	43	~~30·70~~	~~48~~	~~35~~	~~29~~			34·3	33·5	41	38·5		Bright Sunshine	6
	7	30·25	42	30·05	47	42	33			41	38·5	42	41		" "	7
29 65 AB	8	29 ~~30~~ 65	47	29·40	43	38	33			44	42	35	32·5		Blinkes of Sun & Showers of rain	8
	9	29·40	40	29·50	38	37	31			35	32	29	28·5		Blinkes of Sun A.M. Showers of Snow P.M.	9
	10	29·55	38	29·70	33	35	26			31	30	26	25		Bright Sunshine & passing Clouds	10
	11	29·80	34	29·95	35	39	23			32	31	29	28·5		Bright Sunshine	11
	12	29·75	40	29·90	40	47	26			41	38·5	38	36·5		Showery & Blinkes of Sun	12
	13	30·05	43	30·15	44	59	35			45	41·5	37	36		Fine Bright Sun.	13
	14	30·05	48	29·95	48	51	35			46·5	44	48	47		Dull with blinkes of Sun.	14
	15	29·95	49	29·90	50	55	46			50	48	48	45		Blinkes of Sun A.M. Dull P.M.	15
	16	29·85	51	29·65	52	52	46			48·5	47	51	50·5		Dull with slight showers of rain	16
	17	29·70	55	29·70	53	57	49			54	53·5	55	53		Bright Sun A.M. Blinkes of Sun P.M.	17
	18	29·60	50	29·80	49	53	42			48	44	40	37		Bright Sun.	18
	19	29·40	47	29·40	46	52	37			39	37	40	39		Rain A.M. Sun & slight showers P.M.	19
	20	29·65	45	29·80	45	49	34			43	42	42	39		Blinkes of Sun.	20
	21	29·65	48	29·60	48	50	38			47	45	43·5	43		Dull & slight Showers.	21
	22	29·60	52	29·90	50	54	40			52	47·5	47	45·5		Passing Showers & Sun.	22
	23	30·00	53	29·95	53	55	42			50	47·5	51	48		Dull	23
	24	29·95	52	30·25	48	57	45			49	44·5	40	41		Bright Sun.	24
	25	30·25	47	30·10	49	59	32			46	44	45	41		Bright Sunshine	25
	26	30·05	47	Not taken	—	~~40~~	~~30~~			49·5	41·5	—	—		~~Cloudy~~	26
5 AB	27	29·60	51	29·25	52	~~48~~	~~44~~			49	46	48	45		27th Cloudy	27
	28	29·60	49	29·30	47	~~44~~	~~40~~			48	42	44	41		28th Bright Sun A.M. Showery P.M.	28
	29	29·25	49	29·15	49	~~42~~	~~46~~			50 ~~52~~	47	44	41		29th Showery A.M. Blinkes of Sun P.M.	29
	30	29·25	49	~~29·20~~	49 ~~47~~	~~42~~	~~41~~			42	40	43	42		Blinkes of Sun & Showers of rain	30
	31	29·30	51	~~29·45~~	~~47~~	~~42~~	~~49~~			46	43	~~41~~	~~43~~	1	Blinkes of Sun & Heavy Showers of rain	31
	Sums.	25·35	220	23·00	189	80 (1200)	165 (886)			149·0	70·0	64·0	14·5	1·00		
	Means.	29·818	47·1	29·821	46·8	50·6 ~~40·0~~	36·9			44·8	42·3	42·1	40·5			
	† Total Corrections for Instrumental Errors.						−·4			+·5	+·5	+·5	+·5			
	‡ Corrections for Diurnal Range.															
	"Corrected Means."						36·5 ~~35·9~~			45·3	42·8	42·6	41·0			
	No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	19		

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. 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), = 29.818 − .049 = 29.769

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = ~~29.821 − .049~~ = ~~29.772~~

Mean at Station, corrected, and at 32°, (29.769) = 29.7~~76~~ 70

Correction for height, feet above Mean Sea-level, 20.9 = .209

Mean, reduced to 32°, and Sea-level, (29.978) = 29.9~~85~~ 79

Highest Reading, corrected for Index error, on the 6 th, = 30.600

Lowest Do. Do., on the 29th, = 29.250

Difference, or **Monthly Range,** = 1.350

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 13 th, = 59.0

Lowest in Month, corrected for Index errors, on the 11 th, = 22.6

Difference, or **Monthly Range,** = 36.4

"Corrected **Mean" of all the Highest,** (Col. 5), 50.6 = ~~40.0~~

"Corrected **Mean" of all the Lowest,** (Col. 6), 36.5 = ~~35.9~~

Difference, or **Mean Daily Range,** 13.5 = ~~4.1~~

** Calculated **Mean Temperature** of Month, 43.2 = ~~38.0~~

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), = 44.0

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 41.9

‡‡ Computed **Temperature of Dew-Point,** = 39.4

‡‡ Do. **Elastic Force of Vapour,** = .242

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

‡‡ **Relative Humidity, (Saturation = 100),** = 83

RAIN fell on 12 **Days; Amount in Inches,** = 1.00

WIND. SUMMARY.

Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.											
P.M.											
Mean.											

A

* 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) *Malcolm Dunn*

6

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers, are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb,—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather 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.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with or, a little over 40°, or 40½°, respectively. So also 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 "*Max.*" and "*Min.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily at 9 A.M., and the readings entered in the returns of the day previous.

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

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner;—In the column "Velocity and Direction," $\frac{6,\ S.\ W.}{2,\ W.}$ (for example,) will indicate that the *upper* strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st,}$ (*e.g.*) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-*tenths* by lower clouds of the *cumulo-stratus* kind.

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

Underground Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk 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. Mention should be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

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

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

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

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

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

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

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

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

(By Order) A. B.

EDINBURGH, *November 1873.*

BOOK POST.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

DALKEITH AP 7 74

Dalkeith Mar. 1874 –

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

[illegible]	Flower.	First appear.	In [illegible]	Divested of Leaves.	CROPS.	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.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens County of Midlothian, in Lat. ____, Long. ____, Distance from Sea 3 miles.

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of April 1874.

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.	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 11 h. A.M.	Temperature 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	29·50	45	29·30	48	46	37			41	42	44	42	W		NW																		Heavy Shs of Sleet & Bkts of Sun	1
2	29·50	48	28·40	51	45	41			41	44	45	44	W		W																		Heavy Rain throughout.	2
3	28·60	48	28·95	48	47	41			45	40	35	34	W		W																		Heavy Showers of Sleet & Bkts of Sun	3
4	29·—	45	29·—	46	45	32			40	36	40	44	W		SW																		" " "	4
5	29·05	48	29·20	49	52	37			45	42	41·5	41	W		W																		Cloudy am Bkts of Sun P.M.	5
6	29·45	47	29·65	50	56	39			43	44·5	45	43	W		SW																		Bright Sun throughout	6
7	29·70	48·5	29·60	40	55	45			47	44	44	41	W		W																		Bkts of Sun am Cloudy P.M.	7
8	29·50	48	29·45	47	49	39			46	42	41	39	W		W																		Bkts of Sun.	8
9	29·20	50	29·15	49	54	39			48	45	43	41·5	SW		SW																		Bright Sun am Bkts of Sun & Shs P.M.	9
10	29·10	48	29·—	46	53	32			46	43	39	45	W		SW																		Bkts of Sun am Cloudy P.M.	10
11	29·05	48	29·15	48	57	30			46	43	39	37	SW		SW																		Bright Sunshine	11
12	29·35	47	29·40	49	51	31			43	40	39	37	SW		SW																		Bkts of Sun am Cloudy P.M.	12
13	29·05	48	29·35	47	43	30			42	38	42	41	SE		E																		Cloudy —	13
14	29·80	48	29·85	51	60	40			45	44	46	45	NE		E																		Bright Sunshine	14
15	29·95	52	29·80	52	56	37			50	46	48	46	SE		W																		Cloudy am Shs of Rain P.M.	15
16	29·70	50	29·55	48	52	36			48	43	42	37	W		W																		Bkts of Sun am Cloudy P.M.	16
17	29·60	49	29·70	48	52	37			47	45	42	39	W		W																		Bright Sunshine	17
18	29·75	51	29·75	53	55	37			46	41	48	47	SW		W																		Cloudy	18
19	29·80	56	29·85	57	61	42			54	51	52	48	W		W																		Cloudy am Sunshine P.M.	19
20	29·80	58	29·70	56	63	50			56	53	53	50	W		W																		Hlints of Sun.	20
21	29·70	58·5	29·60	57	72	49·5			57·5	52	51	48	W		W																		Bright Sunshine	21
22	29·85	56	29·95	53·5	62	44			54	47·5	45	42	W		W																		" " "	22
23	29·90	53	29·80	57	68	34·5			52·5	49	52	51	W		W																		Bright Sunshine am Cloudy P.M.	23
24	29·80	59	29·90	58	61	49			55	51·5	53	50	W		W																		Bkts of Sun am Cloudy P.M.	24
25	30·—	62	29·90	58	72	47			59	55	51	50	W		W																		Bright Sunshine	25
26	30·—	59	30·—	56	74	45			57	54	47	46	NW		SW																		Hlints of Sun.	26
27	30·05	53	30·10	53	61	43			46	46	46	45	NW		E																		Showery	27
28	30·20	57	30·20	55·5	64·5	43			55	55·5	48	45	SE		NW																		Bright Sunshine	28
29	30·15	55	30·	55	65	38			53	52	53	49	SE		SE																		" " "	29
30	29·90	57	29·85	53·5	59	38			56·5	51	45	43	SE		SE				0·70														" " "	30
31																																						31
Sums.	18·00	520	17·10	42·5	2005	283·0			2655	1800	1595	1105																											
Means.	29·600	51·7	29·570	51·4	56·7	39·4			48·8	46·0	45·3	43·7																											
† Total Corrections for Instrumental Errors.						-4			+5	+5	+5	+5																											
‡ Corrections for Diurnal Range.																																							
"Corrected Means."						39·0			49·3	46·5	45·8	44·2																											
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), = 29·600 − ·062 = 29·538

