

# SCOTTISH METEOROLOGICAL SOCIETY.

Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground 2 feet.

During the MONTH of *February* 18*71*.

The Hours of Observation are of Greenwich Time.

<b>BAROMETER,</b> "corrected Mean" at 9 A.M., <i>minus</i> the Correction $\frac{+}{-}$	
for Temp. (Col. 2), = <u>29.467</u> ..... - <u>0.045</u>	= 29.422
"Corrected Mean" of Barometer at 9 P.M., <i>minus</i> the Correction $\frac{+}{-}$	
for Temp. (Col. 4), = <u>29.483</u> ... - <u>0.043</u>	= 29.440
<b>Mean at Station, corrected, and at 32°,</b> .....	= 29.433
Correction for height, feet, above Mean Sea-level, .....	= 310
<b>Mean, reduced to 32°, and Sea-level,</b> .....	= 29.743
Highest Reading, corrected for Index error, on the 18 <sup>th</sup> ,.....	= 30.057
Lowest Do., Do., on the 5 <sup>th</sup> ,.....	= 28.940
Difference, or <b>Monthly Range,</b> .....	= 1.117

**S.-R. THERMOMETER,** (in shade, etc.), **Highest in Month,** (corrected for Index Errors), on the 15th, ..... 56.0 = 86.0

**Lowest in Month,** corrected for Index errors, on the 28th, ..... 21.0 = 41.0

**Difference, or Monthly Range,** ..... 35.0 = 45.0

**"Corrected Mean" of all the Highest,** (Col. 5), ..... 45.5 = 48.5

**"Corrected Mean" of all the Lowest,** (Col. 6), ..... 32.5 = 32.0

**Difference, or Mean Daily Range,** ..... 13.0 = 16.0

**\* Calculated Mean Temperature of Month,** ..... 39.0 = 39.0

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

<b>HYGROMETER, Mean</b> (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11),.....	=	40.2
<b>Mean</b> (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12),.....	=	38.4
‡‡ Computed <b>Temperature of Dew-Point</b> ,.....	=	36.1
‡‡ Do. <b>Elastic Force of Vapour</b> , .....	=	.214
‡‡ Do. <b>Weight of Vapour in a Cubic Foot of Air</b> , .....	=	
‡‡ <b>Relative Humidity</b> , (Saturation = 100), .....	=	86
<b>RAIN</b> fell on /2 Days; Amount in Inches, .....	=	2.97

RAIN fell on / 2 Days; Amount in Inches, .....		= 2.97									
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	5		2	4	12	1	3			
P.M.	1	5		2	1	7					
Mean.	1	4	0	3	3	11	1	5			

Observations made and  
Return verified by



WITH REMARKS ON THE USE OF INSTRUMENTS.

have been compared with B. *senarum*. Two moderate-priced Barometers have been approved of by the Council; if properly tested and attended to, they are both well adapted for meteorological purposes. An excellent Barometer is constructed by Mr A. de London, the use of which is attended with the great convenience of releasing the use of oil, and the great convenience of requiring no adjustment of the cistern. Its *scale-inches* are not true, but so much shorter as to compensate the error that would

An excellent Barometer is constructed by Mr. Adie of London. The use of this is attended with the great convenience of requiring no adjustment of the stem. Its *scale-tubes* are not true inches but some short as to compensate the error that would otherwise arise from the fluctuations of the surface of mercury in the stem. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form the Barometer, the sides of the *cistern* are of taffee, and thus, instead of a screw, active on the bottom, the pressure of the atmosphere is applied, and must be made with great care. The bulb must be delicate, and must be made with great purity. 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 lightly 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 possible.

*Reading of the Thermometer.*—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index, or column of mercury. The reading site the tip of the index, or column of mercury. The reading ought to be taken to tenths of a degree, i.e., 40° 0, 40° 1, 40° 2, etc. Thus the thermometer will read 38° 3, if it indicates a height of 38° 3, 40° 3, 40° 6, according to the scale of the thermometer, an exact coincidence with those on its ivory frame, under an eye coincident with the tip of the index, or 40° 1 respectively. So also, 40° 3, 40° 6, 40° 9, 40° 12, or 40° 15, respectively, 40° 2, 40° 3, 40° 4, 40° 5, 40° 6, 40° 7, 40° 8, 40° 9, 40° 10, 40° 11, 40° 12, 40° 13, 40° 14, 40° 15, 40° 16, 40° 17, 40° 18, 40° 19, 40° 20, 40° 21, 40° 22, 40° 23, 40° 24, 40° 25, 40° 26, 40° 27, 40° 28, 40° 29, 40° 30, 40° 31, 40° 32, 40° 33, 40° 34, 40° 35, 40° 36, 40° 37, 40° 38, 40° 39, 40° 40, 40° 41, 40° 42, 40° 43, 40° 44, 40° 45, 40° 46, 40° 47, 40° 48, 40° 49, 40° 50, 40° 51, 40° 52, 40° 53, 40° 54, 40° 55, 40° 56, 40° 57, 40° 58, 40° 59, 40° 60, 40° 61, 40° 62, 40° 63, 40° 64, 40° 65, 40° 66, 40° 67, 40° 68, 40° 69, 40° 70, 40° 71, 40° 72, 40° 73, 40° 74, 40° 75, 40° 76, 40° 77, 40° 78, 40° 79, 40° 80, 40° 81, 40° 82, 40° 83, 40° 84, 40° 85, 40° 86, 40° 87, 40° 88, 40° 89, 40° 90, 40° 91, 40° 92, 40° 93, 40° 94, 40° 95, 40° 96, 40° 97, 40° 98, 40° 99, 40° 100, 40° 101, 40° 102, 40° 103, 40° 104, 40° 105, 40° 106, 40° 107, 40° 108, 40° 109, 40° 110, 40° 111, 40° 112, 40° 113, 40° 114, 40° 115, 40° 116, 40° 117, 40° 118, 40° 119, 40° 120, 40° 121, 40° 122, 40° 123, 40° 124, 40° 125, 40° 126, 40° 127, 40° 128, 40° 129, 40° 130, 40° 131, 40° 132, 40° 133, 40° 134, 40° 135, 40° 136, 40° 137, 40° 138, 40° 139, 40° 140, 40° 141, 40° 142, 40° 143, 40° 144, 40° 145, 40° 146, 40° 147, 40° 148, 40° 149, 40° 150, 40° 151, 40° 152, 40° 153, 40° 154, 40° 155, 40° 156, 40° 157, 40° 158, 40° 159, 40° 160, 40° 161, 40° 162, 40° 163, 40° 164, 40° 165, 40° 166, 40° 167, 40° 168, 40° 169, 40° 170, 40° 171, 40° 172, 40° 173, 40° 174, 40° 175, 40° 176, 40° 177, 40° 178, 40° 179, 40° 180, 40° 181, 40° 182, 40° 183, 40° 184, 40° 185, 40° 186, 40° 187, 40° 188, 40° 189, 40° 190, 40° 191, 40° 192, 40° 193, 40° 194, 40° 195, 40° 196, 40° 197, 40° 198, 40° 199, 40° 200, 40° 201, 40° 202, 40° 203, 40° 204, 40° 205, 40° 206, 40° 207, 40° 208, 40° 209, 40° 210, 40° 211, 40° 212, 40° 213, 40° 214, 40° 215, 40° 216, 40° 217, 40° 218, 40° 219, 40° 220, 40° 221, 40° 222, 40° 223, 40° 224, 40° 225, 40° 226, 40° 227, 40° 228, 40° 229, 40° 230, 40° 231, 40° 232, 40° 233, 40° 234, 40° 235, 40° 236, 40° 237, 40° 238, 40° 239, 40° 240, 40° 241, 40° 242, 40° 243, 40° 244, 40° 245, 40° 246, 40° 247, 40° 248, 40° 249, 40° 250, 40° 251, 40° 252, 40° 253, 40° 254, 40° 255, 40° 256, 40° 257, 40° 258, 40° 259, 40° 260, 40° 261, 40° 262, 40° 263, 40° 264, 40° 265, 40° 266, 40° 267, 40° 268, 40° 269, 40° 270, 40° 271, 40° 272, 40° 273, 40° 274, 40° 275, 40° 276, 40° 277, 40° 278, 40° 279, 40° 280, 40° 281, 40° 282, 40° 283, 40° 284, 40° 285, 40° 286, 40° 287, 40° 288, 40° 289, 40° 290, 40° 291, 40° 292, 40° 293, 40° 294, 40° 295, 40° 296, 40° 297, 40° 298, 40° 299, 40° 300, 40° 301, 40° 302, 40° 303, 40° 304, 40° 305, 40° 306, 40° 307, 40° 308, 40° 309, 40° 310, 40° 311, 40° 312, 40° 313, 40° 314, 40° 315, 40° 316, 40° 317, 40° 318, 40° 319, 40° 320, 40° 321, 40° 322, 40° 323, 40° 324, 40° 325, 40° 326, 40° 327, 40° 328, 40° 329, 40° 330, 40° 331, 40° 332, 40° 333, 40° 334, 40° 335, 40° 336, 40° 337, 40° 338, 40° 339, 40° 340, 40° 341, 40° 342, 40° 343, 40° 344, 40° 345, 40° 346, 40° 347, 40° 348, 40° 349, 40° 350, 40° 351, 40° 352, 40° 353, 40° 354, 40° 355, 40° 356, 40° 357, 40° 358, 40° 359, 40° 360, 40° 361, 40° 362, 40° 363, 40° 364, 40° 365, 40° 366, 40° 367, 40° 368, 40° 369, 40° 370, 40° 371, 40° 372, 40° 373, 40° 374, 40° 375, 40° 376, 40° 377, 40° 378, 40° 379, 40° 380, 40° 381, 40° 382, 40° 383, 40° 384, 40° 385, 40° 386, 40° 387, 40° 388, 40° 389, 40° 390, 40° 391, 40° 392, 40° 393, 40° 394, 40° 395, 40° 396, 40° 397, 40° 398, 40° 399, 40° 400, 40° 401, 40° 402, 40° 403, 40° 404, 40° 405, 40° 406, 40° 407, 40° 408, 40° 409, 40° 410, 40° 411, 40° 412, 40° 413, 40° 414, 40° 415, 40° 416, 40° 417, 40° 418, 40° 419, 40° 420, 40° 421, 40° 422, 40° 423, 40° 424, 40° 425, 40° 426, 40° 427, 40° 428, 40° 429, 40° 430, 40° 431, 40° 432, 40° 433, 40° 434, 40° 435, 40° 436, 40° 437, 40° 438, 40° 439, 40° 440, 40° 441, 40° 442, 40° 443, 40° 44

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 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 *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.

The Council would strongly recommend that every victory be furnished with a Thermopile. The amount of Wind self-registering observation may be ascertained by the Velocity of the Wind at the time of observation may be ascertained. For indication, the Force of the Wind, at any particular hour of observation, Lind's Anemometer is also recommended; the method of *Zealanding* Wind Force by such tables as that given in the schedule is to say the least, unsatisfactory.

*Zealanding*.—Many causes conspire to produce anomalies in rain returns. They arise, partly from unimprovable situation for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable

*Self-Recording Thermometers*.—Professor Phillips's, and Negretti and Zamboni's Patent "*Actinoman*" Thermometers are recommended; printed instructions for their use may be obtained with each instrument. The "*Actinoman*" Thermometer of Rutherford is recommended when graduated on the glass scale and affixed to a frame separate from the "*Actinoman*". 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 will 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 hole, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

*Clouds.*—Convenient abbreviations for Luke Howard

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[illegible][illegible][illegible]

Barley, . . .	1
Bere or Bigg, . . .	1
Oats, . . .	1
Wheat, . . .	1
Beans, . . .	1
Peanse, . . .	1
Potatoes, . . .	1
Turnips, . . .	1
Rye Grass, . . .	1
Barley, . . .	1
Bere or Bigg, . . .	1
Oats, . . .	1
Wheat, . . .	1
Beans, . . .	1
Peanse, . . .	1
Potatoes, . . .	1
Turnips, . . .	1
Rye Grass, . . .	1

[illegible][illegible][illegible]

OBSERVATIONS		FOREST TREES	
Allder, . . .	✓	Alder, . . .	✓
Ash, . . .	✓	Beech, . . .	✓
Birch, . . .	✓	Elm, . . .	✓
Larch, . . .	✓	Linch, . . .	✓
Oak, . . .	✓	Sycamore or Pla	✓

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

SHRUBS, &c.	Barberry, . . . . . Bountee or Elder, . . . . . Cherry, . . . . . Hazle, . . . . . <i>Myrt.</i> Hawthorn, . . . . . Holly, . . . . . Laburnum, . . . . . Pear, . . . . . Teach, . . . . . Gooseberry, . . . . . Currant, . . . . . Raspberry, . . . . . Strawberry, . . . . . Rhododendron Ponticum, . . . . . Yellow Birch, . . . . . Yew, . . . . .
Plants in Blossom.	Apple, . . . . . Black Currant, . . . . . Cherry, . . . . . Gooseberry, . . . . . Pear, . . . . . Raspberry, . . . . . Strawberry, . . . . .
FRUITS.	
First in Blossom.	
Fruit Ripen Generally.	
MINORATORY BIRDS.	Cuckoo, . . . . . House-Swallow, . . . . . Lapwing, . . . . . Sand-Martin, . . . . . Starling, . . . . . Swan, . . . . . Rail or Corn Creeper, . . . . .
Plants in Flower.	
Plants in Fruit.	
Departure.	

