

METEOROLOGICAL OFFICE.

BRITISH METEOROLOGICAL AND MAGNETIC YEAR BOOK,  
PART III., SECTION 2.

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GEOPHYSICAL JOURNAL, 1913,

COMPRISING

DAILY VALUES OF THE METEOROLOGICAL AND GEOPHYSICAL ELEMENTS  
AT THREE OBSERVATORIES OF THE METEOROLOGICAL OFFICE;

TOGETHER WITH

WIND COMPONENTS AT FIXED HOURS AT FOUR ANEMOGRAPH STATIONS;

DAILY VALUES OF SOLAR RADIATION AT SOUTH KENSINGTON;

TABULATIONS AND ANNUAL SUMMARY OF OCCASIONAL SOUNDINGS OF THE UPPER AIR;  
AND OF CLOUD OBSERVATIONS.

*PRECEDED BY AN INTRODUCTION.*

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Published by Authority of the Meteorological Committee.

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# METEOROLOGICAL OFFICE.

## BRITISH METEOROLOGICAL AND MAGNETIC YEAR-BOOK : GEOPHYSICAL JOURNAL.

### INTRODUCTION TO THE TABLES FOR 1913.

THE Geophysical Journal gives daily values for the meteorological and geophysical elements observed at the three observatories of the Meteorological Office. Data are given for Meteorology, Solar Radiation, Seismology, Atmospheric Electricity, and Terrestrial Magnetism. From the beginning of 1912 the results of ascents at Upper Air Stations at Pyrton Hill, Aberdeen, Manchester, Brighton, Ditcham Park, and Limerick (Mungret College) have been included in the Journal. The corresponding results for earlier years were published in the Weekly Weather Report. Wind components are given for four additional anemograph stations.

All values are referred to Greenwich Mean Time, and the hours are counted from midnight and numbered 0 to 24.

All the units employed are based on the C.G.S. system.

The tables are as follows :—

1. A table of notes on the records derived from the **Galitzin Seismograph** (two horizontal components and the vertical component) at **Esksdalemuir**, giving (i) the period and amplitude of the microseisms of the North component not attributed directly to wind or other local disturbance of like character for each day at the four hours 0 h., 6 h., 12 h., 18 h. The amplitude selected for publication is the greatest which occurs in half an hour, including the time in question, and the period is that characteristic of this largest wave ; (ii) the character of the earthquakes according to the following notation, with notes on the computed distance of the epicentre, and the "phases" shown by the traces. The magnitude of an earthquake is indicated by—

I. Perceptible, II. Conspicuous, or III. Strong. When it is possible to assign the distance  $\Delta$  of the epicentre, one of the following letters is added, viz. :—

*d* (domesticus) Local.

*v* (vicinus)  $\Delta < 1000$  km.

*r* (remotus)  $\Delta 1000$  to  $5000$  km.

*u* (ultimus)  $\Delta > 5000$  km.

P. is the time of arrival of the first phase (longitudinal waves).

S. is the time of arrival of the second phase (transverse waves).

L. is the time of arrival of the long waves.

The co-ordinates of the epicentre relative to the station are—

$\Delta$  = distance measured along the arc of the great circle.

$\alpha$  = azimuth ( $0^\circ$  to  $360^\circ$ ) measured from North through East.

This table is intended as a Journal of seismological events for purposes of reference so far as concerns the more violent incidents recorded in the trace.

2. **Daily meteorological data** at 9 h. and 21 h. G. M. T. for **Valencia Observatory** in the form customary for entering the corresponding data which are published for eight stations in the British Isles in Section III. of the Year Book (Daily Readings at Meteorological Stations of the First and Second Orders). The instrumental values in the table are taken from the self-recording instruments at the Observatory.

**Pressure** is given in "millibars" (1000 millibars = one megadyne per square centimetre). One millibar is approximately equivalent to the pressure of 0.75008 mm. of mercury. The name is used in the Journal, following the example of Professor Bjerknes of Christiania in his work for the Carnegie Institute of Washington. The expression of atmospheric pressure in millibars involves any necessary reduction of the readings of the barometer to standard temperature and latitude.

**Temperatures** are given in units on the Kelvin Absolute Scale, *i.e.* in centigrade degrees measured from a zero 273° below the normal Freezing Point of water. Temperatures below 273° A. (0° C.) are printed in small type.

**Vapour Pressure**, deduced from the readings of the dry and wet bulb by Glaisher's Tables, is given in millibars.

**Wind Velocity** is expressed in metres per second.























**Wind Direction** is given in points of the Compass, 32 to the complete revolution, from True North (32), through East (8). No direction is given when the anemometer shows a smaller velocity than 1.6 metres per second.

**Precipitation** is given in millimetres of equivalent rainfall.

**Sunshine**, from the Campbell-Stokes instrument, in hours. The mean daily duration is given instead of the total for the month, in accordance with the practice adopted for the other parts of the Year Book. The estimation of cloud amount and the symbols for weather are in accordance with the conventions of the International Meteorological Committee.

A column of **Remarks** in which a summary of the weather for each day is given, the international weather symbols and the letters of the Beaufort Notation being used as far as possible. These symbols and letters are as follows:—

BEAUFORT NOTATION AND INTERNATIONAL WEATHER SYMBOLS.

b.	blue sky.	w.	 dew.	h.	 hail.
c.	clouds (detached).	x.	 hoar frost.		 soft hail.
o.	overcast.		 ice crystals.	t.	 thunder.
g.	gloomy, dull appearance.		 rime.	l.	 lightning.
u.	ugly, threatening appearance.		 glazed frost.	 thunderstorm.	
v.	visibility, unusually clear atmosphere.	e.	water deposited copiously on exposed surfaces, without rain falling.	 gale.	
z.	$\infty$ haze.	p.	passing showers.	q.	squally.
m.	$\equiv^{\circ}$ mist, light fog.	d.	drizzling rain.	 solar corona.	
f.	$\equiv$ fog.	r.	 rain.	 solar halo.	
fe.	$\equiv$ : wet fog, <i>i.e.</i> , fog which deposits water copiously on exposed surfaces.	s.	 snow.	 lunar corona.	
			 snow drift.	 lunar halo.	
		 snow lying (more than half the surrounding country covered with snow).		 rainbow.	
				 aurora.	
				 zodiacal light.	

The figure <sup>0</sup> attached to a symbol indicates very slight, whilst the figure <sup>2</sup> indicates strong or heavy: thus  $\bullet^0$  = slight rain,  $\bullet^2$  = heavy rain.

The table also contains the measurements of the **Magnetic elements** made at Valencia on selected days. (See note at end of section 5 below.)

3. A corresponding **meteorological table** for **Kew Observatory**, with a column for **Solar Radiation** in watts per square centimetre, observed between 11 h. and 13 h. unless otherwise stated. The usual conventional unit for solar radiation, the gramme-calorie per square centimetre per minute, is equivalent to seven hundredths of a watt per square centimetre (·0697 Callendar and Barnes 1902). Instead of the magnetic data, columns are provided for **readings at 10 h. of thermometers exposed in the ground** at depths of 1 foot (0·31 m.) and 4 feet (1·22 m.) below the surface.

4. A corresponding **meteorological table** for **Eskdalemuir Observatory**.

5. A table of values of **electrical and magnetic measurements** for **Kew Observatory**. Daily values of the **potential gradient**, volts per metre in the open, are given for the four hours, 3 h., 9 h., 15 h., 21 h., except on the occasions when the trace is so disturbed that a satisfactory reading cannot be obtained. The potential gradient is positive when the potential in the atmosphere is positive compared with the earth. The values are the means for the period from half an hour before to half an hour after the hour named. A negative potential gradient is indicated by a short thick “-” before the number. When the true value is lost because the trace goes beyond the limit of registration within the hour, a value may be assigned to the hour, which is essentially an underestimate. Such values are marked with an asterisk (\*). When the fluctuations are too large to permit of such an estimate of the hourly mean, “z” is inserted with an appropriate sign to indicate if the gradient was on the whole positive or negative or too variable to permit the dominant sign to be determined.

The value of the **potential gradient** “in the open” is computed from the readings of the trace of an electrograph with a water-dropping collector by means of a factor determined by observations with a standardised electrometer above a flat area.

The **total charge on the ions**, positive and negative, per cubic centimetre and their respective mobilities are derived in the usual way (which neglects the presence of the large Langevin ions) from observations made with Ebert's Aspiration apparatus, extending over about an hour, between 14 h. and 16 h. unless it is otherwise stated.

The **conductivity** in electromagnetic units is computed from the quantity of positive and negative electricity collected and the velocity of the ions for a volt per centimetre as determined with the Ebert apparatus; the figure obtained is multiplied by  $10^{25}$  before it is inserted in the table.

The **Air-Earth Current**,  $c_1$ , is computed from the conductivity and the potential gradient, and it is therefore dependent upon measurements recorded in the other columns. The current  $c_2$  is determined, independently of the Ebert conductivity measurements, with the apparatus designed by Mr. C. T. R. Wilson, and measurements with this apparatus are made at Kew.  $c_1$  and  $c_2$  do not strictly correspond;  $c_2$  (deduced directly from a measurement of the current from the atmosphere into a freely exposed and virtually earth-connected conductor) depends on the number and mobility of the ions of one sign only (positive when the potential gradient is positive); while in calculating  $c_1$  the number and mobility of the ions of both signs are taken into account. At Eskdalemuir only the values of  $c_1$  are obtained, and these are given for comparison with the corresponding data for Kew.

The **electric character of the day** is indicated both for Kew and for Eskdalemuir by the figures 0, 1, or 2, according to the character of the trace of the electrograph as regards negative electric potential; thus 0 means no negative potential; 1, one or more

excursions of limited duration to the negative side of the scale ; 2, negative potential extending in the aggregate over at least two hours.

For Eskdalemuir an estimate is also given of the character of the days as regards the range of potential irrespective of sign within the hourly periods for which an estimate of the mean potential has to be made in the process of tabulation. This characterisation of the day is indicated by the letters *a*, *b*, *c*, according to the range of oscillation within the hour, using a range of about 1000 volts as a criterion : *a* means that for no hour of the day was there a range of 1000 volts ; *b* that that range of oscillation was reached in one hour at least but in fewer than six hours ; *c* that the critical range was reached in six hours or more.

These specifications must not be understood to be rigid criteria. More definite specifications can be given after longer experience.

**The Magnetic Tables** are sufficiently explained in the headings. The magnetic character of the day is given on the scale "0," "1," "2" of the International Magnetic Commission.

The values of magnetic force are all given in terms of  $\gamma$ , or '00001 C.G.S. magnetic unit, so that  $18564 \gamma = 18564$  C.G.S.

Owing to a change in the accepted values of the distribution constants of the magnets, the magnetic values for Kew published in the Journal are about  $5\gamma$  too low and those for Valencia about  $2\gamma$  too low. Finally corrected values of the monthly means will be published in Part IV. Section 2 of the Year-Book, which will also contain the final corrected values for Eskdalemuir.

The magnetographs at Kew were dismantled on May 28th, 1913, and erected in an adjacent building, where the registration recommenced on May 30th. They remained in the new position during structural alterations to the Observatory building in which they were re-erected on December 30th and 31st.

6. Gives tables of **electrical and magnetic data** for **Eskdalemuir** corresponding with those for Kew, except that at Eskdalemuir the geographical components of magnetic force are directly recorded.

7. A table of **wind components** for four principal anemograph stations of the Meteorological Office. The components resolved along the directions of the four cardinal points are given in metres per second.

8. A table giving the results of the **exploration of the free atmosphere** over the British Isles up to heights of 3000 m. by means of **kites and pilot balloons**. Directions are given in degrees from true N. (through East). The other units are as in tables 2, 3, 4.

9. A table giving the results of **soundings of the upper air by registering balloons and pilot balloons**.

10. A table giving the maximum intensity and total amount of **solar radiation** received on a horizontal surface at South Kensington as recorded by the Callendar Instrument.

W. N. SHAW  
(Director).

METEOROLOGICAL OFFICE, LONDON, S.W.,

March 11, 1914.



3. KEW OBSERVATORY, SURREY.—Lat. 51° 28' N. Long. 0° 19' W.

Heights above Mean Sea Level :—Station, H = 5.5 m. Barometer, H<sub>b</sub> = 10.4 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 3.0 m. Rain-gauge, h<sub>r</sub> = 0.5 m. Sunshine Recorder, h<sub>s</sub> = 14.3 m. Cups of Anemometer, h<sub>a</sub> = 21.3 m.

Table with 20 columns: Day, Pressure at Station Level (9h, 21h), Air Temperature in Degrees Absolute (9h, 21h, Max, Min), Humidity (Vapour Pressure, Percentage), Wind Direction in Points and Velocity (9h, 21h), Cloud Amount and Weather (10h, 22h), Rain 24 hours beginning 10h, Sunshine, Solar Radiation, Min. Temp. on Grass, Earth Temperature at 10h (0.3m, 1.2m), Remarks.

Note.—The cloud amounts in italic type at Kew were taken at 18 h.

4. ESKDALE OBSERVATORY, DUMFRIESSHIRE.—Lat. 55° 19' N. Long. 3° 12' W.

Heights above Mean Sea Level :—Station, H = 243.2 m. Barometer, H<sub>b</sub> = 237.1 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 0.8 m. Rain-gauge, h<sub>r</sub> = 0.3 m. Sunshine Recorder, h<sub>s</sub> = 1.5 m. Vane of Anemometer, h<sub>a</sub> = 15.2 m.

Table with 20 columns: Day, Pressure at Station Level (9h, 21h), Air Temperature in Degrees Absolute (9h, 21h, Max, Min), Humidity (Vapour Pressure, Percentage), Wind Direction in Points and Velocity (9h, 21h), Cloud Amount and Weather (10h, 22h), Rain 24 hours beginning 10h, Sunshine, Solar Radiation, Min. Temp. on Grass, Earth Temperature at 10h (0.3m, 1.2m), Remarks.

The solar radiation is the mean of the readings within the nominal hour of observation (11 h. 30 m.—12 h. 30 m.) unless some other hour is specified.



5. KEW OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor 1.74.				Charge per cc. $\times 10^{20}$ .		Velocities of Ions for 1 volt per centimetre.		Conductivity $\times 10^{20}$ .	Air-Earth Current $\times 10^{16}$ .		Electric Character of Day.	Magnetic Character of Day.	Horizontal Force.			West Declination.					
	3 h.	9 h.	15 h.	21 h.	+	-	+	-		c <sub>1</sub>	c <sub>2</sub>			Maximum. 18000 $\gamma$ +.	Minimum. 18000 $\gamma$ +.	Range.	Maximum. 15° +.	Minimum. 15° +.	Range.			
	v/m.	v/m.	v/m.	v/m.	E.-m.U.	E.-m.U.	cm/sec.	cm/sec.		E.-m.U.	Amp/cm <sup>2</sup> .			$\gamma$	h m	$\gamma$	h m	$\gamma$	h m	h m	h m	$\gamma$
1	255	460	510	580	—	—	—	—	—	—	0	0	516	7 46	497	1 10	19	43.8	11 52	40.8	7 30	3.0
2	460	340	670	295	—	—	—	—	—	—	1	1	519	18 9	481	18 29	38	45.5	14 13	40.6	8 25	4.9
3	665	340	425	205	—	—	—	—	—	—	1	1	545	4 41	433	14 27	112	52.5	4 24	36.0	20 36	16.5
4	100	205	340	305	—	—	—	—	—	—	1	1	507	6 10	478	18 29	29	44.7	14 15	34.6	18 43	10.1
5	10	195	205	550	—	—	—	—	—	—	1	0	512	8 18	484	12 7	28	45.6	14 12	40.3	21 3	5.3
6	400	550	580	525	—	—	—	—	—	—	2	0	512	6 15	485	12 17	27	44.6	13 25	39.8	9 28	4.8
7	280	415	410	295	—	—	—	—	—	—	0	0	513	7 23	490	11 0	23	45.5	13 36	40.5	20 17	5.0
8	195	545	715	435	—	—	—	—	—	—	0	0	517	7 20	497	15 23	20	44.5	12 35	40.5	8 15	4.0
9	330	595	610	595	—	—	—	—	—	—	0	0	519	14 50	492	23 42	27	46.3	12 48	39.4	23 43	6.9
10	510	—	—	380	—	—	—	—	—	—	0	1	514	20 53	462	14 40	52	46.9	13 40	35.3	20 45	11.6
11	—	425	0	170	—	—	—	—	—	—	2	0	508	19 58	490	3 40	18	43.6	12 40	39.7	22 52	3.9
12	375	740	440	765	—	—	—	—	—	—	0	0	509	20 44	496	1 46	13	44.5	12 54	39.4	19 28	5.1
13	520	—	860	875	—	—	—	—	—	—	1	0	516	20 16	497	0 57	19	44.6	12 40	38.2	19 16	6.4
14	205	—	715	730	—	—	—	—	—	—	0	0	520	7 17	491	12 20	29	45.1	13 3	39.6	21 28	5.5
15	95	$x \pm$	485	$x \pm$	—	—	—	—	—	—	2	0	519	7 23	491	11 57	28	44.9	11 28	38.6	21 0	6.3
16	255	775	545	$x \pm$	—	—	—	—	—	—	2	0	514	6 39	492	12 23	22	44.5	12 41	39.9	8 8	4.6
17	155	0	—	780	—	—	—	—	—	—	1	1	526	21 31	497	9 47	29	43.7	12 50	36.3	22 54	7.4
18	570	1200	580	750	—	—	—	—	—	—	1	2	521	23 59	475	20 28	46	46.7	13 16	23.5	20 52	23.2
19	655	715	$x$	535	—	—	—	—	—	—	2	1	552	0 28	476	1 20	76	45.7	11 37	34.1	0 23	11.6
20	185	-120	585	—	—	—	—	—	—	—	2	1	517	13 53	488	21 57	29	44.6	13 10	34.4	21 28	10.2
21	—	—	—	—	—	—	—	—	—	—	2	0	511	13 22	488	2 15	23	44.3	12 9	38.9	20 22	5.4
22	—	—	805	$x \pm$	—	—	—	—	—	—	2	0	511	16 25	489	11 9	22	44.9	13 16	37.3	23 53	7.6
23	400	170	315	435	—	—	—	—	—	—	0	0	512	13 40	494	10 58	18	42.6	12 54	37.9	0 0	4.7
24	160	380	350	355	—	—	—	—	—	—	0	0	519	14 33	497	19 40	22	45.5	13 15	39.1	8 8	6.4
25	35	440	475	665	—	—	—	—	—	—	1	1	532	20 30	488	16 42	44	45.3	12 49	36.2	20 23	9.1
26	400	485	630	910	—	—	—	—	—	—	0	0	513	13 15	496	1 56	17	43.9	12 5	39.2	5 5	4.7
27	350	720	715	900	—	—	—	—	—	—	0	0	516	6 17	496	10 40	20	44.4	13 5	40.4	0 0	4.0
28	550	595	485	50	—	—	—	—	—	—	1	0	516	15 50	496	19 44	20	45.2	14 0	37.7	20 0	7.5
29	220	705	475	525	—	—	—	—	—	—	0	0	517	23 30	489	10 1	28	44.3	12 58	39.5	8 15	4.8
30	545	645	595	-270	—	—	—	—	—	—	1	1	531	6 30	485	12 5	46	47.7	8 38	37.6	23 15	10.1
31	170	460	410	630	—	—	—	—	—	—	1	1	511	23 37	484	11 58	27	44.9	13 32	37.5	19 15	7.4
M.	299	509	497	475	—	—	—	—	—	—	—	—	518	—	487	—	31	45.2	—	37.8	—	7.4

Note.—The mean values of the Potential gradient in Table 5 are computed from the data for those days on which values at each of the four hours, 3h, 9h, 15h, 21h, are given in the table. A similar note applies to the values in Table 6.

6. ESKDALE OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor 5.4.				Charge per cc. $\times 10^{20}$ .		Velocities of Ions for 1 volt per centimetre.		Conductivity $\times 10^{20}$ .	Air-Earth Current $\times 10^{16}$ .		Electric Character of Day.	Magnetic Character of Day.	North Component.			West Component.			Vertical Component.				
	3 h.	9 h.	15 h.	21 h.	+	-	+	-		c <sub>1</sub>	c <sub>2</sub>			Maximum. 15000 $\gamma$ +.	Minimum. 15000 $\gamma$ +.	Range.	Maximum. 5000 $\gamma$ +.	Minimum. 5000 $\gamma$ +.	Range.	Maximum. 45000 $\gamma$ +.	Minimum. 45000 $\gamma$ +.	Range.		
	v/m.	v/m.	v/m.	v/m.	E.-m.U.	E.-m.U.	cm/sec.	cm/sec.		E.-m.U.	Amp/cm <sup>2</sup> .			h m	$\gamma$	h m	$\gamma$	h m	h m	$\gamma$	h m	h m	h m	$\gamma$
1	236	442	254	327	—	—	—	—	—	—	0 a	0	14 40	1022	1004	11 20	11 42	212	196	9 10	—	—	—	—
2	393	484	569	175	—	—	—	—	—	—	1 b	0	18 10	1034	981	18 26	14 12	220	188	18 28	—	—	—	—
3	387	1500	175	436	—	—	—	—	—	—	2 b	2	4 46	1065	929	14 27	4 25	264	160	20 32	—	—	—	—
4	188	182	315	345	—	—	—	—	—	—	2 c	1	6 10	1016	983	12 10	14 10	214	152	18 43	—	—	—	—
5	532	333	151	581	—	—	—	—	—	—	1 b	0	7 23	1024	990	12 3	14 20	215	186	21 2	—	—	—	—
6	708	1573	714	284	—	—	—	—	—	—	1 b	0	6 20	1019	994	12 18	1 24	213	190	9 12	—	—	—	—
7	6	212	260	151	—	—	—	—	—	—	1 b	0	21 26	1022	995	12 22	4 0	215	189	21 24	—	—	—	—
8	230	121	442	448	—	—	—	—	—	—	1 a	0	7 20	1022	1001	14 14	3 52	213	193	8 50	—	—	—	—
9	242	109	345	436	—	—	—	—	—	—	0 a	0	1 40	1026	1000	23 38	16 13	226	179	23 43	—	—	—	—
10	303	478	430	309	—	—	—	—	—	—	0 a	2	20 52	1038	966	14 7	13 20	228	158	17 23	—	—	—	—
11	206	$x$	$x$	1753	—	—	—	—	—	—	2 c	0	0 13	1017	999	12 0	13 30	209	191	23 0	—	—	—	—
12	744	424	623	920	—	—	—	—	—	—	1 b	0	21 45	1020	1002	12 28	13 15	211	185	19 27	—	—	—	—
13	345	581	653	744	—	—	—	—	—	—	0 a	0	20 14	1028	1003	12 5	13 10	216	183	19 14	—	—	—	—
14	436	551	551	1204	—	—	—	—	—	—	0 a	0	16 16	1025	995	12 22	13 2	217	190	21 20	—	—	—	—
15	1047	321	182	351	—	—	—	—	—	—	1 b	1	21 51	1023	991	12 0	11 23	216	183	21 0	—	—	—	—
16	333	514	593	496	—	—	—	—	—	—	1 b	0	6 43	1017	997	11 54	13 0	208	194	7 30	—	—	—	—
17	998	472	1252	284	—	—	—	—	—	—	0 a	1	21 32	1044	1000	10 30	13 43	210	168	23 15	—	—	—	Instrument out of order.
18	127	—	333	182	—	—	—	—	—	—	2 c	2	21 16	1051	979	20 27	13 14	232	75	20 43	—	—	—	—
19	327	345	381	708	—	—	—	—	—	—	2 b	2	0 27	1080	976	1 9	11 33	226	154	0 45	—	—	—	—
20	272	605	290	254	—	—	—	—	—	—	1 b	1	21 18	1031	986	16 37	13 20	221	152	21 44	—	—	—	—
21	30	73	175	133	—	—	—	—	—	—	1 b	0	5 56	1015	992	17 6	11 40	212	188	9 8	—	—	—	—
22	103	175	278	399	—	—	—	—	—	—	1 b	1	23 25	1021	989	12 23	14 14	215	175	23 52	—	—	—	—
23	139	157	460	363	—	—	—	—	—	—	1 b	0	22 33	1016	994	11 42	12 50	205	176	0 1	—	—	—	—
24	151	-79	-793	399	—	—	—	—	—	—	2 b	0	23 54	1022	997	19 45	13 7	219	188	23 47	—	—	—	—
25	18	478	635	1373	—	—	—	—	—	—	1 a	1	20 27	1057	987	16 36	14 15	216	168	20 8	—	—	—	—
26	212	272	635	563	—	—	—	—	—	—	0 a	0	22 42	1017	998	10 16	11 50	208	184	0 10	—	—	—	—
27	266	417	460	321	—	—	—	—	—	—	0 a	0	6 10	1020	996	12 20	13 26	208	186	0 0	—	—	—	—
28	254																							

7. Tables of Wind Components in metres per second at fixed hours, together with the mean velocity (horizontal movement) in metres per second for the hour with the maximum hourly run for each day, OR the greatest velocity attained in a gust and the time of its occurrence.

HOLYHEAD. †‡

Height of Head above—Roof 8.3 m., Ground 13.7 m., M.S.L. 19.2 m.  
Height of Cups above—Roof 4.6 m., Ground 7.6 m., M.S.L. 15.2 m.

Table for Holyhead with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, and Time of Gust. Includes data for hours 1-31 and summary statistics.

DEERNESS. †

Height of Cups above—Roof 1.5 m., Ground 4.9 m., M.S.L. 57.3 m.

Table for Deerness with columns for Date, 3 h., 9 h., 15 h., 21 h., Vel. in Max. Hourly Run, and Time of Max. Includes data for hours 1-31 and summary statistics.

SCILLY. †‡

Height of Head above—Ground 9.8 m., M.S.L. 49.7 m.  
Height of Cups above—Ground 5.8 m., M.S.L. 45.7 m.

Table for Scilly with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, and Time of Gust. Includes data for hours 1-31 and summary statistics.

GREAT YARMOUTH. †‡

Height of Head above—Roof 10.7 m., Ground 12.8 m., M.S.L. 15.9 m.  
Height of Cups above—Roof 3.7 m., Ground 13.3 m., M.S.L. 22.3 m.

Table for Great Yarmouth with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, and Time of Gust. Includes data for hours 1-31 and summary statistics.

The velocities at fixed hours are means for the interval from 30 minutes before to 30 minutes after the hour. The hours are numbered 1 h. to 24 h. Time is referred to Greenwich Mean Time. \* No Record. † Robinson Cup Anemometer; Arms 0.61 m.; Diameter of Cups, 0.229 m.; Factor 2.2. ‡ Robinson Cup Anemometer; Arms 0.305 m.; Diameter of Cups 0.127 m.; Factor 2.8. § Dines Pressure Tube Anemometer. At Great Yarmouth, Holyhead, and Scilly the readings at fixed hours are taken from the Robinson Anemometer, the maxima quoted are the greatest winds in a gust as recorded by the Dines Pressure Tube.

8. The Lower Layers of the Atmosphere from the Surface to 3000 metres (10,000 ft.) above Mean Sea Level. Soundings by Kites (K.) and Pilot Balloons (P.).

ABERDEEN. P. 38. January 31. 11 h. 35 m. G.M.T.							
Soundings with Pilot Balloons.	Height above M.S.L.	Wind.				Vertical Velocity.	Cloud Observations and Remarks.
		Direction.	Velocity.	Components.			
				W.-E.	S.-N.		
Greatest height	metres.	Degrees from N.	m/s.	m/s.	m/s.	m/s.	Two theodolites. Balloon lost to out-station soon after commencement. Vertical velocity assumed at 2.9 m.p.s. for readings with home theodolite. Balloon lost in distance.
	2400	...	...	...	...	...	
	2250	269	14.0	+14.0	+ 0.2	2.9 } Assumed.	
	2000	271	14.9	+14.9	- 0.3		
	1500	264	17.3	+17.2	+ 1.7		
	1000	267	18.4	+18.4	+ 1.0		
	500	265	17.1	+17.0	+ 1.4		
	100	255	12.5	+12.1	+ 3.3	2.9	
Ground level	30	235	10.6	+ 8.7	+ 6.0	3.0	
Computed for M.S.L.	0	260	17.5	+17.2	+ 3.0	...	

9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. January 1. 15 h. 0 m. G.M.T.		SOUNDING NO., R. 217.		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.			Reading.	Fall per km.	
GREATEST HEIGHT, } 14.7 km.	120 mb.	211° A.	Latitude, 51° 38' N. Longitude, 1° 1' W.	km.	mb.	°A.	°C.	Good trace.
LOWEST TEMPERATURE, } 10.9 km.	221 mb.	210° A.	Height above M.S.L., } 150 m.	14	136	212	0	
BASE OF STRATOSPHERE, } 10.9 km.	221 mb.	210° A.	PLACE OF FALL, Walton, Norfolk.	13	158	212	0	Overcast. Cirrus S.W.2.
Type No. II.			Distance, 154 km. and Orientation, 35°.	12	186	211	-1	
From observations at Station.		at 7 h.	at 18 h. G.M.T.	11.5	200	211	-1	Clouds at 400 m.
PRESSURE (M.S.L.),		1014 mb.	1013 mb.	11	218	210	-1	
TEMPERATURE,		280° A.	280° A.	10	256	214	4	
VAPOUR PRESSURE,		...	...	9	298	221	7	
GRADIENT WIND:—Direction,		236°	270°	8.9	300	221	6	
Velocity,		13.2 m/s.	10.1 m/s.	8	346	227	6	
Correction for Curvature,		0.0 m/s.	- 1.0 m/s.	7.0	400	233	6	
Final Components, { W. to E.		+ 10.9 m/s.	+ 9.1 m/s.	7	401	233	7	
{ S. to N.		+ 7.4 m/s.	0.0 m/s.	6	462	240	7	
				5.4	500	244	8	
				5	530	248	8	
				4.1	600	253	5	
				4	607	253	8	
				3	692	261	8	
				2.9	700	262	6	
				2	787	267	6	
				1.9	800	268	7	
				1	891	274	7	
				.9	900	...	...	
				Ground M.S.L.	992	280	...	
					1011	...	...	

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. January 3. 7 h. 0 m. G.M.T.		SOUNDING NO., R. 218.		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.			Reading.	Fall per Km.	
GREATEST HEIGHT, } 12.3 km.	...	215° A.	Latitude, 51° 38' N. Longitude, 1° 1' W.	km.	mb.	°A.	°C.	Trace not very distinct.
LOWEST TEMPERATURE, } 10 km.	257 mb.	214° A.	Height above M.S.L., } 150 m.	12.0	187	215	0	
BASE OF STRATOSPHERE, } 10 km.	257 mb.	214° A.	PLACE OF FALL, St Neots.	11.6	200	215	0	Very steep gradient from 6.0 to 9.0 km.
Type No. I.			Distance, 77 km. and Orientation, 41°.	11.0	219	215	-1	
From Observations at Station		at 7 h.	at 18 h. G.M.T.	10.0	257	214	-1	
PRESSURE (M.S.L.),		1011 mb.	1011 mb.	9.0	300	220	6	
TEMPERATURE,		280° A.	282° A.	9.0	301	220	8	
VAPOUR PRESSURE,		...	...	8.0	348	228	8	
GRADIENT WIND:—Direction,		202°	212°	7.1	400	237	10	
Velocity,		15.1 m/s.	14.4 m/s.	7.0	404	238	9	
Correction for Curvature,		0.0 m/s.	0.0 m/s.	6.0	465	247	9	
Final Components, { W. to E.		+ 5.7 m/s.	+ 7.6 m/s.	5.5	500	250	5	
{ S. to N.		+ 14.0 m/s.	+ 12.2 m/s.	5.0	533	252	5	
				4.1	600	258	7	
				4.0	608	259	7	
				3.0	692	262	3	
				2.9	700	263	6	
				2.0	788	268	6	
				1.9	800	266	7	
				1.0	896	275	7	
				1.0	900	...	...	
				Ground M.S.L.	991	278.5	...	
					1011	...	...	

9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.)—continued.

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. January 20. 10 h. 20 m. G.M.T.			SOUNDING No., R. 219.		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 13.5 km.	144 mb.	229° A.	Latitude, 51° 38' N.	Longitude, 1° 1' W.	km.	mb.	°A.	°C.	Ascent occurred in heavy rain after a wet night (58 in.) The balloon was sent up on account of the low barometer.
LOWEST TEMPERATURE, } 7.9 km.	...	220° A.	Height above M.S.L., } 150 m.		13.0	156	228	-2	
BASE OF STRATOSPHERE, } 7.9 km.	337 mb.	220° A.	PLACE OF FALL, Ickleton.		12.0	181	226	-2	
Type. No. I.			Distance, and Orientation, 89 km. 62°.		11.3	200	225	-2	
					11.0	211	224	-1	
					10.0	245	223	-1	
					9.0	284	222	-1	
					8.6	300	221	-2	
					8.0	329	220	8	
					7.0	384	228	8	
					6.7	400	230	8	
					6.0	444	236	9	
					5.2	500	244	9	
					5.0	512	245	6	
					4.0	586	251	6	
					3.8	600	252	8	
					3.0	672	259	8	
					2.7	700	261	7	
					2.0	765	266	7	
					1.7	800	268	6	
					1.0	867	272	6	
					0.7	900	...	...	
					0.0	1000	...	...	
From observations at Station		at 7 h.	at 18 h. G.M.T.		Ground M.S.L.	968	278	...	
PRESSURE (M.S.L.),		989 mb.	986 mb.		M.S.L.	987	...	...	
TEMPERATURE,		279° A.	280° A.						
VAPOUR PRESSURE,		...	...						
GRADIENT WIND:—Direction,		180°	218°						
Velocity,		27.5 m/s.	16.5 m/s.						
Correction for Curvature,		- 9.1 m/s.	- 2.5 m/s.						
Final Components, { W. to E.		0.0 m/s.	+ 8.6 m/s.						
{ S. to N.		+ 18.4 m/s.	+ 11.0 m/s.						

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. January 3. 7 h. 15 m. G.M.T.			SOUNDING No., R.K.C. 50.		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, LIMERICK.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 9.8 km.	268 mb.	219° A.	Latitude, 52° 38' N.	Longitude, 8° 41' W.	km.	mb.	°A.	°C.	Clear. Moderate S. Wind.  The values are not as reliable as usual as the instrument got slightly damaged between the calibration and the ascent.
LOWEST TEMPERATURE, } 9.8 km.	268 mb.	219° A.	Height above M.S.L., } 15 m.		9.0	298	225	7	
BASE OF STRATOSPHERE, } 9.0 km.	298 mb.	225° A.	PLACE OF FALL, Thurles.		9.0	300	225	7	
Type No. ?			Distance, and Orientation, 37 km. 85°.		8.0	347	232	8	
					7.0	399	240	8	
					7.0	400	240	7	
					6.0	459	247	7	
					5.37	500	250	5	
					5.0	528	252	5	
					4.04	600	257	5	
					4.0	604	257	5	
					3.0	688	262	5	
					2.85	700	263	5	
					2.0	778	267	5	
					1.79	800	268	3	
					1.0	884	270	3	
					.84	900	...	...	
					0.0	1000	...	...	
From observations at Station		at 7 h.	at 18 h. G.M.T.		Ground M.S.L.	...	274.5	...	
PRESSURE (M.S.L.),		1002 mb.	993 mb.		M.S.L.	1001	...	...	
TEMPERATURE,		277° A.	282° A.						
VAPOUR PRESSURE,		...	...						
GRADIENT WIND:—Direction,		225°	200°						
Velocity,		11.1 m/s.	30.8 m/s.						
Correction for Curvature,		0.0 m/s.	- 6.1 m/s.						
Final Components, { W. to E.		+ 7.8 m/s.	+ 8.4 m/s.						
{ S. to N.		+ 7.8 m/s.	+ 23.2 m/s.						

Time is expressed in the hours 1 to 24 of civil reckoning.

Pressure is given in millibars (1000 mb. = 1 C.G.S. atmosphere = 750 mm. approximately).

Gradient Wind is taken to be tangential to the isobar and is computed by the formula  $\gamma = 2\omega \rho V \sin \phi$ .

\*Base of Stratosphere.—TYPE 1.—When the stratosphere commences with an inversion, the height and temperature of the first point of zero temperature gradient are given.

TYPE 2.—When the stratosphere begins with an abrupt transition to a temperature gradient below 2° per km. without inversion, the height and temperature of the abrupt transition are given.

TYPE 3.—When there is no such abrupt change of temperature gradient, the base is taken to be where the mean fall of temperature for the kilometer next above is 2° or less, provided that it does not exceed 2° for any subsequent kilometer. If some other position for the base seems to the tabulator to be more suitable, it is noted in the column for "Remarks."

Temperatures are expressed in degrees absolute (273° A = 0° C.).

Heights are given in kilometers (km.).

# METEOROLOGICAL OFFICE OBSERVATORIES—GEOPHYSICAL JOURNAL.

FEBRUARY 1913.—DAILY VALUES REFERRED TO GREENWICH MEAN TIME AND UNITS,  
BASED ON THE C.G.S. SYSTEM.

[Price 1s.]

Third Year.—No. 2. *Meteorology, Solar Radiation, Seismology, Atmospheric Electricity, and Terrestrial Magnetism.*

## 1. SEISMOLOGICAL JOURNAL:—ESKDALE OBSERVATORY.—Lat. 55° 19' N. Long. 3° 12' W.

Date.	Microseisms of N. Component.								Remarks.
	0 h.		6 h.		12 h.		18 h.		
	A <sub>N</sub> . μ	T. s	A <sub>N</sub> . μ	T. s	A <sub>N</sub> . μ	T. s	A <sub>N</sub> . μ	T. s	
1	7.5	6.0	7.5	5.0	8.5	5.0	7.5	5.0	11th I, Faint long waves at 22 h. 33 m.
2	8.0	4.5	7.0	4.0	7.0	4.0	7.0	4.0	
3	7.0	3.0	8.0	4.0	8.0	10.0	8.0	11.5	12th I, P=0 h. 0 m. 26 s. (?), S=0 h. 9 m. 30 s. (?). Remote earthquake. Slight disturbances till 1 h. 45 m.
4	8.0	10.5	8.0	8.5	9.0	8.5	8.5	9.5	
5	9.0	8.5	9.0	6.0	8.5	6.0	8.0	4.5	14th I, Long waves 19 h. 57 m. Slight disturbance till 21 h.
6	7.5	5.5	8.0	5.0	8.0	4.5	7.0	5.0	
7	9.0	8.0	8.0	8.5	8.5	7.5	8.0	5.0	15th I, Long waves 21 h. 42 m. Faint disturbance.
8	6.5	5.0	6.5	4.5	5.0	5.5	7.0	4.0	
9	7.0	4.5	7.0	4.5	7.0	6.0	8.5	7.0	18th I, Faint disturbance 1 h. 5 m -1 h. 26 m.
10	8.0	4.5	7.5	6.0	7.5	4.5	7.5	3.5	
11	7.5	2.5	7.0	2.0	7.0	1.5	6.0	1.5	20th I, P=9 h. 10 m. 59 s., S=9 h. 20 m. 52 s., L=9 h. 37 m., Δ=8650 km.
12	6.5	2.0	6.5	1.5	6.5	1.0	6.5	1.5	
13	7.0	1.5	6.0	1.5	7.0	2.0	7.0	2.0	23rd I, P=3 h. 7 m. 7 s. (?), S=3 h. 17 m. 21 s. (?), L=3 h. 31 m., Δ=9070 km. (?).
14	7.0	2.5	6.0	3.0	6.5	2.5	7.0	1.5	
15	7.0	2.0	7.0	2.0	7.0	2.5	7.0	2.0	27th I, Slight disturbance about 17 h.
16	7.5	2.5	7.0	2.0	7.0	2.0	7.0	1.5	
17	7.0	1.5	7.0	1.0	7.0	1.0	7.0	1.0	27th I, Long waves 22 h. 11 m.-22 h. 33 m.
18	7.0	1.0	6.5	1.0	6.0	1.0	6.0	1.0	
19	6.0	1.0	6.0	1.0	5.5	1.0	6.0	0.5	
20	6.0	0.5	5.0	0.5	6.0	0.5	6.0	0.5	
21	5.5	0.5	5.0	0.5	6.0	0.5	6.0	0.5	
22	5.0	0.5	6.0	0.5	6.0	1.0	6.0	1.5	
23	6.0	2.5	6.0	4.0	6.0	3.0	5.5	2.5	
24	6.0	3.0	6.0	1.5	6.0	1.5	5.5	1.5	
25	5.5	1.5	5.5	1.5	6.0	1.0	6.5	1.0	
26	5.5	1.5	6.0	1.0	5.0	1.0	5.5	1.0	
27	5.0	1.0	6.0	1.5	5.5	1.5	5.5	1.5	
28	5.5	2.0	5.5	1.5	5.5	1.0	5.5	1.5	

An explanation of the notation used is given in the preface. The amplitude A<sub>N</sub> is half of the actual movement of the earth's surface in a N-S direction, between the ends of the swing (μ=0.01 mm.). The period T (in seconds) is the duration of a complete oscillation, i.e. both extreme positions are passed through once during the time T.

## 2. VALENCIA OBSERVATORY, CAHIRCIVEEN (KERRY).—Lat. 51° 56' N. Long. 10° 15' W.

Heights above Mean Sea Level:—Station, H=9.2 m. Barometer Cistern, H<sub>b</sub>=13.7 m.

Heights above Ground:—Thermometers, h<sub>t</sub>=1.2 m. Rain-gauge, h<sub>r</sub>=0.6 m. Sunshine Recorder, h<sub>s</sub>=12.8 m. Cups of Anemometer, h<sub>a</sub>=13.7 m.

Day.	Pressure at Station Level.		Air Temperature in Degrees Absolute.				Humidity.				Wind Direction in points (8=E, 16=S) and Velocity (metres per second).		Cloud Amount and Weather.		Rain 24 hours beginning 10 h.	Sunshine.	Remarks.	Magnetism.		
	9 h.	21 h.	9 h.	21 h.	Max.	Min.	Vapour Pressure.	Percentage.		9 h.	21 h.	10 h.	22 h.	Horizontal Force.				Declination West.	Inclination.	
	mb.	mb.	200+	200+	200+	200+	millibar.	%	%	m/sec.	m/sec.	Tenths of Sky covered.	mm.	hrs.				°	'	''
1	998.4	1003.4	76.6	77.6	79	76	7.1	7.1	90	84	19	5	24	9	10≡ <sup>0</sup>	5	4.8	1.2	▲ and * (sleet) showers a.	
2	1001.6	1011.5	81.3	82.8	83	77	9.5	10.5	87	88	23	12	20	12	7	10≡ <sup>0</sup>	—	—	Unsettled a. Gloomy p.	
3	1011.6	1013.2	83.5	82.9	84	x 83	10.5	11.5	82	95	20	12	18	9	10≡ <sup>0</sup>	10≡ <sup>0</sup>	4.3	—	Misty and gloomy.	
4	1017.1	1014.3	81.2	83.1	83	81	10.2	11.2	94	91	18	4	16	7	10≡ <sup>0</sup>	.8≡ <sup>0</sup>	4.3	0.1	Misty.	
5	1002.9	1008.2	82.5	79.1	83	78	10.5	8.2	89	86	15	9	13	5	10≡ <sup>0</sup>	3	3.8	3.3	≡ <sup>0</sup> a. Visibility p.	
6	997.4	1006.2	82.8	80.4	83	80	11.2	8.2	92	80	17	9	20	9	10≡ <sup>0</sup>	7	17.8	—	Intermittent ● 5 h.-9 h. Misty.	
7	990.1	1008.0	83.7	80.2	x 85	79	12.2	7.5	97	74	15	10	22	17	10≡ <sup>0</sup>	3	2.0	0.1	● 5 h. 20 m.-8 h. 30 m. Squally p.	
8	1021.3	1012.3	81.9	83.5	x 85	79	10.2	12.2	90	95	16	6	15	10	7	10≡ <sup>0</sup>	7.1	3.6	Misty p. ● 19 h.-23 h.	
9	1023.2	1019.4	81.0	82.4	84	81	9.8	9.2	91	79	21	2	8	6	8	10	4.3	1.4	Misty; dull p.	
10	1019.7	1023.7	83.7	83.4	84	x 83	12.9	12.2	100	96	15	5	15	6	10≡ <sup>0</sup>	10≡ <sup>0</sup>	1.5	—	Misty; gloomy p.	
11	1027.7	1032.7	83.2	83.2	x 85	x 83	11.9	11.2	94	90	15	5	13	6	10	7	—	0.2	Dull.	
12	1033.5	1032.5	81.0	80.4	83	80	10.2	9.2	94	88	15	6	15	7	3	5	—	5.6	Fair.	
13	1031.3	1032.9	80.2	78.5	82	78	8.8	8.5	98	94	6	5	16	4	6∞	6∞	—	4.7	Fine to fair. ☐	
14	1032.0	1029.3	79.0	80.1	83	77	8.8	9.5	93	94	—	1	15	2	10∞	10≡ <sup>0</sup>	—	0.8	∞≡ <sup>0</sup> . Fair.	
15	1025.9	1023.0	78.2	79.3	80	78	7.8	8.8	90	92	—	1	—	1	10∞	10∞	—	—	Overcast, with ∞.	
16	1023.4	1024.8	76.1	79.3	81	75	7.1	7.8	94	80	5	2	6	3	9	10≡ <sup>0</sup>	—	1.8	Dull. ∞ p.	
17	1025.0	1024.4	75.1	78.2	81	74	6.1	7.5	84	84	—	1	9	2	2∞	1∞	—	7.9	— early. ∞	
18	1023.9	1024.2	77.1	75.6	78	n 73	7.1	5.1	85	n 67	5	4	4	6	6∞	0∞	—	1.6	— early. ∞	
19	1022.4	1020.6	73.6	74.6	77	n 73	4.8	5.1	72	76	7	4	7	3	1∞	5∞	—	6.9	Fine. ∞	
20	1021.3	1023.4	74.2	74.8	n 76	n 73	4.8	5.1	72	72	6	3	6	4	2∞	10	—	4.2	Fine to fair. ∞	
21	1026.1	1026.3	75.5	76.3	77	75	5.1	5.8	70	75	7	4	9	4	10∞	8∞	—	—	Dull, with ∞.	
22	1022.4	1016.5	78.9	79.9	81	77	6.8	7.5	72	73	11	7	12	11	8∞	10	0.3	2.0	∞ a. Fair to squally.	
23	1008.8	1001.6	81.4	81.4	82	80	8.5	9.5	77	86	12	13	12	11	10≡ <sup>0</sup>	10	22.5	4.0	Intermittent ● 10 h. 30 m.-17 h.	
24	994.3	995.6	82.1	80.1	84	80	10.5	9.2	92	92	12	11	13	5	10≡ <sup>0</sup>	2	10.7	—	● till 8 h. 30 m., then intermittent ● till 20 h.	
25	987.2	1002.2	80.6	80.0	83	79	9.5	9.2	92	93	—	1	—	0	7≡ <sup>0</sup>	3	—	0.4	Misty and showery a. Visibility.	
26	1003.0	1006.8	75.2	77.1	82	75	7.1	7.8	98	94	6	2	—	1	1	2	0.3	8.6	— Fine, with visibility.	
27	1014.1	1020.8	74.2	78.0	83	74	6.5	8.2	95	93	3	2	—	1	0≡ <sup>0</sup>	0	—	9.1	— ∞ <sup>0</sup> . Fine.	
28	1021.3	1017.4	79.3	80.7	83	75	8.8	10.5	92	99	13	3	14	8	10	10≡ <sup>0</sup>	11.9	—	Visibility to misty and showery.	
Means	1015.2	1017.0	79.4	79.7	82.0	77.6	8.7	8.7	88	86	5.3	—	6.0	—	7.4	6.6	98.5	2.27	Monthly Totals or Means.	
Normal 40 years	1012.2	1012.2	79.6	79.8	82.5	77.5	8.4	8.5	87	86	6.0	—	6.1	—	—	—	125.9	2.52	Normals, 40 years.	

x denotes the maximum and n the minimum values in each column.

Note.—The cloud amounts in italic type at Valencia were taken at 21 h.

3. KEW OBSERVATORY, SURREY.—Lat. 51° 28' N. Long. 0° 19' W.

Heights above Mean Sea Level :—Station, H = 5.5 m. Barometer, H<sub>b</sub> = 10.4 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 3.0 m. Rain-gauge, h<sub>r</sub> = 0.5 m. Sunshine Recorder, h<sub>s</sub> = 14.3 m. Cups of Anemometer, h<sub>a</sub> = 21.3 m.

Table with columns for Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points (8=E, 16=S) and Velocity (metres per second), Cloud Amount and Weather, Rain 24 hours beginning 10 h., Sunshine, Solar Radiation, Watts per cm.², Min. Temp. on Grass, Earth Temperature at 10 h., and Remarks. Includes means and normals for 40 years.

4. ESKDALE OBSERVATORY, DUMFRIESSHIRE.—Lat. 55° 19' N. Long. 3° 12' W.

Heights above Mean Sea Level :—Station, H = 243.2 m. Barometer, H<sub>b</sub> = 237.1 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 0.8 m. Rain-gauge, h<sub>r</sub> = 0.3 m. Sunshine Recorder, h<sub>s</sub> = 1.5 m. Vane of Anemometer, h<sub>a</sub> = 15.2 m.

Table with columns for Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points (8=E, 16=S) and Velocity (metres per second), Cloud Amount and Weather, Rain 24 hours beginning 10 h., Sunshine, Solar Radiation, Watts per cm.², Min. Temp. on Grass, Earth Temperature at 10 h., and Remarks. Includes means and normals for 1911-12.

The solar radiation is the mean of the readings within the nominal hour of observation (11 h. 30 m.—12 h. 30 m.) unless some other hour is specified.



7. Tables of Wind Components in metres per second at fixed hours, together with the mean velocity (horizontal movement) in metres per second for the hour with the maximum hourly run for each day, or the greatest velocity attained in a gust and the time of its occurrence.

HOLYHEAD. †‡

Height of Head above—Roof 8.8 m., Ground 13.7 m., M.S.L. 19.2 m. Height of Cups above—Roof 4.6 m., Ground 7.6 m., M.S.L. 15.2 m.

DEERNESS. †

Height of Cups above—Roof 1.5 m., Ground 4.9 m., M.S.L. 57.3 m.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust, and V. Hrs. Min. for Holyhead and Deerness. Includes summary rows for S+N, W+E and S-N, W-E.

SCILLY. †‡

Height of Head above—Ground 9.8 m., M.S.L. 49.7 m. Height of Cups above—Ground 5.8 m., M.S.L. 45.7 m.

GREAT YARMOUTH. †‡

Height of Head above—Roof 10.7 m., Ground 12.8 m., M.S.L. 15.9 m. Height of Cups above—Roof 3.7 m., Ground 18.3 m., M.S.L. 22.3 m.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust, and V. Hrs. Min. for Scilly and Great Yarmouth. Includes summary rows for S+N, W+E and S-N, W-E.

The velocities at fixed hours are means for the interval from 30 minutes before to 30 minutes after the hour. The hours are numbered 1 h. to 24 h. Time is referred to Greenwich Mean Time. \* No Record. † Robinson Cup Anemometer; Arms 0.61 m.; Diameter of Cups, 0.229 m.; Factor 2.2. ‡ Robinson Cup Anemometer; Arms 0.305 m.; Diameter of Cups 0.127 m.; Factor 2.8. § Dines Pressure Tube Anemometer. At Great Yarmouth, Holyhead, and Scilly the readings at fixed hours are taken from the Robinson Anemometer, the maxima quoted are the greatest winds in a gust as recorded by the Dines Pressure Tube. || Trace faint.



8. The Lower Layers of the Atmosphere from the Surface to 3000 metres (10,000 ft.) above Mean Sea Level.

Soundings by Kites (K.) and Pilot Balloons (P.).