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction†† for Temp. (Col. 4), = 29·570 − ·062 = 29·508

Mean at Station, corrected, and at 32°, = 29·523

Correction for height, feet above Mean Sea-level, = ·209

Mean, reduced to 32°, and Sea-level, = 29·732

Highest Reading, corrected for Index error, on the 28th, = 30·200

Lowest Do. Do., on the 2 th, = 28·400

Difference, or **Monthly Range,** = 1·800

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 26 th, = 74·0

Lowest in Month, corrected for Index errors, on the 11 th, = 29·6

Difference, or **Monthly Range,** = 44·4

"Corrected **Mean**" **of all the Highest,** (Col. 5), = 56·7

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = 39·0

Difference, or **Mean Daily Range,** = 17·7

** Calculated **Mean Temperature** of Month, 47 + 45·8 =

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), = 47·6

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 45·4

‡‡ Computed **Temperature of Dew-Point,** = 43·0

‡‡ Do. **Elastic Force of Vapour,** = 0·274

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

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

RAIN fell on 15 **Days; Amount in Inches,** = 0·70

WIND.	SUMMARY.									
Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	0	1	0	5	0	4	18	2	0		
P.M.	0	0	2	3	0	7	16	2	0		
Mean.	0	0	1	4	0	6	17	2	0		

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

Observations made and Return verified by { ____ ____

(*Signed*) Malcolm Dunn

6

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers, are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb,—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather 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.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with or, a little over 40°, or 40½°, respectively. So also 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 "*Max.*" and "*Min.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily at 9 A.M., and the readings entered in the returns of the day previous.

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

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner;—In the column "Velocity and Direction," $\frac{6,\ S.\ W.}{2,\ W.}$, (for example,) will indicate that the *upper* strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" $\frac{4,\ st.}{2,\ cu\text{-}st,}$ column, an entry of———, (*e.g.*) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-*tenths* by lower clouds of the *cumulo-stratus* kind.

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

Underground Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 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. Mention should be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

Ozone.—Mention whether Schönbein's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $\frac{2.W.}{4}$, 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": *i.e.*, that it is *blowing fresh*.

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

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

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

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

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

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

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

(By Order) A. B.

EDINBURGH, *November 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,	2nd May	
Black Currant,	8th "	
Cherry,	12th "	
Gean,	2nd "	
Gooseberry,	2nd "	
Peach,		
Pear,	6th "	
Plum,		
Strawberry,		

CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Cut or Pulled.
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.

BOOK POST.

Dalkeith
April 1874

To

MR ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Galreith Gardens, County of Midlothian, in Lat. _____, Long. _____, Distance from Sea 3 ~ miles.

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of May 1874.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	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.	No. 12 inches.	No. 22 inches.	Temperature of WELL at depth of ____ feet. No.	SEA. Temperature at Flatholm, 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	30·	56	30·05	55	52	41·5			47	42	40	39	SW		SW																						Bright Sunshine.	1
	2	30·05	50·5	29·90	56	52	33			46	40·5	44	40	N.W		N.W																						Bks of Sun A.M. Bright Sun P.M.	2
	3	29·75	53·5	29·75	49·5	54	35			44	41	42	39	N.W		N.W																						Bks of Sun A.M. Cloudy & Slight Sh. of Rain P.M.	3
	4	29·80	49·5	29·80	48	49	37·5			43	39	42	41	N.W		N.E																						Cloudy A.M. Showers of Rain P.M.	4
	5	29·85	50	29·75	50·5	53	40			47·5	41·5	44	42·5	N.W		N.E																						Sunshine A.M. Overcast P.M. Rain @ 7 P.M.	5
	6	29·65	51	29·55	49·5	49	39			39·5	38	42	41	N.E		SW																						Rain to 7. Bks of Sun P.M. Overcast P.M.	6
	7	29·55	50	29·55	48	54	36·5			45	41	41	40	N.W		N.W																						Blinks of Sun.	7
	8	29·55	49	29·50	47·5	51	37			42	41	40	39	N.W		N.W																						Blinks of Sun & passing Showers	8
	9	29·65	51	29·65	47	49	34			44	40	38·5	38	N.W		N.W																						Cloudy A.M. Bks of Sun P.M.	9
	10	29·80	50	29·85	50	53	35			47	41·5	44	41	N.W		N.W																						Bright Sunshine A.M. Overcast P.M.	10
	11	29·95	50·5	30·05	50	53	34·5			48·5	42·5	43	41	N.W		N.E																						Blinks of Sun A.M. Overcast P.M.	11
	12	30·15	49	30·15	48	53	39			44	41	42	39	N.E		N.E																						Cloudy Slight Sh. of Rain @ 5 P.M.	12
	13	30·25	49	30·20	49·5	47	39·5			44	40·5	43	41	N.E		N.E																						Cloudy throughout	13
	14	30·20	53	30·05	52	57	35			50	45	45	44	N.W		N.W																						Cloudy Rain @ 5 P.M.	14
	15	30·15	49	30·20	46	51	37			44	40	37·5	36·5	N.W		N.W																						Bright Sunshine	15
	16	30·25	52	30·20	53	56	31·5			48	43	45	42·5	SE		N.W																						" " "	16
	17	30·15	53	30·10	57	72	33			53	48	49	47	N.W		S.E																						" " "	17
	18	30·15	55	30·15	56	68·5	37			55	49	48·5	46	N		S.E																						" " "	18
	19	30·20	57	30·25	52	60	42			50	47	42·5	42	E		E																						Overcast	19
	20	30·15	53	30·05	54	59·5	39			48	45	47·5	44	E		N.E																						Cloudy A.M. Blinks of Sun P.M.	20
	21	30· –	53	29·85	52	55	42·5			47	44	45	44	S.E		E																						Cloudy throughout	21
	22	29·70	50·5	29·60	51	57	42			45	43	45	44	E		N.E																						Cloudy Rain @ 7 P.M.	22
	23	29·55	52	29·50	54	62·5	43			47·5	46·5	49	48	N.E		N.E																						Cloudy A.M. Bks of Sun P.M.	23
	24	29·50	52	29·50	52	55·5	45			47·5	47	47·5	47	E		N																						Heavy Rain A.M. Showers P.M.	24
	25	29·75	54	29·80	53	55·5	45·5			49·5	48	48	47	E		E																						Showers & Rain A.M. Cloudy P.M.	25
	26	29·85	54	29·80	57	63	46			50	48	52	51	S.E		S.E																						Cloudy throughout	26
	27	29·85	59	29·55	57·5	63	49			56	51	52	50	SW		S.E																						Bks of Sun Rain @ 7 P.M.	27
	28	29·65	58·5	29·70	56·5	66	49			55	49	49	46	W		SW																						Blinks of Sun.	28
	29	29·75	57	29·50	57	65	40			52·5	48	55	53	W		W																						Blinks of Sun A.M. Cloudy & Rain at 6 P.M.	29
	30	29·45	59	29·50	61	66	50			54·5	51	55	52	W		W																						Bks of Sun A.M. Bks & Slight Sh. of Rain P.M.	30
	31	29·60	62	29·55	62	70	51·5			58	55	58	55	W		SW						1·30																Blinks of Sun & Strong SW Wind.	31
	Sums.	14 11 26·90	5 13 3 92·0	14 5 25·60	5 15 5 81·5	5 14 2 2215	4 14 4 1·5			5 12 4 252·0	5 12 3 137·0	5 14 3 176·0	4 13 1 120·5									1·30																			
	Means.	29·868	53·0 x	29·826	52·6	57·1	40·0			48·1	44·4	45·7	43·9																												
	† Total Corrections for Instrumental Errors.						–·4			+·5	+·5	+·5	+·5																												
	‡ Corrections for Diurnal Range.																																								
	"Corrected Means."						39·6			48·6	44·9	46·2	44·4																												
	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), = 29·868 – ·066 = 29·802

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29·826 – ·066 = ~~29·760~~ 29·802

Mean at Station, corrected, and at 32°, = ~~29·761~~ 29·802

Correction for height, feet above Mean Sea-level, = 0·209

Mean, reduced to 32°, and Sea-level, 30·011 = ~~29·971~~ 30·011

Highest Reading, corrected for Index error, on the 13 th, = 30·250

Lowest Do. Do., on the 30 th, = 29·450

Difference, or **Monthly Range,** = 0·800

* 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 17 th, = 72·0

Lowest in Month, corrected for Index errors, on the 16 th, = 31·1

Difference, or **Monthly Range,** = 40·9

"Corrected **Mean" of all the Highest,** (Col. 5), = 57·1

"Corrected **Mean" of all the Lowest,** (Col. 6), = 39·6

Difference, or **Mean Daily Range,** = 17·5

** Calculated **Mean Temperature** of Month, = 48·4

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), = ~~47·4~~ 48·6

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = ~~46·1~~ 44·9

‡‡ Computed **Temperature of Dew-Point,** = ~~43·7~~ 40·9

‡‡ Do. **Elastic Force of Vapour,** = ~~·305~~ ·256 in.

