

## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at March Hall, County of Midlothian, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea \_\_\_\_\_ miles.

Height of Cistern of the Barometer above Mean Sea-level \_\_\_\_\_ feet, above Ground \_\_\_\_\_ feet.

During the MONTH of January 1866.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				SUNSHINE. Hours.	THERMOMETERS. under Ground.			SEA. Temperature at 1 fathom, and Density.	OZONE. 0-10.	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.		Readings of the H-Cup Anemometer.		No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.		9 h. A.M.												
		Barometer. "No.	Attached Thermometer	Barometer. No.	Attached Thermometer	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.			Direction.	Force.	9 h. A.M.	9 h. P.M.	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.	
																																		Temperatures of WELL at Depth of feet. No.
		inches.			inches.																													
	1	29.98	48	29.38	54	41	32			36	34	38	36	W	W																1			
	2	29.41	48	28.89	56	43	34			40	37	43	42	S	SE																2			
	3	29.33	54	29.35	59	48	38			42	39	47	44	W	W																3			
	4	29.19	55	29.39	54	52	36			48	45	48	47	S	SW																4			
	5	29.49	52	29.65	56	40	32			38	36	37	35	SW	W																5			
	6	29.68	56	29.52	55	41	33			36	35	35	34	W	SE																6			
	7	29.09	45	28.99	53	43	33			41	39	43	41	W	W																7			
	8	28.63	50	28.54	51	39	33			35	35	39	37	W	SW																8			
	9	28.47	50	28.58	54	40	33			35	34	37	36	W	W																9			
	10	28.93	51	29.04	49	39	25			33	33	29	29	W	SW																10			
	11	29.08	49	29.09	51	32	20					30	29	W	SW																	11		
	12	29.46	44	29.52	49	30	22					29	28	SW	W																	12		
28-97	13	29.87	45	29.88	53	47	24			37	36	46	44	SW	W																	13		
29-5	14	29.24	46	29.01	57	54	29			51	49	50	49	W	SW																	14		
	15	29.22	51	29.45	50	50	34			40	38	40	38	SW	W																	15		
	16	29.27	51	29.62	51	41	35			40	39	40	39	E	SW																	16		
	17	29.64	50	29.58	57	51	35			41	39	50	48	W	W																	17		
	18	29.52	55	29.14	59	52	45			48	45	50	47	W	W																	18		
	19	29.09	53	29.05	54	50	39			44	40	42	39	W	W																	19		
	20	29.01	53	29.49	54	45	32			44	42	34	34	W	S																	20		
	21	29.23	51	29.22	54	47	32			43	41	44	42	SW	S																	21		
	22	29.29	54	29.42	55	46	38			43	41	43	41	S	SW																	22		
	23	29.84	52	30.16	53	47	34			41	39	40	38	W	SW																	23		
	24	30.18	53	30.19	55	49	37			46	44	45	44	SW	W																	24		
25-14	25	30.16	55	30.19	59	50	41			47	45	49	47	W	W																	25		
	26	30.16	57	30.07	58	51	41			49	47	47	44	W	SW																	26		
	27	29.55	55	29.73	52	56	43			45	43	45	43	SW	W																	27		
	28	29.39	57	29.18	54	47	38			45	43	40	38	SW	SW																	28		
	29	29.19	46	29.45	54	44	31			33	33	38	36	W	SW																	29		
	30	29.76	49	29.56	55	39	29			32	32	35	35	SW	SE																	30		
	31	29.14	53	29.02	59	47	33			41	40	45	45	E	E																	31		
	Sums.	1275 12	1185 14	1281 12	1395 1051	1401				1195 1143	1278 1230																							
	Means.	29.367	57.1	29.378	54.1	45.2	33.9			47.2	39.4	41.2	39.7																					
	† Total Corrections for Instrumental Errors.	+0.42		+0.42		+1.0				-7	-4	-7	-4																					
	Corrections for Diurnal Range.																																	
	"Corrected Means."	29.393		29.420		34.9				40.5	39.0	40.5	39.3																					
	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	31		

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† = 29.334  
for Temp. (Col. 2), = 29.293..... - 0.059  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† = 29.353  
for Temp. (Col. 4), = 29.420..... - 0.067  
Mean at Station, corrected, and at 32°, = 29.344  
Correction for Height, feet, above Mean Sea-level, = 29.6  
Mean, reduced to 32°, and Sea-level, = 29.640  
Highest Reading, corrected for Index error, on the 24th, = 30.190  
Lowest Do., Do., on the 8th, = 28.470  
Difference, or Monthly Range, = 1.720

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 27th, = 56.0  
Lowest in Month, corrected for Index errors, on the 11th, = 21.0  
Difference, or Monthly Range, = 35.0  
"Corrected Mean" of all the Highest, (Col. 5), = 45.2  
"Corrected Mean" of all the Lowest, (Col. 6), = 34.9  
Difference, or Mean Daily Range, = 10.3  
\*\* Calculated Mean Temperature of Month, = 40.0

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, = 40.5  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 39.2  
†† Computed Temperature of Dew-point, = 37.6  
†† Do. Elastic Force of Vapour, = 22.5  
†† Do. Weight of Vapour in a Cubic Foot of Air, = 2.61  
†† Relative Humidity, (Saturation = 100), = 90  
RAIN fell on 21 Days; Amount in Inches, = 3.20

WIND.		SUMMARY.									
Direction.		N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.
A.M.		2	0	2	0	3	7	15	2	0	
P.M.		2	0	1	3	2	7	12	4	0	
Mean.		2	0	2	2	2	7	13	3	0	

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 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

Greatest daily range = 23.0 on the 13th



January 1866.

nonremediable 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  $20^\circ$  or  $30^\circ$  of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *clouds* column, though their appearances and changes ought to be noted among the *Remarks*. The amount of cloud is entered by 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.

as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be read in the following manner:—In the column "Velocity"  $\frac{V}{10}$ ,  $\frac{W}{10}$ ,  $\frac{U}{10}$ , (for example,) will indicate that the "upward" and "downward" velocities are  $\frac{V}{10}$ ,  $\frac{W}{10}$ , and  $\frac{U}{10}$  miles respectively. In the column "Direction" the upper strata of clouds travel with extreme velocity from S.W., and those in the lower regions from W., with one-third the (extreme) speed of the former. Again, in the second "Cloud" column, an entry of  $\frac{2}{3}$ ,  $\frac{1}{2}$ ,  $\frac{1}{3}$ ,  $\frac{1}{4}$ ,  $\frac{1}{5}$ ,  $\frac{1}{6}$ ,  $\frac{1}{7}$ ,  $\frac{1}{8}$ ,  $\frac{1}{9}$ ,  $\frac{1}{10}$ , 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 *cumulus*-*stratus* kind.

*Underground Thermometers.*—As the germination and health of seeds 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 boats 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 the observation; and continuing to observe for particular depths.

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.

*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.

with 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 climate, 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 barometre, thunderstorms, 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.

wise unoccupied, or in two ruled off for the purpose, from the 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 season, 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. For these hourly observations separate schedules will be furnished to observers.

(By Order.) A. B.

 $T_{\mathcal{G}}$ 

*Secretary of the Meteorological Society of Scotland.*

EDINBURGH.

Epizootic disease prevails among Cattle; and the Agricultural condition of the district generally.

[illegible]

FOREST TREES.	In flower.	Leaf buds first appear.	In leaf.	Discard of leaves.	CROPS mounting variety.	Sowing or planting.	Appearance or sowing ground.	In flower.	First Cut
Alder,					Barley,				
Asb,					Bere or Bizz,				
Beech,					Oats,				
Birch,					Wheat,				
Elm,					Beans,				
Larch,					Pease,				
Linn,					Potatoes,				
Oak,					Turnips,				
Sycamore or Plane,					Rye Grass,				



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at March Hall, County of Midlothian, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea \_\_\_\_\_ miles.Height of Cistern of the Barometer above Mean Sea-level \_\_\_\_\_ feet, above Ground \_\_\_\_\_ feet. During the MONTH of February 1866.  
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.		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.		Readings of the H-Cup Anemometer.		No. of hours in which it fell.	Amount in inches.	9 A.M.			P.M.		9 h. A.M.			0-10.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
		Barometer. No.	Attached Ther- mometer	Barometer. No.	Attached 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	9 h. A.M.	9 h. P.M.			No.	Velocity (0-6), and Direction.		Amount (0-10), and Species.	Velocity (0-6), and Direction.	Amount (0-10), and Species.			No.	No. 3 inches.			No. 12 inches.	No. 22 inches.	Temperature of WELL at Depth of feet. No.	Temperature at 1 fathom, and Density.	9 A.M.	9 P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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## NOTATION USED IN GENERAL REMARKS.