PYRTON HILL. K. 5. February 21. 11 h. 50 m. G.M.T.											ABERDEEN. P. 40. February 5. 11 h. 35 m. G.M.T.							
Soundings with Kites.	Height above M.S.L.	Pressure.	Temperature.		Humidity.	Density.	Wind.		Cloud Observations and Remarks.	Soundings with Pilot Balloons.	Height above M.S.L.	Wind.			Vertical Velocity.	Cloud Observations and Remarks.		
			Reading.	Fall per km.			Direction.	Velocity.				Direction.	Velocity.	Components.				
	metres.	mb.	°A.	°C.	%	mb.	mgm/cc.	Degrees from N.	m/s.		metres.	Degrees from N.	m/s.	m/s.	m/s.			
Greatest height.	1150	888.8	27.5	-23	40	2.1	1.140	65	12	Overcast, with a few clear patches. Sharp inversion just over 1000 m. Clouds at 900 m.	Greatest height	560	...	...	...	...	Balloons lost in mist. Day very misty. Balloons could not be seen from outstation, therefore one theodolite only. Vertical velocity assumed.	
	1000	905.8	26.8	6	70	2.9	1.176	65	14			500	215	17.1	+9.8	+14.0		2.9
	500	964.9	27.1	8	90	4.8	1.238	55	14			250	209	11.5	+5.6	+10.1		2.9
100 m. above ground	250	995.6	27.3	5	70	4.3	1.268	45	10			100	195	6.5	+1.7	+6.3		3.0
Ground level	150	1008.1	27.3.5		70	4.4	1.282	45	5			Ground level	30	157	2.5	-1.0		+2.3
Computed for M.S.L.	0	1027.1	...	...	...	...	...	70	14.7	...	Computed for M.S.L.	0	Pressure distribution irregular.			Free lift 49 gr.		

ABERDEEN. P. 41. Feb. 7. 11 h. 30 m. G.M.T.											ABERDEEN. P. 42. Feb. 14. 11 h. 25 m. G.M.T.											ABERDEEN. P. 43. Feb. 19. 11 h. 35 m. G.M.T.										
Soundings with Pilot Balloons.	Height above M.S.L.	Wind.			Vertical Velocity.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.			Vertical Velocity.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.			Vertical Velocity.	Cloud Observations and Remarks.														
		Direction.	Velocity.	Components.				Direction.	Velocity.	Components.				Direction.	Velocity.	Components.																
	metres.	Degrees from N.	m/s.	m/s.	m/s.	metres.	Degrees from N.	m/s.	m/s.	m/s.	metres.	Degrees from N.	m/s.	m/s.	m/s.	metres.	Degrees from N.	m/s.	m/s.	m/s.												
Greatest height	1488	...	...	...	...	1250	...	...	...	...	Balloon seen from home station only. Dense ground haze, but sky visible directly overhead. Surface wind light and variable.	1640	...	...	...	...	1640	...	...	...	...	Disappeared in haze. Flight very erratic, almost spiral. No definite surface wind.										
	...	...	...	...	...	...	...	...	...	...	...	1540	48	6.0	-4.5	-4.0	1.7	1540	48	6.0	-4.5		-4.0									
	...	...	...	...	...	1000	160	5.0	-1.7	+4.7	} (assumed). 2.9 (assumed).	1250	61	6.0	-5.2	-2.9	3.1	1250	61	6.0	-5.2		-2.9									
	1440	228	16.4	+12.2	+11.0	1.8*	750	158	3.2	-1.2		+3.0	1000	113	3.8	-3.5	+1.5	2.1	1000	113	3.8		-3.5	+1.5								
	1000	218	18.9	+11.5	+15.0	3.2	500	206	2.6	+1.1		+2.3	500	206	2.6	+1.1	+2.3	3.9	500	206	2.6		+1.1	+2.3								
	500	200	14.6	+4.9	+13.7	3.5	250	159	2.2	-0.8	+2.1	250	159	2.2	-0.8	+2.1	2.5	250	159	2.2	-0.8	+2.1										
Ground level	100	184	12.0	+0.9	+12.0	3.3	100	174	2.0	-0.2	+2.0	100	174	2.0	-0.2	+2.0	2.7	100	252	1.6	+1.5	+0.5	2.7									
Ground level	30	170	6.0	-1.0	+5.9	...	30	301	0.6	+0.5	-0.3	...	30	...	0.0	0.0	0.0	...	30	...	0.0	0.0	0.0									
Computed for M.S.L.	0	205	17.2	+7.3	+15.6	...	Free lift 44 gr.	0	Pressure distribution irregular.			Lift 49 gr.	0	Pressure distribution irregular.			Lift 43 gr.															

ABERDEEN. P. 44. Feb. 21. 11 h. 20 m. G.M.T.											ABERDEEN. P. 45. Feb. 26. 11 h. 30 m. G.M.T.											ABERDEEN. P. 46. Feb. 28. 11 h. 30 m. G.M.T.										
Greatest height.	Height above M.S.L.	Wind.			Vertical Velocity.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.			Vertical Velocity.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.			Vertical Velocity.	Cloud Observations and Remarks.														
		Direction.	Velocity.	Components.				Direction.	Velocity.	Components.				Direction.	Velocity.	Components.																
	metres.	Degrees from N.	m/s.	m/s.	m/s.	metres.	Degrees from N.	m/s.	m/s.	m/s.	metres.	Degrees from N.	m/s.	m/s.	m/s.	metres.	Degrees from N.	m/s.	m/s.	m/s.												
Greatest height	1138	...	...	...	...	Balloon lost in Fr.-Nb-Cu. cloud base.	970	...	...	...	Balloon lost in haze, which was very dense at time of ascent.	2660	...	...	...	Balloon entered Strato-Cumulus cloud at 2660 metres. Final height as calculated from altitudes read at both stations. These agreed to within 8 metres, so height of cloud is quite certain.																
	1000	43	3.7	-2.5	-2.7	2.0	800	212	17.3	+9.3	+14.6	2.8	2500	339	8.2	+2.9	-7.7	2.1														
	750	58	4.6	-3.9	-2.4	2.1	730	214	15.3	+8.6	+12.7	2.8	2000	345	7.6	+2.0	-7.3	2.4														
	500	56	5.2	-4.3	-2.9	2.5	500	218	13.6	+8.4	+10.7	2.7	1500	333	4.0	+1.8	-3.6	2.8														
	250	48	4.8	-3.6	-3.2	2.8	250	209	8.9	+4.4	+7.8	3.8	1000	6	4.1	-0.4	-4.1	2.4														
Ground level	100	37	3.9	-2.3	-3.1	2.5	100	188	4.5	+0.6	+4.5	3.9	500	12	2.4	-0.5	-2.4	2.5														
Ground level	30	45	1.8	-1.3	-1.3	...	30	169	2.1	-0.4	+2.1	...	100	302	2.5	+2.1	-1.3	2.2														
Ground level	30	45	1.8	-1.3	-1.3	...	30	169	2.1	-0.4	+2.1	...	30	315	1.6	+1.1	-1.1	...														
Computed for M.S.L.	0	Station near centre of anticyclone.			Lift 25 gr.	0	232	8.7	+6.9	+5.4	...	Free lift 58 gr.	0	Station near centre of anticyclone.																		

9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. February 6. 7 h. 0 m. G.M.T.				SOUNDING NO., R. 220.		Height above M.S.L.	Pressure.	Temperature.		REMARKS.	
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.	Latitude, 51° 38' N.	Longitude, 1° 1' W.			Reading.	Fall per Km.		
GREATEST HEIGHT, } 12.3 km.	199 mb.	208° A.	Height above M.S.L., } 150 m.	PLACE OF FALL, Ware.		km.	mb.	°A.	°C.	Light S.E. wind. Low clouds. Isothermal at 272° from 1.5 to 2.6 km. Good distinct trace; the up and down lines constantly cross each other.	
LOWEST TEMPERATURE, } 11.4 km.	...	204° A.		Distance, 67 km. and Orientation, 75°.	12.0	186	207				
BASE OF STRATOSPHERE, } 11.4 km.	208 mb.	204° A.			11.6	200	206				
Type No. I.				11.0	220	205					
				10.0	260	213					
				9.0	300	220					
				9.0	303	221					
				8.0	391	229					
				7.1	400	234					
				7.0	409	239					
				6.0	469	246					
				5.5	500	249					
				5.0	536	253					
				4.1	600	260					
				4.0	613	261					
				3.0	696	268					
				3.0	700	268					
				2.0	791	272					
				1.9	800	272					
				1.0	896	274					
				1.0	900	...					
				1.0	1000	...					
				Ground M.S.L.	994	275					
					1014	...					

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. February 7. 7 h. 6 m. G.M.T.				SOUNDING NO., R. 221.		Height above M.S.L.	Pressure.	Temperature.		REMARKS.	
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.	Latitude, 51° 38' N.	Longitude, 1° 1' W.			Reading.	Fall per Km.		
GREATEST HEIGHT, } 11 km.	166 mb.	210° A.	Height above M.S.L., } 150 m.	PLACE OF FALL, Gt. Braxted.		km.	mb.	°A.	°C.	Low clouds. Moderate S. wind. Isothermal at 272° from 1.8 to 2.2 km.	
LOWEST TEMPERATURE, } 10.4 km.	...	209° A.		Distance, 113 km. and Orientation, 80°.	11.0	222	210				
BASE OF STRATOSPHERE, } 10.4 km.	183 mb.	209° A.			10.0	258	212				
Type No. I.				9.0	300	219					
				9.0	303	219					
				8.0	351	228					
				7.1	400	235					
				7.0	405	236					
				6.0	468	242					
				5.5	500	248					
				5.0	516	251					
				4.2	600	258					
				4.0	612	259					
				3.0	688	266					
				3.0	700	267					
				2.0	792	272					
				1.9	800	272					
				1.0	899	276					
				1.0	900	...					
				1.0	1000	...					
				Ground M.S.L.	998	279					
					1016	...					

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. February 11. 15 h. 30 m. G.M.T.				SOUNDING NO., R. 222.		Height above M.S.L.	Pressure.	Temperature.		Wind.			REMARKS.	
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.	Latitude, 51° 38' N.	Longitude, 1° 1' W.			Reading.	Fall per Km.	Direction.	Velocity.	Components.		
GREATEST HEIGHT, } 11.2 km.	223 mb.	212° A.	Height above M.S.L., } 150 m.	PLACE OF FALL, High Wycombe.		km.	mb.	°A.	°C.	Degrees from N.	m/s.	W. to E.	S. to N.	Clear and calm. The traces differ by about 2° throughout, the mean taken. The balloon was followed by one theodolite for 79 minutes, 12 minutes of which were after it had burst. An unusual increase of an easterly component at the top is shown, and is undoubtedly correct.
LOWEST TEMPERATURE, } 10.8 km.	...	209° A.		Distance, 19 km. and Orientation, 105°.	11.0	230	211							
BASE OF STRATOSPHERE, } 10.8 km.	240 mb.	209° A.			10.0	270	216							
Type No. I.				9.3	300	221								
				9.0	314	224								
				8.0	365	231								
				7.4	400	237								
				7.0	422	240								
				6.0	486	246								
				5.8	500	247								
				5.0	557	253								
				4.4	600	258								
				4.0	635	262								
				3.2	700	269								
				3.0	720	271								
				2.1	800	277								
				2.0	815	278								
				1.2	900	283								
				1.0	920	284								
				0.3	1000	...								
				Ground M.S.L.	1016	283					0.0	0	0	
					1034	...					...	...	...	

9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.)—continued.

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. February 21. 15 h. 35 m. G.M.T.				SOUNDING No., R. 223.		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.	Latitude, 51° 38' N.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 13.4 km.	150 mb.	217° A.	Longitude, 1° 1' W.	Height above M.S.L., } 150 m.	km.	mb.	°A.	°C.	Balloon followed by theodolite for 6½ minutes, then lost sight of in small patch of cloud.  Inversion 268° at '7 to 271° at '9 on one trace; 267° at 1'0 to 272° at 1'2 on the other.	
LOWEST TEMPERATURE, } ...	...	...	PLACE OF FALL, Potterne.	Distance, 69 km.	13.0	160	217	1		
BASE OF STRATOSPHERE, } 10.0 km.	252 mb.	211° A.	Orientation, 243°.		12.0	185	218			
Type. No. I.					11.6	200	217			
					11.0	217	216	-2		
					10.0	252	211	-5		
					9.0	295	216	5		
					8.9	300	217	6		
					8.0	344	222	8		
					7.0	399	230			
					7.0	400	230	7		
					6.0	461	237			
					5.4	500	241	8		
					5.0	531	245			
					4.1	600	253	9		
					4.0	609	254	7		
					3.0	696	261	8		
					3.0	700	261	8		
					2.0	793	269			
					1.9	800	269	0		
					1.0	898	269			
					1.0	900	...	5		
					1.2	1000	274			
From observations at Station			at 7 h.	at 18 h. G.M.T.	Ground	1000	274	...		
PRESSURE (M.S.L.),			1025.4 mb.	1030.1 mb.	M.S.L.	1018	...	...		
TEMPERATURE,			276° A.	277° A.						
VAPOUR PRESSURE,			...	...						
GRADIENT WIND:—Direction,			60°	Station near						
Velocity,			13.0 m/s.	centre of						
Correction for Curvature,			0.0 m/s.	anticyclone.						
Final Components, { W. to E. ?			- 11.3 m/s.							
{ S. to N. ?			- 6.5 m/s.							

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. February 8. 7 h. 0 m. G.M.T.				SOUNDING No., 4, 1913.		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, MANCHESTER.	Latitude, 53° 28' N.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 14.9 km.	119 mb.	225° A.	Longitude, 2° 14' W.	Height above M.S.L., } 40 m.	km.	mb.	°A.	°C.		
LOWEST TEMPERATURE, } 14.9 km.	119 mb.	225° A.	PLACE OF FALL, March, Cambs.	Distance, 185 km.	14.0	137	226	1		
BASE OF STRATOSPHERE, } 8.2 km.	333 mb.	228.5° A.	Orientation, 121°.		13.0	160	227	0.5		
Type No. II.					12.0	187	227.5	0		
					11.6	200	227.5			
					11.0	217	227.5	0		
					10.0	255	227.5			
					9.0	296	228.5	1		
					8.9	300	228.5	2		
					8.0	343	230.5 229	8.5		
					7.0	400	239 235	4		
					6.0	458	243 238.5	3		
					5.4	500	244.5 241.5	9		
					5.0	529	246 243.5			
					4.1	600	254 251	8.5		
					4.0	609	255 252			
					3.0	696	263.5 258.5	2.5		
					2.9	700	263.5 258.5			
					2.0	792	266	5.5		
					1.9	800	266.5			
					1.0	900	271.5			
					0.2	1000	279			
From observations at Station.			at 7 h.	at 18 h. G.M.T.	Ground	1010	280	...		
PRESSURE (M.S.L.),			1018.6 mb.	1027.1 mb.	M.S.L.	1014	...	...		
TEMPERATURE,			280° A.	280° A.						
VAPOUR PRESSURE,			...	...						
GRADIENT WIND:—Direction, ?				Pressure						
Velocity, ?				Distribution						
Correction for Curvature,				Irregular						
Final Components, { W. to E. ?										
{ S. to N. ?										

Time is expressed in the hours 1 to 24 of civil reckoning.

Pressure is given in millibars (1000 mb. = 1 C.G.S. atmosphere = 750 mm. approximately).

Gradient Wind is taken to be tangential to the isobar and is computed by the formula  $\gamma = 2 \omega \rho V \sin \phi$ .

\*Base of Stratosphere.—TYPE 1.—When the stratosphere commences with an inversion, the height and temperature of the first point of zero temperature gradient are given.

TYPE 2.—When the stratosphere begins with an abrupt transition to a temperature gradient below 2° per km. without inversion, the height and temperature of the abrupt transition are given.

TYPE 3.—When there is no such abrupt change of temperature gradient, the base is taken to be where the mean fall of temperature for the kilometer next above is 2° or less, provided that it does not exceed 2° for any subsequent kilometer. If some other position for the base seems to the tabulator to be more suitable, it is noted in the column for "Remarks."

Temperatures are expressed in degrees absolute (273° A = 0° C.).

Heights are given in kilometers (km.).

10. Solar Radiation at South Kensington.

Day.	JANUARY.					FEBRUARY.					MARCH.					REMARKS.
	Max. Rate, Milli-watts per cm <sup>2</sup> .	Daily Amount.		Duration of Bright Sunshine.		Max. Rate, Milli-watts per cm <sup>2</sup> .	Daily Amount.		Duration of Bright Sunshine.		Max. Rate, Milli-watts per cm <sup>2</sup> .	Daily Amount.		Duration of Bright Sunshine.		
		Joules per cm <sup>2</sup> .	% of Ideal.*	Hours.	% of Possible.		Joules per cm <sup>2</sup> .	% of Ideal.*	Hours.	% of Possible.		Joules per cm <sup>2</sup> .	% of Ideal.*	Hours.	% of Possible.	
1	8	101	18	...	...	8	124	15	...	...	25	359	27	...	...	
2	16	239	43	1'8	23	22	201	24	...	...	43	574	42	4'4	40	
3	15	138	25	0'6	8	17	134	16	...	...	25	196	14	0'2	2	
4	10	129	23	...	...	25	331	38	0'2	2	25	170	12	...	...	
5	13	116	21	...	...	8	108	12	...	...	45	931	65	6'8	61	
6	16	165	29	1'8	23	18	210	23	...	...	46	782	54	5'8	52	
7	15	151	26	0'3	4	6	77	8	...	...	38	592	40	1'5	13	
8	10	134	23	...	...	25	468	50	x 5'0	x 53	45	735	49	5'3	47	
9	15	254	43	2'9	36	6	72	8	...	...	38	396	26	0'1	1	
10	3	29	5	...	...	23	416	43	...	...	8	131	8	...	...	
11	n 2	18	3	...	...	24	378	39	1'3	13	42	560	36	1'9	17	
12	18	278	45	3'8	46	13	115	12	...	...	51	873	55	5'5	48	
13	5	54	9	...	...	15	179	18	...	...	20	475	29	1'0	9	
14	18	174	28	0'1	1	8	88	9	...	...	18	219	13	...	...	
15	22	269	42	3'2	39	n 2	n 4	< 1	...	...	53	x 972	59	x 7'5	x 64	
16	18	271	42	2'5	30	25	455	43	3'4	34	36	502	30	...	...	
17	23	285	44	1'0	12	14	183	17	0'1	1	35	428	25	1'9	16	
18	17	224	34	0'1	1	32	488	44	4'5	45	48	864	50	4'5	38	
19	13	169	25	...	...	32	495	44	3'3	32	52	807	46	5'0	42	
20	x 25	210	31	0'9	11	16	204	18	0'1	1	x 55	956	54	6'1	50	
21	8	50	7	...	...	31	316	27	0'5	5	x 55	698	39	2'1	17	
22	8	111	16	...	...	24	231	20	0'4	4	49	658	36	2'4	20	
23	13	113	16	...	...	36	x 717	60	x 5'0	48	48	667	36	3'7	30	
24	10	109	15	...	...	36	706	58	1'0	10	26	423	23	0'1	1	
25	21	151	21	0'2	2	26	308	25	0'4	4	24	385	20	...	...	
26	20	287	38	0'6	7	30	325	26	0'1	1	47	594	31	0'7	6	
27	18	266	35	0'9	10	x 39	472	37	2'6	24	47	698	36	3'7	30	
28	6	76	10	...	...	32	283	22	0'8	7	41	445	22	1'2	10	
29	n 2	n 9	1	...	...	...	...	...	...	...	38	378	19	0'3	2	
30	10	91	11	...	...	...	...	...	...	...	41	508	25	0'9	7	
31	24	x 416	51	x 5'9	x 66	...	...	...	...	...	n 5	n 93	5	...	...	
Total	...	5087	...	26'6	10	...	8088	...	28'7	10	...	17069	...	72'6	20	
Mean	14	R=164	25	H=0'86	...	21	R=289	28	H=1'03	...	38	R=551	33	H=2'34	...	
Ratio of Mean Daily Amount to Mean Duration.	$\frac{R}{H} = 191$					$\frac{R}{H} = 281$					$\frac{R}{H} = 236$					

*Note.*—1 watt per cm<sup>2</sup> = 14'35 gramme-calories per cm<sup>2</sup> per minute. 1 gramme-calorie per minute = 0'7 watt nearly.

If the heat were distributed throughout the atmosphere, 1000 gramme-calories per cm<sup>2</sup> would be sufficient to raise the temperature 4°'1 C. It would take 245 gramme-calories per cm<sup>2</sup> to raise the temperature of the whole atmosphere 1° C.

*N.B.*—The values of Solar Radiation at South Kensington are obtained from the records of a Callendar Instrument which depends upon the difference of temperature between a black and a bright wire exposed horizontally to radiation from the whole of the sky. The values may be taken as representing the total radiation and the maximum rate of radiation per cm<sup>2</sup> received by a horizontal surface. If it is desired to compare the values published for Kew and Eskdalemuir in Tables 3 and 4 with the simultaneous value recorded by the Callendar Instrument the former must be multiplied by the cosine of the zenith distance of the sun at the time of observation. The duration of sunshine in this table is obtained from a Campbell-Stokes Recorder.

\* The "Ideal" intensity of radiation at any instant is taken to be a function of the Sun's altitude only. It is approximately the highest intensity recorded at South Kensington for the corresponding elevation of the Sun. The "Ideal" amount for the day is found by integrating the "Ideal" intensity from sun-rise to sun-set: it is the amount which could be recorded on a day when the atmosphere was in its most transparent state from sun-rise to sun-set. A memoir dealing with the subject is in preparation.

# METEOROLOGICAL OFFICE OBSERVATORIES—GEOPHYSICAL JOURNAL.

MARCH 1918.—DAILY VALUES REFERRED TO GREENWICH MEAN TIME AND UNITS,  
BASED ON THE C.G.S. SYSTEM.

[Price 1s.]

Third Year.—No. 3. *Meteorology, Solar Radiation, Seismology, Atmospheric Electricity, and Terrestrial Magnetism.*

## 1. SEISMOLOGICAL JOURNAL:—ESKDALE OBSERVATORY.—Lat. 55° 19' N. Long. 3° 12' W.

Date.	Microseisms of N. Component.								Remarks.
	0 h.		6 h.		12 h.		18 h.		
	A.N. μ	T. s	A.N. μ	T. s	A.N. μ	T. s	A.N. μ	T. s	
1	1.5	5	1.5	5	2.0	5	2.0	5	1st, I, Disturbed from 15 h. 17 m.—15 h. 40 m.
2	1.5	5.5	1.5	5	1.5	5	1.5	5	2nd, I, Faint disturbance about 3 h. 46 m.
3	1.5	5	2.0	6	2.5	6	2.5	7	6th, II, Earthquake. Max. amp. 2 h. 44 m. 45 s. Too windy to determine any details.
4	2.5	7	2.0	6.5	3.0	7	5.0	7	6th, II, P=2 S=11 h. 23 m. 15 s., L=11 h. 34 m. Max. amp. 11 h. 39 m. 45 s.
5	6.0	7	8.5	8	11.5	8.5	10.5	9	8th, I, L=16 h. 25.5 m. Disturbed till about 17 h. 45 m.
6	8.0	7	7.5	7	6.5	7	5.0	8	10th, I, Disturbed from 15 h. 3 m. to 15 h. 41 m.
7	3.5	7.5	4.0	7.5	3.5	6	3.0	6.5	11th, I, Faint disturbance 19 h. 43 m.—19 h. 47 m.
8	2.5	6	2.0	5.5	1.5	6.5	1.5	7	12th, I, Faint disturbance about 22 h. 40 m.
9	2.5	7	2.0	6.5	2.5	5.5	2.5	6	14th, III, P=8 h. 59 m. 36 s., nearly E.—W. Large disturbance continued for about 3 hours. Too windy to give details.
10	3.5	6.5	4.5	6.5	5.0	7	5.0	7	18th, I, Disturbed from about 1 h. 45 m.—2 h. 32 m.
11	3.5	7	2.5	7	2.5	7	2.5	6	23rd, Iu, Earthquake, L=21 h. 30 m., Δ about 10,000 km. Duration till about 23 h.
12	3.0	6.5	2.5	6	3.0	6.5	3.0	6	24th, I, Faint disturbance from 10 h. 50 m.—11 h. 32 m.
13	2.5	6	2.5	6	2.0	7	2.5	6	24th, I, Faint disturbance from 16 h. 51 m.—17 h. 7 m.
14	4.5	6.5	5.0	6	4.5	7	3.5	7	25th, I, Very faint disturbance about 2 h. 30 m.
15	4.5	7	3.5	7	4.0	7	3.5	7	26th, I, Faint disturbance from 22 h. 4 m. for 1 hour.
16	4.5	7	3.5	7.5	4.0	6	4.5	6.5	27th, I, Faint disturbance from 3 h. 30 m. for 50 min.
17	4.0	7	3.0	5.5	2.5	6	2.5	5.5	27th, I, Faint disturbance from 10 h. 8 m. for 30 min.
18	2.5	5.5	2.0	5.5	2.0	6	2.0	5	30th, I, Faint disturbance 9 h. 56 m.—11 h. 12 m.
19	2.0	5	5.0	5	5.5	6	5.5	6	31st, II, P=3 h. 52 m. 47 s., S=4 h. 2 m. 19 s., L=4 h. 16 m., Δ=8250 km., α=nearly N.—S.
20	3.5	7	5.0	6	4.5	7	5.0	8	
21	3.5	7	4.0	7	3.5	8	3.5	6.5	
22	3.5	6	3.0	6	3.0	5.5	2.5	5.5	
23	2.0	5.5	2.0	5	2.0	5	2.5	5	
24	4.0	5	1.5	5	1.0	5	1.0	5	
25	0.5	4.5	0.5	5	0.5	5	1.0	5	
26	1.0	5	1.0	5	1.0	7	1.0	7	
27	1.5	6.5	1.0	6.5	1.0	6.5	2.0	5	
28	2.0	6	3.5	6	3.5	7	4.0	7	
29	3.0	6.5	3.0	5.5	2.5	6	1.5	6	
30	1.5	6	1.0	6	1.0	5	1.0	6	
31	1.0	5.5	—	—	1.0	6	1.5	8	

An explanation of the notation used is given in the preface. The amplitude A<sub>N</sub> is half of the actual movement of the earth's surface in a N—S direction, between the ends of the swing (μ=0.01 mm.). The period T (in seconds) is the duration of a complete oscillation, i.e. both extreme positions are passed through once during the time T.

## 2. VALENCIA OBSERVATORY, CAHRCIVEEN (KERRY).—Lat. 51° 56' N. Long. 10° 15' W.

Heights above Mean Sea Level:—Station, H=9.2 m. Barometer Cistern, H<sub>b</sub>=13.7 m.

Heights above Ground:—Thermometers, h<sub>t</sub>=1.2 m. Rain-gauge, h<sub>r</sub>=0.6 m. Sunshine Recorder, h<sub>s</sub>=12.8 m. Cups of Anemometer, h<sub>a</sub>=13.7 m.

Day.	Pressure at Station Level.		Air Temperature in Degrees Absolute.				Humidity.				Wind Direction in points (8=E, 16=S) and Velocity (metres per second).				Cloud Amount and Weather.		Rain 24 hours beginning 10 h.	Sunshine.	Remarks.	Magnetism.					
	9 h.	21 h.	9 h.	21 h.	Max.	Min.	Vapour Pressure.		Percentage.		9 h.	21 h.	9 h.	21 h.	10 h.	22 h.				mm.	hrs.	Horizontal Force.	Declination West.	Inclination.	
							millibar.	%	%	m/sec.															m/sec.
1	mb. 1008.7	mb. 1003.8	82.4	80.6	83	80	11.5	9.2	99	88	15	8	20	7	10≡0	2	3.3	—	Intermittent a. Gloomy.	7	0	0			
2	1012.8	1005.2	79.3	83.8	84	78	8.2	12.2	87	95	16	3	16	10	9	10≡0	19.8	2.1	2 <sup>o</sup> 14 h.—17 h. 30 m. Heavy mist p.	...	...	...			
3	1008.1	1013.5	79.6	81.0	84	80	9.2	8.8	93	84	30	7	16	4	10	10	—	3.3	Showery a. Visibility p.	...	...	...			
4	1001.9	1004.6	83.7	81.6	85	80	10.9	8.8	86	81	16	9	20	13	10≡0	10	0.8	—	Gloomy and misty.	...	...	...			
5	1012.1	1008.8	81.1	82.2	83	79	8.5	9.2	80	81	16	7	20	10	10≡0	10	4.1	1.1	Misty and showery.	...	...	...			
6	1009.4	1008.9	80.6	77.3	82	77	8.8	7.1	84	87	18	7	21	13	10≡0	2	16.0	0.1	2 <sup>o</sup> 12 h.—15 h. Misty.	...	...	...			
7	1013.9	1020.1	78.4	78.4	80	76	6.8	6.5	78	73	24	8	25	6	10≡0	10	1.0	4.5	▲ showers a. Fair p.	...	...	...			
8	1029.9	1033.0	80.0	80.4	82	78	7.5	8.2	73	80	28	6	20	6	2	10	0.3	4.7	Fine to fair; 9 <sup>o</sup> showers p.	17911	20	20.5	68	10.3	
9	1028.1	1024.1	81.8	82.6	83	80	9.5	11.5	84	97	19	8	20	10	10≡0	10	1.8	—	9 <sup>o</sup> showers a. 9 <sup>o</sup> 20 h.—24 h.	...	...	...			
10	1026.6	1020.5	80.9	82.6	84	80	9.5	10.5	90	98	16	3	17	8	10≡0	10	3.1	—	Misty.	...	...	...			
11	1025.6	1027.6	80.8	76.8	83	76	8.2	6.8	78	85	26	6	1	2	6	1	—	9.1	Visibility a. Fine.	...	...	...			
12	1018.4	1017.6	81.3	79.5	83	78	9.5	7.8	87	79	15	6	1	4	8	1	4.8	0.1	Dull and misty.	...	...	...			
13	1012.8	1005.5	79.4	81.7	84	75	8.2	10.9	83	97	14	6	18	4	10	10≡0	7.4	0.1	— a. Visibility to misty.	...	...	...			
14	1003.2	1008.1	80.3	77.3	82	76	8.8	6.5	88	76	15	6	19	6	10≡0	9	2.8	4.1	Squally, with ▲ showers.	...	...	...			
15	1015.2	1005.1	77.3	78.1	81	75	7.1	7.8	87	89	20	11	24	12	10≡0	8	5.6	0.7	▲ squalls n. Showery. [K] 18 h. 30 m.	...	...	...			
16	1004.2	997.2	78.5	77.6	80	75	6.8	6.5	77	75	21	14	26	8	6	8≡0	4.3	7.0	▲ showers a.	...	...	...			
17	1001.8	1008.5	77.0	76.0	80	74	7.5	6.8	90	88	4	2	3	2	7	5	5.1	6.8	▲ and * (sleet) showers n. and a.	...	...	...			
18	997.9	984.2	77.3	82.0	83	74	7.8	10.9	92	94	15	5	20	9	10≡0	7	15.5	—	T 11 h. 2 <sup>o</sup> 15 h.	...	...	...			
19	981.1	986.3	78.9	79.2	83	78	7.8	7.5	84	78	21	15	21	13	7	7	3.8	5.6	▲ and * (sleet) squalls.	...	...	...			
20	984.6	982.8	77.1	78.5	80	76	6.8	7.5	84	84	15	8	20	10	8	10	2.8	2.8	T ▲ 7 h. ▲ showers.	...	...	...			
21	982.7	986.6	80.2	79.4	83	78	8.2	8.5	81	87	16	6	18	8	8	9	8.1	2.2	Misty a. Frequent ● showers p.	17913	20	20.3	68	8.9	
22	989.4	990.4	79.8	79.6	84	78	8.8	8.5	89	87	15	3	—	1	4	7	6.1	6.3	Fair; visibility.	...	...	...			
23	996.9	1009.0	79.1	80.4	81	78	8.8	8.2	93	80	30	7	32	6	10≡0	5	1.1	—	2 <sup>o</sup> showers a. Squally p.	...	...	...			
24	1018.4	1021.2	77.5	77.9	83	76	7.5	8.2	90	94	—	1	24	2	6	0	—	7.3	—	— a. Fine.	...	...	...		
25	1022.2	1019.1	80.1	79.8	84	75	8.2	7.8	80	80	11	3	10	4	2	3	—	10.0	—	— a. Fine.	...	...	...		
26	1010.3	1001.5	80.1	80.3	83	79	7.5	8.8	73	85	8	7	12	7	900	3	10.4	2.5	∞ a. Showery p.	...	...	...			
27	992.6	982.2	80.7	82.2	83	80	9.2	9.5	86	82	13	11	11	12	10≡0	10	n25.4	—	Showery a. Gloomy.	...	...	...			
28	978.9	990.2	80.4	79.9	84	80	9.8	8.2	95	81	14	2	14	2	7	8	0.8	8.0	Fair; visibility.	...	...	...			
29	998.1	1000.2	81.1	80.6	85	79	8.8	8.2	82	79	8	5	—	1	7	0	—	5.4	—	Fair; visibility.	...	...	...		
30	1004.1	1003.5	81.7	81.5	84	78	9.2	10.5	81	94	20	4	16	5	5	10	3.1	5.3	Fine a. Unsettled appearance p.	...	...	...			
31	1005.8	1006.2	79.6	78.1	83	78	8.2	7.8	85	90	15	3	25	2	5	10	5.8	5.6	Fair; visibility.	...	...	...			
Means	1006.3	1005.6	79.9	79.9	82.7	77.5	8.2	8.6	85	85	6.4	6.7	7.9	7.0	164.3	3.41	—	—	Monthly Totals or Means.	17912	20	20.4	68	9.6	
Normal 40 years	1011.8	1012.1	80.0	80.1	83.4	77.5	8.5	8.5	85	85	5.6	5.6	—	—	—	—	107.6	4.00	—	Normals, 40 years.	—	—	—	—	—

α denotes the maximum and n the minimum values in each column.

Note.—The cloud amounts in italic type at Valencia were taken at 21 h.

3. KEW OBSERVATORY, SURREY.—Lat. 51° 28' N. Long. 0° 19' W.

Heights above Mean Sea Level :—Station, H = 5.5 m. Barometer, H<sub>b</sub> = 10.4 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 3.0 m. Rain-gauge, h<sub>r</sub> = 0.5 m. Sunshine Recorder, h<sub>s</sub> = 14.3 m. Cups of Anemometer, h<sub>a</sub> = 21.3 m.

Table with columns: Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points and Velocity, Cloud Amount and Weather, Rain 24 hours beginning 10 h., Sunshine, Solar Radiation, Min. Temp. on Grass, Earth Temperature at 10 h., Remarks. Includes monthly means and normals for 40 years.

4. ESKDALE OBSERVATORY, DUMFRIESSHIRE.—Lat. 55° 19' N. Long. 3° 12' W.

Heights above Mean Sea Level :—Station, H = 243.2 m. Barometer, H<sub>b</sub> = 237.1 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 0.8 m. Rain-gauge, h<sub>r</sub> = 0.3 m. Sunshine Recorder, h<sub>s</sub> = 1.5 m. Vane of Anemometer, h<sub>a</sub> = 15.2 m.

Table with columns: Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity, Wind Direction in Points and Velocity, Cloud Amount and Weather, Rain 24 hours beginning 10 h., Sunshine, Solar Radiation, Min. Temp. on Grass, Earth Temperature at 10 h., Remarks. Includes monthly means and normals for 1911-12.

The solar radiation is the mean of the readings within the nominal hour of observation (11 h. 30 m.—12 h. 30 m.) unless some other hour is specified. Temperatures below the normal freezing point of water are printed in small type.

5. KEW OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor 1.71.				Charge per cc. $\times 10^{20}$ .		Velocities of Ions for 1 volt per centimetre.		Conductivity $\times 10^{25}$ .	Air-Earth Current $\times 10^{16}$ .		Electric Character of Day.	Magnetic Character of Day.	Horizontal Force.			West Declination.						
	3 h.	9 h.	15 h.	21 h.	+	-	+	-		$c_1$	$c_2$			Maximum. 18000 $\gamma$ +.	Minimum. 18000 $\gamma$ +.	Range.	Maximum. 15° +.	Minimum. 15° +.	Range.				
	v/m.	v/m.	v/m.	v/m.	E.-m. U.	E.-m. U.	cm/sec.	cm/sec.		E.-m. U.	Amp/cm <sup>2</sup> .			$\gamma$	h m	$\gamma$	h m	$\gamma$	h m	h m	h m		
1	475	560	360	260	—	—	—	—	—	—	—	0	0	514	17 43	501	11 22	n13	42° 5'	11 47	36° 6'	9 12	n5° 9'
2	350	365	65	415	—	—	—	—	—	—	—	2	0	515	22 12	500	10 32	15	42° 5'	12 12	36° 2'	9 8	6° 3'
3	85	140	200	90	—	—	—	—	—	—	—	1	0	514	17 50	497	23 17	17	43° 7'	13 55	36° 1'	22 10	7° 6'
4	310	235	150	185	—	—	—	—	—	—	—	0	0	513	6 22	493	9 52	20	44° 3'	11 54	36° 3'	0 16	8° 0'
5	90	375	185	500	—	—	—	—	—	—	—	0	0	513	20 53	491	9 29	22	44° 2'	13 36	36° 7'	20 40	7° 5'
6	135	325	250	135	—	—	—	—	—	—	—	1	0	514	20 54	487	12 55	27	44° 7'	12 36	35° 7'	21 30	9° 0'
7	100	225	165	450	—	—	—	—	—	—	—	0	1	514	21 37	490	10 56	24	44° 0'	12 57	34° 0'	3 37	10° 0'
8	210	335	2+	595	—	—	—	—	—	—	—	2	1	516	20 12	487	11 20	29	45° 8'	13 0	32° 5'	22 39	13° 3'
9	365	335	160	240	—	—	—	—	—	—	—	0	0	514	18 58	494	0 5	20	42° 5'	13 0	35° 2'	0 13	7° 3'
10	65	200	300	225	—	—	—	—	—	—	—	0	0	513	6 30	493	10 49	20	45° 3'	13 44	35° 3'	9 0	10° 0'
11	85	250	215	510	—	—	—	—	—	—	—	0	1	521	23 38	499	23 7	22	44° 3'	13 9	34° 9'	23 59	9° 4'
12	300	645	275	210	—	—	—	—	—	—	—	1	1	518	6 47	490	11 17	28	44° 7'	13 42	34° 3'	0 4	10° 4'
13	290	400	225	375	—	—	—	—	—	—	—	0	0	518	20 51	491	10 28	27	44° 8'	13 7	36° 2'	8 50	8° 6'
14	50	215	150	265	—	—	—	—	—	—	—	1	2	535	20 38	n440	14 40	n295	52° 0'	13 50	n28° 5'	21 40	n23° 5'
15	235	310	175	285	—	—	—	—	—	—	—	1	1	515	20 23	449	11 46	66	46° 3'	11 34	32° 1'	20 45	14° 2'
16	±	190	215	±	—	—	—	—	—	—	—	2	2	513	19 50	469	16 55	44	44° 7'	22 13	32° 3'	20 43	12° 4'
17	25	175	25	335	—	—	—	—	—	—	—	2	2	517	19 25	467	9 15	50	45° 3'	12 26	29° 0'	19 10	16° 3'
18	240	635	160	350	—	—	—	—	—	—	—	0	0	509	22 46	479	13 8	30	44° 4'	12 58	35° 9'	8 20	8° 5'
19	85	±	185	250	—	—	—	—	—	—	—	2	0	505	0 16	485	9 27	20	43° 9'	12 43	36° 1'	19 38	7° 8'
20	165	385	±	550	—	—	—	—	—	—	—	2	0	506	14 9	479	10 14	27	45° 4'	12 32	34° 6'	8 45	10° 8'
21	100	375	260	415	—	—	—	—	—	—	—	2	1	517	6 42	485	20 40	32	47° 3'	13 40	33° 0'	19 10	14° 3'
22	160	425	340	—	—	—	—	—	—	—	—	2	0	509	15 32	475	10 20	34	44° 7'	13 10	35° 3'	7 57	9° 4'
23	—	—	350	625	—	—	—	—	—	—	—	0?	1	524	14 40	475	15 32	49	47° 5'	14 2	35° 2'	7 47	12° 3'
24	535	390	335	620	—	—	—	—	—	—	—	1	1	524	0 33	479	9 50	45	46° 3'	12 19	36° 3'	7 36	10° 0'
25	385	650	695	750	—	—	—	—	—	—	—	0	0	513	18 23	472	10 48	41	46° 2'	13 25	35° 3'	8 27	10° 9'
26	595	595	750	375	—	—	—	—	—	—	—	1	0	516	7 18	477	10 43	39	45° 5'	12 57	35° 3'	8 15	10° 2'
27	215	135	215	485	—	—	—	—	—	—	—	1	0	522	21 24	478	9 58	44	45° 5'	13 3	35° 0'	7 57	10° 5'
28	435	±	±	635	—	—	—	—	—	—	—	2	0	520	7 43	479	11 11	41	45° 5'	13 5	35° 3'	9 17	10° 2'
29	510	520	±	285	—	—	—	—	—	—	—	1	1	523	0 34	483	16 39	40	44° 4'	13 6	35° 1'	22 43	9° 3'
30	85	125	215	410	—	—	—	—	—	—	—	0	1	527	22 8	482	3 20	45	45° 4'	13 32	33° 5'	22 18	11° 9'
31	415	415	365	415	—	—	—	—	—	—	—	1	1	515	12 53	490	19 10	25	47° 4'	14 49	32° 1'	22 46	15° 3'
M.	210*	351*	256*	361*	—	—	—	—	—	—	—	—	—	516	—	482	—	34	45° 2'	—	34° 5'	—	10° 7'

\* 23 days. The mean values of the Potential gradient in Table 5 are computed from the data for those days on which values at each of the four hours, 3<sup>h</sup>, 9<sup>h</sup>, 15<sup>h</sup>, 21<sup>h</sup>, are given in the table. A similar note applies to the values in Table 6.

6. ESKDALE OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor 5.68.				Charge per cc. $\times 10^{20}$ .		Velocities of Ions for 1 volt per centimetre.		Conductivity $\times 10^{25}$ .	Air-Earth Current $\times 10^{16}$ .		Electric Character of Day.	Magnetic Character of Day.	North Component.			West Component.			Vertical Component.					
	3 h.	9 h.	15 h.	21 h.	+	-	+	-		$c_1$	$c_2$			Maximum. 15000 $\gamma$ +.	Minimum. 15000 $\gamma$ +.	Maximum. 5000 $\gamma$ +.	Minimum. 5000 $\gamma$ +.	Maximum. 45000 $\gamma$ +.	Minimum. 45000 $\gamma$ +.						
	v/m.	v/m.	v/m.	v/m.	E.-m. U.	E.-m. U.	cm/sec.	cm/sec.		E.-m. U.	Amp/cm <sup>2</sup> .			h m	$\gamma$	h m	h m	$\gamma$	h m	h m	$\gamma$	h m			
1	148	193	336	-1046	—	—	—	—	—	—	—	2 b	0	7 55	1017	996	11 20	13 58	211	184	9 14	h m	$\gamma$	$\gamma$	h m
2	193	-40	119	239	—	—	—	—	—	—	—	2 c	0	22 14	1019	994	12 52	12 13	213	183	9 3	—	—	—	—
3	11	108	108	136	—	—	—	—	—	—	—	2 b	0	21 48	1025	994	19 58	14 23	220	175	22 7	—	—	—	—
4	108	45	91	—	—	—	—	—	—	—	—	1 b	0	6 25	1015	990	11 3	11 55	218	177	0 30	—	—	—	—
5	165	165	148	34	—	—	—	—	—	—	—	1 b	0	20 46	1015	988	13 7	13 56	217	181	4 15	—	—	—	—
6	102	170	125	119	—	—	—	—	—	—	—	2 c	0	22 5	1020	979	12 52	14 2	218	171	21 16	—	—	—	—
7	91	-136	—	772	—	—	—	—	—	—	—	1 c	0	3 9	1020	987	11 55	13 46	219	156	3 46	—	—	—	—
8	131	199	176	244	—	—	—	—	—	—	—	0 a	1	20 58	1025	972	11 19	13 0	230	152	22 39	—	—	—	—
9	40	—	91	-182	—	—	—	—	—	—	—	2 b	0	6 40	1018	986	11 55	13 7	214	169	0 6	—	—	—	—
10	—	—	193	574	—	—	—	—	—	—	—	1 b	0	7 38	1015	982	11 36	13 44	220	177	9 3	—	—	—	—
11	-136	80	170	210	—	—	—	—	—	—	—	2 b	0	24 0	1031	988	12 7	14 13	220	163	24 0	—	—	—	—
12	193	182	242	—	—	—	—	—	—	—	—	1 b	0	0 0	1031	985	12 33	13 40	220	160	0 8	—	—	—	—
13	178	350	324	979	—	—	—	—	—	—	—	2 b	0	22 5	1020	985	11 38	13 24	218	177	8 47	—	—	—	—
14	—	159	159	172	—	—	—	—	—	—	—	1 c	2	20 35	n1063	935	14 35	14 14	n255	n125	21 36	—	—	—	—
15	153	121	184	—	—	—	—	—	—	—	—	1 c	2	20 22	1036	n929	11 47	12 34	226	150	20 45	—	—	—	—
16	—	—	184	184	—	—	—	—	—	—	—	1 c	2	19 50	1044	968	16 37	22 9	234	146	20 37	—	—	—	Instrument out of order.
17	127	64	1323	286	—	—	—	—	—	—	—	0 b	2	18 22	1046	964	9 18	14 12	225	132	19 3	—	—	—	—
18	343	420	172	223	—	—	—	—	—	—	—	0 a	0	22 44	1016	970	13 8	13 34	212	170	9 54	—	—	—	—
19	—	-369	83	95	—	—	—	—	—	—	—	2 c	0	4 18	1011	980	10 37	12 58	214	172	9 11	—	—	—	—
20	89	70	229	—	—	—	—	—	—	—	—	1 b	0	23 12	1013	976	10 11	13 38	222	166	8 55	—	—	—	—
21	146	273	299	375	—	—	—	—	—	—	—	1 b	1	6 50	1024	972	13 0	13 38	244	151	19 12	—	—	—	—
22	954	363	286	—	—	—	—	—	—	—	—	1 c	1	22 20	1017	973	10 25	13 8	222	172	5 5	—	—	—	—
23	6	-45	-108	293	—	—	—	—	—	—	—	2 b	1	14 40	1026	961	15 30	14 38	251	170	8 52	—	—	—	—
24	178	140	146	528	—	—	—	—	—	—	—	0 a	0	0 30	1036	969	10 40	12 49	223	172	8 50	—	—	—	—
25	305	439	223	401	—	—	—	—	—	—	—	1 a	0	18 22	1015	967	11 14	13 22	222	171	8 42	—	—	—	—
26	178	178	248	413	—	—</																			

7. Tables of Wind Components in metres per second at fixed hours, together with the mean velocity (horizontal movement) in metres per second for the hour with the maximum hourly run for each day, or the greatest velocity attained in a gust and the time of its occurrence.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust, and sub-columns for S, N, W, E directions. Includes sub-headers for HOLYHEAD and DEERNESS with their respective heights above ground and cup heights.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust, and sub-columns for S, N, W, E directions. Includes sub-headers for SCILLY and GREAT YARMOUTH with their respective heights above ground and cup heights.

The velocities at fixed hours are means for the interval from 30 minutes before to 30 minutes after the hour. The hours are numbered 1 h. to 24 h. Time is referred to Greenwich Mean Time. \* No Record. † Robinson Cup Anemometer; Arms 0.61 m.; Diameter of Cups, 0.229 m.; Factor 2.2. ‡ Robinson Cup Anemometer; Arms 0.305 m.; Diameter of Cups 0.127 m.; Factor 2.8. § Dines Pressure Tube Anemometer. At Great Yarmouth, Holyhead, and Scilly the readings at fixed hours are taken from the Robinson Anemometer, the maxima quoted are the greatest winds in a gust as recorded by the Dines Pressure Tube.





## 9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.)—continued.

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. March 25. 16 h. 50 m. G.M.T.				SOUNDING No., R. 225. PLACE, PYRTON HILL. Latitude, 51° 38' N. Longitude, 1° 0' W. Height above M.S.L., } 150 m.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	Reading.				Fall per Km.		
GREATEST HEIGHT, } 8 km.	356 mb.	232° A.		km.	mb.	°A.	°C.	Entered clouds going N. in 5 minutes. Sharp inversion of 4° at 1.9 km., 265 to 269.	
LOWEST TEMPERATURE, } 8 km.	356 mb.	232° A.		8.0	356	232			
BASE OF STRATOSPHERE, } ? km.	...	...		7.2	400	236			
Type. No. ?				7.0	411	237	+5		
				6.0	473	244	+7		
				5.6	500	247	+8		
				5.0	542	252	+8		
				4.2	600	256	+5		
				4.0	617	257	+5		
				3.1	700	263	+7		
From observations at Station			at 7 h.	at 18 h. G.M.T.					
BAROMETER (M.S.L.)			...	1025 mb.	3.0	740	264		
TEMPERATURE			...	280° A.	2.0	799	269		
VAPOUR PRESSURE			...	...	2.0	800	269	+5	
GRADIENT WIND:—Direction,			Station	102°	1.0	900	272	+3	
Velocity,			in	12.5 m/s.	1.0	903	272	0	
Correction for Curvature,			centre of	0.0 m/s.					
Final Components, { W. to E.			anticyclone.	-12.2 m/s.	Ground M.S.L.	1005	...	...	
				+2.6 m/s.		1023	...	...	

## APRIL 1913. The Upper Air: Soundings by Pilot Balloons (P.) and Registering Balloons (R.)

ABERDEEN. P. 51. April 16. 11 h. 30 m. G.M.T.								ABERDEEN. P. 52. April 23. 11 h. 15 m. G.M.T.							
Soundings with Pilot Balloons.	Height above M.S.L.	Wind.				Vertical Velocity.	Cloud Observations and Remarks.	Height above M.S.L.	Direction.	Wind.			Vertical Velocity.	Cloud Observations and Remarks.	
		Direction.	Velocity.	Components.						Direction.	Velocity.	Components.			
Greatest height.	metres.	Degrees from N.	m/s.	m/s.	m/s.	m/s.	Balloon entered base of Cu.-Nb. cloud, and just before doing so, it was noticed to lift upward suddenly.	metres.	Degrees from N.	m/s.	m/s.	m/s.	m/s.	Two theodolites. After 500 m. balloon turned back upon its course, and at 1110 m. entered a Fr.-Cu. cloud. This cloud belt (quantity covered about 1/3 sky), was the only cloud visible throughout the forenoon, and its duration was not longer than 15 min. It spoiled what might have proved an interesting record. The cloud's direction was almost due W.	
	1620	...	...	...	...	...	Uniform velocity of 2.9 m/s. assumed.	1110	...	...	...	...	...	Lift = 50 gr.	
	1500	203	14.8	+5.8	+13.6	1000		256	2.9	+2.8	+0.7	2.8			
	1000	210	19.0	+9.5	+16.5	750		248	2.4	+2.2	+0.9	2.0			
	500	197	15.8	+4.5	+15.1	500		127	3.4	-2.7	+2.0	2.7			
	100	206	14.4	+6.3	+12.9	250		129	4.0	-3.1	+2.5	3.0			
Ground level	30	180	6.5	0.0	+6.5	100		140	3.3	-2.1	+2.5	2.3			
Computed for M.S.L.		Station in V-shaped depression. Computed velocity for straight isobars is 13.5 m/s.				Lift = 37 gr.	...	210	6.7	+3.4	+5.8	...			

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. April 4. 7 h. 2 m. G.M.T.				SOUNDING No., R. 226. PLACE, PYRTON HILL. Latitude, 51° 38' N. Longitude, 1° 0' W. Height above M.S.L., } 150 m.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	Reading.				Fall per Km.		
GREATEST HEIGHT, } 12.4 km.	188 mb.	?		km.	mb.	°A.	°C.	Temperature at the highest part probably influenced by solar radiation. Very unusual gradient from 6.0 to 8.0. Isothermal at 248° from 4.7 to 5.1. Overcast. Very gusty N.N.E. wind.	
LOWEST TEMPERATURE, } 9.6 km.	272 mb.	216° A.		12.4	185	?			
BASE OF STRATOSPHERE, } 9.6 km.	272 mb.	216° A.		11.6	200	...			
Type No. I.				11.0	216	...			
				10.0	253	220	-1		
				9.0	295	219			
				9.0	300	219	4		
				8.0	345	223			
				7.0	400	232	10		
				6.0	462	242	9		
From observations at Station.			at 7 h.	at 18 h. G.M.T.	5.5	500	246	6	
PRESSURE (M.S.L.)			1020 mb.	1017 mb.	5.0	531	248	6	
TEMPERATURE			279° A.	282° A.	4.1	600	253	6	
VAPOUR PRESSURE			...	...	4.0	609	254	7	
GRADIENT WIND:—Direction,			64°	70°	3.0	695	261	7	
Velocity,			21.7 m/s.	18.6 m/s.	3.0	700	261	7	
Correction for Curvature,			-1.5 m/s.	0.0 m/s.	2.0	791	268		
Final Components, { W. to E.			-18.2 m/s.	-17.5 m/s.	1.9	800	268		
			-8.9 m/s.	-6.4 m/s.	1.0	897	273	5	
					.97	900	...		
					1000	...			
					Ground M.S.L.	997	277.5	...	
						1015	...	...	

