

Ballater

Henderson

666

Summary

18 62NOTATION USED IN GENERAL REMARKS

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb , (Cols. 9 and 11),											=
Mean (corrected) A.M. and P.M. Reading of Wet Bulb , (Cols. 10 and 12),											=
⌈⌈ Computed Temperature of Dew-Point ,											=
⌈⌈ Do. Elastic Force of Vapour ,											=
⌈⌈ Do. Weight of Vapour in a Cubic Foot of Air ,											=
⌈⌈ Relative Humidity , (Saturation = 100),											=
RAIN fell on 27 Days ; Amount in Inches,											= 5.89

WIND.										SUMMARY.		
Direction	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.	
A.M.	6	4		2	3	4	4		5	1.40		
P.M.	6	3		4	3	2	4	4	4	1.44		
Mean.	6	4		2	3	2	4	4	5	1.42		

Observations made and
Return verified by

(Signed)

WITH REMARKS ON THE USE OF INSTRUMENTS.

registering the greatest heat on the sun's rays, and the least from radiation during night. Their bulbs have a black coating which may easily be made or molded, by the application of a mixture of lamp black and printer's ink. They are placed in shallow lampblack boxes, whose slats 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. Sun snow may be removed by means of a brush, or by the sun's heat to affect the Minimum Thermometer by its radiation.

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

to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer (marked by a scratch on the tube) ought to be tested once a year, in snow or melting ice. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

us seriously vitiate the "Hygrometrical Deductions," Observations are specially requested to attend to the following conditions:—

The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-pump must be covered, and placed to the side, and a little below the level of the bulb;—in no case under the bulbs:—the muslin must be of wet bulb;—no muslin under the bulbs:—the muslin must be of medium fineness and distended the neck of the tube by the

cotton, which also supplies it with water. It must be seen to the observer that the muslin is always *clean* and *moist*, and the delivery pure. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed, evaporation will proceed as from the moist cloth in ordinary circumstances.

One form of a "Nelson's" thermometer is highly objectionable, and also supports the water cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the recommended requirements shall be complied with, as far as possible. The great *weakness of the Thermometers* is that they are taken without care to avoid the effect of reflection, by bringing the eye exactly opposite to the glass of the index, and noted in decimals. The readings might be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will read -39° , 9° , 40° , 0° , 41° , or 42° , again 44° , 40° , 5° , 40° , 6° , according as it indicates a little more or less than an exact coincidence with, or a little over 40° , or $40\frac{1}{2}^{\circ}$, respectively. So also $40\frac{1}{2}^{\circ}$, and $40\frac{1}{2}^{\circ}$, more or less must be registered $40\cdot 2$ or $40\cdot 3$, and $40\cdot 7$ or $40\cdot 8$ 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.

reading Rutherford's *Max.* and a *Min.* Thermometers, the indication of that end of the *infer* which is next to the surface of the mercury or alcohol is alone noted. Readings of these Thermometers, especially of the wet and dry *bulbs*, must be rapidly taken, being so readily affected by heat from the person observing.

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

Wind.—A wind-vane ought to be elevated 13 feet at least above surrounding objects. When it oscillates incessantly, the mean direction must be taken; and when it is stationary, the always when the wind is feeble, reference must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, etc.

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

vatory 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 indication of the Force of the Wind, at any particular hour of observation, the Linds's Anemometer is also recommended; the method of *Estimating Wind Force* by such tables as that given in the schedule is to say the least, unsatisfactory.

Rain-gauges.—Many causes conspire to produce anomalies in rain returns. They arise, partly, from unfavourable situations for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain unexcep-

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

Clouds.—Convenient abbreviations for Luke Howard's

WITH REMARKS ON THE USE OF INSTRUMENTS.

Mr ALI

90. ?

2227

POST.

AN,
Meteorological Society of So
8.2.10
8.2.12
8.2.10

[illegible][illegible]

CROPS.		Planting.	Seeding or Appling above Ground
Barley.	• • • • •		
Bore or Bigger.	• • • • •		
Oats.	• • • • •		
Wheat.	• • • • •		
Beans.	• • • • •		
Peas.	• • • • •		
Potatoes.	• • • • •		
Turnips.	• • • • •		
Rye Grass.	• • • • •		

First in Blossom.	generally.	MIGRATORY BIRDS.
		Cuckoo.
		Curlew.
		House-Swallow.
		Lapwing.
		Sand-Martin.
		Plover.
		Starling.

SECTION WITH 7		Dried of	
	In Leaf.		Leaves.
Apple,			
Black Currant,			
Cherry,			
Gean,			
Gooseberry,			
Leach,			
Pear,			

[illegible]

OBSERVATIONS	
FOREST TREE	
Alder,	
Ash,	
Beech,	
Birch,	
Elm,	
Larch,	
Lime,	
Oak,	Sycamore or P
shrubs	
Barberry,	
Broom,	Routee or E
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	

8
10
Mr. ALEXANDER
Secretary
10-2 078
67 052
ST.
10-2 078

М

[illegible][illegible]

CROPS.		Planting.	Seeding or Appling above Ground
Barley.	• • • • •		
Bore or Bigger.	• • • • •		
Oats.	• • • • •		
Wheat.	• • • • •		
Beans.	• • • • •		
Peas.	• • • • •		
Potatoes.	• • • • •		
Turnips.	• • • • •		
Rye Grass.	• • • • •		

First in Blossom.	generally.	MIGRATORY BIRDS.
		Cuckoo.
		Curlew.
		House-Swallow.
		Lapwing.
		Sand-Martin.
		Plover.
		Starling.

Barley, .	First in Blossom.
Bere or Pearl,	
Oats, .	
Wheat, .	
Beans, .	
Pease,	
Potatoes,	
Turnips,	
Rye Grass,	

SECTION WITH		FRUITS.	
Apple,	.	.	.
Black Currant,	.	.	.
Cherry,	.	.	.
Clean,	.	.	.
Gooseberry,	.	.	.
Peach,	.	.	.
Pear,	.	.	.

[illegible]

OBSERVATIONS	
FOREST TREE	
Alder,	
Ash,	
Beech,	
Birch,	
Elm,	
Larch,	
Lime,	
Oak,	Sycamore or P
shrubs	
Barberry,	
Broom,	Routee or E
Hazel,	
Hawthorn,	
Holly,	
Laburnum,	

FOREST TREES.		In		First in		First in		First in	
Flower.	Leaf buds	first appear.	In leaf	Diverged of leaves.	CROPS,	Planting	Sowing or	Appering	In Ear
					in	or above ground.			
cedar,	h.				Barley,				First C
oak,	ech,				Oats,				or buds
ash,	ech,				Wheat,				
elm,	ech,				Beans,				
maple,	ech,				Pease,				
box,	ech,				Potatoes,				
chestnut,	ech,				Turnips,				
camellia or plane,	ech,				Rye Grass,				

[illegible][illegible]

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Ballata, County of Meriden, in Lat. 37° 12' N. Long 27° 24' W. Distance from Sea 43 miles.
Height of Cistern of the Barometer above Mean Sea-level 666 feet, above Ground 102 feet. During the MONTH of February

The Hours of Observation are of Greenwich Time.

BAROMETER, "corrected mean" at 9 A.M., <i>minus</i> the Correction $\{ + \}$	=	29.095
for Temp. (Col. 2), = $\{ 29.146... - 0.5... \}$		
"Corrected Mean" of Barometer at 9 P.M., <i>minus</i> the Correction $\{ + \}$	=	29.124
for Temp. (Col. 4), = $\{ 29.174... - 0.5... \}$		
Mean at Station, corrected, and at 32°,	=	29.110
Correction for height, feet above Mean Sea-level,	=	714
Mean, reduced to 32°, and Sea-level,	=	29.834
Highest Reading, corrected for Index error, on the 14 th,	=	29.861
Lowest " Do., Do., on the 18 th,	=	29.260
Difference, or Monthly Range,	=	1.662

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 22 th,.....	= 55.0
Lowest in Month, corrected for Index errors, on the 28 th,	= 20.0
Difference, or Monthly Range,	= 35.0
" Corrected Mean " of all the Highest, (Col. 5),	= 45.8
" Corrected Mean " of all the Lowest, (Col. 6),	= 33.7
Difference, or Mean Daily Range,	= 12.1
** Calculated Mean Temperature of Month,	= 39.8

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),	=	39.0
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12),	=	37.3
†† Computed Temperature of Dew-Point,	=	35.1
†† Do. Elastic Force of Vapour,	=	205
†† Do. Weight of Vapour in a Cubic Foot of Air,	=	
†† Relative Humidity, (Saturation = 100),	=	86
RAIN fell on 14 Days; Amount in Inches,	=	1.30

WIND.	SUMMARY.										Mean Force.	Mean Velocity in miles per day.
	Direction	N	NE	E	SE	S	SW	W	NW	Calm or Variable.		
A.M.		2					11	12	1	2	1.71	
P.M.		1					9	11	3	4	1.85	
Mean.		0.2	0.0	0.0	0.0	0.0	10	11	2	3	1.80	

3.24

Observations made and
Return verified by

James W. Paterson
Ballantine

(Signed)

J. A. Peterson

8.489

WITH REMARKS ON THE USE OF INSTRUMENTS.