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

## 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), = 29.286 294  
“Corrected Mean” of Barometer at 9 P.M., minus the Correction ++ for Temp. (Col. 4), = 29.306  
Mean at Station, corrected, and at 32°, = 29.286 300  
Correction for Height, feet, above Mean Sea-level, = 29.6  
Mean, reduced to 32°, and Sea-level, = 29.596  
Highest Reading, corrected for Index error, on the 21 th, = 30.060  
Lowest Do., Do., on the 25 th, = 28.870  
Difference, or Monthly Range, = 1.190

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 5 th, = 51.2  
Lowest in Month, corrected for Index errors, on the 28 th, = 25.0  
Difference, or Monthly Range, = 26.7  
“Corrected Mean” of all the Highest, (Col. 5), = 41.9  
“Corrected Mean” of all the Lowest, (Col. 6), = 33.2  
Difference, or Mean Daily Range, = 8.7  
\*\* Calculated Mean Temperature of Month, = 37.6

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, = 37.0  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 36.0  
†† Computed Temperature of Dew-point, = 34.6  
†† Do. Elastic Force of Vapour, = 2.00  
†† Do. Weight of Vapour in a Cubic Foot of Air, = 2.30  
†† Relative Humidity, (Saturation = 100), = 91

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	1	5	3	8	1	13	3	0		
P.M.	2	2	2	2	0	6	9	0			
Mean.	2	2	3	2	0	4	9	6	0		

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 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gunned or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

greatest daily range = 14.7 on 6th







## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at March Hall, County of Midlothian, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea \_\_\_\_\_ miles.

Height of Cistern of the Barometer above Mean Sea-level \_\_\_\_\_ feet, above Ground \_\_\_\_\_ feet.

During the MONTH of March 1866.

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 Bulbs.		9 h. A.M.		9 h. P.M.		Readings of the H-Cup Anemometer.		No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.		9 h. A.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
		Barometer. * No.	Attached Thermometer.	Barometer. No.	Attached Thermometer.	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	9 h. A.M.	9 h. P.M.	Velocity, (0-6), and Direction.	Amount, (0-10), and Species.		Velocity, (0-6), and Direction.	Amount, (0-10), and Species.	No.						No.	No.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	
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BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† = 29.462  
for Temp. (Col. 2), = 29.519, minus the Correction†† = 29.462  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† = 29.461  
for Temp. (Col. 4), = 29.524, minus the Correction†† = 29.461  
Mean at Station, corrected, and at 32°, = 29.462  
Correction for Height, feet, above Mean Sea-level, = 29.6  
Mean, reduced to 32°, and Sea-level, = 29.758  
Highest Reading, corrected for Index error, on the 10th, = 30.190  
Lowest Do., Do., on the 4th, = 28.570  
Difference, or Monthly Range, = 1.620

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 29th, = 58.7  
Lowest in Month, corrected for Index errors, on the 5th, = 20.0  
Difference, or Monthly Range, = 38.7  
"Corrected Mean" of all the Highest, (Col. 5), = 43.0  
"Corrected Mean" of all the Lowest, (Col. 6), = 32.5  
Difference, or Mean Daily Range, = 10.5  
\*\* Calculated Mean Temperature of Month, = 37.7

S.-R. THERMOMETER, Black Bulb, in Sun, Highest, (corrected, for Index Errors), on the 11th, = 58.7  
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 58.7  
Lowest at Night, Black Bulb, (corrected for Index errors), on the 11th, = 20.0  
"Corrected Mean," (Col. 8), of Black Bulb Min. on grass, = 20.0  
Difference of above Means or Range ("exposed"), = 38.7

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = 37.6  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 36.6  
†† Computed Temperature of Dew-point, = 35.3  
†† Do. Elastic Force of Vapour, = 2.06  
†† Do. Weight of Vapour in a Cubic Foot of Air, = 2.42  
†† Relative Humidity, (Saturation = 100), = 92  
RAIN fell on 17 Days; Amount in Inches, = 2.40

WIND.	SUMMARY.									
	Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.
A.M.		2	6	9	3	1	3	5	2	0
P.M.		1	5	6	3	0	3	5	8	0
Mean.		2	5	8	3	0	3	5	5	0

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 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

Greatest daily range = 21.7 on the 24th



WITH REMARKS ON THE USE OF INSTRUMENTS.

The nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the clouds' column, though their appearance and changes ought to be noted among the *phenom's*. 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 *observations*, and so on. Observations of the clouds are made at 9 A.M. at sunrise,

column, an entry of  $2_{4, \text{arc}}^{25}$  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.

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

*Temperature of the Sea.*—A knowledge of the temperature of

therefore, recommend that the temperature of the sea be fully 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 13th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, nothing altering the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

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* at 4 miles per hour.

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

wise unoccupied, or in two ruled off for the purpose, from the headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner, or on the side of the page.

The Council recommend that *term-day* observations be taken on a selected piece of ground or farm.

(By Order,) A. B.

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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 zootic disease prevails among Cattle; and the Agricultural condition of the district generally.

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.

Whether,

Grain, Hay, Po  
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## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at March Hall, County of Midlothian, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea \_\_\_\_\_ miles.

Height of Cistern of the Barometer above Mean Sea-level \_\_\_\_\_ feet, above Ground \_\_\_\_\_ feet.

During the MONTH of April 1866.

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.			Temperature of WELL, at Depth of feet. No. _____	SEA.	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 Bulbs.		9 h. A.M.		9 h. P.M.		Readings of the H-Cup Anemometer.		No. of hours in which it fell.	Amount in inches. No. _____	9 A.M.		P.M.		9 h. A.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.	Wet bulb.	Dry bulb.	Wet bulb.	Direc- tion.	Force .....			Direc- tion.	Force .....	9 h. A.M.	9 h. P.M.	Velocity, (0-6), and Direc- tion.	Amount, (0-10), and Species.	Velocity, (0-6), and Direc- tion.	Amount, (0-10), and Species.	No. _____						No. _____	No. _____																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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BAROMETER, "corrected Mean" at 9 A.M., minus the Correction ++  
for Temp. (Col. 2), =  $29.734 - 0.70$  = 29.664  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction ++  
for Temp. (Col. 4), =  $29.770 - 0.70$  = 29.696  
Mean at Station, corrected, and at 32°, = 29.680  
Correction for Height, feet, above Mean Sea-level, = 29.6  
Mean, reduced to 32°, and Sea-level, = 29.976  
Highest Reading, corrected for Index error, on the 22 th, = 30.320  
Lowest Do., Do., on the 16 th, = 29.150  
Difference, or Monthly Range, = 1.170

\* 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.  
† Entering corrections for both capillarity and Index Errors.  
‡ The Diurnal Range for Scotland is as yet unknown.  
§ Practically, though not absolutely, a minus correction.  
|| These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition only.  
¶ While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."  
\*\* Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the Observer, in each Schedule. See Over.

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 22 th, = 59.7  
Lowest in Month, corrected for Index errors, on the 30 th, = 27.0  
Difference, or Monthly Range, = 32.7  
"Corrected Mean" of all the Highest, (Col. 5), = 48.9  
"Corrected Mean" of all the Lowest, (Col. 6), = 37.5  
Difference, or Mean Daily Range, = 11.4  
\*\* Calculated Mean Temperature of Month, = 43.7

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = 42.9  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 41.6  
†† Computed Temperature of Dew-point, = 40.0  
†† Do. Elastic Force of Vapour, = 2.48  
†† Do. Weight of Vapour in a Cubic Foot of Air, = 2.89  
†† Relative Humidity, (Saturation = 100), = 90  
RAIN fell on 14 Days; Amount in Inches, = 1.50

WIND.	SUMMARY.										Mean Force.	Mean Velocity in miles per day.
	Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.		
A.M.		0	2	13	6	3	3	3	0	0		
P.M.		1	1	14	4	2	1	7	0	0		
Mean.		1	2	13	5	2	2	5	0	0		

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 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

Greatest daily range = 23.0 on the 21<sup>st</sup>



INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS.

WITH REMARKS ON THE USE OF INSTRUMENTS.

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 the instruments, different hours of observation, or even from the use of differently constructed instruments. It is therefore urged, 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; not 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. Allie 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 action 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 secured 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 hand 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 drawbacks, both of which must be guarded against, and may be easily remedied by an observer. When the column of spirit breaks, it may be reunited 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. This instrument must be hung perfectly horizontal; the bulb and should incline slightly downwards, rather than the other.

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 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 alcohol by distillation.

**Verification of Thermometers.**—No instrument ought to be used for Meteorological purposes, that has not 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 property 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 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 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. From the film of ice so formed before the hour of observation, the film of ice must be removed by a scratch.

One form of "*Alcohol*" Hygrometer is enclosed, in a tin case, which 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—38°·3, 40°·0, or 40°·1; or again, 40°·4, 40°·5, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°; or 40°·3, respectively. So also 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "*Max*," and "*Min*," Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be carefully 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 deductions or inference.

Clouds. — Convenient abbreviations for Luke Howard's

noncondensate 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 30° or 50° 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 2, east; (*e.g.*) will indicate that the higher regions are covered to the "*amount*" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

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

**Temperature of the Sea.**—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council, therefore, recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by that of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, noting always the temperature of the air, and the gear 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.—Moffat's are preferred. 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 $\frac{3}{4}$ , as an ozone entry in the schedule, will indicate that the ozone paper is tinted as "*3*" on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "*4*," i.e., that it is *blowing fresh*.

**Electricity.**—Too much importance cannot be attached to electric condition of the atmosphere in connection with terrestrial magnetism, and as a meteorological phenomenon. A proper Electrometer is necessary to every complete meteorological observatory. **Remarks.**—The "*Remarks*" column is too narrow, but unavoidable 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 contrivances ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and at 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, 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. For these hourly observations separate schedules will be furnished to observers.