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

‡‡ **Relative Humidity,** (**Saturation** = 100), = ~~94~~ ~~78~~ 75

RAIN fell on 13 **Days; Amount in Inches,** = 1·30

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	5	3	0	2	4	12	0		
P.M.	1	7	3	5	0	4	2	9	0		
Mean.	1	6	4	4	0	3	3	10	0		

Observations made and Return verified by _____ _____

(*Signed*) _____

6
4

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers, are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb,—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather 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.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with or, a little over 40°, or 40½°, respectively. So also 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 "*Max.*" and "*Min.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily at 9 A.M., and the readings entered in the returns of the day previous.

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

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," $\frac{6,\ S.\ W.}{2,\ W.}$, (for example,) will indicate that the *upper* strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st}$, (*e.g.*) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-*tenths* by lower clouds of the *cumulo-stratus* kind.

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

Underground Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk 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. Mention should be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

Ozone.—Mention whether Schönbein's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{N.W.}_{4}$, 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": *i.e.*, that it is *blowing fresh*.

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

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

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

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

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

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

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

(By Order) A. B.

Edinburgh, *November 1873.*

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.

BOOK POST.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

Dalkeith
May 1874.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dalkeith Gardens, County of Midlothian, in Lat. ____, Long. ____, Distance from Sea 3 miles.

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of June 1874.

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	29·80	63	29·75	64	73	51·5			60·5	55	58	54	SW		S																				Blinks of Sun & Strong S. Wind	1
2	29·75	66	30 —	66	73	55			63	56	56	52	S		SW																				Blinks of Sun.	2
3	29·75	62	30·25	63	74	48			57	51	55	52·5	SW		SW																				Bright Sunshine	3
4	30·15	67	30·20	67	78·5	47			65·5	57	62	59	SW		SW																				Bright Sun A.M. Bks P.M.	4
5	30·15	64·5	30·18	67	73	53			60	59	53	49	SW		SW																				Bright Sun A.M. Overcast P.M.	5
6	29·95	60·5	30·05	60·5	67	45			56	48	51	47	SW		SW																				Bright Sunshine	6
7	30·05	60	30·10	61	73·5	41·5			55	49	55	54	SW		SW																					7
8	30	61	30·05	62	72	49			56	52	56	53	W		W																				Bright Sun A.M. Bks P.M.	8
9	29·80	63	29·80	62	76	49			61	53	52·5	51	SW		W																				Bks & Sun A.M. Cloudy P.M. Slight & Rain	9
10	29·95	59	30·05	57	66	46			53	51	49	47	W		W																				Blinks of Sun	10
11	29·65	61	30·15	55	70	46			58	55	47	42	W		N																					11
12	30·25	54·5	30·35	57	68	35·5			53	44·5	49	45	N		E																				Bright Sun Due, Bks P.M.	12
13	30·35	56·5	30·35	58	68	38			55	47	50	41	E		E																				Bright Sunshine	13
14	30·40	56·5	30·50	59·5	69·5	41			54	49	52·5	49	NE		NE																				" "	14
15	30·50	60	30·55	61	70·5	48			56	51	50	48·5	E		E																				" "	15
16	30·45	59	30·35	60	70	44			55	50	51·5	45	E		E																				" "	16
17	30·25	61	30·30	59	75·5	46			59	52·5	49	47	E		E																				" "	17
18	30·25	61	30·25	64	73·5	46			58	52	59	55	E		E																				" "	18
19	30·10	64	30·15	60	67·5	46			65	57	53	48	E		E																				Bks of Sun Cloudy Overcast P.M. Slight rain at 3-30	19
20	30·15	60	29·95	59	68	41·5			53	46	52	48	E		SE																				Cloudy A.M. Bks of Sun P.M.	20
21	29·85	60·5	29·85	63	71·5	49·5			56	51·5	56·5	56	SE		SE																				Blinks of Sun	21
22	29·80	63	29·80	62	72	46			61·5	60	55	53	SW		SE																					22
23	29·70	64	29·65	62	70	47			62	55	55	51	SW		SE																				Bks of Sun slight Showers of rain @ 4 P.M.	23
24	29·60	64	29·55	58	74	46			61	54	50	47	S		E																				Bks of Sun Cloudy Thunder Heavy rain from 2-30 to 6-30	24
25	29·60	63	29·55	59	64	42			60	55	52	51	SE		SE																				Bks of Sun Cloudy Thunderstorm Rain Hail from 10 to 30 to 12-30	25
26	29·55	59	29·55	60	70	45			55	53	55	53	SW		SW																				Bks & Sun.	26
27	29·55	58	29·55	62	71	43			53	52	57	53	SE		SE																					27
28	29·65	62·5	29·70	65·5	77	42			57	54	60·5	56·5	E		SE																				Bright Sunshine	28
29	29·75	64·5	29·75	59	74	52			62	59	51	50	E		NW																				Bks of Sun A.M. Thunderstorm Rain & Hail from 3-30 to 5-30	29
30	29·70	62	29·50	63	69	44			59	55	59	57	SW		SW						1·90														Cloudy Rain from 4-40 to 6-30 P.M.	30
31																																				31
Sums.	28·65	61·4	29·70	62·5	71·4	45·2			59·12	53·31	57·15	54·1																								
Means.	29·955	61·3	29·990	61·0	71·09	45·8			58·0	52·8	55·37	50·5																								
† Total Corrections for Instrumental Errors.						-4			+5	+5	+5	+5																								
‡ Corrections for Diurnal Range.																																				
"Corrected Means."	29·955	61·3	29·990	61·0		45·4			58·5	53·3	54·2	51·0																								
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30						

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), = 29·955 ..... − 0.87 ..... } = 29·868

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29·990 ..... − 0.87 ..... } = 29·903

Mean at Station, corrected, and at 32°, 29·886 = 29·886

Correction for height, feet above Mean Sea-level, ... = ·209

Mean, reduced to 32°, and Sea-level, 30·095 = 30·095

Highest Reading, corrected for Index error, on the 15 th, ... = 30·500

Lowest Do. Do., on the 26 th, ... = 29·550

Difference, or **Monthly Range,** ..... = 0·950

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 4 th, ... = 78·5

Lowest in Month, corrected for Index errors, on the 12 th, ... = 37·1

Difference, or **Monthly Range,** ..... = 41·4

"Corrected **Mean**" **of all the Highest,** (Col. 5), ... = 70·9

"Corrected **Mean**" **of all the Lowest,** (Col. 6), ... = 45·4

Difference, or **Mean Daily Range,** ..... = 25·5

** Calculated **Mean Temperature** of Month, ... = 58·2

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), ... = 58·5 56·4

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), ... = 53·3 52·2

‡‡ Computed **Temperature of Dew-Point,** ..... = 48·7 48·3

‡‡ Do. **Elastic Force of Vapour,** ..... = ·344 ·340

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

‡‡ **Relative Humidity, (Saturation** = 100), ... = 78 74

RAIN fell on 7 **Days; Amount in Inches,** ..... = 1·90

WIND. Direction.	SUMMARY. N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	1	9	3	2	11	3	0	0		
P.M.	1	1	8	7	1	8	3	1	0		
Mean.	1	1	8	5	2	10	3	0	0		

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

† Embracing corrections for both capillarity and Index Errors.

‡ The Diurnal Range for Scotland is as yet unknown.

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

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

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

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

Observations made and Return verified by _____

(*Signed*) Malcolm Dunn

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers, are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb,—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather 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.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with or, a little over 40°, or 40½°, respectively. So also 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 "*Max.*" and "*Min.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily at 9 A.M., and the readings entered in the returns of the day previous.