Time is expressed in the hours 1 to 24 of civil reckoning.

Pressure is given in millibars (1000 mb. = 1 C.G.S. atmosphere = 750 mm. approximately).

Gradient Wind is taken to be tangential to the isobar and is computed by the formula  $\gamma = 2\omega \rho V \sin \phi$ .

\*Base of Stratosphere.—TYPE 1.—When the stratosphere commences with an inversion, the height and temperature of the first point of zero temperature gradient are given.

TYPE 2.—When the stratosphere begins with an abrupt transition to a temperature gradient below 2° per km. without inversion, the height and temperature of the abrupt transition are given.

TYPE 3.—When there is no such abrupt change of temperature gradient, the base is taken to be where the mean fall of temperature for the kilometer next above is 2° or less, provided that it does not exceed 2° for any subsequent kilometer. If some other position for the base seems to the tabulator to be more suitable, it is noted in the column for "Remarks."

Temperatures are expressed in degrees absolute (273° A = 0° C.).  
Heights are given in kilometers (km.).

# METEOROLOGICAL OFFICE OBSERVATORIES—GEOPHYSICAL JOURNAL.

APRIL 1913.—DAILY VALUES REFERRED TO GREENWICH MEAN TIME, AND UNITS  
BASED ON THE C.G.S. SYSTEM.

[Price 1s.]

Third Year.—No. 4. *Meteorology, Solar Radiation, Seismology, Atmospheric Electricity, and Terrestrial Magnetism.*

## 1. SEISMOLOGICAL JOURNAL:—ESKDALE OBSERVATORY.—Lat. 55° 19' N. Long. 3° 12' W.

Date.	Microseisms of N. Component.								Remarks.
	0 h.		6 h.		12 h.		18 h.		
	A.N.	T.	A.N.	T.	A.N.	T.	A.N.	T.	
1	2.0	7.5	2.0	7.5	2.0	8	1.5	7	3rd, I, P? S=0 h. 15 m. 44 s., L=0 h. 32.5 m. Disturbed till about 1 h. 16 m. 4th, I, Disturbed from 14 h. 22 m.-14 h. 47 m. Well marked regular waves 14 h. 31 m.-14 h. 32 m. 7th, Iu, P=14 h. 0 m. 31 s.?
2	1.5	7	1.5	6	1.0	6.5	1.5	6	S=14 h. 11 m. 12 s., L=14 h. 29 m., Δ=9620 km. Disturbed till about 15 h. 38 m. 7th, I, Numerous trains of small waves between 17 h. 30 m. and 19 h. 30 m. 8th, Iu, P=2 h. 33 m. 32 s., S=2 h. 44 m. 22 s., L=3 h. 5.5 m., Δ=9820 km. Disturbed till about 4 h. 0 m. 9th, I, Faint disturbance 5 h. 47 m.-6 h. 10 m.
3	1.0	6	1.0	6.5	1.0	6	1.0	5.5	9th, I, Disturbed from 18 h. 12 m.-20 h. 30 m. 11th, I, L=0 h. 2m. Disturbed till about 0 h. 35 m. 11th, I, L=15 h. 46 m. Disturbed till about 16 h. 20 m. 12th, I, Very faint disturbance 21 h. 50 m.-22 h. 16 m.
4	0.5	5	0.5	6	0.5	5	0.5	4.5	13th, Iu, P=6 h. 53 m. 1 s., S=7 h. 3 m. 19 s., L=7 h. 20.5 m., Δ=9190 km. Epicentre 33° N., 128° E.
5	0.5	5	0.5	4.5	1.0	5	0.5	5	14th, Iu, P? S=8 h. 12 m. 19 s., L=8 h. 30 m., Δ=10,000 km. approx. A strong well marked wave movement occurred at 8 h. 45 m. 15 s. 17th, I, L=13 h. 20 m. Disturbed till about 13 h. 49 m. 18th, I, Very faint disturbance about 3 h. 37 m. 18th, I, L=14 h. 1 m. Disturbed till about 14 h. 37 m. 18th, Iu, P=? S=19 h. 29 m. 53 s., L=19 h. 50 m. Approx. Δ=11,000 km. 20th, I, Disturbed from about 3 h. 30 m.-3 h. 54 m.
6	0.5	4	0.4	4.5	0.5	5	0.5	4	Max. movement at 3 h. 35 m. 20th, I, Faint disturbance about 11 h. 20th, I, Very faint disturbance about 15 h. 40 m. 21st, I, Faint disturbance from 0 h. 55 m.-1 h. 4 m. 22nd, I, Faint disturbance from 14 h. 14 m.-14 h. 27 m. 24th, I, Faint disturbance from 1 h. 18 m.-1 h. 38 m. 24th, Iu, P=? S=10 h. 41 m. 4 s., L=11 h. 2.5 m., Δ=12,000 km. approx. Impulses at 12 h. 40 m. 15 s., and 12 h. 41 m. 21 s. 24th, I, Disturbed from about 12 h. 56 m.-13 h. 25 m. 24th, I, L=22 h. 26 m. Very small earthquake. Probably not very remote. Duration only a few minutes. 25th, I, Small disturbance from about 0 h. 34 m.-1 h. 8 m.
7	0.4	5	0.5	5	0.4	5	0.3	4.5	25th, I, Small disturbance from about 1 h. 37 m.-2 h. 4 m. 25th, I, P=? S=4 h. 31 m. 35 s., L=4 h. 36 m. Disturbed till about 5 h. 0 m. 25th, I, L=5 h. 23 m. Disturbed till about 5 h. 48 m. 25th, I, L=7 h. 7.5 m. Very small earthquake. Probably not very remote. Duration about 7 m. 25th, Iu, P=18 h. 10 m. 36 s., S=18 h. 21 m. 20 s., L=18 h. 39.5 m., Δ=9680 km. Epicentre, 21° N., 114° E. Large earthquake.
8	0.3	4.5	0.3	4.5	0.3	4.5	0.3	4.5	26th, I, Disturbance from about 5 h. 0 m.-6 h. 0 m. 26th, I, L=13 h. 14.5 m. Duration till about 13 h. 35 m.
9	0.3	4.5	0.3	4.5	0.3	4.5	0.3	4.5	27th, I, Small earthquake. Disturbed from about 9 h. 5 m.-9 h. 38 m. 28th, I, L=4 h. 18 m. ? Disturbed till 4 h. 56 m. 28th, I, Disturbed from about 19 h. 33 m.-20 h. 15 m. 29th, I, Disturbed from about 4 h. 3 m.-4 h. 30 m. 29th, I, Very faint disturbance between 21 h. 45 m. and 22 h. 30 m. 29th, Iu, P=23 h. 40 m. 47 s., S=23 h. 50 m. 56 s., Δ=8980 km. Epicentre 44° N., 177° E. Disturbed till about 1 h. 30 m. 30th, Iu, P=11 h. 46 m. 39 s., S=11 h. 56 m. 7 s., L=12 h. 12.5 m., Δ=8160 km. Epicentre 51° N., 177° E. Disturbed till about 13 h. 48 m. 30th, I, Very faint disturbance between 21 h. 31 m. and 22 h. 1 m.
10	0.5	5	0.5	5	1.0	5	1.0	5.5	An explanation of the notation used is given in the preface. The amplitude A <sub>N</sub> is half of the actual movement of the earth's surface in a N-S direction, between the ends of the swing (μ=0.01 mm.). The period T (in seconds) is the duration of a complete oscillation, i.e. both extreme positions are passed through once during the time T.
11	1.0	5	1.0	5	1.0	5.5	1.0	5	
12	1.5	5	1.5	5	1.0	5	1.0	5	
13	1.0	5	0.5	5	0.5	5	0.5	5	
14	1.0	5	1.0	5	1.0	4.5	1.0	5	
15	1.0	5.5	1.5	6	2.0	6.5	2.0	7	
16	2.5	7	3.0	5.5	3.0	6.5	3.5	6	
17	3.0	6	2.5	6	2.0	6.5	2.5	6.5	
18	1.5	6	1.5	6	1.0	5.5	1.0	5.5	
19	1.0	5	1.0	5	1.0	6	1.0	5	
20	1.5	4	1.0	4	1.0	4	1.0	5	
21	0.5	5	0.5	4.5	0.5	6	0.5	5	
22	1.0	6	1.0	7	1.5	6	1.0	6	
23	1.0	6.5	1.5	6.5	1.5	6	1.0	6	
24	1.5	6	1.0	6	1.0	5.5	1.0	5.5	
25	1.0	6	1.0	5	1.0	5	1.0	5	
26	1.0	5	1.0	6	1.0	5	1.5	5	
27	1.0	5	1.5	5	1.5	5	1.5	5.5	
28	1.5	5	1.5	5	1.5	5	1.5	5	
29	1.0	5	1.0	4.5	1.0	5	1.0	4.5	
30	1.0	5	0.5	5	0.5	5	0.5	5	

## 2. VALENCIA OBSERVATORY, CAHIRCIVEEN (KERRY).—Lat. 51° 56' N. Long. 10° 15' W.

Heights above Mean Sea Level:—Station, H=9.2 m. Barometer Cistern, H<sub>b</sub>=13.7 m.

Heights above Ground:—Thermometers, h<sub>t</sub>=1.2 m. Rain-gauge, h<sub>r</sub>=0.6 m. Sunshine Recorder, h<sub>s</sub>=12.8 m. Cups of Anemometer, h<sub>a</sub>=13.7 m.

Day.	Pressure at Station Level.		Air Temperature in Degrees Absolute.				Humidity.				Wind Direction in points (8=E, 16=S) and Velocity (metres per second).		Cloud Amount and Weather.		Rain 24 hours beginning 10 h.	Sunshine.	Remarks.	Magnetism.						
	9 h.	21 h.	9 h.	21 h.	Max.	Min.	Vapour Pressure.		Percentage.		9 h.	21 h.	10 h.	22 h.				mm.	hrs.	Horizontal Force.	Declination West.	Inclination.		
							9 h.	21 h.	9 h.	21 h.													m/sec.	m/sec.
1	1011.1	1009.0	79.0	79.3	82	78	7.5	8.8	78	94	23	6	21	2	4	10	16.0	6.4	Fair to dull. ▲ showers.	...	...	...		
2	1002.7	1005.1	80.1	79.3	81	79	9.2	8.2	91	84	13	5	28	6	10	10	2.0	—	≡ <sup>0</sup> ; dull later.	...	...	...		
3	1012.1	1022.1	80.7	82.1	84	77	9.2	8.8	89	76	13	5	8	3	4	3	—	9.2	Fair to fine; good visibility.	...	...	...		
4	1025.0	1021.5	81.4	82.3	85	79	7.5	7.1	67	n 61	5	10	5	7	0	5	—	9.3	Fine, with ∞.	...	...	...		
5	1017.7	1015.8	80.7	82.0	x 86	79	7.8	8.2	74	70	7	11	4	5	7	1	—	10.3	Fine, with ∞.	...	...	...		
6	1014.9	1014.8	81.0	84.0	x 86	78	7.5	8.2	70	63	6	7	5	4	1	2	—	11.6	Fine, with ∞.	...	...	...		
7	1016.2	1020.0	81.9	81.3	85	77	7.8	7.8	68	72	5	8	4	4	2	0	—	11.7	Fine, with ∞.	17886	20	20.5	68	9.5
8	1023.4	1024.0	81.7	82.2	85	77	8.5	10.2	77	87	4	2	24	3	0	2	—	9.6	∞. Fine, with ∞.	...	...	...		
9	1025.5	1028.0	82.2	81.4	84	80	9.8	9.2	84	85	3	4	31	6	2	10	—	9.9	Fine during day. Gloomy n.	...	...	...		
10	1025.2	1023.5	82.1	82.2	83	81	9.5	9.8	83	84	30	6	29	7	9	10	0.3	—	Dull, with ∞.	...	...	...		
11	1019.3	1015.3	82.3	81.8	83	81	11.5	9.2	98	81	28	6	30	8	10	8	0.8	—	Overcast, with ≡ <sup>0</sup> .	...	...	...		
12	1017.6	1018.7	80.4	79.5	83	78	8.2	7.5	78	78	31	7	31	2	8	3	0.3	4.3	Showery to fair.	...	...	...		
13	1016.7	1014.8	79.8	81.6	84	n 75	8.8	10.2	88	91	—	1	17	4	10	10	3.6	0.2	∞ early. Dull throughout.	...	...	...		
14	1010.3	1010.9	82.3	81.7	85	80	10.5	9.5	89	85	16	5	21	4	10	10	2.8	1.6	≡ <sup>0</sup> early; fair to dull later.	...	...	...		
15	1006.5	987.9	81.9	83.9	84	79	9.2	12.2	80	94	15	6	18	13	10	10	11.4	0.1	Gloomy, with ≡ <sup>0</sup> .	...	...	...		
16	994.0	996.3	80.0	79.9	84	77	6.5	8.2	65	82	23	12	23	7	2	8	3.1	4.7	▲ showers. [evening.]	...	...	...		
17	1000.2	999.9	79.2	80.1	83	78	8.2	9.2	86	92	24	8	20	9	7	6	6.1	5.8	☾ 16 h. 30 m.-17 h. 30 m. ▲ <sup>0-2</sup>	...	...	...		
18	997.7	996.9	82.0	82.3	85	80	9.8	10.2	87	87	17	5	21	9	10	10	2.5	0.3	≡ <sup>0</sup> ; unsettled appearance.	...	...	...		
19	1003.2	1010.1	80.9	80.7	83	79	7.8	7.8	73	73	24	9	25	4	7	3	1.8	6.7	Squally, with ▲ showers.	...	...	...		
20	1008.4	999.3	80.8	83.1	84	76	7.8	12.2	75	99	10	6	15	4	10	10	20.8	—	≡ <sup>2</sup> ; intermittent ● after 9 h.	...	...	...		
21	1001.7	1014.6	83.8	82.5	84	82	12.2	11.5	95	96	—	1	31	7	10	10	1.0	0.1	≡ <sup>0</sup> showers; heavy appearance.	17901	20	20.4	68	9.6
22	1021.2	1022.5	83.4	81.8	84	80	10.5	9.2	83	82	3	4	31	4	10	10	—	—	Dull throughout.	...	...	...		
23	1018.9	1006.6	83.5	82.1	85	79	9.8	11.2	77	96	—	1	14	8	8	10	x 22.1	5.7	Dull. ≡ <sup>0</sup> n.	...	...	...		
24	994.3	1001.7	83.5	80.3	84	80	12.6	8.2	98	80	17	5	24	8	10	10	3.1	2.2	● <sup>0</sup> early; showers later.	...	...	...		
25	992.3	990.7	77.9	77.3	81	76	7.1	6.8	84	82	26	2	26	8	10	4	13.2	2.6	▲ showers; good visibility.	...	...	...		
26	974.7	982.2	81.3	79.8	83	77	10.2	6.8	94	75	15	9	21	6	10	7	4.6	4.7	● <sup>0</sup> early; fair later.	...	...	...		
27	981.4	985.8	79.9	80.1	83	76	8.8	8.2	90	82	14	6	15	6	7	8	8.1	7.3	▲ showers; ☾ 21 h. 30 m.	...	...	...		
28	991.3	1000.8	81.3	81.1	85	78	8.8	8.8	84	82	15	7	15	5	4	2	10.2	9.1	Squally, with ▲ showers. Fine n.	...	...	...		
29	1006.3	1006.5	81.1	81.2	x 86	79	9.8	9.8	93	91	14	4	—	1	7	8	0.5	8.0	▲ <sup>0-2</sup> showers early; good visibility.	...	...	...		
30	1004.9	1008.0	83.3	80.7	x 86	78	10.2	9.8	82	95	18	4	—	1	6	7	4.6	7.1	Fair; showery evening.	...	...	...		
Means	1007.8	1008.4	81.3	81.3	84.0	78.5	9.1	9.1	83	83	5.7	5.5	6.8	6.9	138.9	4.95	Monthly Totals or Means.			17894	20	20.5	68	9.6
Normal 40 years	1011.1	1011.3	82.0	81.6	85.0	79.0	9.4	9.4	82	85	5.5	5.0	—	—	98.0	5.30	Normals, 40 years.							

∞ denotes the maximum and n the minimum values in each column.

Note.—The cloud amounts in italic type at Valencia were taken at 21 h.

3. KEW OBSERVATORY, SURREY.—Lat. 51° 28' N. Long. 0° 19' W.

Heights above Mean Sea Level :—Station, H = 5.5 m. Barometer, H<sub>b</sub> = 10.4 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 3.0 m. Rain-gauge, h<sub>r</sub> = 0.5 m. Sunshine Recorder, h<sub>s</sub> = 14.3 m. Cups of Anemometer, h<sub>a</sub> = 21.3 m.

Table with 20 columns: Day, Pressure at Station Level (9h, 21h), Air Temperature in Degrees Absolute (9h, 21h, Max, Min), Humidity (Vapour Pressure, Percentage), Wind Direction in Points and Velocity (9h, 21h), Cloud Amount and Weather (10h, 22h), Rain 24 hours beginning 10 h, Sunshine, Solar Radiation (Watts per cm²), Min. Temp. on Grass, Earth Temperature at 10 h (0.3m, 1.2m), Remarks.

4. ESKDALE OBSERVATORY, DUMFRIESSHIRE.—Lat. 55° 19' N. Long. 3° 12' W.

Heights above Mean Sea Level :—Station, H = 243.2 m. Barometer, H<sub>b</sub> = 237.1 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 0.8 m. Rain-gauge, h<sub>r</sub> = 0.3 m. Sunshine Recorder, h<sub>s</sub> = 1.5 m. Vane of Anemometer, h<sub>a</sub> = 15.2 m.

Table with 20 columns: Day, Pressure at Station Level (9h, 21h), Air Temperature in Degrees Absolute (9h, 21h, Max, Min), Humidity (Vapour Pressure, Percentage), Wind Direction in Points and Velocity (9h, 21h), Cloud Amount and Weather (10h, 22h), Rain 24 hours beginning 10 h, Sunshine, Solar Radiation (Watts per cm²), Min. Temp. on Grass, Earth Temperature at 10 h (0.3m, 1.2m), Remarks.

The solar radiation is the mean of the readings within the nominal hour of observation (11 h. 30 m.—12 h. 30 m.) unless some other hour is specified. Temperatures at or below the normal freezing point of water are printed in small type.



7. Tables of Wind Components in metres per second at fixed hours, together with the mean velocity (horizontal movement) in metres per second for the hour with the maximum hourly run for each day, or the greatest velocity attained in a gust and the time of its occurrence.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust, and V. for HOLYHEAD. †§ and DEERNES. †. Includes sub-headers for S, N, W, E directions and V. in Max. Hourly Run.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust, and V. for SCILLY. †§ and GREAT YARMOUTH. †§. Includes sub-headers for S, N, W, E directions and V. in Max. Hourly Run.

The velocities at fixed hours are means for the interval from 30 minutes before to 30 minutes after the hour. The hours are numbered 1 h. to 24 h. Time is referred to Greenwich Mean Time. \* No Record. † Robinson Cup Anemometer; Arms 0.61 m.; Diameter of Cups, 0.229 m.; Factor 2.2. ‡ Dines Pressure Tube Anemometer. At Great Yarmouth, Holyhead, and Scilly the readings at fixed hours are taken from the Robinson Anemometer, the maxima quoted are the greatest winds in a gust as recorded by the Dines Pressure Tube. § Six days only. ¶ Seven days only. For Upper Air Observations for April, see page 20.

# METEOROLOGICAL OFFICE OBSERVATORIES—GEOPHYSICAL JOURNAL.

MAY 1913.—DAILY VALUES REFERRED TO GREENWICH MEAN TIME, AND UNITS  
BASED ON THE C.G.S. SYSTEM.

[Price 1s.]

Third Year.—No. 5. *Meteorology, Solar Radiation, Seismology, Atmospheric Electricity, and Terrestrial Magnetism.*

## 1. SEISMOLOGICAL JOURNAL:—ESKDALE OBSERVATORY.—Lat. 55° 19' N. Long. 3° 12' W.

Date.	Microseisms of N. Component.								Remarks.
	0 h.		6 h.		12 h.		18 h.		
	A <sub>N</sub> . μ	T. s	A <sub>N</sub> . μ	T. s	A <sub>N</sub> . μ	T. s	A <sub>N</sub> . μ	T. s	
1	0.4	5	0.4	5	0.4	5	0.3	5	1st, I, Very faint disturbance from 14 h. 31 m.—14 h. 45 m.
2	0.3	5	0.3	5	0.3	5	—	—	3rd, I, Faint disturbance about 7 h. 53 m.
3	0.4	4	0.5	4	0.5	5	0.5	5	4th, I, L=10 h. 1.5 m. Disturbed till about 10 h. 12 m.
4	1.0	5	1.0	5	1.0	5	1.0	5	5th, I, Very faint disturbance from 7 h. 29 m.—7 h. 46 m.
5	1.0	5	0.5	5	0.5	4	1.0	4	5th, I, Very faint disturbance from 21 h. 12 m.—21 h. 20 m.
6	1.0	4	1.0	4.5	1.0	4.5	—	—	6th, I, Several very small disturbances between 1 h. and 2 h.
7	2.5	5.5	2.5	5	2.5	5.5	2.0	5	6th, I, L=2 h. 12 m. Well marked movements at 1 h. 49 m. 58 s., and 1 h. 55 m. 58 s.
8	1.5	5	1.0	5	1.5	5	—	—	7th, I, Small disturbance about 0 h. 40 m.—1 h. 19 m.
9	—	—	—	—	—	—	1.5	5	8th, I, Disturbance about 18 h. 55 m.—20 h. 44 m.
10	1.0	5	1.5	4	1.5	4.5	1.0	5	9th, I, Small disturbance from 16 h. 57 m.—17 h. 46 m.
11	—	—	—	—	—	—	—	—	9th, I, L=22 h. 12 m. Small disturbance till 22 h. 36 m.
12	—	—	—	—	—	—	0.5	4	16th, Iu, S=12 h. 4 m. 17 s., L=12 h. 14 m., Δ=6800 km. approx. Disturbed till about 13 h. 40 m.
13	—	—	—	—	0.5	5	0.4	5	17th, I, Small disturbance from 8 h. 30 m. to about 9 h. 56 m.
14	0.4	5	0.5	5	0.4	4.5	0.5	5	18th, II, P=2 h. 23 m. 10 s. Prolonged and confused disturbance till about 4 h. 48 m.
15	0.4	5	0.4	4.5	0.4	4.5	0.4	4.5	19th, Ir, P=15 h. 48 m. 17 s., S=15 h. 50 m. 56 s., L=15 h. 51.5 m., Δ=1520 km. Disturbed till about 16 h. 20 m.
16	0.4	5	0.5	5	0.4	4.5	0.4	4	20th, I, L=4 h. 40 m. Small disturbance till about 5 h. 13 m.
17	0.4	5	0.5	4	1.0	4	1.0	4.5	20th, I, Very faint disturbance from 11 h. 17 m.—11 h. 31 m.
18	1.5	5	1.5	5.5	2.0	5.5	1.5	5.5	21st, I, Disturbed from about 14 h. 56 m.—15 h. 52 m.
19	2.0	5	1.0	5	1.0	4.5	1.0	5	21st, I, L=21 h. 16 m. Faint disturbance till about 21 h. 35 m.
20	1.0	5.5	1.0	5	1.0	5.5	1.5	5	24th, Iu, P=23 h. 38 m. 38 s., S=23 h. 49 m. 18 s., L=0 h. 9.5 m., Δ=9600 km. Epicentre=16° S., 61° W.
21	1.5	5	2.0	5.5	1.5	5.5	1.5	5.5	25th, I, Very faint disturbance from about 11 h. 27 m.—11 h. 47 m.
22	1.5	5	1.0	5	1.0	5	1.0	5	29th, Iu, P=10 h. 24 m. 42 s., S=10 h. 35 m. 6 s., L=10 h. 52 m., Δ=9280 km. Duration till about 11 h. 30 m.
23	0.5	4	0.5	5	0.4	4	0.4	4	29th, Iu, S=13 h. 52 m. 50 s., L=14 h. 11 m., Δ=approx. 10,000 km. Duration till about 15 h. 0 m.
24	0.4	4	—	—	0.4	4	0.2	4	30th, III, P=12 h. 8 m. 18 s. S=12 h. 21 m. 8 s. L=12 h. 43 m. Conspicuous but confused disturbance.
25	0.4	4	0.2	4	0.2	4	0.4	4	End about 15 h. 5 m.
26	0.4	4.5	0.5	4	0.5	4.5	—	—	
27	—	—	—	—	—	—	0.4	4	
28	0.2	4	0.2	4	0.1	4	0.2	4	
29	0.2	4	0.4	4.5	1.0	5	1.0	5.5	
30	1.0	5.5	1.0	6	1.0	5.5	1.0	5	
31	1.0	5	1.0	5	1.0	4	1.0	5	

An explanation of the notation used is given in the preface. The amplitude A<sub>N</sub> is half of the actual movement of the earth's surface in a N-S direction, between the ends of the swing (μ=0.001 mm.). The period T (in seconds) is the duration of a complete oscillation, i.e. both extreme positions are passed through once during the time T.

## 2. VALENCIA OBSERVATORY, CAHRCIVEEN (KERRY).—Lat. 51° 56' N. Long. 10° 15' W.

Heights above Mean Sea Level:—Station, H=12.6 m. Barometer Cistern, H<sub>b</sub>=13.7 m.

Heights above Ground:—Thermometers, h<sub>t</sub>=1.2 m. Rain-gauge, h<sub>r</sub>=0.56 m. Sunshine Recorder, h<sub>s</sub>=12.8 m. Cups of Anemometer, h<sub>a</sub>=13.9 m.

Day.	Barometer at 273° A. Mean Sea Level and Standard Gravity (Lat. 45°).		Air Temperature in Degrees Absolute.				Humidity.				Wind Direction in Points (8=E, 16=S) and Velocity (metres per second).		Cloud Amount and Weather.		Rain 24 hours beginning 10 h.	Sunshine.	Remarks.	Magnetism.						
	9 h.	21 h.	9 h.	21 h.	Max.	Min.	Vapour Pressure.		Percentage.		9 h.	21 h.	9 h.	21 h.	10 h.	22 h.		mm.	hrs.	Horizontal Force.	Declination West.	Inclination.		
	mb.	mb.	200+	200+	200+	200+	millibar.	%	%	m/sec.	m/sec.	Tenths of Sky covered.	mm.	hrs.	mm.	hrs.		mm.	hrs.	mm.	hrs.	mm.	hrs.	
1	1010.0	1012.7	82.9	82.0	85	n78	9.8	9.5	83	83	20	4	25	6	6	8	3.1	5.9	7.0	0	0	0		
2	1012.8	1002.9	82.7	83.0	83	81	10.5	12.2	88	99	21	4	18	3	10≡ <sup>0</sup>	10≡ <sup>0</sup>	28.2	—	...	...	...			
3	1004.5	1006.4	82.6	80.6	84	79	8.8	8.2	73	78	27	7	27	10	9	7	3.6	4.5	...	...	...			
4	1009.1	1010.2	82.2	81.7	84	79	8.2	9.2	69	81	27	8	28	4	10≡ <sup>0</sup>	9	—	8.7	...	...	...			
5	1005.7	1000.7	82.9	81.4	84	79	10.5	7.5	87	70	14	6	28	9	10≡ <sup>0</sup>	6	14.5	—	...	...	...			
6	1001.4	997.4	81.0	80.1	84	n78	8.5	8.5	79	85	22	6	22	3	7	8	14.0	5.2	...	...	...			
7	990.1	991.7	82.8	79.8	85	80	9.5	9.2	80	94	19	6	19	2	4	8	11.4	8.1	17890	20	20.5	68	9.9	
8	978.6	987.9	80.7	79.6	n82	79	8.5	9.4	85	—	1	14	5	10≡ <sup>0</sup>	10	5.3	0.1	—	...	...	...			
9	988.2	988.7	82.3	82.5	85	79	9.2	9.5	79	80	11	5	12	10	4	9	5.3	6.8	...	...	...			
10	990.6	992.1	82.8	82.8	85	82	10.9	10.9	89	92	13	8	14	8	10≡ <sup>0</sup>	10	9.4	1.5	...	...	...			
11	1003.6	1001.0	83.8	82.5	87	82	11.5	9.8	90	82	17	5	8	10	8	10≡ <sup>0</sup>	5.1	5.0	...	...	...			
12	1001.5	1013.1	85.1	83.9	87	83	12.9	11.5	91	89	—	1	32	8	10	10	3.3	0.2	...	...	...			
13	1020.9	1024.4	86.1	86.0	89	82	12.2	12.2	81	83	3	3	32	6	6	4∞	—	11.9	...	...	...			
14	1026.6	1026.3	83.5	83.1	86	82	10.5	10.2	85	83	1	8	32	5	8	5	—	6.3	...	...	...			
15	1024.5	1022.8	83.5	84.2	86	80	9.5	10.2	77	76	8	10	32	4	2∞	3∞	—	12.0	...	...	...			
16	1019.3	1014.9	87.0	83.5	88	81	10.2	12.6	n65	98	4	3	25	4	2∞	10≡ <sup>2</sup>	0.5	13.4	...	...	...			
17	1011.3	1014.5	82.8	82.2	85	82	9.8	9.2	83	79	30	9	29	6	7	7	1.0	2.3	...	...	...			
18	1017.0	1018.5	83.1	81.7	85	81	8.2	9.2	67	82	28	8	25	3	5	6	3.1	11.3	...	...	...			
19	1016.5	1015.3	82.6	84.0	86	81	11.5	12.2	96	94	—	0	20	8	10≡ <sup>0</sup>	10≡ <sup>0</sup>	1.0	0.1	...	...	...			
20	1013.1	1007.8	84.3	83.7	85	82	11.2	12.2	84	95	16	6	15	8	10	10	5.1	0.4	...	...	...			
21	1006.5	1013.2	84.4	82.8	86	82	11.2	9.8	84	81	18	8	22	8	8	7	1.8	5.5	17897	20	18.5	68	9.5	
22	1015.0	1017.4	84.1	84.2	87	81	12.6	12.9	96	98	14	4	20	6	10≡ <sup>0</sup>	10≡ <sup>0</sup>	0.3	—	...	...	...			
23	1019.1	1021.2	85.1	84.6	87	84	13.9	13.2	98	98	19	5	15	4	10≡ <sup>0</sup>	10≡ <sup>0</sup>	—	—	...	...	...			
24	1021.7	1020.6	86.7	85.1	90	x85	14.6	13.6	94	97	14	6	14	5	7∞	10≡ <sup>0</sup>	1.0	3.4	...	...	...			
25	1021.6	1024.0	85.1	84.0	88	81	13.6	11.2	95	87	21	5	—	1	10	1	0.3	8.9	...	...	...			
26	1022.8	1020.5	86.7	85.9	x91	80	11.9	13.2	76	90	25	2	—	1	3	8	—	10.5	...	...	...			
27	1017.9	1015.6	88.4	85.1	90	x85	13.2	13.2	75	94	15	3	15	5	4∞	10≡ <sup>0</sup>	—	5.2	...	...	...			
28	1010.8	1009.6	85.0	84.3	86	84	12.6	12.6	89	93	15	7	18	3	10≡ <sup>0</sup>	10	0.8	—	...	...	...			
29	1007.7	1002.0	85.2	83.9	86	83	11.9	12.6	86	96	—	0	29	5	10	10≡ <sup>0</sup>	23.15	0.1	...	...	...			
30	993.2	995.7	83.1	81.1	84	80	11.9	10.5	96	97	30	6	22	5	10≡ <sup>0</sup>	10	18.8	—	...	...	...			
31	1002.7	1011.0	84.1	82.3	88	79	10.9	10.2	84	86	15	4	—	0	7	1	—	9.4	...	...	...			
Means	1009.2	1009.7	84.0	83.0	86.0	81.1	11.0	10.8	84	88	5.1	5.3	7.5	8.0	168.4	4.73	—	—	Monthly Totals or Means.	17893	20	19.5	68	9.7
Normal 40 years	1013.9	1014.3	84.7	83.8	87.4	81.0	10.9	10.8	79	84	5.1	4.4	—	—	78.2	6.68	—	—	Normals, 40 years.	—	—	—	—	—

x denotes the maximum and n the minimum value in the column.

Note.—The cloud amounts in italic type at Valencia were taken at 21 h.

3. KEW OBSERVATORY, SURREY.—Lat. 51° 28' N. Long. 0° 19' W.

Heights above Mean Sea Level :—Station, H = 5·5 m. Barometer, H<sub>b</sub> = 10·4 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 3·0 m. Rain-gauge, h<sub>r</sub> = 0·53 m. Sunshine Recorder, h<sub>s</sub> = 13·3 m. Cups of Anemometer, h<sub>a</sub> = 19·81 m.

Table with columns for Day, Barometer at 273 A, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points (8=E, 16=S) and Velocity (metres per second), Cloud Amount and Weather, Rain 24 hours beginning 10 h., Sunshine, Solar Radiation, Watts per cm², Min. Temp. on Grass, Earth Temperature at 10 h., and Remarks. Includes monthly totals and means for 40 years.

4. ESKDALE OBSERVATORY, DUMFRIESSHIRE.—Lat. 55° 19' N. Long. 3° 12' W.

Heights above Mean Sea Level :—Station, H = 242·0 m. Barometer, H<sub>b</sub> = 237·0 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 0·9 m. Rain-gauge, h<sub>r</sub> = 0·40 m. Sunshine Recorder, h<sub>s</sub> = 1·5 m. Vane of Anemometer, h<sub>a</sub> = 15·0 m.

Table with columns for Day, Barometer at 273 A, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points (8=E, 16=S) and Velocity (metres per second), Cloud Amount and Weather, Rain 24 hours beginning 10 h., Sunshine, Solar Radiation, Watts per cm², Min. Temp. on Grass, Earth Temperature at 10 h., and Remarks. Includes monthly totals and means for 1911-12.

The solar radiation is the mean of the readings within the nominal hour of observation (11 h. 30 m.—12 h. 30 m.) unless some other hour is specified. Temperatures at or below the normal freezing point of water are printed in small type.





7. Tables of Wind Components in metres per second at fixed hours, together with the mean velocity (horizontal movement) in metres per second for the hour with the maximum hourly run for each day, or the greatest velocity attained in a gust and the time of its occurrence.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust, and DEERNESS. †. Includes sub-headers for S, N, W, E directions and V. Hrs. Min. for gust time.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust, and GREAT YARMOUTH. †‡. Includes sub-headers for S, N, W, E directions and V. Hrs. Min. for gust time.

The velocities at fixed hours are means for the interval from 30 minutes before to 30 minutes after the hour. The hours are numbered 1 h. to 24 h. Time is referred to Greenwich Mean Time. † Robinson Cup Anemometer; Arms 0.61 m.; Diameter of Cups, 0.229 m.; Factor 2.2. ‡ Robinson Cup Anemometer; Arms 0.305 m.; Diameter of Cups 0.127 m.; Factor 2.8. § Dines Pressure Tube Anemometer. At Great Yarmouth, Holyhead, and Scilly the readings at fixed hours are taken from the Robinson Anemometer, the maxima quoted are the greatest winds in a gust as recorded by the Dines Pressure Tube.

8. The Lower Layers of the Atmosphere from the Surface to 3000 metres (10,000 ft.) above Mean Sea Level.

Soundings by Kites (K.) and Pilot Balloons (P.).

BRIGHTON. K. May 18. 10 h. 0 m. to 11 h. 30 m. G.M.T.										
Soundings with Kites.	Height above M.S.L.	Pressure.	Temperature.		Humidity.		Density.	Wind.		Cloud Observations and Remarks.
			Reading.	Fall per km.	%	mb.		mgm/cc.	Direction.	
	metres.	mb.	°A.	°C.	%	mb.	mgm/cc.	Degrees from N.	m/s.	
Greatest height.	600	939.7	279.5	...	65	5.5	1.168	310	12	Half overcast. Cu.-st. Wind very erratic. Kite not sustainable at any definite height. Convection currents.
...	...	...	...	9.3	...	...	...	...	...	
Ground level	115	996.3	284	...	58	5.7	1.219	275	8.9	
Computed for M.S.L.	0	1010.1	...	...	...	...	...	320	12	...

ABERDEEN. P. 53. May 2. 11 h. 10 m. G.M.T.											ABERDEEN. P. 54. May 7. 11 h. 15 m. G.M.T.											ABERDEEN. P. 55. May 14. 11 h. 30 m. G.M.T.										
Soundings with Pilot Balloons.	Height above M.S.L.	Wind.				Vertical Velocity.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.				Vertical Velocity.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.				Vertical Velocity.	Cloud Observations and Remarks.											
		Direction.	Velocity.	Components.					Direction.	Velocity.	Components.					Direction.	Velocity.	Components.														
				W.-E.	S.-N.						W.-E.	S.-N.						W.-E.	S.-N.													
Greatest height.	750	...	...	...	...	Two theodolites; but balloon lost to out station in the first minute owing to the rapid formation of fog; lost at 750 m. to home station in the fog.	680	...	...	...	...	Balloon lost to out station through encountering the eddy in the lee of the tower from which it was sent off. A strong wind was blowing (12-13 m/s.) and the balloon dipped for about half a minute immediately after leaving the tower.	840	...	...	...	...	One theodolite only. Balloon entered a film of Stratus cloud, above which there was a sheet of St.-Cu.														
	700	198	0.6	+0.2	+0.6		600	121	16.5	-14.1	+8.5		...	750	349	8.6	+1.6		-8.4	...												
	500	105	2.3	-2.2	+0.6		3.0 assumed.	475	118	19.1	-16.8		+9.0	2.9 assumed.	500	357	8.3		+0.4	-8.3	3.0 assumed.											
	300	80	4.2	-4.1	-0.7			300	116	15.7	-14.1		+6.8		300	345	8.3		+2.1	-8.0												
	100	79	2.6	-2.6	-0.5			100	116	12.6	-11.3		+5.6		100	354	5.1		+0.5	-5.1												
Ground level	30	90	3.1	-3.1	0.0	...	30	125	13.0	-10.7	+7.4	...	30	360	3.5	0.0	-3.5	...														
Computed for M.S.L.	0	Pressure distribution irregular.				Lift 45 gm.	0	150	24.9	-12.5	+21.6	...	Lift 37 gm.	0	Pressure distribution irregular.				Lift 49 gm.													

ABERDEEN. P. 56. May 16. 11 h. 15 m. G.M.T.											ABERDEEN. P. 57. May 21. 11 h. 20 m. G.M.T.											ABERDEEN. P. 58. May 23. 11 h. 30 m. G.M.T.										
Greatest height.	Height above M.S.L.	Wind.				Vertical Velocity.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.				Vertical Velocity.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.				Vertical Velocity.	Cloud Observations and Remarks.											
		Direction.	Velocity.	Components.					Direction.	Velocity.	Components.					Direction.	Velocity.	Components.														
				W.-E.	S.-N.						W.-E.	S.-N.						W.-E.	S.-N.													
	1930	...	...	...	...	Two theodolites. Flight of balloon most erratic; it showed the "land and sea breeze" circulation well. Balloon entered St.-Cu. belt. At 12 h. this cloud sheet began to degrade and was measured with the nephoscope. The components (assuming 1900 m. as the height) were:— W.-E.=+8.6 m/s. S.-N.=+4.4 m/s.	1110	...	...	...	...	One theodolite. Balloon entered base of Cu.-Nb. cloud.	1200	...	...	...	...	One theodolite only. Small lift of 18 gm. due to exhaustion of the hydrogen supply. * See note below.														
	1800	283	8.6	+8.4	-1.9		2.0	...	...	...	...		...	1000	217	15.7	+9.5		+12.5	...												
	1500	291	7.4	+6.9	-2.6		2.7	3.0 assumed.	750	215	17.1		+9.9	+14.0	750	267	5.4		+5.4	+0.3	2.2 assumed.											
	1000	309	5.8	+4.5	-3.6		2.5		500	232	10.8		+8.5	+6.7	500	243	3.3		+2.9	+1.5												
	500	277	1.7	+1.7	-0.2		2.9		300	191	13.3		+2.5	+13.1	250	160	4.4		-1.5	+4.1												
Ground level	100	106	1.9	-1.8	+0.5	1.6	100	189	15.9	+2.4	+15.7	...	100	147	5.0	-2.7	+4.2															
Ground level	30	135	2.5	-1.8	+1.8	...	30	180	4.4	0.0	+4.4	...	30	135	2.5	-1.8	+1.8	...														
Computed for M.S.L.	0	260	7.1	+7.0	+1.2	...	Lift 56 gm.	0	210	12.1	+6.1	+10.5	...	Lift 48 gm.	0	260	5.9	+5.8	+1.0	...	Lift 18 gm.											

\* Note attached to P. 58.—Base of cloud (rather low Cu.-Nb.) which balloon entered was assumed at 1200 m., and the vertical velocity at 2.2 m/s. The path of balloon again shows the South-Easterly lower current giving place to North-Westerly one higher up. As balloon approached base of Cu.-Nb. cloud the altitude of the balloon increased, which probably shows a more rapid lift just below the cloud base.

## 9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. May 5. 18 h. 55 m. G.M.T.				SOUNDING No., R. 228.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 15.2 km.	? mb.	217° A.	Latitude, 51° 38' N.	km.	mb.	°A.	°C.	Isothermal at 269° from 2.3 km. to 2.6 km.	
LONGITUDE, } 1° 1' W.			Longitude, 1° 1' W.	15.0	119	217	1		
LOWEST TEMPERATURE, } ? km.	? mb.	? A.	Height above M.S.L., } 150 m.	14.0	139	218	1		
BASE OF STRATOSPHERE, } 10.5 km.	240 mb.	216° A.	PLACE OF FALL, Bracknell.	13.0	163	219	0		
Type No. 1			Distance, 31 km.	12.0	189	219	0		
			Orientation, 147° from N.	11.62	200	218	-2		
				11.0	223	217	1		
				10.0	257	218	1		
				9.00	300	222	4		
				8.0	349	229	7		
				7.06	400	237	8		
				7.0	404	237	8		
				5.50	500	241	8		
				6.0	464	245	8		
				5.0	533	253	8		
				4.11	600	260	8		
				4.0	609	261	8		
				3.0	691	266	5		
				2.88	700	266	4		
				2.5	...	269	4		
				2.0	783	270	4		
				1.82	800	272	9		
				1.5	...	275	9		
				1.0	888	279	9		
				.88	900	278	6		
				0.5	...	282	6		
				Ground M.S.L.	...	284	...		
					1003	...	...		
From observations at Station. at 7 h. at 18 h. G.M.T.									
PRESSURE (M.S.L.),		1004 mb.	1005 mb.						
TEMPERATURE,		282° A.	286° A.						
VAPOUR PRESSURE,		...	...						
GRADIENT WIND:—Direction,		Pressure	Pressure						
Velocity,		Distribution	Distribution						
Correction for Curvature,		Irregular.	Irregular.						
Final Components, { W. to E.		...	...						
{ S. to N.		...	...						
1913. May 6. 6 h. 53 m. G.M.T.				SOUNDING No. R. 229.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 10.0 km.	256 mb.	221° A.	Latitude, 51° 38' N.	km.	mb.	°A.	°C.	Surface wind S.E. 4. Overcast. Balloon lost in clouds in less than a minute. Good trace but duplicated; mean taken.	
LONGITUDE, } 1° 1' W.			Longitude, 1° 1' W.	10.0	256	221	1		
LOWEST TEMPERATURE, } ? km.	? mb.	? A.	Height above M.S.L., } 150 m.	9.0	300	222	1		
BASE OF STRATOSPHERE, } 9.6 km.	272 mb.	217° A.	PLACE OF FALL, Towcester.	8.99	300	222	8		
Type No. ?			Distance, 51 km.	8.0	348	230	8		
			Orientation, 360° from N.	7.04	400	240	10		
				7.0	493	240	8		
				6.0	463	248	8		
				5.43	500	251	6		
				5.0	529	254	6		
				4.08	600	260	7		
				4.0	605	261	6		
				3.0	689	267	6		
				2.87	700	268	5		
				2.5	...	269	5		
				2.0	781	272	5		
				1.80	800	273	6		
				1.5	...	275	6		
				1.0	884	278	6		
				8.5	900	279	6		
				.5	...	281	6		
				Ground M.S.L.	...	281	...		
					1000	...	...		
From observations at Station. at 7 h. at 18 h. G.M.T.									
PRESSURE (M.S.L.),		1002 mb.	1001 mb.						
TEMPERATURE,		282° A.	281° A.						
VAPOUR PRESSURE,		...	...						
GRADIENT WIND:—Direction,		Pressure	285°						
Velocity,		Distribution	8.8 m/s.						
Correction for Curvature,		Irregular.	+1.0 m/s.						
Final Components, { W. to E.		...	+9.5 m/s.						
{ S. to N.		...	-2.5 m/s.						
1913. May 6. 19 h. 0 m. G.M.T.				SOUNDING No. R. 230.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 14.4 km.	? mb.	221° A.	Latitude, 51° 38' N.	km.	mb.	°A.	°C.	Lost in three minutes. Isothermal 3.9 to 4.1 km. at 254°.	
LONGITUDE, } 1° 1' W.			Longitude, 1° 1' W.	14.0	137	221	1		
LOWEST TEMPERATURE, } ? km.	? mb.	? A.	Height above M.S.L., } 150 m.	13.0	157	222	0		
BASE OF STRATOSPHERE, } 8.5 km.	327 mb.	221° A.	PLACE OF FALL, Weedon.	12.0	184	222	0		
Type No. 1			Distance, 67 km.	11.47	200	222	0		
			Orientation, 355° from N.	11.0	216	222	0		
				10.0	251	222	-1		
				9.0	291	221	-1		
				8.80	300	222	4		
				8.0	337	225	7		
				7.0	392	232	7		
				6.85	400	233	9		
				6.0	452	241	9		
				5.27	500	247	8		
				5.0	520	249	8		
				4.0	596	254	5		
				3.94	600	254	5		
				3.0	681	259	5		
				2.79	700	260	6		
				2.5	...	262	6		
				2.0	774	265	6		
				1.74	800	267	7		
				1.5	...	269	7		
				1.0	881	272	7		
				.82	900	273	8		
				.5	...	276	8		
				Ground M.S.L.	...	280	...		
					999	...	...		
From observations at Station. at 7 h. at 18 h. G.M.T.									
PRESSURE (M.S.L.),		1002 mb.	1001 mb.						
TEMPERATURE,		282° A.	281° A.						
VAPOUR PRESSURE,		...	...						
GRADIENT WIND:—Direction,		Pressure	285°						
Velocity,		Distribution	8.8 m/s.						
Correction for Curvature,		Irregular.	+1.0 m/s.						
Final Components, { W. to E.		...	+9.5 m/s.						
{ S. to N.		...	-2.5 m/s.						

9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.)—continued.

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. May 7. 6 h. 45 m. G.M.T.				SOUNDING No., R. 231.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.	M.S.L.		Reading.	Fall per Km.		
GREATEST HEIGHT, } 10.0 km.	253 mb.	228° A.	Latitude, 51° 38' N. Longitude, 1° 1' W. Height above M.S.L., } 150 m.	km.	mb.	°A.	°C.	Wind S.E. 3-4. Lost in 3 minutes in clouds from S.S.W. Overcast. Showers. Very small gradient 3.3 to 3.8 km.	
LOWEST TEMPERATURE, } ? km.	? mb.	? A.	PLACE OF FALL, St. Albans.	10.0	253	228	-2		
BASE OF STRATOSPHERE, } 9.1 km.	289 mb.	226° A.	Distance, 47 km.	9.0	295	226	3		
Type No. 1			Orientation, 76° from N.	8.85	300	226	3		
				8.0	341	229	4		
				7.0	395	233	4		
				6.91	400	234	7		
				6.0	452	240	7		
				5.29	500	245	7		
				5.0	520	247	6		
				4.0	594	253	6		
				3.93	600	253	6		
				3.0	680	259	8		
				2.80	700	261	8		
				2.5	...	263	5		
				2.0	776	267	6		
				1.77	800	268	5		
				1.5	...	269	5		
				1.0	883	272	6		
				.83	900	273	6		
				.5	...	275	6		
				Ground M.S.L.	...	278	...		
					1001	...	...		
From observations at Station				at 7 h.	at 18 h. G.M.T.				
PRESSURE (M.S.L.),				1005 mb.	1004 mb.				
TEMPERATURE,				280° A.	285° A.				
VAPOUR PRESSURE,				...	...				
GRADIENT WIND:—Direction,				Pressure	210°				
Velocity,				Distribution	15.4 m/s.				
Correction for Curvature,				Irregular.	0.0 m/s.				
Final Components, { W. to E.					+ 7.7 m/s.				
{ S. to N.					+ 13.3 m/s.				
1913. May 7. 18 h. 55 m. G.M.T.				SOUNDING No., R. 232.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.	M.S.L.		Reading.	Fall per Km.		
GREATEST HEIGHT, } 9.2 km.	? mb.	226° A.	Latitude, 51° 38' N. Longitude, 1° 1' W. Height above M.S.L., } 150 m.	km.	mb.	°A.	°C.	Wind S.S.E. 3. Cirrus and a few low clouds. Lost behind small patch of cloud after 5 minutes. Isothermal 2.2 to 2.6 km. at 263°.	
LOWEST TEMPERATURE, } ? km.	? mb.	? A.	PLACE OF FALL, Orford.	9.0	296	224	1		
BASE OF STRATOSPHERE, } 9.0 km.	296 mb.	226° A.	Distance, 173 km.	8.90	300	224	1		
Type No. ?			Orientation, 77° from N.	8.0	341	225	7		
				7.0	396	232	8		
				6.92	400	233	8		
				6.0	457	240	7		
				5.35	500	244	7		
				5.0	524	247	8		
				4.01	600	255	7		
				4.0	601	255	7		
				3.0	685	262	5		
				2.83	700	263	5		
				2.5	...	265	7		
				2.0	778	267	7		
				1.79	800	268	8		
				1.5	...	271	8		
				1.0	883	274	8		
				.84	900	275	8		
				.5	...	278	8		
				Ground M.S.L.	...	282	...		
					1002	...	...		
From observations at Station				at 7 h.	at 18 h. G.M.T.				
PRESSURE (M.S.L.),				1005 mb.	1004 mb.				
TEMPERATURE,				280° A.	285° A.				
VAPOUR PRESSURE,				...	...				
GRADIENT WIND:—Direction,				Pressure	210°				
Velocity,				Distribution	15.4 m/s.				
Correction for Curvature,				Irregular.	0.0 m/s.				
Final Components, { W. to E.					+ 7.7 m/s.				
{ S. to N.					+ 13.3 m/s.				
1913. May 8. 6 h. 52 m. G.M.T.				SOUNDING No., R. 233.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.	M.S.L.		Reading.	Fall per Km.		
GREATEST HEIGHT, } 11.7 km.	? mb.	217° A.	Latitude, 51° 38' N. Longitude, 1° 1' W. Height above M.S.L., } 150 m.	km.	mb.	°A.	°C.	Overcast. Lost in 6 minutes. Isothermal 2.2 to 2.5 km. at 268°. Very small gradient from 3 to 5 km.	
LOWEST TEMPERATURE, } ? km.	? mb.	? A.	PLACE OF FALL, Peterboro'.	11.0	221	214	2		
BASE OF STRATOSPHERE, } 10.5 km.	245 mb.	213° A.	Distance, 112 km.	10.0	260	216	9		
Type No. 1			Orientation, 28° from N.	9.02	300	225	9		
				9.0	303	225	8		
				8.0	349	233	9		
				7.05	400	242	8		
				7.0	403	242	8		
				6.0	463	250	9		
				5.46	500	255	3		
				5.0	529	259	3		
				4.03	600	262	4		
				4.0	603	262	4		
				3.0	688	266	3		
				2.85	700	266	3		
				2.5	...	268	7		
				2.0	780	269	7		
				1.80	800	270	7		
				1.5	...	272	8		
				1.0	883	276	8		
				.85	900	277	8		
				.5	...	280	8		
				Ground M.S.L.	...	282	...		
					1000	...	...		
From observations at Station				at 7 h.	at 18 h. G.M.T.				
PRESSURE (M.S.L.),				1003 mb.	1002 mb.				
TEMPERATURE,				282° A.	284° A.				
VAPOUR PRESSURE,				...	...				
GRADIENT WIND:—Direction,				170°	Pressure				
Velocity,				20.5 m/s.	Distribution				
Correction for Curvature,				- 3.2 m/s.	Irregular.				
Final Components, { W. to E.					- 3.0 m/s.				
{ S. to N.					+ 17.0 m/s.				