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

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, 4th December 1863.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds first appear.	In Leaf.	Divested of Leaves.	GROUPS of neighbouring variety.	Showering or above ground.	Planting or above ground.	First Cut.
Alder, .....					Baleys, .....			
Asp, .....					Bere or Biggs, .....			
Beech, .....					Wheat, .....			
Birch, .....					Beans, .....			
Elm, .....					Pease, .....			
Larch, .....					Potatoes, .....			
Lime, .....					Rye Grass, .....			
Sycamore or Plane, .....								

SHRUBS, ETC.	First in Blossom.	Barberry, .....	Boutree or Elder, .....	Black Currant, .....	Cherry, .....	Broom, .....	Hazel, .....	Hawthorn, .....	Holly, .....	Laburnum, .....	Lilac, .....	Mezereum, .....	Mountain Ash or Rowan, .....	Red Flowering Currant, .....	Rhododendron Ponticum, .....	Viburnum, .....
FRUITS.	First in Blossom.															
MIGRATORY BIRDS.	First in Blossom.															
First Arrival.	Departure.															
Cuckoo, .....																
Cartew, .....																
House-Swallow, .....																
Lapwing, .....																
Plover, .....																
Sand-Martin, .....																
Starling, .....																
Swan, .....																
Rail or Corn Crake, .....																
Other Birds, naming them, .....																
Strawberry, .....																
Plum, .....																
Pear, .....																
Gooseberry, .....																
Apple, .....																
Black Currant, .....																
Cherry, .....																
Broom, .....																
Hazel, .....																
Hawthorn, .....																
Mountain Ash or Rowan, .....																
Red Flowering Currant, .....																
Rhododendron Ponticum, .....																
Viburnum, .....																

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.

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

BOOK-POST.

Edinburgh  
April 1866



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Murch Hall, County of Edinburgh, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea \_\_\_\_\_ miles.

Height of Cistern of the Barometer above Mean Sea-level \_\_\_\_\_ feet, above Ground \_\_\_\_\_ feet.

During the MONTH of May 1866.

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.		Readings of the H-Cup Anemometer.		No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.		9 h. A.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.	Wet bulb.	Dry bulb.	Wet bulb.	Direc- tion.	Force			Direc- tion.	Force	Velocity, (0-6), and Direction.	Amount, (0-10), and Species.	Velocity, (0-6), and Direction.	Amount, (0-10), and Species.	No. _____ 3 inches.	No. _____ 12 inches.	No. _____ 22 inches.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
																															Temperature of Well at Depth of feet. No. _____			Temperature at 1 fathom, and Density.			0-10.  9 A.M. 9 P.M.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
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BAROMETER, "corrected Mean" at 9 A.M., minus the Correction++  
for Temp. (Col. 2), =  $29.822 - 0.75$  =  $29.747$  738  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction++  
for Temp. (Col. 4), =  $29.811 - 0.76$  =  $29.735$   
Mean at Station, corrected, and at 32°, =  $29.747$  736  
Correction for Height, feet, above Mean Sea-level, =  $2.96$   
Mean, reduced to 32°, and Sea-level, =  $30.027$  032  
Highest Reading, corrected for Index error, on the 27 th, =  $30.470$  30290  
Lowest Do., Do., on the 11 th, =  $29.080$   
Difference, or Monthly Range, =  $1.290$  1210

\* 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.  
† Only the corrections for both capillarity and Index Errors.  
‡ The Diurnal Range for Scotland is as yet unknown.  
§ Practically, though not absolutely, a minus correction.  
|| These "Hygrometrical Deductions" are calculated from Glaisher's Hygrometrical Tables, Second Edition only.  
¶ While the Diurnal Range is unknown, the Arithmetical Mean of Cols. 5 and 6 will be entered as the "Calculated Mean Temperature."  
Any Observations not taken under the conditions specified in the Directions on the other side, or noted at the Top of each column, must be marked as such by the Observer, in each Schedule. See over.

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 23 th, =  $76.7$   
Lowest in Month, corrected for Index errors, on the 1 th, =  $30.0$   
Difference, or Monthly Range, =  $46.7$   
"Corrected Mean" of all the Highest, (Col. 5), =  $56.6$   
"Corrected Mean" of all the Lowest, (Col. 6), =  $40.4$  39.4  
Difference, or Mean Daily Range, =  $16.2$  17.2  
\*\* Calculated Mean Temperature of Month, =  $48.5$  48.0

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, =  $47.6$   
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, =  $43.7$   
†† Computed Temperature of Dew-point, =  $39.9$   
†† Do. Elastic Force of Vapour, =  $2.242$   
†† Do. Weight of Vapour in a Cubic Foot of Air, =  $2.78$   
†† Relative Humidity, (Saturation = 100), =  $74$   
RAIN fell on 10 Days; Amount in Inches, =  $1.40$

WIND.	SUMMARY.											
	Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.		0	1	8	6	0	2	12	2	0		
P.M.		1	0	10	5	1	1	10	3	0		
Mean.		0	1	9	6	0	2	11	2	0		

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 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

Greatest daily range = 35.7 on the 23<sup>rd</sup>



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 therefore hoped, that those persons who render them quite incompatible, may arise from dissimilarity in the position or shelter of instrument, or from the use of differently constructed instruments. It is therefore hoped, that those persons who kindly furnish Reports to the Society will, by a scrupulous attention to the following Directions, secure for their Monthly Returns an accuracy and value commensurate with the labour and pains involved in making them; and, for the public benefit, 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. It is hoped that the utmost care will be taken, in the time of reading the instruments will be punctuality. Observers, in some few cases, may find this impossible; in such instances they are specially requested to mark opposite every reading at what time it was taken, if not at 9 o'clock.

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

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

An excellent Barometer is constructed by Mr. A. de London, the use of which is attended with the great convenience of requiring no adjustment of the cistern. Its *scale-tubes* are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of 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 to 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 *verrier*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *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 to 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 back 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, 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 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 wiped, or renewed, by the application of a mixture of lamp black and painters' ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "*Minimum*" should be freely exposed to the Sun, and the "*Maximum*" should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these Thermometers; nor the Sun's heat to affect the alcohol by distillation.

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers are specially requested to attend to the following conditions:—The bulbs must hang *down*, by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the *vacuum-cap* must be covered, and placed to the side, and a little below the level of the rest bulb;—in no case under the bulbs;—the *merlin* must be of medium fineness, and fastened at *diagonal* of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the *merlin* 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 cloud 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, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40°·3, respectively. So also 40°·5, and 40°·7 or 40°·8 respectively. In reading Rutherford's "*Min.*" and "*Max.*" Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

**How of Observing Temperature.**—The Hygrometer is read at 9 A.M. and 9 P.M. The self-registering Thermometers are read at 9 P.M. only, as indicating the greatest and least degrees of temperature in the 24 hours preceding. It is not a matter of indifference when the self-registering Thermometers are read, since, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications 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 unavoidable situation for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell.

**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

non-temperature 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 clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," 2, W., (for example,) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of 2, <sup>4</sup> <sub>SE</sub>, (i.e.,) will indicate that the 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 exist shadows, should be entered in the proper column.

**Uninterrupted Thermometers.**—As the germination and health of *orogard* 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 land, 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 other 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.—Moffat's are preferred. 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<sup>+</sup>, as an ozone entry in the schedule, will indicate that the ozone paper is tinted as 3<sup>+</sup> 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 undeniably so. Some of the most valuable observations that can be taken are those for which no rules can be given nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms as have been hinted at above, as well as such notes on storms as attain their maximum, and 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. Observations ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm.

The Council recommend that *term-day* observations be taken;—*viz.*, on the 21st days of March, June, September, and December. For these hourly observations separate schedules will be furnished to observers.

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 1853.

BOOK-POST.

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

EDINBURGH.

10, St Andrew Square,

FOREST TREES.	FRUIT.	MIGRATORY BIRDS.	First Departure.
In Leaf.	First in Blossom.	First in Blossom.	First Arrival.
Alder, .....	Apple, .....	Cuckoo, .....	
Aspen, .....	Black Currant, .....	Crow, .....	
Beech, .....	Cherry, .....	House-Swallow, .....	
Birch, .....	Gooseberry, .....	Lapwing, .....	
Elm, .....	Holly, .....	Plover, .....	
Larch, .....	Laburnum, .....	Sand-Plover, .....	
Oak, .....	Lilac, .....	Starling, .....	
Sycamore or Plane, .....	Mountain Ash or Rowan, .....	Swan, .....	
	Strawberry, .....	Tail or Corn Crake, .....	
		Other Birds, naming them—	

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 in perfection; or in perfection; and the Agricultural condition of the district generally.

March Hall, May 1858



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Marchhall, County of Edinburgh, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea \_\_\_\_\_ miles.

Height of Cistern of the Barometer above Mean Sea-level \_\_\_\_\_ feet, above Ground \_\_\_\_\_ feet.

During the MONTH of June 1866.