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

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction,"——$\frac{6,\ S.\ W.}{2,\ W.}$, (for example,) will indicate that the *upper* strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of——$\frac{4,\ st.}{2,\ cu\text{-}st}$, (*e.g.*) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-*tenths* by lower clouds of the *cumulo-stratus* kind.

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

Underground Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk 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. Mention should be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

Ozone.—Mention whether Schönbein's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $\frac{3}{N.W.}$, 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": *i.e.*, that it is *blowing fresh*.

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

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

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

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

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

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

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

(By Order) A. B.

EDINBURGH, *November 1873.*

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First appear.	In 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 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,				
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.

BOOK POST.

Dalkeith
June 1874

To

MR ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

SCOTTISH METEOROLOGICAL SOCIETY.

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

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of July 1874.

The Hours of Observation are of Greenwich Time.

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	Min. on Grass.	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 Helibum, 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	29·65	65	29·70	67	69	44·5			62	56	61	59	SW		SW																			Blinks & Sun AM Cloudy PM	1
2	29·55	66	29·50	67·5	71	56			63	61	60	58	S		S																			Blinks & Sun Shower & rain 5 PM	2
3	29·50	67	29·55	65·	69	55·5			62·5	57	56	53	S		S																			Blinks & Sun & Slight Shs of rain	3
4	29·55	64	29·65	64	66	52			59	53	55	54	S		SW																			Blinks & Sun & passing Clouds	4
5	29·85	65	30·10	63	68	50			59	54	53	59	SW		SW																			Blinks & Sun AM Bright PM	5
6	30·10	63	30·05	62	64	45·5			59	52	55	52	SW		SW																			Blinks & Sun	6
7	30·—	64·5	29·90	64	73	50			61·5	55	58·5	54·5	SW		SW																			" " "	7
8	29·90	67	29·95	66·5	73	52			64	57	61	58	SW		SW																			" " "	8
9	29·95	67·5	30·10	67	73	56			63	61	62·5	59	SW		SW																			Blinks & Sun AM Cloudy PM	9
10	30·05	68	30·—	67	76	54·5			65	59	57	55	SW		SW																			Bright Blinks & Sun	10
11	29·95	66	30·—	62	65	51			59	54·5	54·5	53	SW		SE																			Overcast - Rain at 9 PM	11
12	29·95	60	30·—	65	67	50·5			53·3	53	56	54	SE		SE																			Rain to 8·20 AM Blks & Sun PM	12
13	29·95	62·5	29·90	65	72	46·5			61·5	57	61	59	SE		SW																			Bright Sun to 11·30 AM Overcast PM	13
14	29·80	67	29·90	65	72	58			64	60	59	56	W		SW																			Blinks & sun AM Overcast PM	14
15	30·—	65	30·10	67·5	75	51			64	58	59·5	58	W		SW																			Bright Sunshine	15
16	30·10	63	30·10	66	74	52			58	57	60	57·5	W		SE																			Blinks & Sun	16
17	30·05	65·5	30·10	73	82	53			63·5	60	65	63	SE		SE																			Bright Sunshine	17
18	30·10	71	30·05	73·5	86	53·5			74	62	69·5	64·5	S		SE																			" " "	18
19	29·95	73	29·90	74	84	57·5			75·5	60·5	66	61	W		SW																				19
20	29·80	71·5	29·75	69·5	73	56			63	60	61·5	58	S		S																			Blinks & Sun	20
21	29·60	68·5	29·55	64	69·5	54·5			61·5	59	57	56	SE		S																			Bks & Sun AM Thunder & shs of rain from 12 to 1·30 PM	21
22	29·60	64·5	29·65	65	68	53·5			59·5	54	57	55	W		S																			Blinks & Sun	22
23	29·65	65	29·65	63	70	48·5			62	56	56·5	53	W		W																			Blinks & Sun & Slight shs of rain	23
24	29·65	58	29·80	63	65	50			51	51	57	55	W		W																			Thunder at 8 rain to 11 AM Blinks & Sun PM	24
25	29·75	64	29·70	64·5	70	48·5			62	56	57	55	SE		SE																			Bright Sunshine AM Overcast PM	25
26	29·50	62	29·40	63·5	70·5	52			57	55	58	55	S		S																			Cloudy & Shs of rain AM Blinks & Sun PM	26
27	29·50	65	29·55	64	70	47			62·5	55·5	54·5	52	S		S																			Bright Sunshine heavy rain at 1 PM Blks & Sun PM	27
28	29·50	61	29·55	61	66	45·5			59	57	54	51	S		NW																			Bright Sun AM Thunder & heavy shs of hail at 12·30	28
29	29·60	61·5	29·65	63·5	71	46·5			58	55	57·5	54	NW		NW																			Bright Sun AM Overcast PM	29
30	29·70	62·5	29·80	64	67·5	50			60	54·5	56	53	W		W																			Blinks & Sun	30
31	29·75	63·5	29·50	63	64	50·5			59	54	59	56	NW		NW				2·55															Cloudy throughout	31
Sums.	24·55	15·7·0	25·10	17·20	34·5	40·0			45·5	20·12	26·45	19·05																							
Means.	29·492	65·1	29·810	65·6	71·1	51·3			61·5	56·6	58·5	56·6																							
† Total Corrections for Instrumental Errors.					J Am	-·4			+·5	+·5	+·5	+·5																							
‡ Corrections for Diurnal Range.																																			
"Corrected Means."						50·9			62·0	57·1	59·0	56·6																							
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), = 29·695

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29·710

Mean at Station, corrected, and at 32°, = 29·702

Correction for height, feet above Mean Sea-level, = ·209

Mean, reduced to 32°, and Sea-level, = 29·911

Highest Reading, corrected for Index error, on the 6 th, = 30·100

Lowest Do. Do., on the 26 th, = 29·400

Difference, or **Monthly Range,** = 0·700

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 18 th, = 86·0

Lowest in Month, corrected for Index errors, on the 1 th, = 44·1

Difference, or **Monthly Range,** = 41·9

"Corrected **Mean" of all the Highest,** (Col. 5), = 71·1

"Corrected **Mean" of all the Lowest,** (Col. 6), = 50·9

Difference, or **Mean Daily Range,** = 20·2

** Calculated **Mean Temperature** of Month, = 61·0

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), = 60·5

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 56·8

‡‡ Computed **Temperature of Dew-Point,** = 53·6

‡‡ Do. **Elastic Force of Vapour,** = ·411

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

‡‡ **Relative Humidity,** (**Saturation** = 100), = 75·0

RAIN fell on 10 **Days; Amount in Inches,** = 2·55

WIND. Direction.	SUMMARY. N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	0	0	0	5	8	8	5	2	0		
P.M.	0	0	0	6	4	12	3	3	0		
Mean.	0	0	0	6	7	10	6	2	0		

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

Observations made and Return verified by _____

(*Signed*) Malcolm Dunn

6

14.

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers, are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb,—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather 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.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with or, a little over 40°, or 40½°, respectively. So also 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 "*Max.*" and "*Min.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily at 9 A.M., and the readings entered in the returns of the day previous.

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

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

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

6, S. W.
——, (for example,) will indicate that the
2, W.

upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of

4, st.
——, (*e.g.*) will indicate that the higher
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.

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

Underground Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 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. Mention should be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

Ozone.—Mention whether Schönbein's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{\frac{N.W.}{4}}$, 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": *i.e.*, that it is *blowing fresh*.

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

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

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

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

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

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

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

(By Order) A. B.

EDINBURGH, *November 1873.*

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,	

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,				

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.

BOOK POST.

x Dalkeith
July 1874

To

MR ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

SCOTTISH METEOROLOGICAL SOCIETY.