## 9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).—continued.

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. May 7. 6 h. 0 m. G.M.T.				SOUNDING No., 9 (1913).		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, MANCHESTER.	Latitude, 53° 28' N.	Longitude, 2° 14' W.			Reading.	Fall per Km.	
GREATEST HEIGHT, } 16.5 km.	91 mb.	221° A.	Height above M.S.L. } 40 m.	PLACE OF FALL, near Burnley.		km.	mb.	°A.	°C.	
LOWEST TEMPERATURE, } 16.5 km.	91 mb.	221° A.	Distance, 42 km. and Orientation, 353° from N.	16.5	91	16.0	97	221.5		1.5
BASE OF STRATOSPHERE, } 9.1 km.	285 mb.	221.5° A.		15.88	100	15.0	116	223		0.5
Type No. 1.				14.0		14.0	136	223.5		0.5
				13.0		13.0	157	224		0.5
				12.0		12.0	183	224.5		0.5
				11.35	200	11.35	200	224.5		- 1
				11.0		11.0	212	223.5		- 1.5
				10.0		10.0	248	222		0
				9.0		9.0	289	222		0
				8.75	300	8.75	300	224		6.5
				8.0		8.0	337	228.5		5
				7.0		7.0	391	233.5		
				6.85	400	6.85	400	234.5		7
				6.0		6.0	452	240.5		6
				5.28	500	5.28	500	245		
				5.0		5.0	520	246.5		6
				4.0		4.0	597	252.5		
				3.97	600	3.97	600	253		7.5
				3.0		3.0	684	260		6.5
				2.84	700	2.84	700	261		
				2.5		2.5	730	263		7.5
				2.0		2.0	781	266.5		6.5
				1.80	800	1.80	800	268		7.5
				1.5		1.5	834	270.5		
				1.0		1.0	888	274		
				0.88	900	0.88	900	275		
				0.5		0.5	943	277		
				0.02	1000	0.02	1000	278		
				Ground M.S.L.		Ground M.S.L.	997	278		...
							1002	...		...
From observations at Station. at 7 h. at 18 h. G.M.T.										
PRESSURE (M.S.L.),			1003 mb.		1001 mb.					
TEMPERATURE,			279° A.		282° A.					
VAPOUR PRESSURE,			...		...					
GRADIENT WIND:—Direction,			Pressure		190°					
Velocity,			Distribution		15.8 m/s.					
Correction for Curvature,			Irregular.		- 2.7 m/s.					
Final Components, { W. to E. . . . .			...		+ 2.3 m/s.					
{ S. to N. . . . .			...		+ 12.9 m/s.					
1913. May 8. 6 h. 0 m. G.M.T.				SOUNDING No., 10 (1913).		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, MANCHESTER.	Latitude, 53° 28' N.	Longitude, 2° 14' W.			Reading.	Fall per Km.	
GREATEST HEIGHT, } 12.1 km.	182 mb.	222° A.	Height above M.S.L. } 40 m.	PLACE OF FALL, near Leyburn, Yorks.		km.	mb.	°A.	°C.	
LOWEST TEMPERATURE, } 10.4 km.	235 mb.	218.5° A.	Distance, 95 km. and Orientation, 16° from N.	12.0		12.0	184	221.5		- 2.5
BASE OF STRATOSPHERE, } 10.4 km.	235 mb.	218.5° A.		11.45	200	11.0	216	219		1.5
Type No. 1.				10.0		10.0	252	220.5		5.5
				9.0		9.0	294	226		7
				8.88	300	8.88	300	227		6.5
				8.0		8.0	342	233		6.5
				7.0		7.0	395	239.5		6.5
				6.93	400	6.93	400	240		6.5
				6.0		6.0	455	246		6.5
				5.32	500	5.32	500	250.5		6
				5.0		5.0	523	252.5		5.5
				4.0		4.0	599	258.5		5.5
				3.98	600	3.98	600	259		8
				3.0		3.0	684	264		
				2.82	700	2.82	700	265.5		5.5
				2.5		2.5	729	267.5		
				2.0		2.0	777	269.5		
				1.78	800	1.78	800	271		
				1.5		1.5	829	272		
				1.0		1.0	883	277.5		
				0.86	900	0.86	900	275.5		
				0.5		0.5	943	279		
				0.0	1000	0.0	1000	283		
				Ground M.S.L.		Ground M.S.L.	996	283		...
							1000	...		...
From observations at Stations. at 7 h. at 18 h. G.M.T.										
PRESSURE (M.S.L.),			1002 mb.		999 mb.					
TEMPERATURE,			282° A.		283° A.					
VAPOUR PRESSURE,			...		...					
GRADIENT WIND:—Direction,			160°		172°					
Velocity,			26.2 m/s.		24.7 m/s.					
Correction for Curvature,			- 5.1 m/s.		- 5.9 m/s.					
Final Components, { W. to E. . . . .			- 7.2 m/s.		- 2.6 m/s.					
{ S. to N. . . . .			+ 19.8 m/s.		+ 18.6 m/s.					
1913. May 9. 19 h. 0 m. G.M.T.				SOUNDING No., 11 (1913).		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, MANCHESTER.	Latitude, 53° 28' N.	Longitude, 2° 14' W.			Reading.	Fall per Km.	
GREATEST HEIGHT, } 12.8 km.	163 mb.	222° A.	Height above M.S.L. } 40 m.	PLACE OF FALL, Rockcliffe, near Carlisle.		km.	mb.	°A.	°C.	
LOWEST TEMPERATURE, } 9.9 km.	260 mb.	220.5° A.	Distance, 174 km. and Orientation, 343° from N.	12.0		12.0	184	223.5		1
BASE OF STRATOSPHERE, } 9.9 km.	260 mb.	220.5° A.		11.50	200	11.0	217	224.5		- 4
Type No. 1.				10.0		10.0	256	220.5		5
				9.0		9.0	296	225.5		7
				8.88	300	8.88	300	220.5		6
				8.0		8.0	343	232.5		4.5
				7.0		7.0	397	238.5		6.5
				6.94	400	6.94	400	239		
				6.0		6.0	457	243		
				5.37	500	5.37	500	247.5		7
				5.0		5.0	526	249.5		7.5
				4.0		4.0	603	256.5		
				4.02	600	4.02	600	256.5		
				3.0		3.0	688	263		
				2.86	700	2.86	700	263.5		6
				2.5		2.5	734	266		
				2.0		2.0	784	270.5		
				1.83	800	1.83	800	271.5		6
				1.5		1.5	836	272.5		
				1.0		1.0	888	276.5		
				0.88	900	0.88	900	277.5		
				0.5		0.5	944	281		
				0.00	1000	0.00	1000	285		
				Ground M.S.L.		Ground M.S.L.	997	285		...
							1001	...		...
From Observations at Station. at 7 h. at 18 h. G.M.T.										
PRESSURE (M.S.L.),			1002 mb.		1002 mb.					
TEMPERATURE,			281° A.		285° A.					
VAPOUR PRESSURE,			...		...					
GRADIENT WIND:—Direction,			154°		180°					
Velocity,			13.9 m/s.		12.6 m/s.					
Correction for Curvature,			- 1.7 m/s.		- 1.4 m/s.					
Final Components, { W. to E. . . . .			- 5.3 m/s.		0.0 m/s.					
{ S. to N. . . . .			+ 11.0 m/s.		+ 11.2 m/s.					



9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.)—continued.

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. May 10. 5 h. 53 m. G.M.T.				SOUNDING No., 12 (1913).		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, MANCHESTER.	Reading.	Fall per Km.					
GREATEST HEIGHT, } 14.9 km.	120 mb.	229° A.	Latitude, 53° 28' N. Longitude, 2° 14' W.	km. 14.0 13.0 12.0 11.65 11.0 10.0 9.0 8.93 8.0 7.0 6.96 6.0	mb. 139 163 190 200 220 257 297 300 344 397 400 459	°A. 229 229.5 231.5 232 230.5 231.5 230 229.5 233 237.5 238 247.5	°C. 0.5 2 -1 1 -1.5 3 4.5 10	Trace somewhat blurred and calibration indistinct.  Instrument broken.  Readings therefore somewhat doubtful.		
LOWEST TEMPERATURE, } 14.9 km.	120 mb.	229° A.	Height above M.S.L., } 40 m.	5.40 5.0 4.04 4.0 3.0 2.86 2.5 2.0 1.87 1.5 1.0 0.93 0.5 0.04	500 529 600 604 689 700 736 786 800 837 890 900 946 1000	253 256 263 263 269 270 272.5 275 275.5 277 279 279.5 281 282	8.5 7 6 6 4			
BASE OF STRATOSPHERE, } 8.5 km.	320 mb.	229.5° A.	PLACE OF FALL, near Carlisle. Distance, 162 km. and Orientation, 344° from N.	Ground M.S.L.	1000	282	...	...		
Type No. 1.										
From Observations at Station.				at 7 h.	at 18 h. G.M.T.					
PRESSURE (M.S.L.),				1004 mb.	1007 mb.					
TEMPERATURE,				281° A.	285° A.					
VAPOUR PRESSURE,				...	...					
GRADIENT WIND:—Direction,				170°	Pressure					
Velocity,				10.2 m/s.	Distribution					
Correction for Curvature,				- 1.1 m/s.	Irregular.					
Final Components, { W. to E. S. to N.				- 1.6 m/s. + 9.0 m/s.						

1913. May 5. 7 h. 5 m. G.M.T.				SOUNDING No., R. 238 E. 1.		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, ESKDALEMUIR.	Reading.	Fall per Km.					
GREATEST HEIGHT, } 15.2 km.	117 mb.	220° A.	Latitude, 55° 19' N. Longitude, 3° 12' W.	km. 15.0 14.0 13.0 12.0 11.66 11.0 10.0 9.00 8.0 7.03 7.0 6.0	mb. 120 141 164 191 200 221 257 300 347 400 403 464	°A. 220 221 222 222 223 224 225 226 226 234 234 242	°C. 1 1 0 2 1 1 0 8 8	Dead calm. Foggy. Inversion 276° to 278° at .9 km.		
LOWEST TEMPERATURE, } 15 km.	? mb.	220° A.	Height above M.S.L., } 243 m.	5.45 5.0 4.11 4.0 3.0 2.95 2.5 2.0 1.88 1.5 1.0 .92 .5	500 533 600 609 694 700 742 790 800 840 892 900 949	246 250 257 257 264 264 268 271 272 275 278 278	8 7 7 7 7			
BASE OF STRATOSPHERE, } 7.9 km.	353 mb.	226° A.	PLACE OF FALL, Selkirk. Distance, 34 km. and Orientation, 42° from N.	Ground M.S.L.	1011	280	...	...		
Type No. 2.										
From observations at Station.				at 7 h.	at 18 h. G.M.T.					
PRESSURE (M.S.L.),				1008 mb.	1004 mb.					
TEMPERATURE,				280° A.	282° A.					
VAPOUR PRESSURE,				...	...					
GRADIENT WIND:—Direction,				Pressure 183°						
Velocity,				Distribution 10.1 m/s.						
Correction for Curvature,				Irregular. - 0.6 m/s.						
Final Components, { W. to E. S. to N.				... ...	+ 0.5 m/s. + 9.5 m/s.					

1913. May 5. 18 h. 37 m. G.M.T.				SOUNDING No., R. 239 E. 2.		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, ESKDALEMUIR.	Reading.	Fall per Km.					
GREATEST HEIGHT, } 15.0 km.	124 mb.	220° A.	Latitude, 55° 19' N. Longitude, 3° 12' W.	km. 15.0 14.0 13.0 12.0 11.69 11.0 10.0 9.08 9.0 8.0 7.11 7.0 6.0	mb. 124 140 164 192 200 223 260 300 300 351 400 403 465	°A. 220 221 222 223 222 221 218 222 222 231 240 240 246	°C. 1 1 1 -2 -3 4 9 9 6	Overcast, raining. Light S.E. wind.		
LOWEST TEMPERATURE, } 9.6 km.	277 mb.	217° A.	Height above M.S.L., } 243 m.	5.50 5.0 4.13 4.0 3.0 2.94 2.5 2.0 1.87 1.5 1.0 .92 .5	500 535 600 611 695 700 742 788 800 835 890 900 948	253 259 260 266 266 269 272 273 275 278 278 280	7 7 6 6 6 6 6 6			
BASE OF STRATOSPHERE, } 9.6 km.	277 mb.	217° A.	PLACE OF FALL, Hawick. Distance, 29 km. and Orientation, 60° from N.	Ground M.S.L.	1008	281	...	...		
Type No. 1.										
From observations at Station.				at 7 h.	at 18 h. G.M.T.					
PRESSURE (M.S.L.),				1008 mb.	1004 mb.					
TEMPERATURE,				280° A.	282° A.					
VAPOUR PRESSURE,				...	...					
GRADIENT WIND:—Direction,				Pressure 183°						
Velocity,				Distribution 10.1 m/s.						
Correction for Curvature,				Irregular. - 0.6 m/s.						
Final Components, { W. to E. S. to N.				... ...	+ 0.5 m/s. + 9.5 m/s.					

## 9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).—continued.

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. May 6. 7 h. 5 m. G.M.T.				SOUNDING No., R. 240 E. 3.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, ESKDALEMUIR.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 13.2 km.	157 mb.	224° A.	Latitude, 55° 19' N.	Longitude, 3° 12' W.	km.	mb.	°A.	°C.	Overcast, E.S.E. 5-6. Balloon lost in cloud in 2 minutes. Isothermal 0.6 to 1.0 km. and from 3.0 to 3.2 km. at 263°.
LOWEST TEMPERATURE, } 10.3 km.	245 mb.	214° A.	Height above M.S.L., } 243 m.	PLACE OF FALL, Larbert.	13.0	163	224	-1	
BASE OF STRATOSPHERE, } 10.3 km.	245 mb.	214° A.	Distance, 84 km.	Orientation, 334° from N.	12.0	189	223	-1	
Type No. 2.					11.61	200	222	-2	
					11.0	221	221	-5	
					10.0	257	216	5	
					9.00	300	221	8	
					8.0	348	229		
					7.01	400	238	9	
					7.0	401	238	9	
					6.0	464	247		
					5.40	500	252	8	
					5.0	529	255	2	
					4.05	600	257	6	
					4.0	604	257	6	
					3.0	690	263	7	
					2.85	700	264	7	
					2.5	733	267	7	
					2.0	783	270	7	
					1.81	800	271	7	
					1.5	832	274	7	
					1.0	885	277	2	
					.87	900	277	2	
					.5	942	278	2	
From observations at Station.			at 7 h.	at 18 h. G.M.T.	Ground M.S.L.	...	281	...	
PRESSURE (M.S.L.),			1001 mb.	1000 mb.		1004	...	...	
TEMPERATURE,			280° A.	279° A.					
VAPOUR PRESSURE,			...	...					
GRADIENT WIND:—Direction,			168°	140°					
Velocity,			11.3 m/s.	22.8 m/s.					
Correction for Curvature,			0.0 m/s.	0.0 m/s.					
Final Components, { W. to E.			-2.3 m/s.	-14.7 m/s.					
{ S. to N.			+11.1 m/s.	+17.5 m/s.					
1913. May 7. 7 h. 0 m. G.M.T.				SOUNDING No., R. 241 E. 4.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, ESKDALEMUIR.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 10.6 km.	245 mb.	224° A.	Latitude, 55° 19' N.	Longitude, 3° 12' W.	km.	mb.	°A.	°C.	Overcast, but clear in S.W. Balloon rose vertically and then went N.N.W. Very small gradient to 3.0 km.
LOWEST TEMPERATURE, } 9.0 km.	296 mb.	219° A.	Height above M.S.L., } 243 m.	PLACE OF FALL, Kilpatrick.	10.0	256	222	-3	
BASE OF STRATOSPHERE, } 9.0 km.	296 mb.	219° A.	Distance, 102 km.	Orientation, 315° from N.	9.0	296	219	6	
Type No. 1.					8.98	300	219	6	
					8.0	344	225	9	
					7.00	400	234	7	
					6.0	461	241	9	
					5.42	500	246	7	
					5.0	531	250	5	
					4.05	600	257	6	
					4.0	604	257	6	
					3.0	689	263	5	
					2.88	700	264	5	
					2.5	734	266	4	
					2.0	783	268	4	
					1.82	800	269	4	
					1.5	836	270	4	
					1.0	888	272	4	
					.90	900	272	4	
					.5	944	274	4	
From observations at Station.			at 7 h.	at 18 h. G.M.T.	Ground M.S.L.	...	276	...	
PRESSURE (M.S.L.),			1003 mb.	1003 mb.		1003	...	...	
TEMPERATURE,			277° A.	279° A.					
VAPOUR PRESSURE,			...	...					
GRADIENT WIND:—Direction,			175°	149°					
Velocity,			8.7 m/s.	25.2 m/s.					
Correction for Curvature,			-0.3 m/s.	0.0 m/s.					
Final Components, { W. to E.			-0.7 m/s.	-13.0 m/s.					
{ S. to N.			+8.4 m/s.	+21.6 m/s.					
1913. May 7. 19 h. 0 m. G.M.T.				SOUNDING No., R. 242 E. 5.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, ESKDALEMUIR.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 15.0 km.	120 mb.	218° A.	Latitude, 55° 19' N.	Longitude, 3° 12' W.	km.	mb.	°A.	°C.	Overcast. Balloon lost in clouds at once. Very strong east wind. Small gradient 3.0 to 3.4 km.
LOWEST TEMPERATURE, } 8.1 km.	335 mb.	217° A.	Height above M.S.L., } 243 m.	PLACE OF FALL, West Linton.	15.0	120	218	1	
BASE OF STRATOSPHERE, } 8.1 km.	335 mb.	217° A.	Distance, 55 km.	Orientation, 351° from N.	14.0	136	219	1	
Type No. 1.					13.0	157	220	1	
					12.0	184	221	1	
					11.46	200	222	1	
					11.0	216	222	-1	
					10.0	249	221	-1	
					9.0	291	220	-2	
					8.80	300	220	9	
					8.0	340	218	10	
					7.0	396	227	9	
					6.91	400	228	9	
					6.0	457	237	9	
					5.35	500	243	9	
					5.0	525	246	9	
					4.02	600	255	9	
					4.0	601	255	5	
					3.0	688	260	7	
					2.86	700	261	7	
					2.5	732	263	7	
					2.0	781	267	6	
					1.82	800	268	6	
					1.5	835	270	8	
					1.0	887	273	8	
					.88	900	274	8	
					.5	944	277	8	
From observations at Station.			at 7 h.	at 18 h. G.M.T.	Ground M.S.L.	...	278	...	
PRESSURE (M.S.L.),			1003 mb.	1003 mb.		1005	...	...	
TEMPERATURE,			277° mb.	279° A.					
VAPOUR PRESSURE,			...	...					
GRADIENT WIND:—Direction,			175°	149°					
Velocity,			8.7 m/s.	25.2 m/s.					
Correction for Curvature,			-0.3 m/s.	0.0 m/s.					
Final Components, { W. to E.			-0.7 m/s.	-13.0 m/s.					
{ S. to N.			+8.4 m/s.	+21.6 m/s.					

9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).—continued.

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. May 8. 7 h. 0 m. G.M.T.				SOUNDING No., R. 243 E. 6.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, ESKDALEMUIR.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 14.2 km.	133 mb.	221° A.	Latitude, 55° 19' N.	km. 14.0	mb. 137	°A. 221	°C. 0	Strong E.S.E. wind. Overcast.	
LOWEST TEMPERATURE, } 9.5 km.	276 mb.	217° A.	Longitude, 3° 12' W.	13.0	160	221	0		
BASE OF STRATOSPHERE, } 9.5 km.	276 mb.	217° A.	Height above M.S.L., } 243 m.	12.0	187	222	1	Balloon lost in one minute.	
Type No. 1.			PLACE OF FALL, Leith.	11.56	200	222	-1		
			Distance, 72 km.	11.0	217	221	-3	Isothermal 2.2 to 2.5 km. at 268°. Inversion 256°-257° at 4.2 km.	
			Orientation, 0° from N.	10.0	256	218	-3		
				9.0	297	221	3		
				8.98	300	221	8		
				8.0	345	229	8		
				7.0	399	237	8		
				6.99	400	237	8		
				6.0	460	245	8		
				5.41	500	249	7		
				5.0	529	252	4		
				4.07	600	256	9		
				4.0	605	256	4		
				3.0	689	265	9		
				2.88	700	265	4		
				2.5	734	268	4		
				2.0	782	269	7		
				1.82	800	270	7		
				1.5	832	273	8		
				1.0	885	276	8		
				.86	900	277	8		
				.5	941	280	8		
				Ground M.S.L.	...	281	...		
					1004	...	...		
1913. May 9. 7 h. 0 m. G.M.T.				SOUNDING No., R. 245 E. 7.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, ESKDALEMUIR.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 15.2 km.	116 mb.	225° A.	Latitude, 55° 19' N.	km. 15.0	mb. 120	°A. 225	°C. -1	Overcast, raining.	
LOWEST TEMPERATURE, } 9.1 km.	293 mb.	220° A.	Longitude, 3° 12' W.	14.0	141	224	0		
BASE OF STRATOSPHERE, } 9.1 km.	293 mb.	220° A.	Height above M.S.L., } 243 m.	13.0	164	224	-2	Wind E.N.E. squally.	
Type No. 1.			PLACE OF FALL, Braco.	12.0	189	222	1		
			Distance, 120 km.	11.62	200	222	1		
			Orientation, 340° from N.	11.0	220	223	-2		
				10.0	257	221	-1		
				9.0	297	220	8		
				8.98	300	220	8		
				8.0	344	228	9		
				7.0	399	237	9		
				6.98	400	237	6		
				6.0	461	243	8		
				5.40	500	248	8		
				5.0	529	251	6		
				4.03	600	257	6		
				4.0	603	257	5		
				3.0	687	262	5		
				2.87	700	263	5		
				2.5	733	264	5		
				2.0	783	267	7		
				1.82	800	268	7		
				1.5	835	270	6		
				1.0	888	274	6		
				.89	900	275	6		
				.5	944	277	6		
				Ground M.S.L.	...	278	...		
					1004	...	...		
1913. May 9. 19 h. 3 m. G.M.T.				SOUNDING No., R. 246 E. 8.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, ESKDALEMUIR.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 12.0 km.	193 mb.	223° A.	Latitude, 55° 19' N.	km. 12.0	mb. 193	°A. 223	°C. 0	Overcast, calm.	
LOWEST TEMPERATURE, } 9.1 km.	294 mb.	219° A.	Longitude, 3° 12' W.	11.58	200	223	0		
BASE OF STRATOSPHERE, } 9.1 km.	294 mb.	219° A.	Height above M.S.L., } 243 m.	11.0	219	223	-4	Balloon lost in 3 minutes going N.	
Type No. 1.			PLACE OF FALL, Fort Augustus.	10.0	255	219	1		
			Distance, 219 km.	9.0	297	220	1		
			Orientation, 335° from N.	8.90	300	221	10		
				8.0	344	230	8		
				7.0	397	238	8		
				6.96	400	238	5		
				6.0	459	243	5		
				5.36	500	247	6		
				5.0	527	249	6		
				4.03	600	256	7		
				4.0	603	256	7		
				3.0	689	263	7		
				2.88	700	264	5		
				2.5	734	266	5		
				2.0	784	268	5		
				1.84	800	269	5		
				1.5	825	271	10		
				1.0	886	273	10		
				.88	900	274	10		
				.5	944	278	10		
				Ground M.S.L.	...	280	...		
					1005	...	...		
From observations at Station.				at 7 h.	at 18 h. G.M.T.				
PRESSURE (M.S.L.),			1004 mb.	1002 mb.					
TEMPERATURE,			280° A.	280° A.					
VAPOUR PRESSURE,			...	...					
GRADIENT WIND:—Direction,			144°	165°					
Velocity,			19.1 m/s.	17.6 m/s.					
Correction for Curvature,			- 1.4 m/s.	- 2.7 m/s.					
Final Components, { W. to E.			- 10.4 m/s.	- 3.9 m/s.					
{ S. to N.			+ 14.3 m/s.	+ 14.4 m/s.					

## 9. The Upper Air:—Soundings By Registering Balloons (R.) and Pilot Balloons (P.).—continued.

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. May 5. 7 h. 0 m. G.M.T.				SOUNDING No., R.M.C. 51.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, MUNGRET COLLEGE.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 11.3 km.	209 mb.	?	Latitude, 52° 38' N.	km.	mb.	°A.	°C.	Light S.E. wind. A little cirrus. Balloon disappeared nearly overhead. Inversion 264° at 2.1 km. to 265° at 2.5 km.	
LOWEST TEMPERATURE, } ?	?	?	Longitude, 8° 41' W.	11.0	215	?			
BASE OF STRATOSPHERE, } 9.4 km.	280 mb.	217° A.	Height above M.S.L., } 15 m.	10.0	256	217			
				9.0	297	220	3		
Type ?			PLACE OF FALL, Youghal.	8.92	300	221			
			Distance, 94 km.	8.0	344	227	7		
			and	7.00	400	235	8		
			Orientation, 130° from N.	6.0	461	244	9		
				5.41	500	248	7		
				5.0	529	251			
				4.03	600	258	7		
				4.0	604	258			
				3.0	687	263	5		
				2.86	700	263			
				2.5	732	264	3		
				2.0	781	266			
				1.82	800	267	5		
				1.5	833	268			
				1.0	889	271			
				.91	900	272	8		
				.5	945	275			
From observations at Station.		at 7 h.	at 18 h. G.M.T.	Ground M.S.L.	...	280	...		
PRESSURE (M.S.L.),		1008 mb.	998 mb.	M.S.L.	1008	...	...		
TEMPERATURE,		281° A.	282° A.						
VAPOUR PRESSURE,		...	...						
GRADIENT WIND:—Direction,		Pressure	Station						
Velocity,		Distribution	in V-shaped						
Correction for Curvature,		Irregular.	Depression.						
Final Components, { W. to E.		...	...						
{ S. to N.		...	...						

1913. May 6. 7 h. 12 m. G.M.T.				SOUNDING No., R.M.C. 52.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, MUNGRET COLLEGE.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 15.0 km.	? mb.	226° A.	Latitude, 52° 38' N.	km.	mb.	°A.	°C.	Wind N.W. Cirrus moving slowly from S.E.  Isothermal 4.8 to 5.1 km. at 245°.	
LOWEST TEMPERATURE, } 8.2 km. and higher	? mb.	225° A.	Longitude, 8° 41' W.	15.0	...	226			
BASE OF STRATOSPHERE, } 8.2 km.	327 mb.	225° A.	Height above M.S.L., } 15 m.	14.0	137	225	-1		
				13.0	159	225	0		
Type No. 1.			PLACE OF FALL, Killaloe.	12.0	184	225	0		
			Distance, 20 km.	11.50	200	226	1		
			and	11.0	217	226	0		
			Orientation, 30° from N.	10.0	251	226	0		
				9.0	291	226	0		
				8.79	300	226	0		
				8.0	336	226			
				7.0	388	233	7		
				6.77	400	235	8		
				6.0	448	241			
				5.20	500	244	4		
				5.0	515	245			
				4.0	592	250	5		
				3.90	600	251	7		
				3.0	677	257			
				2.76	700	258	6		
				2.5	724	260			
				2.0	773	263			
				1.74	800	265	7		
				1.5	825	266			
				1.0	883	270			
				.83	900	271			
				.5	939	274			
From observations at Station.		at 7 h.	at 18 h. G.M.T.	Ground M.S.L.	...	279	...		
PRESSURE (M.S.L.),		1002 mb.	999 mb.	M.S.L.	999	...	...		
TEMPERATURE,		280° A.	282° A.						
VAPOUR PRESSURE,		...	...						
GRADIENT WIND:—Direction,		147°	225°						
Velocity,		12.2 m/s.	11.2 m/s.						
Correction for Curvature,		0.0 m/s.	+2.0 m/s.						
Final Components, { W. to E.		-6.6 m/s.	+9.3 m/s.						
{ S. to N.		+10.2 m/s.	+9.3 m/s.						

1913. May 7. 7 h. 7 m. G.M.T.				SOUNDING No., R.M.C. 53.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, MUNGRET COLLEGE.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 10.5 km.	232 mb.	?° A.	Latitude, 52° 38' N.	km.	mb.	°A.	°C.	Overcast. Wind S.E. 4.	
LOWEST TEMPERATURE, } 7.8 km.	344 mb.	223° A.	Longitude, 8° 41' W.	10.0	248	228			
BASE OF STRATOSPHERE, } 7.8 km.	344 mb.	223° A.	Height above M.S.L., } 15 m.	9.0	288	226	-2		
				8.71	300	225	-3		
Type No. 1.			PLACE OF FALL, Loughrea.	8.0	335	223	6		
			Distance, 60 km.	7.0	388	229			
			and	6.80	400	230	6		
			Orientation, 0° from N.	6.0	449	235			
				5.23	500	242	9		
				5.0	517	244	8		
				4.0	593	252			
				3.92	600	253	7		
				3.0	679	259			
				2.76	700	261	7		
				2.5	724	263			
				2.0	770	266			
				1.71	800	268	6		
				1.5	823	269			
				1.0	877	272			
				.80	900	273	6		
				.5	933	275			
From observations at Station.		at 7 h.	at 18 h. G.M.T.	Ground M.S.L.	...	280	...		
PRESSURE (M.S.L.),		994 mb.	994 mb.	M.S.L.	991	...	...		
TEMPERATURE,		280° A.	282° A.						
VAPOUR PRESSURE,		...	...						
GRADIENT WIND:—Direction,		170°	210°						
Velocity,		20.5 m/s.	11.9 m/s.						
Correction for Curvature,		-4.2 m/s.	0.0 m/s.						
Final Components, { W. to E.		-2.8 m/s.	+6.0 m/s.						
{ S. to N.		+16.1 m/s.	+10.3 m/s.						

9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.)—continued.

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. May 9. 7 h. 13 m. G.M.T.				SOUNDING No., R.M.C. 54.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, MUNGRET COLLEGE.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 14.2 km.	133 mb.	230° A.	Latitude, 52° 38' N.	km. 14.0	mb. 139	°A. 230	°C. 1	Overcast. Wind S.E. 4.	
LOWEST TEMPERATURE, } 7.3 km.	368 mb.	222° A.	Longitude, 8° 41' W.	13.0	159	231	0		
BASE OF STRATOSPHERE, } 7.3 km.	368 mb.	222° A.	Height above M.S.L., } 15 m.	12.0	186	231	0		
Type No. 1.			PLACE OF FALL, Oughterard.	11.48	200	231	0		
			Distance, 98 km.	11.0	215	231	-1		
			Orientation, 327° from N.	10.0	248	230	-2		
				9.0	287	228	-3		
				8.70	300	227	-3		
				8.0	331	225	-1		
				7.0	384	224	10		
				6.76	400	226	10		
				6.0	448	234	10		
				5.25	500	241	10		
				5.0	517	244	9		
				4.0	592	253	7		
				3.90	600	254	6		
				3.0	677	260	6		
				2.75	700	261	6		
				2.5	723	263	6		
				2.0	772	266	6		
				1.71	800	268	6		
				1.5	823	270	6		
				1.0	877	272	6		
				.79	900	273	6		
				.5	733	275	6		
From observations at Station.		at 7 h.	at 18 h. G.M.T.	Ground M.S.L.	...	278	...		
PRESSURE (M.S.L.),		992 mb.	993 mb.	M.S.L.	989	...	...		
TEMPERATURE,		280 A°.	284 A°.						
VAPOUR PRESSURE,		...	...						
GRADIENT WIND:—Direction,		133°	172°						
Velocity,		17.6 m/s.	16.7 m/s.						
Correction for Curvature,		- 2.2 m/s.	- 3.0 m/s.						
Final Components, { W. to E.		- 11.3 m/s.	- 1.9 m/s.						
{ S. to N.		+ 10.5 m/s.	+ 13.6 m/s.						

1913. May 9. 7 h. 0 m. G.M.T.				SOUNDING No., R.D.P. 49.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, DITCHAM PARK.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 7.7 km.	? mb.	? A.	Latitude, 50° 57' N.	km. 7.00	mb. 400	°A. 236 ?	°C. 8	Isothermal 1.8 to 2.1 km. at 271°.	
LOWEST TEMPERATURE, } ? km.	? mb.	? A.	Longitude, 0° 56' W.	6.0	460	244	8		
BASE OF STRATOSPHERE, } not reached			Height above M.S.L., } 168 m.	5.42	500	248	7		
Type No. ?			PLACE OF FALL, Wolverton.	5.0	528	251	7		
			Distance, 131 km.	4.07	600	259	9		
			Orientation, 3° from N.	4.0	603	260	5		
				3.0	688	265	5		
				2.89	700	265	6		
				2.5	736	269	6		
				2.0	780	271	6		
				1.85	800	272	6		
				1.5	832	273	6		
				1.0	884	277	6		
				.91	900	278	6		
				.5	943	280	6		
From observations at Station.		at 7 h.	at 18 h. G.M.T.	Ground M.S.L.	...	282	...		
PRESSURE (M.S.L.),		1003 mb.	1003 mb.	M.S.L.	1003	...	...		
TEMPERATURE,		283° A.	285° A.						
VAPOUR PRESSURE,		...	...						
GRADIENT WIND:—Direction,		170°	196°						
Velocity,		11.2 m/s.	6.6 m/s.						
Correction for Curvature,		- 1.2 m/s.	0.0 m/s.						
Final Components, { W. to E.		- 1.7 m/s.	+ 1.8 m/s.						
{ S. to N.		+ 9.8 m/s.	+ 6.3 m/s.						

1913. May 10. 7 h. 0 m. G.M.T.				SOUNDING No., R.D.P. 50.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, DITCHAM PARK.	Reading.			Fall per km.		
GREATEST HEIGHT, } 10.6 km.	? mb.	225° A.	Latitude, 50° 57' N.	km. 10.0	mb. 256	A° 223	A° 0		
LOWEST TEMPERATURE, } 9.0-10.0 km.	? mb.	223° A.	Longitude, 0° 56' W.	9.0	293	223	3		
BASE OF STRATOSPHERE, } 9.0 km.	293 mb.	223° A.	Height above M.S.L., } 168 m.	8.85	300	223	3		
Type No. 2.			PLACE OF FALL, Sharnbrook.	8.0	341	226	6		
			Distance, 141 km.	7.0	396	232	8		
			Orientation, 10° from N.	6.95	400	232	8		
				6.0	459	240	8		
				5.40	500	245	8		
				5.0	528	248	7		
				4.06	600	255	7		
				4.0	605	255	8		
				3.0	689	263	8		
				2.90	700	264	7		
				2.5	736	267	7		
				2.0	784	270	7		
				1.85	800	271	7		
				1.5	837	274	7		
				1.0	888	277	7		
				.83	900	278	4		
				.5	947	279	4		
From observations at Station.		at 7 h.	at 18 h. G.M.T.	Ground M.S.L.	...	281	...		
PRESSURE (M.S.L.),		1006 mb.	1008 mb.	M.S.L.	1006	...	...		
TEMPERATURE,		283° A.	287° A.						
VAPOUR PRESSURE,		...	...						
GRADIENT WIND:—Direction,		Pressure	210°.						
Velocity,		Distribution	7.8 m/s.						
Correction for Curvature,		Irregular.	- 1.0 m/s.						
Final Components, { W. to E.		...	+ 3.4 m/s.						
{ S. to N.		...	+ 5.9 m/s.						

## Note on the Soundings by Registering Balloons and the Tabulation of the Records.

By W. H. Dines, F.R.S.

The weather throughout the week was of a very similar character, a southerly or south-easterly type prevailing. The individual results are also all very similar, showing the peculiarity of a low value of  $H_c$  for the time of year, and in many instances very steep gradients, reaching  $10^\circ$  per km. once or twice, in the upper part of the troposphere.

It is noteworthy that the mean value of  $H_c$  over the British Isles has been much less since September 1911 than the average of the previous years would lead one to expect. The standard deviation is about 1.6 km., and the difference in the means of January 1908 to September 1911, and October 1911 to June 1913 is more than six times the probable error due to paucity of observations.

Out of these 23 ascents\*, 14 taken at random were worked up by my assistant, Mr H. W. Baker, this being his first experience of the work. The first 2 were compared at once with the results I had obtained, and differences discussed. The remaining 12 were then done in absolute independence, and the results obtained compared when the 12 were finished.

The following results were found from the comparison:—

Mr Baker's average reading of the temperature was  $.55^\circ$  below mine. The maximum difference between us was  $3^\circ.0$ .

The mean of the differences, without regard to sign, was  $1^\circ.2$ . The standard deviation was  $1^\circ.5$ , giving a probable error of  $1^\circ$ .

The probable error in the value of  $H_c$  was equivalent to 5 mb. of pressure, or at 11 km., to 150 metres.

The probable error in the pressure at the highest point reached was 6 mb., giving 300 metres on the height at 16 km., which is the average height reached. This is largely caused by uncertainty about the position of the top of the trace owing to the blur consequent on the bursting of the balloon.

The maximum difference of  $3^\circ.0$  C. was due to my carelessness rather than to any real difficulty of reading, and as a result of the comparison it seems to me that two careful and experienced computers would as a rule differ by about  $.5^\circ$  C. in their readings of temperature, and by about 1.5 mm. in their readings of pressure.

\* For Pyrton Hill, Eskdalemuir, Mungret College, and Ditcham Park. The traces for Manchester are worked up by Miss Margaret White.

TABLE SHOWING ASCENTS PUBLISHED ABOVE, AND THE TIMES AT WHICH THEY WERE MADE.

Date.	Pyrton Hill.		Manchester.		Eskdalemuir.		Mungret College.		Ditcham Park.	
	h	m	h	m	h	m	h	m	h	m
May 5	18	55	7	0	{ 7 18 }	{ 5 37 }	7	0	...	...
6	{ 6 19 }	{ 53 0 }	19	30	7	5	7	12	...	...
7	{ 6 18 }	{ 45 55 }	6	0	{ 7 19 }	{ 0 0 }	7	7	...	...
8	6	52	6	0	7	0	...	...	...	...
9	{ 6 18 }	{ 52 53 }	19	0	{ 7 19 }	{ 0 3 }	7	13	7	0
10	6	53	5	53	...	...	...	...	7	0

Time is expressed in the hours 1 to 24 of civil reckoning.

Pressure is given in millibars (1000 mb. = 1 C.G.S. atmosphere = 750 mm. approximately).

Temperatures are expressed in degrees absolute ( $273^\circ$  A. =  $0^\circ$  C.).

Heights are given in kilometers (km.).

Gradient Wind is taken to be tangential to the isobar and is computed by the formula  $\gamma = 2 \omega \rho V \sin \phi$ .

\*Base of Stratosphere.—TYPE 1.—When the stratosphere commences with an inversion, the height and temperature of the first point of zero temperature gradient are given. TYPE 2.—When the stratosphere begins with an abrupt transition to a temperature gradient below  $2^\circ$  per km. without inversion, the height and temperature of the abrupt transition are given. TYPE 3.—When there is no such abrupt change of temperature gradient, the base is taken to be where the mean fall of temperature for the kilometer next above is  $2^\circ$  or less, provided that it does not exceed  $2^\circ$  for any subsequent kilometer. If some other position for the base seems to the tabulator to be more suitable, it is noted in the column for "Remarks."

# METEOROLOGICAL OFFICE OBSERVATORIES—GEOPHYSICAL JOURNAL.

JUNE 1918.—DAILY VALUES REFERRED TO GREENWICH MEAN TIME, AND UNITS  
BASED ON THE C.G.S. SYSTEM.

[Price 1s.]

Third Year.—No. 6. *Meteorology, Solar Radiation, Seismology, Atmospheric Electricity, and Terrestrial Magnetism.*

## 1. SEISMOLOGICAL JOURNAL:—ESKDALE OBSERVATORY.—Lat. 55° 19' N. Long. 3° 12' W.

Date.	Microseisms of N. Component.								Remarks.
	0 h.		6 h.		12 h.		18 h.		
	A.N. $\mu$	T. s	A.N. $\mu$	T. s	A.N. $\mu$	T. s	A.N. $\mu$	T. s	
1	0.9	5	0.9	5	0.8	5	0.9	5	4th, I, Small remote earthquake from 1 h. 19 m.—2 h. 38 m.
2	0.8	5	0.9	5	1.0	5	1.4	5	4th, II, L=10 h. 52 m. Disturbance from 10 h. 18 m.—12 h. 42 m.
3	1.1	5	1.3	5	1.0	5	0.9	4.5	6th, I, Small earthquake. S(?)=3 h. 4 m. 34 s. L=3 h. 24 m. End 4 h. 0 m.
4	0.7	5.5	0.7	5.5	0.5	4.5	0.6	5	11th, I, Small earthquake. L=6 h. 43 m. Impulse at 6 h. 21 m. 52 s.
5	0.5	5	0.4	4.5	0.5	5	0.5	5	13th, I, P=3 h. 6 m. 25 s. S=3 h. 20 m. 28 s. L=3 h. 42.5 m. $\Delta=12200$ km. Nearly N.-S. End 5 h. 30 m.
6	0.5	5	0.7	4.5	0.6	5	0.7	4	14th, I, P=8 h. 49 m. 5 s. S=8 h. 59 m. 2 s. L=9 h. 14 m. $\Delta=8730$ km. Nearly due W.
7	0.7	5	0.9	5	1.1	5	2.0	6	14th, III, } Two more earthquakes occurred, causing a continuous disturbance till 13 h. 20 m.
8	2.0	6	1.2	6	—	—	—	—	14th, I, }
9	—	—	—	—	—	—	—	—	18th, I, Very small disturbance between 7 h. 50 m. and 8 h. 0 m.
10	2.5	5.5	2.5	5.5	3.0	5.5	2.5	5.5	19th, I, ,, ,, ,, 0 h. 27 m. and 0 h. 38 m.
11	1.5	5	1.3	5	1.2	5	0.9	5	19th, I, ,, ,, ,, 1 h. 35 m. and 1 h. 51 m.
12	0.6	4.5	0.6	4	0.6	4	0.5	4	19th, I, ,, ,, ,, 3 h. 55 m. and 4 h. 14 m.
13	0.3	5	0.4	3.5	0.4	5	0.5	4	19th, I, ,, ,, ,, 17 h. 28 m. and 18 h. 0 m.
14	0.4	5	0.4	4.5	—	—	0.4	5	20th, I, ,, ,, ,, 20 h. 10 m. and 20 h. 20 m.
15	0.4	5	0.4	6	0.5	5	0.5	5	20th, I, ,, ,, ,, 19 h. 51 m. and 19 h. 56 m.
16	0.5	5	0.5	5	0.4	5	0.4	4.5	22nd, II, L=3 h. 41.5 m. S(?)=3 h. 35 m. 30 s. End 4 h. 10 m.
17	0.3	5	0.3	5	0.2	5	0.3	4.5	22nd, II, P=14 h. 1 m. 53 s. S=14 h. 11 m. 23 s. L=14 h. 26 m. $\Delta=8200$ km. Epicentre=51° N., 177° E.
18	0.4	5	0.5	5.5	0.6	6.5	0.7	7	End 18 h. 4 m.
19	0.9	7	0.7	6	0.9	5	1.0	5	25th, I, Very small disturbance between 5 h. 50 m. and 6 h. 5 m.
20	1.1	5	0.9	5	0.8	5	0.8	5	26th, III, Very large earthquake. First movement 5 h. 14 m. 35 s. End at 10 h. 20 m.
21	0.5	5	0.4	4	0.5	5	0.4	6	27th, I, Very small disturbance between 0 h. 8 m. and 0 h. 11 m.
22	0.5	5.5	0.6	6	0.4	5.5	0.5	5	27th, I, ,, ,, ,, 2 h. 45 m. and 3 h. 0 m.
23	0.4	5	0.3	4	0.4	5	0.3	4.5	28th, II, P=8 h. 57 m. 37 s. S=9 h. 1 m. 17 s. L=9 h. 2.5 m. $\Delta=2200$ km. in S.Ely. direction. End 9 h. 45 m.
24	0.3	5.5	0.3	4.5	0.2	4	0.1	4	31st, I, L=7 h. 49 m. End 8 h. 14 m. Very faint disturbance.
25	0.1	3.5	0.1	4	0.2	4	0.2	4	
26	0.3	4	0.4	4	0.4	5	0.8	5	
27	0.8	5	0.8	5	0.6	4.5	0.6	5	
28	0.5	4.5	0.4	5	0.5	4	0.6	4	
29	—	—	—	—	0.6	5	0.6	5	
30	0.4	5.5	0.4	5	0.2	4.5	0.2	4	

An explanation of the notation used is given in the preface. The amplitude  $A_N$  is half of the actual movement of the earth's surface in a N-S direction, between the ends of the swing ( $\mu=0.01$  mm.). The period T (in seconds) is the duration of a complete oscillation, i.e. both extreme positions are passed through once during the time T.

## 2. VALENCIA OBSERVATORY, CAHIRCIVEEN (KERRY).—Lat. 51° 56' N. Long. 10° 15' W.

Heights above Mean Sea Level:—Station, H=12.6 m. Barometer Cistern, H<sub>b</sub>=13.7 m.

Heights above Ground:—Thermometers, h<sub>t</sub>=1.2 m. Rain-gauge, h<sub>r</sub>=0.56 m. Sunshine Recorder, h<sub>s</sub>=12.8 m. Cups of Anemometer, h<sub>a</sub>=13.9 m.

Day.	Pressure at Station Level.		Air Temperature in Degrees Absolute.				Humidity.				Wind Direction in Points (8=E, 16=S) and Velocity (metres per second).		Cloud Amount and Weather.		Rain 24 hours beginning 10 h.	Sunshine.	Remarks.	Magnetism.						
	9 h.	21 h.	9 h.	21 h.	Max.	Min.	Vapour Pressure.		Percentage.		9 h.	21 h.	10 h.	22 h.				mm.	hrs.	Horizontal Force.	Declination West.	Inclination.		
							9 h.	21 h.	9 h.	21 h.														
	mb.	mb.	200+	200+	200+	200+	millibar.	%	%	m/sec.	m/sec.	Tenths of Sky covered.	mm.	hrs.										
1	1015.5	1013.8	86.2	84.3	88	87	11.5	11.9	76	88	14	2	15	5	8	9	9.7	8.5	Fair to dull.	7.	0	0		
2	1006.8	1010.5	84.1	83.2	87	82	12.9	10.8	98	88	15	8	21	4	10 <sup>≡0</sup>	3	0.8	4.6	Dull; ≡ <sup>0</sup> . • 7 h.-10 h. ≡ <sup>0</sup>	...	...	...		
3	1013.5	1012.5	86.2	86.3	88	82	13.2	13.9	86	92	14	4	11	5	8 <sup>≡0</sup>	10 <sup>≡0</sup>	2.0	1.1	≡ <sup>0</sup> . • 17 h.-21 h.	...	...	...		
4	1009.3	1005.9	87.1	85.4	88	85	14.2	13.9	88	96	12	5	13	3	10 <sup>≡0</sup>	10 <sup>≡0</sup>	9.9	—	≡ <sup>0</sup> . • 17 h.-21 h.	...	...	...		
5	1003.7	1010.5	85.7	83.2	86	83	12.9	9.5	88	77	24	3	24	11	10 <sup>≡0</sup>	10 <sup>≡0</sup>	0.5	1.9	Gloomy and showery.	...	...	...		
6	1015.3	1004.1	85.1	85.1	86	82	11.5	13.5	83	98	21	7	17	8	10 <sup>≡0</sup>	10 <sup>≡0</sup>	12.2	1.6	Dull; ≡ <sup>0</sup> . • 15 h.-21 h.	...	...	...		
7	1010.8	1011.4	83.9	82.4	87	81	10.8	10.2	82	88	21	11	16	3	5	10 <sup>≡0</sup>	6.4	6.0	Fair to fine. ∞ <sup>≡0</sup> p.	17878	20	19.7	68	9.4
8	1014.3	1020.4	84.1	83.6	87	81	9.8	10.5	74	82	24	9	20	7	6	7	0.3	10.7	• <sup>0</sup> showers a. [mist p.]	...	...	...		
9	1016.1	1006.8	84.3	84.7	85	83	11.5	13.2	85	97	18	9	19	12	10 <sup>≡0</sup>	10 <sup>≡0</sup>	0.2	11.2	Gloomy; • 13 h.-16 h. Heavy	...	...	...		
10	1009.4	1015.6	84.6	84.0	87	84	12.5	10.5	92	81	23	7	24	6	8	7	0.3	5.5	Visibility.	...	...	...		
11	1018.7	1015.6	84.5	83.9	86	83	10.5	12.5	78	96	20	6	16	2	8	10 <sup>≡0</sup>	3.3	0.3	Visibility. Heavy mist p.	...	...	...		
12	1018.2	1016.9	86.3	85.5	88	83	12.9	13.9	84	96	—	1	19	7	7	10 <sup>≡0</sup>	0.3	7.4	Fine to dull and misty.	...	...	...		
13	1020.1	1023.9	84.6	84.3	87	84	12.2	12.5	91	95	24	6	—	1	10 <sup>≡0</sup>	10 <sup>≡0</sup>	0.5	2.4	• <sup>0</sup> showers a. ≡ <sup>0</sup>	...	...	...		
14	1024.7	1022.5	87.7	86.7	89	84	15.2	13.9	92	89	13	2	14	3	10	10	—	0.1	Dull.	...	...	...		
15	1019.3	1019.2	87.3	86.2	91	84	12.9	13.2	79	87	12	3	—	0	10	10	—	6.7	Dull. ≡ <sup>0</sup> p.	...	...	...		
16	1017.5	1013.9	89.8	89.1	93	82	15.6	15.9	82	88	—	1	—	0	3 <sup>∞</sup>	4 <sup>∞</sup>	—	14.0	Fine. ∞	...	...	...		
17	1012.4	1012.8	85.3	85.9	90	85	13.9	14.2	97	96	22	3	14	3	10 <sup>≡0</sup>	10 <sup>≡0</sup>	8.1	0.9	≡ in morning.	...	...	...		
18	1012.7	1015.1	86.8	85.2	89	85	13.9	12.2	89	87	22	3	21	6	5	4	1.0	9.7	Fine. • <sup>0</sup> showers 16 h.	...	...	...		
19	1018.7	1020.3	86.7	85.6	88	85	12.5	13.5	81	95	22	5	—	1	10	10	1.3	1.4	Dull and showery.	...	...	...		
20	1019.6	1017.7	88.2	87.3	91	85	14.2	14.9	83	92	—	1	15	2	7	10	7.6	6.8	Fine.	...	...	...		
21	1016.3	1019.7	85.9	85.9	89	85	14.2	13.2	96	90	27	7	22	4	10 <sup>≡0</sup>	10	—	6.8	≡ <sup>0</sup> , then fair to dull.	17885	20	17.7	68	7.4
22	1020.6	1011.9	86.8	85.4	89	84	12.2	13.5	78	94	21	4	13	11	7	10	21.75	2.1	Fair.	...	...	...		
23	1007.9	1016.9	84.1	84.6	87	84	12.2	11.2	93	82	20	16	23	6	10 <sup>≡0</sup>	10	0.3	2.8	Gloomy a; brighter p.	...	...	...		
24	1017.0	1018.5	85.6	85.0	88	82	10.8	10.5	74	76	—	0	2	3	10	1	1.5	2.0	Showery.	...	...	...		
25	1022.1	1023.2	86.9	85.3	91	80	12.5	12.2	79	86	—	1	—	1	5	3	1.3	15.1	∞. Fine.	...	...	...		
26	1022.1	1027.0	86.9	85.2	87	85	15.6	11.2	99	79	18	3	28	5	10 <sup>≡0</sup>	5	—	6.6	Heavy mist clearing to fair.	...	...	...		
27	1030.0	1031.5	86.3	86.7	90	84	12.5	13.9	84	88	23	4	23	2	6	10	—	7.9	Fine to fair.	...	...	...		
28	1032.3	1032.0	87.5	86.5	91	83	14.9	13.2	90	87	21	2	—	0	10 <sup>≡0</sup>	2	—	9.8	Misty to fine; visibility p.	...	...	...		
29	1029.5	1028.6	90.6	87.7	94	81	14.2	13.5	70	82	—	1	15	2	4	4	—	13.5	Fine.	...	...	...		
30	1027.4	1026.9	89.5	88.2	91	83	15.6	13.5	83	80	—	1	2	3	10 <sup>∞</sup>	7	—	2.2	Fair. ∞	...	...	...		
Means	1017.4	1017.5	86.3	85.4	88.6	83.0	13.0	12.7	85	88	4.5	4.2	8.2	7.9	96.0	5.28	—	—	Monthly Totals or Means.	17882	20	18.7	68	8.4
Normal 40 years	1014.4	1014.6	87.2	86.3	89.9	83.7	13.2	13.0	80	84	4.7	4.1	—	—	88.6	6.33	—	—	Normals, 40 years.	—	—	—	—	—

x denotes the maximum and n the minimum value in the column.