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.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
		Barometer. No.	Attached Thermometer	Barometer. No.	Attached Thermometer	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force	Direction.	Force	Readings of the H-Cup Anemometer. No.	No. of hours in which it fell.	Amount in inches.	Velocity, (0-6), and Direction.	Amount, (0-10), and Species.	Velocity, (0-6), and Direction.						Amount, (0-10), and Species.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
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NOTATION USED IN GENERAL REMARKS.			
a.	denotes aurora.	m.	denotes meteor.
cl.	" cirrus.	ms.	" meteors.
cl.-cu.	" cirro-cumulus.	n.	" nimbus.
ch.-s.	" cirro-stratus.	r.	" rain.
cu.	" cumulus.	h. r.	" heavy rain.
cu.-s.	" cumulo-stratus.	c. h. r.	" continued heavy rain.
d.	" dew.	s.	" stratus.
f.	" fog.	sc.	" scud.
fr.	" frost.	sl.	" sleet.
h.-fr.	" hoar-frost.	sn.	" snow.
h.	" haze.	so. ha.	" solar halo.
h. d.	" heavy dew.	sq.	" squall.
ll.	" hail.	sq.	" 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.					
Esti- mated Force, 0-6.	Common Designation.	Esti- mated Force, 0-6.	Common Designation.	Esti- mated 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), = 29.701 - 0.082 = 29.619  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction++  
for Temp. (Col. 4), = 29.714 - 0.085 = 29.629  
Mean at Station, corrected, and at 32°, = 29.619  
Correction for Height, \_\_\_\_\_ feet, above Mean Sea-level, \_\_\_\_\_ = 29.6  
Mean, reduced to 32°, and Sea-level, = 29.915  
Highest Reading, corrected for Index error, on the 24 th, = 30.030  
Lowest Do., \_\_\_\_\_ Do., \_\_\_\_\_ on the 16 th, = 29.140  
Difference, or Monthly Range, = 0.890

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for  
Index errors), on the 27 th, = 79.7  
Lowest in Month, corrected for Index errors, on the 19 th, = 37.0  
Difference, or Monthly Range, = 42.7  
"Corrected Mean" of all the Highest, (Col. 5), = 65.0  
"Corrected Mean" of all the Lowest, (Col. 6), = 49.9 - 48.9  
Difference, or Mean Daily Range, = 15.1 - 16.1  
\*\* Calculated Mean Temperature of Month, = 57.5 - 57.0

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, \_\_\_\_\_ = 55.5  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, \_\_\_\_\_ = 52.2  
Computed Temperature of Dew-point, \_\_\_\_\_ = 49.0  
Do. Elastic Force of Vapour, \_\_\_\_\_ = 3.50  
Do. Weight of Vapour in a Cubic Foot of Air, \_\_\_\_\_ = 3.91  
Relative Humidity, (Saturation = 100), \_\_\_\_\_ = 80  
RAIN fell on 14 Days; Amount in Inches, \_\_\_\_\_ = 0.80

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

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 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed) Donald Miller

Greatest daily range = 27.7° on the 19<sup>th</sup>







## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Marshall, County of Edinburgh, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea \_\_\_\_\_ miles.

Height of Cistern of the Barometer above Mean Sea-level \_\_\_\_\_ feet, above Ground \_\_\_\_\_ feet.

During the MONTH of July 1866.

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.		No. of hours in which it fell.	Amount in inches.	9 A.M.		P.M.		9 h. A.M.								
		Barometer. "No.	Attached Thermometer	Barometer. No.	Attached Thermometer	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force	Direction.	Force			Velocity (0-6), and Direction.	Amount, (0-10), and Species.	Velocity (0-6), and Direction.	Amount, (0-10), and Species.	No.	No.	No.						
		inches.	"	inches.	"																				inches.	inches.	inches.					
	1	29.21	59	29.14	58	63	47			55	55	50	48	W	1	W	1														1	
	2	29.07	55	29.04	55	61	45			50	48	49	46	W	1	W	1														2	
	3	29.24	56	28.91	54	61	44			55	49	51	51	W	2	SW	2														3	
	4	29.16	55	29.08	55	60	44			54	52	50	50	SW	0.5	SE	1.5														4	
	5	29.16	55	29.32	56	65	47			50	49	52	53	SE	0	SE	0.5														5	
	6	29.48	57	29.52	54	60	44			52	47	51	48	SE	2	SE	1.5														6	
	7	29.68	57	29.67	56	62	46			55	49	56	53	SW	1	SW	1.5														7	
	8	29.63	57	29.66	60	65	54			60	57	61	58	SW	1.5	W	1.5														8	
	9	29.66	60	29.81	60	66	55			62	58	59	54	W	2	W	1.5														9	
	10	29.84	60	29.98	61	66	51			62	57			W	2	W	1														10	
	11	30.07	63	30.08	65	70	57							W	1	W	0.5														11	
	12	30.01	68	29.86	67	83	57					70	66	W	1	W	0														12	
	13	29.88	65	29.78	66	78	60			64	61	63	58	SW	0.5	S	0.5														13	
	14	29.83	66	29.88	65	71	57			65	60	62	60	SE	2	W	1															14
	15	30.01	64	29.98	64	70	56			61	56	60	57	W	2	W	1.5															15
	16	30.01	63	30.01	63	63	56			59	56	58	55	E	1.5	SE	1															16
	17	29.91	60	29.84	61	71	50			58	55	58	56	E	0.5	E	0.5															17
	18	29.83	60	29.73	63	75	51			60	56	56	50	SE	0.5	E	1															18
	19	29.76	61	29.73	60	68	51			59	56	56	53	E	1.5	E	0.5															19
	20	29.83	61	29.84	60	75	45			59	54	55	52	SE	1	E	1.5															20
	21	29.88	60	29.95	56	70	48			58	48	52	51	E	1	SE	0.5															21
	22	29.91	60	29.82	58	73	50			60	56	55	51	E	1.5	SE	1															22
	23	29.86	59	29.99	57	69	50			60	57	55	51	SE	1.5	SE	1.5															23
	24	29.88	57	30.02	58	69	52			57	53	58	53	E	0.5	SE	1															24
	25	30.01	60	29.97	61	65	55			61	58	58	57	E	0	E	0.5															25
	26	29.86	59	29.80	56	59	51			55	54	52	51	E	1	SE	0.5															26
	27	29.68	56	29.58	58	55	50			53	51	52	52	E	1	SE	1.5															27
	28	29.59	55	29.47	59	55	50			51	50	51	50	SE	1	SE	1															28
	29	29.41	56	29.46	57	54	48			53	52	49	48	SE	0.5	W	1															29
	30	29.56	55	29.66	55	53	47			51	49	49	48	W	1.5	W	1															30
	31	29.71	55	29.72	60	64	46			51	48	53	48	SE	2	SE	1.5															31
	Sums.	714	513	193	513	11	12			510	316	512	311		355	310																
	Means.	29.685	59.2	29.690	59.3	65.8	50.5			56.9	53.5	53.4	52.7		1.15	1.00																
	† Total Corrections for Instrumental Errors.	+0.42		+0.42		-3	+10			-7	-4	-7	-4		06	06																
	† Corrections for Diurnal Range.																															
	"Corrected Means."	29.727		29.732		65.5	50.5			56.2	53.1	54.7	52.3																			
	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	31

BAROMETER, “corrected Mean” at 9 A.M., minus the Correction†† = 29.646  
for Temp. (Col. 2), = 29.727 - 0.081.....  
“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† = 29.651  
for Temp. (Col. 4), = 29.732 - 0.081.....  
Mean at Station, corrected, and at 32°, = 29.648  
Correction for Height, feet, above Mean Sea-level, = 29.6  
Mean, reduced to 32°, and Sea-level, = 29.944  
Highest Reading, corrected for Index error, on the 11 th, = 30.080  
Lowest Do., Do., on the 3 th, = 28.910  
Difference, or Monthly Range, = 1.170

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

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 2nd; 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.

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 12 th, = 82.7  
Lowest in Month, corrected for Index errors, on the 3 th, = 44.0  
Difference, or Monthly Range, = 38.7  
“Corrected Mean” of all the Highest, (Col. 5), = 65.5  
“Corrected Mean” of all the Lowest, (Col. 6), = 50.5  
Difference, or Mean Daily Range, = 15.0  
\*\* Calculated Mean Temperature of Month, = 58.0

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, = 55.4  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 52.7  
†† Computed Temperature of Dew-point, = 50.1  
†† Do. Elastic Force of Vapour, = 36.4  
†† Do. Weight of Vapour in a Cubic Foot of Air, = 40.7  
†† Relative Humidity, (Saturation = 100), = 83  
RAIN fell on 14 Days; Amount in Inches, = 2.90

WIND.	SUMMARY.									
	Direction.	N	NE	E	SE	S	SW	W	NW	Mean Velocity in miles per day.
A.M.		1	6	9	3	0	4	8	0	1.15
P.M.		1	6	6	5	1	2	10	0	1.00
Mean.		1	6	8	4	0	3	9	0	1.08 = 1.17

(Signed) Donald Miller

Greatest daily range = 29.7 on the 20<sup>th</sup>



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

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

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

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

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

An excellent Barometer is constructed by Mr. A. de la Roche, the use of which is attended with the great convenience of requiring no adjustment of the cistern. Its *scale-inches* are not true inches, but so much shorter as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the zero-point of the fixed scale; when 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 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 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 lids 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 drawbacks, both of which must be guarded against, and may be easily remedied by an observer. When the *column* of spirit breaks, it may be re-joined by striking the instrument repeatedly against the palm of the hand; when 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 alcohol by distillation.