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

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of August 1874.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	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 Flatholm, 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	29·65	61	29·60	61·5	64	47			57·5	55	56·5	53	NW		NW																				Blinks of Sun	1
	2	29·35	66	29·25	62·5	68·5	55			64	59	56	52·5	NW		NW																				Blks. of sun & Showers NW Wind	2
	3	29·65	62	29·75	58·5	65	50			57	50	51	49	N		N																				Blks. of sun Slight Sh. of rain at 1.30 PM	3
	4	29·65	60	29·70	61	65	47			54	52	53·5	51·5	W		W																				Cloudy Slight Sh. of rain and Bright sun PM	4
	5	29·50	62	29·25	60·5	64·5	43·5			55	51	53	48·5	W		NW																				Cloudy AM Blks. of Sun PM	5
	6	29·55	59	29·65	60·5	67	49			58	55	55	50	W		W																				Bright Sun AM Blinks PM	6
	7	29·30	64	29·30	61	69	50			63·5	60·5	55	53	W		W																				Bright Blks. of Sun & Sh. of rain	7
	8	29·30	62	29·35	58	65·5	40·5			58	54	54·5	50	W		NW																				Blks. of sun, Thunder rain & hail at 7PM	8
	9	29·46	60	29·40	61	65·5	48			58	54	51	49	N		S.E																				Blinks of Sun AM Bright PM	9
	10	29·25	59	29·25	61	64·5	49			54	53	52·5	51·5	SW		NW																				Blks of sun Thunder & heavy rain at 1.30 PM	10
	11	29·25	61·5	29·25	59	61	47·5			57·5	55	53	52	N		N																				Rain from 10·20 PM	11
	12	29·30	59	29·35	59	65	50			55	53	53	50·5	SW		SW																				Blks of sun AM Thunder & Rain at 1 PM	12
	13	29·35	59·5	29·20	59	66	47			60	56	53	51	W		E																				Blinks of Sun AM, Overcast & rain from 5 PM	13
	14	29·15	57	29·40	59	57	48			52	51	57	53	E		NW																				heavy rain AM. Showers PM	14
	15	29·60	56	29·65	57·5	63	48			50	48·5	52·5	50	W		W																				Showers of rain AM Cloudy PM	15
	16	29·70	58	29·65	57·5	65	47·5			57·5	53·5	53	49	W		W																				Blinks of Sun Passing Clouds	16
	17	29·85	58·5	29·95	57	63	49·5			57	51	51·5	49	W		W																				Blinks of Sun	17
	18	29·88	61·5	30·05	64	70	48			60·5	58·5	62·5	60	SW		SW																					18
	19	30·15	66·5	30·20	69	78	55			70	66	64	61·5	S		SW																				Bright Blinks of Sun	19
	20	30·30	65·5	30·35	64·5	65·5	58			59	58	55·5	54	SE		SE																				Cloudy throughout	20
	21	30·40	62·5	30·35	61	70	52			58	55	53	54	SE		S																				Bright Sun from 11 AM	21
	22	30·30	65·5	30·25	64	78·5	50			68	63	56	55	S		SE																				Bright Sunshine	22
	23	30·30	65	30·25	60	69	50			60	56·5	54·5	50	E		E																				" " "	23
	24	30·15	62	30 —	60·5	65	49·5			57·5	54	55	53·5	E		NE																				Blinks of Sun AM overcast PM	24
	25	30 —	60·5	29·98	62·5	65·5	51·5			55	53·5	55	53·5	E		E																				Cloudy Blks of sun Mid-day	25
	26	29·85	62·5	29·70	63·5	68	54			59	56·5	59·5	57·5	SE		SE																					26
	27	29·55	64	29·45	59	65	52·5			61	58	52·5	50·5	SW		SW																				Cloudy, rain from 3.30 to 6 PM	27
	28	29·45	59	29·55	60	65	45			57	52	52	49	SW		SW																				Blinks of Sun AM Bright PM	28
	29	29·45	57·5	29·50	57·5	61·5	48			51·5	50	46	45	SW		SW																				Rain from 8.30 to 10.30 am. Blks. sun PM	29
	30	29·55	58	29·40	58	63·5	41·5			55	51	52·5	51·5	SW		SW																				Blinks of Sun AM. Rain from 4.30 PM	30
	31	29·35	58·5	29·60	59	66	48			59	54·5	52	50	SW		SW						4·30														Blinks of Sun Passing Clouds	31
	Sums.	20·45	13 9 / 6 15 6	3 3·0	20·40	13 9 / 4 14 2	17·0	6 15 5 / 4 12 4	189·0	289·5				5 15 3 / 5 12 4	248·5	147·0	7 11 2 / 5 10 5	123·0	57·5																			
	Means.	29·660	61·1	29·658	60·6	66·1	46·3			58·0	54·7	54·0	51·9																									
	† Total Corrections for Instrumental Errors.						−4			+5	+6	+5	+5																									
	‡ Corrections for Diurnal Range.																																					
	"Corrected Means."						48·9			58·5	55·2	54·5	52·4																									
	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), = 29·660 − 0·086 = 29·574

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29·658 − 0·085 = 29·573

Mean at Station, corrected, and at 32°, = 29·573

Correction for height, feet above Mean Sea-level, = ·209

Mean, reduced to 32°, and Sea-level, = 29·782

Highest Reading, corrected for Index error, on the 21th, = 30·400

Lowest Do. Do., on the 14th, = 29·150

Difference, or **Monthly Range,** = 1·250

* 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 12th, = 78·5

Lowest in Month, corrected for Index errors, on the 30th, = 41·1

Difference, or **Monthly Range,** = 37·4

"Corrected **Mean" of all the Highest,** (Col. 5), = 66·1

"Corrected **Mean" of all the Lowest,** (Col. 6), = 48·9

Difference, or **Mean Daily Range,** = 17·2

** Calculated **Mean Temperature** of Month, = 57·5

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** (Cols. 9 and 11), = 56·5

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 53·8

‡‡ Computed **Temperature of Dew-Point,** = 51·3

‡‡ Do. **Elastic Force of Vapour,** = ·379

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

‡‡ **Relative Humidity, (Saturation** = 100), = 83·2

RAIN fell on 13 **Days; Amount in Inches,** = 4·30

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

Observations made and Return verified by _____

(*Signed*) Malcolm Dunn

6
4

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers, are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb,—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather 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.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with or, a little over 40°, or 40½°, respectively. So also 40½°, and 40⅞°, more or less must be registered 40°.2 or 40°.3 and 40°.7 or 40°.8 respectively. In reading Rutherford's "*Max.*" and "*Min.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily at 9 A.M., and the readings entered in the returns of the day previous.

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

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

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

6, S. W.
2, W.

4, st.
2, cu-st,

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

Underground Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 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. Mention should be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

Ozone.—Mention whether Schönbein's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner;—thus $\frac{3^{N.W.}}{4}$, 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": *i.e.*, that it is *blowing fresh*.

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

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

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

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

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

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

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

(By Order) A. B.

EDINBURGH, *November 1873.*

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.

Dalkeith
Aug. 1874

2.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK POST.

SCOTTISH METEOROLOGICAL SOCIETY.

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

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of September 1874.

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.____ (°)	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.____	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	29·20	62	29·40	60·5	69·5	49			63	59	57·5	50	S		SW																	Bright Blinks of sun & light wind	1
2	29·45	60	29·50	60	66·5	49			59	55	51·5	49·5	S		SE																					2
3	29·55	59	29·45	60	66	47			55	52·5	51	49	S		S																	Blinks of sun & slight Sh. of rain	3
4	29·45	58·5	29·60	57	63	46			55	51	51	48	W		NW																	Blinks of sun & passing Clouds	4
5	29·70	56·5	29·75	58	61·5	45·5			55	50	47·5	45	W		W																	Blinks of sun Sh. of rain at 6·30 P.M.	5
6	29·80	55·5	29·80	57·5	57·5	39·5			52·5	50	51	49	S		SW																	Blinks of sun	6
7	29·80	58·5	29·70	58	61·5	49·5			56	54·5	54	53	SE		SE																	Cloudy & slight Sh. of rain	7
8	29·70	58·5	29·50	58	66	49			55	52	54	51	W		W																	Blinks of sun Am. Overcast P.M.	8
9	29·25	57	29·15	57·5	64	50			51·5	51	47	45·5	W		SW																	Blinks of sun & passing Clouds	9
10	29·05	54·5	29·15	55·5	57	45			54	49	51	45·5	SW		W																	Blks. of sun & very slight rain from 10·30 to 12·30	10
11	29·30	55	29·15	57	64	46			54·5	50·5	50	49	W		SW																	Bright Blinks of sun	11
12	29·60	55·5	29·80	57·5	63·5	45			52	49	52	50	SE		N																	Blks. of sun Am. Overcast P.M.	12
13	30·05	53·5	30·10	52	61	38			52	44·5	45	43·5	N		NW																	Bright Sunshine	13
14	30 —	55	29·75	58	60·5	39·5			55	51	54	54·5	W		W																	Cloudy throughout	14
15	29·65	61	29·80	57·5	63	53			60	54	47·5	46·5	S		SW																	Showers of rain and Blks. of sun P.M.	15
16	29·90	55·5	29·87	53	56	39·5			52	47	47·5	46	SW		W																	Cloudy throughout	16
17	29·75	52	29·45	55	61	37·5			53	49	52	50	W		W																	Bright Sun Am. Blks. P.M.	17
18	29·55	56	29·70	55	62	49·5			55	50·5	51·5	48·5	W		W																	Bright Blks. of sun & passing clouds	18
19	29·65	57·5	29·55	59·5	64	45·5			56	52	57·5	57·5	W		SW																	" "	19
20	29·55	60	29·65	60	66	53			60	55·5	55	51·5	SW		SW																	" "	20
21	29·60	59	29·55	59·5	58·5	50			54·5	53	53·5	53	S		S																	Rain Throughout	21
22	29·45	58	29·60	58	63·5	46			56	52	53·5	51·5	S		S																	Blks. of sun Pass. Clouds rain from 7 P.M.	22
23	29·70	58	29·80	56	62	51			55	53	49	48	S		S																	Cloudy Am. Bright sun from 1 P.M.	23
24	29·90	58	29·90	58	63	44			58	54	54	51·5	S		SW																	Bright Blks. of sun Am. Overcast P.M.	24
25	29·85	58·5	29·90	58	58·5	51·5			54·5	53	54·5	54	W		W																	Cloudy & slight Sh. of rain	25
26	30·05	55	29·90	57	59	44			52	50	50	49	W		W																	Bright Sun from 9. to 11 A.M. Overcast P.M.	26
27	29·80	56·5	29·70	59	62·5	47			55	53	52	51	W		W																	Bright Blinks of sun	27
28	29·50	61	29·30	60	66·5	46			63	58·5	58	54	S		S																	Blinks of sun A.M. Overcast P.M.	28
29	29·25	59	29·30	55	60	49			54	51	46	43	S		S																	Bright sun Am. Rain from 3·55 P.M.	29
30	29·50	53	29·50	54	59·5	43			52	48	47·5	45	S		S						1·30											Blinks of sun & passing Clouds	30
31																																			31
Sums.	18·45	21·70	18·20	22·10	71·5	187·5			159·5	52·5	44·5	28·5																								
Means.	29·615	57·2	29·067	57·4	62·4	46·2			55·3	51·8	51·5	49·4																								
† Total Corrections for Instrumental Errors.						-4			+5	+5	+5	+5																								
‡ Corrections for Diurnal Range.																																				
"Corrected Means."						45·5			55·8	52·3	52·0	49·4																								
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), = 29·615 − ·075 = 29·540