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 diseases prevail among cattle; and the Agricultural condition of the district generally.

BOOK-POST.

*Secretary of the Meteorological Society of Scotland,*

EDINBURGH

Mr ALEXANDER BUCHAN.

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# SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at Cluny, County of Aberdeen, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea 17 miles.  
Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground \_\_\_\_\_ feet. During the MONTH of March 18 71.  
The Hours of Observation are of Greenwich Time.

BAROMETER, "corrected mean" at 9 A.M., minus the Correction $\pm$ }		
for Temp. (Col. 2), = ..29.516... - .017..	=	<u>29.499</u>
"Corrected Mean" of Barometer at 9 P.M., minus the Correction $\pm$ }		
for Temp. (Col. 4), = ..29.571... - .049..	=	<u>29.522</u>
Mean at Station, corrected, and at 32', .....	=	<u>29.5496</u>
Correction for height, feet, above Mean Sea-level, .....	=	<u>369</u>
Mean, reduced to 32', and Sea-level, .....	=	<u>29.805</u>
Highest Reading, corrected for Index error, on the 28th, .....	=	<u>30.369</u>
Lowest Do., Do., on the 12th, .....	=	<u>28.96</u>
Difference, or Monthly Range, .....	=	<u>1.573</u>

<b>S.-R. THERMOMETER,</b> (in shade, etc.), <b>Highest in Month,</b> (corrected for Index Errors), on the 25 <sup>th</sup> .....	65.0	=	85.0
<b>Lowest in Month,</b> corrected for Index errors, on the 15 <sup>th</sup> .....	20.0	=	20.0
Difference, or <b>Monthly Range,</b> .....	45.0	=	65.0
" Corrected <b>Mean</b> " of all the <b>Highest,</b> (Col. 5), .....	30.5	=	50
" Corrected <b>Mean</b> " of all the <b>Lowest,</b> (Col. 6), .....	32.6	=	38
Difference, or <b>Mean Daily Range,</b> .....	17.9	=	17.9
<b>** Calculated Mean Temperature</b> of Month, .....	41.6	=	

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

<b>HYGROMETER, Mean</b> (corrected) A.M. and P.M. Reading of <b>Dry Bulb</b> , (Cols. 9 and 11),.....	=	42.6
<b>Mean</b> (corrected) A.M. and P.M. Reading of <b>Wet Bulb</b> , (Cols. 10 and 12),.....	=	40.7
†† Computed <b>Temperature of Dew-Point</b> ,.....	=	38.6
†† Do. <b>Elastic Force of Vapour</b> , .....	=	2.33
†† Do. <b>Weight of Vapour in a Cubic Foot of Air</b> , .....	=	
†† <b>Relative Humidity</b> , (Saturation = 100), .....	=	86
<b>RAIN</b> fell on <b>5 Days</b> ; Amount in Inches, .....	=	0.34

WIND.	SUMMARY.											
	Direction	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	"	2	"	3	2	16	1	7				
P.M.	"	1	"	2	13	11	2	12				
Month	0	1	0	2	3	13	2	10	0	-		

Observations made and Return verified by		Date	
1		18	1880
2		19	1880
3		20	1880
4		21	1880
5		22	1880
6		23	1880
7		24	1880
8		25	1880
9		26	1880
10		27	1880
11		28	1880
12		29	1880
13		30	1880
14		31	1880
15		1	1881
16		2	1881
17		3	1881
18		4	1881
19		5	1881
20		6	1881
21		7	1881
22		8	1881
23		9	1881
24		10	1881
25		11	1881
26		12	1881
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28		14	1881
29		15	1881
30		16	1881
31		17	1881
32		18	1881
33		19	1881
34		20	1881
35		21	1881
36		22	1881
37		23	1881
38		24	1881
39		25	1881
40		26	1881
41		27	1881
42		28	1881
43		29	1881
44		30	1881
45		31	1881
46		1	1882
47		2	1882
48		3	1882
49		4	1882
50		5	1882
51		6	1882
52		7	1882
53		8	1882
54		9	1882
55		10	1882
56		11	1882
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72		27	1882
73		28	1882
74		29	1882
75		30	1882
76		31	1882
77		1	1883
78		2	1883
79		3	1883
80		4	1883
81		5	1883
82		6	1883
83		7	1883
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102		26	1883
103		27	1883
104		28	1883
105		29	1883
106		30	1883
107		31	1883
108		1	1884
109		2	1884
110		3	1884
111		4	1884
112		5	1884
113		6	1884
114		7	1884
115		8	1884
116		9	1884
117		10	1884
118		11	1884
119		12	1884
120		13	1884
121		14	1884
122		15	1884
123			



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 incompatible, 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 comprehensiveness among the several Returns, without which the Society's Reports must inevitably fall in relieving one of the main objects of Meteorological Observation.

Hour of Observation.—The Council recommend that Observations be made precisely at 9 o'clock (Greenwich or Railway Time only) twice a-day for some, and once (morning or evening) for other instruments, as specified, in the following remarks, or at the top of the scale. It is hoped that the utmost punctuality in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to mark opposite every reading at what time it was taken, if not at 9 o'clock. Barometer.—Weather glasses and Aneroids, though admirably adapted, as the latter certainly are, to indicate variations of atmospheric pressure, are not well fitted for scientific purposes. Nor can any Barometer be used for Meteorological Observations that is not supplied with such means of adjustment or compensation as will secure the height of the mercury in the tube being accurately measured from the fluctuating surface of the mercury in the cistern. It is also necessary that every Barometer shall have been compared with a Standard.

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

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

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

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

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

Protection of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside, and black within, and fixed 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 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 distilled from, thence by heating that part over a lamp the alcohol will evaporate and again condense on the body of the liquid. These instruments should be hung horizontally.

The above remarks apply equally to the Thermometers for

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner;—In the column "Velocity of Direction," (for example,) will indicate that the upper strata of clouds travel with extreme velocity from S.W., and those in the lower regions from W., with one-third the (extreme) speed of the former. Again, in the second "Cloud" column, an entry of 2, east, 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 low 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 3d, 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.

Observations.—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 at 4.43 on the scale 0—6 is 4°; i. e., that it is showing 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 untenable 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 sun-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered either in two columns, otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner on the side-margin. Additional remarks may be made on the margin, as 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 form day observations be taken;—viz., on the 21st days of March, June, September, and December.

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

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

(By Order) A. B.

Edinburgh, 30th December 1872.

INSTRUCTIONS FOR TAKING METEOROLOGICAL OBSERVATIONS.

WITH REMARKS ON THE USE OF INSTRUMENTS.

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

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(By Order) A. B.

Edinburgh, 30th December 1872.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth	Eleventh	Twelfth	Thirteenth	Fourteenth	Fifteenth	Sixteenth	Seventeenth	Eighteenth	Nineteenth	Twentieth	Twenty-first	Twenty-second	Twenty-third	Twenty-fourth	Twenty-fifth	Twenty-sixth	Twenty-seventh	Twenty-eighth	Twenty-ninth	Thirtieth
Alder, . . . . .																															
Aspen, . . . . .																															
Beech, . . . . .																															
Birch, . . . . .																															
Elm, . . . . .																															
Larch, . . . . .																															
Lincoln, . . . . .																															
Oak, . . . . .																															
Sycamore or Plane, . . . . .																															

SHRUBS, &c.	First in Blossom.	Barberry, . . . . .																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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Have the goodness also to state any information you may be able to collect relative to the condition of the district generally. Turnips, Potatoes, etc., in perfection; whether any have suffered from blight, disease, etc. Whether Hay, Potatoes, etc., are in perfection; whether any have suffered from blight, disease, etc.

BOOK-POST.

M. ALEXANDER BUCHANAN

Secretary of the Meteorological Society of Scotland,

EDINBURGH.



SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at W. Gordon's Ferry, Castle, County of Aberdeen, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea 17 miles.  
Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground \_\_\_\_\_ feet. During the MONTH of April 1871.  
The Hours of Observation are of Greenwich Time.

<b>BAROMETER,</b> "corrected Mean" at 9 A.M., minus the Correction ++		=	29.452
for Temp. (Col. 2), = 29.490 - 0.38			
<b>"Corrected Mean" of Barometer at 9 P.M., minus the Correction ++</b>		=	29.450
for Temp. (Col. 4), = 29.487 - 0.37			
<b>Mean at Station, corrected, and at 32°,.....</b>		=	29.451
Correction for height,	feet above Mean Sea-level,.....	=	310
<b>Mean, reduced to 32°, and Sea-level,.....</b>		=	29.761
Highest Reading, corrected for Index error, on the 4th,.....		=	29.913
Lowest	Do. Do. on the 15th,.....	=	28.878
Difference, or <b>Monthly Range</b> ,.....		=	1.034

<b>S.-R. THERMOMETER,</b> (in shade, etc.), <b>Highest in Month,</b> (corrected for Index Errors), on the <u>12</u> th,.....	=	<u>62.0</u>
<b>Lowest in Month,</b> corrected for Index errors, on the <u>11</u> th,.....	=	<u>20.0</u>
Difference, or <b>Monthly Range,</b> .....	=	<u>42.0</u>
"Corrected <b>Mean</b> " of all the <b>Highest,</b> (Col. 5), .....	=	<u>48.8</u>
"Corrected <b>Mean</b> " of all the <b>Lowest,</b> (Col. 6), .....	=	<u>31.10</u>
Difference, or <b>Mean Daily Range,</b> .....	=	<u>17.70</u>
** Calculated <b>Mean Temperature</b> of Month, .....	=	<u>39.8</u>

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

<b>HYGROMETER, Mean</b> (corrected) A.M. and P.M. Reading of <b>Dry Bulb</b> , (Cols. 9 and 11), .....	=	40.7
<b>Mean</b> (corrected) A.M. and P.M. Reading of <b>Wet Bulb</b> , (Cols. 10 and 12), .....	=	39.3
‡ Computed <b>Temperature of Dew-Point</b> , .....	=	37.5
‡ Do. <b>Elastic Force of Vapour</b> , .....	=	225
‡ Do. <b>Weight of Vapour in a Cubic Foot of Air</b> , ... =		
‡ <b>Relative Humidity</b> , (Saturation = 100), .....	=	89
<b>RAIN</b> fell on 18 Days; Amount in Inches, .....	=	4.064

RAIN fell on 18 Days; Amount in Inches, .....										= 4.064		
WIND.		SUMMARY.										
Direction.	N	NE	E	SE	S	SW	W	NW	Calu or Variable.	Mean Force.	Mean Velocity in miles per day.	
A.M.		5	11	1	2		11					
P.M.	1	9	1	8		3		8				
Mean.	1	7	1	9	1	2	0	9	0			

Observations made and  
Return verified by



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 their Monthly attention to the following Directions, secure for their Monthl Returns, an accuracy and value commensurate with the labour and pains involved in making them; and, for the Tables published by the Society, an entire comparableness among the several Returns, without which the Society's Reports must inevitably fall in achieving one of the main objects of Meteorological Observation.

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

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

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

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

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then screw up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on inclining the instrument so that the mercury strikes the top of the tube, a silvery 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 *lylch*, 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 is then gently tapped, and the cistern adjustment carefully made. By raising and lowering the eye, it must be brought into the plane of the back and front of the index;—usually the lower edge of the vernier, which must be carefully adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly, so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

Position of Thermometers.—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from every local influence. 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 the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These boxes may be had from the opticians.