**Verification of Thermometers.**—No instrument ought to be used for Meteorological purposes, that has not 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 after-wards 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 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 sent 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 fast in 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, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40½°, respectively. So also 40½°, and 40¾°, more or less, must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "*Max*," and "*Min*," Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," *e.g.*, W. (for example,) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of 2, *cast*, (*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.

**Shade.**—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 waters. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes have elapsed, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, nothing always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

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

**Ozone.**—Mention whether Schönbien's or Moffat's papers are used—Moffat's are preferred. 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<sup>50</sup>, as an *ozone* entry in the schedule, will indicate that the ozone paper is fitted 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 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 side 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. For these hourly observations separate schedules will be furnished to observers.

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.

Emerson, 9th December 1866.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In flower.	Leaf buds.	In leaf.	Decayed of leaves.	CROPS.	Soiling or mellowing variety.	Barley.	Bare or bigg.	Wheat.	Beans.	Peas.	Potatoes.	Turnips.	Rye Grass.
Alder.														
Ash.														
Beech.														
Birch.														
Elm.														
Larch.														
Lime.														
Oak.														
Sycamore or Plane.														

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry.							
Bourtree or Elder.							
Black Currant.							
Cherry.							
Cean.							
Gooseberry.							
Holly.							
Hawthorn.							
Hazel.							
Laburnum.							
Lilac.							
Mezereon.							
Mountain Ash or Rowan.							
Red Flowering Currant.							
Rhododendron Ponticum.							
Whin.							

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

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EDINBURGH.

10, St Andrew Square,

Secretary of the Meteorological Society of Scotland,

Mr ALEXANDER BUCHAN,

Edinburgh 2  
July 1866.



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at March Hall, County of Edinburgh, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea \_\_\_\_\_ miles.Height of Cistern of the Barometer above Mean Sea-level 250 feet, above Ground \_\_\_\_\_ feet.During the MONTH of August 1866.

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. 9 A.M. 9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc.  Mention the hour at which Storms began and ended.	Days of Month.																													
		9 h. A.M.		9 h. P.M.		Protected, Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		Readings of the H-Cup Anemometer. No. —		No. of hours in which it fell.	Amount in inches.	9 A.M. Velocity, (0—6), and Direction.	P.M. Velocity, (0—6), and Direction.	Amount, (0—10), and Species.	Amount, (0—10), and Species.	9 h. A.M.																																							
		Barometer. * No. —	Attached Thermometer	Barometer. No. —	Attached Thermometer	Max. No.	Min. No.	Max. in Sun's rays No. —	Min. on Grass. No. —	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force							Direction.	Force		9 h. A.M.	9 h. P.M.	No. —						Amount, (0—6), and Species.	No. —	Amount, (0—6), and Species.	No. —	No. —	No. —																							
																																							Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
1	29.72	56	29.42	61	65	46			54	57	56	52	E	0.5	E	0.5																1																													
2	29.31	60	29.45	60	59	51			58	56	55	52	E	1	SE	1.5																2																													
3	29.32	60	29.22	60	62	52			58	54	52	50	SW	1.5	W	4																3																													
4	29.01	61	29.25	60	62	50			55	52	55	50	W	4	W	3		2.1														4																													
5	29.32	62	29.47	57	62	46			55	47	50	46	W	3	W	2																5																													
6	29.26	56	29.02	60	60	48			54	50	59	56	W	1.5	SW	0.5																6																													
7	28.83	57	29.23	59	62	48			56	53	54	50	SW	0.5	W	1.5																7																													
8	29.19	57	29.06	56	58	47			55	50	51	50	W	1.5	SW	0.5																8																													
9	29.18	55	29.31	57	64	48			50	49	53	49	W	1	W	1.5																9																													
10	29.36	58	29.68	57	61	45			54	49	52	49	W	1.5	W	1.5																10																													
11	29.81	55	29.70	59	62	48			57	47	55	51	SW	0.5	W	1		0.6														11																													
12	29.54	58	29.51	58	62	50			56	53	55	53	SE	1.5	E	0.5																12																													
13	29.74	57	29.54	59	60	50			57	55	55	53	SE	0.5	S	1.5																13																													
14	29.48	59	29.62	60	68	54			57	55	56	53	SW	1.5	W	1.5																14																													
15	29.68	59	29.58	60	61	49			55	49	52	48	W	1.5	SW	1.5																15																													
16	29.35	54	29.24	59	62	45			47	44	48	46	W	1.5	W	1.5																16																													
17	29.44	58	29.64	60	62	40			55	50	50	48	W	1.5	SW	1.5																17																													
18	29.66	56	29.53	60	58	44			50	46	55	57	W	1	SW	1		0.7														18																													
19	29.54	61	29.62	63	61	53			60	57	59	57	S	1.5	SE	0.5																19																													
20	29.64	60	29.72	61	65	54			57	55	57	55	E	0.5	E	0.5																20																													
21	29.81	60	29.82	60	65	54			56	55	55	53	E	1.5	SE	0.5																21																													
22	29.84	57	29.89	60	63	50			54	52	53	51	E	1	SE	1.5																22																													
23	29.89	59	29.87	61	65	47			56	54	57	55	E	0.5	E	0																23																													
24	29.79	61	29.81	61	65	54			59	57	57	55	E	0	NE	0																24																													
25	29.77	60	29.71	63	65	51			59	57	61	59	SE	0	NE	0		0.3														25																													
26	29.68	68	29.60	67	72	58			64	58	59	56	S	1.5	S	1																26																													
27	29.38	61	29.44	64	66	53			57	54	54	50	SW	1.5	W	0.5																27																													
28	29.45	60	29.40	60	64	47			55	52	56	54	SW	0.5	SE	1																28																													
29	29.38	59	29.41	60	56	51			54	53	54	57	SE	1.5	SE	1																29																													
30	29.42	59	29.46	60	66	46			54	50	55	51	N	1	W	1																30																													
31	29.51	59	29.45	59	62	44			54	51	55	51	W	0.5	W	1.5		0.4														31																													
Sums.	16 15 5 15 15.37	272	16 10 15.38	10 6 11 4 13 1 77 283					5 15 5 13 5 14 5 11 166 65 147 57					3 9 0 390																			20 4.10 252																												
Means.	29.496	58.8	29.496	60.0	62.5	49.1			55.4	52.1	54.8	51.8		1.26		1.11																	cloud 8.1																												
+ Total Corrections for Instru- mental Errors.	+0.42		+0.42		-3	+1.0			-7	-4	-7	-4		1.8		5.6																																													
+ Corrections for Diurnal Range.																																																													
"Cor- rected Means."	29.538		29.538		62.2	50.1			54.7	51.7	54.1	51.4																																																	
No. of Column.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31																														

BAROMETER, “corrected Mean” at 9 A.M., minus the Correction†† = 29.458  
for Temp. (Col. 2), = 29.538 - 0.080 }  
“Corrected Mean” of Barometer at 9 P.M., minus the Correction†† = 29.455  
for Temp. (Col. 4), = 29.538 - 0.083 }  
Mean at Station, corrected, and at 32°, = 29.456  
Correction for Height, feet, above Mean Sea-level, = 29.6  
Mean, reduced to 32°, and Sea-level, = 29.752  
Highest Reading, corrected for Index error, on the 20 th, = 29.890  
Lowest Do., Do., on the 4 th, = 29.040  
Difference, or Monthly Range, = 0.850

\* Each instrument tested at the Office in Edinburgh bears the stamp “S.M.S.” and a number to be entered in the Heading; or the Number and Initials of the Maker may be here given.  
† Embracing corrections for both capillarity and Index Errors.  
†† The Diurnal Range for Scotland is as yet unknown.  
‡ Practically, though not absolutely, a minus correction.  
‡‡ These “Hygrometrical Deductions” are calculated from 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.

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 26 th, = 71.7  
Lowest in Month, corrected for Index errors, on the 17 th, = 41.0  
Difference, or Monthly Range, = 30.7  
“Corrected Mean” of all the Highest, (Col. 5), = 62.2  
“Corrected Mean” of all the Lowest, (Col. 6), = 50.1  
Difference, or Mean Daily Range, = 12.1  
\*\* Calculated Mean Temperature of Month, = 56.2

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = 54.4  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 51.6  
†† Computed Temperature of Dew-point, = 48.9  
†† Do. Elastic Force of Vapour, = 3.45  
†† Do. Weight of Vapour in a Cubic Foot of Air, = 3.94  
†† Relative Humidity, (Saturation = 100), = 81  
RAIN fell on 20 Days; Amount in Inches, = 4.10

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	0	7	4	2	5	11	1		1.26	
P.M.	0	4	4	4	2	5	11	1		1.11	
Mean.	0	2	6	4	2	5	11	1	0	1.18	= 1.39

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 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed) Donald Miller

Greatest daily range = 20.7° on the 17<sup>th</sup>



INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS.

WITH REMARKS ON THE USE OF INSTRUMENTS.

USE 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 from 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 in accuracy and value commensurate with the labour expended by the Society, an entire comparative uniformity in 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 *Anemometers*, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with the 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. Ains 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; 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 *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 (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, 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 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 reunited 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 merely, by the application of a mixture of lamp-black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind. The "Maximum" should rest on wooden supports a few inches from the surface of the grass, in an open situation. Show must not be allowed to cover either of these Thermometers; nor the Sun's heat to affect the alcohol by distillation.