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29·607 − ·075 = 29·532

Mean at Station, corrected, and at 32°, = 29·536

Correction for height, feet above Mean Sea-level, = ·209

Mean, reduced to 32°, and Sea-level, = 29·745

Highest Reading, corrected for Index error, on the 13 th, = 30·100

Lowest Do. Do., on the 10 th, = 29·050

Difference, or **Monthly Range,** = 1·050

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 1 th, = 69·5

Lowest in Month, corrected for Index errors, on the 17 th, = 37·1

Difference, or **Monthly Range,** = 32·4

"Corrected **Mean" of all the Highest,** (Col. 5), = 62·4

"Corrected **Mean" of all the Lowest,** (Col. 6), = 45·8

Difference, or **Mean Daily Range,** = 16·6

** Calculated **Mean Temperature** of Month, = 54·1

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), = 53·9

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = 51·1

‡‡ Computed **Temperature of Dew-Point,** = 44·4

‡‡ Do. **Elastic Force of Vapour,** = ·338

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

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

RAIN fell on 9 **Days; Amount in Inches,** = 1·30

WIND. Direction.	SUMMARY. N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	0	0	2	12	3	12	0	0		
P.M.	1	0	0	2	6	8	11	2	0		
Mean.	1	0	0	2	9	5	12	1	0		

W

* 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*) Malcolm Dunn

6

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers, are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb,—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather 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.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with or, a little over 40°, or 40½°, respectively. So also 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 "*Max.*" and "*Min.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily at 9 A.M., and the readings entered in the returns of the day previous.

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

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner;—In the column "Velocity and Direction," $\frac{6,\ S.\ W.}{2,\ W.}$, (for example,) will indicate that the *upper* strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of $\frac{4,\ st.}{2,\ cu\text{-}st}$, (*e.g.*) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-*tenths* by lower clouds of the *cumulo-stratus* kind.

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

Underground Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk 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. Mention should be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

Ozone.—Mention whether Schönbein's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $\frac{2}{S.W.}$, 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": *i.e.*, that it is *blowing fresh*.

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

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

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

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

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

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

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

(By Order) A. B.

EDINBURGH, *November 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 Pontienm,	
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.

Dalkeith
Sept. 1874

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

BOOK POST.

SCOTTISH METEOROLOGICAL SOCIETY.

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

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of October 1874.

The Hours of Observation are of Greenwich Time.

Days of Month.	BAROMETER. 9 h. A.M. * No.	Attached Thermometer	9 h. P.M. 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. 8 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	29·35	54	29·25	51	58·5	42			47	46	46	44	SE		SW																	Bright sun from 11 to 1 – am pm	1
2	28·75	54	28·60	51·5	55·5	42			52	47	45	42·5	SW		SW																	Blinks of sun & high wind	2
3	28·65	52·5	28·85	51·5	56·5	42			51·5	47	46	42·5	W		W																	Bright sun Very high wind	3
4	29· –	52	29·30	48·5	57	44			50·5	46	43·5	40·5	W		W																	Bright Sunshine	4
5	29·60	48·5	29·55	48	54·5	35			47	42	42	40	W		W																		5
6	29·20	52	28·90	54	56	40			51·5	49·5	50	49·5	S		SW																	Rain throughout	6
7	28·95	52·5	29·35	52	57	44·5			50	47·5	44	42	SW		SW																	Bright & K.s. of sun	7
8	29·65	49	29·55	49	54	38			48	45	44	41	SW		SW																		8
9	29·40	53	29·60	51	59·5	42			52	50	46	44	S		SW																	Bright sun Am Bk.s PM	9
10	29·55	54	29·70	54	61	41			52	51	47·5	46	S		S																	Bright sun Mid-day	10
11	29·60	53	29·75	53	60	37·5			54·5	50·5	46	44	SW		SW																	Bk.s & sun Am Cloudy 7 & 8 pm	11
12	29·75	50	29·70	53	56·5	38·5			46·5	45	50	49	SW		SW																	Shot of rain heavy @ 9 PM	12
13	29·75	51·5	29·80	50	54·5	43			46·5	45	38	37	N		N																	Blinks of sun	13
14	29·65	48·5	29·35	52	55	34·5			45	43	51	49	S		S																	Blinks of sun Am Overcast PM	14
15	29·15	55·5	29·10	57	64	43			55	52·5	56	54	SE		SW																	Blinks of sun rain at 11.30 PM	15
16	29·45	51	29·55	48	57·5	44			50	46·5	41	39·5	SW		SW																	Bright Sunshine	16
17	29·30	52·5	29·35	54	63	39·5			51	49·5	52	49	S		SW																		17
18	29·50	55	29·45	54	60·5	47			55	53	49	48	SW		SW																	Bk.s Sun Am slight sh.r rain PM	18
19	29·40	53	29·75	48·5	54	46			49	46	42	40·5	SW		W																	Blinks of sun	19
20	29·70	49·5	29·40	52	53·5	38			47	44	52·5	50·5	SW		SW																	Bk.s of sun & Sht of rain	20
21	28·75	51	29·20	46	55	44			47	43	41	38·5	W		W																	Bk.s of sun Gale of wind Am	21
22	29·35	47	29·35	46·5	54	39			45	40·5	42	40	W		W																	Bright Sunshine	22
23	29·75	45	29·75	45	51	33·5			41·5	38·5	40·5	39	W		W																		23
24	29·70	48	29·45	52	53	38			46·5	43·5	52	49	W		W																	Cloudy throughout high wind all PM	24
25	29·30	54	29·70	50·5	59·5	45			53	51	46	44	W		W																	Blinks of sun	25
26	29·85	46·5	29·65	51	53·5	35·5			42	40·5	46·5	46	W		SE																	Cloudy, rain from 4.30 PM	26
27	29·65	52	29·85	49	57	43			52	50·5	44	42·5	SW		NW																	Cloudy Am Sunshine PM	27
28	30·–	45·5	29·95	47	53	36			41	39·5	39	38·5	W		W																	Bright sun Am Bk.s PM	28
29	30·–	41	30·15	48·5	50	31			35·5	34·5	46·5	44·5	W		NW																	Foggy with glimpses of sun Am Cloudy PM	29
30	30·25	48·5	30·30	49	52·5	43			45	44	43·5	42	SE		E																	Glimpses of sun Am Cloudy PM	30
31	30·25	44	30·15	43·5	49·5	33			39	37	32	32	SE		SE				2·40													" " "	31
Sums.	15·920	1535	16·555	1514	1840	1343			1485	1683	1615	1585																								
Means.	29·494	50·3	29·534	50·3	55·9	40·1			48·0	45·4	45·3	43·5																								
† Total Corrections for Instrumental Errors.						-4			+5	+5	+5	+6																								
‡ Corrections for Diurnal Range.																																				
"Corrected Means."						39·7			118·5	45·9	45·8	44·6																								
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), = 29·494 – ·057 = **29·437**

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction ++ for Temp. (Col. 4), = 29·534 – ·057 = **29·477**

Mean at Station, corrected, and at 32°, = **29·455**

Correction for height, feet above Mean Sea-level, = **·209**

Mean, reduced to 32°, and Sea-level, = **29·864**

Highest Reading, corrected for Index error, on the 30th, = **30·300**

Lowest Do. Do., on the 24th, = **28·600**

Difference, or **Monthly Range,** = **1·700**

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 15th, = **64·0**

Lowest in Month, corrected for Index errors, on the 29th, = **30·6**

Difference, or **Monthly Range,** = **33·4**

"Corrected **Mean" of all the Highest,** (Col. 5), = **55·4**

"Corrected **Mean" of all the Lowest,** (Col. 6), = **39·7**

Difference, or **Mean Daily Range,** = **16·2**

** Calculated **Mean Temperature** of Month, = **47·8**

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), = **47·2**

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = **45·0**

‡‡ Computed **Temperature of Dew-Point,** = **42·6**

‡‡ Do. **Elastic Force of Vapour,** = **·273**

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

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

RAIN fell on **7** **Days; Amount in Inches,** = **1·40**

WIND. Direction.	SUMMARY. N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	0	0	4	5	10	11	0	0		
P.M.	1	1	1	2	2	13	10	1	0		
Mean.	1	0	0	3	4	12	11	0	0		

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

Observations made and Return verified by _____

(Signed) Malcolm Dunn

Severe Gale of wind on the morning of the 21st doing great damage to trees, house roofs, stackyards &c. Many large trees blown clean over, & the limbs of hundreds terribly smashed; especially Oaks, that were still heavily clothed with foliage. Storm began about 2 a.m., at its height about 5 a.m., & went down about 9 a.m.