Hour of Observation.—The Council recommended 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 the time of every reading at what time it was taken, if not at 9 o'clock.

Barometer.—*Weather glasses* and *Anemids*, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well adapted 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.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *seize* up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern 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 (the case being taken to prevent the loss of mercury by the air hammering the ivory peg), and gently tapping it; and if this again 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.

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

The above remarks apply equally to the Thermometers for

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

seales and frames to which they are attached, the frame must be so constructed that the tubes can be raised or lowered, and be such as will bring the tubes forward by an incl. from any bound on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb, — in no case under the bulb; — the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and the water pure. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed, evaporation will proceed as from the moist skin in ordinary circumstances.

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

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.

Run-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 run-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 run-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

Clouds.—Convenient abbreviations for Luke Howard's

WITH REMARKS ON THE USE OF INSTRUMENTS.

column, an entry of $\frac{1}{2}$, (z.g.) will indicate that the higher $2_{\text{cu-st.}}$ 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.

1. *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

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 indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3rd, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as 4th on the scale, that the wind is from the N.W., and that its force on the scale, that is 4th, i.e., that it is *blowing fresh*.

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

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

(By Order) A. B.

(By Order) . . . A. B.

EDINBURGH, 9th December 1865.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.		Alder.	Ash.	Beech.	Birch.	Elm.	Larch.	James.	Oak.	Sycamore or Plane.
In	Flower.									
Leaf buds	first appear.									
In	Leaf.									
Divided of										
CROPS.										
Barley.										
Bere or Bieg.										
Oats.										
Wheat.										
Beans.										
Pease.										
Potatoes.										
Turnips.										
Rye Grass.										
Planting.										
Sowing or										
above ground.										
Appearing										
In Ear.										
In Flower.										
First Cut										
or Second.										

[illegible]

Have the goodness as 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.

It give much discomfort to the
 the system was not in agreement but as a needed dampener
 can thus stop, as the Frankfort fell to 22, 20 and 18 cents per ton
 the last quarter has been on 20. The rainfall is 10.7 in. for the
 average of the last five years although in February 1863 only 5.7 inches was received
 production, grain commenced in the 18th which was also the case w/ the
 forwarded out previous. Confirmed with - House beginning before

 T_0

Mr ALEXANDER BUCHAN.

Secretary of the Meteorological Society of Scotland.

EDINBURGH.

BOOK-POST.

Paillat
Feb 1867

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Ballast, County of Meriden, in Lat. 57° 12' 1/4 Long 292° 1/4, Distance from Sea 43 miles.
Height of Cistern of the Barometer above Mean Sea-level 666 feet, above Ground 10 1/2 feet. During the MONTH of March

The Hours of Observation are of Greenwich Time.

BAROMETER, "corrected Mean" at 9 A.M., <i>minus</i> the Correction $\left\{ \begin{array}{l} + \\ + \end{array} \right\}$ for Temp. (Col. 2), = $\underline{29.215}$	
"Corrected Mean" of Barometer at 9 P.M., <i>minus</i> the Correction $\left\{ \begin{array}{l} + \\ + \end{array} \right\}$ for Temp. (Col. 4), = $\underline{29.202}$	
Mean at Station, corrected, and at 32°, = $\underline{29.209}$	
Correction for height, feet, above Mean Sea-level, = $\underline{724}$	
Mean, reduced to 32°, and Sea-level, = $\underline{29.933}$	
Highest Reading, corrected for Index error, on the 3 rd th, = $\underline{30.150}$	
Lowest Do., Do., on the 16 th th, = $\underline{28.779}$	
Difference, or Monthly Range, = $\underline{1879}$	

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 3 th,	=	54.3
Lowest in Month, corrected for Index errors, on the 17 th,	=	1.0
Difference, or Monthly Range,	=	53.3
"Corrected Mean " of all the Highest, (Col. 5),	=	39.1
"Corrected Mean " of all the Lowest, (Col. 6),	=	24.3
Difference, or Mean Daily Range,	=	14.8
** Calculated Mean Temperature of Month,	=	31.7

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb , (Cols. 9 and 11),	=	31.8
Mean (corrected) A.M. and P.M. Reading of Wet Bulb , (Cols. 10 and 12),	=	30.8
†† Computed Temperature of Dew-Point ,	=	28.6
†† Do. Elastic Force of Vapour ,	=	1.56
†† Do. Weight of Vapour in a Cubic Foot of Air ,	=	
†† Relative Humidity , (Saturation = 100),	=	86
RAIN fell on 23 Days ; Amount in Inches,	=	5.54

WIND.		SUMMARY.									
Direction	N	NE	E	SE	S	SW	W	NW	Calcs or Variable.	Mean Force.	Mean Velocity in miles per day
A.M.		8	5	1	2	2	4	1	8	1.45	
P.M.	2	5	10	1		3	4	2	4	1.56	
Mean.	1	7	7	1	1	2	4	2	6	1.50	

The instrument tested at the Office in Edinburgh bears the stamp "N.35.3," and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.

Any necessary corrections for local capillarity and Index Errors.

The Diurnal Range for Scotland is as yet unknown.

A practical example though not *absolutely a minus* correction.

The *Arithmetical Mean* of the *Thermometrical Deviations* 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 with a *minus* sign. See *note*.

Observations made and
Return verified by

James Walter Paterson
Ballater

(Signed)

J. W. Paterson

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS.

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-tubes* are not true inches but so much shorter as to *compensate* the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; their coincidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *under-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 *serve up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern uppermost. Before suspending the Barometer for use, the tube is ascertained whether this 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 repacked.

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 vernier, which must be index—usually the lower edge of the vernier; which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

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

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

The above remarks apply equally to the Thermometers for

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

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

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

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

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

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

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

By the use of abbreviations, the state of the weather at 9 a.m. and 9 p.m. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner or on the side-margin. Additional remarks may be made on the margin. **Observations** in connection with the periodic return of the seasons, possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds, and in the case of crops, to specified sorts reared from year to year on a 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 have agreed to recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) .
A. B.

EDINBURGH, 9th December 1865.

Clouds.—Convenient abbreviations for Luke Howard's nature of deduction or inference.

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 unexpected position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its legs are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

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

Clouds.—Convenient abbreviations for Luke Howard's nature of deduction or inference.

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 unexpected position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its legs are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

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

Clouds.—Convenient abbreviations for Luke Howard's nature of deduction or inference.

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 unexpected position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its legs are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

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

Clouds.—Convenient abbreviations for Luke Howard's nature of deduction or inference.

Boletín
March 1867

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK-POST.

To

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

12 18 1867

18 Long.

The Hours of Observation are of Greenwich Time.

491

WITH REMARKS ON THE USE OF INSTRUMENTS.

precipitating the greatest heat from the sun's rays, and the least from radiation during night. Their bulls 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 small shallow blackened boxes, whose sides protect the bulls from the wind. The "*Minimim*" should be freely exposed to the sun, and the "*Maximim*" 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; for the snow would prevent the sun's rays from striking the sun's heat to affect the Minimum Thermometer by radiation.

Verification of Thermometers.—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are *not* graduated on the stem, but merely on an attached scale, underground, they are very liable to be removed from their position on the scale, and very often afterwards to be used, *without being re-tested*. The self-registering, and especially the *Minimum* *re-thermeters*, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer (marked by a scratch on the tube) ought to be tested once a year, in snow or melting ice. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer (marked by a scratch on the tube) ought to be tested once a year, in snow or melting ice. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Secretary.

thus seriously violate the "Hygeometrical 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 side, and a little below the level of the web, —in no case under the bulbs;—the muslin must be of medium fineness, and distended at the neck of thub 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

The bulb must be delicate, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed. As from the moist cloth in ordinary circumstances.

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

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The readings ought to be taken to tenths of a degree, and noted in decimals. Thus the thermometer will be read -33.9° , 40.0° , or 40.1° ; or again, 40.1° , 40.2° , or 40.4° , according as it indicates a little over 40° , or a little over 40.1° , or a little over 40.2° , or an exact coincidence with, or a little over 40° , or 40.1° , or 40.2° , respectively. So also 40.3° and 40.4° , more or less must be read, respectively. So also 40.2° and 40.7° or 40.8° respectively. In

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 indicated registered

Wind.—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the

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

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

tionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the surface of the grass around its mouth. The rain-gauge ought to be placed daily, and the readings entered in the returns on the day on which the rain fell.

Snow falls may, for convenience, be registered in the rain column, under the following conditions:—When a Snow shower occurs it must be noted in the 4th 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 has accumulated, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as mentioned 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

BOOK-1

POST.

[illegible]

First Cut
or Missed.