Self-registering Thermometers.—Professor Phillips, and Negretti and Zambra's Patent "Marinium" Thermometers are recommended: printed directions for their use may be obtained with each instrument. The "Marinium" Thermometer of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Marinium." 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 floats by high temperature, it will be found near the top of the tube and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate, and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

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

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

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

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

Reading of the Thermometers.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index or column of mercury. The reading ought to be taken to tenths of a degree, and noted in decimals. Thus the Thermometer will be read—39°.9, 40°.0, or 40°.1; or again, 40°.4, 40°.5, or 40°.6, according as it indicates a little more or less than 40°. 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 rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

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

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

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

Clouds.—Convenient abbreviations for Luke Howard's

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity 6, S. W." (for example), will indicate that the 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  $\frac{2}{2}$ , (e.g.) will indicate that the higher regions are covered to the "amount" of 4-tenths with strata 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 pool or column.

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

Temperature of the Sea.—A knowledge of the temperature of the sea is not only in itself, but in its relations to that of our island, a very important branch of Meteorology. The Council therefore recommend that the temperature of the sea be carefully taken by a properly constructed apparatus, from the ends of piers and rocks round the coast, where it is not influenced by the heat of the sun's rays. 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 Mofra's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation in the following manner:—thus 8" as an ozone entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale 0—6 is "4"; i.e., that it is blowing fresh.

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

Remarks.—The "Remarks" column is too narrow, but unfortunately so. Some of the most valuable observations that can be taken are those for which no notices 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, color, 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 air currents, auroral boreas, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour on storms as have been hinted at above. When July falls 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 was 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 periods return of the seasons' possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm.

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

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

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

EDINBURGH, 19th November 1893. (By Order) A. B.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

STIRUPS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry, . . . . .		Apple, . . . . .			Cuckoo, . . . . .	24 <sup>th</sup>	first time heard
Bourtree or Elder, . . . . .		Black Currant, . . . . .	24 <sup>th</sup>		Curlew, . . . . .		
Broom, . . . . .		Cherry, . . . . .	24 <sup>th</sup>		House-Swallow, . . . . .		
Hazel, . . . . .		Gean, . . . . .			Lapwing, . . . . .		
Hawthorn, . . . . .		Gosberry, . . . . .			Plover, . . . . .		
Holly, . . . . .		Peach, . . . . .			Sand-Martin, . . . . .		
Laburnum, . . . . .		Pear, . . . . .			Starling, . . . . .		
Lilac, . . . . .		Plum, . . . . .			Swan, . . . . .		
Mezerion, . . . . .		Strawberry, . . . . .			Rail or Corn Crake, . . . . .		
Mountain Ash or Rowan, . . . . .							
Red Flowering Currant, . . . . .							
Rhododendron Ponticum, . . . . .							
Whin, . . . . .							

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

EDINBURGH.

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland,

MR ALEXANDER BUCHAN,





# SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gardens Quay, County of Abertee, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea 17 miles.

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

During the MONTH of May 1871.

The Hours of Observation are of Greenwich Time.

[illegible]

<b>BAROMETER,</b> "corrected Mean" at 9 A.M., <i>minus</i> the Correction <sup>††</sup>		
for Temp. (Col. 2),	= 29.711... - 0.61 }	= 29.650
<b>"Corrected Mean" of Barometer at 9 P.M., <i>minus</i> the Correction<sup>††</sup></b>		
for Temp. (Col. 4),	= 29.754... - 0.64 }	= 29.695
<b>Mean at Station, corrected, and at 32°,.....</b>		= 29.672
Correction for height, feet above Mean Sea-level,.....		= 30.5
<b>Mean, reduced to 32°, and Sea-level,.....</b>		= 29.977
Highest Reading, corrected for Index error, on the 25th,.....		= 30.082
Lowest Do. Do., on the 3 th,.....		= 29.127
Difference, or <b>Monthly Range,</b> .....		= 0.935

<b>S.-R. THERMOMETER,</b> (in shade, etc.), <b>Highest in Month,</b> (corrected for Index Errors), on the <u>16</u> th, .....	=	<u>75.0</u>
<b>Lowest in Month,</b> corrected for Index errors, on the <u>15</u> th, .....	=	<u>75.0</u>
Difference, or <b>Monthly Range,</b> .....	=	<u>50.0</u>
"Corrected <b>Mean</b> " of all the <b>Highest,</b> (Col. 5), .....	=	<u>58.7</u>
"Corrected <b>Mean</b> " of all the <b>Lowest,</b> (Col. 6), .....	=	<u>36.0</u>
Difference, or <b>Mean Daily Range,</b> .....	=	<u>22.7</u>
** Calculated <b>Mean Temperature</b> of Month, .....	=	<u>47.4</u>
 <b>S.-R. THERMOMETER, Black Bulb in Sun, Highest,</b> (corrected for Index Errors), on the      th, .....		
"Corrected <b>Mean,</b> " (Col. 7), <b>of Black Bulb, Max. in Sun,</b> .....	=	
 <b>Lowest at Night,</b> Black Bulb, (corrected for Index errors), on the      th, .....		
"Corrected <b>Mean,</b> " (Col. 8), <b>of Black Bulb, Min. on grass,</b> .....	=	
Difference of above Means or Range ("exposed"), .....	=	

<b>HYGROMETER, Mean</b> (corrected) A.M. and P.M. Reading of Dry		
<b>Bulb,</b> (Cols. 9 and 11),	=	49.1
<b>Mean</b> (corrected) A.M. and P.M. Reading of <b>Wet Bulb,</b> (Cols. 10 and 12),	=	46.8
‡ Computed <b>Temperature of Dew-Point,</b>	=	44.3
‡ Do. <b>Elastic Force of Vapour,</b>	=	292
‡ Do. <b>Weight of Vapour in a Cubic Foot of Air,</b> ...	=	
‡ <b>Relative Humidity,</b> (Saturation = 100),	=	84
<b>RAIN</b> fell on 4 Days; Amount in Inches,	0.94 =	0.94

WIND.		SUMMARY.									
Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	5	7		7	4		1	7			
P.M.	5	5	8	2	6	2	1	9			
Mean.	5	6	0	4	5	2	1	8	0		

Observations made and  
Return verified by

(Signed)



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

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An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-inches* are not true inches but so much shorter as to *compensate* the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and the surface 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 *back-screw* on this little piston-pod is brought, by the adjusting screw, *to a screw* fixed 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; a slight error here will vitiate the readings from the *remainder*.

When a Barometer, having a ivory peg, must be covered so as to form a tight plug to the cistern. Then *sew* up the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern 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 holding the instrument so that the mercury strikes the top of the tube, a *slight tap* is produced. If this is prevented by air it may be removed to the cistern, and got rid of by inverting the Barometer (care being taken to prevent the loss of mercury by tightening the ivory peg), and gently tapping it; and if this plan fails, the instrument must be repaired.

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

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

**Protection of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box painted white outside and inside, and fixed 4 feet above ground in an exposed position, free from merely local influences. The falls 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-balls, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the officers, Negretti and Zambra's Patent "Museum Thermometers" and Negretti and Zambra's Patent "Museum Hygrometers" are recommended; printed directions for their use may be obtained with each instrument. The "Museum Thermometer" of Rutherford is recommended when graduated on the glass stem and affixed to a frame separate from the "Museum." This Thermometer is liable to two demerits, both of which must be guarded against, and may be easily remedied by striking the instrument repeatedly against the palm of the hand; when part of the spirit discolors by high temperature, it will be found near the top of the tube, and must be discoloured from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments 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; for the sun's heat to affect the Minimum Thermometer by distillation.

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

The Hygrometer consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested* form of this apparatus seriously vitiate the "Hygrometrical Deductions," Observers are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side, and a little below the level of the wet bulb;—in no case under the bulbs;—the man 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 man is always *clean* and *moist*, and the water pure. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances. One form of the Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water-cup underneath. The 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 under, 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 40½°, 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 Self-registering 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 the difference between the lower strata of clouds overclouded, and to the direction of snow, etc.

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

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

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

**Snowfalls may, for convenience, be registered in the rain column, under the following circumstances:**—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 of the snow may have accumulated, and as a check upon the indications of the rain-gauge. For wind, rain, and snow, as is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge, 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 Lunt 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 *apparent* (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *clouds* column, though their appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky overhead is *half covered* by clouds, 5 is entered as the *observation*, and so on.

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," 2, W., (for example,) will indicate that the upper strata of clouds travel with *deterrae* velocity from S. W., and those in the lower regions from W., with one-third the (deterrae) speed of the former. Again, in the second "Cloud" column, an entry of 4, st., (sq.) 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 *cumulostratus* 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 continuing, extra sea observations might be taken for *other* great depths, noting always the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

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

**Ozone.**—Mention whether Schönbach's or Meißner's papers are used. The paper is annexed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3 P.M., as an ozone entry on the schedule, will indicate that the ozone paper is tinted as 3 on the scale, that the wind is from the N. W., and that its force on the scale 0–6 is "4 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 notes can be given by the forms 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 climatic 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 thermometer, thunder storms, and other remarkable falls of snow, hail, or rain, the hour of sunrise, and attempting their direction, as well as such notes on storms as have been admitted 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 observations, 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-marginal. Additional remarks may be made on the margin of the "Observations" in connection with the periodic return of the seasons, and possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would therefore 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 specified piece of ground or farm.

The Council recommend that rain-day observations be taken twice, on the 21st days of March, June, September and December.

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

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

(By Order) A. B.

Edinburgh, 10th November 1850.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland.

MR ALEXANDER BUCHAN,

To





SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gas and Lime Centre, County of Meriden, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea 17 miles.

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

During the MONTH of June 1871

The Hours of Observation are of Greenwich Time.

<b>BAROMETER,</b> "corrected Mean" at 9 A.M., <i>minus</i> the Correction <sup>††</sup>		=	29.607
for Temp. (Col. 2), = 29.674... - 0.67...		=	29.622
"Corrected Mean" of Barometer at 9 P.M., <i>minus</i> the Correction <sup>††</sup>		=	29.614
for Temp. (Col. 4), = 29.687... - 0.65...		=	30.24
<b>Mean at Station, corrected, and at 32°,.....</b>		=	29.918
Correction for height,	feet above Mean Sea-level,.....	=	
<b>Mean, reduced to 32°, and Sea-level,.....</b>		=	
Highest Reading, corrected for Index error, on the	1 <sup>st</sup> th., 30.041	30.041	
Lowest Do.	Do., on the 18 <sup>th</sup> , 29.092	29.171	
Difference, or <b>Monthly Range</b> ,.....			8.949

<b>S.-R. THERMOMETER</b> , (in shade, etc.), <b>Highest in Month</b> , (corrected for Index Errors), on the 17 <sup>th</sup> , .....	=	71.0
<b>Lowest in Month</b> , corrected for Index errors, on the 26 <sup>th</sup> , .....	=	30.0
Difference, or <b>Monthly Range</b> , .....	=	41.0
"Corrected <b>Mean</b> " of all the <b>Highest</b> , (Col. 5), .....	=	59.1
"Corrected <b>Mean</b> " of all the <b>Lowest</b> , (Col. 6), .....	=	41.3
Difference, or <b>Mean Daily Range</b> , .....	=	17.8
** Calculated <b>Mean Temperature</b> of Month, .....	=	50.2

<b>S.-R. THERMOMETER</b> , <b>Black Bulb in Sun</b> , <b>Highest</b> , (corrected for Index Errors), on the 17 <sup>th</sup> , .....	=	59.1
"Corrected <b>Mean</b> ," (Col. 7), of <b>Black Bulb. Max. in Sun</b> , .....	=	41.3
<b>Lowest at Night</b> , <b>Black Bulb</b> , (corrected for Index errors), on the 26 <sup>th</sup> , .....	=	30.0
"Corrected <b>Mean</b> ," (Col. 8), of <b>Black Bulb. Min.</b> on grass, .....	=	17.8
Difference of above Means or Range ("exposed"), .....	=	50.2

<b>HYGROMETER, Mean</b> (corrected) A.M. and P.M. Reading of <b>Dry Bulb</b> , (Cols. 9 and 11), .....	=	52.2
<b>Mean</b> (corrected) A.M. and P.M. Reading of <b>Wet Bulb</b> , (Cols. 10 and 12), .....	=	49.0
‡ Computed <b>Temperature of Dew-Point</b> , .....	=	45.7
‡ Do. <b>Elastic Force of Vapour</b> , .....	=	3.08
‡ Do. <b>Weight of Vapour in a Cubic Foot of Air</b> , ...	=	
‡ <b>Relative Humidity</b> , (Saturation = 100), .....	=	77
<b>RAIN</b> fell on 9. Days; Amount in Inches, .....	=	1.44

WIND.	SUMMARY.											
	Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	53	17	6	1	7							
P.M.	56	8	6	1	4							
Mean.	54	10	8	1	5	0						

Observations made and  
Return verified by

(Signed)

Alex<sup>r</sup> Macdonnell



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

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

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

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

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-inches* are not true inches but so much shorter as to *compensate* the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus, by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; its stem passes freely through the lid and case of the cistern. When the *water-tube* on this fixed glass-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 *erase* 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 *slight top* is produced. If this is prevented by an 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 perpendicularly, and exposed to neither the sun's direct rays nor the heat of a fire.