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers, are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb,—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather 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.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with or, a little over 40°, or 40½°, respectively. So also 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 "*Max.*" and "*Min.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily at 9 A.M., and the readings entered in the returns of the day previous.

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

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner;—In the column "Velocity and Direction," $\frac{\text{6, S. W.}}{\text{2, W.}}$, (for example,) will indicate that the *upper* strata of clouds travel with *extreme* velocity fr[illegible] and those in the lower regions from W., with one [illegible] (*extreme*) speed of the former. Again, in the second [illegible] column, an entry of $\frac{\text{4, st.}}{\text{2, cu-st,}}$ (*e.g.*) will indicate that t[illegible] regions are covered to the "amount" of 4-tenths wit[illegible] clouds; and that the sky is further obscured to the [illegible] 2-*tenths* by lower clouds of the *cumulo-stratus* kind.

Sunshine.—The number of hours in which object[illegible] sun's rays cast shadows, should be entered in the proper [illegible]

Underground Thermometers.—As the germination an[illegible] of crops and plants greatly depend on the temperatur[illegible] soil,—its amount and constancy,—the Council recomme[illegible] observations in this interesting department be made at 9 [illegible] thermometers placed in the earth, their bulbs being s[illegible] depths of 3, 12, and 22 inches, and the stems above grou[illegible] tected from the sun's rays, and fitted with sloping tin [illegible] to prevent rain water being conveyed to the bulbs by the [illegible] or wooden frames. Mention should be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

Ozone.—Mention whether Schönbein's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{\text{N.W.}}_{4}$, 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—6 is "4": *i.e.*, that it is *blowing fresh.*

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

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

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

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

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

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

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

(By Order) A. B.

EDINBURGH, *November* 1873.

BOOK POST.

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

Dalkeith
Oct 1874

3

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 Reaped.
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.

Inside

SCOTTISH METEOROLOGICAL SOCIETY.

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

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of November 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.	No. 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.
ELECTRICITY.	inches.	°	inches.	°	°	°	°	°	°	°	°	°																									
1	30·10	46	30·05	45·5	44	29·6			38	37	42	41·5	S.E.		S.E.																				Foggy throughout	1
2	29·80	48	29·70	49	51	36			46·5	45	46	45·5	S.E.		S.W.																				Sht. of rain AM Cloudy PM	2
3	29·70	49	29·65	51·5	53	44			46·5	45	50	48	S.		S.W.																				Cloudy AM Sht. of rain PM	3
4	29·75	53	29·70	52·5	58	45			55	53·5	51	48	S.W.		S.W.																				Cloudy AM Bright sunshine PM	4
5	29·80	55	29·80	50·5	56·5	49			55	51	44·5	44	S.W.		S.W.																				Cloudy. Rain from 4 30 PM	5
6	30·—	47	29·90	48	59	36			43	42	41	40	W.		W.																				Bright sunshine	6
7	30·05	48·5	30·15	48·5	52	39			46·5	44	45	43·5	W.		W.																				Bkn. sun AM Overcast PM	7
8	30·10	49·5	30·05	52	57·5	41			47·5	45	51	49·5	W.		W.																				Blinks of sun	8
9	30·—	53·5	29·90	55·5	61	45			53·5	50	53	51·5	W.		W.																				Bkn. of sun AM rain PM Wind from 6 PM	9
10	29·90	46	29·95	42	52·5	36·5			40	36	32	30·5	N.		N.																				Bkn. of sun Slight sht. snow AM 11·20	10
11	29·90	43·5	29·85	39	37·5	30			32·5	32	31	30	E.		N.																				Heavy sht. of snow AM Cold wind	11
12	29·90	39	29·75	41	43	29·5			35	33	38·5	35	N.		N.W.																				Blinks of sun AM Cloudy PM	12
13	29·80	43	29·90	42	45·5	37			41·5	37	39	36·5	N.		N.																				Blinks of sun	13
14	29·95	43	29·80	49	51	35·5			41	39	50	48·5	W.		W.																				Sunshine	14
15	29·60	48	29·35	45	52	43			45	42	40·5	39·5	W.		W.																				Dull throughout	15
16	29·35	45	29·25	46	46	38			41·5	38	44	40·5	W.		W.																					16
17	29·50	43	29·65	45	47·5	35·5			39·5	36·5	40·5	39	W.		W.																				Sunshine AM Sht. of rain PM	17
18	29·50	45	29·45	46·5	47	37			40	39·5	46	45	W.		N.W.																				Rain AM Bkn. of sun PM	18
19	29·35	45	29·40	45	46·5	38			41	40	40	38·5	W.		W.																				Sht. of rain AM Bkn. of sun PM	19
20	29·70	44	29·85	44·5	46·5	37·5			41	38·5	40	39	N.W.		N.W.																				Cloudy throughout	20
21	29·95	44	29·95	44	45	34·5			38	37	38	37	W.		S.W.																					21
22	29·85	37·5	29·80	38·5	43·5	29			31·5	32	34	32·5	W.		W.																				Sunshine	22
23	29·90	35	29·90	40	38·5	27			29·5	30	36	35	N.W.		S.E.																				Foggy throughout	23
24	29·90	41·5	29·75	44	46	34			36·5	35	40	38	S.E.		S.E.																				Bkn. of sun Mid-day	24
25	29·55	46	29·45	45·5	44·5	38·5			42	41	43·5	42	S.E.		S.E.																				Rain AM Cloudy PM	25
26	29·55	45	29·40	43	47	37·5			41	40	37	35·5	S.E.		S.E.																				Bkn. of sun Mid-day	26
27	29·45	40·5	29·40	39	37	31·5			32·5	32	31	30·5	S.E.		S.E.																				Showers of snow AM Continued heavy to 3·30 PM	27
28	29·40	42	29·10	42	37·5	29·5			34	32	36	33·5	S.E.		S.E.																				Cold wind, Bkn. of sun Mid-day	28
29	28·70	43·5	28·30	45	42	34·5			39	37	41	40	E.		E.																				Heavy rain throughout	29
30	28·75	45	29·—	44	42·5	39			40·5	39·5	39·5	37	E.		E.				5·25																Heavy rain AM Sht. of rain & Dull	30
31																																					31
Sums.	20·75	1520	19·15	1630	2325	1970			3140	2795	4110	2920																									
Means.	29·692	45·1	29·638	45·4	44·7	36·6			41·1	39·3	41·1	39·7																									
† Total Corrections for Instrumental Errors.						-·4			+·5	+·5	+·5	+·5																									
‡ Corrections for Diurnal Range.																																					
"Corrected Means."						36·2			41·6	39·8	41·6	40·2																									
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.
li. 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), = 29·692 − ·044 = **29·648**

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29·638 − ·044 = **29·594**

Mean at Station, corrected, and at 32°, = **29·621**

Correction for height, feet above Mean Sea-level, = **·209**

Mean, reduced to 32°, and Sea-level, = **29·830**

Highest Reading, corrected for Index error, on the 7 th, = **30·150**

Lowest Do. Do., on the 29 th, = **28·500**

Difference, or **Monthly Range,** = **1·650**

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 9 th, = **61·0**

Lowest in Month, corrected for Index errors, on the 23 th, = **26·6**

Difference, or **Monthly Range,** = **34·4**

"Corrected **Mean**" **of all the Highest,** (Col. 5), = **47·7**

"Corrected **Mean**" **of all the Lowest,** (Col. 6), = **36·2**

Difference, or **Mean Daily Range,** = **11·5**

** Calculated **Mean Temperature** of Month, = **42·0**

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

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

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

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading **of Dry Bulb,** (Cols. 9 and 11), = **41·8**

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb,** (Cols. 10 and 12), = **40·0**

‡‡ Computed **Temperature of Dew-Point,** = **37·7**

‡‡ Do. **Elastic Force of Vapour,** = **·227**

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

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

RAIN fell on 13 **Days; Amount in Inches,** = **3·25**

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

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

Observations made and Return verified by _____

(*Signed*) Malcolm Dunn

E H

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers, are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb,—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather 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.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with or, a little over 40°, or 40½°, respectively. So also 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 "*Max.*" and "*Min.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily at 9 A.M., and the readings entered in the returns of the day previous.