[illegible]

THE PERIODICAL RETURN OF	
CROPS,	Sowing or
mentioning variety,	Planting or
Barley,	
Bere or Bigg,	
Oats,	
Wheat,	
Beans,	
Pease,	
Potatoes,	
Turnips,	
Rye Grass,	

[illegible]

FOREST TREES.	Alder, Ash, Beech, Birch, Elm, Laroh, Lime, Oak, Sycamore or Plane,
---------------	---

FOREST TREES.		In flower.	In leaf buds.	In leaf.	Divided of leaves.	CROPS.	Planting.	Sowing or above ground.	Appearing in ear.	First C or final
..	Barley,
..	Bere or Bigg,
..	Oats,
..	Wheat,
..	Beans,
..	Pease,
..	Potatoes,
..	Turnips,
..	Rye Grass,

[illegible]

FOREST TREES.		In Flower.	In Leaf first appear.	In Leaf.	Diseased or Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Apprenting or above Ground.	In Ear or Flower.	First Cut or Mashed.
Alder.	Barley.	...	...	...	...
Asb.	Bare or Bigg.	...	...	...	...
Beech.	Oats.	...	...	...	...
Birch.	Wheat.	...	...	...	...
Elm.	Beans.	...	...	...	...
Larch.	Tenae.	...	...	...	...
Linne.	Potatoes.	...	...	...	...
Oak.	Turnips.	...	...	...	...
Sycamore or Plane.	Rye Grass.	...	...	...	...

In Flower.	First Bud appears.	In Leaf.	Dressed of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Above Ground.	In Ear	First Cut.
Alder.				Barley.				
Aspen.				Oats or Biers.	4 th			
Beech.				Wheat.				
Birch.				Beans.				
Elm.				Lentils.				
Larch.				Potatoes.				
Oak.				Turnips.				
Sycamore or Plane.				Rye Grass.				

POST.

EDIN.

EDINBURGH.

BOOK-POST

OK

33.9

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Ballata, County of Albion, in Lat. 57° 21' N, Long. 99° 21' W, Distance from Sea 13 miles.
Height of Cistern of the Barometer above Mean Sea-level 666 feet, above Ground 103 feet. During the MONTH of May

The Hours of Observation are of Greenwich Time.

BAROMETER,	"Corrected Mean" at 9 A.M., minus the Correction ++	=	
	for Temp. (Col. 2), = .. <u>29.327</u> - .061..}	=	<u>29.266</u>
"Corrected Mean"	of Barometer at 9 P.M., minus the Correction ++	=	
	for Temp. (Col. 4), = .. <u>29.340</u> - .060..}	=	<u>29.280</u>
Mean at Station, corrected, and at 32°,.....		=	<u>29.270</u>
Correction for height,	feet, above Mean Sea-level,	=	<u>727</u>
Mean, reduced to 32°, and Sea-level,.....		=	<u>29.557</u>
Highest Reading, corrected for Index error, on the 22th,.....		=	<u>29.646</u>
Lowest " " , Do., on the 17th,.....		=	<u>29.872</u>
Difference, or Monthly Range,.....		=	<u>0.774</u>

S.-R. THERMOMETER, (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 6th, = 66.5

Lowest in Month, corrected for Index errors, on the 26th, = 79.0

Difference, or **Monthly Range,** = 37.5

" Corrected **Mean** " of all the **Highest,** (Col. 5), = 51.2

" Corrected **Mean** " of all the **Lowest,** (Col. 6), = 28.3

Difference, or **Mean Daily Range,** = 12.9

**** Calculated Mean Temperature** of Month, = 44.8

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),	=	45.2
Mean (corrected) A.M. and P.M. Reading of Wet Bulb , (Cols. 10 and 12),	=	42.6
‡ Computed Temperature of Dew-Point ,	=	39.6
‡ Do. Elastic Force of Vapour ,	=	.243
‡ Do. Weight of Vapour in a Cubic Foot of Air ,	=	
‡ Relative Humidity , (Saturation = 100),	=	81
RAIN fell on 18 Days; Amount in Inches,	=	2.45

WIND.	SUMMARY.											
	Direction	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	4	7		1	3	2			8	2.00	
P.M.	2	13	6		1	3				5	1.35	
Mean.	2	13	6	0	1	3	1	0		4	1.68	

Observations made and
Return verified by

(Signed)

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS.

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

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

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

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

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

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

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

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *calibrated* form of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-dep 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 20 minutes before the hour of observation. From the film of ice thus formed, evaporation will proceed as from the moist cloth in ordinary circumstances.

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

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, of 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° for 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 at 9 P.M. on the 2nd, and extending till 9 P.M. on the 3rd.

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

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

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

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

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

Clouds.—Convenient abbreviations for Luke Howard's

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

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

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

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

Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

Temperature of the Sea.—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council, therefore, recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, noting always the temperature of the air and the hour of observation; and confining 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 Solferino's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3°, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as 3° on the scale, that the wind is from the N.W., and that its force on the scale 0–6 is 4½°, i.e., that it is *blowing fresh*.

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

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

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

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

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

(By Order)

EDINBURGH, 9th December 1862.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	Flower.	In Leaf.	Leaf buds first appear.	In Leaf.	Dressed of	OPPOS.	Flowering or above ground.	Soiling or above ground.	In flower or blazed.	First Cut
Alder.						Barley.				
Beech.						Oats.				
Birch.						Wheat.				
Blm.						Beans.				
Larch.						Pease.				
Lime.						Potatoes.				
Oak.						Turnips.				
Sycamore or Plane.						Mye Grass.				

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	First ripe.	Depature.	First Arrival.	Depature.
Barberry.							
Boutree or Elder.							
Broom.							
Black Currant.							
Cherry.							
Bloom.							
Wazel.							
Hawthorn.							
Holly.							
Laburnum.							
Lilac.							
Mezereum.							
Mountain Ash or Rowan.							
Red-flowering Currant.							
Rhododendron Roseum.							
Whin.							

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

BOOK-POST.