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

**Protection of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the boxes are arranged so as at once to "protect" the Thermometers and to allow a complete ventilation of the interior. The instruments are suspended on cross-laths, in the centre of the box, and face the door opening to the north. To accommodate a dial to situate the door opening to the north. To accommodate a dial to situate the door opening to the north. To accommodate a dial to situate the door opening to the north.

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

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

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

**Reading of the Thermometer.**—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite the tip of the index, or *column* of mercury. The readings ought to be taken to tenths of a degree, and noted in decimal figures, 40° 4, 40° 5, or 40° 6, according as it indicates a little under, an exact coincidence with, or a little over 40°; or 40° 1, 40° 2, or 40° 3, respectively. So also 40½°, and 40½°, more or less must be registered 40° 2 or 40° 3, and 40° 1 or 40° 3 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, in winter at least, the extremes may occur at any hour; and it is necessary to refer their occurrence to their proper meteorological day. In the Society's schedules, the indications registered on the 24 are those of a series of phenomena commencing at 9 p.m. on the 24, and extending till 9 p.m. on the 25.

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

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

The Council recommend that every observatory be furnished with a Hemispherical Cup Anemometer;—a self-registering instrument which shows the amount of Wind that passes in 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 unfavorable situations for observation and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexceptionable position for the rain-gauge; but in all cases the gauges 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-gauges 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, annexed 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 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 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," <sup>2</sup>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-half the (*extreme*) speed of the former. Again, in the second "Cloud column, an entry of <sup>2</sup>cu-st. (e.g.) will indicate that the higher regions are covered to the "amount" of 4 tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2 tenths by lower clouds of the *cumulo-stratus* kind.

**Sunshine.**—The number of hours in which objects in the sun's rays cast shadows, should be entered in the proj. or column. **Underground Thermometers.**—As the germination and health of crops and plants greatly depend on the temperature of the soil,—its amount and consistency,—the Council recommend that observations in this interesting department be made at 9 a.m., by thermometers placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and the stems above ground protected from the sun's rays and fitted with sloping iron 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 Schönböhm's or Mollat's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 a.m. and 9 p.m. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3<sup>xx</sup>, as an ozone entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0-6 is "4"; i.e., that it is *blowing fresh*.

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

**Remarks.**—The "Remarks" column is too narrow, but unavoidably so. Some of the most valuable observations that can be taken are those for which no rules can be given, nor hours assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and in use at Greenwich, and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, &c. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms of wind attaining their maximum, as well as such notes on storms as have been 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 incomplete, 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 *year day* observations be taken;—viz., on the 21st days of March, June, September, and December.

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

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

EDINBURGH. (By Order) A. B.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

FOREST TREES.	In Flower.	Leaf Buds First appear.	In Leaf.	Divested of Leaves.	CROPS, mentioning variety.	Sowing or Planting.	Appearing above Ground.	In Ear or Flower.	First Out or Raised.
Alder, . . . . .					Barley, . . . . .				
Ash, . . . . .					Bere or Bigg, . . . . .				
Beech, . . . . .					Oats, . . . . .				
Birch, . . . . .					Wheat, . . . . .				
Elm, . . . . .					Banns, . . . . .				
Larch, . . . . .					Pease, . . . . .				
Lime, . . . . .		8.	20		Potatoes, . . . . .				
Oak, . . . . .		20.	26		Turnips, . . . . .				
Scammore or Plane,					Rye Grass, . . . . .				

SHRUBS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe, generally.	MIGRATORY BIRDS.	First Arrival.	Departure.
Barberry, . . . . .	6	Apple, . . . . .			Cuckoo, . . . . .		
Bontree or Elder, . . . . .	4	Black Currant, . . . . .			Curlew, . . . . .		
Broom, . . . . .		Cherry, . . . . .			House-Swallow, . . . . .		
Hazel, . . . . .		Gean, . . . . .			Lapwing, . . . . .		
Hawthorn, . . . . .		Goscherry, . . . . .			Plover, . . . . .		
Holly, . . . . .		Peach, . . . . .			Sand-Martin, . . . . .		
Laburnum, . . . . .	12	Pear, . . . . .			Starling, . . . . .		
Lilac, . . . . .	4	Plum, . . . . .			Swan, . . . . .		
Mezerion, . . . . .		Strawberry, . . . . .			Rail or Corn Crake, . . . . .		
Mountain Ash or Rowan, . . . . .	4						
Red Flowering Currant, . . . . .							
Rhododendron Ponticum, . . . . .							
Whin, . . . . .							

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

EDINBURGH.

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland,

MR ALEXANDER BUCHAN,

76



Edinburgh June 1871

4 P. EDINBURGH 17 6



## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gordon Highlanders County of Shetland, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea 17 miles.  
Height of Cistern of the Barometer above Mean Sea-level 280 feet, above Ground \_\_\_\_\_ feet.  
During the MONTH of July 1877.  
The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.						
		9 h. A.M.		9 h. P.M.		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.C. Cap Anemometer.		No. of hours in which it fell.		9 A.M.		P.M.		9 h. A.M.										
		No.	Barometer.	No.	Barometer.	No.	Min.	No.	Min.	No.	Wet bulb.	No.	Wet bulb.	No.	Wet bulb.	No.	Wet bulb.	No.	Force.	No.	Force.	No.	Force.	No.	Force.	No.					Force.	No.	Force.	No.	Force.	
		inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.					inches.	inches.	inches.	inches.	inches.	inches.
		* No.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.					Barometer.	Barometer.	Barometer.	Barometer.	Barometer.	Barometer.
1	29.472	58	29.517	60	67	45	63	58	55	53	SW	S.																				1				
2	29.456	61	29.363	62	69	45	65	59	57	53	S.	SW.																				2				
3	29.271	59	29.268	60	61	46	57	54	55	52	SE.	SW.																				3				
4	29.275	58	29.367	61	68	42	63	58	56	54	SE.	S.																				4				
5	29.321	59	29.512	62	64	45	58	55	54	51	N.	SE.																				5				
6	29.572	58	29.467	60	69	42	59	55	56	54	SW.	S.																				6				
7	29.517	60	29.417	60	64	47	62	59	57	55	SE.	SE.																				7				
8	29.311	63	29.286	60	69	50	65	59	57	53	S.	S.																				8				
9	29.361	63	29.417	60	68	41	63	59	57	52	S.	SW.																				9				
10	29.462	62	29.514	61	68	50	66	59	54	53	S.	S.																				10				
11	29.522	63	29.517	61	66	48	64	59	53	51	S.	S.																				11				
12	29.476	59	29.417	60	69	40	65	60	52	50	S.	S.																				12				
13	29.344	61	29.311	63	69	45	64	59	61	59	S.	W.																				13				
14	29.414	64	29.412	62	74	52	68	63	61	58	SE.	S.																				14				
15	29.459	63	29.516	61	70	49	88	62	57	56	SW.	SE.																				15				
16	29.612	62	29.712	62	71	52	63	56	58	55	SW.	SE.																				16				
17	29.459	63	29.539	63	74	52	70	65	56	53	SW.	SW.																				17				
18	29.562	64	29.562	62	69	49	63	56	56	54	SW.	SE.																				18				
19	29.412	62	29.366	60	62	47	57	52	53	54	SE.	NE.																				19				
20	29.509	63	29.628	61	63	45	54	57	52	51	NW.	W.																				20				
21	29.420	59	29.266	61	60	47	59	56	58	56	SW.	SE.																				21				
22	29.445	59	29.114	61	68	41	63	58	54	52	SW.	SW.																				22				
23	29.159	58	29.216	61	67	47	57	55	55	54	N.	NE.																				23				
24	29.157	59	29.018	60	65	47	61	57	52	57	NE.	NW.																				24				
25	28.885	54	28.832	55	56	38	52	53	51	50	NE.	NW.																				25				
26	28.796	55	29.034	54	58	44	53	51	53	52	NE.	NE.																				26				
27	29.123	58	29.147	60	67	46	62	57	54	53	NW.	S.																				27				
28	29.420	59	29.420	59	65	41	60	57	54	53	SE.	SW.																				28				
29	29.439	60	29.373	58	68	42	63	58	55	54	SW.	NE.																				29				
30	29.271	59	29.417	60	67	50	58	57	57	55	SE.	SE.																				30				
31	29.572	58	29.610	59	67	43	62	58	50	49	NW.	S.																				31				
Sums.		29.514	1803	29.552	1769	2052	1414	1909	1761	1719	1652																									
Means.		29.663	58.0	29.572	57.2	66.4	45.7	64.8	57.7	55.8	53.9																									
† Total Corrections for Instrumental Errors.																																				
‡ Corrections for Diurnal Range.																																				
“Corrected Means.”																																				
No. of Columns.		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  $\uparrow$  for Temp. (Col. 2), = 29.277  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction  $\uparrow$  for Temp. (Col. 4), = 29.282  
Mean at Station, corrected, and at 32°, = 29.280  
Correction for height, feet above Mean Sea-level, = 300  
Mean, reduced to 32°, and Sea-level, = 29.580  
Highest Reading, corrected for Index error, on the 16 th, = 29.712  
Lowest Do. Do., on the 26 th, = 28.796  
Difference, or Monthly Range, = 0.916

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 17 th, = 74.0  
Lowest in Month, corrected for Index errors, on the 14 th, = 38.0  
Difference, or Monthly Range, = 36.0  
"Corrected Mean" of all the Highest, (Col. 5), = 66.2  
"Corrected Mean" of all the Lowest, (Col. 6), = 45.7  
Difference, or Mean Daily Range, = 20.5  
\*\* Calculated Mean Temperature of Month, = 56.0  
S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the \_\_\_\_\_ th, = \_\_\_\_\_  
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = \_\_\_\_\_  
Lowest at Night, Black Bulb, (corrected for Index errors), on the \_\_\_\_\_ th, = \_\_\_\_\_  
"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass, = \_\_\_\_\_  
Difference of above Means or Range ("exposed"), = \_\_\_\_\_

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 58.4  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 55.3  
Computed Temperature of Dew-Point, = 52.5  
Do. Elastic Force of Vapour, = 396  
Do. Weight of Vapour in a Cubic Foot of Air, = \_\_\_\_\_  
Relative Humidity, (Saturation = 100), = 81  
RAIN fell on 19 Days; Amount in Inches 3.60

WIND.		SUMMARY.									
Direction.	Force.	N	NE	E	SE	S	SW	W	NW	Mean Force.	Mean Velocity in miles per day.
A.M.		1	3		7	7	9	1	3		
P.M.		4			7	10	6	2	2		
Mean.		1	3	0	7	8	8	2	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 3d; those from Other Places, not later if possible than the 6th. This Schedule not to be Gunned or Fastened, and Forwarded by Book Post, prepaid.

Observations made and  
Return verified by

(Signed)

*Alex Macdonald*



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 suns, 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 cases, may find this impossible; in such instances they are specially requested to mark opposite every reading at what time it was taken, if not at 9 o'clock.

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

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

An excellent Barometer is constructed by Mr. Adie of London, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-inches* are not true inches but so much shorter as to *compensate* the error that would otherwise arise from the fluctuations of the surface of mercury in the cistern. This form of instrument has been adopted by the Board of Trade, and has received the approval of the Meteorological Committee of the British Association. In another form of the Barometer, the sides of the *cistern* are of leather, and thus by aid of a screw acting on the bottom, the surface of the contained mercury can be adjusted to the *zero-point* of the fixed scale; their coincidence being indicated by a little ivory float, whose stem passes freely through the lid and case of the cistern. When the *back-screw* on this little piston-pool 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. The ivory peg must be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. The ivory peg must be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern.

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

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

**The Hygrometer** consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-tested* form of this apparatus seriously vitiate the "*Hygrometrical Deductions*," Observers are specially requested to attend to the following conditions:—The bulbs must *hang down* by at least an inch free from the scales and frame to which they are attached;—the frame must be such as will bring the tubes forward by an inch, from any board on which it may be suspended; the water-cup must be covered, and placed to the side and a little below the level of the wet bulb; in no case under the bulb;—the man must be of medium height, and inserted 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 man is always *clean* and *moist*, and the water pure. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances. One form of "*Mason's*" Hygrometer is highly objectionable. The frame of the water-cup underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the *frontenational* 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°·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 read their observations for their proper meteorological *day*. In the Society's schedules, the indications registered on the 24 are those of a series of phenomena, commencing at 9 P.M. on the 24, and extending till 9 P.M. on the 30.