**Registration of Thermometers.**—No instrument ought to be used for Meteorological purposes, that has not 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 deranged from their position on the Scale, and ought never afterwards to be used, without being *re-tested*. The self-registering, and especially the "Minimum" Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer (marked by a scratch on the tube) ought to be tested once a year, in snow or melting ice. For comparison of Thermometers, a properly tested Thermometer may be had, on loan, by any observer, from the Meteorological Society.

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and well-tested form of this apparatus are specially vitiated 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 supported;—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 by 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 below the boat 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, or 40°·6, according as it indicates a little under, an exact coincidence with, or a little over 40°, or 40°·3, respectively. So also 40°·3, and 40°·8, more or less, must be registered. 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Rutherford's "Max." and "Min." Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

(By Order.) A. B.

Edinburgh, 9th December 1866.

nonendure of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e. within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the clouds column, though their appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered 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," 6, S.W. (for example,) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (average) speed of the former. Again, in the second "Cloud" column, an entry of 2, east, (e.g.) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

**Sunshine.**—The number of hours in which objects in the sun's rays cast shadows, should be entered in the proper column of *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 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 Schönbem's or Moffat's papers are used—Moffat's are preferred. 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—5 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 barometers ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich and at Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character of colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the 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 seasons, possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena, that the published Summaries may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm.

The Council recommend that *year-day* observations be taken;—viz., on the 21st days of March, June, September, and December. For these hourly observations separate schedules will be furnished to observers.

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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 1866.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	Alder,	Ash,	Beech,	Birch,	Elm,	Larch,	Limbe,	Oak,	Sycamore or Plane,
In flower.									
Last buds in flower.									
First appearance of leaves.									
Decayed of leaves.									
CROPS of mentioning variety.									
Swelling or falling of grain.									
Harvesting or above ground.									
In ear or raised.									
First cut.									

SHRUBS, ETC.	First in blossom.	FRUIT.	First in blossom.	First in blossom.	First in blossom.	First in blossom.	First in blossom.	First in blossom.	First in blossom.
Barberry,		Apple,		Black Currant,		Cherry,		Broom,	
Hazel,		Gean,		Gooseberry,		Hawthorn,		Holly,	
Laburnum,		Pear,		Plum,		Strawberry,		Mountain Ash or Rowan,	
Red Flowering Currant,		Mezerion,		Other Birds, naming them—		Rail or Corn Crake,		Swan,	
Rhododendron Ponticum,		Whin,							

Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Kraits, etc., in perfection; 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.

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.

BOOK-POST.

Edinburgh  
August 1866.

To



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *March Hall*, County of *Edinburgh*, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea \_\_\_\_\_ miles.

Height of Cistern of the Barometer above Mean Sea-level \_\_\_\_\_ feet, above Ground \_\_\_\_\_ feet.

During the MONTH of *September* 186*6*.

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 of Surface 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 Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		9 A.M.		P.M.		9 h. A.M.											
		Barometer.	Attached Ther- mometer	Barometer.	Attach- ed Ther- mometer	Max.	Min.	Max.	Min.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Velocity (0-6), and Direction.	Amount (0-10), and Species.	Velocity (0-6), and Direction.	Amount (0-10), and Species.	No.	3 inches.		No.	12 inches.	No.						22 inches.
		* No.		No.		No.		No.		No.		No.		No.		No.		No.		No.		No.			No.		No.						
		inches.		inches.																													
	1	29.24	60	29.34	57	63	50			55	57	57	49	SW	1.5	W	0.5															1	
	2	29.13	60	29.17	58	58	47			53	48	50	47	S	1	W	1.5														2		
	3	29.22	58	29.28	58	65	25			57	47	47	46	W	1.5	SW	1														3		
	4	29.25	58	29.14	58	62	44			53	49	53	51	W	0.5	NE	1														4		
	5	28.99	59	28.95	58	60	51			56	53	53	51	NE	0.5	NE	0.5														5		
	6	29.24	57	29.20	60	66	43			52	48	53	51	W	1.5	SW	1														6		
	7	29.25	57	29.50	60	62	50			57	48	53	50	N	1.5	NE	0														7		
	8	29.51	56	29.51	59	61	51			52	51	50	50	E	0.5	E	0														8		
	9	29.52	57	29.30	60	63	44			52	51	55	53	SE	1.5	SE	1.5														9		
	10	29.42	61	29.08	61	68	52			58	55	54	52	SE	1.5	S	0.5														10		
	11	29.42	60	29.40	60	62	49			56	53	55	51	S	1.5	W	1.5														11		
	12	29.65	55	29.51	59	57	43			49	45	49	47	W	1	S	1.5														12		
	13	29.37	57	29.31	60	60	48			51	50	50	49	S	0.5	SW	0.5														13		
	14	28.95	57	29.07	59	60	49			54	50	57	47	SW	1.5	W	3														14		
	15	29.24	59	29.14	55	59	46			53	49	48	45	W	3	S	1.5														15		
	16	29.08	56	29.18	59	59	43			49	47	48	45	S	0.5	SW	0.5														16		
	17	29.37	59	29.59	48	59	44			50	45	49	46	W	1.5	W	1.5														17		
	18	29.67	55	29.35	60	58	42			50	47	57	53	S	2	S	3														18		
	19	29.30	58	29.22	58	60	40			52	49	57	49	SW	2	SW	3														19		
	20	29.48	55	29.06	59	59	48			53	49	49	47	SW	3	S	2														20		
	21	29.05	55	28.95	56	56	41			49	45	48	45	SW	4	W	3														21		
	22	28.92	53	29.00	58	56	45			49	46	46	43	SW	2	S	2														22		
	23	29.14	55	29.30	56	59	37			49	45	45	43	S	1.5	SW	0.5														23		
	24	29.39	54	29.57	57	59	39			46	44	50	47	S	0.5	S	0.5														24		
	25	29.52	57	29.45	58	60	45			52	50	56	53	S	2	S	4														25		
	26	29.54	59	29.62	60	62	49			53	50	53	50	S	1.5	S	0.5														26		
	27	29.70	56	29.69	57	61	46			50	49	50	48	SW	0.5	S	0.5														27		
	28	29.75	53	29.72	54	54	42			47	45	50	49	SE	1.5	S	0.5														28		
	29	29.61	57	29.79	60	59	48			52	53	53	52	NE	1.5	SE	0.5														29		
	30	29.46	57	30.02	60	60	48			53	57	54	53	SE	0.5	S	0.5														30		
	31																															31	
Sums.		1413	57	1411	57	1807	169			1560	1469	1532	1462	455	380			20	220	222													
Means.		29.357	57.0	29.358	58.1	60.2	45.6			52.0	49.0	57.0	48.7	1.52	1.27																		
† Total Corrections for Instrumental Errors.		+0.42		+0.42		-3	+10			-7	-4	-7	-4	58	56																		
† Corrections for Diurnal Range.																																	
"Corrected Means."		29.399		29.400		59.9	46.6			51.3	48.6	50.3	48.3																				
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	31	

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction†† for Temp. (Col. 2), =  $29.399 - 0.75$  =  $29.324$   
"Corrected Mean" of Barometer at 9 P.M., minus the Correction†† for Temp. (Col. 4), =  $29.400 - 0.78$  =  $29.322$   
Mean at Station, corrected, and at 32°, =  $29.323$   
Correction for Height, feet, above Mean Sea-level, =  $29.6$   
Mean, reduced to 32°, and Sea-level, =  $29.619$   
Highest Reading, corrected for Index error, on the 20th, =  $29.960$   
Lowest Do., Do., on the 22nd, =  $28.920$   
Difference, or Monthly Range, =  $1.040$

S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 10th, =  $67.7$   
Lowest in Month, corrected for Index errors, on the 23rd, =  $38.0$   
Difference, or Monthly Range, =  $29.7$   
"Corrected Mean" of all the Highest, (Col. 5), =  $59.9$   
"Corrected Mean" of all the Lowest, (Col. 6), =  $46.6$   
Difference, or Mean Daily Range, =  $13.3$   
\*\* Calculated Mean Temperature of Month, =  $53.2$

S.-R. THERMOMETER, Black Bulb, in Sun, Highest, (corrected, for Index Errors), on the 10th, = \_\_\_\_\_  
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = \_\_\_\_\_  
Lowest at Night, Black Bulb, (corrected for Index errors), on the 10th, = \_\_\_\_\_  
"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, =  $50.8$   
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, =  $48.4$   
†† Computed Temperature of Dew-point, =  $45.9$   
†† Do. Elastic Force of Vapour, =  $3.10$   
†† Do. Weight of Vapour in a Cubic Foot of Air, =  $3.54$   
†† Relative Humidity, (Saturation = 100), =  $84.2$   
RAIN fell on 20 Days; Amount in Inches, =  $2.28$

WIND.	SUMMARY.									
	Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.
A.M.		1	2	1	4	9	7	5	1	0
P.M.		0	3	2	1	12	5	6	1	0
Mean.		1	2	2	2	10	6	6	1	0

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 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

*Donald Miller*

*Greatest rainy range = 21.7 on the 6th*



Edinburgh  
Sept. 1866.

# 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 incommensurate, 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 time, 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, they are specially requested to mark opposite, in such instances, they are specially requested to mark opposite, every reading at what time it was taken, if not at 9 o'clock.