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

Mr ALEXANDER BUCHANAN

To

Bellona
May 1867

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Ballate County of Highland, in Lat. 57° 12' N Long. 2° 42' W, Distance from Sea 43 miles.
Height of Cistern of the Barometer above Mean Sea-level 667 feet, above Ground 102 feet. During the MONTH of June 1867.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No. —				WIND.				RAIN.		CLOUDS.				SUNSHINE. Hours.	THERMOMETERS. under Ground.			SEA.	OZONE. 0—10.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Epidemic Diseases, &c. Mention the hour at which Storms began and ended.	Days of Month.			
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.			9 h. A.M.									
		Barometre * No.	Attach- ed Ther- mometer	Barometre. No.	Attach- ed Ther- mometer	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direc- tion.	Force.	Direc- tion.	Force.			No. of the H Cup Anemometer No. —	9 h. A.M.	Velocity, (0—6), and Direc- tion.	Amount, (0—10), and Species.		Velocity, (0—6), and Direc- tion.	Amount, (0—10), and Species.	No. 8 inches.					No. 13 inches.	No. 22 inches.	
		inches.	°	inches.	°	°	°	°	°	°	°	°	°	°																				
	1	29.300	61	29.350	64	67.5	47			55	53	54	57	2	2	Dr.	0.5			4.4	5.0	1.9	5.0									hot sun & fresh breeze	1	
	2	29.330	68	29.308	62.5	67.8	50			65.3	58.5	57	44.5		2	Dr.	0.5			12	2.0	1.0	0									sultry, thunder & rain in P.M.	2	
	3	29.290	64	29.240	64.5	59.5	40			56.3	52.5	57.2	50.4	8	1	0				12	2.0	7.0	2.0	10.0								heavy rain in P.M.	3	
	4	29.200	61	29.200	61	58.8	46			57.6	50.5	50	45	9	0.5	Dr.	0.5			12	2.9	10.0	2.0	10.0								very heavy rain	4	
	5	28.948	57	28.846	58.5	53	44.5			48.8	46	50.5	50	8	1	Dr.	2			22	3.5	10.0	1.9	10.0								heavy rain in P.M.	5	
	6	28.826	61	28.868	60	62.5	47			55.3	52.3	52	50	4	0					14	3.0	10.0	1.5	10.0								cloudy, see. do. heavy rain in P.M.	6	
	7	28.826	55	29.270	57	52	41			45	42	42	39	4	1.5	Dr.	1.5			22	3.0	10.0	2.0	10.0								dark & cold in P.M.	7	
	8	29.276	55.5	29.118	55	52	37.5			48	44	45.5	44.6	4	2	Dr.	1			26	2.0	10.0	3.0	10.0								wintry weather	8	
	9	29.286	61	29.288	59	62	40			55.5	50.5	53	50	9	2	Dr.	3			4	4	10.0	4.0	10.0								with strong wind in P.M.	9	
	10	29.378	63	29.628	60.5	63	50.5			60.8	57.5	52.5	49.5		4	Dr.	3			0		3.0	10.0									light & sun in P.M.	10	
	11	29.630	67.5	29.348	66.5	68	49			60.8	56.7	61	55		3	Dr.	2			0.4	3.0	10.0	2.0	10.0								cloudy, & rain in P.M.	11	
	12	29.630	67.5	29.348	66.5	68	49			60.8	56.7	61	55		3	Dr.	2			0.4	3.0	10.0	2.0	10.0								see. showers & strong breeze	12	
	13	29.300	64	29.322	63	64	49.5			60	50	50.5	45		2	Dr.	2			3	5.0	8.0	5.0									see. showers & strong breeze	13	
	14	29.246	66	29.178	61.5	63	40			53.6	49.4	47.5	44		2	Dr.	1.5			12	4.0	1.0	3.0	3.0								see. showers & strong breeze	14	
	15	29.190	62.5	29.324	57.4	59	44			50.8	45.5	48.8	44	2	Dr.	3				0.6	4.0	8.0	3.0	8.0								dark & very cold	15	
	16	29.400	56	29.428	56	49	42.5			44.3	41	48.8	46	2	Dr.	3				4	10.0	4.0	10.0									cloudy & see. sun in P.M.	16	
	17	29.520	57	29.508	57.5	60.5	46			49.6	46.6	49.5	46.5		13	Dr.	0.5			3	10.0	2.0	10.0									heavy rain at 10 P.M.	17	
	18	29.488	60	29.476	61.5	62	48			55	51.2	58.8	55	2	Dr.	0.5	0			20	2.0	10.0	1.0	10.0								do do	18	
	19	29.456	63	29.480	57.5	60	48.5			60	56.3	50	49		6	3			0.2	1.0	10.0	4.0	10.0									cloudy & very fine in P.M.	19	
	20	29.572	61	29.406	58.5	58	45.5			53.5	48.3	47	44.5	8	0.5	0				18	10.0	0.5	8.0									not in hills, sun breaks in P.M.	20	
	21	29.562	59.5	29.588	57.4	54.5	36			57.2	44.5	48	45.5	4	0.5	0.5	0.5			0.1	1.0	9.0	1.0	10.0								cloudy with see. in P.M.	21	
	22	29.576	58.5	29.580	55	54.3	45			52	47	47	46.5		0.5	0.5	0.5			0.4	0	10.0	1.0	10.0								do do	22	
	23	29.536	57	29.500	57.5	58.3	45			52	48.5	50.3	48	4	1.5	0				2.0	10.0	2.0	10.0									very quiet, a few drops in P.M.	23	
	24	29.444	63.5	29.446	60	64	45.5			63	55	54.4	52		2	Dr.	0.5			2	5.0	1.0	1.0	10.0								heavy rain in P.M.	24	
	25	29.488	62	29.530	62	64	46			53	57	52	57	4	0					17	2.0	1.0	1.0	10.0								cloudy & see.	25	
	26	29.688	63	29.833	60.5	66	47			58	54	54	57.5		2	Dr.	2			2.0	1.0	2.0	10.0									light & very warm in P.M.	26	
	27	29.930	69	29.918	66	75	46			67.5	59.5	58.5	55		4	1.5				2.0	1.0	2.0	10.0									fine & warm air	27	
	28	29.928	70	29.982	64	70.8	46			67.8	59	54	57	4	3	Dr.	2			2.0	1.0	2.0	10.0									after very warm	28	
	29	30.038	66	29.908	65	69.5	44.5			53.5	45	58	53	4	2	2				0.1	1.0	3.0	10.0									hot sun	29	
	30	29.712	68	29.508	66	72.8	54			63	58.2	58.5	52	9	8	Dr.	2			3.0	1.0	3.0	10.0									light sun in P.M.	30	
	31	29.301	67	29.328	61	60.8	47			57.6	52	48.3	46		3	Dr.	1			3.0	1.0	2.0	10.0											
Sums.		882.636	132	882.822	115	1742.1	134.5			1670.2	152.5	1540.3	1463.3		52.5	38			137															
Means.		29.421	62.2	29.427	60.0	61.5	45.0			55.7	50.8	51.3	48.6		1.75	1.27																		
† Total Corrections for Instrumental Errors.										+2	+2																							
† Corrections for Diurnal Range.																																		
"Corrected Means."										55.9	51.3																							
No. of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30			

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.	" squall.		
fr.	" frost.	sl.	" sleet.		
h-fr.	" hoar-frost.	sn.	" 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

NOTATION USED IN GENERAL REMARKS.

a.	denotes aurora.	m.	denotes mist.
cl.	" cirrus.	ms.	" mists.
ci-cu.	" cirro-cumulus.	n.	" nimbus.
ci-s.	" cirro-stratus.	r.	" rain.
cu.	" cumulus.	h. r.	" heavy rain.
cu-s.	" cumulo-stratus.	c. h. r.	" continued heavy rain.
d.	" dew.	s.	" sleet.
f.	" fog.	so.	" snow.
fr.	" frost.	so. h.	" solar halo.
h. fr.	" hoar-frost.	sq.	" squall.
h.	" haze.	sq. s.	" squalls.
h. d.	" heavy dew.	t.	" thunder.
hl.	" hail.	t. s.	" thunder storm.
l.	" lightning.	w.	" wind.
li. cl.	" light clouds.	g.	" gale of wind.
li. sh.	" light showers.		
lu. co.	" lunar corona.		
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), = 29.333
"Corrected Mean" of Barometer at 9 P.M., minus the Correction ++ for Temp. (Col. 4), = 29.344
Mean at Station, corrected, and at 32°, = 29.338
Correction for height, feet, above Mean Sea-level, = 73.5
Mean, reduced to 32°, and Sea-level, = 30.073
Highest Reading, corrected for Index error, on the 29 th, = 30.038
Lowest Do., Do., on the 6 th, = 28.816
Difference, or Monthly Range, = 1.222

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 7 th, = 75.0
Lowest in Month, corrected for Index errors, on the 20 th, = 36.0
Difference, or Monthly Range, = 39.0
"Corrected Mean" of all the Highest, (Col. 5), = 61.5
"Corrected Mean" of all the Lowest, (Col. 6), = 45.0
Difference, or Mean Daily Range, = 16.5
** Calculated Mean Temperature of Month, = 53.2

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected, for Index errors), on the 7 th, = 75.0
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 75.0
Lowest at Night, Black Bulb, (corrected for Index errors), on the 20 th, = 36.0
"Corrected Mean" (Col. 8), of Black Bulb Min. on grass, = 36.0
Difference of above Means or Range ("exposed"), = 39.0

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 53.6
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 49.9
†† Computed Temperature of Dew-Point, = 46.1
†† Do. Elastic Force of Vapour, = 3.11
†† Do. Weight of Vapour in a Cubic Foot of Air, = 76
†† Relative Humidity, (Saturation = 100), = 76
RAIN fell on 16 Days; Amount in Inches, = 1.37

WIND.	SUMMARY.									
	Direction	N	NE	E	SE	S	SW	W	NW	Calm or Variable.
A.M.		1	5	3	1	2	5	8	2	3
P.M.		4	7	1			5	6	1	6
Mean.		2	6	2	1	1	5	7	2	4

227

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

Observations made and Return verified by

James W. Paterson
Ballate

(Signed)

James W. Paterson

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

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

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

Beyond.—*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, *serve up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern inverted. 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 replaced.

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

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

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

The above remarks apply equally to the Thermometers for

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

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

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

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

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be held—39.9, 40.0, or 40.1; or again, 40.4, 40.5, or 40.6, according as it indicates a little under, an exact coincidence with, or a little over 40°; or 40.5, respectively. So also 40.5, and 40.7, or 40.8 respectively. In reading Rutherford's "*Max*," and "*Min*," Thermometers, the indication of that end of the tube which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

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

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

Clouds.—Convenient abbreviations for Luke Howard's

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 *seen* to judge of their amount, we ought not to take them into account in the "*Remarks*," though their appearance and changes ought to be noted among the "*Remarks*." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is half covered by clouds, 5 is entered as the *observation*, and so on. Illustrations of the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are made in the following manner:—In the column "Velocity" and Direction, 2 W. (for example) will indicate that the upper strata of clouds travel with extreme velocity from S.W. and those in the lower regions from W., with one-third the (extreme) speed of the former. Again, in the second "Clouds" column, an entry of 4, (e.g.) will indicate that the higher regions are covered to the "amount" of 4 tenths with stratus clouds; and that the sky is further obscured to the extent of 2 tenths by lower clouds of the cumulo-stratus kind.

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

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

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

Ozone.—Mention whether Schönbien's or Moffat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 a.m. and 9 p.m. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3.85, as an ozone entry on the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is 4.1; i.e., that it is blowing fresh.

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

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

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

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

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

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

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

(By Order) A. B.

EDINBURGH, 9th December, 1865.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.									
FOREST TREES.	In Flower.	In Leaf.	First appearance.	First in Blossom.	First in Blossom.	First in Blossom.	First in Blossom.	First in Blossom.	First in Blossom.
Alder.									
Aspen.									
Beech.									
Birch.									
Elm.									
Larch.									
Maple.									
Potatoes.									
Turnips.									
Rye Grass.									
MIGRATORY BIRDS.									
First Arrival.	First Departure.	First in Nest.	First in Nest.	First in Nest.	First in Nest.	First in Nest.	First in Nest.	First in Nest.	First in Nest.
Swallow.									
Robin.									
Blackbird.									
Chaffinch.									
Goldfinch.									
House Sparrow.									
Jackdaw.									
Magpie.									
Parrot.									
Starling.									
Swallow.									
Thrush.									
Wren.									
Woodcock.									
Yellowthroat.									