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

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

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

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

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

**Clouds.**—Convenient abbreviations for Luke Howard's nomenclature of clouds will be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky overhead (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the "*clouds*" column, though their appearances and changes 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 "*Clouds*" column, an entry of 4½, (*e.g.*) will indicate that the higher regions are covered to the "*amount*" of 4-tenths with *strata* 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 20th, 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 Schwabe's or Meissner's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3°·, as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0–6 is "4½," i.e., that it is *blowing fresh*.

**Electricity.**—Too much importance cannot be attached to 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 will be sent at Greenwich, and Southern, are given in the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, &c. Remarks ought to be made on the occurrence of meteors, aurora borealis, remarkable depressions and elevations of the barometer, thunder storms, and remarkable falls of snow, hail, or rain, the hour of storms, of wind attaining their maximum, as well as such notes on storms as have been 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.

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-marginal. Additional remarks may be made on the margin.

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

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

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

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

EDINBURGH.

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

MR ALEXANDER BUCHAN,





# SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at *Long Castle Gardens*, County of *Argyll*, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea *17* miles.  
 Height of Cistern of the Barometer above Mean Sea-level *280* feet, above Ground \_\_\_\_\_ feet.  
 During the MONTH of *August* 187*1*.  
 The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.		SELF-REGISTERING THERMOMETERS. Read Daily, at 9 P.M.				HYGROMETER.				WIND.				RAIN.		CLOUDS.		THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.					
		9 h. A.M.		9 h. P.M.		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.		9 h. A.M.											
		Barometer.	Attached Thermometer.	Barometer.	Attached Thermometer.	Max.	Min.	Max. in Sun or Shade.	Min. on Grass.	Dry bulb.	Wet bulb.	Dry bulb.	Wet bulb.	Direction.	Force.	Direction.	Force.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	Velocity (0-10), and Direction.	Amount (0-10), and Species.	No. 1.					No. 2.	No. 3.			
		No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.					No.	No.	No.		
		inches.		inches.																											
	1	29.6058	29.617	59	69	37				67	60	56	54	SW	SE			Cu	Cu						Very fine throughout	1					
	2	29.60963	29.596	63	76	46				66	61	63	60	SE	SW			Cu	Cu						Line	2					
	3	29.15963	29.150	63	65	55				60	58	59	57	S	S			Cu	Cu						overcast and windy	3					
	4	29.15062	29.150	62	66	45				65	60	53	50	S	N.W.			Cu	Cst						overcast a.m. fine bright in P.M.	4					
	5	29.15058	29.150	64	70	42				55	53	65	58	SE	S.W.			Vi	Cu						Line	5					
	6	29.15061	29.150	63	76	49				69	64	67	65	S.W.	SE			Cu	Cu						Very fine	6					
	7	29.16462	29.174	63	78	42				72	66	64	61	SE	SE			Cu	Cu						very fine	7					
	8	29.15867	29.174	61	75	51				73	68	59	58	SW	SW			Cu	Cu						very fine throughout	8					
	9	29.15465	29.150	69	81	49				74	68	64	61	S	S			Cu	Cu						Excessive heat	9					
	10	29.17136	29.150	67	77	48				73	67	69	66	S	S			Cu	Cu						very warm and fine	10					
	11	29.17067	29.150	70	79	57				69	64	65	63	SE	S			Cu	Cu						warm and very fine	11					
	12	29.15966	29.158	68	76	50				70	65	60	59	S	S			Cu	Cu						warm (and fine)	12					
	13	29.14567	29.145	67	76	43				69	62	60	58	S	S			Cu	Cu						very fine	13					
	14	29.14159	29.150	67	73	39				67	61	62	60	S	S			Cu	Cu						very fine	14					
	15	29.17000	29.150	66	71	46				59	55	59	56	N.W.	SE			Cst	Cst						slightly overcast	15					
	16	29.17060	29.170	60	61	58				59	55	57	55	SE	SE			Cst	Cst						overcast and thin rain	16					
	17	29.19561	29.150	60	62	52				59	58	57	55	SE	SE			Vi	Cst						overcast a.m. fine P.M.	17					
	18	29.18360	29.150	63	62	52				58	57	58	52	SE	S			Vi	Cu						showery throughout	18					
	19	29.14160	29.150	58	65	52				60	55	49	46	SE	S.W.			Cu	Cu						changeable overcast and sun at times	19					
	20	29.16458	29.150	56	69	35				59	55	54	52	SE	SE			Cu	Vi						heavy rain throughout	20					
	21	29.14157	29.150	55	62	40				52	50	45	44	N.W.	N.W.			Cu	Cu						changeable sea and showers	21					
	22	29.16454	29.150	54	67	35				61	53	55	53	SE	N.W.			Cu	Cst						changeable	22					
	23	29.17153	29.150	56	68	47				58	54	55	53	SE	SE			Cu	Cst						overcast	23					
	24	29.14954	29.150	59	59	45				56	54	58	53	SE	SW			Vi	Cst						rain throughout	24					
	25	29.18856	29.150	58	65	48				57	54	59	59	W	W			Cu	Cu						windy and fine	25					
	26	29.19157	29.150	56	60	40				57	54	58	50	SE	SW			Vi	Cst						changeable sun and showers	26					
	27	29.18756	29.150	57	67	43				56	55	59	57	SE	N.W.			Vi	Cst						Line	27					
	28	29.15560	29.150	60	70	48				64	59	53	52	S	S			Cu	Cu						very fine	28					
	29	29.17454	29.150	59	68	36				62	59	55	54	SE	S			Cu	Cu						very fine	29					
	30	29.18955	29.150	60	60	42				58	53	56	55	S	SE			Cu	Cu						Bright sun and wind	30					
	31	29.15056	29.150	60	74	49				57	56	56	55	SE	SE			Cst	Cu						Line	31					
Sums.		1712.11	1735.11	1735.11	1735.11	1735.11				1735.11	1735.11	1735.11	1735.11	1735.11	1735.11	1735.11	1735.11	1735.11	1735.11	1735.11	1735.11	1735.11	1735.11	1735.11	1735.11						
Means.		29.637	29.637	29.637	29.637	29.637				29.637	29.637	29.637	29.637	29.637	29.637	29.637	29.637	29.637	29.637	29.637	29.637	29.637	29.637	29.637	29.637						
Total Corrections for Instrumental Errors.																															
Total Corrections for Diurnal Range.																															
Corrected Means.																															
No. of Column.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30

NOTATION USED IN GENERAL REMARKS.

a. denotes aurora.

ci. cirrus.

ci-cu. cirro-cumulus.

ci-s. cirro-stratus.

cu. cumulus.

cu-s. cumulo-stratus.

d. dew.

f. fog.

fr. frost.

h. hoar-frost.

h. d. hoary dew.

h. l. hail.

li. lightning.

li. cl. light clouds.

li. sh. light showers.

lu. co. lunar corona.

lu. ha. lunar halo.

m. denotes meteor.

ms. meteors.

n. nimbus.

r. rain.

h. r. heavy rain.

c. h. r. continued heavy rain.

s. stratus.

sc. scud.

sl. sleet.

sn. snow.

so. lu. solar halo.

sq. squall.

sgs. squalls.

t. thunder.

ts. thunder storm.

w. wind.

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

1

2

3

4

5

6

Calm

Very light air

Light air

Light breeze

Fresh breeze

Very fresh

Blowing hard

Blowing a gale

Violent gale

BAROMETER, "corrected Mean" at 9 A.M., minus the Correction ++ for Temp. (Col. 2), = *29.627* ... *52.5*  
 "Corrected Mean" of Barometer at 9 P.M., minus the Correction ++ for Temp. (Col. 4), = *29.550* ... *50.0*  
 Mean at Station, corrected, and at 32°, = *29.512*  
 Correction for height, feet above Mean Sea-level, = *280*  
 Mean, reduced to 32°, and Sea-level, = *29.860*  
 Highest Reading, corrected for Index error, on the *20* th, = *30.150*  
 Lowest Do. Do., on the *20* th, = *28.700*  
 Difference, or Monthly Range, = *1.450*

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the *9* th, = *81.0*  
 Lowest in Month, corrected for Index errors, on the *20* th, = *35.0*  
 Difference, or Monthly Range, = *46.0*  
 "Corrected Mean" of all the Highest, (Col. 5), = *69.3*  
 "Corrected Mean" of all the Lowest, (Col. 6), = *45.7*  
 Difference, or Mean Daily Range, = *23.6*  
 \*\* Calculated Mean Temperature of Month, = *57.5*  
 S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the \_\_\_\_\_ th, = \_\_\_\_\_  
 "Corrected Mean" (Col. 7), of Black Bulb, Max. in Sun, = \_\_\_\_\_  
 Lowest at Night, Black Bulb, (corrected for Index errors), on the \_\_\_\_\_ th, = \_\_\_\_\_  
 "Corrected Mean" (Col. 8), of Black Bulb, Min. on grass, = \_\_\_\_\_  
 Difference of above Means or Range ("exposed"), = \_\_\_\_\_

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = *60.4*  
 Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = *57.2*  
 Computed Temperature of Dew-Point, = *54.4*  
 Do. Elastic Force of Vapour, = *424*  
 Do. Weight of Vapour in a Cubic Foot of Air, = \_\_\_\_\_  
 Relative Humidity, (Saturation = 100), = *81*  
 RAIN fell on *10* Days; Amount in Inches, = *1.87*

WIND.		SUMMARY.	
Direction.	N N E E S S W W N W	Calms or Variable.	Mean Force.
A.M.			
P.M.			
Mean.			

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

Observations made and Return verified by \_\_\_\_\_

(Signed) *W. Macdonald*



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

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

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

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

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

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

**Protection of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from merely local influences. The laths forming the sides and doors of the Boxes are arranged so as to protect the Thermometers, and to allow a complete ventilation of the interior. The instruments are suspended on cross-sticks, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians *Self-registering Thermometers*—Professors Phillips, and Negretti and Zamboni Patent *Maximum* Thermometers are recommended; printed directions for their use may be obtained with each instrument. The *Minimum* Thermometer of Huthford 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-ventilated by striking the instrument repeatedly against the palm of the hand; when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be discoloured from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

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

Observations of the clouds are made at 9 a.m. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity 6, S. W." (for example), will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (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.

**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 consistency,—the Council recommend that observations in this interesting department be made at 9 a.m., by thermometers placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and the stems above ground protected from the sun's rays, and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames. Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

**Temperature of Wells.**—The temperature of the water at the bottoms of wells ought, when practicable, to be taken, and the depth of the well and of the water noted. **Season.**—Mention whether Schomburgk's or Mörke's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 a.m. and 3 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>1</sup>/<sub>2</sub>, as an *east* entry in the schedule, will indicate that the zone paper is tilted as "3" on the scale, that the wind is from the N.W., and that its force on the scale 0—6 is "4"; i.e., that it is blowing fresh.

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

**Remarks.**—The "Remarks" column is too narrow, but unfortunately so. Some of the most valuable observations that can be taken are those for which no space can be given nor signs assigned. The use of contractions ought, therefore, to be taken every advantage of, and a list of such as are recognised and suggested (Greenwich and Southampton), are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given to this column to prevalent diseases, affections in characters, colour, velocity, and direction of winds, the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of *deposits*, *foggy mornings*, remarkable *depressions*, and *clearings* of the thermometer, of storms, and remarkably *fine* of sunny, hail, or rain, the hour of setting and retreating of the moon, as well as such other phenomena as have been mentioned above. When *foggy* thick, 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 3 p.m. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purpose, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner on the side 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 *per farm*.

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

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

(By Order) A. B.

Edinburgh, 19th November 1850.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

SIMULS, ETC.	First in Blossom.	FRUITS.	First in Blossom.	Fruit Ripe generally.	REPTILES AND BIRDS.	First Captured.	Departure.
Barberry, . . . . .		Apple, . . . . .			Cuckoo, . . . . .		
Bountree or Elder, . . . . .		Black Currant, . . . . .			Gull, . . . . .		
Broom, . . . . .		Cherry, . . . . .			House-Swallow, . . . . .		
Hazel, . . . . .		Glean, . . . . .			Lapwing, . . . . .		
Hawthorn, . . . . .		Gross-berry, . . . . .			Plover, . . . . .		
Holly, . . . . .		Peach, . . . . .			Sand Martin, . . . . .		
Jaburum, . . . . .		Pear, . . . . .			Starling, . . . . .		
Lilac, . . . . .		Plum, . . . . .			Swan, . . . . .		
Mezerion, . . . . .		Strawberry, . . . . .			Rail or Corn Crake, . . . . .		
Mountain Ash or Rowan, . . . . .							
Red Flowering Currant, . . . . .							
Rhododendron Ponticum, . . . . .							
Whin, . . . . .							