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

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner;—In the column "Velocity and Direction,"

6, S. W.
———,(for example,) will indicate that the
2, W.

upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of

4, st.
———, (*e.g.*) will indicate that the higher
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.

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

Underground Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 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. Mention should be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

Ozone.—Mention whether Schönbein's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{\frac{S.W.}{4}}$, 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": *i.e.*, that it is *blowing fresh*.

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

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

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

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

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

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

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

(By Order) A. B.

EDINBURGH, *November 1873.*

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 Pulled.
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.

BOOK POST.

Dalkeith
Nov. 1874

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

SCOTTISH METEOROLOGICAL SOCIETY.

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

Height of Cistern of the Barometer above Mean Sea-level 190 feet, above Ground 4 feet. During the MONTH of December 1874.

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	29·30	42·5	29·45	39	40·5	34			35	32·5	31	31	N.E		E																				Sunshine Midday	1
2	29·75	39·5	29·75	33·5	35·5	25			25·5	26	26	26·5	N		NW																					2
3	29·70	39	29·80	41	43	25			37	35	36·5	34·5	W		NW																				Blinks of Sun Midday	3
4	29·55	42·5	29·30	47	51	34			41	39	48	44	W		W																				Blinks of Sun Midday Frequent Wind	4
5	29·25	45·5	29·20	45	45	41			43	41	39·5	38	W		W																				Blinks of Sun.	5
6	29·10	43·5	29·15	42	40·5	33·5			36·5	35·5	36	33·5	W		NW																				Cloudy with shrs of Sleet	6
7	29·25	39	29·55	40	39·5	31			34	32	35	32	NW		NW																				Heavy shrs of snow @ 8.30 Frequent Bright Sun Midday	7
8	29·35	39·5	28·75	41·5	38	29			34·5	32	37	36	S.E		E																				Barometer fell from 29·35 to 28·75 between 9 A.M. & 9 P.M. Continued Heavy Sleet from 9.30 & high wind	8
9	29·15	41	29·40	39	41	32·5			34	31·5	32	29·5	N		N.W																				Bright Sun Midday	9
10	29·45	38	29·25	34·5	32·5	23·5			24	24	30	28	S.W		S.W																				Bright Sun from 9.30 to 2.20	10
11	28·55	38·5	28·65	40	38·5	23·5			32·5	32	37	36	S.E		S.E																				Heavy shrs of Snow rain from 4	11
12	29·10	41	29·30	40·5	38·5	33·5			36·5	35	34	33·5	S.E		E																				Cloudy & Slight shrs of rain & hail @ 4.15	12
13	29·50	40·5	29·75	39	36·5	32			34	32	35	34·5	E		N.E																				Heavy shrs snow & rain hail evening	13
14	29·95	40·5	29·95	36	38	28			35	32	28·5	28	N.E		N.E																				Glimpses of Sun Midday	14
15	29·85	31·5	29·45	35	31·5	18			20	20·5	31	29·5	S.E		E																				Glimpses of Sun & Cold Wind	15
16	29·75	37	30·—	38	38·5	27			29·5	29	34·5	33·5	N		N																				Blinks of Sun & Shrs of Snow	16
17	30·15	37	30·10	33·5	35	23			28	27	25	26	N		N																				Glimpses of Sun Midday	17
18	29·85	37	29·70	41	43·5	22·5			36	32	40	37	NW		NW																					18
19	29·70	40·5	29·55	39	40·5	29·5			32	32	34	31·5	NW		N.W																				Bright Sun " All Cloudy PM	19
20	29·45	40	29·35	38	40	30·5			36	33	33·5	31·5	N		N																					20
21	29·35	36·5	29·40	34	35·5	28			32	30	26	28	N		S.E																				Cloudy AM Shrs of Snow from 3.45	21
22	29·65	36	29·70	32·5	34·5	23			30·5	30	25	25·5	S.E		S.E																				Sunshine AM Cloudy PM	22
23	29·75	36·5	29·50	36	30·5	19·5			23	23	26	26	S.E		S.E																				Bright Sunshine	23
24	29·40	38	29·40	34	33	21			30	30	26	26	S.E		S.E																				Heavy Shrs of Snow AM Cloudy PM	24
25	29·55	37	29·65	35	29	22·5			26	24	31	30	S.E		S.W																				Blinks of Sun Midday	25
26	29·70	37·5	29·85	33	37	26			27	25	22	23	S.W		S.W																				Glimpses of Sun AM, Cloudy PM	26
27	29·95	36	30·—	35	34·5	21·5			25	25	29	28	S.W		S.W																				Bright Sun AM. Overcast PM	27
28	30·05	35	30·—	28	33·5	17·5			18	18	20	20	S.W		S.W																				Glimpses of Sun AM Cloudy PM	28
29	30·05	31	30·10	33	30·5	12·5			15	15	27	28	S.W		S.E																				Glimpses of Sun AM, Shrs of Snow PM	29
30	30·15	34·5	30·10	35	30·5	16			18	18	24	24	S.W		S.W																				Heavy Showers of Snow.	30
31	30·05	37	29·95	30	33	23			30	30	15	15	N		W				1·90																5 Falls of 6 inches of Snow this morning before 8 AM. Cloudy throughout.	31
Sums.	1411	3/1157	1148	3/1133	3/1354	2/1061			3/1133	2/1012	3/1142	3/1155																								
	918·35	2585	1810	2180	2215	1885			85	287·0	245	306·5																								
Means.	29·592	38·3	29·584	37·0	37·1	26·1			30·3	29·3	30·8	29·9																								
† Total Corrections for Instrumental Errors.						-·4			+·5	+·5	+·5	+·5																								
‡ Corrections for Diurnal Range.																																				
"Corrected Means."						25·7			30·8	29·8	31·3	30·4																								
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), = 29.592 − .025 = **29·567**

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction †† for Temp. (Col. 4), = 29.584 − .022 = **29·562**

Mean at Station, corrected, and at 32°, = **29·564**

Correction for height, feet above Mean Sea-level, = **·209**

Mean, reduced to 32°, and Sea-level, = **29·773**

Highest Reading, corrected for Index error, on the 30 th, = **30·150**

Lowest Do. Do., on the 11 th, = **28·550**

Difference, or **Monthly Range**, = **1·600**

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month**, (corrected for Index Errors), on the 11 th, = **51·0**

Lowest in Month, corrected for Index errors, on the 29 th, = **12·1**

Difference, or **Monthly Range**, = **38·9**

"Corrected **Mean**" **of all the Highest**, (Col. 5), = **37·1**

"Corrected **Mean**" **of all the Lowest**, (Col. 6), = **25·7**

Difference, or **Mean Daily Range**, = **11·4**

** Calculated **Mean Temperature** of Month, = **31·4**

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), = **31·0**

Mean (corrected) A.M. and P.M. Reading **of Wet Bulb**, (Cols. 10 and 12), = **30·1**

‡‡ Computed **Temperature of Dew-Point**, = **27·6**

‡‡ Do. **Elastic Force of Vapour**, = **·350**

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

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

RAIN fell on **9 Days; Amount in Inches**, = **1·90**

WIND. Direction.	SUMMARY. N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	7	2	1	8	0	6	4	3	0		
P.M.	4	2	3	6	0	16	3	7	0		
Mean.	6	2	2	7	0	6	3	5	0		

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

Observations made and Return verified by _____

(Signed) Malcolm Dunn

64

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS,

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested form* of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers, are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb,—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather 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.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or *column* of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little under, an exact coincidence with or, a little over 40°, or 40½°, respectively. So also 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 "*Max.*" and "*Min.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily at 9 A.M., and the readings entered in the returns of the day previous.

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

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner;—In the column "Velocity and Direction,"

6, S. W.
——, (for example,) will indicate that the
2, W.

upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of

4, st.
——, (*e.g.*) will indicate that the higher
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.

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

Underground Thermometers.—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and constancy,—the Council recommend that observations in this interesting department be made at 9 A.M., by thermometers placed in the earth, their bulbs being sunk to 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. Mention should be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

Ozone.—Mention whether Schönbein's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indications registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus $3^{N.W.}_{4}$, 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": *i.e.*, that it is *blowing fresh*.

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

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

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

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

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

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

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

(By Order) A. B.

Edinburgh, *November 1875*.

BOOK POST.

Dalkeith.
Dec. 1874.

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

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.
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.