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, &c., whether plentiful, or in perfection; whether any have suffered from blight, disease, &c. Whether Hay, Potatoes, &c., are in perfection; whether any have suffered from blight, disease, &c. Whether Hay, Potatoes, &c., are in perfection; whether any have suffered from blight, disease, &c.

Mr ALEXANDER BUCHAN.

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK-POST.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Ballate, County of Shedden, in Lat. 57° 12' N Long 2° 42' W, Distance from Sea 4.3 miles.
Height of Cistern of the Barometer above Mean Sea-level 667 feet, above Ground 102 feet. During the MONTH of July 1869.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				THERMOMETERS. under Ground.			SEA.	OZONE.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. Mention the hour at which Storms began and ended.	Days of Month.		
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 A.M.		P.M.		9 h. A.M.										
		Barometre * No.	Attach- ed Ther- mometer	Barometre. No.	Attach- ed Ther- mometer	Max. No.	Min. No.	Max. in Sun's rays No.	Min. or Grass. No.	Dry bulb. No.	Wet bulb. No.	Dry bulb. No.	Wet bulb. No.	Direction. No.	Force No.	Direction. No.	Force No.	Velocity (0-10), and Direction. No.	Amount, (0-10), and Species. No.	Velocity, (0-10), and Direction. No.	Amount, (0-10), and Species. No.	No. 3 inches.	No. 12 inches.	No. 22 inches.								
		inches.	°	inches.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°						
	1	29.450	61	29.350	57	59	42			57.5	45.3	46	44	N.E.	1	N.E.	2			32	10.	Dist.	100					heavy uniform drizzle but?	1			
	2	29.324	55	29.218	58	52.5	43			48.5	46	48	45	E.	2	E.	2			01	23.	10.	24.	10.					Cloudy & cold and	2		
	3	29.328	60	29.250	57	62	44.5			53.5	57.8	52	50.8	S.E.	1	S.E.	3			09	24.	8.	35.	10.					heavy shower at 7 p.m. Bar. damp	3		
	4	29.136	62	29.132	63	69	50			55	52	52.5	48	N.E.	2	N.E.	2			07	3.	5.	34.	2.					cool with a cold shower	4		
	5	29.158	65	29.332	60	68.5	48			58.5	52.5	50	44.5	N.W.	4	N.W.	4			4	10.	5.	34.	10.					ice showers & strong breeze	5		
	6	29.438	63	29.590	56	53.3	46.5			55	44	47.8	44.5	N.	4	N.	2			4	10.	3.	24.	10.					do	6		
	7	29.660	60	29.700	57	59	34.5			57.5	45.8	45	42.5	N.E.	2	N.E.	1			3	10.	2.	24.	10.					light cold and	7		
	8	29.684	55.3	29.662	62.5	69.5	40			52	47.8	57	54	N.	1	N.	0.5			10	10.	10.	10.						fine but?	8		
	9	29.664	72	29.662	68	79.2	45	108	44.5	70.5	63	57.6	57.5	E.	0.5	E.	0			10.2	0.5	30.	10.						very dry hot	9		
	10	29.616	70	29.608	68.3	74	50			65.5	62.8	57.4	57	N.E.	0.5	N.E.	0			13	0.5	30.	10.						very fresh & S. heavy & drizzle	10		
	11	29.348	65	29.446	67.8	70.5	53			67.5	62	59.8	57	N.	0	N.	0			14	24.	30.	10.						light drizzle & drizzle	11		
	12	29.334	66.5	29.288	62	69	52.5			60.8	57	57	52.5	N.E.	2	N.E.	0.5			25	10.	12.	10.						fine but?	12		
	13	29.250	62	29.208	61	69.8	49			58.5	54	55	52	N.	1	N.	0.5			54	1.	10.	2.	10.						Cloudy & drizzle & drizzle	13	
	14	29.088	62.5	29.008	62	57.3	50			57.8	57	54.8	54.6	N.	1	N.	1.5			24	10.	30.	10.						very wet & drizzle & drizzle	14		
	15	29.108	71	28.988	61	68	57.5			61	55	54	53	N.	2	N.	2			11.2	24	30.	10.						fine but?	15		
	16	28.688	60.2	28.642	62	56	50			52.2	52	53.8	53	N.	0	N.	0			42	30.	10.	10.							Cloudy & drizzle	16	
	17	28.738	63	28.840	62	57.5	50.5			56.8	55	54	53.3	N.E.	1	N.E.	0			23	10.	10.	10.							Cloudy & drizzle - not drizzle	17	
	18	28.744	63.5	28.896	61	60	57			56	54	54.5	52.3	N.	2	N.	3			08	10.	4.	10.							heavy drizzle	18	
	19	29.024	60	29.152	55	58	46			49	46	47	44.5	N.	4	N.	1			02	4.	10.	2.	10.						very cold & drizzle & drizzle	19	
	20	29.150	58.5	29.056	55	59	43			49	45.5	48	46	N.E.	2	N.E.	2			3.	10.	10.	10.							light cold and ice & drizzle	20	
	21	28.540	58	28.880	55	54.5	38			57.8	48.2	46.5	46.5	N.	2	N.	1			21	10.	10.	10.							showers & drizzle	21	
	22	28.52	52	28.892	52	48.3	44			47.1	46.9	45	44.5	N.	3	N.	2			24	10.	30.	10.							drizzle & drizzle	22	
	23	28.58	52	29.034	57.5	48.3	43			48.5	45	46	44.8	N.	2	N.	2			07	10.	30.	10.							do & drizzle & drizzle	23	
	24	29.060	53	29.202	52	52.8	44			50.5	47.5	46	45.5	N.	2	N.	2			07	10.	10.	10.							Cloudy & drizzle & drizzle	24	
	25	29.250	53.5	29.344	52	57	44			48	46	46	45	N.E.	2	N.E.	2			07	10.	10.	10.							drizzle & drizzle	25	
	26	29.394	53	29.446	52	57	42.5			50	46	48	45.5	N.	3	N.	2			3	10.	30.	10.							do & drizzle	26	
	27	29.864	56	29.920	55.5	58	45.5			50.5	47	48.5	45	N.E.	3	N.E.	3			4	10.	10.	10.							do & drizzle	27	
	28	29.414	58.2	29.488	58	53.4	46			57.8	49	48.5	44.5	N.	3	N.	3			5	10.	10.	10.							do & drizzle	28	
	29	29.474	58	29.434	58	56	45			50.5	48	57.8	48	N.E.	1.5	N.E.	1.5			2	10.	2.	10.							Cloudy & drizzle & drizzle	29	
	30	29.596	60	29.598	58	57	48			54.5	57.5	45.5	45.8	N.	1	N.	1			02	10.	2.	10.							do & drizzle & drizzle	30	
	31	29.422	58.8	29.480	57	58	45			50.8	48	46	44	N.E.	2	N.E.	2			1	10.	1.	5.								do & drizzle & drizzle	31
	Sums.	90.682	(17)	90.717	125.4	103.9	142.5			107.83	106.4	106.4	106.8	56.3	16.5	58.9															NOTATION USED IN GENERAL REMARKS.	
	Means.	29.252	60.6	29.260	58.3	59.8	46.0			54.1	50.6	50.6	48.7	18.2	15.2																	
	+ Total Corrections																															
	+ Corrections for Diurnal Range.																															
	"Corrected Means."																															
	No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction $\frac{1}{2}$ for Temp. (Col. 2), = 29.169
"Corrected Mean" of Barometer at 9 P.M., minus the Correction $\frac{1}{2}$ for Temp. (Col. 4), = 29.182
Mean at Station, corrected, and at 32°, = 29.176
Correction for height, feet, above Mean Sea-level, = 71.3
Mean, reduced to 32°, and Sea-level, = 29.889
Highest Reading, corrected for Index error, on the 7 th, = 29.700
Lowest Do., Do., on the 7 th, = 28.642
Difference, or Monthly Range, = 1.058

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 9 th, = 79.2
Lowest in Month, corrected for Index errors, on the 7 th, = 34.5
Difference, or Monthly Range, = 44.7
"Corrected Mean" of all the Highest, (Col. 5), = 59.8
"Corrected Mean" of all the Lowest, (Col. 6), = 46.0
Difference, or Mean Daily Range, = 13.8
** Calculated Mean Temperature of Month, = 52.9

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected, for Index errors), on the 7 th, = 79.2
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 79.2
Lowest at Night, Black Bulb, (corrected for Index errors), on the 7 th, = 34.5
"Corrected Mean" (Col. 8), of Black Bulb Min. on grass, = 46.0
Difference of above Means or Range ("exposed"), = 13.8

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 52.3
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 49.6
† Computed Temperature of Dew-Point, = 46.9
† Do. Elastic Force of Vapour, = 322
† Do. Weight of Vapour in a Cubic Foot of Air, = 82
† Relative Humidity, (Saturation = 100), = 82
RAIN fell on 20 Days; Amount in Inches, = 4.89

WIND.	SUMMARY.									
	Direction	N	N.E.	E	S.E.	S	S.W.	W	N.W.	Calm or Variable.
A.M.		3	13	6	2	1	-	-	2	4
P.M.		4	11	8	1	-	-	1	1	5
Mean.		3	12	7	1	0	1	1	4	4.6

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

Observations made and Return verified by

James W. Paterson
Ballate

(Signed)

J. W. Paterson

166
109

WITH REMARKS ON THE USE OF INSTRUMENTS.