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

Handwritten notes and stamps on the back of the document, including a date stamp "August 1871" and a signature "J. Buchanan".







WITH REMARKS ON THE USE OF INSTRUMENTS.

from radiation during night. The sun's rays have a direct action on the ink which may easily be made, or hardened, by the application of a mixture of lamp black and printer's ink. They are placed in shallow blackened boxes, whose sides protect the brails 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. Show must not be allowed to cover either of these Thermometers; nor the sun's heat to affect the Minimum Thermometer by dissipation.

*Verification of the Thermometers.*—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers are not *Standard* 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 zero-point of each Thermometer (marked by a scratch on

the tibia) ought to be tested once a year, in snow or mending time. For comparison of Thermometers a properly tested thermometer may be laid, on loan, by any observer, from the Meteorological Secretary.

The *Thermometer* consists of two Thermometers usually, but not necessarily, mounted on one frame. As apparently slight deviations from the approved and *well-defined form* of this apparatus seriously vitiate the “Geometrical Deductions,” Observers are specially requested to attend to the following particulars:—The bulbs must *long* 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; the vane-cup must be covered on which it may be suspended; the bulb must be of the *wide bulb*,—in no case under the bulbs;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean* and *moist*, and that

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 thermometer is used, to prevent the formation of a film of ice on the bulb, which would obstruct observation. From the film of ice thus formed evaporation must proceed as from the moist cloth in ordinary circumstances.

The form of "Maxson's" Hygrometer is highly objectionable. The frame of the Thermometers is enclosed in a tin case, which also supports the water up underneath. This arrangement must be immediately altered by pulling the boxwood frame out of the tin case, and hanging them side by side, so that the frame-enclosed thermometers shall be compelled with air as possible.

*Reading of the Thermometer*.—Great care must be taken to avoid the effects of refraction, by bringing the eye exactly opposite to the tip of the index, or column of mercury. The readings on the tip of the index, or column of mercury. The readings ought to be taken to tenths of a degree, and noted in decimals.

This the Thermometer will be read— $39^{\circ}.9$ ,  $40^{\circ}.0$ , or  $40^{\circ}.1$ —and not  $39^{\circ}.9$ ,  $40^{\circ}.0$ , or  $40^{\circ}.1$ , according as it indicates a falling, a rising, an exact coincidence with, or a little over  $40^{\circ}$ , or  $40^{\circ}.1$ , respectively. In exact coincidences with, or a little over or less must be respectively  $40^{\circ}.2$ , or  $40^{\circ}.3$ , and  $40^{\circ}.7$  or  $40^{\circ}.8$  respectively. In readings below  $40^{\circ}$ , the *"Max"* and the *"Min"* Thermometers, that reading below  $40^{\circ}$  is the *"Max"* 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, and, 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 *pd* are those of a series of phenomena commencing at 9 P.M. on the 24<sup>th</sup>, and extending till 9 P.M. on the 26<sup>th</sup>.

*Wind.*—A wind-gauge 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, the lower strata of clouds overhead, and to the direction of snole, etc.

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

The Council recommended that every observation be furnished to the Council, *in person*, or by a self-record.

ing instrument which shows the amount of Wind that passes over a given space in a given time, is called a *Wind gauge*, or *anemometer*; the instrument which shows the velocity of the Wind at the time of day; from which 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, *Smith's Anemometer* is also very recommended; the method of *Estimating* Wind-moment is also very recommended; the method of *Estimating* Wind-Force by such tables as that given in the schedule is, to say the least, unsatisfactory. Many causes conspire to produce anomalies in rain returns. They arise partly from unfavorable situations for observation, and partly from the defective nature of the instruments used. It is, indeed, difficult to obtain an unexpected position for the rain-gauge; but in all cases the gauge must be sunk in the ground till its edges are on a level with the close cut grass around its mouth. The rain-gauge ought to be read daily, and the readings entered in the returns on the day on which the rain fell. *For convenience*, he registered in the rain columns, under the following contents:—when a Show shower occurs it must be noted in the "Remarks." The letter S affixed to the depth of water received in gauges. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as indicated in every column, the observer cannot be too careful to record (*showers observations only*), mentioning that particles of the

*Clouds*.—Convenient abbreviations for Luke Howard's

amounts of clouds will be found on the olive scale. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky *overcast* (4), within 20° or 30° of the zenith. The strata of clouds that appear near the horizon are viewed obliquely; and thus, being seen through the horizon, we ought not to take account of the thickness of their amount, we ought not to take account of the *cloud* column, though the clouds are *seen* and changes ought to be noted among 6 or 10; thus, when the sky *overcast* is *half* overcast, the clouds are 5 or 10; thus, when the sky *overcast* is *half* overcast, the clouds are made at 9, a.m. and at sunset.

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

**2-Genius** Bower clones of the *cineraria* species.

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

**Underground Thermometers**.—As the germination of the seed of crops and plants greatly depend on the temperature of the soil, its amount and constancy, the Council requires that observations in this interesting department be made at 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 110, 120, and 22 inches, and the stems above ground protected from the sun's rays, and filled with stopping like cotton or paper, water being conveyed to the bulbs by the system of siphon frames.

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

*Temperature of the sea.*—The sea is not only in itself, but in its relations to that of the atmosphere, a very important branch of Meteorology. The Commaire therefore recommends that the temperatures of the sea be everywhere taken by a properly constructed apparatus, from the surface of the water to the bottom, at the distance of 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, and 200 fathoms, the thermometer ought to be suspended by a line of 15 fathoms, and after ten minutes observation, drawn up and read. When convenient, extra sea observations might be taken for other and greater depths, nothing always being neglected for the temperature of the air, and the hour of observation; and continuing to observe for particular depths.

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

*Ozone*—Mention whether Scholten's or Norton's papers are used. The paper is affected by a pin to a board in the three corners of the box, and the indications registered at 9 a.m. and 9 p.m. are noted. The paper is then placed in a box, and the wind is noted on a note-book, and the indications registered at 9 a.m. and 9 p.m. It is desired that these indications be registered in correct order with the force and direction of the wind at the time of observation, in the following manner:—thus 8 N.W., as an *example* entry in the record book, 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 was 8. On the scale 0—6 is '4'; i.e., that it is *blowing fresh*.

*Electricity*—To much insurance cannot be attached to

*Remarks*—The "Remarks" column is too narrow, but unavoidably so. Some of the most valuable observations that can be given on storms assigned, taken are those for which no tables can be given nor hours assigned. The use of contractions is ought, therefore, to be taken over all ranges of, and a list of such as are recognized and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the winds, and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of meteors, aurora borealis, and other such phenomena.

Remarks, depressions and elevations of the barometer, storms of wind attaining their maximum, as well as such other phenomena as may be observed, and which are not on storms as have been hinted at above. When told by the observer, in the vicinity of an Observatory, the height of clouds and the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M., and 1 P.M. ought to be registered, either in two columns, either in one, and in two mild of for the purpose, from that wise unoccupied, or in two mild of for the purpose, from that intended "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 of considerable interest to the Agriculturist. The Council would therefore the special attention of the Observers to the registration of such

phenomenon; 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 *twelve day* observations be taken, — viz., on the 21st days of March, June, September, and Decem-

Full decades past, and these men above have once primed; and may be had along with them from the markets.

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

(By Order) A. B.

omenclature 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 their amount, we ought not to take them into account in the *cloud* column, though their appearance and changes ought to be noted among the *Remarks*. The amount of cloud is entered on a scale of 0 to 10; thus, when the sky *overhead* is *half* covered by clouds, 5 is entered as the *observation*; and so on. Observations of the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction,"  $\frac{2}{6}$ ,  $\frac{W}{S}$ , (for example,) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W.; and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of  $\frac{2}{4}$ ,  $\frac{ci-st.}{4}$ , (*eg.*) will indicate that the higher regions are covered to the "amount" of 4-tenths with *stratus* clouds; and that the sky is further obscured to the extent of 2-tenths by lower clouds of the *cumulo-stratus* kind. *Remarks*.—The number of hours in which objects in the sun's surface shadows should be entered in the proper column.

*Thermopod thermometer*.—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 soil-thermometers in this interesting department be made at 9 a.m., by observers placed in the sun, their bulbs being sunk to 3, 6, 9, 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. Attention must be made of the geological formation and agricultural condition of the soil in which these thermometers are placed.

*Temperature of the sea.*—The sea is not only in itself, but in its relations to that of the atmosphere, a very important branch of Meteorology. The Comma-nders of our ships have been ever since the beginning of the century, therefore recommended that the temperatures of the sea be carefully taken by a properly constructed apparatus, from the surface of piers and rocks round the coast, where it is not influenced by the current of river water. At or near the time of high water, on the 1st, 15th, and 27th of each month, the thermometer ought to be sunk exactly six feet (one fathom), and after ten minutes observation 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.

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*Ozone*—Mention whether Scholten's or Norton's papers are used. The paper is affected by a pin to a board in the three corners of the box, and the indications registered at 9 a.m. and 9 p.m. are noted. The paper is then placed in a box, and the wind is noted on a note-book. It is desired that these indications be registered in a column and in rows, with the force and direction of the wind at the time of observation, in the following manner—thus 8 N.W., as an *example* entry in the column, will indicate that the ozone paper is fitted as 8 g. in the schedule, that the wind is from the N.W., and that its force was 8. The wind is then noted in the column, and the force is noted on the scale 0—6 is 10, i.e., that it is *blowing fresh*.

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*Remarks*—The "Remarks" column is too narrow, but unavoidably so. Some of the most valuable observations that can be given on storms assigned, taken are those for which no tables can be given nor hours assigned. The use of contractions is ought, therefore, to be taken over all ranges of, and a list of such as are recognized and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the winds, and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of meteors, aurora borealis, and

Remarks, depressions and elevations of the barometer, storms of wind attaining their maximum, as well as such other phenomena as may be observed, and which are not on storms as have been hinted at above. When told by the observer, in the vicinity of an Observatory, the height of clouds and the snow-line in winter ought to be recorded.

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

Full decades past, and these men above have seen primacy; and may be had along with them from the makers.

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

(By Order) A. B.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

little crops of grain than for the past 15 years - Turnip good. Hay poor. Potatoes fine in quality and crop, but disease, galling ground, weather unfavorable for becoming the corn crops, little or none in stackyard up to this time,

EDINBURGH.

General Post Office Buildings,

Secretary of the Meteorological Society of Scotland,

MR ALEXANDER BUCHAN,

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SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Lawrence Bay Station, County of Aberdeen, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea 17 miles.

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

During the MONTH of October 1871.

The Hours of Observation are of Greenwich Time.