Note.—The cloud amounts in italic type at Valencia were taken at 21 h.

3. KEW OBSERVATORY, SURREY.—Lat. 51° 28' N. Long. 0° 19' W.

Heights above Mean Sea Level :—Station, H = 5.5 m. Barometer, H<sub>b</sub> = 10.4 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 3.0 m. Rain-gauge, h<sub>r</sub> = 0.53 m. Sunshine Recorder, h<sub>s</sub> = 13.3 m. Cups of Anemometer, h<sub>a</sub> = 19.81 m.

Day.	Pressure at Station Level.		Air Temperature in Degrees Absolute.				Humidity.				Wind Direction in Points (8=E, 16=S) and Velocity (metres per second).				Cloud Amount and Weather.		Rain 24 hours beginning 10 h.	Sunshine.	Solar Radiation, Milliwatts per cm <sup>2</sup> .	Min. Temp. on Grass.	Earth Temperature at 10 h.		Remarks.	
	9 h.	21 h.	9 h.	21 h.	Max.	Min.	Vapour Pressure.		Percentage.		m/sec.		10 h.	22 h.	mm.	hrs.		200+	200+	200+				
	mb.	mb.	200+	200+	200+	200+	9 h.	21 h.	9 h.	21 h.	9 h.	21 h.	9 h.	21 h.	Tenths of Sky covered.				0.3m.	1.2m.				
1	1017.3	1018.5	88.2	86.0	90	80	9.8	11.2	56	75	4	2	—	1	6	10<	—	4.7	—	74	88.0	85.2	Fine till 10 h. 30 m., then dull.	
2	1019.2	1017.2	87.9	86.5	94	81	12.2	10.8	72	71	20	3	17	2	3	1	—	14.1	77	75	87.6	85.3	Fine all day. [ < A	
3	1017.5	1017.5	91.2	89.0	97	81	13.2	13.9	64	78	16	3	—	1	7	1	—	10.2	—	75	88.0	85.3	Fine most of day.	
4	1016.1	1013.0	92.5	88.9	94	84	15.6	13.2	69	74	16	2	—	1	9	1	—	5.5	—	79	88.6	85.4	Fine to fair during day.	
5	1009.2	1008.0	91.4	85.8	92	85	13.5	11.5	65	79	16	5	17	4	7	9	1.5	7.2	—	78	88.4	85.5	Fine to fair. ● 14 h. 30 m.	
6	1008.9	1015.2	85.5	84.8	90	83	12.2	10.5	85	75	20	5	20	4	9	1	1.8	1.1	—	81	87.9	85.7	● 6 h. 15 m.—7 h. Dull to fair.	
7	1011.0	1015.8	86.0	86.2	92	83	13.2	10.8	90	71	18	8	23	2	10	0	0.5	8.5	—	80	87.3	85.7	Fine after 10 h. 30 m.	
8	1011.4	1017.1	87.9	85.2	92	82	15.2	9.1	91	66	17	7	23	2	10	1	2.0	3.5	—	76	87.3	85.7	Dull a. ● 14 h. 40 m. [late	
9	1021.3	1015.7	86.4	85.3	91	81	10.5	10.5	68	74	21	4	19	8	5	10	—	6.2	—	77	86.7	85.7	⊕ 8 h. 15 m.—9 h. Fine a., dull	
10	1007.5	1010.6	86.6	86.5	92	85	12.9	11.2	83	72	19	8	22	5	10	10	—	7.3	—	83	86.9	85.7	Dull, a.; fine later.	
11	1016.6	1015.9	87.0	86.3	91	83	9.5	9.1	61	60	23	4	23	5	6	10	—	10.3	—	79	87.0	85.7	Fine most of day.	
12	1018.3	1019.0	86.9	87.1	91	84	10.5	13.2	66	83	25	2	17	2	9	8	—	2.2	—	81	87.2	85.7	Fair most of day.	
13	1020.2	1024.8	88.2	86.7	90	85	12.5	11.5	73	73	24	2	7	4	9	10	—	0.5	—	78	87.6	85.6	Dull most of day.	
14	1027.8	1026.0	88.5	86.7	94	85	11.5	11.5	67	73	7	3	7	6	10	2	—	2.0	—	85	87.6	85.7	Dull to fine during day.	
15	1023.8	1020.5	90.8	89.8	96	86	11.9	11.9	59	63	6	6	7	3	0∞	0	—	14.5	69	83	88.1	85.7	Fine all day.	
16	1017.7	1015.9	93.1	92.9	101	84	14.9	15.9	63	68	7	3	6	2	1	1≡0	—	11.9	59	77	88.6	85.7	≡ a. Fine during day.	
17	1014.9	1015.3	94.5	92.7	100	87	18.3	17.3	72	76	6	2	20	2	5	1	—	7.7	—	82	89.7	85.7	Fine most of day.	
18	1015.4	1014.3	90.2	90.2	97	85	13.5	15.6	70	79	19	3	20	4	4	10	—	8.2	66	82	89.9	85.8	Fine most of day.	
19	1016.5	1017.4	88.8	87.1	92	85	11.5	11.2	64	70	22	5	24	2	5	3	0.3	10.8	—	85	90.3	85.9	Fair to fine during day.	
20	1016.6	1017.1	87.1	85.9	90	84	11.2	14.2	70	96	21	2	—	0	10	2≡0	24.3	1.4	—	81	89.6	86.2	⊔ 15 h. ● 16 h. 50 m.—17 h.	
21	1017.8	1018.9	87.4	87.6	93	81	14.2	13.2	88	79	3	3	6	2	1	1	—	5.5	—	78	88.7	86.3	≡ a. Fair to fine. [25 m	
22	1020.7	1020.1	89.9	88.8	95	82	15.2	14.9	80	85	—	1	17	3	5	2	—	6.1	—	78	88.7	86.3	≡ a. Fair to fine.	
23	1017.7	1015.5	89.1	87.5	92	85	12.9	13.2	72	80	17	5	19	4	10	1	0.5	2.1	—	82	89.1	86.3	● 12 h.—12 h. 30 m. Dull to fine	
24	1015.9	1016.0	87.4	86.4	92	85	10.8	9.8	66	65	22	5	23	3	10	10	—	1.1	—	80	88.5	86.4	Dull most of day.	
25	1015.6	1020.2	87.3	88.6	91	84	11.2	13.2	70	76	27	6	31	2	9	10	—	4.4	48	82	88.0	86.4	Fair to fine.	
26	1022.7	1020.8	89.1	89.5	93	85	10.2	11.2	56	60	28	4	25	4	9	9•	—	6.2	—	80	88.6	86.4	Fine at intervals.	
27	1022.7	1026.4	87.1	87.1	92	85	10.2	10.2	62	63	28	5	28	2	9	0	—	8.9	—	80	88.7	86.4	Fine most of day.	
28	1027.3	1026.4	88.1	92.4	97	82	11.9	14.2	70	64	20	3	24	3	7	7	—	7.3	80	77	88.2	86.4	Fair a.; fine later.	
29	1026.5	1026.7	92.2	89.8	98	87	14.2	13.5	64	71	27	4	6	3	4	1	—	13.4	75	82	89.4	86.4	Fine all day.	
30	1027.4	1026.6	89.9	89.8	95	85	11.5	13.9	61	74	3	2	8	2	7≡0	10	—	6.4	—	80	89.9	86.4	⊕ 10 h. Fine to fair.	
Means	1018.1	1018.4	88.9	87.9	93.3	83.7	12.5	12.4	70	73	3.9	2.9	—	—	7.1	4.7	10.9	6.64	—	79.7	88.3	85.9	Monthly Totals or Means.	
Normal 40 years	1015.4	1015.2	88.2	87.5	92.7	83.5	12.2	12.5	71	75	3.6	2.7	—	—	—	—	57.9	6.47	—	—	—	—	—	Normals, 40 years.

4. ESKDALE OBSERVATORY, DUMFRIESSHIRE.—Lat. 55° 19' N. Long. 3° 12' W.

Heights above Mean Sea Level :—Station, H = 242.0 m. Barometer, H<sub>b</sub> = 237.0 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 0.9 m. Rain-gauge, h<sub>r</sub> = 0.40 m. Sunshine Recorder, h<sub>s</sub> = 1.5 m. Vane of Anemometer, h<sub>a</sub> = 15.0 m.

Day.	Pressure at Station Level.		Air Temperature in Degrees Absolute.				Humidity.				Wind Direction in Points (8=E, 16=S) and Velocity (metres per second).				Cloud Amount and Weather.		Rain 24 hours beginning 10 h.	Sunshine.	Solar Radiation, Milliwatts per cm <sup>2</sup> .	Min. Temp. on Grass.	Earth Temperature at 10 h.		Remarks.			
	9 h.	21 h.	9 h.	21 h.	Max.	Min.	Vapour Pressure.		Percentage.		m/sec.		10 h.	22 h.	mm.	hrs.			200+	200+	200+					
1	986.9	989.6	83.4	80.3	87	76	9.5	8.5	75	85	20	8	—	1	9 h.	21 h.	9 h.	10.8								
2	986.5	980.9	85.1	81.5	88	74	9.1	10.2	65	91	16	11	20	13	7	4	—	10.2								
3	985.8	989.7	83.5	79.9	86	76	8.8	8.5	68	87	20	7	—	1	6	2	—	6.1								
4	988.5	983.7	88.3	88.1	93	75	13.2	13.9	76	82	—	1	—	1	3	10	—	1.0								
5	980.2	976.4	85.1	84.7	90	84	11.9	12.5	85	93	—	1	—	0	10≡0	10≡0	—	2.5								
6	978.0	980.4	85.7	81.7	88	81	11.9	9.1	83	81	24	4	20	5	9	1	—	8.6								
7	973.6	978.4	83.7	81.9	85	80	8.1	7.8	63	70	20	15	20	13	7	3	—	5.1								
8	977.2	980.1	80.7	80.4	85	80	9.1	8.1	87	81	20	9	24	13	10	10	—	4.1								
9	982.5	973.6	81.3	81.1	82	80	9.5	10.2	86	96	20	12	20	13	10	10	—	24.6								
10	968.6	978.6	81.3	80.3	85	79	9.5	7.8	88	76	24	10	24	3	9	4	—	0.8								
11	984.3	982.9	82.0	80.4	85	79	8.8	8.1	79	79	24	7	24	6	9	6	—	1.3								
12	987.8	990.0	82.4	81.2	86	78	8.8	8.1	73	74	28	9	24	5	7	10	—	1.0								
13	993.3	997.8	83.9	82.4	85	78	9.1	10.2	71	86	4	6	—	1	5	10	—	—								
14	998.5	998.2	83.0	84.5	89	80	10.5	11.5	85	84	—	1	—	1	10	2	—	—								
15	997.1	994.4	89.4	85.3	93	77	13.5	11.9	74	84	16	3	32	2	2	7	—	—								
16	993.4	991.3	91.2	87.9	96	81	13.2	11.2	63	67	—	1	4	2	4	7	—	—								
17	989.5	987.9	87.9	87.0	94	84	13.2	15.2	78	85	32	4	—	0	10	10	—	0.3								
18	987.4	985.6	85.9	84.5	88	83	13.9	11.9	93	88	—	1	—	1	10	10	—	0.5								
19	983.5	984.7	84.5	83.9																						



5. KEW OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor 1.70. †				Charge per cc. × 10 <sup>20</sup> .		Velocities of Ions for 1 volt per centimetre.		Conductivity × 10 <sup>25</sup> .	Air-Earth Current × 10 <sup>16</sup> .		Electric Character of Day.	Magnetic Character of Day.	Horizontal Force. ‡			West Declination. ‡			
	3 h.	9 h.	15 h.	21 h.	+	-	+	-		c <sub>1</sub>	c <sub>2</sub>			Maximum. 18000 γ +.	Minimum. 18000 γ +.	Range.	Maximum. 15° +.	Minimum. 15° +.	Range.	
	v/m.	v/m.	v/m.	v/m.	E.-m.U.	E.-m.U.	cm/sec.	cm/sec.		E.-m.U.	Amp/cm <sup>2</sup> .			γ	h m	γ	h m	γ	h m	h m
1	425	425	265	300	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	210	175	135	255	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	200	325	200	280	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	210	350	115	330	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	65	160	110	230	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6	85	110	—	215	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	135	165	100	290	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	200	85	z	305	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9	175	185	115	115	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	50	110	-65	110	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11	115	165	65	115	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12	150	175	135	200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
13	65	190	-35	375	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14	90	250	230	290	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15	225	350	405	375	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16	215	530	110	415	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	105	355	85	225	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18	150	135	165	200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	135	160	75	200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20	140	140	z±	275	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21	475	—	500	230	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22	190	—	85	265	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	115	175	185	200	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	75	135	75	190	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	135	100	135	160	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26	60	110	125	160	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	165	175	85	100	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	135	190	90	190	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	140	190	150	350	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	160	450	255	280	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M.	151*	229*	133*	237*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

\* 25 days. The mean values of the Potential gradient in Table 5 are computed from the data for those days on which values at each of the four hours, 3<sup>h</sup>, 9<sup>h</sup>, 15<sup>h</sup>, 21<sup>h</sup>, are given in the table. A similar note applies to the values in Table 6. † Owing to an insufficient number of absolute observations of potential gradient, the factor is not based as usual only on the observations of the individual month. ‡ Records on 1st and 2nd too unsatisfactory for exact measurement. During the whole month the magnetic records are less reliable than usual,—the magnetographs being in a building possessed of a large diurnal range of temperature.

6. ESKDALE OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor 5.24.				Charge per cc. × 10 <sup>20</sup> .		Velocities of Ions for 1 volt per centimetre.		Conductivity × 10 <sup>25</sup> .	Air-Earth Current × 10 <sup>16</sup> .		Electric Character of Day.	Magnetic Character of Day.	North Component.			West Component.			Vertical Component.			
	3 h.	9 h.	15 h.	21 h.	+	-	+	-		c <sub>1</sub>	c <sub>2</sub>			Maximum. 15000 γ +.	Minimum. 15000 γ +.	Maximum. 5000 γ +.	Minimum. 5000 γ +.	Maximum. 45000 γ +.	Minimum. 45000 γ +.				
	v/m.	v/m.	v/m.	v/m.	E.-m.U.	E.-m.U.	cm/sec.	cm/sec.		E.-m.U.	Amp/cm <sup>2</sup> .			h m	γ	h m	h m	γ	h m	h m	γ	h m	h m
1	202	118	160	390	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2	251	265	202	1582	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3	167	167	181	467	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	362	153	91	98	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	237	49	111	265	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6	460	91	104	223	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
7	752	77	z	111	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
8	132	z	77	000	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
9	63	-1331	-293	-516	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10	z	35	70	216	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11	167	56	125	77	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12	-91	118	153	21	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
13	56	216	77	223	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
14	35	84	146	307	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15	341	125	146	279	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
16	230	139	98	167	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
17	181	111	181	160	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
18	216	369	98	216	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
19	167	104	70	153	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20	111	91	z	139	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
21	146	202	139	223	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
22	362	174	118	160	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
23	84	139	132	84	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
24	286	z	z	244	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
25	334	146	104	153	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
26	125	153	118	118	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
27	132	42	118	223	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
28	90	139	84	167	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
29	188	174	244	195	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30	132	111	132	181	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
M.	185*	85*	114*	98*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

\* 25 days. See note above.

z Indeterminate.

An explanation of the Headings of the columns is given in the Preface.

z denotes the maximum and n the minimum value in the column.

Instrument out of order.

7. Tables of Wind Components in metres per second at fixed hours, together with the mean velocity (horizontal movement) in metres per second for the hour with the maximum hourly run for each day, or the greatest velocity attained in a gust and the time of its occurrence.

HOLYHEAD. †§

Height of Head above—Roof 8'8 m., Ground 13'7 m., M.S.L. 19'2 m.  
Height of Cups above—Roof 4'6 m., Ground 7'8 m., M.S.L. 15'2 m.

DEERNESS. †

Height of Cups above—Roof 1'5 m., Ground 4'9 m., M.S.L. 57'3 m.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust, and Vel. in Max. Hourly Run. Includes sub-tables for S+N&W, W+E, S-N&W, W-E for both stations.

SCILLY. †§

Height of Head above—Ground 9'8 m., M.S.L. 49'7 m.  
Height of Cups above—Ground 5'8 m., M.S.L. 45'7 m.

GREAT YARMOUTH. †§

Height of Head above—Roof 10'7 m., Ground 12'8 m., M.S.L. 15'9 m.  
Height of Cups above—Roof 3'7 m., Ground 18'3 m., M.S.L. 22'3 m.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust, and Vel. in Max. Hourly Run. Includes sub-tables for S+N&W, W+E, S-N&W, W-E for both stations.

The velocities at fixed hours are means for the interval from 30 minutes before to 30 minutes after the hour. The hours are numbered 1 h. to 24 h. Time is referred to Greenwich Mean Time. \* No Record—instrument dismantled. † Robinson Cup Anemometer; Arms 0'61 m.; Diameter of Cups, 0'229 m.; Factor 2'2. ‡ Robinson Cup Anemometer; Arms 0'305 m.; Diameter of Cups 0'127 m.; Factor 2'8. § Dines Pressure Tube Anemometer. At Great Yarmouth, Holyhead, and Scilly the readings at fixed hours are taken from the Robinson Anemometer, the maxima quoted are the greatest winds in a gust as recorded by the Dines Pressure Tube. || 29 days.

8. The Lower Layers of the Atmosphere from the Surface to 3000 metres (10,000 ft.) above Mean Sea Level. Soundings by Kites (K.) and Pilot Balloons (P.).

ABERDEEN. P. 59. June 4. 11 h. 15 m. G.M.T.								ABERDEEN. P. 60. June 6. 11 h. 20 m. G.M.T.								ABERDEEN. P. 61. June 11. 11 h. 15 m. G.M.T.								
Soundings with Pilot Balloons.	Height above M.S.L.	Wind.			Vertical Velocity.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.			Vertical Velocity.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.			Vertical Velocity.	Cloud Observations and Remarks.						
		Direction.	Velocity.	Components.				Direction.	Velocity.	Components.				Direction.	Velocity.	Components.								
				W.-E.						S.-N.									W.-E.	S.-N.		W.-E.	S.-N.	
Greatest height.	metres. Degrees from N.	m/s.	m/s.	m/s.	m/s.	metres. Degrees from N.	m/s.	m/s.	m/s.	m/s.	metres. Degrees from N.	m/s.	m/s.	m/s.	m/s.	metres. Degrees from N.	m/s.	m/s.	m/s.	m/s.				
670	...	...	...	...	...	3430	...	...	...	...	1940	...	...	...	...	...	...	...	...	...				
...	...	...	...	...	...	3000	182	3.6	+0.1	+3.6	2.6	...	...	...	...	...	...	...	...	...				
...	...	...	...	...	...	2500	186	3.7	+0.4	+3.7	2.9	...	...	...	...	...	...	...	...	...				
...	...	...	...	...	...	2000	173	2.6	-0.3	+2.6	2.0	...	...	...	...	...	...	...	...	...				
...	...	...	...	...	...	1500	225	1.8	+1.3	+1.3	2.6	...	...	...	...	...	...	...	...	...				
500	218	11.1	+6.9	+8.7	2.1	1000	330	2.0	+1.0	-1.7	2.6	1750	314	14.9	+10.7	-10.4	2.7	1500	311	9.8	+7.4	-6.4	1.8	
300	207	8.5	+3.8	+7.6	3.3	500	350	4.0	+0.7	-3.9	2.9	1000	311	12.5	+9.4	-8.3	2.4	500	312	9.8	+7.3	-6.6	1.0	
100	178	3.6	-0.1	+3.6	3.1	100	68	2.7	-2.5	-1.0	2.9	500	302	8.4	+7.1	-4.5	3.8	100	302	8.4	+7.1	-4.5	3.8	
Ground level	30	160	2.7	-0.9	+2.5	...	30	119	1.2	-1.1	+0.6	...	30	310	6.0	+4.6	-3.8	...	30	310	6.0	+4.6	-3.8	...
Computed for M.S.L.	0	188	8.0	+1.1	+7.9	...	Lift 64 gm.	0	Station in a region of low pressure.				Lift 49 gm.	0	300	12.1	+10.5	-6.1	...	Lift 50 gm.				

\* Note attached to P. 60:—At 14 h. 30 m. a slight thunderstorm passed over Aberdeen, and the Cu.-Nb. clouds showed in some places a curious columnar structure (a development of the mammato form). Their direction was from N.W., but varying.

9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).

TABLE OF HEIGHTS, PRESSURES, TEMPERATURES, AND WIND.

1913. June 5. 7 h. 0 m. G.M.T.				SOUNDING No., R. 249.		Height above M.S.L.		Temperature.		Wind.			REMARKS.	
GREATEST HEIGHT,	Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL.		km.	mb.	°A.	°C.	Direction.	Velocity.	Components.		
				Latitude,	Longitude,							W. to E.		S. to N.
17.0 km.	91 mb.	225° A.		52° 38' N.	1° 0' W.	17.0	91	225	...	...	...	...	...	
10.3 km.	252 mb.	222° A.		Height above M.S.L. } 150 m.		16.35	100	224	-1	...	...	...	...	
10.3 km.	252 mb.	222° A.		PLACE OF FALL, Kilsby.		16.0	107	224	-1	...	...	...	...	
Type No. 1.				Distance, 75 km.		15.0	124	223	0	...	...	...	...	
				Orientation, 351° from N.		14.0	144	222	-1	...	...	...	...	
						13.0	168	222	0	...	...	...	...	
						12.0	196	224	2	...	...	...	...	
						11.82	200	224	-2	...	...	...	...	
						11.0	227	222	1	...	...	...	...	
						10.0	264	223	7	...	...	...	...	
						9.12	300	229	7	...	...	...	...	
						9.0	305	230	...	...	...	...	...	
						8.0	353	237	7	162	16	-5	15	
						7.10	400	245	9	...	...	...	...	
						7.0	406	246	...	158	16	-6	15	
						6.0	465	253	7	150	14	-7	12	
						5.47	500	257	7	...	...	...	...	
						5.0	531	260	...	166	16	-4	16	
						4.07	600	265	5	...	...	...	...	
						4.0	606	265	6	169	10	-2	10	
						3.0	689	271	...	173	8	-1	8	
						2.86	700	272	...	...	...	...	...	
						2.0	779	275	4	174	10	-1	10	
						1.78	800	276	...	...	...	...	...	
						1.0	881	279	4	180	3	0	3	
						.82	900	...	...	...	...	...	...	
						Ground M.S.L.	991	288	...	...	...	...	...	
							1005	...	...	...	...	...	...	

10. Solar Radiation at South Kensington.

Day.	APRIL.					MAY.					JUNE.					REMARKS.
	Max. Rate, Milli-watts per cm <sup>2</sup> .	Daily Amount.		Duration of Bright Sunshine.		Max. Rate, Milli-watts per cm <sup>2</sup> .	Daily Amount.		Duration of Bright Sunshine.		Max. Rate, Milli-watts per cm <sup>2</sup> .	Daily Amount.		Duration of Bright Sunshine.		
		Joules per cm <sup>2</sup> .	% of Ideal.*	Hours.	% of Possible.		Joules per cm <sup>2</sup> .	% of Ideal.*	Hours.	% of Possible.		Joules per cm <sup>2</sup> .	% of Ideal.*	Hours.	% of Possible.	
1	51	610	29	2'2	17	74	1409	49	5'3	36	62	1371	41	3'6	22	
2	61	964	46	4'0	31	72	1321	46	5'5	37	86	2425	72	14'4	88	
3	60	1122	51	6'4	49	73	1449	50	3'7	25	79	2222	66	10'5	64	
4	23	327	15	0'0	0	54	644	22	1'0	7	57	947	28	4'7	29	
5	69	793	36	3'5	27	70	812	28	1'7	11	74	1589	47	6'2	38	
6	63	1352	61	8'1	61	69	820	28	1'4	9	100	1040	30	1'5	9	
7	60	898	40	3'2	24	81	1429	48	5'5	36	88	1586	46	7'5	46	
8	48	746	33	3'8	29	23	440	15	0'0	0	79	1097	32	3'6	22	
9	27	420	18	0'1	1	48	688	23	0'0	0	92	2027	59	6'0	37	
10	23	248	11	0'0	0	76	1670	55	7'0	46	84	1385	40	6'7	41	
11	13	170	7	0'0	0	88	1610	53	7'3	48	90	1782	52	9'3	56	
12	57	855	36	3'5	26	38	973	32	0'1	1	85	1327	39	2'9	18	
13	66	1024	44	5'7	42	74	1684	54	8'3	54	56	766	22	0'5	3	
14	50	674	28	0'4	3	72	1164	37	3'2	21	77	1461	42	2'2	13	
15	59	908	37	2'4	17	70	1775	57	7'3	47	73	2459	71	14'2	86	
16	72	744	30	4'0	29	71	1811	57	8'7	56	65	2069	60	11'6	70	
17	70	1312	52	6'5	47	74	2123	67	12'1	78	83	1691	49	5'8	35	
18	49	731	29	0'3	2	88	2003	63	12'8	82	77	2196	63	8'7	52	
19	76	1219	47	6'4	46	80	1693	53	10'3	66	86	1908	55	10'2	61	
20	66	1770	68	10'7	76	69	789	25	1'2	8	92	1282	37	1'8	11	
21	67	693	26	0'4	3	84	1492	46	4'6	29	53	1085	31	3'2	19	
22	51	692	26	1'8	13	79	1746	54	8'1	51	84	1945	56	8'4	51	
23	60	1538	57	10'5	73	80	1399	43	6'1	38	62	1147	33	1'2	7	
24	61	1422	52	6'9	48	78	1940	59	10'2	64	58	1000	29	1'1	7	
25	73	867	32	2'8	19	76	2412	74	14'4	90	75	1445	42	3'6	22	
26	63	1052	38	2'3	16	79	1841	56	10'5	66	77	1823	53	6'7	40	
27	64	944	34	1'9	13	68	1641	50	9'5	59	87	1865	54	6'7	40	
28	40	655	23	0'7	5	78	2140	64	10'2	63	...	...	...	7'1	43	
29	?	(1470)	52	6'9	47	79	1320	40	1'5	9	78	2385	69	11'5	70	
30	71	1012	36	2'1	14	80	2268	68	11'8	73	77	1611	47	3'8	23	
31						82	1571	47	6'0	37						
Total	...	27232	37	107'5	26	...	46077	47	195'3	41	...	46936	47	185'2	38	
Mean	56	R=908	37	H=3'58	26	72	R=1486	47	H=6'30	41	77	R=1618	47	H=6'17	38	
Ratio of Mean Daily Amount to Mean Duration.			$\frac{R}{H} = 254$					$\frac{R}{H} = 236$						$\frac{R}{H} = 262$		

Note.—1 watt per cm<sup>2</sup> = 14'35 gramme-calories per cm<sup>2</sup> per minute. 1 gramme-calorie per minute = 0'7 watt nearly. 1 Joule = 0'239 gramme-calories.

If the heat were distributed throughout the atmosphere, 1000 gramme-calories per cm<sup>2</sup> would be sufficient to raise the temperature 4°1 C. It would take 245 gramme-calories per cm<sup>2</sup> to raise the temperature of the whole atmosphere 1° C.

N.B.—The values of Solar Radiation at South Kensington are obtained from the records of a Callendar Instrument which depends upon the difference of temperature between a black and a bright wire exposed horizontally to radiation from the whole of the sky. The values may be taken as representing the total radiation and the maximum rate of radiation per cm<sup>2</sup> received by a horizontal surface. If it is desired to compare the values published for Kew and Eskdalemuir in Tables 3 and 4 with the simultaneous value recorded by the Callendar Instrument the former must be multiplied by the cosine of the zenith distance of the sun at the time of observation. The duration of sunshine in this table is obtained from a Campbell-Stokes Recorder.

For values January to March see p. 14

\* The "Ideal" intensity of radiation at any instant is taken to be a function of the Sun's altitude only. It is approximately the highest intensity recorded at South Kensington for the corresponding elevation of the Sun. The "Ideal" amount for the day is found by integrating the "Ideal" intensity from sun-rise to sun-set: it is the amount which could be recorded on a day when the atmosphere was in its most transparent state from sun-rise to sun-set. A memoir dealing with the subject is in preparation.

Notes on the Tables of Upper Air Results, p. 45.

Time is expressed in the hours 1 to 24 of civil reckoning. Temperatures are expressed in degrees absolute (273° A. = 0° C.). Pressure is given in millibars (1000 mb. = 1 C.G.S. atmosphere = 750 mm. approximately). Heights are given in kilometers (km.). Gradient Wind is taken to be tangential to the isobar and is computed by the formula  $\gamma = 2\omega\rho V \sin \phi$ . Base of Stratosphere.—TYPE 1.—When the stratosphere commences with an inversion, the height and temperature of the first point of zero temperature gradient are given. TYPE 2.—When the stratosphere begins with an abrupt transition to a temperature gradient below 2° per km. without inversion, the height and temperature of the abrupt transition are given. TYPE 3.—When there is no such abrupt change of temperature gradient, the base is taken to be where the mean fall of temperature for the kilometer next above is 2° or less, provided that it does not exceed 2° for any subsequent kilometer. If some other position for the base seems to the tabulator to be more suitable, it is noted in the column for "Remarks."



3. KEW OBSERVATORY, SURREY.—Lat. 51° 28' N. Long. 0° 19' W.

Heights above Mean Sea Level :—Station, H = 5.5 m. Barometer, H<sub>b</sub> = 10.4 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 3.0 m. Rain-gauge, h<sub>r</sub> = 0.53 m. Sunshine Recorder, h<sub>s</sub> = 13.3 m. Cups of Anemometer, h<sub>a</sub> = 19.81 m.

Table with columns for Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points (8=E, 16=S) and Velocity (metres per second), Cloud Amount and Weather, Rain 24 hours beginning 10 h., Sunshine, Solar Radiation, Milliwatts per cm<sup>2</sup>, Min. Temp. on Grass, Earth Temperature at 10 h., and Remarks. Includes means and normals for 40 years.

4. ESKDALE OBSERVATORY, DUMFRIESSHIRE.—Lat. 55° 19' N. Long. 3° 12' W.

Heights above Mean Sea Level :—Station, H = 242.0 m. Barometer, H<sub>b</sub> = 237.0 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 0.9 m. Rain-gauge, h<sub>r</sub> = 0.40 m. Sunshine Recorder, h<sub>s</sub> = 1.5 m. Vane of Anemometer, h<sub>a</sub> = 15.0 m.

Table with columns for Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points (8=E, 16=S) and Velocity (metres per second), Cloud Amount and Weather, Rain 24 hours beginning 10 h., Sunshine, Solar Radiation, Milliwatts per cm<sup>2</sup>, Min. Temp. on Grass, Earth Temperature at 10 h., and Remarks. Includes means and normals for 1911-12.

The solar radiation is the mean of the readings within the nominal hour of observation (11 h. 30 m.—12 h. 30 m.) unless some other hour is specified. Temperatures at or below the normal freezing point of water are printed in small type.



7. Tables of Wind Components in metres per second at fixed hours, together with the mean velocity (horizontal movement) in metres per second for the hour with the maximum hourly run for each day, or the greatest velocity attained in a gust and the time of its occurrence.

HOLYHEAD. †§

Height of Head above—Roof 8.8 m., Ground 13.7 m., M.S.L. 19.2 m. Height of Cups above—Roof 4.6 m., Ground 7.6 m., M.S.L. 15.2 m.

Table for Holyhead with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, and Time of Gust. Includes summary rows for S+N, W+E, S-N, and W-E.

DEERNESS. †

Height of Cups above—Roof 1.5 m., Ground 4.9 m., M.S.L. 57.3 m.

Table for Deerness with columns for Date, 3 h., 9 h., 15 h., 21 h., Vel. in Max. Hourly Run, and Time of Max. Includes summary rows for S+N, W+E, S-N, and W-E.

SCILLY. †§

Height of Head above—Ground 9.8 m., M.S.L. 49.7 m. Height of Cups above—Ground 5.8 m., M.S.L. 45.7 m.

Table for Scilly with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, and Time of Gust. Includes summary rows for S+N, W+E, S-N, and W-E.

GREAT YARMOUTH. †§

Height of Head above—Roof 10.7 m., Ground 12.8 m., M.S.L. 15.9 m. Height of Cups above—Roof 3.7 m., Ground 18.3 m., M.S.L. 22.3 m.

Table for Great Yarmouth with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust (Gorleston), and Time of Gust. Includes summary rows for S+N, W+E, S-N, and W-E.

The velocities at fixed hours are means for the interval from 30 minutes before to 30 minutes after the hour. The hours are numbered 1 h. to 24 h. Time is referred to Greenwich Mean Time. \* No Record. † Robinson Cup Anemometer; Arms 0.61 m.; Diameter of Cups, 0.229 m.; Factor 2.2. ‡ Robinson Cup Anemometer; Arms 0.305 m.; Diameter of Cups 0.127 m.; Factor 2.8. § Dines Pressure Tube Anemometer. At Great Yarmouth, Holyhead, and Scilly the readings at fixed hours are taken from the Robinson Anemometer, the maxima quoted are the greatest winds in a gust as recorded by the Dines Pressure Tube.



8. The Lower Layers of the Atmosphere from the Surface to 3000 metres (10,000 ft.) above Mean Sea Level.

Soundings by Kites (K.) and Pilot Balloons (P.).

BRIGHTON. K. 4. July 9. 10 h. 0 m. to 12 h. 0 m. G.M.T.											BRIGHTON. K. 5. July 17. 12 h. 55 m. to 13 h. 30 m. G.M.T.										
Soundings with Kites.	Height above M.S.L.	Pressure.	Temperature.		Humidity.	Density.	Wind.		Cloud Observations and Remarks.	Height above M.S.L.	Pressure.	Temperature.		Humidity.	Density.	Wind.		Cloud Observations and Remarks.			
			Reading.	Fall per km.			Direction.	Velocity.				Reading.	Fall per km.			Direction.	Velocity.				
Greatest height	metres.	mb.	°A.	°C.	%	mb.	mgm/cc.	Degrees from N.	m/s.		metres.	mb.	°A.	°C.	%	mb.	mgm/cc.	Degrees from N.	m/s.		
	500	?	281'0		?	?	?	230	9	Overcast, St.-Cu.	500	959'8	284		100	13'1	1'171	250	13'4	Overcast, Cu.-Nb.	
100 m. above ground	215	992'3	284'5	12	80	10'8	1'210	230	9		215	992'9	286'5	9	100	15'4	1'200	250	12'5		
Ground level	115	1004'2	287'2	27	68	11'0	1'213	220 to 230	7'6		115	1004'5	289	25	89	16'0	1'204	250	6'7		
Computed for M.S.L.	0	1017'9	...	...	...	...	...	216	8'3	...	0	1018'3	...	...	...	...	...	270	12'4	...	
BRIGHTON. K. 6. July 17. 3 h. 0 m. to 6 h. 0 m. G.M.T.											BRIGHTON. K. 7. July 20. 10 h. 0 m. to 11 h. 0 m. G.M.T.										
Greatest height	865	919'4	28'3		89	10'8	1'127	300	11	Overcast, Cu.-Nb.	500	960'9	283		58	7'1	1'180	350	?	Partly overcast. Fr.-Cu. Kite carried to 500 m. in convection currents.	
100 m. above ground	500	960'4	28'5	5	89	12'4	1'168	280	11		215	?	?	15	?	?	?	?	?		
Ground level	215	993'6	28'5	0	89	12'4	1'209	280	15		115	1005'5	286'5	15	89	13'6	1'217	270	11		
Computed for M.S.L.	0	1019'3	...	...	...	...	...	275	12'4	...	0	1019'6	...	...	...	...	...	350	7'3	...	
BRIGHTON. K. 8. July 27. 11 h. 0 m. to 12 h. 50 m. G.M.T.																					
Greatest height	500	964'8	28'6		80	11'9	1'170	50	5	Overcast, St. Level 180 m. above ground. Temperature 283 at 300 m.											
100 m. above ground	215	998'0	28'6	0	86	12'8	1'210	50	6												
Ground level	115	1009'9	28'8	20	86	14'5	1'215	45	6												
Computed for M.S.L.	0	1023'7	...	...	Pressure Distribution Irregular.																
ABERDEEN. P. 64. July 4. 11 h. 45 m. G.M.T.																					
Soundings with Pilot Balloons.	Height above M.S.L.	Wind.				Vertical Velocity.	Cloud Observations and Remarks.														
		Direction.	Velocity.	Components.																	
				W.-E.	S.-N.																
Greatest height.	metres.	Degrees from N.	m/s.	m/s.	m/s.																
	1100	...	...	...	...	} 3'0 Assumed.															
	1000	316	8'7	+ 6'0	- 6'3																
	750	315	10'9	+ 7'7	- 7'7																
	500	305	9'1	+ 7'5	- 5'2																
	100	317	6'7	+ 4'6	- 4'9																
Ground level	30	310	7'0	+ 5'4	- 4'5	...															
Computed for M.S.L.	0	335	10'5	+ 4'4	- 9'5	...															
						Lift 53 gr.															

## 9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. July 3.		7 h. 17 m. G.M.T.		SOUNDING No., R.M.C. 55. PLACE, MUNGRET COLLEGE.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	Reading.				Fall per Km.		
GREATEST HEIGHT, } 15.3 km.	117 mb.	? ° A.	Latitude, 52° 38' N.	km.	mb.	° A.	° C.	Overcast.	
LONGITUDE, } 8° 41' W.			Longitude, 8° 41' W.	15.0	123	?			
LOWEST TEMPERATURE, } 11.9 km.	203 mb.	207° A.	Height above M.S.L., } 15 m.	14.49	100	...		Isothermal 3.4 to 3.5 at 273°.	
BASE OF STRATOSPHERE, } 11.9 km.	203 mb.	207° A.	PLACE OF FALL, Macroom.	14.0	144	211	-1		
Type . . . . . No. 1.			Distance, 86 km.	13.0	169	210	-3	Influenced by solar radiation above 14.0 km.	
			Orientation, 192° from N.	12.0	199	207			
				11.95	200	207			
				11.0	235	210	3		
				10.0	276	218	8		
				9.41	300	223			
				9.0	319	227	9		
				8.0	381	237	10		
				7.42	400	243	10		
				7.0	424	247	8		
				6.0	487	255			
				5.80	500	256	6		
				5.0	556	261			
				4.40	600	266	8		
				4.0	629	269			
				3.19	700	275	7		
				3.0	715	276			
				2.06	800	280	4		
				2.0	807	280			
				1.10	900	284	4		
				1.0	911	284			
				.21	1000	286			
				Ground	1025	286	...		
				M.S.L.	...	...	...		
From observations at Station.		at 7 h.	at 18 h. G.M.T.						
PRESSURE (M.S.L.), . . . . .		1027 mb.	1023 mb.						
TEMPERATURE, . . . . .		287° A.	290° A.						
VAPOUR PRESSURE, . . . . .		...	...						
GRADIENT WIND:—Direction, . . . . .		10°	12°						
Velocity, . . . . .		5.5 m/s.	11.3 m/s.						
Correction for Curvature, . . . . .		+0.4 m/s.	+1.1 m/s.						
Final Components, { W. to E. . . . .		-1.0 m/s.	-2.5 m/s.						
		-5.8 m/s.	-12.1 m/s.						

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. July 29.		19 h. 56 m. G.M.T.		SOUNDING No., R. 254. PLACE, PYRTON HILL.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	Reading.				Fall per Km.		
GREATEST HEIGHT, } 17.6 km.	84 mb.	220° A.	Latitude, 51° 38' N.	km.	mb.	° A.	° C.	Light N.E. wind; a few clouds in N.W.	
LONGITUDE, } 1° 0' W.			Longitude, 1° 0' W.	17.0	92	220		Large balloon, 4½ lbs., with 2 lbs. free lift.	
LOWEST TEMPERATURE, } 12 km.	203 mb.	214° A.	Height above M.S.L., } 150 m.	16.46	100	219	-1		
BASE OF STRATOSPHERE, } 12.0 km.	203 mb.	214° A.	PLACE OF FALL, Wadborough.	16.0	108	219			
Type . . . . . No. 1.			Distance, 93 km.	15.0	128	218	-1		
			Orientation, 304° from N.	14.0	148	218	0		
				13.0	172	218	0		
				12.03	200	214	-4		
				12.0	203	214	5		
				11.0	236	219			
				10.0	275	227, 224	8 5		
				9.37	300	232, 229	8 8		
				9.0	317	235, 232	6 9		
				8.0	366	241			
				7.24	400	247	8		
				7.0	420	249			
				6.0	480	256	7		
				5.68	500	258			
				5.0	549	263	7		
				4.28	600	267	6		
				4.0	623	269			
				3.08	700	274	5		
				3.0	705	274			
				2.0	797	279	5		
				1.97	800	279			
				1.00	900	286	7		
				.16	1000	290	5		
				Ground	1000	290	...		
				M.S.L.	1017	...	...		
From observations at Station.		at 7 h.	at 18 h. G.M.T.						
PRESSURE (M.S.L.), . . . . .		1021 mb.	1018 mb.						
TEMPERATURE, . . . . .		285° A.	293° A.						
VAPOUR PRESSURE, . . . . .		...	...						
GRADIENT WIND:—Direction, . . . . .		Pressure	130°						
Velocity, . . . . .		Distribution	7.0 m/s.						
Correction for Curvature, . . . . .		Irregular.	+0.8 m/s.						
Final Components, { W. to E. . . . .		...	-6.0 m/s.						
		...	+5.0 m/s.						

Time is expressed in the hours 1 to 24 of civil reckoning.

Temperatures are expressed in degrees absolute (273° A. = 0° C.).

Pressure is given in millibars (1000 mb. = 1 C.G.S. atmosphere = 750 mm. approximately).

Heights are given in kilometers (km.).

Gradient Wind is taken to be tangential to the isobar and is computed by the formula  $\gamma = 2\omega\rho V \sin\phi$ .

Base of Stratosphere.—TYPE 1.—When the stratosphere commences with an inversion, the height and temperature of the first point of zero temperature gradient are given. TYPE 2.—When the stratosphere begins with an abrupt transition to a temperature gradient below 2° per km. without inversion, the height and temperature of the abrupt transition are given. TYPE 3.—When there is no such abrupt change of temperature gradient, the base is taken to be where the mean fall of temperature for the kilometer next above is 2° or less, provided that it does not exceed 2° for any subsequent kilometer. If some other position for the base seems to the tabulator to be more suitable, it is noted in the column for "Remarks."



3. KEW OBSERVATORY, SURREY.—Lat. 51° 28' N. Long. 0° 19' W.

Heights above Mean Sea Level :—Station, H=5.5 m. Barometer, H<sub>b</sub>=10.4 m.

Heights above Ground :—Thermometers, h<sub>t</sub>=3.0 m. Rain-gauge, h<sub>r</sub>=0.53 m. Sunshine Recorder, h<sub>s</sub>=13.3 m. Cups of Anemometer, h<sub>a</sub>=19.81 m.

Table with columns: Day, Pressure at Station Level (9h, 21h), Air Temperature in Degrees Absolute (9h, 21h, Max, Min), Humidity (Vapour Pressure, Percentage), Wind Direction in Points (8=E, 16=S) and Velocity (metres per second), Cloud Amount and Weather (10h, 22h), Rain 24 hours beginning 10h, Sunshine, Solar Radiation, Milliwatts per cm², Min. Temp. on Grass, Earth Temperature at 10h (0.3m, 1.2m), Remarks.

4. ESKDALE OBSERVATORY, DUMFRIESSHIRE.—Lat. 55° 19' N. Long. 3° 12' W.

Heights above Mean Sea Level :—Station, H=242.0 m. Barometer, H<sub>b</sub>=237.0 m.

Heights above Ground :—Thermometers, h<sub>t</sub>=0.9 m. Rain-gauge, h<sub>r</sub>=0.40 m. Sunshine Recorder, h<sub>s</sub>=1.5 m. Vane of Anemometer, h<sub>a</sub>=15.0 m.

Table with columns: Day, Pressure at Station Level (9h, 21h), Air Temperature in Degrees Absolute (9h, 21h, Max, Min), Humidity (Vapour Pressure, Percentage), Wind Direction in Points (8=E, 16=S) and Velocity (metres per second), Cloud Amount and Weather (10h, 22h), Rain 24 hours beginning 10h, Sunshine, Solar Radiation, Milliwatts per cm², Min. Temp. on Grass, Earth Temperature at 10h (0.3m, 1.2m), Remarks.

The solar radiation is the mean of the readings within the nominal hour of observation (11 h. 30 m.—12 h. 30 m.) unless some other hour is specified. Temperatures at or below the normal freezing point of water are printed in small type.



7. Tables of Wind Components in metres per second at fixed hours, together with the mean velocity (horizontal movement) in metres per second for the hour with the maximum hourly run for each day, OR the greatest velocity attained in a gust and the time of its occurrence.

HOLYHEAD. †‡

Height of Head above—Roof 8.8 m., Ground 13.7 m., M.S.L. 19.2 m. Height of Cups above—Roof 4.6 m., Ground 7.6 m., M.S.L. 15.2 m.

DEERNESS. †

Height of Cups above—Roof 1.5 m., Ground 4.9 m., M.S.L. 57.3 m.

Main table for Holyhead and Deerness stations, showing wind components (S, N, W, E) for 3h, 9h, 15h, 21h intervals, maximum velocity, and time of gust for each day from 1 to 31. Includes summary statistics for S+N & W+E and S-N & W-E.

SCILLY. †‡

Height of Head above—Ground 9.8 m., M.S.L. 49.7 m. Height of Cups above—Ground 5.8 m., M.S.L. 45.7 m.

GREAT YARMOUTH. †‡

Height of Head above—Roof 10.7 m., Ground 12.8 m., M.S.L. 15.9 m. Height of Cups above—Roof 3.7 m., Ground 18.3 m., M.S.L. 22.3 m.

Main table for Scilly and Great Yarmouth stations, showing wind components (S, N, W, E) for 3h, 9h, 15h, 21h intervals, maximum velocity, and time of gust for each day from 1 to 31. Includes summary statistics for S+N & W+E and S-N & W-E.

The velocities at fixed hours are means for the interval from 30 minutes before to 30 minutes after the hour. The hours are numbered 1 h. to 24 h. Time is referred to Greenwich Mean Time. \* No Record. † Robinson Cup Anemometer; Arms 0.61 m.; Diameter of Cups, 0.229 m.; Factor 2.2. ‡ Robinson Cup Anemometer; Arms 0.305 m.; Diameter of Cups 0.127 m.; Factor 2.8. § Dines Pressure Tube Anemometer. At Great Yarmouth, Holyhead, and Scilly the readings at fixed hours are taken from the Robinson Anemometer, the maxima quoted are the greatest winds in a gust as recorded by the Dines Pressure Tube. ¶ 24 days only. ¶¶ 23 days only.

8. The Lower Layers of the Atmosphere from the Surface to 3000 metres (10,000 ft.) above Mean Sea Level.  
Soundings by Kites (K.) and Pilot Balloons (P.).

BRIGHTON. K. 9. August 24. 10 h. 0 m. to 12 h. 10 m. G.M.T.										
Soundings with Kites.	Height above M.S.L.	Pressure.	Temperature.		Humidity.		Density.	Wind.		Cloud Observations and Remarks.
			Reading.	Fall per km.	%	mb.		Direction.	Velocity.	
Greatest height	metres.	mb.	°A.	°C.	%	mb.	mgm/cc.	Degrees from N.	m/s.	Quarter overcast (St. and St.-Cu.) to almost clear; rain squalls afterwards.
	1000	901.3	276	10	75	6.8	1.135	270	17	
	500	958.1	281	11	75	8.8	1.184	270	15	
Ground level	215	991.5	284	56	75	11.8	1.211	260	17	
	115	1003.3	289.6		68	12.7	1.201	250	9	
Computed for M.S.L.	0	1016.9	...	...	...	...	...	279	14.9	...

9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. August 7. 19 h. 45 m. G.M.T.				SOUNDING No., 16 (1913). PLACE, MANCHESTER.		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	Latitude, 53° 28' N.	Longitude, 2° 14' W.	Reading.			Fall per Km.		
GREATEST HEIGHT, } 6.5 km.	433 mb.	241.5° A.	Height above M.S.L., } 40 m.	PLACE OF FALL, Egginton, near Burton-on-Trent.	km.	mb.	°A.	°C.	Stratosphere not reached.	
LOWEST TEMPERATURE, } 6.5 km.	433 mb.	241.5° A.			5.48	500	466	246.5		7.5
BASE OF STRATOSPHERE, } Type No. ?	Not Reached.		5.0	534	534	254	5.5			
	Distance and Orientation, 80 km. 150° from N.	4.16	600	612	258.5	259.5	7			
From observations at Station	at 7 h.	at 18 h. G.M.T.	4.0	699	699	266.5	6			
PRESSURE (M.S.L.),	1019 mb.	1018 mb.	3.0	700	700	266.5	6			
TEMPERATURE,	285° A.	287° A.	2.98	746	746	270.5	6			
VAPOUR PRESSURE,	...	...	2.5	795	795	272.5	6			
GRADIENT WIND:—Direction,	338°	317°	2.0	800	800	272.5	5			
Velocity,	4.1 m/s.	3.6 m/s.	1.95	847	847	273.5	5			
Correction for Curvature,	0.0 m/s.	0.0 m/s.	1.5	900	900	277.5	9			
Final Components, { W. to E. S. to N.	+1.5 m/s. -3.8 m/s.	2.5 m/s. -2.6 m/s.	1.00	956	956	282	9			
			0.5	1000	1000	286	9			
			0.12	1012	1012	287	...			
			Ground M.S.L.	1016	1016	...	...			

TABLE OF HEIGHTS, PRESSURES, TEMPERATURES, AND WINDS.

1913. August 5. 19 h. 30 m. G.M.T.				SOUNDING No., R. 255. PLACE, PYRTON HILL.		Height above M.S.L.	Pressure.	Temperature.		Wind.			REMARKS.
Height above M.S.L.	Pressure.	Temp.	Latitude, 51° 38' N.	Longitude, 1° 0' W.	Reading.			Fall per Km.	Direction.	Velocity.	Components.		
GREATEST HEIGHT, } 12.9 km.	171 mb.	220° A.	Height above M.S.L. } 150 m.	PLACE OF FALL, Sevenoaks.	km.	mb.	°A.	°C.	Degrees from N.	m/s.	W. to E.	S. to N.	Isothermal at 267° from 2.8 to 3.0 km.  Clear with clouds forming in north. Balloon lost to sight after 17 minutes.
LOWEST TEMPERATURE, } ...	...	...			12.0	196	196	222	...	...	...	...	
BASE OF STRATOSPHERE, } Type No. 1.	218 mb.	218° A.	11.81	200	200	221	-3	...	...	...	...		
			Distance, and Orientation, 90 km. 118° from N.	11.0	228	228	219	6 4	...	...	...	...	
From observations at Station	at 7 h.	at 18 h. G.M.T.	10.0	265	265	223	...	...	...	...	...		
PRESSURE (M.S.L.),	1020 mb.	1016 mb.	9.12	300	300	227	5 5	...	...	...	...		
TEMPERATURE,	285° A.	290° A.	9.0	307	307	230	228	...	...	...	...		
VAPOUR PRESSURE,	...	...	8.0	356	356	237	235	7 7	...	...	...		
GRADIENT WIND:—Direction,	31°	Pressure	7.15	400	400	242	240	6 6	...	...	...		
Velocity,	5.4 m/s.	Distribution	7.0	409	409	243	241	8 8	...	...	...		
Correction for Curvature,	+1.2 m/s.	Irregular.	6.0	469	469	251	249	...	...	...	...		
Final Components, { W. to E. S. to N.	-3.4 m/s. -5.7 m/s.	...	5.52	500	500	254	252	7 6	...	...	...		
			5.0	536	536	258	255	...	...	...	...		
			4.14	600	600	262	260	5 6	...	...	...		
			4.0	611	611	263	261	4 6	...	...	...		
			3.0	697	697	267	...	27	2.2	-1	-2		
			2.98	700	700	267	...	2 4	...	...	...		
			2.0	793	793	269	271	27	2.2	-1	-2		
			1.92	800	800	270	271	8 5	...	...	...		
			1.0	900	900	277	276	45	1.4	-1	-1		
			Ground M.S.L.	997	997	284	...	45	1.4	-1	-1		
				1015	1015	...	...	...	...	...	...		