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

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

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

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *screw* up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern upmost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on 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 *lull*, 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 nearly local influences. The lids forming the sides and doors of the Boxes are arranged so as to open to "protect" the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-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 Zamboni's Patent "Maximum" Thermometers are recommended; printed directions for their use may be obtained with each instrument. The "Minimum" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Maximum." This Thermometer is liable to two derangements, both of which must be guarded against, and may be easily remedied by 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. This instrument must be hung perfectly horizontal; the bulb end should incline slightly downwards, rather than the other.

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 90° or 30° of the zenith). The train of clouds that appear near the horizon are viewed obliquely; and thus being unable to judge of their amount, we ought not to take them into account in the *clouds* column, though their appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is half-covered by clouds, 5 is entered as the observation, and so on.

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

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

**Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature of the soil, its amount and constancy; the Council recommend that observations of 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 stopping 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 Schimper's or Moffat's papers are used. Moffat's are preferred. 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 3/4, as an ozone entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—5 is "4," 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 purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner, or on the side-margin. Additional remarks may be made on the margin.

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

The Council recommend that *ten-day* observations be taken;—viz. on the 21st days of March, June, September, and December. For these hourly observations separate schedules will be furnished to observers.

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 1863.

## OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	FRUITS.	MIGRATORY BIRDS.
Alder, .....	Apple, .....	Cuckoo, .....
Ash, .....	Black Currant, .....	Curlew, .....
Beech, .....	Cherry, .....	House-Sparrow, .....
Birch, .....	Gooseberry, .....	Lapwing, .....
Elm, .....	Holly, .....	Plover, .....
Larch, .....	Laburnum, .....	Sand-Martin, .....
Lin, .....	Peach, .....	Starling, .....
Oak, .....	Pear, .....	Swan, .....
Potatoes, .....	Plum, .....	Rail or Corn Crake, .....
Turnip, .....	Strawberry, .....	Other Birds, naming them, .....
Rye Grass, .....		

SHRUBS, ETC.	FRUITS.	MIGRATORY BIRDS.
First in Blossom, .....	Apple, .....	Cuckoo, .....
First in Blossom, .....	Black Currant, .....	Curlew, .....
First in Blossom, .....	Cherry, .....	House-Sparrow, .....
First in Blossom, .....	Gooseberry, .....	Lapwing, .....
First in Blossom, .....	Holly, .....	Plover, .....
First in Blossom, .....	Laburnum, .....	Sand-Martin, .....
First in Blossom, .....	Peach, .....	Starling, .....
First in Blossom, .....	Pear, .....	Swan, .....
First in Blossom, .....	Plum, .....	Rail or Corn Crake, .....
First in Blossom, .....	Strawberry, .....	Other Birds, naming them, .....
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, diseases, etc. Whether Epizootic disease prevails among Cattle; and the Agricultural condition of the district generally.

## BOOK-POST.

Mr ALEXANDER BUCHAN,

Secretary of the Meteorological Society of Scotland,

10, St Andrew Square,

EDINBURGH.



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Marchhall, County of Edinburgh, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea \_\_\_\_\_ miles.

Height of Cistern of the Barometer above Mean Sea-level \_\_\_\_\_ feet, above Ground \_\_\_\_\_ feet.

During the MONTH of October 1866.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read daily, at 9 P.M.				HYGROMETER. No.				WIND.				RAIN.		CLOUDS.				SUNSHINE. Hours.	THERMOMETERS. under Ground.			SEA. Temperature at Surface and 10 fathoms.	OZONE. 0-10. 9 A.M. 9 P.M.	GENERAL REMARKS. As to occurrence of Thunder, Lightning, Storms, Hail, Meteors, Remarkable Depression or Elevation of Barometer, Prevalent Diseases, etc.  Mention the hour at which Storms 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.							
		Barometer. No.	Attached Thermometer	Barometer. No.	Attached Thermometer	Max. No.	Min. No.	Max. in Sun's rays No.	Min. on Grass. No.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.			Velocity (0-6), and Species.	Amount (0-10), and Species.	Velocity (0-6), and Direction.	Amount (0-10), and Species.		No. 3 inches.	No. 12 inches.	No. 22 inches.					
		9 h. A.M.	9 h. P.M.	9 h. A.M.	9 h. P.M.	9 h. A.M.	9 h. P.M.	9 h. A.M.	9 h. P.M.	9 h. A.M.	9 h. P.M.	9 h. A.M.	9 h. P.M.	9 h. A.M.	9 h. P.M.	9 h. A.M.	9 h. P.M.			9 h. A.M.	9 h. P.M.	9 h. A.M.	9 h. P.M.		9 h. A.M.	9 h. P.M.	9 h. A.M.					9 h. P.M.
30	1	29.05	55	29.95	56	58	45			50	49	52	53	SE	0.5	NE	1.5			10											1	
	2	29.94	55	29.97	56	53	49			57	50	51	51	SE	0.5	E	0.5			10											2	
	3	29.97	57	29.93	59	56	50			53	52	55	54	SE	0.5	N	0.5			10											3	
	4	29.96	56	30.03	58	56	50			54	53	52	51	SE	0.5	SE	0.5			10											4	
	5	30.14	56	30.26	57	54	50			53	52	52	51	SE	0.5	W	0			10											5	
	6	30.31	56	30.32	57	55	48			50	49	50	48	SW	1	W	1.5			10											6	
	7	30.26	56	30.26	58	58	47			54	51	53	50	W	1.5	S	0			10											7	
	8	30.26	57	30.21	56	59	47			51	49	49	47	W	0.5	S	0			5											8	
	9	30.17	53	30.09	57	50	42			46	45	48	47	S	0	E	0			10											9	
	10	30.05	53	30.02	55	54	40			47	46	49	47	SE	0.5	S	0			10											10	
	11	30.00	52	29.94	55	53	42			47	45	50	48	W	0.5	W	0.5			10											11	
	12	29.85	53	29.76	55	52	46			48	47	49	45	SW	0	W	0.5			10											12	
	13	29.64	54	29.72	57	51	44			50	48	45	44	SW	1.5	W	0.5			10											13	
	14	29.84	48	29.92	52	50	35			44	43	44	41	W	0.5	W	0			6											14	
	15	29.75	50	29.93	51	52	38			46	43	43	42	W	1.5	W	0.5			5											15	
	16	29.48	48	29.96	52	57	37			43	40	45	43	W	0	S	0.5			5											16	
	17	29.86	50	29.74	53	52	37			43	40	45	43	SE	0.5	S	1.5			5											17	
	18	29.91	53	29.56	53	52	45			50	47	53	50	SE	2	SE	3			10											18	
	19	29.69	56	29.66	58	61	50			52	52	57	54	SE	1.5	S	1.5			5											19	
	20	29.94	58	29.94	60	62	52			55	52	52	52	S	1.5	S	0.5			6											20	
	21	29.80	59	29.68	60	60	52			56	54	56	54	SE	0.5	S	0.5			10											21	
	22	29.62	58	29.75	58	57	48			54	51	49	47	SW	1.5	W	0.5			10											22	
	23	29.78	57	29.70	57	58	41			44	43	53	50	W	0	W	1.5			5											23	
	24	29.43	55	29.41	53	52	43			50	47	42	41	SW	2	W	1.5			10											24	
	25	29.51	49	29.69	54	48	35			43	39	37	36	W	0.5	W	0			10											25	
	26	29.74	45	29.67	51	51	32			36	35	44	41	SW	0.5	W	0			4											26	
	27	29.64	53	29.55	55	55	41			48	48	52	51	SW	0.5	S	1.5			10											27	
	28	29.84	56	29.98	53	56	42			46	42	45	42	W	1.5	W	1.5			0											28	
	29	29.80	50	29.57	54	51	43			48	45	51	48	SW	2	SW	4			1											29	
	30	29.24	55	29.67	52	54	40			53	51	41	39	W	0.5	W	1.5			10											30	
	31	29.77	50	29.53	54	55	39			45	42	55	51	W	0.5	W	2			10											31	
Sums.		18.13	15	15.14	14	12	12			"	"	"	"	"	"	"	9			247												
Means.		26.54	11.3	26.37	16.6	14.2	13.50			15.11	14.50	15.25	14.61		3.95		4.15			9	1.20											
+ Total Corrections for Instrumental Errors.		+0.42		+0.42		-3	+10			-7	-4	-7	-4																			
Corrected Means.		29.858		29.893		54.3445				48.0464	48.5467																					
No. of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction++ for Temp. (Col. 2), = 29.898 - 0.67 = 29.831"Corrected Mean" of Barometer at 9 P.M., minus the Correction++ for Temp. (Col. 4), = 29.853 - 0.72 = 29.821Mean at Station, corrected, and at 32°, = 29.826Correction for Height, feet, above Mean Sea-level, = 0.296Mean, reduced to 32°, and Sea-level, = 30.122Highest Reading, corrected for Index error, on the 6th, = 30.320Lowest Do., Do., on the 30th, = 29.240Difference, or Monthly Range, = 1.080S.-R. THERMOMETER, (in shade, etc.), Highest in Month (corrected for Index errors), on the 20th, = 61.7Lowest in Month, corrected for Index errors, on the 26th, = 33.0Difference, or Monthly Range, = 28.7"Corrected Mean" of all the Highest, (Col. 5), = 54.3"Corrected Mean" of all the Lowest, (Col. 6), = 44.5Difference, or Mean Daily Range, = 9.8\*\* Calculated Mean Temperature of Month, = 49.4

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

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

Lowest at Night, Black Bulb, (corrected for Index errors), on the \_\_\_\_\_th, = \_\_\_\_\_

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

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

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, = 48.2Mean (corrected) A.M. and P.M. Reading of Wet Bulb, = 46.6†† Computed Temperature of Dew-point, = 44.9†† Do. Elastic Force of Vapour, = 2.98†† Do. Weight of Vapour in a Cubic Foot of Air, = 3.38†† Relative Humidity, (Saturation = 100), = 89RAIN fell on 9 Days; Amount in Inches, = 1.20

WIND.	SUMMARY.										Mean Force.	Mean Velocity in miles per day.
	Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.		
A.M.		0	4	0	6	2	8	10	1	0	1.27	
P.M.		2	1	2	2	8	2	10	4	0	1.34	
Mean.		1	2	1	4	5	5	10	3	0	1.30	1.69

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 2nd; those from Other Places, not later if possible than the 6th. This Schedule not to be Gummed or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

Donald Miller

Greatest daily range = 18.3° on the 26th



# INSTRUCTIONS

WITH REMARKS ON THE USE OF INSTRUMENTS.