<b>BAROMETER,</b> "corrected Mean" at 9 A.M., <i>minus</i> the Correction <sup>††</sup>	=	29.505
for Temp. (Col. 2), = 29.554 - .054		
 "Corrected Mean" of Barometer at 9 P.M., <i>minus</i> the Correction <sup>††</sup>	=	29.544
for Temp. (Col. 4), = 29.599 - .055		
 <b>Mean at Station, corrected, and at 32°;</b> .....	=	29.524
 Correction for height,                      feet above Mean Sea-level,.....	=	307
 <b>Mean, reduced to 32°, and Sea-level;</b> .....	=	29.631
 Highest Reading, corrected for Index error, on the / th,.....	=	30.000
Lowest                      Do,                      on the 10 th,.....	=	28.980
 Difference, or <b>Monthly Range,</b> .....	=	1.110

<b>S.-R. THERMOMETER</b> , (in shade, etc.), <b>Highest in Month</b> , (corrected for Index Errors), on the <u>3</u> th, .....	=	<u>61.8</u>
<b>Lowest in Month</b> , corrected for Index errors, on the <u>10</u> th, .....	=	<u>24.0</u>
Difference, or <b>Monthly Range</b> , .....	=	<u>37.8</u>
" <b>Corrected Mean</b> " of all the <b>Highest</b> , (Col. 5), .....	=	<u>54.0</u>
" <b>Corrected Mean</b> " of all the <b>Lowest</b> , (Col. 6), .....	=	<u>36.1</u>
Difference, or <b>Mean Daily Range</b> , .....	=	<u>17.9</u>
** Calculated <b>Mean Temperature</b> of Month, .....	=	<u>45.9</u>

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

<b>HYGROMETER, Mean</b> (corrected) A.M. and P.M. Reading of <b>Dry Bulb</b> , (Cols. 9 and 11), .....	=	46.4
<b>Mean</b> (corrected) A.M. and P.M. Reading of <b>Wet Bulb</b> , (Cols. 10 and 12), .....	=	44.7
# <b>Computed Temperature of Dew-Point</b> , .....	=	42.8
# <b>Do. Elastic Force of Vapour</b> , .....	=	.275
# <b>Do. Weight of Vapour in a Cubic Foot of Air</b> , ...	=	
# <b>Relative Humidity</b> , (Saturation = 100), .....	=	88
<b>RAIN</b> fell on <sup>12</sup> Days; Amount in Inches, .....	=	4.530

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		8	4	12		6			
P.M.				10	3	10		8			
Mean.	1	0		09	4	11	0	6			

Colr 1, and 3. ~~has~~ <sup>has</sup> not been reduced but ~~and~~ shows the actual reading <sup>and</sup>

Observations made and  
Return verified by

(Signed)

Key McDonald



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

One of the objects of immediate importance that the Scottish Meteorological Society has proposed to itself is to secure a *periodical 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 incomprehensible, 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, it 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 independent 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, 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 liquid scale-mercury can be adjusted to the *zero-point* of the fixed scale; their coincidence being indicated by a little ivory hair, 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 *index* must be set in its position, and the ivory peg, and gently tapping it; and if this setting must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *vernier*.

When a Barometer having adjustable surfaces has to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *screw up* the mercury to within a quarter of an inch of the top of the tube, and take down the instrument; it may then be carried with the cistern uppermost. Before suspending the Barometer for use, it must be ascertained whether the space above the mercury in the tube is a complete vacuum; this is the case when, on holding 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 *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 feet from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

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

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

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

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

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

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

One form of "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°, or 40¾°. So also 40½°, and 40¾°, more or less must be respectively 40°·2, or 40°·3, and 40°·7, or 40°·8 respectively. In reading Rutherford's "Min." and "Max." Thermometers, the reading 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 really affected by heat from the person of the observer.

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

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

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

The Council recommend that every observatory be furnished with a Hemispherical Cup Anemometer;—a self-registering instrument which shows the amount of Wind that passes it per day, from which also the Velocity of the Wind at the time of observation may be ascertained. For indicating the force of the Wind, at any particular hour of observation, Lind's Anemometer is also recommended; the method of *Estimating* Wind Force by such scales 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 unknown 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 noted 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 may be found on the other side. The amount of cloud in the atmosphere ought to be estimated from the greater or less obscuration of the sky *overhead* (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *clouds* column, though their appearances and changes ought to be noted among the "Remarks." The amount of cloud is entered from a scale of 0 to 10; thus, when the sky *overhead* is *half covered* by clouds, 5 is entered as the *observation*, and so on.

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction," 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 that (extreme) speed of the former. Again, in the second "Cloud" column, an entry of 4, st., (sq.) will indicate that the higher regions are covered to the "amount" of 4-tenths with *strata* 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 climate, 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 Schönbein's or Meffert's papers are used. The paper is affixed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus 3½%, as an ozone entry in the schedule, will indicate that the ozone paper is tinted as "3" on the scale 0-6 is "4" to "4½," 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 recognized and in use at Greenwich, and Southampton, are given at the foot of the column. Besides special and extraordinary observations great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity and direction between the lower and upper strata of clouds, the colour of the sky, &c. Remarks on 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 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 selected piece of ground or farm.

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

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

(By Order) A. B.

Enslinman, 20th November 1892.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

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



# SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Gardens Cluny Castle, County of Aberdeen, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea 17 miles.

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

During the MONTH of November 1871

The Hours of Observation are of Greenwich Time.

<b>BAROMETER,</b> “corrected Mean ” at 9 A.M., <i>minus</i> the Correction $\uparrow$ )		=	29.640
for Temp. (Col. 2), = 29.676. — 0.036 }			
“Corrected Mean ” of Barometer at 9 P.M., <i>minus</i> the Correction $\uparrow$ )		=	29.660
for Temp. (Col. 4), = 29.692 — 0.032 }			
<b>Mean at Station, corrected, and at 32°,</b> .....		=	29.650
Correction for height,                      feet above Mean Sea-level,.....		=	3.3
<b>Mean, reduced to 32°, and Sea-level,</b> .....		=	29.963
Highest Reading, corrected for Index error, on the 5 <sup>th</sup> ,.....		=	30.019
Lowest	Do.                      Do,                      on the 8 <sup>th</sup> ,.....	=	28.959
Difference, or <b>Monthly Range,</b> .....		=	1.060

<b>S.-R. THERMOMETER,</b> (in shade, etc.), <b>Highest in Month,</b> (corrected for Index Errors), on the 14 <sup>th</sup> .....	50.0	=	49
<b>Lowest in Month,</b> corrected for Index errors, on the 19 <sup>th</sup> .....	18.0	=	18
Difference, or <b>Monthly Range,</b> .....	32.0	=	31
"Corrected <b>Mean</b> " of all the <b>Highest,</b> (Col. 5), .....	41.2	=	41
"Corrected <b>Mean</b> " of all the <b>Lowest,</b> (Col. 6), .....	28.6	=	31
Difference, or <b>Mean Daily Range,</b> .....	12.6	=	10
** Calculated <b>Mean Temperature</b> of Month, .....	34.9	=	44
 <b>S.-R. THERMOMETER, Black Bulb 'in Sun, Highest,</b> (corrected for Index Errors), on the      th, ... =			
"Corrected <b>Mean,</b> " (Col. 7), of <b>Black Bulb, Max. in Sun</b> .....		=	
<b>Lowest at Night,</b> Black Bulb, (corrected for Index errors), on the      th, ... =		=	
"Corrected <b>Mean,</b> " (Col. 8), of <b>Black Bulb, Min.</b> on grass, .....		=	
Difference of above Means or Range ("exposed"), .....		=	

<b>HYGROMETER, Mean</b> (corrected) A.M. and P.M. Reading of <b>Dry Bulb</b> , (Cols. 9 and 11), .....	=	86.2
<b>Mean</b> (corrected) A.M. and P.M. Reading of <b>Wet Bulb</b> , (Cols. 10 and 12), .....	=	85.0
‡‡ Computed <b>Temperature of Dew-Point</b> , .....	=	73.2
‡‡ Do. <b>Elastic Force of Vapour</b> , .....	=	19.1
‡‡ Do. <b>Weight of Vapour in a Cubic Foot of Air</b> , ...	=	
‡‡ <b>Relative Humidity</b> , (Saturation = 100), .....	=	89
<b>RAIN</b> fell on 8 Days; Amount in Inches, .....	=	4.016 - 1.26

RAIN fell on 8 Days; Amount in Inches, ..... = 1.016 - 1.28

WIND.		SUMMARY.									
Direction.	N	NE	E	SE	S	SW	W	NW	Calm or Variable.	Mean Force.	Mean Velocity in miles per day.
A.M.	7	3		6	3	2		6	1		
P.M.	12	3		3	3	1		4	4		
Mean.	11	3	0	4	3	2	0	5	2.		

Observations made and  
Return verified by

(Signed) Alex McDonald



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

One of the objects of immediate importance that the Scottish Meteorological Society has proposed to itself is to secure a *perfect uniformity* in the system of observation pursued at all its Stations. A certain degree of uniformity is absolutely necessary to justify the publication of Monthly Returns 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 accurate comparableness among the several Returns, without which the Society's Reports must inevitably fall in achieving one of the main objects of Meteorological Observation.

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

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

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

An excellent Barometer is constructed by Mr. A. de la Roche, the use of which is attended with the great convenience of requiring *no adjustment* of the cistern. Its *scale-inches* are not true, 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 scale; scales and their consequence being indicated by a little ivory hand, whose stem passes freely through the lid and case of the cistern. When the *index-tube* on this little piston, not is brought, by the adjusting screw, *to form one straight line* with those of the ivory frame, the scale of the mercury is then at the exact height from which the reading 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 index, 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 *slump* *keeps* 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 tilting 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 exactly adjusted to form exactly a tangent to the convex surface of the mercury in the tube. Observations must be taken quickly; so as to prevent heat from the observer's hands and person from affecting the mercury. The use of a lens will greatly facilitate an accurate adjustment and reading of the Barometer.

**Protection of Thermometers.**—The Council of the Society recommend that self-registering Thermometers and Hygrometers be enclosed in a box, painted white outside and inside, and fixed 4 feet above ground in an exposed position, free from merely local influence. 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 multiplicity of instruments, which is most desirable, doors are also made to open to the south. These boxes may be had from the opticians.

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

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

**Verification of Thermometers.**—No instrument ought to be used for Meteorological purposes till it has been *carefully tested* by comparison with a *Standard Thermometer*. When such Thermometers as are *not graduated* on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved 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 corner, at which it may be suspended; the water-cup must be covered, and placed to the side and a little below the level of the wet bulb;—in no case under the bulb;—the muslin must be of medium fineness, and fastened at the neck of the bulb by the cotton, which also supplies it with water. It must be seen to by the observer that the muslin is always *clean and moist*, and the water pure. In frosty weather observation is a matter of much delicacy, and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed, evaporation will proceed as from the moist cloth in ordinary circumstances.

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

**Reading of the 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 41½°, and 40½°, more or less must be registered 40°·2 or 40°·3, and 40°·7 or 40°·8 respectively. In reading Ruthven's "Max." and "Min." Thermometers, the indication of that end of the *index* which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry *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 schedule, the indications registered on the 2d are those of a series of phenomena commencing at 9 P.M. on the 2d, and extending till 9 P.M. on the 3d. *Wind.*—A wind-vane ought to be elevated 12 feet at least above surrounding objects. When it oscillates incessantly, the mean direction must be taken; and when it is stationary, and always when the wind is feeble, relevance must be made to the direction of the lower strata of clouds overhead, and to the direction of smoke, &c.

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

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

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

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

*Clouds.*—Convenient abbreviations for Julia Howard's

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

Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition and currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "Velocity and Direction,"  $\frac{2}{6} \text{ S. W.}$  (for example) will indicate that the upper strata of clouds travel with *extreme* velocity from S.W., and those in the lower regions from W., with one-third the (*extreme*) speed of the former. Again, in the second "Cloud" column, an entry of  $\frac{2}{4} \text{ c. s.}$  (*c. s.*) 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, 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 Schönbein's or Meillet's papers are used. The paper is annexed by a pin to a board in the thermometer box, and the indication registered at 9 A.M. and 9 P.M. It is desired that these indications be registered in connection with the force and direction of the wind at the time of observation, in the following manner:—thus  $8 \frac{2}{10}$ , as an *ozone* entry in the schedule, will indicate that the ozone paper is tinted as "8" 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, &c. Remarks on remarkable depressions and elevations of meteors, aurora borealis, storms, and remarkable falls of snow, hail, or rain, the hour of storms, and wind attending, 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 purposes, from that headed "Remarks." It is intended that observations by the Electrometer should be entered in this manner on the station-magazine. Additional remarks may be made on the margin. "Observations in connection with the periodic return of the seasons," possess not only great scientific value, but are of considerable interest to the Agriculturist. The Council would direct the special attention of Observers to the registration of such phenomena; that the published Summaries may fairly represent the whole of Scotland. Observation ought to be confined to individual trees and shrubs; to particular species of birds; and, in the case of crops, to specified sorts reared from year to year on a selected piece of ground or farm.

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

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

Edinburgh, 10th November 1870. (By Order) A. B.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

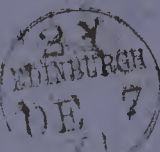
Have the goodness also to state any information you may be able to collect relative to the Crops of Grain, Hay, Potatoes, Turnips, Fruits, etc., whether plentiful, or in perfection; whether any have suffered from blight, disease, etc. Whether Epizootic disease prevails among cattle; and the Agricultural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

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

MR ALEXANDER BUCHAN,



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## SCOTTISH METEOROLOGICAL SOCIETY.

Observations taken at The Palace, Cluny Castle, County of Highland, in Lat. \_\_\_\_\_, Long. \_\_\_\_\_, Distance from Sea 17 miles.  
Height of Cistern of the Barometer above Mean Sea-level, 280 feet, above Ground \_\_\_\_\_ feet. During the MONTH of Dec 1871.

The Hours of Observation are of Greenwich Time.