## 9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.)—continued.

TABLE OF HEIGHTS, PRESSURES, TEMPERATURES, AND WINDS.

1913. August 7. 6 h. 53 m. G.M.T.				SOUNDING No., R. 256.		Height above M.S.L.	Temperature.		Wind.			REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, PRYTON HILL		Pressure.		Reading.	Fall per Km.	Direction.	Velocity.	Components.	
			Latitude, 51° 38' N.	Longitude, 1° 0' W.			°A.	°C.	Degrees from N.	m/s.	W. to E. S. to N.	
GREATEST HEIGHT, } 14.6 km.	133 mb.	228° A.	Height above M.S.L., } 150 m.		km.	mb.	°A.	°C.				
LOWEST TEMPERATURE, } 10.2 km.	259 mb.	222° A.			14.0	145	227	-1	...	...	...	...
BASE OF STRATOSPHERE, } 10.2 km.	259 mb.	222° A.	PLACE OF FALL, E. Grinstead.		13.0	169	226	1	...	...	...	...
Type No. 1.			Distance, 90 km.		12.0	197	227	-3	...	...	...	...
			Orientation, 130° from N.		11.90	200	227	-3	...	...	...	...
					11.0	229	224	-1.5	...	...	...	...
					10.0	267	222.5	-1.5	...	...	...	...
					9.25	300	226	4.5	...	...	...	...
					9.0	311	227	9	...	...	...	...
					8.0	359	236	8	...	...	...	...
					7.23	400	242	8	...	...	...	...
					7.0	412	244	8	...	...	...	...
					6.0	473	252	6	...	...	...	...
					5.60	500	254	6	...	...	...	...
					5.0	540	258	6	...	...	...	...
					4.23	600	263	6	...	...	...	...
					4.0	617	264	5	...	...	...	...
					3.01	700	269	5	...	...	...	...
					3.0	701	269	2	...	...	...	...
					2.0	795	271	2	360	1	0	-1
					1.95	800	271	7	...	...	...	...
					1.01	900	278	7	...	...	...	...
					1.0	901	278	90	1	-1	0	0
					Ground M.S.L.	999	286.5	...	90	1	-1	0
						1016	...	...	...	...	...	...
From observations at Station.			at 7 h.	at 18 h. G.M.T.								
PRESSURE (M.S.L.),			1019 mb.	1017 mb.								
TEMPERATURE,			285° A.	289° A.								
VAPOUR PRESSURE,			...	...								
GRADIENT WIND:—Direction,			316°	296°								
Velocity,			3.7 m/s.	3.5 m/s.								
Correction for Curvature,			0.0 m/s.	0.0 m/s.								
Final Components, { W. to E.			+2.6 m/s.	+3.1 m/s.								
{ S. to N.			-2.7 m/s.	-1.5 m/s.								

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. August 8. 6 h. 55 m. G.M.T.				SOUNDING No., R. 257.		Height above M.S.L.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, PYRTON HILL		Pressure.		Reading.	Fall per Km.	
			Latitude, 51° 38' N.	Longitude, 1° 0' W.			°A.	°C.	
GREATEST HEIGHT, } 11.5 km.	219 mb.	220° A.	Height above M.S.L., } 150 m.		km.	mb.	°A.	°C.	
LOWEST TEMPERATURE, } 10.0 km.	263 mb.	219° A.			11.0	224	220	-1	2
BASE OF STRATOSPHERE, } 10.1 km.	259 mb.	219° or 222° A.	PLACE OF FALL, Walton-on-Thames.		10.0	263	219	222	5
Type No. 1.			Distance, 48 km.		9.10	300	223	227	5
			Orientation, 125° from N.		9.0	304	224	228	8
					8.0	355	232	234	8
					7.13	400	239	240	8
					7.0	409	240	241	8
					6.0	471	248	250	8
					5.45	500	251	254	5
					5.0	537	253	257	7
					4.18	600	259	261	7
					4.0	616	260	262	7
					3.0	699	267	...	7
					2.98	700	267	...	3
					2.0	793	270	...	8
					1.93	800	271	...	8
					1.0	897	278	...	...
					.98	900	...	...	...
					Ground M.S.L.	994	283.5	...	...
						1012	...	...	...
From observations at Station.			at 7 h.	at 18 h. G.M.T.					
PRESSURE (M.S.L.),			1016 mb.	1012 mb.					
TEMPERATURE,			285° A.	290° A.					
VAPOUR PRESSURE,			...	...					
GRADIENT WIND:—Direction,			Pressure	Distribution					
Velocity,			Irregular	...					
Correction for Curvature,			...	...					
Final Components, { W. to E.			...	...					
{ S. to N.			...	...					

Time is expressed in the hours 1 to 24 of civil reckoning.

Pressure is given in millibars (1000 mb. = 1 C.G.S. atmosphere = 750 mm. approximately).

Gradient Wind is taken to be tangential to the isobar and is computed by the formula  $\gamma = 2 \omega \rho V \sin \phi$ .

Base of Stratosphere.—TYPE 1.—When the stratosphere commences with an inversion, the height and temperature of the first point of zero temperature gradient are given. TYPE 2.—When the stratosphere begins with an abrupt transition to a temperature gradient below 2° per km. without inversion, the height and temperature of the abrupt transition are given. TYPE 3.—When there is no such abrupt change of temperature gradient, the base is taken to be where the mean fall of temperature for the kilometer next above is 2° or less, provided that it does not exceed 2° for any subsequent kilometer. If some other position for the base seems to the tabulator to be more suitable, it is noted in the column for "Remarks."

Temperatures are expressed in degrees absolute (273° A. = 0° C.).

Heights are given in kilometers (km.).



SEPTEMBER 1913.—DAILY VALUES REFERRED TO GREENWICH MEAN TIME, AND UNITS  
BASED ON THE C.G.S. SYSTEM. [Price 1s.

Third Year.—No. 9. *Meteorology, Solar Radiation, Seismology, Atmospheric Electricity, and Terrestrial Magnetism.*

1. SEISMOLOGICAL JOURNAL:—ESKDALE OBSERVATORY.—[Lat. 55° 19' N. Long. 3° 12' W.

Date.	Microseisms of N. Component.								Remarks.
	0 h.		6 h.		12 h.		18 h.		
	A <sub>N</sub> . μ	T. s	A <sub>N</sub> . μ	T. s	A <sub>N</sub> . μ	T. s	A <sub>N</sub> . μ	T. s	
1	0.4	5	0.4	5	0.4	5	—	—	1st, I, P (?) = 21 h. 6 m. 25 s., L = 21 h. 56 m. End 23 h. 26 m.
2	0.5	4.5	0.4	4.5	0.4	4.5	0.6	4.5	2nd, I, Very small disturbance from 18 h. 35 m.—19 h. 0 m.
3	0.4	4.5	0.3	4	—	—	—	—	2nd, I, P = 19 h. 23 m. 11 s., S (?) = 19 h. 33 m. 26 s., L = 20 h. 1 m. Small earthquake. End 21 h. 30 m.
4	0.3	4	0.2	4	0.3	3.5	0.3	3.5	3rd, II, S (?) = 21 h. 22 m. 28 s., L = 21 h. 48 m. Large remote earthquake. End 1 h. 43 m.
5	0.2	4	0.3	3	0.3	4	0.4	3.5	4th, I, Small disturbance from 12 h. 33 m.—13 h. 13 m.
6	0.3	3	0.3	3	0.3	5	0.3	5	9th, I, Very small disturbance from 19 h. 16 m.—19 h. 25 m.
7	0.3	4	0.3	4.5	0.3	5	0.2	5	10th, I, Very small disturbance from 7 h. 34 m.—8 h. 48 m.
8	—	—	—	—	0.3	4.5	0.4	5	10th, I, Very small disturbance from 9 h. 42 m.—10 h. 24 m.
9	0.4	5	—	—	0.4	5	—	—	11th, I, Very small disturbance from 2 h. 43 m.—2 h. 56 m.
10	0.3	4.5	0.3	4	0.3	4.5	0.3	4	13th, I, L = 2 h. 59 m. Earthquake; first movement, 2 h. 44 m. End 3 h. 32 m.
11	0.3	4	0.4	5	0.6	5	1.0	5	15th, I, L = 6 h. 18 m. Earthquake; first movement, 6 h. 3 m. End 7 h. 6 m.
12	1.2	6	2.3	6.5	2.7	6.5	2.4	6.5	16th, I, P = 12 h. 6 m. 39 s., S = 12 h. 14 m. 43 s., L = 12 h. 28 m., Δ = 6520 km. Epicentre 5° N. 34° E.
13	2.1	7	2.4	5.5	1.7	5.5	1.9	6	End 13 h. 53 m.
14	1.0	6	1.0	5.5	1.0	5	1.2	4.5	18th, I, P = 12 h. 18 m. 2 s., S = 12 h. 27 m. 26 s., L = 12 h. 44 m., Δ = 8080 km. Epicentre (?) 52° N. 177° E.
15	1.6	5	1.5	6	1.2	6	1.2	5	End 13 h. 38 m.
16	1.1	5.5	1.1	5.5	0.9	4	0.9	4	22nd, I, L = 17 h. 38 m. Very small earthquake. End 17 h. 56 m.
17	0.7	4	0.5	5	0.3	5	0.2	4.5	24th, I, Small disturbance from 2 h. 28 m.—2 h. 39 m.
18	0.3	4	0.2	4.5	0.3	5	0.2	4	26th, I, Small disturbance from 9 h. 55 m.—10 h. 10 m.
19	0.4	3.5	0.3	4	0.3	4	0.4	5	26th, I, L = 12 h. 22 m. Small disturbance from 12 h. 22 m.—12 h. 43 m.
20	0.5	4	0.4	5	0.5	4	0.4	4.5	26th, I, P (?) = 22 h. 1 m. 19 s., L (?) = 22 h. 56 s. Small remote earthquake. End at 0 h. 6 m.
21	0.4	4.5	0.4	5	0.6	4	0.6	5	28th, I, Small disturbance from 15 h. 17 m. 20 s.—15 h. 26 m.
22	0.6	5.5	0.6	5	0.4	6.5	0.7	5	29th, I, L = 20 h. 41 m. Small earthquake. End at 20 h. 56 m.
23	0.6	4.5	1.0	4.5	0.9	4.5	0.6	4.5	30th, I, P (?) = 4 h. 14 m. 22 s., L = 4 h. 48 m. Small remote earthquake. End 5 h. 51 m.
24	0.6	4	1.0	0.5	1.0	5.5	1.0	5	30th, I, P = 7 h. 39 m. 39 s. Small earthquake. End 8 h. 41 m.
25	0.9	4.5	0.9	0.4	1.3	4.5	1.2	5	
26	1.1	5	1.5	5.5	1.7	5	1.6	5	
27	1.1	5	0.9	4	0.6	4	0.5	4	An explanation of the notation used is given in the preface. The amplitude A <sub>N</sub> is half of the actual movement of the earth's surface in a N-S direction, between the ends of the swing (μ = 0.01 mm.). The period T (in seconds) is the duration of a complete oscillation, i.e. both extreme positions are passed through once during the time T.
28	0.4	3.5	0.2	4	0.3	4	—	—	
29	0.7	4.5	—	—	—	—	0.3	4	
30	0.3	4	—	—	0.3	4.5	0.2	4	

2. VALENCIA OBSERVATORY, CAHRCIVEEN (KERRY).—[Lat. 51° 56' N. Long. 10° 15' W.

Heights above Mean Sea Level:—Station, H = 12.6 m. Barometer Cistern, H<sub>b</sub> = 13.7 m.

Heights above Ground:—Thermometers, h<sub>t</sub> = 1.2 m. Rain-gauge, h<sub>r</sub> = 0.56 m. Sunshine Recorder, h<sub>s</sub> = 12.8 m. Cups of Anemometer, h<sub>a</sub> = 13.9 m.

Day.	Pressure at Station Level.		Air Temperature in Degrees Absolute.				Humidity.				Wind Direction in Points (8 = E, 16 = S) and Velocity (metres per second).		Cloud Amount and Weather.		Rain 24 hours beginning 10 h.	Sunshine.	Remarks.	Magnetism.				
	9 h.	21 h.	9 h.	21 h.	Max.	Min.	Vapour Pressure.		Percentage.		9 h.	21 h.	9 h.	21 h.				10 h.	22 h.	Horizontal Force.	Declination West.	Inclination.
	mb.		200 +	200 +	200 +	200 +	millibar.		%	%	m/sec.		Tenths of Sky covered.					mm.	hrs.			
1	1016.9	1017.1	86.8	87.3	90	86	11.2	13.5	71	84	7	5	—	1	10∞	10∞	—	—	Dull; ∞.	7.0	0	0
2	1017.5	1017.6	87.8	88.2	91	87	14.2	14.6	85	86	—	0	—	0	10∞	10	—	—	Fair; ∞.	...	...	...
3	1017.9	1018.5	87.2	87.9	91	85	14.2	14.9	88	87	—	0	—	1	10∞	8=0	—	—	Fair; ∞.	...	...	...
4	1016.7	1016.3	89.0	88.7	92	86	14.2	15.9	80	91	—	1	—	0	7∞	10	—	2.8	Fine; ∞.	...	...	...
5	1016.9	1022.1	89.2	88.8	x 93	87	16.6	15.6	90	88	—	0	—	1	7∞	4∞	—	0.6	Fine; ∞.	...	...	...
6	1025.7	1028.7	89.1	87.9	92	84	15.6	15.2	86	91	—	1	—	0	7∞	2∞	0.3	3.5	Fine; ∞.	...	...	...
7	1029.8	1029.0	86.7	85.8	92	83	11.5	12.5	74	85	—	1	—	0	0∞	0∞	—	10.4	Fine; ∞.	...	...	...
8	1028.6	1027.4	87.4	89.3	92	83	14.2	17.6	87	97	—	0	—	0	3∞	10=0	2.0	2.6	Fair; ∞.	...	...	...
9	1023.9	1026.9	89.6	87.9	90	87	17.9	13.2	97	78	28	5	1	6	10=0	3	—	3.1	∞ a. Fair.	17852	20 22.2	68 7.8
10	1030.5	1028.4	87.4	88.5	90	84	12.2	16.6	75	95	1	2	—	0	4	10=0	2.5	9.0	Fine; visibility p.	...	...	...
11	1022.5	1014.7	88.6	89.5	91	x 88	16.9	17.9	97	97	25	5	22	6	8	10=0	4.1	3.3	Showery early and late.	...	...	...
12	1003.3	1000.8	86.6	84.9	90	84	14.2	10.8	92	77	29	6	30	3	10=0	8	6.4	0.1	∞ a. and p.	...	...	...
13	998.9	997.9	83.8	84.1	86	82	10.8	9.1	84	70	3	3	32	5	7	4	6.4	6.9	Showery to fair; visibility.	...	...	...
14	993.9	990.7	84.5	83.5	n 85	82	8.8	10.8	n 66	87	32	12	26	12	10	10=0	12.7	0.4	Squally and showery.	...	...	...
15	986.1	989.8	85.1	84.9	88	84	12.9	11.5	91	82	29	2	7	5	5	8	3.6	7.2	Showery to fair; visibility.	...	...	...
16	999.2	1003.7	85.6	87.2	89	85	11.2	12.2	77	77	5	7	2	6	4	8	0.3	9.2	Fair; unsettled appearance p.	...	...	...
17	1005.3	1009.1	85.9	83.2	88	81	12.5	11.5	84	93	—	1	2	2	8∞	0=0	0.3	7.4	∞ showers a. ∞	...	...	...
18	1010.9	1009.8	84.3	86.5	89	n 79	12.5	13.5	94	89	—	1	15	3	10∞	10	14.2	2.3	D <sup>2</sup> a. Hazy to fair; visibility.	...	...	...
19	1009.2	1013.7	86.8	86.0	89	85	12.5	11.9	80	80	28	5	25	4	10	3	0.8	6.1	∞ <sup>2</sup> 1 h.—3 h. Fair; visibility.	...	...	...
20	1017.0	1018.8	86.5	87.8	89	84	11.9	16.3	77	97	25	4	22	6	8	10=0	4.3	1.7	Fair to dull and showery.	...	...	...
21	1022.3	1021.3	85.3	87.3	90	83	12.9	15.2	91	94	—	1	13	3	10	10	x 25.7	1.2	Dull. ∞ p.	...	...	...
22	1010.6	1003.7	86.8	87.6	89	86	15.2	15.9	98	97	15	8	18	7	10=0	10=0	19.6	—	Heavy mist. ∞ <sup>2</sup> 5 h. 30 m.—16 h.	17853	20 19.7	68 8.2
23	1005.9	999.8	85.1	87.2	89	85	13.2	13.5	94	83	19	2	6	8	8	10	8.1	3.0	Fair; visibility p.	...	...	...
24	996.0	1000.8	88.0	86.2	90	85	13.9	13.2	83	87	15	8	10	2	5	10	1.8	3.9	Showery a.; squally.	...	...	...
25	1002.4	1007.9	88.5	87.8	90	83	16.6	16.3	96	97	17	3	15	5	8	9	0.5	1.0	Visibility.	...	...	...
26	1011.4	1009.9	88.1	88.2	90	87	16.3	15.2	97	90	16	3	15	2	7=0	10	3.6	3.4	∞ p.	...	...	...
27	1006.2	1005.1	88.5	88.7	90	x 88	16.9	17.3	97	97	—	0	4	4	10=0	10=0	19.1	—	∞. Intermittent ∞ 15 h. 30 m.—	...	...	...
28	1007.7	1013.3	88.0	87.3	91	86	15.6	15.2	93	94	16	2	—	1	10	5	3.1	2.6	Dull to fair.	...	...	...
29	1014.7	1013.3	88.8	88.1	x 93	85	15.9	15.6	89	92	—	1	—	0	6	1	0.3	7.1	Fair to fine.	...	...	...
30	1013.4	1013.7	86.7	87.3	90	83	13.9	13.2	88	81	7	3	6	3	0∞	3∞	—	8.5	Fine; ∞.	...	...	...
Means	1012.0	1012.3	87.1	87.1	89.9	84.4	13.9	14.2	87	88	3.1	3.2	7.4	7.2	139.7	3.58	—	—	Monthly Totals or Means.	17853	20 21.0	68 8.0
Normal 40 years	1014.1	1014.2	86.6	86.1	89.6	83.8	13.3	13.1	85	86	4.8	4.3	—	—	108.9	4.40	—	—	Normals, 40 years.	...	...	...

x denotes the maximum and n the minimum value in the column.

Note.—The cloud amounts in italic type at Valencia were taken at 21 h.

3. KEW OBSERVATORY, SURREY.—Lat. 51° 28' N. Long. 0° 19' W.

Heights above Mean Sea Level :—Station, H = 5.5 m. Barometer, H<sub>b</sub> = 10.4 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 3.0 m. Rain-gauge, h<sub>r</sub> = 0.53 m. Sunshine Recorder, h<sub>s</sub> = 13.3 m. Cups of Anemometer, h<sub>a</sub> = 19.81 m.

Table with columns: Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points and Velocity, Cloud Amount and Weather, Rain 24 hours beginning 10 h., Sunshine, Solar Radiation, Min. Temp. on Grass, Earth Temperature at 10 h., Remarks. Includes monthly means and normals for 40 years.

4. ESKDALE OBSERVATORY, DUMFRIESSHIRE.—Lat. 55° 19' N. Long. 3° 12' W.

Heights above Mean Sea Level :—Station, H = 242.0 m. Barometer, H<sub>b</sub> = 237.0 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 0.9 m. Rain-gauge, h<sub>r</sub> = 0.40 m. Sunshine Recorder, h<sub>s</sub> = 1.5 m. Vane of Anemometer, h<sub>a</sub> = 15.0 m.

Table with columns: Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points and Velocity, Cloud Amount and Weather, Rain 24 hours beginning 10 h., Sunshine, Solar Radiation, Min. Temp. on Grass, Earth Temperature at 10 h., Remarks. Includes monthly means and normals for 1911-12.

The solar radiation is the mean of the readings within the nominal hour of observation (11 h. 30 m.-12 h. 30 m.) unless some other hour is specified. Temperatures at or below the normal freezing point of water are printed in small type

## 5. KEW OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor †.				Charge per cc. × 10 <sup>20</sup> .		Velocities of Ions for 1 volt per centimetre.		Conductivity × 10 <sup>25</sup> .	Air-Earth Current × 10 <sup>16</sup> .		Electric Character of Day.	Magnetic Character of Day.	Horizontal Force.			West Declination.						
	3 h.	9 h.	15 h.	21 h.	+	-	+	-		c <sub>1</sub> .	c <sub>2</sub> .			Maximum. 18000 γ +.	Minimum. 18000 γ +.	Range.	Maximum. 15° +.	Minimum. 15° +.	Range.				
	v/m.	v/m.	v/m.	v/m.	E.-m.U.	E.-m.U.	cm/sec.	cm/sec.		E.-m.U.	Amp/cm <sup>2</sup> .			γ	h m	γ	h m	γ	h m	γ	h m		
1	50	30	185	100	—	—	—	—	—	—	0	0	516	19 52	475	9 27	41	44° 1	12 37	31° 8	7 13	12° 3	
2	70	135	195	365	—	—	—	—	—	—	0	0	515	21 35	469	9 16	46	43° 5	12 49	31° 8	7 41	11° 7	
3	135	365	285	205	—	—	—	—	—	—	0	0	508	16 8	468	10 7	40	42° 8	12 50	30° 8	7 25	12° 0	
4	70	255	410	215	—	—	—	—	—	—	0	0	514	19 26	467	9 36	47	44° 0	12 55	32° 0	7 20	12° 0	
5	40	265	70	175	—	—	—	—	—	—	0	0	515	21 41	469	11 3	46	42° 6	13 34	32° 0	9 24	10° 6	
6	185	255	345	470	—	—	—	—	—	—	0	0	521	22 39	464	10 32	57	43° 6	13 31	28° 9	22 54	14° 7	
7	235	265	365	500	—	—	—	—	—	—	0	0	509	22 24	461	8 10	48	41° 7	13 6	31° 3	22 44	10° 4	
8	175	540	345	355	—	—	—	—	—	—	1	1	527	2 58	437	11 37	20	45° 2	12 39	29° 4	2 55	15° 8	
9	215	420	195	665	—	—	—	—	—	—	1	1	516	5 41	426	10 20	20	44° 0	12 28	27° 9	2 38	16° 1	
10	325	480	185	165	—	—	—	—	—	—	0	0	509	19 20	462	12 10	47	39° 8	11 40	n 27° 4	19 0	12° 4	
11	120	205	195	275	—	—	—	—	—	—	0	0	503	0 31	462	9 45	41	40° 4	11 42	31° 3	0 30	9° 1	
12	155	165	275	305	—	—	—	—	—	—	0	0	511	23 42	466	10 5	45	42° 4	13 21	31° 1	8 0	11° 3	
13	120	205	255	365	—	—	—	—	—	—	0	0	511	21 30	469	11 1	42	40° 3	12 43	31° 9	6 11	8° 4	
14	145	225	185	580	—	—	—	—	—	—	0	0	515	23 26	476	11 40	39	40° 3	12 5	32° 5	22 4	7° 8	
15	315	—	±	825	—	—	—	—	—	—	2	2	518	23 34	478	10 39	40	42° 0	13 14	32° 6	4 56	9° 4	
16	185	550	—	±	—	—	—	—	—	—	1	1	513	0 50	480	10 45	33	40° 4	12 11	32° 6	8 15	7° 8	
17	175	275	365	145	—	—	—	—	—	—	1	1	522	15 16	475	10 44	47	43° 0	12 35	33° 2	7 40	9° 8	
18	400	315	295	305	—	—	—	—	—	—	0	0	514	18 55	487	11 56	27	41° 5	13 34	31° 1	8 18	10° 4	
19	145	60	215	450	—	—	—	—	—	—	0	0	517	22 15	467	12 35	50	42° 7	13 56	29° 1	7 31	13° 6	
20	80	245	255	415	—	—	—	—	—	—	1	1	508	23 28	466	12 2	42	41° 2	12 58	31° 1	8 5	10° 1	
21	195	210	210	290	—	—	—	—	—	—	0	0	506	16 58	475	10 49	31	41° 7	13 22	31° 3	7 59	10° 4	
22	295	235	—	120	—	—	—	—	—	—	1	1	517	23 39	446	11 44	71	45° 5	12 20	27° 8	23 58	17° 7	
23	160	210	185	155	—	—	—	—	—	—	0	0	511	0 46	457	10 19	54	40° 7	13 20	27° 8	0 0	12° 9	
24	125	185	295	425	—	—	—	—	—	—	0	0	509	20 40	473	11 9	36	40° 1	12 38	31° 8	8 16	8° 3	
25	295	—	—	270	—	—	—	—	—	—	0	0	517	2 59	481	12 10	36	39° 5	13 36	30° 5	3 14	9° 0	
26	225	170	280	305	—	—	—	—	—	—	0	0	507	7 26	489	14 30	n 18	39° 3	14 7	33° 1	9 0	n 6° 2	
27	260	280	295	275	—	—	—	—	—	—	0	0	512	23 53	480	10 45	32	39° 6	12 40	31° 7	8 18	7° 9	
28	220	245	500	445	—	—	—	—	—	—	0	0	511	0 47	483	14 26	28	39° 4	12 40	31° 4	4 22	8° 0	
29	365	400	500	415	—	—	—	—	—	—	0	0	507	20 39	479	10 50	28	40° 0	12 18	30° 4	7 44	9° 6	
30	375	365	—	345	—	—	—	—	—	—	0	0	499	18 48	475	10 35	24	38° 7	12 45	30° 2	6 26	8° 5	
M.	176*	256*	275*	335*	—	—	—	—	—	—	—	—	513	—	469	—	44	41° 7	—	30° 9	—	—	10° 8

\* 25 days. The mean values of the Potential gradient in Table 5 are computed from the data for those days on which values at each of the four hours, 3<sup>h</sup>, 9<sup>h</sup>, 15<sup>h</sup>, 21<sup>h</sup>, are given in the table. A similar note applies to the values in Table 6.  
 † 2° 09 to 10 a.m. on 20th and 1° 45 after.

## 6. ESKDALE OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor † 5·24.				Charge per cc. × 10 <sup>20</sup> .		Velocities of Ions for 1 volt per centimetre.		Conductivity × 10 <sup>25</sup> .	Air-Earth Current × 10 <sup>16</sup> .		Electric Character of Day.	Magnetic Character of Day.	North Component.			West Component.			Vertical Component.				
	3 h.	9 h.	15 h.	21 h.	+	-	+	-		c <sub>1</sub> .	c <sub>2</sub> .			Maximum. 15000 γ +.	Minimum. 15000 γ +.	Maximum. 5000 γ +.	Minimum. 5000 γ +.	Maximum. 45000 γ +.	Minimum. 45000 γ +.					
	v/m.	v/m.	v/m.	v/m.	E.-m.U.	E.-m.U.	cm/sec.	cm/sec.		E.-m.U.	Amp/cm <sup>2</sup> .			h m	γ	γ	h m	h m	γ	γ	h m	h m	γ	γ
1	48	14	21	90	—	—	—	—	—	—	1a	0	15 20	1029	981	9 44	12 53	210	144	7 12	17 35	282	263	11 45
2	76	76	138	117	—	—	—	—	—	—	0a	0	21 34	1033	974	9 56	13 0	206	143	7 45	16 45	284	261	11 50
3	90	48	83	110	—	—	—	—	—	—	1a	1	16 8	1029	978	10 42	±	±	±	±	17 15	282	262	12 50
4	152	110	131	110	—	—	—	—	—	—	0a	0	23 58	1033	968	10 36	13 17	205	142	8 19	17 45	284	267	12 10
5	—	138	131	221	—	—	—	—	—	—	0a	1	21 45	1031	978	11 2	14 4	202	141	9 22	17 15	284	266	12 58
6	131	110	97	180	—	—	—	—	—	—	0a	2	22 36	1046	969	10 59	13 3	214	128	22 55	18 15	292	262	2 5
7	207	110	166	380	—	—	—	—	—	—	1a	2	22 20	1029	978	15 2	13 9	192	146	22 45	15 50	290	261	12 17
8	332	235	152	138	—	—	—	—	—	—	0a	2	2 57	n 1049	n 932	11 33	13 33	217	135	2 57	14 45	288	n 233	3 55
9	338	380	117	380	—	—	—	—	—	—	0a	2	5 42	1038	n 932	10 3	0 16	229	127	2 37	17 22	290	244	0 50
10	131	290	173	152	—	—	—	—	—	—	0a	2	19 8	1042	970	12 12	11 43	184	116	19 0	19 10	284	267	4 3
11	180	28	173	290	—	—	—	—	—	—	0a	1	0 27	1027	970	9 38	13 42	191	145	1 5	18 50	284	263	0 35
12	83	-207	41	193	—	—	—	—	—	—	1b	1	23 40	1030	971	10 2	13 20	206	139	19 10	19 5	282	265	11 25
13	76	—	-152	55	—	—	—	—	—	—	2c	1	21 29	1026	975	11 4	12 25	192	146	17 59	17 55	283	271	12 28
14	221	+	124	242	—	—	—	—	—	—	1b	0	20 28	1022	977	11 40	12 51	184	154	22 1	2 5	278	268	12 20
15	221	249	145	283	—	—	—	—	—	—	0a	0	23 31	1029	981	13 28	13 40	196	152	4 55	17 15	277	264	12 0
16	173	145	97	193	—	—	—	—	—	—	0a	1	0 56	1023	986	11 8	12 12	189	148	9 8	16 30	278	267	11 35
17	402	332	145	325	—	—	—	—	—	—	0a	1	16 49	1033	973	10 45	13 52	209	153	7 56	3 0	275	259	12 10
18	97	69	97	345	—	—	—	—	—	—	0a	0	19 32	1025	981	11 56	13 35	197	141	22 49	15 38	274	262	12 15
19	242	297	249	318	—	—	—	—	—	—	0a	1	22 16	1040	968	12 34	14 0	196	130	22 51	21 50	275	262	11 20
20	242	138	166	173	—	—	—	—	—	—	0a	0	20 7	1023	964	12 5	14 11	187	143	8 56	21 55	274	263	12 20
21	41	124	159	187	—	—	—	—	—	—	0a	0	20 2	1020	976	11 12	13 25	196	139	8 48	6 40	273	255	12 50
22	117	138	145	242	—	—	—	—	—	—	0a	2	23 32	1040	940	11 42	12 19	212	115	24 0	17 40	292	263	12 5
23	145	+	193	207	—	—	—	—	—	—	0a	2	3 0	1027	959	10 17	13 22	187	n 109	{ 1 33 } { 1 59 }	19 40	271	248	3 0
24	180	332	352	401	—	—	—	—	—	—	2a	0	6 33	1019	979	11 31	14 0	182	149	8 18	8 10	268	258	12 40
25	373	166	228	76	—	—	—	—	—	—	0a	1	3 0	1033	981	12 10	13 36	180	142	3 26	20 50	270	254	11 23
26	173	332	76	-35	—	—	—	—	—	—	1a	0	18 46	1027	987	14 30	14 9	184	151	9 15	23 50	269	254	14 3
27	124	559	332	345	—	—	—	—	—	—	1a	0	23 20	1023	984	11 5								

7. Tables of Wind Components in metres per second at fixed hours, together with the mean velocity (horizontal movement) in metres per second for the hour with the maximum hourly run for each day, or the greatest velocity attained in a gust and the time of its occurrence.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust, and Date, 3 h., 9 h., 15 h., 21 h., Vel. in Hourly Run, Time of Max. for HOLYHEAD and DEERNESS.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust, and Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust, Time of Gust for SCILLY and GREAT YARMOUTH.

The velocities at fixed hours are means for the interval from 30 minutes after the hour. The hours are numbered 1 h. to 24 h. Time is referred to Greenwich Mean Time. \* No Record. † Robinson Cup Anemometer; Arms 0.61 m.; Diameter of Cups, 0.229 m.; Factor 2.2. ‡ Robinson Cup Anemometer; Arms 0.305 m.; Diameter of Cups 0.127 m.; Factor 2.8. § Dines Pressure Tube Anemometer. At Great Yarmouth, Holyhead, and Scilly the readings at fixed hours are taken from the Robinson Anemometer; the maxima quoted are the greatest winds in a gust as recorded by the Dines Pressure Tube. || 29 days only.

8. The Lower Layers of the Atmosphere from the Surface to 3000 metres (10,000 ft.) above Mean Sea Level.  
Soundings by Kites (K.) and Pilot Balloons (P.).

FALMOUTH. P. 1. September 21. 11 h. 20 m. G.M.T.							
Soundings with Pilot Balloons.	Height above M.S.L.	Wind.				Vertical Velocity of Balloon.	Cloud Observations and Remarks.
		Direction.	Velocity.	Components.			
				W.-E.	S.-N.		
Greatest height.	metres.	Degrees from N.	m/s.	m/s.	m/s.	m/s.	One theodolite used.
	3880	226	13·6	+ 9·7	+ 9·5	Assumed at 2·6.	
	3500	230	11·5	+ 8·8	+ 7·4		
	3000	241	8·8	+ 7·7	+ 4·3		
	2500	240	7·0	+ 6·1	+ 3·5		
	2000	240	7·7	+ 6·7	+ 3·8		
	1500	250	6·3	+ 5·9	+ 2·1		
	1000	245	4·7	+ 4·3	+ 2·0		
	500	253	6·9	+ 6·6	+ 2·0		
Ground level	61	255	5·8	+ 5·6	+ 1·5	...	
Computed for M.S.L.	0	Station near centre of region of high pressure					

BRIGHTON. K. 10. September 3. 14 h. 0 m. to 17 h. 0 m. G.M.T.										
Soundings with Kites.	Height above M.S.L.	Pressure.	Temperature.		Humidity.		Density.	Wind.		Cloud Observations and Remarks.
			Reading.	Fall per km.	%	mb.		Direction.	Velocity.	
Greatest height	metres.	mb.	°A.	°C.	%	mb.	mgm/cc.	Degrees from N.	m/s.	Clear sky.
	755	932·3	290·4	2·6	83	16·4	1·111	60	10	
	215	992·8	291·8	0	77	16·5	1·178	60	10	
Ground level	115	1004·4	291·8	0	77	16·5	1·192	60	8	
Computed for M.S.L.	0	1017·9	...	...	...	...	...	96	10·4	...

BRIGHTON. K. 11. September 14. 11 h. 0 m. to 12 h. 20 m. G.M.T.										
Greatest height	1065	877·1	277·5	7·9	95	8·0	1·097	235	?	Sky clear, with a few Fr.-Cu. clouds, just reached. The kite was not sustainable at 100 m. Anemo. pen not working. Wind increasing till 500 m. was reached, then decreasing.
	500	939·4	282·0	1·7	86	9·8	1·156	240	?	
	215	?	?	?	?	?	?	?	?	
Ground level	115	983·5	288·4	66	11·5	11·5	1·183	250	9	
Computed for M.S.L.	0	996·9	...	...	...	...	...	223	12·5	...

BRIGHTON. K. 12. September 28. 10 h. 0 m. to 12 h. 0 m. G.M.T.										
Greatest height	500	957·4	289	7·3	65	11·8	1·149	130	?	Clear sky. Anemo. pen failed.
	215	?	?	?	?	?	?	?	?	
Ground level	115	1001·5	291·8	78	16·8	16·8	1·188	90	7	Wind decreasing with altitude.
Computed for M.S.L.	0	1014·9	...	...	...	...	...	157	8·4	...



9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.)—continued.

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

			SOUNDING No., 17, 1913.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
						Reading.	Fall per Km.	
1913. September 4. 5 h. 40 m. G.M.T.			PLACE, MANCHESTER.	km.	mb.	°A.	°C.	
	Height above M.S.L.	Pressure.	Temp.	12.0	195	220.5	-5	
GREATEST HEIGHT,	} 12.0 km.	195 mb.	220.5° A.	Latitude, 53° 28' N.	11.83	200	215.5	
				Longitude, 2° 14' W.	11.0	229	215.5	7
LOWEST TEMPERATURE,	} 11.4 km.	215 mb.	213.5° A.	Height above M.S.L., } 40 m.	10.0	268	222.5	9.5
				10.23	300	225		
BASE OF STRATOSPHERE,	} 11.4 km.	215 mb.	213.5° A.	PLACE OF FALL, near Preston.	9.0	309	232	8.5
				8.0	357	240.5		
Type	No. 1.			Distance and Orientation, 40.5 km. 314° from N.	7.25	400	246.5	8
					7.0	415	248.5	7
					6.0	476	255.5	6.5
					5.63	500	258	
					5.0	543	262	6
					4.24	600	267	4.5
					4.0	619	268	
					3.03	700	272.5	6
					3.0	703	272.5	
					2.5	748	274.5	7
					2.0	797	278.5	
					1.98	800	278.5	1.5
					1.5	850	281.5	
					1.0	905	280	7
					1.05	900	280	
					.5	961	283.5	
					.18	1000	286	
					Ground M.S.L.	1017 1022	287.5 ...	... ...

From observations at Station.		at 7 h.	at 18 h. G.M.T.
PRESSURE (M.S.L.),		1022 mb.	1020 mb.
TEMPERATURE,		286° A.	290° A.
VAPOUR PRESSURE,		...	...
GRADIENT WIND :—Direction,		97°	105°
Velocity,		14.6 m/s.	11.4 m/s.
Correction for Curvature,		0.0 m/s.	+ 1.2 m/s.
Final Components,	{ W. to E. S. to N.	- 14.5 m/s. + 1.8 m/s.	- 12.2 m/s. + 3.3 m/s.

Time is expressed in the hours 1 to 24 of civil reckoning.

Temperatures are expressed in degrees absolute (273° A. = 0° C.).

Pressure is given in millibars (1000 mb. = 1 C.G.S. atmosphere = 750 mm. approximately).

Heights are given in kilometers (km.).

Gradient Wind is taken to be tangential to the isobar and is computed by the formula  $\gamma = 2 \omega \rho V \sin \phi$ .

Base of Stratosphere.—TYPE 1.—When the stratosphere commences with an inversion, the height and temperature of the first point of zero temperature gradient are given. TYPE 2.—When the stratosphere begins with an abrupt transition to a temperature gradient below 2° per km. without inversion, the height and temperature of the abrupt transition are given. TYPE 3.—When there is no such abrupt change of temperature gradient, the base is taken to be where the mean fall of temperature for the kilometer next above is 2° or less, provided that it does not exceed 2° for any subsequent kilometer. If some other position for the base seems to the tabulator to be more suitable, it is noted in the column for "Remarks."

10. Solar Radiation at South Kensington.

Day.	JULY.					AUGUST.					SEPTEMBER.					REMARKS.
	Max. Rate, Milli-watts per cm <sup>2</sup> .	Daily Amount.		Duration of Bright Sunshine.		Max. Rate, Milli-watts per cm <sup>2</sup> .	Daily Amount.		Duration of Bright Sunshine.		Max. Rate, Milli-watts per cm <sup>2</sup> .	Daily Amount.		Duration of Bright Sunshine.		
		Joules per cm <sup>2</sup> .	% of Ideal.*	Hours.	% of Possible.		Joules per cm <sup>2</sup> .	% of Ideal.*	Hours.	% of Possible.		Joules per cm <sup>2</sup> .	% of Ideal.*	Hours.	% of Possible.	
1	75	1546	45	4'3	26	76	1205	39	4'6	30	20	n 41	2	0'0	0	
2	78	1465	43	3'5	21	58	1097	36	2'5	16	n 14	210	9	0'0	0	
3	73	1118	33	2'6	16	68	1904	63	10'1	66	33	635	27	1'2	9	
4	78	1020	30	1'3	8	70	938	31	1'7	11	60	637	27	0'8	6	
5	43	726	21	0'0	0	83	x 2085	69	7'5	49	29	334	15	0'0	0	
6	53	692	20	0'5	3	75	1643	55	7'7	51	39	579	25	0'1	1	
7	86	1621	48	5'0	30	68	985	33	1'8	12	x 68	1211	54	6'4	49	
8	85	1408	41	3'3	20	63	1036	35	3'3	22	63	x 1439	65	x 10'8	x 82	
9	77	1526	45	1'2	7	62	1314	45	4'6	31	59	531	24	1'0	8	
10	60	666	20	0'2	1	83	1553	53	8'0	54	67	1234	57	7'3	56	
11	65	1256	37	3'7	23	73	909	31	1'3	9	62	911	42	3'1	24	
12	67	1501	45	0'9	6	62	746	26	1'3	9	61	990	44	5'3	41	
13	x 87	1158	34	1'4	9	58	763	27	0'4	3	60	1286	62	7'0	55	
14	70	972	29	1'0	6	59	1263	45	1'8	12	65	1312	63	8'9	70	
15	33	506	15	0'0	0	33	473	17	0'0	0	65	1026	50	4'7	37	
16	60	1081	33	2'6	16	56	1114	40	4'2	29	59	836	42	2'4	19	
17	65	1204	36	1'4	9	59	1628	59	10'7	74	54	444	22	0'1	1	
18	74	646	19	0'5	3	72	760	28	1'4	10	51	590	30	1'4	11	
19	52	568	17	0'0	0	33	489	18	0'1	1	47	769	40	4'1	33	
20	x 87	x 1888	58	x 11'5	x 72	80	1270	47	5'7	40	35	601	31	1'1	9	
21	57	1074	33	0'1	1	67	1643	62	10'8	76	53	728	39	2'3	19	
22	83	993	31	2'0	13	59	753	28	0'5	4	43	726	39	0'7	6	
23	n 26	n 444	14	0'1	1	70	900	34	5'1	36	38	543	29	0'0	0	
24	81	1742	54	7'2	46	x 85	1448	56	6'8	48	52	1343	74	9'9	x 82	
25	80	1076	34	6'0	38	73	1744	68	x 12'2	x 87	51	1070	60	6'7	56	
26	60	886	28	0'3	2	62	1300	51	8'7	63	50	692	39	1'9	16	
27	30	658	21	0'3	2	58	1051	42	3'4	25	49	1237	71	9'5	80	
28	63	1655	53	9'7	62	55	1403	56	9'4	68	45	1092	64	9'2	78	
29	56	1661	53	10'4	67	28	481	20	1'5	11	43	877	52	6'5	56	
30	42	447	14	0'0	0	(32)	...	...	0'0	0	48	810	48	5'8	50	
31	68	1490	48	7'8	51	n 17	n 235	10	0'0	0						
Total	...	34694	34	88'8	18	...	34133	41	137'1	31	...	24734	42	118'2	32	
Mean	65	R=1119		H=2'86		61	R=1138		H=4'42		49	R=824		H=3'94		
Ratio of Mean Daily Amount to Mean Duration.			$\frac{R}{H} = 391$				$\frac{R}{H} = 257$					$\frac{R}{H} = 209$				

Note.—1 watt per cm<sup>2</sup> = 14'35 gramme-calories per cm<sup>2</sup> per minute. 1 gramme-calorie per minute = 0'7 watt nearly. 1 Joule = 0'239 gramme-calories.

If the heat were distributed throughout the atmosphere, 1000 gramme-calories per cm<sup>2</sup> would be sufficient to raise the temperature 4'1 C. It would take 245 gramme-calories per cm<sup>2</sup> to raise the temperature of the whole atmosphere 1' C.

N.B.—The values of Solar Radiation at South Kensington are obtained from the records of a Callendar Instrument which depends upon the difference of temperature between a black and a bright wire exposed horizontally to radiation from the whole of the sky. The values may be taken as representing the total radiation and the maximum rate of radiation per cm<sup>2</sup> received by a horizontal surface. If it is desired to compare the values published for Kew and Eskdalemuir in Tables 3 and 4 with the simultaneous value recorded by the Callendar Instrument the former must be multiplied by the cosine of the zenith distance of the sun at the time of observation. The duration of sunshine in this table is obtained from a Campbell-Stokes Recorder.

For values January to March see p. 14; April to June see p. 46.

\* The "Ideal" intensity of radiation at any instant is taken to be a function of the Sun's altitude only. It is approximately the highest intensity recorded at South Kensington for the corresponding elevation of the Sun. The "Ideal" amount for the day is found by integrating the "Ideal" intensity from sun-rise to sun-set: it is the amount which could be recorded on a day when the atmosphere was in its most transparent state from sun-rise to sun-set. A memoir dealing with the subject is in preparation.



# METEOROLOGICAL OFFICE OBSERVATORIES—GEO PHYSICAL JOURNAL.

OCTOBER 1913.—DAILY VALUES REFERRED TO GREENWICH MEAN TIME, AND UNITS  
BASED ON THE C.G.S. SYSTEM.

[Price 1s.]

*Third Year.—No. 10. Meteorology, Solar Radiation, Seismology, Atmospheric Electricity, and Terrestrial Magnetism.*

## 1. SEISMOLOGICAL JOURNAL:—ESKDALE OBSERVATORY.—Lat. 55° 19' N. Long. 3° 12' W.

Date.	Microseisms of N. Component.								Remarks.
	0 h.		6 h.		12 h.		18 h.		
	A.N. <i>μ</i>	T. s	A.N. <i>μ</i>	T. s	A.N. <i>μ</i>	T. s	A.N. <i>μ</i>	T. s	
1	0.4	3.5	0.3	4	0.3	3	0.2	4	1st, I, Very small disturbance from 19 h. 27 m.—20 h. 6 m. 2nd, Iu, P=4 h. 35 m. 20 s., S=4 h. 45 m. 12 s., L=(?), Δ=8630 km., S.S.W. direction. Epicentre by Eskdalemuir and Ottawa=8° 7' N. 84° 5' W. End 7 h. 47 m. 2nd, I, Small disturbance from 18 h. 12 m.—18 h. 22 m. 3rd, Iu, P=0 h. 28 m. 2 s., S=0 h. 38 m. 10 s., L=0 h. 54 m., Δ=8950 km. Epicentre=43° N. 152° E. End 1 h. 49 m. 3rd, I, Very small disturbance from 7 h. 49 m.—8 h. 21 m. 4th, Iu, P=0 h. 19 m. 2 s., S=0 h. 29 m. 5 s., L=0 h. 44 m., Δ=8850 km., in N.—S line. End 1 h. 25 m. 4th, I, L=18 h. 35 m. Small earthquake not very remote. End 18 h. 59 m. 4th, Iu, P=22 h. 17 m. 25 s., S=22 h. 27 m. 13 s., L=22 h. 47 m., Δ=8550 km. S. phase well marked. End 24 h. 0 m. 6th, I, Earthquake at 22 h. 51 m. 50 s. Very small disturbance till 23 h. 32 m. 7th, I, L=3 h. 2 m. Small earthquake. End 3 h. 37 m. 8th, I, Earthquake at 6 h. 3 m. 1 s., L=6 h. 36 m. Small earthquake. End 7 h. 30 m. 9th, Iu, P=18 h. 48 m. 35 s., S=18 h., 58 m. 23 s., L=19 h. 13 m., Δ=8550 km. End 20 h. 0 m. 9th, I, Earthquake at 22 h. 14 m. 14 s., L=22 h. 25 m. Small earthquake. End merged into the following. 9th, I, L=23 h. 42 m. Small earthquake. End 1 h. 2 m. 11th, I, P(?)=1 h. 53 m. 26 s., S(?)=2 h. 5 m. 28 s., L=2 h. 31 m. End merged into the following. 11th, II, S(?)=4 h. 26 m. 55 s., L=5 h. 0 m. End 7 h. 25 m. 11th, Iu, P=9 h. 22 m. 15 s., S=9 h. 32 m. 17 s., L=9 h. 46.5 m., Δ=8830 km. Epicentre 44° N. 159° E. End 11 h. 30 m. 12th, I, Small disturbance from 13 h. 10 m.—13 h. 22 m. 12th, Iu, P=17 h. 16 m. 6 s., S=17 h. 26 m. 14 s., L=17 h. 41.5 m., Δ=8950 km. Epicentre 43° N. 156° E. End 18 h. 52 m. 13th, I, Very small disturbance from 9 h. 44 m.—9 h. 56 m. 14th, I, Small disturbance about 7 h. 14th, III, S=8 h. 28 m. 0 s. Large impulses at 8 h. 51.5 m. and 9 h. 10 m. Large remote disturbance. End 11 h. 8 m. 14th, I, Small disturbance from 15 h. 3 m.—15 h. 15 m. 14th, I, L=16 h. 53 m. Small earthquake. End 17 h. 17 m. 14th, I, L=22 h. 22 m. Small earthquake. End 22 h. 42 m. 16th, I, Small disturbance from 3 h. 34 m.—4 h. 16 m. 22nd, I, Small disturbance from 7 h. 19 m.—7 h. 47 m. 23rd, I, L=12 h. 26 m. Small earthquake from 12 h. 23 m.—12 h. 39 m. 23rd, I, S=15 h. 22 m. 19 s., L=15 h. 31 m. Small earthquake. End 16 h. 23 m. 25th, I, L=15 h. 52.5 m. Small earthquake. End 16 h. 27 m. 26th, I, L=14 h. 10 m. Small earthquake. End 14 h. 27 m. 26th, I, L=23 h. 21 m. Small earthquake. End 0 h. 16 m. 28th, I, Very small disturbance from about 16 h. 43 m.—16 h. 51 m. 29th, I, S=4 h. 56 m. 55 s., L=5 h. 18 m. Remote shock. End 6 h. 30 m. 30th, I, Small earthquake from 3 h. 0 m.—3 h. 6 m. Not very remote.
2	0.3	4	—	—	0.3	4	0.2	4	
3	0.3	3.5	0.2	4	0.2	4.5	0.2	4.5	
4	0.3	5	0.3	5	0.3	6	0.7	6	
5	0.8	6.5	0.9	6.5	0.9	6	0.9	6.5	
6	0.8	5	1.0	5	0.8	5.5	0.5	4.5	
7	0.6	4	0.5	4	0.5	4	0.5	5	
8	0.5	3.5	0.7	4	0.7	4.5	0.8	4	
9	0.9	4	0.9	5	1.0	5	1.0	4.5	
10	1.0	4.5	1.0	5	1.3	5	1.3	5	
11	1.5	5	1.5	4.5	1.2	5	1.3	5	
12	1.0	5	1.0	6	0.9	5.5	0.9	4.5	
13	0.8	5.5	0.7	5	1.1	5.5	1.0	6	
14	1.0	5	2.2	5.5	1.8	5.5	1.4	5	
15	1.5	5	1.5	4.5	1.3	4	1.2	4.5	
16	0.8	5	0.8	5	0.8	5	1.3	5.5	
17	1.2	5.5	1.6	6	2.2	5	1.8	6	
18	2.5	5	1.9	5.5	2.0	4.5	1.9	5	
19	1.4	5	1.0	5	0.9	5	1.2	4	
20	1.2	4.5	1.5	5	1.7	5	1.7	5	
21	1.6	6.5	1.6	6	1.8	6	2.0	6	
22	1.8	6	2.4	6	2.5	6.5	1.9	7	
23	2.5	6	2.7	5.5	2.4	5.5	2.6	5	
24	1.4	5.5	1.7	5.5	1.5	5.5	1.7	5	
25	1.3	5	1.4	4.5	1.1	5	1.0	5	
26	1.0	5	1.0	6	0.8	6	0.8	5	
27	0.7	4	1.0	4	0.9	4.5	0.7	4.5	
28	0.8	5	0.8	5	1.0	5	1.2	5.5	
29	1.3	6	1.6	5	1.6	6	1.6	5	
30	1.8	5	1.4	5	1.4	5	1.0	5	
31	1.1	5	1.1	5	1.4	5	1.3	5	

An explanation of the notation used is given in the preface. The amplitude A<sub>N</sub> is half of the actual movement of the earth's surface in a N—S direction, between the ends of the swing ( $\mu = .001$  mm.). The period T (in seconds) is the duration of a complete oscillation, i.e. both extreme positions are passed through once during the time T.

## 2. VALENCIA OBSERVATORY, CAHIRCIVEEN (KERRY).—Lat. 51° 56' N. Long. 10° 15' W.

Heights above Mean Sea Level :—Station, H=12.6 m. Barometer Cistern, H<sub>b</sub>=13.7 m.

Heights above Ground :—Thermometers, h<sub>t</sub>=1.2 m. Rain-gauge, h<sub>r</sub>=0.56 m. Sunshine Recorder, h<sub>s</sub>=12.8 m. Cups of Anemometer, h<sub>a</sub>=13.9 m.