The above remarks apply equally to the Thermometers for registering the greater 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 changed, by the application of a mixture of lamp-black and gum's ink. They are placed in shallow blackened boxes, whose sides protect the bulbs from the wind, and the "Minimum" should be freely exposed to the Sun, and the "Maximum" should rest on wooden supports a few inches from the surface of the grass, in an open situation. Snow must not be allowed to cover either of these instruments; not the Sun's heat to affect the alcohol by distillation. The "Maximum" Thermometer, which has not been carefully tested for Meteorological purposes, that has not been carefully tested by comparison with a Standard Thermometer. When such Thermometers are not graduated on the stem, but merely to be 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 rectified form of the apparatus seriously vitiate the "Hygrometrical" Delinquencies, Observers are specially requested to attend to the following conditions:—The bulbs must hang down by as light as possible free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulb;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean and moist*, and the water pure. In frosty weather observation is a matter of much delicacy and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

One form of Mason's Hygrometer is 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, or 40.6, according as it indicates a little under, an exact coincidence with, or a little over 40, or 40.5, respectively. So also 40.1, and 40.2, more or less, must be registered 40.2 or 40.3, and 40.7 or 40.8 respectively. In reading Rutherford's "Max." and "Min." Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

**Hour of Observing Temperature.**—The Hygrometer is read at 9 A.M. and 9 P.M. The self-registering Thermometers are read at 9 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 schedule, 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, will 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 observations, 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

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 clouds column, though their appearance and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is *half covered* by clouds, 5 is entered as the *observation*, and so on. Observations of the clouds and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," 2 W. (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (extreme) speed of the former. Again, in the second "Cloud" column, an entry of 2, east, (e.g.) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind.

**Shadows.**—The number of hours in which objects in the sun's rays cast shadows, should be entered in the proper column. **Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature of the soil, it is almost an necessity that 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 edge of piers and rocks round the coast, where it is not influenced by the flow of river water. At or near the time of high water, on the 5th, 15th, and 25th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes largely changed, 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. **Observations of the Moon.**—The temperature of the Moon's surface is not known, but the indication registered on a board in the thermometer box, and the indication registered on 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:—Plus 3°, as an *excess* 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 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 purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner, or on the side-margin. Additional remarks may be made on the margin. **Observations** in connection with the periodic return of the seasons, possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm.

The Council recommend that *year-day* observations be taken;—viz., on the 21st days of March, June, September, and December. For these hourly observations separate schedules will be furnished to observers.

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 1863.

## Observations in connection with the Periodical Return of the Seasons.

FOREST TREES.	In Flower.	In Leaf.	Dissected of Leaves.	CROPS.	Sowing or Above Ground.	In Bar or First Cut
Alder, .....				Barley, .....		
Beech, .....				Bare or Bigg, .....		
Birch, .....				Wheat, .....		
Elm, .....				Oats, .....		
Larch, .....				Beet or Bigg, .....		
Maple, .....				Barley, .....		
Pine, .....				Planting, .....		
Poplar, .....				Planting, .....		
Spruce, .....				Planting, .....		
Willow, .....				Planting, .....		
Yew, .....				Planting, .....		

SHRUBS, ETC.		First in Blossom.	FRUITS.			First in Blossom.	First in Fruit Ripeness.	MIGRATORY BIRDS.			First Arrival.	Departure.
Barberry, .....	.....	.....	Apple, .....	.....	.....	.....	.....	Cuckoo, .....	.....	.....	.....	.....
Bouquet of Elder, .....	.....	.....	Black Currant, .....	.....	.....	.....	.....	House Sparrow, .....	.....	.....	.....	.....
Broom, .....	.....	.....	Cherry, .....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Hazel, .....	.....	.....	Gean, .....	.....	.....	.....	.....	Lapwing, .....	.....	.....	.....	.....
Hawthorn, .....	.....	.....	Gooseberry, .....	.....	.....	.....	.....	Plover, .....	.....	.....	.....	.....
Holly, .....	.....	.....	Peach, .....	.....	.....	.....	.....	Sand-Martin, .....	.....	.....	.....	.....
Laburnum, .....	.....	.....	Pear, .....	.....	.....	.....	.....	Starling, .....	.....	.....	.....	.....
Lilac, .....	.....	.....	Plum, .....	.....	.....	.....	.....	Swan, .....	.....	.....	.....	.....
Mezerion, .....	.....	.....	Strawberry, .....	.....	.....	.....	.....	Rail or Corn Crake, .....	.....	.....	.....	.....
Mountain Ash or Rowan, .....	.....	.....	.....	.....	.....	.....	.....	Other Birds, naming them—	.....	.....	.....	.....
Red-flowering Currant, .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Rhododendron Ponticum, .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Whin, .....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....



Height of Cistern of the Barometer above Mean Sea-level \_\_\_\_\_ feet, above Ground \_\_\_\_\_ feet. During the MONTH of *November* 186*6*.

The Hours of Observation are of Greenwich Time.

Greatest daily range =  $15.4^{\circ}\text{C}$







# SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Marsh Hall, County of Edinburgh, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea \_\_\_\_\_ miles.

Height of Cistern of the Barometer above Mean Sea-level\_\_\_\_\_feet, above Ground\_\_\_\_\_feet.

During the MONTH of December 18 66

The Hours of Observation are of Greenwich Time.

[illegible]

<b>BAROMETER,</b> “corrected Mean” at 9 A.M., <i>minus</i> the Correction $\frac{+}{-}$	
for Temp. (Col. 2), = $29.513 \dots - 0.02 \dots$	= <u>29.461</u>
<b>“Corrected” Mean” of Barometer at 9 P.M., <i>minus</i> the Correction <math>\frac{+}{-}</math></b>	
for Temp. (Col. 4), = $29.507 \dots - 0.04 \dots$	= <u>29.453</u>
<b>Mean at Station, corrected, and at 32', .....</b>	= <u>29.457</u>
Correction for height, feet, above Mean Sea-level, .....	<u>296</u>
<b>Mean, reduced to 32', and Sea-level, .....</b>	= <u>29.753</u>
Highest Reading, corrected for Index error, on the 22 <sup>th</sup> , .....	= <u>30.160</u>
Lowest Do., Do., on the 7 <sup>th</sup> , .....	= <u>28.550</u>
Difference, or <b>Monthly Range</b> , .....	= <u>1.610</u>

<b>S.-R. THERMOMETER,</b> (in shade, etc.), <b>Highest in Month,</b> (corrected for Index Errors), on the 17 <sup>th</sup> ,.....	=	<u>55.7</u>
<b>Lowest in Month,</b> corrected for Index errors, on the 31 <sup>th</sup> , .....	=	<u>28.0</u>
Difference, or <b>Monthly Range,</b> .....	=	<u>27.7</u>
" Corrected <b>Mean</b> " of all the <b>Highest,</b> (Col. 5), .....	=	<u>46.4</u>
" Corrected <b>Mean</b> " of all the <b>Lowest,</b> (Col. 6), .....	=	<u>37.2</u>
Difference, or <b>Mean Daily Range,</b> .....	=	<u>9.2</u>
* Calculated <b>Mean Temperature</b> of Month, .....	=	<u>41.8</u>

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

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

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

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

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

<b>HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11),</b>	=	41.2
<b>Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12),</b>	=	39.1
<b>Computed Temperature of Dew-Point,</b>	=	36.5
<b>Do. Elastic Force of Vapour,</b>	=	2
<b>Do. Weight of Vapour in a Cubic Foot of Air,</b>	=	2.5
<b>Relative Humidity, (Saturation = 100),</b>	=	84
<b>RAIN fell on / 5 Days; Amount in Inches,</b>	=	2.30

WIND.		SUMMARY.									
Direction	N	NE	E	SE	S	SW	W	NW	Calcs or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	1	0	0	1	3	14	8	4	0	1.81	
P.M.	1	2	0	1	6	6	13	2	0	1.90	
Mean.	1	1	0	1	4	10	11	3	0	1.86	= 3.466

Observations made and  
Return verified by

(Signed) Donald Miller

greatest daily range =  $20.7^{\circ}$  on the 17<sup>th</sup>

P