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,

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.

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 *serew* up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be examined with the

In taking an *Observation*, the detached *Tellurometer* is first introduced; the tube must then be gently tipped and the instrument carefully made. By rising and lowering the eye, it must be brought into the plane of the back and front of the lens—usually the lower edge of the venter, 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; as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate accurate adjustment and reading of the *Barometer*.

The *Self Registering Thermometer*—Professor Phillips, and Messrs. J. W. Greig and Zambesi Patent "*Macaroni*." Thermometers are commonly obtained in the form of a glass stem on which is marked, printed directions for their use may be obtained from each instrument. The "*Macaroni*" Thermometer of the Macaroni Company is recommended when graduated on the glass stem and affixed to a frame separate from the "*Macaroni*." This thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; when the column of spirit distils by high temperature, it will be found in the upper lobe, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments are to be hung horizontally.

The above remarks apply equally to the Thermometers for

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

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

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 series of phenomena registered on the *3rd* day, the observations are taken at 9 P.M. on the *2nd*, and extending till 9 P.M. on the *3rd*.

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

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

Snow-falls may, for convenience, be registered in the rain columns, under the following conditions:—When snow shows up, it must be noted in the "Remarks," and the last of the snow must be measured in some open place where it is fixed to the depth of water, received in gages. The depth of the snow must be measured in some open place where it is not blown or drifted, and the measurement must be taken as a check upon the indications of the rain-gauge. For wind, rain, and snow, register *observations* only; and nothing that partakes of the nature of *deductions* or inferences.

Clouds.—Convenient abbreviations for Luke Howard's

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," $S, W,$ (for example,) will indicate that the $S, W,$ 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 $\frac{1}{2}, \text{cr-st.},$ (*eq.*) will indicate that the higher $\frac{1}{2}, \text{cr-st.},$

Temperature of the Sea.—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council, therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, 25th of each month, the thermometer ought to be plunged, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, nothing allowing of 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.

Remarks.—The *α Perseus* column is too narrow, but undoubtedly 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 lists of such are recognised and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of mists, aureole boreales, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been limited at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the low-line in winter ought to be recorded.

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

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

(By Order) A. B.

EDINBURGH, 9th December 1865.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	Alder,	Beech,	Birch,	Elm,	Larch,	Pine,	Oak,	Sycamore or Plane,
In Flower.
In Leaf buds first appear.
In Leaf.
Dressed of Leaves.
CROPS.	Barley,	Oats,	Wheat,	Beans,	Fescue,	Potatoes,	Tumlops,	Rye Grass,
Growing variety.
Sowing or above ground.
Appearing in Ear.
In Flower.
First Cut.

[illegible]

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

6 Jul 1867

To

Mr ALEXANDER BUCHAN

Secretary of the Meteorological Society of Scotland

EDINBURGH.

BOOK-POST

887-11-104

EDINBURGH.

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Pallat, County of Abertoe, in Lat. 57° 21' N, Long. 2° 22' W, Distance from Sea 43 miles.Height of Cistern of the Barometer above Mean Sea-level 667 feet, above Ground 102 feet.During the MONTH of August 18 67.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No. _____				WIND.				RAIN.				CLOUDS.				SUNSHINE. Hours.	THERMOMETERS. under Ground.			TEMPERATURE of WELL at Depth of feet. No. _____	SEA. Temperature at 1 fathom and Density.	OZONE. 0-10.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. Mention the hour at which Storms began and ended.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulb.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 A.M.		P.M.		9 h. A.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
		Baromete No. _____	Attach- ed Ther- mometer	Baromete. No. _____	Attach- ed Ther- mometer	Max. No. _____	Min. No. _____	Max. in Sun's rays No. _____	Min. on Grass. No. _____	Dry bulb. No. _____	Wet bulb. No. _____	Dry bulb. No. _____	Wet bulb. No. _____	Direction. No. _____	Force No. _____	Direction. No. _____	Force No. _____	Velocity, (0-10), and Direction.	Amount, (0-10), and Species.	Velocity, (0-10), and Direction.	Amount, (0-10), and Species.	No. _____	No. _____	No. _____																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		inches.	°	inches.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°	°	°						°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction \pm for Temp. (Col. 2), = 29.147
"Corrected Mean" of Barometer at 9 P.M., minus the Correction \pm for Temp. (Col. 4), = 29.161
Mean at Station, corrected, and at 32°, = 29.154
Correction for height, feet, above Mean Sea-level, = 707
Mean, reduced to 32°, and Sea-level, = 29.861
Highest Reading, corrected for Index error, on the 7 th, = 29.500
Lowest Do., Do., on the 16 th, = 28.850
Difference, or Monthly Range, = 0.650

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 14 th, = 81.0
Lowest in Month, corrected for Index errors, on the 2 th, = 34.5
Difference, or Monthly Range, = 46.5
"Corrected Mean" of all the Highest, (Col. 5), = 64.8
"Corrected Mean" of all the Lowest, (Col. 6), = 47.2
Difference, or Mean Daily Range, = 17.6
** Calculated Mean Temperature of Month, = 56.0

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), = 56.9
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 53.2
Computed Temperature of Dew-Point, = 50.3
Do. Elastic Force of Vapour, = 36.6
Do. Weight of Vapour in a Cubic Foot of Air, =
Relative Humidity, (Saturation = 100), = 82
RAIN fell on 3 Days; Amount in Inches, = 2.85

WIND.		SUMMARY.									
Direction		N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.		4	2	-	1	13	9	-	2		1.78
P.M.		1	2	-	-	14	4	-	8		0.84
Mean.		1.3	2.0	-	1.3	7	5	-	1.3		1.31

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

Observations made and Return verified by

James N. Paterson
Pallat

(Signed)

James N. Paterson

136

499

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS.

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

An excellent Barometer is constructed by Mr. Adie of London, requiring no adjustment with the great convenience of reading 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 *sew up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a *sharp tap* is produced. If this is prevented by air, it may be removed to the cistern, and got rid of, by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired.

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

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

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside, and black within, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as 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, the doors are also made to open to the south. These Boxes may be had at the Society's Office.

Self-registering Thermometers.—Professor Phillips's, and Nevrett and Zambra's Patent "*Moriana*" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "*Minimam*" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "*Maximum*." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by an observer. When the *column* of spirit breaks, it may be re-united by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found in the upper lobe, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. 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, the greater or less absorption of the sky *on-head* (*i. e.*, within 24° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *clouds* column, though their appearance and changes ought to be noted among the "*Remarks*." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky *on-head* is *half covered* by clouds, 5 is entered as the *observation*, and so on.

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner;—In the column *Velocity* and *Direction*, "S. W." (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S. W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of $\frac{1}{4}$ st. (*eg.*) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

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

Temperature of the Sea.—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council, therefore, recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, noting always the temperature of the air, and the *behaviour* 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 indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner;—thus 33°, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N. W., and that its force on the scale 0—6 is "4"; *i. e.*, that it is *blowing fresh*.

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

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

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

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

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

(By Order) A. B.

Eninburgh, 6th December 1865.

Ballate
Aug 1867

To

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK-POST.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	ALDER.	ASH.	BEECH.	BIRCH.	ELM.	LARCH.	THORN.	OAK.	SYCAMORE OR PLANE.
In flower.									
Leaf buds first appear.									
In leaf.									
Dressed of									
CROPS.	Barley.	Bare or Bigg.	Oats.	Wheat.	Beans.	Potatoes.	Turnips.	Rye Grass.	
Planting.									
Sowing or above ground.									
Appearing									
In flower.									
First Cut									

SHRUBS, ETC.	BURBERRY.	BOUTREE OR ELDER.	BLACK CURRANT.	CHERRY.	GREEN.	GOOSEBERRY.	HOLLY.	HAWTHORN.	HAZEL.
First in blossom.									
First in blossom.									
First in blossom.									
First in blossom.									
First in blossom.									
First in blossom.									
First in blossom.									
First in blossom.									
First in blossom.									