Day.	Pressure at Station Level.		Air Temperature in Degrees Absolute.				Humidity.				Wind Direction in Points (8=E, 16=S) and Velocity ( <i>metres per second</i> ).				Cloud Amount and Weather.		Rain 24 hours beginning 10 h.	Sunshine.	Remarks.	Magnetism.			
	9 h.	21 h.	9 h.	21 h.	Max.	Min.	Vapour Pressure.		Percentage.		9 h.	21 h.	9 h.	21 h.	10 h.	22 h.				Horizontal Force.	Declination West.	Inclination.	
	mb.	mb.	200+	200+	200+	200+	millibar.	%	%	m/sec.	m/sec.	Tenths of Sky covered.		mm.	hrs.								
1	1013.8	1013.0	86.0	86.2	89	82	13.2	12.9	88	84	6	4	4	3	1∞	1∞	—	6.8	∞	...	...	...	
2	1012.7	1011.7	86.4	87.0	89	85	12.9	13.5	84	85	4	3	7	2	3∞	8∞ <sup>2</sup>	—	6.5	∞	...	...	...	
3	1011.5	1007.8	85.6	84.1	x 90	84	13.5	12.5	94	94	—	0	—	0	10∞	0∞	—	...	∞	...	...	...	
4	1001.5	999.6	84.7	83.4	87	82	12.5	11.9	92	94	29	5	26	5	10∞	10∞	23.5	1.1	∞	...	...	...	
5	998.0	1002.1	83.5	81.1	86	80	10.8	9.8	87	93	25	2	3	2	10	2	1.0	1.2	∞	...	...	...	
6	1003.9	1002.4	83.4	84.1	86	80	11.2	11.2	90	84	4	5	5	8	7	10	2.4	2.4	∞	...	...	...	
7	998.2	997.0	83.9	84.9	86	83	10.8	11.2	83	82	4	7	1	6	6∞	10	0.5	3.8	∞	...	...	...	
8	1000.0	1004.9	83.5	79.8	86	79	10.8	9.1	85	93	3	2	3	3	2∞	0	—	9.3	∞	...	...	...	
9	1006.7	1005.7	86.3	87.6	89	79	12.5	12.9	82	77	9	6	11	9	10	1.0	1.0	1.7	∞	...	...	...	
10	998.4	996.3	87.9	85.2	88	84	11.2	12.9	n 66	91	11	14	15	6	10∞	10	2.8	0.1	∞	...	...	...	
11	1004.6	1008.1	85.6	86.5	88	83	12.9	14.6	89	95	15	3	14	9	7	10∞	15.8	6.8	∞	...	...	...	
12	1013.7	1013.6	88.1	88.5	x 90	x 87	16.3	15.9	95	93	15	6	15	10	10∞	10∞	1.5	0.6	∞	...	...	...	
13	1016.0	1015.2	88.5	87.2	89	x 87	16.6	15.6	96	97	15	9	15	9	10∞	10∞	3.0	—	∞	...	...	...	
14	1017.0	1022.1	87.4	85.3	88	83	15.9	12.2	97	86	—	0	—	1	10∞	4	0.3	—	∞	...	...	...	
15	1024.5	1023.8	83.4	80.7	87	80	10.5	9.8	85	94	4	3	8	2	0	0	—	9.2	∞	...	...	...	
16	1019.8	1015.6	87.4	88.5	x 90	83	14.6	17.3	91	99	14	8	15	8	10∞	10∞	2.5	0.1	∞	...	...	...	
17	1011.6	1009.3	87.9	87.1	89	x 87	15.9	14.9	94	92	14	11	14	10	8∞	10	4.8	0.1	∞	...	...	...	
18	1009.7	1006.7	87.5	87.4	88	x 87	16.3	14.6	99	90	15	4	13	9	10∞	10	3.0	—	∞	...	...	...	
19	997.2	990.8	86.2	84.5	88	82	14.6	12.5	96	93	18	5	22	9	10	10	6.9	0.3	∞	...	...	...	
20	997.5	994.0	81.8	79.9	84	79	9.5	9.1	84	93	15	4	20	3	7	10	14.0	2.1	∞	...	...	...	
21	996.9	996.6	80.3	80.3	83	77	8.5	7.8	83	75	22	4	25	5	8	3.3	1.8	3.3	∞	...	...	...	
22	1002.1	1013.9	76.7	81.0	83	75	7.1	7.8	90	74	2	3	5	6	0	1	—	8.3	—	∞	...	...	...
23	1022.2	1025.5	79.5	77.8	n 82	77	8.1	6.1	86	71	6	8	5	7	2	0	—	8.2	—	∞	...	...	...
24	1023.9	1018.3	73.7	76.7	n 82	n 73	5.4	7.1	84	91	—	1	6	2	4	0	—	8.1	—	∞	...	...	...
25	1010.9	1001.8	82.0	86.4	89	77	9.5	13.2	84	86	6	2	9	4	6	10	3.3	6.9	∞	...	...	...	
26	996.3	996.0	86.0	85.7	87	85	14.2	13.2	95	91	16	6	18	5	10∞	8	—	0.1	∞	...	...	...	
27	989.9	982.4	85.6	84.8	87	84	12.2	12.2	84	88	11	5	12	5	8	3	11.7	2.1	∞	...	...	...	
28	978.3	977.7	86.5	82.9	87	82	12.9	10.5	84	87	10	9	10	3	10	4	5.3	1.8	∞	...	...	...	
29	974.6	978.7	81.3	83.8	86	80	10.2	12.2	95	95	—	1	20	6	2	10	8.4	6.9	∞	...	...	...	
30	987.2	994.8	82.9	81.2	85	80	11.9	8.5	97	80	21	5	20	6	10∞	3	3.6	3.2	∞	...	...	...	
31	1002.1	1004.9	81.4	80.9	83	80	8.8	9.1	81	86	22	4	15	5	6	4	2.0	3.8	∞	...	...	...	
Means	1004.5	1004.2	84.2	83.9	86.7	81.4	12.0	11.7	88	88	4.8	5.4	6.9	6.2	209.0	3.40	—	—	—	17883	20 17.9	68 8.6	
Normal 40 years	1010.7	1011.0	83.7	83.5	86.6	81.1	11.1	11.0	86	85	5.3	5.1	—	—	139.4	3.26	—	—	—	—	—	—	—

x denotes the maximum and n the minimum value in the column.

Note.—The cloud amounts in italic type at Valencia were taken at 21 h.

3. KEW OBSERVATORY, SURREY.—Lat. 51° 28' N. Long. 0° 19' W.

Heights above Mean Sea Level:—Station, H = 5.5 m. Barometer, H<sub>b</sub> = 10.4 m.

Heights above Ground:—Thermometers, h<sub>t</sub> = 3.0 m. Rain-gauge, h<sub>r</sub> = 0.53 m. Sunshine Recorder, h<sub>s</sub> = 13.3 m. Cups of Anemometer, h<sub>a</sub> = 19.81 m.

Table with columns: Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points (8 = E, 16 = S) and Velocity (metres per second), Cloud Amount and Weather, Rain, 24 hours beginning 10 h., Sunshine, Solar Radiation, Milliwatts per cm², Min. Temp. on Grass, Earth Temperature at 10 h., Remarks.

4. ESKDALE OBSERVATORY, DUMFRIESSHIRE.—Lat. 55° 19' N. Long. 3° 12' W.

Heights above Mean Sea Level:—Station, H = 242.0 m. Barometer, H<sub>b</sub> = 237.0 m.

Heights above Ground:—Thermometers, h<sub>t</sub> = 0.9 m. Rain-gauge, h<sub>r</sub> = 0.40 m. Sunshine Recorder, h<sub>s</sub> = 1.5 m. Vane of Anemometer, h<sub>a</sub> = 15.0 m.

Table with columns: Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points (8 = E, 16 = S) and Velocity (metres per second), Cloud Amount and Weather, Rain, 24 hours beginning 10 h., Sunshine, Solar Radiation, Milliwatts per cm², Min. Temp. on Grass, Earth Temperature at 10 h., Remarks.

The solar radiation is the mean of the readings within the nominal hour of observation (11 h. 30 m.—12 h. 30 m.) unless some other hour is specified. Temperatures at or below the normal freezing point of water are printed in small type.

## 5. KEW OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor 1·73.				Charge per cc. × 10 <sup>20</sup> .		Velocities of Ions for 1 volt per centimetre.		Conductivity × 10 <sup>20</sup> .	Air-Earth Current × 10 <sup>16</sup> .		Electric Character of Day.	Magnetic Character of Day.	Horizontal Force.					West Declination.							
	3 h. 9 h. 15 h. 21 h.				+	-	+	-		E.-m. U.	C <sub>1</sub>			C <sub>2</sub>	Maximum. 18000 γ +.			Minimum. 18000 γ +.			Maximum. 15° +.			Minimum. 15° +.		
	v/m.	v/m.	v/m.	v/m.											E.-m. U.	E.-m. U.	cm/sec.	cm/sec.	E.-m. U.	Amp/cm <sup>2</sup> .	γ	h m	γ	h m	γ	h m
1	195	365	—	390	—	—	—	—	—	—	1	0	505	23 55	469	10 43	36	41° 0	12 45	30° 7	2 6	10° 3				
2	255	375	z+	270	—	—	—	—	—	—	2	0	505	6 16	469	11 20	36	40° 6	13 11	29° 9	8 35	10° 7				
3	265	650	210	295	—	—	—	—	—	—	1	0	509	19 50	479	10 3	30	38° 4	13 8	30° 0	8 26	8° 4				
4	305	230	305	305	—	—	—	—	—	—	1	1	536	21 56	484	10 39	52	40° 0	12 53	32° 0	8 9	8° 0				
5	z+	135	290	400	—	—	—	—	—	—	1	2	535	0 49	454	10 28	81	40° 9	12 58	23° 2	2 42	17° 7				
6	245	590	410	575	—	—	—	—	—	—	1	2	520	4 45	435	12 15	85	42° 6	6 51	27° 6	4 7	15° 0				
7	330	z±	375	475	—	—	—	—	—	—	2	2	522	19 36	449	14 45	73	41° 7	1 50	19° 0	19 27	22° 7				
8	z±	505	z+	155	—	—	—	—	—	—	2	1	527	19 43	446	10 30	81	43° 1	4 56	24° 2	19 16	18° 9				
9	85	375	220	70	—	—	—	—	—	—	1	1	516	17 20	461	12 25	55	39° 5	12 8	23° 3	17 5	16° 2				
10	290	475	400	465	—	—	—	—	—	—	0	1	507	20 29	435	12 8	72	40° 3	11 14	28° 6	0 28	11° 7				
11	170	135	-135	—	—	—	—	—	—	—	2	0	499	20 50	470	10 47	29	38° 0	11 44	28° 8	8 9	9° 2				
12	50	—	375	210	—	—	—	—	—	—	0	1	510	20 50	459	12 5	51	40° 3	11 40	25° 4	20 46	14° 9				
13	575	170	255	440	—	—	—	—	—	—	0	1	513	20 30	473	10 10	40	39° 4	12 47	27° 9	17 29	11° 5				
14	290	315	355	455	400	120	—	—	—	—	0	0	511	23 32	481	12 12	30	39° 0	12 56	31° 8	8 3	7° 2				
15	125	355	295	340	280	220	—	—	—	—	0	0	507	22 45	486	21 30	21	39° 7	13 32	29° 9	20 40	9° 8				
16	325	330	255	490	480	200	—	—	—	—	0	1	507	22 16	489 <sup>?</sup>	16 50 <sup>?</sup>	18 <sup>?</sup>	36° 2 <sup>+</sup>	?	28° 7	22 25	7° 5 <sup>+</sup>				
17	515	710	—	490	240	60	—	—	—	—	0	0	503	20 8	475	12 30	28	38° 9	13 32	30° 0	0 16	8° 9				
18	205	295	210	430	—	—	—	—	—	—	0	2	503	8 43	n 434	18 38	69	39° 7	13 11	22° 8	22 15	16° 9				
19	240	280	240	270	—	—	—	—	—	—	0	1	494	21 56	456	13 2	38	41° 6	13 40	24° 2	0 0	17° 4				
20	75	280	270	110	520	80	—	—	—	—	2	1	503	19 20	448	9 24	55	40° 5	12 21	28° 8	18 15	11° 7				
21	-125	95	—	575	—	—	—	—	—	—	2	0	512	22 8	475	11 2	37	39° 0	13 2	31° 1	8 38	7° 9				
22	325	695	325	305	440	320	—	—	—	—	1	0	525	21 14	482	10 58	43	40° 3	12 33	30° 1	21 9	10° 2				
23	465	610	700	505	—	—	—	—	—	—	0	0	514	18 10	485	10 35	29	38° 0	12 20	30° 6	8 25	7° 4				
24	430	410	475	-10	420	280	—	—	—	—	2	0	515	6 53	499	15 34	n 16	37° 8	12 20	31° 3	8 26	6° 5				
25	205	340	455	340	—	—	—	—	—	—	1	1	514	6 13	484	9 52	30	38° 4	12 5	27° 4	23 12	11° 0				
26	205	380	z-	—	—	—	—	—	—	—	2	0	512	22 53	481	10 46	31	37° 9	13 24	32° 0	0 1	n 5° 9				
27	—	—	120	180	220	140	—	—	—	—	1	0	520	18 1	484	11 5	36	38° 2	12 13	31° 1	8 46	7° 1				
28	135	110	—	230	500	20	—	—	—	—	2	0	512	20 30	479	10 8	33	39° 3	13 20	31° 0	8 50	8° 3				
29	120	245	z±	230	—	—	—	—	—	—	1	0	513	23 19	483	11 0	30	38° 6	12 20	31° 4	8 13	7° 2				
30	85	290	195	240	220	280	—	—	—	—	1	0	512	7 18	480	11 8	32	39° 2	12 42	26° 5	23 28	12° 7				
31	120	465	265	560	380	0	—	—	—	—	1	1	z 541	0 44	480	11 45	61	40° 2	11 56	27° 1	1 44	13° 1				
M.	259*	398*	324*	344*	—	—	—	—	—	—	—	—	514	—	470	—	44	39° 6	—	28° 3	—	11° 4				

\* 18 days. The mean values of the Potential gradient in Table 5 are computed from the data for those days on which values at each of the four hours, 3h, 9h, 15h, 21h, are given in the table. A similar note applies to the values in Table 6.

+ Probably a slight underestimate; some trace lost; clock stopped.

## 6. ESKDALE OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor 5·24.				Charge per cc. × 10 <sup>20</sup> .		Velocities of Ions for 1 volt per centimetre.		Conductivity × 10 <sup>20</sup> .	Air-Earth Current × 10 <sup>16</sup> .		Electric Character of Day.	Magnetic Character of Day.	North Component.				West Component.				Vertical Component.				
	3 h. 9 h. 15 h. 21 h.				+	-	+	-		E.-m. U.	C <sub>1</sub>			C <sub>2</sub>	Maximum. 15000 γ +.		Minimum. 15000 γ +.		Maximum. 5000 γ +.		Minimum. 5000 γ +.		Maximum. 45000 γ +.		Minimum. 45000 γ +.	
	v/m.	v/m.	v/m.	v/m.											E.-m. U.	E.-m. U.	cm/sec.	cm/sec.	E.-m. U.	Amp/cm <sup>2</sup> .	h m	γ	h m	γ	h m	γ
1	144	165	117	21	—	—	—	—	—	—	1a	0	1 42	1018	974	10 43	12 45	187	136	8 50	17 20	265	254	11 20		
2	144	110	69	144	—	—	—	—	—	—	0a	0	5 48	1018	978	10 2	12 10	187	134	9 0	16 20	264	253	11 50		
3	48	41	41	171	—	—	—	—	—	—	0a	0	3 28	1022	989	11 9	13 10	174	136	8 48	15 20	264	255	11 50		
4	377	446	144	206	—	—	—	—	—	—	0a	1	21 47	1053	984	10 41	12 55	184	147	9 16	16 0	264	250	12 15		
5	82	-21	117	69	—	—	—	—	—	—	1a	2	0 51	1047	962	10 27	5 25	202	88	2 43	17 7	273	n225	5 50		
6	0	199	144	206	—	—	—	—	—	—	1a	2	4 41	1036	n 930	7 11	2 50	205	120	4 6	17 50	274	233	3 25		
7	130	69	144	89	—	—	—	—	—	—	1b	2	19 30	1057	949	11 20	1 53	202	n 66	19 26	15 30	281	244	2 15		
8	z	z	171	75	—	—	—	—	—	—	2c	2	19 42	z 1067	950	7 37	4 55	z 216	93	19 11	15 15	277	236	5 7		
9	110	—	137	206	—	—	—	—	—	—	1a	2	17 13	1057	960	12 27	23 12	190	87	17 3	17 5	277	238	23 37		
10	151	123	254	357	—	—	—	—	—	—	0a	1	20 20	1030	938	12 10	13 23	185	119	0 30	16 55	286	241	0 0		
11	219	34	-178	110	—	—	—	—	—	—	2a	0	4 40	1010	974	12 13	0 42	175	131	8 0	18 50	269	257	1 30		
12	103	473	151	405	—	—	—	—	—	—	1a	1	20 48	1040	971	11 29	11 43	174	102	20 30	16 30	271	262	11 20		
13	583	309	137	357	—	—	—	—	—	—	0a	1	20 27	1032	975	10 58	12 56	177	114	17 29	17 25	274	260	4 35		
14	69	-1221	207	213	—	—	—	—	—	—	2b	0	23 33	1022	981	11 40	12 56	176	143	9 45	17 20	268	259	12 0		
15	110	192	137	528	—	—	—	—	—	—	1a	0	4 34	1019	982	10 56	13 33	183	84	20 10	20 20	272	259	12 50		
16	185	171	206	219	—	—	—	—	—	—	0a	0	22 17	1034	981	11 38	13 28	180	127	22 30	17 40	269	260	13 10		
17	226	233	110	123	—	—	—	—	—	—	0a	0	22 2	1015	983	11 50	13 27	176	128	0 13	16 30	268	258	10 35		
18	206	158	—	—	—	—	—	—	—	—	—	2	17 22	1017	947	18 35	{13 12}	187	77	22 22	19 53	z 321	254?	10 22		
19	—	—	—	—	—	—	—	—	—	—	—	2	5 14	1022	961	13 0	13 33	191	92	0 0	16 20	286	256	5 15		
20	—	—	206	z	—	—	—	—	—	—	—	1	6 29	1024	960	9 10	12 25	185	117	18 14	18 27	298	265	6 15		
21	z	137	130	151	—	—	—	—	—	—	1c	0	0 50	1025	972	11 30	13 3	175	138	8 57	15 55	282	272	1 14		
22	130	343	144	309	—	—	—	—	—	—	1b	0	21 12	1033	978	12 23	12 37	186	132	21 29	15 55	285	272	10 48		
23	110	-137	110	377	—	—	—	—	—	—	1b	0	18 50	1012	984	12 0	13 8	173	140	9 3	20 0	280	272	11 50		
24	288	185	130	226	—	—	—	—	—	—	0a	0	18 27	1016	991	10 17	13 1	172	143	9 10	15 30	278	272	10 45		
25	206	192	281	418	—	—	—	—	—	—	1b	1	5 31	1018	982	9 50	12 26	178	108	23 11</						

7. Tables of Wind Components in metres per second at fixed hours, together with the mean velocity (horizontal movement) in metres per second for the hour with the maximum hourly run for each day, or the greatest velocity attained in a gust and the time of its occurrence.

HOLYHEAD. †‡

Height of Head above—Roof 8.3 m., Ground 13.7 m., M.S.L. 19.2 m. Height of Cups above—Roof 4.6 m., Ground 7.6 m., M.S.L. 15.2 m.

DEERNESS. †

Height of Cups above—Roof 1.5 m., Ground 4.9 m., M.S.L. 57.3 m.

Main table for Holyhead and Deerness stations, containing columns for Date, 3h, 9h, 15h, 21h, Max. in a Gust, Time of Gust, and Vel. in Max. Hourly Run.

SCILLY. †‡

Height of Head above—Ground 9.8 m., M.S.L. 49.7 m. Height of Cups above—Ground 5.8 m., M.S.L. 45.7 m.

GREAT YARMOUTH. †‡

Height of Head above—Roof 10.7 m., Ground 12.8 m., M.S.L. 15.9 m. Height of Cups above—Roof 3.7 m., Ground 13.3 m., M.S.L. 22.3 m.

Main table for Scilly and Great Yarmouth stations, containing columns for Date, 3h, 9h, 15h, 21h, Max. in a Gust, Time of Gust, and Vel. in Max. Hourly Run.

The velocities at fixed hours are means for the interval from 30 minutes before to 30 minutes after the hour. The hours are numbered 1 h. to 24 h. Time is referred to Greenwich Mean Time. \* No Record. † Robinson Cup Anemometer; Arms 0.61 m.; Diameter of Cups, 0.229 m.; Factor 2.2. ‡ Robinson Cup Anemometer; Arms 0.305 m.; Diameter of Cups 0.127 m.; Factor 2.8. § Dines Pressure Tube Anemometer. At Great Yarmouth, Holyhead, and Scilly the readings at fixed hours are taken from the Robinson Anemometer; the maxima quoted are the greatest winds in a gust as recorded by the Dines Pressure Tube. || 26 days only. ¶ 28 days only. a 27 days only.

8. The Lower Layers of the Atmosphere from the Surface to 3000 metres (10,000 ft.) above Mean Sea Level.  
Soundings by Kites (K.) and Pilot Balloons (P.).

ABERDEEN. P. 65. October 17. 11 h. 30 m. G.M.T.								ABERDEEN. P. 66. October 22. 11 h. 20 m. G.M.T.								
Soundings with Pilot Balloons.	Height above M.S.L.	Wind.					Vertical Velocity of Balloon.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.					Vertical Velocity of Balloon.	Cloud Observations and Remarks.
		Direc-tion.	Velo-city.	Components.						Direc-tion.	Velo-city.	Components.				
				W.-E.	S.-N.							W.-E.	S.-N.			
Greatest height.	metres.	Degrees from N.	m/s.	m/s.	m/s.	m/s.		metres.	Degrees from N.	m/s.	m/s.	m/s.	m/s.			
	1940	...	...	...	...	...	Balloon lost in distance and town haze. Clouds at time were St. Cu. in long lenticular bands moving from W.S.W., their major axes lying W.S.W. - E.N.E. Wind squally. Temperature relatively high (61° F.)	1250?	...	...	...	...	...	Two theodolites used till balloon reached 100 m., when it was lost to out-station through passing directly overhead. It finally entered some Cu. clouds which were forming rapidly. A nephoscope observation at 13 h. gave W. - E. + 12'2 S. - N. + 0'1 (height of cloud assumed as 1250m.).		
	1775	242	21'9	+ 19'4	+ 10'1	2'8		1000	275	11'0	+ 11'0	- 1'0	...		} 2'9 assumed.	
	1500	242	24'4	+ 21'5	+ 11'5	2'8		700	272	9'9	+ 9'9	- 0'4	...			
	1000	246	24'4	+ 22'3	+ 9'8	3'1		500	262	8'9	+ 8'8	+ 1'2	...			
	500	237	19'9	+ 16'7	+ 10'8	4'5		250	246	7'2	+ 6'6	+ 2'9	...			
Ground level.	100	231	14'1	+ 11'0	+ 8'9	2'5	100	237	9'1	+ 7'6	+ 5'0	...				
Computed for M.S.L.	0	233	16'3	+ 13'0	+ 9'8	...	Lift 45 gm.	0	257	10'8	+ 10'5	+ 2'4	...	Lift 50 gm.		
ABERDEEN. P. 67. October 31. 11 h. 15 m. G.M.T.								FALMOUTH.* P. 5. October 9. 11 h. 0 m. G.M.T.								
	1250	...	...	...	...	...	Two theodolites used to 500 m., when balloon was lost to out-station. One theodolite used to 1250 m. Balloon was finally lost in distance and high haze. The balloon swept rapidly upward at first and then forward. Wind was very squally. Readings from both stations agreed in the vertical velocity at 100 m.	2130	...	...	...	...	...	} 2'2 assumed.		
	1000	229	14'9	+ 11'2	+ 9'9	3'0		2000	275	6'7	+ 6'5	- 0'6	...			
	750	234	12'5	+ 10'1	+ 7'4	3'0		1500	253	4'4	+ 4'2	+ 1'3	...			
	500	226	13'0	+ 9'4	+ 9'0	3'0		1000	222	4'5	+ 3'0	+ 3'3	...			
Ground level.	100	208	17'0	+ 7'9	+ 15'0	5'2		500	211	5'0	+ 2'6	+ 4'3	...			
Computed for M.S.L.	0	236	17'3	+ 14'3	+ 9'7	...	Lift 55 gm.	0	Pressure distribution of "Wedge" type.				Lift 20 gm.			
FALMOUTH. P. 10. October 15. 11 h. 30 m. G.M.T.								FALMOUTH. P. 14. October 22. 11 h. 30 m. G.M.T.								
	3920	301	16'1	+ 13'8	- 8'3	...	} 2'4 assumed.	2330	176	9'3	- 0'7	+ 9'3	...	} 2'6 assumed.		
	3500	318	12'8	+ 8'6	- 9'5	...		...	...	...	...	...	...			
	3000	323	10'4	+ 6'2	- 8'3	...		...	...	...	...	...	...			
	2500	313	12'8	+ 9'3	- 8'8	...		...	...	...	...	...	...			
	2000	319	7'6	+ 5'0	- 5'7	...		2000	173	8'6	- 1'0	+ 8'5	...			
	1500	338	6'3	+ 2'4	- 5'8	...		1500	166	7'3	- 1'8	+ 7'1	...			
	1000	349	6'9	+ 1'3	- 6'8	...		1000	147	7'8	- 4'3	+ 6'5	...			
Ground level.	500	12	7'7	- 1'6	- 7'5	...	500	132	7'4	- 5'5	+ 4'9	...				
Computed for M.S.L.	0	15	4'0	- 1'0	- 3'9	...	Lift 27'4 gm.	0	190	5'4	+ 0'9	+ 5'3	...	Lift 33'6 gm.		
FALMOUTH. P. 19. October 28. 12 h. 25 m. G.M.T.								FALMOUTH. P. 22. October 31. 11 h. 30 m. G.M.T.								
	2030	...	...	...	...	...	} 2'4 assumed.	2790	...	...	...	...	...	} 2'6 assumed.		
	...	...	...	...	...	...		2700	226	11'1	+ 8'0	+ 7'7	...			
	...	...	...	...	...	...		2500	230	9'3	+ 7'1	+ 6'0	...			
	2000	172	24'2	- 3'3	+ 24'0	...		2000	232	10'7	+ 8'4	+ 6'6	...			
	1500	170	23'6	- 4'0	+ 23'3	...		1500	230	10'0	+ 7'7	+ 6'4	...			
	1000	173	16'6	- 2'1	+ 16'5	...		1000	231	10'0	+ 7'8	+ 6'3	...			
Ground level.	500	166	15'8	- 3'8	+ 15'3	...		500	230	9'4	+ 7'2	+ 6'1	...			
Computed for M.S.L.	0	178	15'1	- 0'5	+ 15'1	...	Lift 27'2 gm.	0	220	12'2	+ 7'8	+ 9'3	...	Lift 36'1 gm.		

Time is expressed in the hours 1 to 24 of civil reckoning.

Pressure is given in millibars (1000 mb. = 1 C.G.S. atmosphere = 750 mm. approximately).

Gradient Wind is taken to be tangential to the isobar and is computed by the formula  $\gamma = 2\omega \rho V \sin \phi$ .

Base of Stratosphere.—TYPE 1.—When the stratosphere commences with an inversion, the height and temperature of the first point of zero temperature gradient are given.  
TYPE 2.—When the stratosphere begins with an abrupt transition to a temperature gradient below 2° per km. without inversion, the height and temperature of the abrupt transition are given.

TYPE 3.—When there is no such abrupt change of temperature gradient, the base is taken to be where the mean fall of temperature for the kilometer next above is 2° or less, provided that it does not exceed 2° for any subsequent kilometer. If some other position for the base seems to the tabulator to be more suitable, it is noted in the column for "Remarks."

\* For Falmouth cloud observations for October, see p. 79.

## 9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. October 2. 6 h. 55 m. G.M.T.				SOUNDING No., R. 260. PLACE, PYRTON HILL. Latitude, 51° 38' N. Longitude, 1° 0' W. Height above M.S.L., } 150 m. PLACE OF FALL, Cirencester. Distance and Orientation, 66 km. 277° from N.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.		
GREATEST HEIGHT, } LOWEST TEMPERATURE, } BASE OF STRATOSPHERE, } Type No. 1.	Height above M.S.L.	Pressure.	Temp.				km.	mb.		Reading.	Fall per Km.
										°A.	°C.
	12.4 km.	180 mb.	223° A.	12.0	191	223		Good trace, somewhat duplicated in the lower part. Foggy. Light E.N.E. wind. Heavy thunderstorm in afternoon; 45.7 mm. of rain at Oxford.			
	9.7 km.	275 mb.	219° A.	11.73	200	223	-1				
	9.7 km.	275 mb.	219° A.	11.0	223	222	-2				
				10.0	261	220					
				9.09	300	224					
				9.0	305	224	4				
				8.0	353	232	8				
				7.14	400	239	8				
				7.0	408	240					
				6.0	469	247	7				
				5.54	500	251	8				
				5.0	537	255					
				4.18	600	260	6				
				4.0	612	261.	6				
				3.0	697	267	7				
				2.97	700	267					
				2.0	790	274					
				1.90	800	275	6				
				1.0	893	280					
				.93	900	280	8				
				Ground M.S.L.	992	286.5	...				
					1009	...	...				

TABLE OF HEIGHTS, PRESSURES, TEMPERATURES, AND WINDS.

1913. October 13. 15 h. 53 m. G.M.T.				SOUNDING No., R. 262. PLACE, PYRTON HILL. Latitude, 51° 38' N. Longitude, 1° 0' W. Height above M.S.L., } 150 m. PLACE OF FALL, Northwood. Distance and Orientation, 41 km. 100° from N.	Height above M.S.L.	Pressure.	Temperature.		Wind.			REMARKS.		
GREATEST HEIGHT, } LOWEST TEMPERATURE, } BASE OF STRATOSPHERE, } Type No. 1.	Height above M.S.L.	Pressure.	Temp.				km.	mb.	Read- ing.	Fall per Km.	Direc- tion.		Velo- city.	Components.
									°A.	°C.	Degrees from N.		m/s.	W. to E. m/s.
	14.8 km.	125 mb.	204° A.	14.0	143	203	0	...	...	...	Light N.E. wind. Cirrus clouds. Inversion from 278° at 1.3 km. to 280° at 1.7 km., plainly shown on both traces at the same height.			
	12.5 km.	183 mb.	201° A.	13.0	168	203	0	...	...	...				
	12.5 km.	183 mb.	201° A.	12.0	197	203	...	...	...	...				
				11.93	200	203 204	7 9	...	...	...				
				11.0	233	210 212	8 8	...	...	...				
				10.0	272	218 220	9 9	...	...	...				
				9.35	300	224 226	9 9	...	...	...				
				9.0	417	227 229	9 9	...	...	...				
				8.0	367	236 238	9 9	...	...	...				
				7.38	400	242 244	9 9	...	...	...				
				7.0	422	245 247	8 6	...	...	...				
				6.0	484	253	8	...	...	...				
				5.75	500	255	...	...	...	...				
				5.0	552	261	6	...	...	...				
				4.36	600	265	...	...	...	...				
				4.0	628	267	...	...	...	...				
				3.14	700	272	6	...	...	...				
				3.0	712	273	194	8.2	2	8				
				2.06	800	278	5	...	...	...				
				2.0	808	278	2	194	8.2	2				
				1.11	900	280	...	...	...	...				
				1.0	912	280	180	6.0	0	6				
				.24	1000	286	7	...	...	...				
				Ground M.S.L.	1011	287	...	...	...	...				
					1028	...	...	...	...	...				

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. October 2. 17 h. 50 m. G.M.T.				SOUNDING No., R.M.C. 56. PLACE, MUNGRETT COLLEGE. Latitude, 52° 38' N. Longitude, 8° 41' W. Height above M.S.L., } 15 m. PLACE OF FALL, Bantry. Distance and Orientation, 124 km. 210° from N.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.		
GREATEST HEIGHT, } LOWEST TEMPERATURE, } BASE OF STRATOSPHERE, } Type No. 2.	Height above M.S.L.	Pressure.	Temp.				km.	mb.		Reading.	Fall per Km.
										°A.	°C.
	14.6 km.	132 mb.	220° A.	14.0	145	220	-1	Overcast. Light N.E. wind. The figures are somewhat doubtful, for the instrument was damaged between the calibration and the ascent. Particularly clear trace. Isothermal from 2.6 to 2.9 km. Base of stratisphere indefinite.			
	13.0 km.	127 mb.	219° A.	13.0	168	219	1				
	11.0 km.	268 mb.	221° A.	12.0	196	220					
				11.88	200	220	1				
				11.0	229	221					
				10.0	268	224	3				
				9.21	300	229	6				
				9.0	310	230	8				
				8.0	358	238	8				
				7.22	400	244	8				
				7.0	413	246	8				
				6.0	494	254	6				
				5.57	500	257	6				
				5.0	540	260					
				4.21	600	265	6				
				4.0	616	266	6				
				3.0	700	272	4				
				2.0	790	276	7				
				1.93	800	276					
				1.0	897	283					
				.96	900	283					
				.10	1000	286	3				
				Ground M.S.L.	1010	286	...				
					1011	...	...				

# METEOROLOGICAL OFFICE OBSERVATORIES—GEOPHYSICAL JOURNAL.

NOVEMBER 1913.—DAILY VALUES REFERRED TO GREENWICH MEAN TIME, AND UNITS  
BASED ON THE C.G.S. SYSTEM. [Price 1s.]

Third Year.—No. 11. *Meteorology, Solar Radiation, Seismology, Atmospheric Electricity, and Terrestrial Magnetism.*

## 1. SEISMOLOGICAL JOURNAL:—ESKDALE OBSERVATORY.—Lat. 55° 19' N. Long. 3° 12' W.

Date.	Microseisms of N. Component.								Remarks.
	0 h.		6 h.		12 h.		18 h.		
	A.N. μ	T. s	A.N. μ	T. s	A.N. μ	T. s	A.N. μ	T. s	
1	1'3	5	1'1	5'5	1'1	5'5	1'5	5'5	1st, I, Very small disturbance from 3 h. 19'5 m.—3 h. 48 m.
2	1'9	5'5	1'8	5'5	2'1	6'5	3'9	8	4th, I, S=10 h. 24 m. 18 s., L=10 h. 39 m. End 11 h. 36 m.
3	4'7	9	4'3	8'5	5'6	9	3'8	7'5	6th, I, Small disturbance from 11 h. 0 m.—11 h. 51 m.
4	3'3	6	2'0	7'5	2'4	6	1'8	7'5	9th, I, L=14 h. 7'5 m. Small earthquake. End 14 h. 54 m.
5	2'4	6	2'2	6'5	2'0	6'5	2'6	7'5	10th, Iu, P=21 h. 31 m. 58 s., L=22 h. 23 m. Very remote earthquake, nearly due N. End 0 h. 5 m.
6	3'1	8	2'8	7'5	2'4	8	2'1	7	15th, I, L=6 h. 35 m. Small earthquake. End 7 h. 36 m.
7	1'6	6'5	1'6	6'5	1'2	6	0'9	5'5	19th, I, S(?)=3 h. 45 m. 41 s. L=4 h. 12 m. Small earthquake. End 6 h. 0 m.
8	1'0	5	0'9	6'5	0'9	6	1'0	5	23rd, I, S(?)=21 h. 38 m. 43 s., L=21 h. 55'5 m. Small earthquake. End 22 h. 42 m.
9	1'0	6	1'1	7	1'1	6'5	1'0	7	
10	1'0	7	1'0	6	1'0	6'5	1'0	5	
11	1'0	4'5	1'0	4'5	1'0	4'5	0'9	5	
12	1'0	5	1'0	5	1'1	5	1'3	5	
13	1'3	5	1'2	4'5	1'1	5	1'1	5	
14	1'1	6	1'1	5	1'8	6	2'4	7'5	
15	4'3	7'5	2'9	7'5	3'0	7	3'0	7	
16	3'3	7	2'7	7'5	3'2	7'5	3'0	7	
17	2'5	6'5	3'1	6	3'1	7	4'2	7'5	
18	6'7	7	5'5	6'5	4'0	6'5	3'2	7	
19	3'4	6'5	3'5	7	2'6	7	2'7	6'5	
20	3'0	6'5	3'4	6	3'9	6	3'7	6'5	
21	3'4	6	2'9	6	1'8	6	1'8	6	
22	2'1	5	1'4	5	1'6	6	2'0	5'5	
23	1'9	6	2'5	6'5	3'4	7	3'1	6'5	
24	3'8	7	2'6	6'5	2'7	7	2'3	6'5	
25	2'2	7	2'2	7	2'8	7	3'5	7	
26	4'1	7	5'5	7'5	6'3	7'5	7'3	8	
27	6'2	8	4'4	7	2'7	7'5	2'2	7	
28	2'2	6'5	2'3	6	2'6	6	3'1	6'5	
29	3'1	7'5	2'9	7	2'2	7	3'3	7	
30	4'3	7	6'6	7	6'8	8	5'0	7	

An explanation of the notation used is given in the preface. The amplitude A<sub>N</sub> is half of the actual movement of the earth's surface in a N-S direction, between the ends of the swing (μ = .001 mm.). The period T (in seconds) is the duration of a complete oscillation, i.e. both extreme positions are passed through once during the time T.

## 2. VALENCIA OBSERVATORY, CAHIRCIVEEN (KERRY).—Lat. 51° 56' N. Long. 10° 15' W.

Heights above Mean Sea Level:—Station, H = 12.6 m. Barometer Cistern, H<sub>b</sub> = 13.7 m.

Heights above Ground:—Thermometers, h<sub>t</sub> = 1.2 m. Rain-gauge, h<sub>r</sub> = 0.56 m. Sunshine Recorder, h<sub>s</sub> = 12.8 m. Cups of Anemometer, h<sub>a</sub> = 13.9 m.

Day.	Pressure at Station Level.		Air Temperature in Degrees Absolute.				Humidity.				Wind Direction in Points (8=E, 16=S) and Velocity (metres per second).		Cloud Amount and Weather.		Rain 24 hours beginning 10 h.	Sunshine.	Remarks.	Magnetism.				
	9 h.	21 h.	9 h.	21 h.	Max.	Min.	Vapour Pressure.		Percentage.		9 h.	21 h.	10 h.	22 h.				Horizontal Force.	Declination West.	Inclination.		
	mb.	mb.	200+	200+	200+	200+	millibar.	%	%	m/sec.	m/sec.	Tenths of Sky covered.		mm.	hrs.							
1	1003.7	995.5	80.6	84.6	85	77	9.5	11.9	91	88	13	5	20	7	10	3	12.2	—	Visibility. ☉ 15 h. 30 m.—18 h.	7.	...	...
2	999.4	1003.1	84.5	83.2	85	80	11.5	9.1	85	74	18	5	22	12	10	5	7.4	—	Gloomy.	...	...	...
3	1011.9	1013.6	84.0	79.7	85	79	9.8	8.8	76	90	22	9	—	1	7	2	1.3	6.4	Showery to fair.	...	...	...
4	1006.4	1004.0	83.7	82.8	86	82	11.5	10.2	91	84	14	6	20	7	10≡0	3	6.9	0.1	☉.	...	...	...
5	1000.6	993.8	82.2	81.0	84	80	10.2	9.5	89	90	21	7	22	7	10≡0	10	10.7	2.8	Showery; visibility. [showery.	...	...	...
6	992.1	1001.8	81.2	82.6	84	80	9.1	9.8	85	83	27	5	30	8	10≡0	7	5.6	1.9	☉ 9 h. 40 m. Squally and	...	...	...
7	1006.2	996.5	78.5	82.6	84	77	8.5	11.2	96	95	3	2	24	7	7	10≡0	15.8	0.7	Visibility. ☉ 16 h.—22 h.	17899	20 19.7	68 8.8
8	999.8	995.7	81.4	84.1	85	81	9.5	11.5	86	87	18	3	14	8	10≡0	8	3.1	0.5	Showery; visibility.	...	...	...
9	992.8	989.0	85.1	86.6	87	84	13.2	12.9	95	83	14	8	9	9	10≡0	10	17.3	—	Showery.	...	...	...
10	990.4	990.1	85.1	85.2	87	84	12.2	11.5	88	82	13	7	12	8	7	10	3.3	2.8	Fair. Showery late p.	...	...	...
11	985.7	981.6	83.8	81.3	86	80	11.5	10.2	89	93	9	4	—	1	7	4	10.7	2.9	Showery to fair.	...	...	...
12	987.6	993.4	82.9	80.7	84	80	11.2	7.8	91	75	28	9	29	9	10≡0	9	3.8	1.2	☉ a. Showery p.	...	...	...
13	999.3	1000.1	81.6	82.0	84	79	8.5	9.8	76	86	28	8	20	4	7	10≡0	4.3	4.6	Visibility; showery.	...	...	...
14	1000.0	1001.3	81.9	81.1	84	81	9.1	9.1	81	86	27	11	25	13	7	7	5.6	1.6	Squally and showery.	...	...	...
15	1004.8	1007.4	82.4	83.5	84	81	9.8	10.2	84	81	25	8	23	12	5	10	—	0.5	Squally and showery.	...	...	...
16	1012.4	1013.9	83.8	85.6	86	83	10.2	13.9	78	95	22	7	21	6	10≡0	10≡0	0.5	—	Dull, with ☉.	...	...	...
17	1013.9	1016.8	85.4	82.0	86	82	13.9	10.8	97	95	20	11	17	2	10≡0	10≡0	11.7	—	☉. ☉ 20 h. 30 m.—23 h.	...	...	...
18	1010.6	1023.7	83.4	81.3	85	80	10.5	7.8	84	72	22	13	25	10	9≡0	9	1.5	3.5	Squally and showery.	...	...	...
19	1026.0	1016.3	82.0	83.8	84	80	8.8	10.2	78	80	20	6	17	8	10	10	3.8	0.4	Dull; visibility.	...	...	...
20	1012.2	1004.6	84.3	84.5	85	83	12.9	13.5	97	100	21	9	18	4	8≡0	10≡0	4.1	—	Dull, with ☉.	...	...	...
21	1008.2	1020.0	81.0	80.7	84	80	8.5	7.8	81	74	26	7	26	6	4	1	1.8	4.4	Fair to showery; visibility.	17902	20 18.2	68 8.8
22	1023.9	1016.1	79.3	83.2	83	76	8.1	9.8	85	81	14	4	15	9	8	10	21.8	—	Visibility to gloomy.	...	...	...
23	1003.5	1009.5	83.7	80.1	84	79	12.5	8.1	99	81	15	10	24	9	10≡0	10	10.2	—	Heavy mist a. ☉ 8 h.—12 h.	...	...	...
24	1008.5	1014.2	81.7	81.5	84	79	10.2	9.5	92	88	16	7	24	4	10≡0	10≡0	7.4	—	Showery a. Gloomy.	...	...	...
25	1018.0	1019.1	84.4	84.5	85	82	12.2	12.9	90	95	20	6	20	8	10≡0	10≡0	2.3	0.1	☉.	...	...	...
26	1025.7	1029.8	81.8	79.6	85	79	8.8	9.1	80	92	27	3	23	2	7	5	1.8	1.8	Fair. ☉ n.	...	...	...
27	1031.3	1033.1	84.0	83.4	85	82	12.9	12.5	99	99	22	5	24	2	10≡0	10≡0	0.5	—	☉ 2 h.—5 h. ☉ and ☉.	...	...	...
28	1032.9	1031.1	83.5	83.4	84	83	12.5	12.5	99	100	22	4	17	4	10≡0	7≡0	0.8	—	☉ a. and p.	...	...	...
29	1028.0	1025.8	84.1	83.8	85	83	12.9	12.5	100	98	18	4	20	3	10≡0	10≡0	1.0	—	☉ all day.	...	...	...
30	1025.5	1022.2	82.6	84.0	85	82	11.9	12.9	99	99	—	1	22	2	10≡0	10≡0	3.8	—	Heavy mist a.	...	...	...
Means	1008.7	1008.8	82.8	82.7	84.7	80.6	10.7	10.6	89	88	6.5	6.4	8.8	8.0	177.0	1.21	—	—	Monthly Totals or Means.	17900	20 19.0	68 8.8
Normal 40 years	1011.4	1011.5	81.3	81.4	84.2	79.0	9.6	9.6	87	86	5.7	5.8	—	—	136.9	2.20	—	—	Normals, 40 years.	—	—	—

z denotes the maximum and n the minimum value in the column.

Note.—The cloud amounts in italic type at Valencia were taken at 21 h.

3. KEW OBSERVATORY, SURREY.—Lat. 51° 28' N. Long. 0° 19' W.

Heights above Mean Sea Level :—Station, H = 5.5 m. Barometer, H<sub>b</sub> = 10.4 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 3.0 m. Rain-gauge, h<sub>r</sub> = 0.53 m. Sunshine Recorder, h<sub>s</sub> = 13.3 m. Cups of Anemometer, h<sub>a</sub> = 19.81 m.

Table for Kew Observatory, Surrey, containing columns for Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points and Velocity, Cloud Amount and Weather, Rain 24 hours beginning 10 h, Sunshine, Solar Radiation, Min. Temp. on Grass, Earth Temperature at 10 h, and Remarks. Includes monthly totals and normals for 40 years.

4. ESKDALE OBSERVATORY, DUMFRIESSHIRE.—Lat. 55° 19' N. Long. 3° 12' W.

Heights above Mean Sea Level :—Station, H = 242.0 m. Barometer, H<sub>b</sub> = 237.0 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 0.9 m. Rain-gauge, h<sub>r</sub> = 0.40 m. Sunshine Recorder, h<sub>s</sub> = 1.5 m. Vane of Anemometer, h<sub>a</sub> = 15.0 m.

Table for Eskdale Observatory, Dumfriesshire, containing columns for Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity, Wind Direction in Points and Velocity, Cloud Amount and Weather, Rain 24 hours beginning 10 h, Sunshine, Solar Radiation, Min. Temp. on Grass, Earth Temperature at 10 h, and Remarks. Includes monthly totals and normals for 1911-12.

The solar radiation is the mean of the readings within the nominal hour of observation (11 h. 30 m.—12 h. 30 m.) unless some other hour is specified. Temperatures at or below the normal freezing point of water are printed in small type.



5. KEW OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor 1.76.				Charge per cc. × 10 <sup>20</sup> .		Velocities of Ions for 1 volt per centimetre.		Conductivity × 10 <sup>10</sup> .	Air-Earth Current × 10 <sup>16</sup> .		Electric Character of Day.	Magnetic Character of Day.	Horizontal Force.			West Declination.					
	3 h.	9 h.	15 h.	21 h.	+	-	+	-		c <sub>1</sub>	c <sub>2</sub>			Maximum. 18000 γ +.	Minimum. 18000 γ +.	Range.	Maximum. 15° +.	Minimum. 15° +.	Range.			
	v/m.	v/m.	v/m.	v/m.	E.-m. U.	E.-m. U.	cm/sec.	cm/sec.	E.-m. U.	Amp/cm <sup>2</sup> .	γ	h m	γ	h m	γ	h m	h m	h m	h m			
1	110	375	360	540	—	—	—	—	—	—	I	0	504	22 46	472	11 28	32	39° 0	12 11	32° 0	8 10	7° 0
2	95	130	360	230	—	—	—	—	—	—	I	2	517	23 24	450	13 37	26 67	41° 3	13 23	23° 2	22 9	18° 1
3	120	480	310	505	140	400	—	—	—	—	I	1	509	22 10	446	13 9	63	41° 4	4 22	27° 8	0 0	13° 6
4	460	600	400	420	—	—	—	—	—	—	I	0	500	21 11	475	10 41	25	37° 4	12 32	31° 0	8 27	6° 4
5	240	255	±	565	—	—	—	—	—	—	I	0	504	20 34	475	10 12	29	37° 4	12 24	32° 2	8 30	5° 2
6	360	605	370	120	180	220	—	—	—	—	I	1	497	21 35	471	18 55	26	36° 3	11 19	30° 4	22 26	5° 9
7	445	425	370	520	240	120	—	—	—	—	I	1	512	23 19	445	16 24	26 67	35° 6	12 4	26° 9	2 2	8° 7
8	385	385	280	685	—	—	—	—	—	—	I	1	516	20 58	471	12 5	45	35° 6	12 54	29° 5	21 36	6° 1
9	145	435	375	385	—	—	—	—	—	—	I	0	497	20 41	475	13 50	22	36° 6	12 38	30° 6	18 16	6° 0
10	220	255	340	460	220	0	—	—	—	—	2	0	504	20 43	478	10 5	26	36° 5	13 34	31° 6	7 46	4° 9
11	445	255	325	310	340	280	—	—	—	—	2	0	510	19 30	483	10 25	27	36° 9	13 10	30° 4	21 34	6° 5
12	130	±	375	70	160	280	—	—	—	—	2	0	509	22 25	479	11 42	30	36° 7	13 6	29° 3	10 38	7° 4
13	85	110	105	170	220	60	—	—	—	—	2	0	511	5 1	485	13 26	26	36° 1	12 27	30° 8	9 0	5° 3
14	240	110	255	425	260	400	—	—	—	—	2	0	507	20 41	487	10 52	20	36° 4	12 39	30° 8	23 20	5° 6
15	85	400	195	85	—	—	—	—	—	—	1	0	506	19 34	492	10 37	14	35° 5	12 45	30° 6	0 9	4° 9
16	190	205	230	230	—	—	—	—	—	—	0	0	508	16 40	488	11 18	20	37° 3	12 22	30° 9	9 36	6° 4
17	275	280	—	205	340	360	—	—	—	—	2	0	508	17 56	485	10 35	23	36° 4	13 30	31° 8	9 12	4° 6
18	120	—	—	—	240	380	—	—	—	—	0?	0	505	21 23	488	10 42	17	36° 4	12 50	30° 8	9 4	5° 6
19	—	—	315	420	140	100	—	—	—	—	0	0	518	22 0	489	12 37	29	34° 9	12 40	29° 6	22 34	5° 3
20	95	275	230	205	—	—	—	—	—	—	0	0	508	19 22	484	10 2	24	35° 5	12 34	31° 7	23 19	3° 8
21	85	240	25	190	—	—	—	—	—	—	2	0	510	22 21	486	10 52	24	35° 1	12 7	29° 6	22 19	5° 5
22	515	665	700	155	—	—	—	—	—	—	1	0	508	17 50	488	11 48	20	35° 4	12 19	30° 6	23 11	4° 8
23	1195	1015	495	520	—	—	—	—	—	—	0	0	510	19 15	482	10 28	28	35° 1	12 26	30° 6	22 59	4° 5
24	290	590	445	675	—	—	—	—	—	—	0	0	503	18 45	486	10 57	17	35° 1	11 51	30° 8	19 15	4° 3
25	190	350	250	250	360	360	—	—	—	—	0	0	505	18 40	487	11 58	18	35° 2	12 15	30° 6	8 52	4° 6
26	110	160	265	455	320	80	—	—	—	—	0	0	505	7 35	478	11 10	27	36° 4	13 28	30° 6	22 10	5° 8
27	375	395	275	135	180	100	—	—	—	—	0	1	505	7 42	466	17 14	39	37° 4	17 23	27° 5	21 3	9° 9
28	120	255	280	400	300	260	—	—	—	—	0	1	530	21 55	463	12 21	26 67	36° 6	12 44	26° 0	15 14	10° 6
29	300	410	395	220	—	—	—	—	—	—	0	0	498	20 8	463	11 54	35	36° 1	13 14	30° 5	8 8	5° 6
30	70	230	250	180	—	—	—	—	—	—	0	0	495	22 30	480	15 2	15	35° 1	12 50	29° 5	20 47	5° 6
M.	220*	365*	315*	339*	—	—	—	—	—	—	—	—	507	—	477	—	31	36° 6	—	29° 9	—	6° 6

\* 25 days. The mean values of the Potential gradient in Table 5 are computed from the data for those days on which values at each of the four hours, 3h, 9h, 15h, 21h, are given in the table. A similar note applies to the values in Table 6.  
 † Action of instrument doubtful.  
 ‡ Indeterminate.