ELECTRICITY.	Days of Month.	BAROMETER.				SELF-REGISTERING THERMOMETERS.				HYGROMETER.				WIND.				RAIN.		CLOUDS.				THERMOMETERS under Ground.			SEA.	OZONE.	GENERAL REMARKS.	Days of Month.
		9 h. A.M.		9 h. P.M.		Protected in Shade, 4 feet above Ground.		Exposed Black Bulbs.		9 h. A.M.		9 h. P.M.		9 h. A.M.		9 h. P.M.		Readings of the H.Cup Anemometer.		9 h. A.M.		9 h. P.M.		9 h. A.M.						
		No.	Barometer.	Attached Thermometer.	No.	Barometer.	Attached Thermometer.	No.	Max.	Min.	No.	Max.	Min.	No.	Max.	Min.	No.	Max.	Min.	No.	Max.	Min.	No.	Max.	Min.	No.				
	1	30.019	40	30.050	41	38	31			38	35	37	35	N	2					Cst	Ni								Changeable and cold	1
	2	29.966	41	29.967	40	29	30			39	37	38	26	N	2					Ni	Ni								Changeable	2
	3	29.928	38	29.943	31	39	22			29	27	27	26	N	2					Cst	Cst								Changeable	3
	4	30.022	39	30.012	39	31	16			33	32	35	35	NW	2					Cst	Cst								Changeable	4
	5	29.817	40	29.810	39	37	26			33	32	35	35	NW	2					Cst	Cst								Changeable	5
	6	29.936	34	29.935	40	36	19			29	29	35	35	N	2					Cst	Ni								Changeable	6
	7	29.920	40	30.069	40	36	30			35	35	33	33	N	2					Ni	Ni								Changeable	7
	8	30.019	40	29.966	41	37	20			33	32	35	34	N	2					Ni	Cst								Changeable	8
	9	29.909	41	29.920	40	39	29			35	34	36	35	NW	2					Cst	Ni								Changeable	9
	10	29.870	40	29.902	40	40	25			31	30	29	38	N	2					Cst	Ni								Changeable	10
	11	29.944	43	29.859	44	45	25			29	29	44	41	N	2					Cst	Cst								Changeable	11
	12	29.948	48	29.856	45	48	26			45	44	40	39	NW	2					Ni	Cst								Changeable	12
	13	30.019	40	29.967	40	41	30			38	32	35	35	NW	2					Cst	Ni								Changeable	13
	14	29.941	43	29.894	40	38	26			35	35	30	30	NW	2					Ni	Cst								Changeable	14
	15	29.817	41	29.912	43	43	24			35	34	42	40	NW	2					Cst	Cst								Changeable	15
	16	29.906	45	29.916	42	40	26			35	35	35	34	N	2					Cst	Cst								Changeable	16
	17	29.896	48	28.953	48	46	26			45	41	46	44	NW	2					Cst	Ni								Changeable	17
	18	29.999	50	29.049	49	55	40			47	49	44	42	NW	2					Cst	Cst								Changeable	18
	19	29.262	43	29.267	41	41	30			35	34	38	36	NW	2					Ni	Ni								Changeable	19
	20	29.120	40	29.130	44	39	28			35	34	32	31	NW	2					Cst	Cst								Changeable	20
	21	29.260	44	29.136	34	38	19			35	34	20	20	NW	2					Cst	Cst								Changeable	21
	22	29.625	38	29.558	35	35	19			26	25	25	25	N	2					Ni	Cst								Changeable	22
	23	29.675	38	29.459	42	42	15			28	28	40	39	N	2					Cst	Ni								Changeable	23
	24	29.612	40	29.051	48	50	31			41	39	48	45	NW	2					Cst	Cst								Changeable	24
	25	29.209	44	29.370	40	49	30			37	35	35	33	NW	2					Cst	Cst								Changeable	25
	26	29.267	42	29.017	42	41	23			35	34	40	39	NW	2					Cst	Cst								Changeable	26
	27	28.834	46	28.911	40	42	31			42	40	35	34	NW	2					Cst	Cst								Changeable	27
	28	28.863	43	28.916	42	43	32			40	41	36	36	N	2					Cst	Cst								Changeable	28
	29	29.062	43	29.052	44	42	29			37	36	42	40	NW	2					Cst	Cst								Changeable	29
	30	28.902	47	29.012	43	30	24			49	47	44	41	NW	2					Cst	Cst								Changeable	30
	31	29.230	40	29.300	46	51	30			40	39	48	44	NW	2					Cst	Cst								Changeable	31

NOTATION USED IN GENERAL REMARKS.

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

TABLE FOR ESTIMATING FORCE OF WIND.

Estimated Force, 0-4.	Common Designation.	Estimated Force, 5-6.	Common Designation.	Estimated Force, 7-8.	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), = 29.553  
"Corrected Mean" of Barometer at 9 P.M., minus the Correction for Temp. (Col. 4), = 29.535  
Mean at Station, corrected, and at 32°, = 29.544  
Correction for height, feet above Mean Sea-level, = 313  
Mean, reduced to 32°, and Sea-level, = 29.857  
Highest Reading, corrected for Index error, on the 29th, = 30.069  
Lowest Do. Do., on the 29th, = 28.854  
Difference, or Monthly Range, = 1.215

S.-R. THERMOMETER, (in shade, etc.), Highest in Month, (corrected for Index Errors), on the 10th, = 55.0  
Lowest in Month, corrected for Index errors, on the 15th, = 15.0  
Difference, or Monthly Range, = 40.0  
"Corrected Mean" of all the Highest, (Col. 5), = 47.1  
"Corrected Mean" of all the Lowest, (Col. 6), = 26.8  
Difference, or Mean Daily Range, = 14.3  
\*\* Calculated Mean Temperature of Month, = 34.0

S.-R. THERMOMETER, Black Bulb in Sun, Highest, (corrected for Index Errors), on the 10th, = 55.0  
"Corrected Mean," (Col. 7), of Black Bulb, Max. in Sun, = 47.1  
Lowest at Night, Black Bulb, (corrected for Index errors), on the 15th, = 15.0  
"Corrected Mean," (Col. 8), of Black Bulb, Min. on grass, = 26.8  
Difference of above Means or Range ("exposed"), = 14.3

HYGROMETER, Mean (corrected) A.M. and P.M. Reading of Dry Bulb, (Cols. 9 and 11), = 36.4  
Mean (corrected) A.M. and P.M. Reading of Wet Bulb, (Cols. 10 and 12), = 35.1  
# Computed Temperature of Dew-Point, = 33.2  
# Do. Elastic Force of Vapour, = 1.91  
# Do. Weight of Vapour in a Cubic Foot of Air, = 1.89  
# Relative Humidity, (Saturation = 100), = 100  
RAIN fell on 5 Days; Amount in Inches, = 1.070

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

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

Observations made and  
Return verified by

(Signed) Alexander McDonald



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

One of the objects of immediate importance that the Society has in view 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 Reports 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 times so punctually in the time of reading the instruments will be observed. Observers, in some few cases, may find this impossible; in such instances, they are specially requested to 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-bubbles* are not rare 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 coincidence being indicated by a little ivory float, whose stem passes freely through the lid and ends of the cistern. When the *bubble-line* on this little piston-rod is brought by the adjusting screw, to *form one straight line* with those on the ivory frame, the scale is graduated. In taking an observation, this *preliminary setting* must be made with scrupulous accuracy; as a slight error here will vitiate the readings from the *aneroid*.

When a Barometer having adjustable surfaces is to be removed from its fastenings, the ivory peg must be screwed so as to form a tight plug to the cistern. Then *score 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 *lymph*, which may be improved by putting a piece of white paper behind the tube. It must be perfectly perpendicular, and exposed to neither the sun's direct rays nor the heat of a fire.

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

**Protection of Thermometers.**—The Council of the Society recommend that Self-registering Thermometers and Hygrometers be enclosed in a Box, painted white outside and inside, and fixed 4 feet above grass in an exposed position, free from easily local influences. The latus 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-sticks, in the centre of the Box, and face the door opening to the north. To accommodate a duplicate set of instruments, which is most desirable, doors are also made to open to the south. These Boxes may be had from the opticians.

**Self-registering Thermometers.**—Professor Phillips'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 disadvantages, both of which must be guarded against, and may be easily remedied by striking the instrument repeatedly against the palm of the hand, when part of the spirit distils by high temperature, it will be found near the top of the tube, and must be dislodged from thence by heating that part over a lamp; the alcohol will evaporate and again condense in contact with the body of the liquid. These instruments should be hung horizontally.

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

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

**Verification of Thermometers.**—No instrument ought to be used for Meteorological purposes till it has been carefully tested by comparison with a *Standard Thermometer*. When such Thermometers as are *not* graduated on the stem, but merely on an attached scale, undergo repairs, they are very liable to be moved from their position on the Scale, and ought never afterwards to be used, without being *re-tested*. The self-registering, and especially the "*Minimum*" Thermometers, ought frequently to be compared with the dry bulb of the Hygrometer. The freezing-point of each Thermometer (marked by a scratch on the tube) ought to be tested once a year in snow or melting ice, 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 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 bulbs;—the meniscus must be of medium fineness, and assisted 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 meniscus is always *clean and moist*, and the water pure. In frosty weather observation is a matter of much delicacy and must be made with great care. The bulb must be moistened by immersion from 15 to 30 minutes before the hour of observation. From the film of ice thus formed evaporation will proceed as from the moist cloth in ordinary circumstances.

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

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**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°.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°.3, and 40°.7, or 40°.8 respectively. In reading Rutherford's "*Max*" and "*Min*," Thermometers, the indication of that end of the index which is next to the surface of the mercury or alcohol is alone noted. Readings of the Thermometers, especially of the wet and dry bulbs, must be rapidly taken, being so readily affected by heat from the person of the observer.

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

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

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

The Council recommend that every 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.

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

**Snowfalls** may, *for convenience*, be registered in the rain columns, under the following conditions:—When a Snow shower occurs it must be noted in the "*Remarks*," and the letter S affixed to the depth of water received in gauge. The depth of the snow must be measured in some open place where no drift is observed, and registered in addition to, and as a check upon, the indications of the rain-gauge. For wind, rain, and snow, as 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 *erected* (i.e., within 20° or 30° of the zenith). The strata of clouds that appear near the horizon are viewed obliquely; and thus, being unable to judge of their amount, we ought not to take them into account in the *cloud* column, though their appearance and changes ought to be noted among the "*Remarks*." The amount of cloud is entered from a scale of 0 to 10; thus when the sky *overland* is *half covered* by clouds, 5 is entered as the *description*, and so on. Observations of the clouds are made at 9 A.M. and at sunset, as illustrating the condition of currents of the upper and lower regions of the atmosphere. The entries in the schedule are to be made in the following manner:—In the column "*Velocity*" (S.W., for example) will indicate that the 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  $\frac{2}{2}$ , (e.g.) will indicate that the higher regions are covered to the "amount" of 4 tenths with *stratus* clouds; and that the sky is further obscured to that of our 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 thermometers placed in the earth, their bulbs being sunk to 3, 12, and 22 inches, and the stems above ground protected from the sun's rays and fitted with sloping tin collars, to prevent rain-water being conveyed to the bulbs by the stems or wooden frames. Mention must be made of the geological formation and agricultural condition of the soil in which these Thermometers are placed.

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

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

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

**Electricity.**—Too much importance cannot be attached to electric condition of the atmosphere in connection with terrestrial magnetism, 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 recognized and in use at Greenwich and Southampton, are given at the foot of the column. Besides special and extraordinary observations, great prominence ought to be given in this column to prevalent diseases, differences in character, colour, velocity, and direction between the lower and upper strata of clouds, the colour of the sky, etc. Remarks ought to be made on the occurrence of meteors, aurora borealis, and remarkable depressions and elevations of the barometrical hand, storms, and remarkable falls of snow, hail, or rain, the hour of on storms as have been hinted at above. When lofty hills are in the vicinity of an Observatory, the height of clouds and of the snow-line in winter ought to be recorded.

By the use of abbreviations, the state of the weather at 9 A.M. and 9 P.M. ought to be registered, either in two columns, otherwise unoccupied, or in two ruled off for the purpose, from that headed "*Remarks*." It is intended that observations by the Electrometer should be entered in this manner 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 points reared from year to year on selected pieces of ground or farm, day observations be taken;—viz., on the 21st days of March, June, September, and December.

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

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

(By Order) A. B. Examiners, 20th November 1850.

OBSERVATIONS IN CONNECTION WITH THE PERIODICAL RETURN OF THE SEASONS.

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

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

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

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