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 Ballinacorney, County of Wexford, in Lat. 52° 19', Long. 10° 12', Distance from Sea 43 miles.Height of Cistern of the Barometer above Mean Sea-level 66 feet, above Ground 102 feet.During the MONTH of September 1867.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER. No. —				WIND.				RAIN.		CLOUDS.				THERMOMETERS. under Ground.				SEA.	OZONE.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc. Mention the hour at which Storms began and ended.	Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 A.M.		P.M.		9 h. A.M.		P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		Barometer. No.	Attach- ed Ther- mometer	Barometer. No.	Attach- ed Ther- mometer	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass. No.	Dry bulb. No.	Wet bulb. No.	Dry bulb. No.	Wet bulb. No.	Direction. No.	Force No.	Direction. No.	Force No.	Readings of the H. Cup Anemometer No.	No. of hours in which it fell.	Amount in inches.	Velocity, (0-10), and Direction. No.	Amount, (0-10), and Species. No.	Velocity, (0-10), and Direction. No.	Amount, (0-10), and Species. No.	No. 1. No.	No. 2. No.	No. 3. No.					Temperature of WELL at Depth of feet. No.	Temperature at 1 fathom. No.	Temperature at 2 fathoms. No.	0-10. No.	9 A.M. No.	9 P.M. No.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
		Inches.	°	Inches.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°					°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction ++
for Temp. (Col. 2), = 29.288602 - 0.033 = 29.255602
"Corrected Mean" of Barometer at 9 P.M., minus the Correction ++
for Temp. (Col. 4), = 29.298 - 0.04 = 29.258
Mean at Station, corrected, and at 32°, = 29.255602
Correction for height, feet, above Mean Sea-level, = 71.3
Mean, reduced to 32°, and Sea-level, = 29.255602
Highest Reading, corrected for Index error, on the 17th, = 29.888
Lowest "Do., "Do., on the 6th, = 28.896
Difference, or Monthly Range, = 0.992

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 4th, = 66.0
Lowest in Month, corrected for Index errors, on the 18th, = 30.5
Difference, or Monthly Range, = 35.5
"Corrected Mean" of all the Highest, (Col. 5), = 60.1
"Corrected Mean" of all the Lowest, (Col. 6), = 44.0
Difference, or Mean Daily Range, = 16.1
** Calculated Mean Temperature of Month, = 52.0

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS.

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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

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

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

An excellent Barometer is constructed by Mr 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 the aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the zero-point of the fixed scale; when passes freely through the lid and case of the cistern. When the index-line on this little piston-rod is brought, by the adjusting screw, to form one straight line with those on its ivory frame, the surface of the mercury is then at the exact height from which the scale is graduated. In taking an observation, this preliminary setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the vernier.

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

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

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

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

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

The above remarks apply equally to the Thermometers for

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

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

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

Reading of the Thermometer.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read 39° 9', 40° 0', or 40° 1'; or again, 40° 4', 40° 5', or 40° 6', according as it indicates a little under, an exact coincidence with, or a little over 40°; or 40½, respectively. So also 44½, and 44° 7' or 44° 8' respectively. In reading Rutherford's "Max." and "Min." Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

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

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

Clouds.—Convenient abbreviations for Luke Howard's above have been printed, and may be had along with them from the publishers. The Council have agreed to recommend that observers, before purchasing new instruments, should communicate with the Meteorological Secretary; and they consider it desirable that he should have full power to reject any instrument which, on being presented for comparison, does not afford him satisfaction.

(By Order) A. B.

EDINBURGH, 9th December 1852.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	Flower.	Leaf buds.	In leaf.	Decayed of leaves.	CROPS mentioning variety.	Sowing or planting.	Appearing or above ground.	In bud or flower.	First Cut
Alder,					Barley,				
Beech,					Oats,				
Birch,					Wheat,				
Elm,					Peas,				
Larch,					Potatoes,				
Oak,					Rye Grass,				
Sycamore or Plane,									

SHRUBS, ETC.	First in blossom.	First in fruit.	First in blossom.	First in fruit.	First in blossom.	First in fruit.	First in blossom.	First in fruit.	First in blossom.	First in fruit.
Berry,					Apple,					
Bourtree or Elder,					Black Currant,					
Broom,					Cherry,					
Hazel,					Gear,					
Hawthorn,					Gooseberry,					
Holly,					Peach,					
Laburnum,					Pear,					
Lilac,					Plum,					
Mezereum,					Strawberry,					
Rhododendron Ponticum,										
Red flowering Currant,										
Mountain Ash or Rowan,										
Swamp,										
Rail or Corn Crane,										
Swamp,										
Shrub,										
Sand-Martin,										
Plover,										
Lapwing,										
House-Swallow,										
Cuckoo,										
First in blossom.					First in blossom.					
First in fruit.					First in fruit.					
First in blossom.					First in blossom.					
First in fruit.					First in fruit.					

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 Hay, Potatoes, disease prevails among cattle; and the Agricultural condition of the district generally.

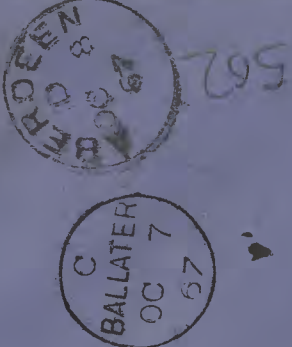
Mr. ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

BOOK-POST.

Bulletin
Sept 1861



SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Ballater, County of Aberdeen, in Lat. 57° 21', Long. 2° 21' W, Distance from Sea 43 miles.

Height of Cistern of the Barometer above Mean Sea-level 662 feet, above Ground 10½ feet.

During the MONTH of October 1869.

The Hours of Observation are of Greenwich Time.

[illegible]

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction †† } = 29.038
for Temp. (Col. 2), = 29.103.... - 0.65.... }

"Corrected Mean" of Barometer at 9 P.M., *minus* the Correction $\ddagger\ddagger$ } = 29.040
for Temp. (Col. 4), = 29.603..... - 0.63.... }

Mean at Station, corrected, and at 32°, = 29.039

Correction for height, feet, above Mean Sea-level, = 72

Mean, reduced to 32°, and Sea-level, = 29.76

Highest Reading, corrected for Index error, on the 4th,..... = 29.556

Lowest Do., Do., on the 27th,..... = 28.32

Difference, or **Monthly Range**,..... = 1.23

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

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 11th, = 68.6

Lowest in Month, corrected for Index errors, on the 6th, = 24.0

Difference, or **Monthly Range**, = 44.6

"Corrected Mean" of all the Highest, (Col. 5), = 52.3

"Corrected Mean" of all the Lowest, (Col. 6), = 36.9

Difference, or **Mean Daily Range**,..... = 75.4

1111

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, —————

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry

Bulb, (Cols. 9 and 11), = 44.4 ⁶

Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10, 11) 62.4

10 and 12	424
11	425

```

## Do Elastic Force of Vapour

```

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

Relative Humidity, (Saturation = 100), = 87

RAIN fell on 16 Days; Amount in Inches, = 2.83

WIND.	SUMMARY.											
Direction	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.	
A.M.	2		1	3			8	10	4	23	1.53	
P.M.			1	1			6	9	2	11	1.21	
Mean.	1	1	1	2	0	7	9	3	7	1.37		

* 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.
 § The "Hygrometrical Deductions" are extracted from Glashier'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)

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Dallater, County of Aberdeen, in Lat. 57° 12' N., Long. 2° 12' W., Distance from Sea 43 miles.Height of Cistern of the Barometer above Mean Sea-level 666 feet, above Ground 102 feet.During the MONTH of November 1897.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				SUNSHINE. Hours.	THERMOMETERS. under Ground.			SEA.	OZONE.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Deposition or Elevation of Barometer, Prevalent Diseases, etc. Mention the hour at which Storms began and ended.	Days of Month.				
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 h. A.M.		P.M.		9 h. A.M.													
		Barometer.	Atmospheric Thermometer.	Barometer.	Atmospheric Thermometer.	Max.	Min.	Max.	Min.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Readings of the H Cup Anemometer No.	No. of hours in which it fell.	Amount in inches.	Velocity, (0-10), and Direction.	Amount, (0-10), and Species.	Velocity, (0-10), and Direction.		Amount, (0-10), and Species.	No. 1.	No. 2.					No. 3.			
		* No.	°	No.	°	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.		No.	No.	No.					No.	No.	No.	No.
		inches.	°	inches.	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°		°	°	°					°	°	°	°
	1	28.972	50.5	29.156	49	45	36.5			41	38	40	38	41	2	41	2			35	35	10	10	40	10					1					
	2	29.664	49	29.664	48.5	44	35			39	36.5	49	46	41.1	0.5	41.1	1			30	10	10	10							2					
	3	29.500	49	29.368	52	49	37			49	46	49.5	46	"	2	"	2														3				
	4	29.500	52	29.686	49	51	36			46	43.5	37.3	35	"	2	41.1	1			0.5	30	10	10	10							4				
	5	29.708	48	29.700	46	41	31			36	33.5	33	32	0	59	0.5				20	2										5				
	6	29.750	46	29.722	47	50.5	27.5			36.5	33	33.3	33	6	0.5	4	0.5				10	0									6				
	7	29.620	49	29.572	53	51.8	32.5			45.2	43	37.8	49	4	1	"	2			5	10	3	10	10							7				
	8	29.680	51.5	29.844	54	52	43			46	42	48.5	44.5	8	2	59	0.5			10	10	10	10								8				
	9	29.904	54	29.904	54	54	42			48	45	44	41.5	SW	0.5	W	1			1	4	3	10	10								9			
	10	29.876	51.5	29.780	50	45	32			39.7	38.3	33.5	33.2	SW	0.5	0				10	10	10	10									10			
	11	29.680	50.5	29.568	47	43	29			38	37.3	32	32	0	5	10	0.5															11			
	12	29.490	44	29.322	42	41.5	23			26	25.7	29	29	SW	0.5	W	0.5			0												12			
	13	29.200	46	29.088	47.5	45	28			33	32.5	42	40.5	"	0.5	"	2			0.1	2	10	3	10	10							13			
	14	28.992	47	28.962	47	43	39			42	40	40.2	39.8	SW	0.5	0				1.5	2.5	10	2.5	10								14			
	15	29.100	48.8	29.346	48	46	39			45.8	44	41	39	SW	0.5	4	3			0.8	3	10	3	10	10								15		
	16	29.430	44	29.540	44	41	35			36	34.5	38	35	SW	0.5	"	0.5			0.3	4	10	2	10								16			
	17	29.630	44	29.606	45.5	41	30.5			36	34.8	38.5	37	SW	0.5	SW	0.5			2	"	10	0									17			
	18	29.618	47	29.608	49	49	36.5			44	41.5	44.5	41	"	1.5	"	1			3	10	0										18			
	19	29.644	48	29.692	44	46.5	36			44	40.4	37.3	33.8	SW	1	4	2			4	10	4	10	10								19			
	20	29.814	45	29.892	45	38	35			37	33.5	37.3	34.8	"	1.5	4	2			0.2	4	10	4	10	10							20			
	21	29.944	44	29.966	46.5	41	34			38	36	41	39	0	4	10	1.5			3	10	3	10	10								21			
	22	29.872	47	29.858	48	44	39			43	40	43.5	41	SW	1	W	0.5			2	10	3	10	10								22			
	23	29.886	48	29.872	48	44.5	35			41	40	37	36	0	0					3	10	3	10	10								23			
	24	29.824	46	29.740	47	43.5	30			39	31	33.5	33	SW	0.5	0				2	10	3	10	10								24			
	25	29.558	45.5	29.280	45.5	49	31			38	36.5	49.5	45.5	"	0.5	W	3			3	10	3	10	10								25			
	26	29.182	50	29.360	47	50	33			44	40.5	34	32.5	"	0.5	4	1			0.5	2	10	0									26			
	27	29.500	45	29.492	45	40	30			32.5	31.3	34	32	0	5	10	0.5			2	10	0										27			
	28	29.400	45	29.450	49	48.4	30.5			41.7	39.6	42.8	42	SW	2	0				2	10	2	10	10								28			
	29	29.472	50	29.344	50	49	40			43.5	44.5	43	40	0	W	3				1	10	3	10	10								29			
	30	29.064	49.5	28.582	49.5	44.5	42			43.8	42.3	43.5	42	SW	1	0				0.8	3	10	2	10	10							30			
	31																																31		
Sums.		886.444	153	885.944	130.0	137.12	102.8			1207.7	1146.6	1201.5	1143.1		265		34.5			82															
Means.		29.548	47.8	29.531	47.7	45.7	34.3			40.3	38.2	40.1	38.1		8.6		1.3																		
Total Corrections for Instru- mental Errors.																																			
Correc- tions for Diurnal Range.																																			
"Cor- rected Means."																																			
No. of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30				

NOTATION USED IN GENERAL REMARKS.

a.	aurora.	m.	meteor.
ci.	cirrus.	ms.	meteor.
ci. cu.	cirrocumulus.	r.	rain.
cu.	cumulus.	h. r.	heavy rain.
cu. s.	cumulo-stratus.	c. h. r.	continued heavy rain.
d.	drizzle.	s.	showers.
f.	fog.	sc.	scud.
fr.	frost.	sl.	sleet.
h. fr.	hoar-frost.	sn.	snow.
h.	haze.	so. h.	solar halo.
h. d.	heavy dew.	sq.	squall.
hl.	hail.	sg.	squalls.
l.	lightning.	t.	thunder.
li. cl.	light clouds.	t. s.	thunder storm.
li. sh.	light showers.	w.	wind.
li. co.	lunar corona.	g.	gale of wind.
li. h.	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.
0.5	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 \pm = 29.497
for Temp. (Col. 2), = 29.548... - 0.5...
Corrected Mean of Barometer at 9 P.M., minus the Correction \pm = 29.481
for Temp. (Col. 4), = 29.531... - 0.5...
Mean at Station, corrected, and at 32°, = 29.489
Correction for height, feet, above Mean Sea-level, = 734
Mean, reduced to 32°, and Sea-level, = 30.219
Highest Reading, corrected for Index error, on the 21st, = 29.966
Lowest Do., Do., on the 30th, = 28.562
Difference, or Monthly Range, = 1.404

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 9th, = 54.0
Lowest in Month, corrected for Index errors, on the 17th, = 23.0
Difference, or Monthly Range, = 31.0
Corrected Mean of all the Highest, (Col. 5), = 45.7
Corrected Mean of all the Lowest, (Col. 6), = 34.3
Difference, or Mean Daily Range, = 11.4
** Calculated Mean Temperature of Month, = 40.0

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected, for Index errors), on the 1st, = 54.0
Corrected Mean, (Col. 7), of Black Bulb, Max. in Sun, = 54.0
Lowest at Night, Black Bulb, (corrected for Index errors), on the 1st, = 23.0
Corrected Mean, (Col. 8), of Black Bulb Min. on grass, = 34.3
Difference of above Means or Range ("exposed"), = 20.7

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 40.24
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 38.2
Computed Temperature of Dew-Point, = 35.64
Do. Elastic Force of Vapour, = 2.089
Do. Weight of Vapour in a Cubic Foot of Air, = 85.3
Relative Humidity, (Saturation = 100), = 85.3
RAIN fell on 9 Days; Amount in Inches, = 0.82

WIND.		SUMMARY.									
Direction		N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.		2	1	2	2	1	1	2	9		1.13
P.M.		1	4	5	5	5	5	5	5		0.85
Mean.		2	2	1	1	8	4	4	2		1.00

* 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 "Hygrometric Disturbances" are calculated from Glisher's Hygrometric 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."
** Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the observer, in each Schedule. See over.

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

Observations made and
Returned verified by

Jas. W. Paterson
Dallater

(Signed)

J. W. Paterson

SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Pallatin, County of Aberdeen, in Lat. 57° 22' N., Long. 2° 12' W., Distance from Sea 43 miles.
Height of Cistern of the Barometer above Mean Sea-level 666 feet, above Ground 103 feet. During the MONTH of December 1867.
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS.				HYGROMETER.				WIND.				RAIN.				CLOUDS.				SUNSHINE.	THERMOMETERS.			SEA.	OZONE.	GENERAL REMARKS.		Days of Month.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Balls.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		Readings of the H. Cap Anemometer.		No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.			9 h. A.M.								Temperature of Well, at Depth of feet, No.	Temperature and Direction.	0-10.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
		Barometer.	Attach- ed Ther- mometer	Barometer.	Attach- ed Ther- mometer	Max. No.	Min. No.	Max. in Sun's rays.	Min. on Grass.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	No.	Amount in inches.			Velocity (0-10), and Direction.	Amount, (0-10), and Species.	Velocity (0-10), and Direction.	Amount, (0-10), and Species.		No. 3 inches.	No. 12 inches.	No. 22 inches.								0 A.M.	0 P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
																																							* No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
		inches.		inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						</

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction $\frac{1}{100}$ for Temp. (Col. 2), = 29.175
"Corrected Mean" of Barometer at 9 P.M., minus the Correction $\frac{1}{100}$ for Temp. (Col. 4), = 29.196
Mean at Station, corrected, and at 32°, = 29.186
Correction for height, feet, above Mean Sea-level, = 73.4
Mean, reduced to 32°, and Sea-level, = 29.920
Highest Reading, corrected for Index error, on the 30th, = 29.762
Lowest Do., Do., on the 1st, = 28.394
Difference, or Monthly Range, = 1.368

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 16th, = 53.8
Lowest in Month, corrected for Index errors, on the 3th, = 18.0
Difference, or Monthly Range, = 35.8
"Corrected Mean" of all the Highest, (Col. 5), = 42.7
"Corrected Mean" of all the Lowest, (Col. 6), = 30.4
Difference, or Mean Daily Range, = 12.3
** Calculated Mean Temperature of Month, = 36.6

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index errors), on the 1st, = 53.8
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 42.7
Lowest at Night, Black Bulb, (corrected for Index errors), on the 1st, = 18.0
"Corrected Mean" (Col. 8), of Black Bulb Min. on grass, = 30.4
Difference of above Means or Range ("exposed"), = 12.3

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 37.2
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 35.8
Computed Temperature of Dew-Point, = 33.97
Do. Elastic Force of Vapour, = 1.953
Do. Weight of Vapour in a Cubic Foot of Air, = 88.6
Relative Humidity, (Saturation = 100), = 88.6
RAIN fell on 16 Days; Amount in Inches, = 2.21

WIND.		SUMMARY.									
Direction.		N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.		2	3	-	-	0	1	8	1	16	
P.M.		1	3	-	-	7	13	2	5	134	
Mean.		2	3	0	0	7	10	2	6	1.25	

1.56

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

Observations made and
Return verified by

James W. Paterson
Pallatin

(Signed)

J. W. Paterson