6. ESKDALE OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor 5.24.				Charge per cc. × 10 <sup>20</sup> .		Velocities of Ions for 1 volt per centimetre.		Conductivity × 10 <sup>10</sup> .	Air-Earth Current × 10 <sup>16</sup> .		Electric Character of Day.	Magnetic Character of Day.	North Component.			West Component.		Vertical Component.					
	3 h.	9 h.	15 h.	21 h.	+	-	+	-		c <sub>1</sub>	c <sub>2</sub>			Maximum. 15000 γ +.	Minimum. 15000 γ +.	Range.	Maximum. 5000 γ +.	Minimum. 5000 γ +.	Maximum. 45000 γ +.	Minimum. 45000 γ +.	Range.			
	v/m.	v/m.	v/m.	v/m.	E.-m. U.	E.-m. U.	cm/sec.	cm/sec.	E.-m. U.	Amp/cm <sup>2</sup> .	h m	γ	h m	γ	h m	h m	γ	h m	h m	γ	h m	γ	h m	γ
1	z	83	160	271	—	—	—	—	—	—	2 c	0	4 20	1018	982	11 22	13 1	179	144	1 48	16 20	281	266	0 50
2	21	187	139	840	—	—	—	—	—	—	2 c	2	23 22	1033	960	13 15	6 59	192	83	21 47	15 18	286	244	2 13
3	42	42	97	167	—	—	—	—	—	—	1 b	1	22 5	1030	954	13 10	4 27	195	116	0 7	15 10	280	272	0 0
4	180	201	278	97	—	—	—	—	—	—	1 a	0	21 11	1013	983	10 53	12 29	172	145	9 6	15 10	280	272	0 0
5	49	340	—	—	—	—	—	—	—	—	1 b	0	5 18	1015	983	10 12	12 24	167	143	8 59	15 30	274	269	11 20
6	—	—	534	333	—	—	—	—	—	—	—	1	5 5	1020	978	18 53	11 17	171	137	22 28	19 10	284	262	24 0
7	229	264	243	472	—	—	—	—	—	—	1 a	2	23 15	1034	958	16 24	10 36	169	121	2 2	16 23	2300	250	3 18
8	201	104	555	90	—	—	—	—	—	—	1 a	1	20 54	1041	985	12 3	0 9	173	134	18 36	15 57	278	257	0 35
9	389	645	347	465	—	—	—	—	—	—	1 a	0	23 10	1016	982	13 37	13 13	173	141	18 10	14 50	274	267	0 0
10	194	49	278	999	—	—	—	—	—	—	2 b	0	5 20	1016	985	12 12	13 54	174	144	10 5	14 8	272	266	1 0
11	173	298	368	278	—	—	—	—	—	—	1 b	0	19 28	1020	994	11 50	12 52	172	139	21 33	15 0	269	265	6 2
12	312	153	368	361	—	—	—	—	—	—	2 c	0	22 23	1026	990	11 40	13 7	172	130	22 38	15 20	269	261	2 28
13	173	472	208	146	—	—	—	—	—	—	0 a	0	5 6	1022	991	13 25	12 22	170	147	23 49	15 20	268	261	10 35
14	28	90	z	z	—	—	—	—	—	—	2 c	0	23 58	1017	994	11 23	13 0	172	145	0 11	0 30	268	262	10 50
15	69	z	125	z	—	—	—	—	—	—	2 c	0	0 5	1018	1003	12 38	13 23	170	145	0 6	1 40	266	258	13 0
16	69	69	97	14	—	—	—	—	—	—	2 b	0	17 43	1019	995	11 18	12 52	172	146	9 38	15 10	266	261	11 45
17	76	0	83	97	—	—	—	—	—	—	1 a	0	16 41	1027	997	12 5	14 13	172	150	9 19	14 40	266	261	11 10
18	104	90	153	278	—	—	—	—	—	—	2 c	0	6 32	1019	1000	12 8	13 15	171	146	9 35	17 20	264	258	11 50
19	104	-284	132	56	—	—	—	—	—	—	1 c	0	21 55	1037	1000	11 35	13 0	165	140	22 34	14 40	266	259	22 3
20	-62	125	160	146	—	—	—	—	—	—	2 b	0	19 23	1019	997	9 55	12 45	169	147	0 25	14 40	263	259	5 55
21	-167	125	285	417	—	—	—	—	—	—	2 b	0	22 19	1030	1000	11 38	13 14	168	141	22 20	21 15	263	260	24 0
22	229	486	618	597	—	—	—	—	—	—	0 a	0	6 41	1019	997	10 32	12 55	170	150	23 22	14 10	263	259	10 0
23	354	305	340	264	—	—	—	—	—	—	0 a	0	19 17	1021	996	10 46	13 0	166	144	22 53	9 30	262	257	19 20
24	69	250	264	347	—	—	—	—	—	—	2 c	0	17 20	1017	1000	10 38	13 13	169	149	0 13	0 1	259	255	5 0
25	264	236	174	21	—	—	—	—	—	—	1 b	0	21 5	1024	1002	10 22	13 50	168	147	21 55	15 0	259	255	3 25
26	83	76	—	—	—	—	—	—	—	—	—	0	7 32	1022	991	11 11	13 29	178	144	22 6	13 30	259	253	9 50
27	—	—	167	153	—	—	—	—	—</															

7. Tables of Wind Components in metres per second at fixed hours, together with the mean velocity (horizontal movement) in metres per second for the hour with the maximum hourly run for each day, or the greatest velocity attained in a gust and the time of its occurrence.

HOLYHEAD. †§

Height of Head above—Roof 8.8 m., Ground 13.7 m., M.S.L. 19.2 m. Height of Cups above—Roof 4.6 m., Ground 7.6 m., M.S.L. 15.2 m.

DEERNESS. †

Height of Cups above—Roof 1.5 m., Ground 4.9 m., M.S.L. 57.3 m.

Main data table for Holyhead and Deerness stations, including columns for Date, 3h, 9h, 15h, 21h, Max. in a Gust, Time of Gust, and Vel. in Max. Hourly Run.

SCILLY. †§

Height of Head above—Roof 9.8 m., M.S.L. 49.7 m. Height of Cups above—Ground 5.8 m., M.S.L. 45.7 m.

GREAT YARMOUTH. †§

Height of Head above—Roof 10.7 m., Ground 12.8 m., M.S.L. 15.9 m. Height of Cups above—Roof 3.7 m., Ground 13.3 m., M.S.L. 22.3 m.

Main data table for Scilly and Great Yarmouth stations, including columns for Date, 3h, 9h, 15h, 21h, Max. in a Gust, Time of Gust, and Vel. in Max. Hourly Run.

The velocities at fixed hours are means for the interval from 30 minutes before to 30 minutes after the hour. The hours are numbered 1 h. to 24 h. Time is referred to Greenwich Mean Time. † Robinson Cup Anemometer; Arms 0.61 m.; Diameter of Cups, 0.229 m.; Factor 2.2. § Dines Pressure Tube Anemometer. At Great Yarmouth, Holyhead, and Scilly the readings at fixed hours are taken from the Robinson Anemometer; the maxima quoted are the greatest winds in a gust as recorded by the Dines Pressure Tube.

8. The Lower Layers of the Atmosphere from the Surface to 3000 metres (10,000 ft.) above Mean Sea Level.

Soundings by Kites (K.) and Pilot Balloons (P.).

ABERDEEN. P. 68. November 5. 11 h. 20 m. G.M.T.							ABERDEEN P. 69. November 14. 11 h. 20 m. G.M.T.							
Soundings with Pilot Balloons.	Height above M.S.L.	Wind.			Vertical Velocity of Balloon.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.			Vertical Velocity of Balloon.	Cloud Observations and Remarks.		
		Direction.	Velocity.	Components.				Direction.	Velocity.	Components.				
				W.-E.						S.-N.			W.-E.	S.-N.
metres.	Degrees from N.	m/s.	m/s.	m/s.	m/s.	metres.	Degrees from N.	m/s.	m/s.	m/s.	m/s.			
Greatest height.	4000	...	...	...	...	3100	...	...	...	...	...	Two theodolites to 4000 m. See note below.	Two theodolites to 2300 m. See note below.	
	3750	195	15.8	+ 4.2	+15.2	2.8	...	...	...	...	...			
	3500	206	16.9	+ 7.4	+15.2	2.8	...	...	...	...	...			
	3000	224	13.4	+ 9.4	+ 9.6	2.7	3000	287	12.1	+11.5	- 3.6			
	2500	241	7.8	+ 6.8	+ 3.7	3.2	2500	290	10.7	+10.1	- 3.6			
	2000	254	2.9	+ 2.8	+ 0.8	3.2	2000	292	16.3	+15.1	- 6.1	2.3		
	1500	268	3.4	+ 3.4	+ 0.1	2.6	1500	291	18.8	+17.5	- 6.7	2.3		
	1000	298	4.3	+ 3.8	- 2.0	2.7	1000	277	14.6	+14.5	- 1.9	3.5		
	500	308	5.7	+ 4.5	- 3.5	2.7	500	264	10.6	+10.5	+ 1.1	3.4		
	100	265	3.4	+ 3.4	+ 0.3	2.5	100	237	6.8	+ 5.7	+ 3.7	2.4		
Ground level.	30	270	2.0	+ 2.0	0.0	...	30	239	4.3	+ 3.7	+ 2.2	...		
Computed for M.S.L.	0	225	6.3	+ 4.5	+ 4.5	...	0	260	11.7	+11.5	+ 2.0	...	Lift 46 gm.	
ABERDEEN. P. 70. November 19. 11 h. 20 m. G.M.T.							ABERDEEN. P. 71. November 21. 11 h. 20 m. G.M.T.							
Greatest height.	3400	...	...	...	...	...	2700	...	...	...	...	Balloon lost in high haze. It was lost to home station in chimney smoke after 2500 m. At 11 h. 45 m. a sheet of floccular Ci.-Cu. of rather coarse type appeared and was observed with the nephoscope. Assuming an altitude of 5000 m. (on account of its rather coarse type), the observations would give components as follows:—W.-E. + 30.0 m/s.; S.-N. - 9.0 m/s.	Two theodolites. Balloon lost in sheet of A.-St. cloud.	
	3250	288	14.2	+13.5	- 4.3	2.7 as-sumed.	...	...	...	...	...			
	3000	293	14.5	+13.3	- 5.7	...	...	...	...	...	...			
	2500	289	23.1	+21.9	- 7.4	2.0	2500	252	11.4	+10.8	+ 3.5	2.7		
	2000	278	29.6	+29.3	- 4.3	4.9	2000	280	12.3	+12.1	- 2.2	3.4		
	1500	278	22.8	+22.6	- 3.2	4.6	1500	301	12.1	+10.4	- 6.2	3.2		
	1000	275	17.8	+17.7	- 1.7	3.1	1000	302	13.2	+11.2	- 7.0	2.9		
	500	262	10.5	+10.4	+ 1.5	2.1	500	287	8.9	+ 8.5	- 2.6	2.6		
	100	241	6.5	+ 5.6	+ 3.1	1.7	100	259	3.7	+ 3.6	+ 0.7	3.0		
Ground level.	30	241	6.0	+ 5.2	+ 2.9	...	30	270	1.2	+ 1.2	0.0	...		
Computed for M.S.L.	0	265	18.8	+18.7	+ 1.6	...	0	312	9.9	+ 7.4	- 6.6	...	Lift 53 gm.	
ABERDEEN. P. 72. November 26. 11 h. 20 m. G.M.T.							ABERDEEN. P. 73. November 28. 11 h. 20 m. G.M.T.							
Greatest height.	3200	...	...	...	...	...	3340	...	...	...	...	Two theodolites. See note below.	One theodolite. Balloon lost in a lenticular A.-Cu. cloud. A nephoscopic observation of these clouds at about 13 h. gave components as follows (alt. of 3300 m. assumed.) W.-E. + 32.7 m/s. S.-N. - 5.3 m/s.	
	3000	281	29.6	+29.0	- 5.8	3.0	3250	287	28.2	+27.0	- 8.3			
	2500	282	34.4	+33.6	- 7.2	3.7	3000	288	23.1	+22.0	- 7.1			
	2000	282	33.9	+33.2	- 6.9	3.7	2500	295	30.4	+27.5	-12.9			
	1500	281	30.0	+29.4	- 5.6	3.5	2000	289	33.3	+31.5	-10.9			
	1000	270	22.3	+22.3	- 0.1	3.0	1500	282	24.4	+23.8	- 5.1			
	500	266	17.7	+17.6	+ 1.3	2.5	1000	279	20.8	+20.5	- 3.4			
	100	260	9.8	+ 9.6	+ 1.7	2.6	500	275	16.4	+16.3	- 1.4			
Ground level.	30	249	7.3	+ 6.8	+ 2.6	...	100	269	13.5	+13.5	+ 0.2			
Computed for M.S.L.	0	280	20.0	+19.7	- 3.5	...	0	288	14.3	+13.6	- 4.4	...	Lift 52 gm.	

Note attached to P. 68:—Balloon entered coarse type of Ci.-St. to A.-St. (probably mostly the latter). Nephoscopic readings on this day gave the following components at 10 h., 12 h., and 13 h. (assuming 4 km. as the height of cloud). From this it will be seen that the direction was changing from W. to E., and that the rapid drop in the W.-E. component shown by the above Pilot Balloon readings is real. The change of sign in the S.-N. component at 500 m. and 1000 m. is also quite in order.

Hour.	W.-E.	S.-N.
10 h.	+4.8	+18.4
12 h.	-1.2	+16.0
13 h.	-1.6	+15.6

Note attached to P. 69:—At 2300 m. the balloon was lost to home station in smoke from intervening chimney, but while the out station continued to observe the balloon, a nephoscope observation was made of some Ci.-Cu. which had just made its appearance. The Ci.-Cu. was of a rather floccular type, grouped in lenticular masses, and moved from 275° with a velocity equivalent to 2.6 m/s. at 1000 m. Assuming a height of 6000 m. (on account of the rather coarse type of cloud), the components would then be:—W.-E. + 15.6 m/s.; S.-N. - 1.2 m/s. This shows a further "backing" of the air currents in continuation of that shown by the above Pilot Balloon readings. It is noteworthy that on the following day also the upper Ci.-Cu. came from W.S.W., while the lower St.-Cu. moved from W. Therefore the conditions shown by the above readings were not merely transitory.

Note attached to P. 72:—Balloon lost behind a St.-Cu. cloud. At 12 h. a band of Ci.-Cu. appeared and was observed with the nephoscope. The cloud became lenticular shortly after its appearance. If an altitude of 5000 m. is assumed, the components found from the observations are as follows:—W.-E. + 43.5 m/s.; S.-N. - 25.0 m/s.

8. The Lower Layers of the Atmosphere from the Surface to 3000 metres (10,000 ft.) above Mean Sea Level.—*continued.*

## Soundings by Kites (K.) and Pilot Balloons (P.).

FALMOUTH. P. 25. November 5. 11 h. 25 m. G.M.T.								FALMOUTH. P. 27. November 7. 11 h. 25 m. G.M.T.										
Soundings with Pilot Balloons.	Height above M.S.L.	Wind.				Vertical Velocity of Balloon.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.				Vertical Velocity of Balloon.	Cloud Observations and Remarks.				
		Direction.	Velocity.	Components.					Direction.	Velocity.	Components.							
				W.-E.	S.-N.						W.-E.	S.-N.						
Greatest height.	metres. } 2790	Degrees from N.	m/s.	m/s.	m/s.	m/s.	metres. } 3680	Degrees from N.	m/s.	m/s.	m/s.	m/s.	metres. } 3680	Degrees from N.	m/s.	m/s.	m/s.	m/s.
	... }	...	...	...	...	...	3500	312	9.5	+ 7.0	- 6.3	...	3000	316	11.2	+ 7.7	- 8.1	...
	2500	276	12.4	+ 12.3	- 1.4	2.6 assumed.	2500	314	9.4	+ 6.8	- 6.5	2.7 assumed.	2000	301	7.4	+ 6.4	- 3.8	One theodolite used. The day was bright and fine except for a few showers in the evening. Wind moderate, backing from N.N.W. in morning to S.S.E. at midnight.
	2000	284	11.2	+ 10.8	- 2.8		2000	301	7.4	+ 6.4	- 3.8		1500	300	8.7	+ 7.5	- 4.3	
	1500	280	11.7	+ 11.5	- 2.0		1500	300	8.7	+ 7.5	- 4.3		1000	308	6.6	+ 5.2	- 4.0	
	1000	291	12.1	+ 11.3	- 4.3		1000	308	6.6	+ 5.2	- 4.0		500	310	9.3	+ 7.1	- 6.0	
	500	268	13.8	+ 13.8	+ 0.5		500	310	9.3	+ 7.1	- 6.0		61	311	7.3	+ 5.5	- 4.8	
Ground level.	61	250	5.3	+ 5.0	+ 1.8	...	61	311	7.3	+ 5.5	- 4.8	...	...	...	...	...	...	
Computed for M.S.L.	0	254	9.3	+ 8.9	+ 2.6	...	Lift 35.5 gm.	0	320	7.8	+ 5.0	- 6.0	...	Lift 39.4 gm.				
FALMOUTH. P. 28. November 8. 11 h. 25 m. G.M.T.								FALMOUTH. P. 36. November 22. 11 h. 25 m. G.M.T.										
Greatest height.	metres. } 3200	Degrees from N.	m/s.	m/s.	m/s.	m/s.	metres. } 3650	Degrees from N.	m/s.	m/s.	m/s.	m/s.	metres. } 3650	Degrees from N.	m/s.	m/s.	m/s.	m/s.
	... }	...	...	...	...	...	3500	344	8.1	+ 2.2	- 7.8	...	3500	344	8.1	+ 2.2	- 7.8	...
	3000	276	9.9	+ 9.8	- 1.1	2.7 assumed.	3000	346	6.0	+ 1.5	- 5.8	2.3 assumed.	3000	346	6.0	+ 1.5	- 5.8	One theodolite used. Fine sunny day; rather cool, with light wind N.N.W. to N.W.
	2500	270	8.3	+ 8.3	0.0		2500	329	4.5	+ 2.3	- 3.8		2500	329	4.5	+ 2.3	- 3.8	
	2000	263	13.3	+ 13.2	+ 1.6		2000	347	2.2	+ 0.5	- 2.1		2000	347	2.2	+ 0.5	- 2.1	
	1500	270	7.5	+ 7.5	0.0		1500	317	2.5	+ 1.7	- 1.8		1500	317	2.5	+ 1.7	- 1.8	
	1000	273	9.1	+ 9.1	- 0.4		1000	332	3.7	+ 1.7	- 3.2		1000	332	3.7	+ 1.7	- 3.2	
Ground level.	61	258	9.4	+ 9.2	+ 2.0	...	61	356	3.8	+ 0.3	- 3.8	...	61	356	3.8	+ 0.3	- 3.8	
Computed for M.S.L.	0	240	10.5	+ 9.1	+ 5.3	...	Lift 38.1 gm.	0	Station near centre of local high pressure system.	...	Lift 19.4 gm.							
FALMOUTH. P. 37. November 24. 11 h. 5 m. G.M.T.								FALMOUTH. P. 39. November 27. 11 h. 50 m. G.M.T.										
Greatest height.	metres. } 2470	Degrees from N.	m/s.	m/s.	m/s.	m/s.	metres. } 2380	Degrees from N.	m/s.	m/s.	m/s.	m/s.	metres. } 2380	Degrees from N.	m/s.	m/s.	m/s.	m/s.
	2400	272	11.8	+ 11.8	- 0.5	2.4 assumed.	2300	323	12.3	+ 7.4	- 9.8	2.3 assumed.	2300	323	12.3	+ 7.4	- 9.8	One theodolite used. A mild humid day, with light wind. Dull and overcast until evening, when the sky cleared somewhat.
	2000	271	12.2	+ 12.2	- 0.3		2000	325	12.5	+ 7.2	- 10.2		2000	325	12.5	+ 7.2	- 10.2	
	1500	269	10.8	+ 10.8	+ 0.1		1500	336	10.1	+ 4.2	- 9.2		1500	336	10.1	+ 4.2	- 9.2	
	1000	252	8.5	+ 8.1	+ 2.6		1000	335	9.7	+ 4.1	- 8.8		1000	335	9.7	+ 4.1	- 8.8	
	500	258	8.8	+ 8.6	+ 1.9		500	312	9.3	+ 6.9	- 6.2		500	312	9.3	+ 6.9	- 6.2	
Ground level.	61	252	6.2	+ 5.9	+ 1.9	...	61	287	8.0	+ 7.6	- 2.4	...	61	287	8.0	+ 7.6	- 2.4	
Computed for M.S.L.	0	248	8.1	+ 7.5	+ 3.0	...	Lift 28.4 gm.	0	300	11.9	+ 9.7	- 5.6	...	Lift 18.4 gm.				

**Observations of the Amount, Form, and Motion of Clouds**  
(on the days of Balloon Ascents and on the preceding and succeeding days).

FALMOUTH, OCTOBER 1913.

Day.	Hour.	Amount. (0-10).	Form.	Motion From.	Meteorological Changes in Progress.	Day.	Hour.	Amount (0-10).	Form.	Motion From.	Meteorological Changes in Progress.
Oct. 8th	7	8	St.-Cu.	W.S.W.		Oct. 21st	7	2	St.-Cu.	W.	
"	13	9	Cu, Cu.-Nb.	W.S.W.		"	13	10	Cu.-Nb, St.	S.W.	
"	18	0	...	...		"	18	4	Ci.-St.	S.S.E.	
9th	7	1	St.	W.	October 9th.	22nd	7	1	St.-Cu.	S.W.	October 22nd.
"	13	7	St.	W.		"	10	0	...	...	
"	18	1	Ci.	...	Very bright day on the whole, but slightly cloudy about noon. Light wind W. in morning, backing to S. during forenoon. In late evening wind commenced to rise.	"	12	3	St.-Cu, Ci.-St.	E.S.E.	Hoar-frost early morning, slight shower at 5 h.
10th	7	6	Ci.-St, Cu.	E.S.E.	The wind the previous day was N.W.	"	14	3	St.-Cu, Ci.-St.	E.S.E.	Morning and forenoon bright, sky becoming overcast about 14 h.
"	13	7	St, St.-Cu.	S.E.		"	16	10	St.-Cu, Nb.	E.	Moderate wind, W.S.W. in morning, backing gradually to E.
"	18	10	Nb.	S.S.E.		"	18	10	St.-Cu, Nb.	E.	Afternoon dull and threatening, and heavy showers in evening, when it also became milder.
14th	7	10	St.	S.W.		23rd	7	9	St, Cu.-Nb.	E.	
"	13	6	Ci, St.-Cu.	S.W.		"	13	9	M.-Cu, Cu.-Nb.	N.E.	
"	18	7	Ci.-St.	S.W.		"	18	7	St, Ci.	E.N.E.	
15th	7	10	St.	N.	October 15th.	27th	7	8	St, Cu.-Nb.	S.S.E.	
"	10	4	St, Fr.-Cu.	N.	Day opened cloudy; before noon sun broke through, sky cleared, and remained so all day.	"	13	10	St, Cu.-Nb.	S.S.E.	
"	12	1	St, Cu.	N.	Moderate N. wind.	"	18	9	Nb, Fr.-St.	S.E.	October 28th.
"	14	0	...	...		"	13	8	Ci, Nb, St.	S.S.E.	
"	16	0	...	...		"	18	7	A.-Cu, Nb.	S.	In the early morning the wind was strong, S.S.E. to S.E., and somewhat shifty in direction.
"	18	0	...	...		29th	7	7	Nb, Fr.-St.	S.	Several heavy showers overnight and at intervals during day.
16th	7	1	St.	...		"	13	9	Fr.-Cu, Nb, Ci.-St.	S.S.W.	Mild; sky occasionally clearing.
"	13	1	Cu.	S.W.		"	18	8	Nb.	S.S.W.	The torrential showers were a remarkable feature of the day.
"	18	0	...	...		30th	7	6	Ci.-St, Nb.	S.	
						"	13	10	St, Nb.	S.	
						"	18	10	Nb.	N.N.W.	
						31st	7	8	Cu.-Nb.	W.	October 31st.
						"	12	5	Ci.	...	
						"	14	5	Ci, Cu.	W.S.W.	On the whole bright, with considerable visibility.
						"	18	6	Ci, St.-Cu.	W.S.W.	Frequent heavy showers. Light wind S.W. to W.S.W.
						Nov. 1st	7	4	Ci, Fr.-Cu, Nb.	S.W.	* Streaked and torn Ci. clouds running from S.W. to N.E.
						"	13	10	Nb.	S.W.	
						"	18	10	Fr.-Cu.	W.S.W.	

FALMOUTH, NOVEMBER 1913.

Day.	Hour.	Amount (0-10).	Form.	Motion From.	Meteorological Changes in Progress.	Day.	Hour.	Amount (0-10).	Form.	Motion From.	Meteorological Changes in Progress.
Nov. 4th	7	10	St.	...		Nov. 21st	7	10	Nb.	S.W.	
"	13	10	St. } misty.	...		"	13	10	Nb.	N.W.	
"	18	10	St. }	...		"	18	8	Fr.-St, Cu.-Nb.	N.	
5th	7	9	Nb. and St.	W.S.W.	November 5th.	22nd	7	2	Cu.	N.W.	November 22nd.
"	9	9	"	"		"	9 <sup>30</sup>	1	Cu.	"	
"	11	5	Cu.	"	Morning overcast, with rain about 9 h. and a moderate W. wind. Sky commenced to clear about 10 h. 30 m., and the day was bright and fine till about 18 h., when heavy intermittent rain set in with a somewhat high wind.	"	11 <sup>30</sup>	4	Cu.	"	Fine sunny day, rather cool, with light wind N.N.W. to N.W.
"	12	3	"	"		"	13	2	Cu, St.-Cu.	"	
"	15	5	Cu, Fr.-Cu.	"		"	16	2	Cu, St.-Cu.	"	
"	18	9	Cu, Cu.-Nb.	W.		"	18	2	St, Cu.	N.	
6th	7	10	Nb.	S.W.		23rd	7	4	St, Ci.-Cu.	S.W.	
"	13	10	Nb.	"		"	13	3	Cu.	S.	
"	18	10	Nb.	W.		"	18	4	St.	S.	
7th	7	1	St.	N.W.	November 7th.	24th	7	5	St, Ci.-Cu.	N.W.	November 24th.
"	10	9	Cu, Cu.-Nb.	N.W.	Day bright and fine, except for a few showers in the evening.	"	10	2	Cu, Ci.	N.W.*	
"	11	4	Cu, Fr.-Cu, S.	N.W.	Wind moderate, backing from N.N.W. in morning to S.S.E. at midnight.	"	12	8	Cu, Mam.-Cu.	N.W.	Heavy showers and squalls overnight. Forenoon cold but fairly sunny, afternoon cloudy and overcast, and rain in the evening. Wind moderate and backing from N.N.W. in the morning to S.W. in the evening, when it also became stronger.
"	13	4	Ci.-St, St.-Cu.	...		"	14	9	St, Cu.-St, Ci.-St.	S.W.	*Cir. feather-shaped, with quill towards S.
"	14	3	A.-Ca, St.-Cu.	W.		"	16	10	St, Nb.	S.W.	
"	18	9	St, Cu.	S.W.		"	18	10	Nb.	...	
8th	7	1	St.	W.	November 8th.	25th	7	3	Fr.-St, Cu.-Nb.	W.N.W.	
"	9 <sup>30</sup>	1	Cu.	"	Very fine day; much sun, clear sky, light wind, backing slowly from W. in morning to S. at midnight.	"	13	10	Nb.	W.	
"	11 <sup>30</sup>	2	"	"		"	18	10	St, Nb.	W.	
"	13	2	Ci, Cu.	W.		26th	7	8	} mist.	W.	
"	14	1	St.	"		"	13	10	...	N.W.	
"	16	1	"	"		"	18	0	...	...	
"	18	1	St.-Cu.	S.W.		27th	7	5	Ci.-St, Cu.	N.	November 27th.
9th	7	8	St.-Cu.	S.S.E.		"	10	10	St, Mam.-Cu.	N.	A mild humid day, with light wind.
"	13	8	St.-Cu.	S.S.E.		"	12	10	St, Mam.-Cu.	N.	Dull and overcast until evening, when sky cleared somewhat.
"	18	9	Nb.	S.S.E.		"	14	10	St.	W.	
						"	16	9	St, Fr.-Cu, A.-Cu.	W.	
						"	18	8	Fr.-Cu, St.	W.	
						28th	7	8	Fr.-St, Nb.	W.N.W.	
						"	13	9	St.	N.W.	
						"	18	10	St.	N.W.	

### Cloud Observations and Weather Diary.—Eskdale Observatory.

WEDNESDAY, NOVEMBER 5TH, 1913.

In consequence of this being an "International Day," two extra observations of the clouds were made, at noon and at 13 h. 30 m. The following types of clouds were noticed during the day:—

Hour.	Form.	Direction from	Amount (0-10).	Wind Direction.
9 h.	{ alto-stratus, alto-cum. } stratus	S.	7	Calm.
Noon.	{ cirrus } alto-cum. } st.-cu	S. } W.S.W. }	5	W.
13 h. 30 m.	{ cirrus } cu., strato-cu.	S. } W.S.W. }	5	W.S.W.
15 h.	{ cirrus } alto-cum. } cum.	S. } S.W. }	4	S.W.
21 h.	alto-stratus	? S.S.W.	2	Calm.

In all cases the clouds both upper and lower were moving (apparently) with a moderate speed.

The day was fine and bright, the only rain which fell being recorded before 3 h. The sky cleared gradually, but no sunshine was registered before 11 h. 30 m., but from then onward until 15 h. 15 m. the burn on the sunshine card was continuous.

Temperature fell rapidly after sundown, the clearness of the sky allowing radiation to take place into the atmosphere. Maximum for the day 49°·1 F.; Minimum 35°·0 F. (both readings at 21 h.).

The barometer fell slowly all day.

THURSDAY, NOVEMBER 6TH, 1913.

During the night the wind had remained calm, but between 7 h. and 8 h. a light breeze sprang up from the N.E., and remained steady from that direction all day.

The Barometer rose steadily all day, and the day was generally fine in spite of the sky being overcast for the first part of the morning.

During the second half of the morning (after 11 h.) the clouds opened a little and some of the upper clouds were visible.

Observations of Cirrus showed that between 11 h. and 16 h. the movement of that type of cloud was from the south, but the movement was so slow as to be scarcely perceptible.

All other clouds (including alto-cum. and alto-stratus) moved from the E.N.E.

At 21 h. the sky was quite clear except for a patch of cloud (alto-cum.) on the N.W. horizon.

0·5 mm. of rain was measured as the result of a slight shower at 3 h.

Temperature was about normal.

FRIDAY, NOVEMBER 7TH, 1913.

The Barometer was steady all day and the weather was fine and bright, with practically clear sky during most of the day.

Observations of clouds were:—

Hour.	Form.	Direction from	Amount (0-10).	Wind Direction.
9 h.	{ alto-cum., alto-stratus } cum., stratus	N.W.	8	N.W.
Noon.	{ alto-cum. } strato-cum.	N.W.	3	W.N.W.
13 h. 30 m.	{ alto-cum. (lenticularis) } cum.	N.W.	3	W.
15 h.	Alto-cum.	W.N.W.	2	S.W.
21 h.	Cirrus (Radiant point N.W.).	N.N.W.	5	Calm.

At 21 h. 25 m. a lunar halo was observed, but had not any marked definition, being very indistinct in places. Commenced to freeze just before 21 h. and continued hard all night.

Wind light during the day, fell to calm after 18 h.

Rain nil.

Sunshine 5·1 hours.

Temperature slightly above normal during day—below during night.

**Time** is expressed in the hours 1 to 24 of civil reckoning.

**Pressure** is given in millibars (1000 mb. = 1 C.G.S. atmosphere = 750 mm. approximately).

**Gradient Wind** is taken to be tangential to the isobar and is computed by the formula  $\gamma = 2 \omega \rho V \sin \phi$ .

**Base of Stratosphere.**—TYPE 1.—When the stratosphere commences with an inversion, the height and temperature of the first point of zero temperature gradient are given.

TYPE 2.—When the stratosphere begins with an abrupt transition to a temperature gradient below 2° per km. without inversion, the height and temperature of the abrupt transition are given.

TYPE 3.—When there is no such abrupt change of temperature gradient, the base is taken to be where the mean fall of temperature for the kilometre next above is 2° or less, provided that it does not exceed 2° for any subsequent kilometre. If some other position for the base seems to the tabulator to be more suitable, it is noted in the column for "Remarks."

**Temperatures** are expressed in degrees absolute (273° A. = 0° C.).

**Heights** are given in kilometres (km.).

# METEOROLOGICAL OFFICE OBSERVATORIES—GEOPHYSICAL JOURNAL.

DECEMBER 1913.—DAILY VALUES REFERRED TO GREENWICH MEAN TIME, AND UNITS  
BASED ON THE C.G.S. SYSTEM.

[Price 1s.]

Third Year.—No. 12. *Meteorology, Solar Radiation, Seismology, Atmospheric Electricity, and Terrestrial Magnetism.*

## 1. SEISMOLOGICAL JOURNAL:—ESKDALE OBSERVATORY.—Lat. 55° 19' N. Long. 3° 12' W.

Date.	Microseisms of N. Component.								Remarks.
	0 h.		6 h.		12 h.		18 h.		
	An.	T.	An.	T.	An.	T.	An.	T.	
	$\mu$	s	$\mu$	s	$\mu$	s	$\mu$	s	
1	4.1	7	3.7	7	3.1	6.5	2.6	6	1st, I, Small disturbance from 22 h. 53 m.—23 h. 18 m.
2	2.4	5.5	2.0	5	1.8	6	1.8	6	3rd, I, Small disturbance from 8 h. 49 m.—9 h. 10 m.
3	2.1	5	3.0	5.5	2.7	5	2.8	5	6th, I, Very small disturbance from 0 h. 53 m.—1 h. 1 m.
4	4.0	5	4.6	5	6.1	5.5	3.7	6	6th, I, L=15 h. 28 m. Small earthquake. End 16 h. 42 m.
5	3.1	5.5	—	—	2.6	5	2.0	5.5	7th, I, Very small disturbance from 6 h. 15 m.—6 h. 27 m.
6	2.1	5.5	1.8	5	1.7	5	1.8	5	15th, I, Very small disturbance from 4 h. 29 m.—4 h. 44 m.
7	1.8	5	2.4	5	1.6	6	1.3	6	15th, I, L=18 h. 26.5 m. Small earthquake. End 19 h. 0 m.
8	1.1	6	1.4	5	1.2	5.5	1.9	6.5	20th, I, Very small disturbance from 2 h. 12 m.—2 h. 35 m.
9	2.5	7	2.9	8	2.9	7.5	3.3	7	21st, I, Very small disturbance from 0 h. 36 m.—1 h. 4 m.
10	3.5	8	4.8	7.5	2.9	8	2.7	6.5	21st, II, P=15 h. 59 m. 55 s., L(?)=16 h. 17 m. Prominent maximum at 16 h. 23.5 m. End 18 h. 20 m.
11	2.9	7	2.8	7	2.1	6	2.8	7	25th, I, P=6 h. 55 m. 1 s., S=6 h. 59 m. 55 s., L=7 h. 2.8 m. $\Delta=3150$ km. Epicentre 32° N. 27° W.
12	2.9	6.5	2.1	7	2.4	7.5	2.1	6.5	29th, I, Small disturbance at about 10 h. 42 m.
13	1.8	7	1.8	6	1.8	6.5	2.1	6	
14	2.3	6.5	2.3	7	2.4	5.5	2.0	6	
15	1.8	6	1.6	5.5	1.2	5.5	1.1	6	
16	1.4	6	2.1	6	2.3	6	2.1	6	
17	1.5	6	1.4	5.5	1.5	6	1.1	6	
18	1.2	6.5	1.5	7	1.5	6	1.4	5.5	
19	1.2	5.5	1.4	6	1.5	6.5	1.5	6	
20	1.3	6	1.3	5.5	1.2	5.5	1.0	5.5	
21	1.9	5	1.0	6	1.5	6	1.4	5.5	
22	1.6	6	1.5	5.5	2.0	5.5	1.5	6	
23	1.9	5.5	2.3	6	1.9	6	2.0	5	
24	2.2	5	2.2	5	1.5	5	1.7	5	
25	1.5	5	1.3	5	1.4	5	1.4	5.5	
26	1.6	6	2.1	6	3.0	7	3.8	7	
27	3.3	6	3.1	7	2.9	7	2.7	6.5	
28	2.2	7	2.8	6	2.5	6	2.4	6	
29	2.1	6	2.0	6	2.6	5	1.7	5	
30	1.3	5	1.3	5	1.2	5.5	1.2	5	
31	1.1	4.5	0.9	5	0.8	5.5	1.0	5	

An explanation of the notation used is given in the preface. The amplitude  $A_N$  is half of the actual movement of the earth's surface in a N-S direction, between the ends of the swing ( $\mu=0.001$  mm.). The period T (in seconds) is the duration of a complete oscillation, i.e. both extreme positions are passed through once during the time T.

## 2. VALENCIA OBSERVATORY, CAHIRCIVEEN (KERRY).—Lat. 51° 56' N. Long. 10° 15' W.

Heights above Mean Sea Level:—Station, H=12.6 m. Barometer Cistern, H<sub>b</sub>=13.7 m.

Heights above Ground:—Thermometers, h<sub>t</sub>=1.2 m. Rain-gauge, h<sub>r</sub>=0.56 m. Sunshine Recorder, h<sub>s</sub>=12.8 m. Cups of Anemometer, h<sub>a</sub>=13.9 m.

Day.	Pressure at Station Level.		Air Temperature in Degrees Absolute.				Humidity.				Wind Direction in Points (8=E, 16=S) and Velocity (metres per second).		Cloud Amount and Weather.		Rain 24 hours beginning 10 h.	Sunshine.	Remarks.	Magnetism.						
	9 h.	21 h.	9 h.	21 h.	Max.	Min.	Vapour Pressure.		Percentage.		9 h.	21 h.	9 h.	22 h.				Horizontal Force.	Declination West.	Inclination.				
	mb.	mb.	200+	200+	200+	200+	millibar.	%	%	m/sec.	m/sec.	Tenths of Sky covered.	mm.	hrs.	$\gamma$ .	°	°							
1	1022.0	1021.5	82.3	81.0	85	81	11.5	9.8	99	94	—	1	—	1	10 <sup>≡</sup> 0	9	2.0	—	Heavy mist and ●.	...	...	...		
2	1015.3	1008.6	83.2	83.4	84	81	12.2	11.9	98	95	2	7	18	6	10 <sup>≡</sup> 0	10 <sup>≡</sup> 0	6.4	0.1	Gloomy and misty.	...	...	...		
3	994.6	994.8	84.1	80.1	85	79	12.5	7.4	96	72	17	9	25	14	10 <sup>≡</sup> 0	5	15.8	—	Gloomy. Intermittent ● 7 h.—15 h.	...	...	...		
4	1008.6	1014.5	78.7	81.3	82	76	6.4	8.8	73	81	30	13	22	12	6	10	1.5	1.6	☐ 4 h. Squally a. Visibility.	...	...	...		
5	1011.9	1002.3	82.6	84.5	85	81	10.8	13.2	91	99	22	9	22	7	10 <sup>≡</sup> 0	10 <sup>≡</sup> 0	21.6	8	Unsettled appearance. Inter-	...	...	...		
6	1003.4	1011.1	83.5	83.3	85	83	11.9	11.2	95	89	24	11	27	8	10 <sup>≡</sup> 0	10 <sup>≡</sup> 0	0.8	0.1	[mittent ●.	...	...	...		
7	1015.0	1018.0	82.1	83.9	84	82	11.2	12.9	96	99	—	1	—	0	10 <sup>≡</sup> 0	10 <sup>≡</sup> 0	4.8	—	Gloomy a. Heavy mist p.	...	...	...		
8	1018.0	1017.0	84.2	84.3	85	83	13.2	13.2	100	98	16	5	16	6	10 <sup>≡</sup> 0	10 <sup>≡</sup> 0	3.1	—	—	...	...	...		
9	1018.0	1026.5	82.9	81.8	85	81	11.2	9.5	92	85	26	5	25	6	7	6 <sup>≡</sup> 0	0.3	0.6	● Showers a. Visibility.	17925	20	15.4	68	8.9
10	1029.2	1027.7	81.3	80.7	82	81	10.2	10.2	94	99	25	4	24	5	6 <sup>≡</sup> 0	8 <sup>≡</sup> 0	0.8	0.8	≡ <sup>0</sup> . Fair to showery.	...	...	...		
11	1023.1	1015.2	81.8	82.9	84	81	11.2	11.5	99	94	20	3	17	5	10 <sup>≡</sup> 0	5	2.8	—	—	...	...	...		
12	1016.9	1022.3	82.4	80.6	85	80	9.1	9.8	76	94	26	8	—	1	10	5	1.0	0.2	Visibility; dull.	...	...	...		
13	1027.0	1028.5	75.4	80.3	81	75	6.8	8.8	95	85	4	2	22	2	7	10	1.5	2.5	Fair; visibility.	...	...	...		
14	1025.3	1023.7	82.6	82.8	84	80	11.9	11.5	99	96	16	5	17	4	10 <sup>≡</sup> 0	10 <sup>≡</sup> 0	1.5	—	Heavy mist a. and p.	...	...	...		
15	1019.4	1018.5	83.6	82.3	84	82	12.5	9.1	99	78	16	6	24	11	10 <sup>≡</sup> 0	2	1.8	—	Gloomy, with ≡ <sup>0</sup> .	...	...	...		
16	1026.3	1031.8	81.7	82.1	82	81	8.5	8.1	76	70	28	6	32	4	7	10	—	0.2	Fair to dull. Visibility.	...	...	...		
17	1034.7	1034.8	76.7	79.5	82	77	7.8	7.1	96	74	6	3	9	3	8	8	—	0.2	Fair to dull.	...	...	...		
18	1033.5	1033.7	80.1	79.1	81	77	7.4	7.1	72	77	7	5	6	3	2	10	—	6.0	Fair to fine.	...	...	...		
19	1032.5	1033.0	78.5	78.5	81	76	7.1	6.8	80	74	8	6	7	3	2	5	—	0.8	Fine a. and p. ∞	...	...	...		
20	1034.1	1037.4	78.6	79.3	80	75	7.1	7.1	79	74	7	2	10	3	10 <sup>∞</sup>	5 <sup>≡</sup> 0	—	0.1	∞. Dull to fair.	...	...	...		
21	1038.3	1035.8	73.1	77.8	78	73	4.7	6.8	89	77	6	3	10	2	5 <sup>∞</sup>	10 <sup>≡</sup> 0	—	0.9	∞. Fine a. Gloomy p.	...	...	...		
22	1027.0	1018.9	78.5	77.6	79	77	7.4	7.8	82	91	—	0	7	2	10 <sup>∞</sup>	10 <sup>≡</sup> 0	0.3	—	∞. Dull.	17919	20	16.8	68	9.1
23	1013.0	1013.3	75.2	79.8	81	75	6.4	6.4	91	65	5	2	30	8	10 <sup>≡</sup> 0	5	0.8	1.8	≡ <sup>0</sup> a. Fair; visibility.	...	...	...		
24	1016.8	1022.7	79.6	80.2	81	78	6.8	8.1	72	81	30	9	26	3	5	9	—	3.8	Fair.	...	...	...		
25	1021.3	1016.7	80.8	82.8	83	80	9.5	10.5	90	88	21	6	20	10	10 <sup>≡</sup> 0	10 <sup>≡</sup> 0	0.8	0.1	Unsettled appearance a. Gloomy	...	...	...		
26	1012.2	1008.1	83.0	80.2	84	80	11.2	8.1	92	79	20	11	26	11	10 <sup>≡</sup> 0	10 <sup>≡</sup> 0	6.6	—	● showers 15 h.—18 h.	...	...	...		
27	1011.4	1006.1	79.7	79.3	80	78	6.1	7.1	n 63	75	25	11	25	8	5	3	3.1	—	Fair; unsettled appearance later.	...	...	...		
28	1007.0	1014.1	77.8	77.6	79	76	6.8	6.4	74	73	31	10	30	9	7	3	4.8	1.4	Showery a. T▲ p.	...	...	...		
29	1017.2	1020.5	77.2	76.7	80	76	7.1	6.8	85	84	31	7	2	3	5	5	1.3	4.0	Showery a. Visibility p.	...	...	...		
30	1023.7	1028.3	75.1	77.7	n 77	71	5.4	4.7	75	77	4	2	—	1	1	0	—	6.1	Fine; visibility.	...	...	...		
31	1032.1	1035.7	70.7	77.6	78	n 70	4.4	6.4	82	76	—	1	12	5	0	0	—	3.6	Fine.	...	...	...		
Means	1020.3	1020.7	80.0	80.4	82.1	78.2	8.9	8.8	87	84	5.6	5.4	7.5	7.2	79.4	1.13	—	—	Monthly Totals or Means.	17922	20	16.1	68	9.0
Normal 40 years	1010.3	1010.4	80.2	80.4	82.9	77.9	9.1	9.3	88	88	6.3	6.5	—	—	158.2	1.32	—	—	Normals, 40 years.	...	...	...		

x denotes the maximum and n the minimum value in the column.

Note.—The cloud amounts in italic type at Valencia were taken at 21 h.

3. KEW OBSERVATORY, SURREY.—Lat. 51° 28' N. Long. 0° 19' W.

Heights above Mean Sea Level :—Station, H = 5.5 m. Barometer, H<sub>b</sub> = 10.4 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 3.0 m. Rain-gauge, h<sub>r</sub> = 0.53 m. Sunshine Recorder, h<sub>s</sub> = 13.3 m. Cups of Anemometer, h<sub>a</sub> = 19.81 m.

Table with columns for Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points (8 = E, 16 = S) and Velocity (metres per second), Cloud Amount and Weather, Rain 24 hours beginning 10 h., Sunshine, Solar Radiation, Milliwatts per cm.², Min. Temp. on Grass, Earth Temperature at 10 h., and Remarks. Includes monthly totals and normals for 40 years.

4. ESKDALE OBSERVATORY, DUMFRIESSHIRE.—Lat. 55° 19' N. Long. 3° 12' W.

Heights above Mean Sea Level :—Station, H = 242.0 m. Barometer, H<sub>b</sub> = 237.0 m.

Heights above Ground :—Thermometers, h<sub>t</sub> = 0.9 m. Rain-gauge, h<sub>r</sub> = 0.40 m. Sunshine Recorder, h<sub>s</sub> = 1.5 m. Vane of Anemometer, h<sub>a</sub> = 15.0 m.

Table with columns for Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity (Vapour Pressure, Percentage), Wind Direction in Points (8 = E, 16 = S) and Velocity (metres per second), Cloud Amount and Weather, Rain 24 hours beginning 10 h., Sunshine, Solar Radiation, Milliwatts per cm.², Min. Temp. on Grass, Earth Temperature at 10 h., and Remarks. Includes monthly totals and normals for 1911-12.

The solar radiation is the mean of the readings within the nominal hour of observation (11 h. 30 m.—12 h. 30 m.) unless some other hour is specified. Temperatures at or below the normal freezing point of water are printed in small type.



5. KEW OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor 1·81.				Charge per cc. × 10 <sup>20</sup> .		Velocities of Ions for 1 volt per centimetre.		Conductivity × 10 <sup>10</sup> .	Air-Earth Current × 10 <sup>16</sup> .		Electric Character of Day.	Magnetic Character of Day.	Horizontal Force.			West Declination.							
	3 h.	9 h.	15 h.	21 h.	+	-	+	-		c <sub>1</sub>	c <sub>2</sub>			Maximum. 18000 γ +.	Minimum. 18000 γ +.	Range.	Maximum. 15° +.	Minimum. 15° +.	Range.					
	v/m.	v/m.	v/m.	v/m.	E.-m.U.	E.-m.U.	cm/sec.	cm/sec.		E.-m.U.	Amp/cm <sup>2</sup> .			γ	h m	γ	h m	γ	h m	h m	h m			
1	105	285	495	565	420	300	—	—	—	—	—	0	0	499	7 37	481	2 35	18	36·8	3 30	29·8	22 10	7·0	
2	320	335	285	—	380	200	—	—	—	—	—	0	0	499	7 35	473	21 52	26	35·1	12 45	29·1	20 44	6·0	
3	—	265	265	150	400	360	—	—	—	—	—	0	0	499	6 58	480	12 49	19	34·6	12 27	30·7	20 10	3·9	
4	105	415	±	310	—	—	—	—	—	—	—	1	1	499	7 12	n 431	19 13	z 68	34·9	17 37	n 19·5	19 23	z 15·4	
5	320	115	485	750	360	120	—	—	—	—	—	1	1	506	5 30	469	14 47	37	36·7	13 52	27·9	23 59	8·8	
6	675	710	635	610	—	—	—	—	—	—	—	0	0	496	18 30	476	11 7	20	34·3	13 46	27·8	0 2	6·5	
7	610	515	275	460	—	—	—	—	—	—	—	0	1	z 526	21 30	474	19 7	52	34·8	12 39	28·7	22 44	6·1	
8	470	645	345	250	420	380	—	—	—	—	—	0	0	504	6 20	479	23 18	25	34·7	13 37	31·1	0 2	3·6	
9	70	170	160	560	—	—	—	—	—	—	—	0	0	500	7 54	472	19 0	28	34·6	13 0	29·2	19 10	5·4	
10	230	480	390	595	—	—	—	—	—	—	—	0	0	495	19 12	479	10 55	16	35·7	12 49	31·3	3 43	4·4	
11	380	635	485	390	—	—	—	—	—	—	—	0	0	498	9 10	481	3 10	17	33·7	13 33	31·1	7 40	2·6	
12	90	285	335	620	—	—	—	—	—	—	—	0	0	500	18 48	481	20 58	19	34·6	12 25	29·1	20 51	5·5	
13	415	655	460	505	—	—	—	—	—	—	—	0	0	498	19 18	486	11 41	12	34·6	12 32	30·3	21 38	4·3	
14	320	440	425	470	—	—	—	—	—	—	—	0	0	502	12 3	480	16 9	22	35·6	15 59	30·8	21 58	4·8	
15	250	—	390	380	—	—	—	—	—	—	—	0	0	500	8 58	485	23 39	15	34·0	13 9	30·6	2 48	3·4	
16	125	515	325	285	—	—	—	—	—	—	—	0	0	502	8 50	482	1 5	20	33·6	5 43	31·0	20 28	2·6	
17	170	400	560	595	—	—	—	—	—	—	—	1	0	498	18 10	483	4 38	15	33·8	12 43	31·1	7 43	2·7	
18	530	790	760	940	—	—	—	—	—	—	—	0	0	503	18 25	488	1 41	15	34·8	11 49	28·8	22 15	6·0	
19	860	1160	955	760	—	—	—	—	—	—	—	0	0	502	9 6	469	14 58	33	36·9	14 50	29·3	22 33	7·6	
20	540	840	610	865	—	—	—	—	—	—	—	0	0	499	19 30	478	1 0	21	33·3	12 12	30·6	18 53	2·7	
21	715	910	335	380	—	—	—	—	—	—	—	0	0	497	22 45	486	11 52	n 11	33·4	12 43	29·1	23 9	4·3	
22	415	540	620	585	—	—	—	—	—	—	—	0	0	505	10 26	483	1 5	22	33·4	19 3	30·9	6 4	2·5	
23	460	585	±	z -	—	—	—	—	—	—	—	0	0	493	9 15	477	23 9	16	32·4	11 46	30·8	7 40	n 1·6	
24	620	840	435	700	—	—	—	—	—	—	—	0	0	490	9 35	474	1 6	16	33·3	13 5	30·5	20 19	2·8	
25	550	680	520	285	—	—	—	—	—	—	—	0	1	499	5 50	443	21 15	56	34·6	11 18	22·5	20 48	12·1	
26	70	125	185	—	—	—	—	—	—	—	—	1	1	499	2 23	455	16 3	44	z 39·9	2 0	26·8	16 30	13·1	
27	-60	185	210	285	—	—	—	—	—	—	—	1	1	492	22 4	465	17 49	27	34·7	13 43	27·5	17 58	7·2	
28	135	320	195	195	—	—	—	—	—	—	—	0	0	485	22 57	468	1 20	17	34·4	13 25	30·0	19 22	4·4	
29	—	—	—	—	—	—	—	—	—	—	—	1	0	489	17 30	475	0 53	14	33·3	12 58	28·5	20 41	4·8	
30	—	—	—	—	—	—	—	—	—	—	—	0	—	—	—	—	—	—	—	—	—	—	—	—
31	220	790	920	795	—	—	—	—	—	—	—	0	—	—	—	—	—	—	—	—	—	—	—	—
M.	370*	561*	475*	541*	—	—	—	—	—	—	—	—	—	499	—	474	—	25	34·7	—	29·1	—	5·6	

\* 23 days. The mean values of the Potential gradient in Table 5 are computed from the data for those days on which values at each of the four hours, 3<sup>h</sup>, 9<sup>h</sup>, 15<sup>h</sup>, 21<sup>h</sup>, are given in the table. A similar note applies to the values in Table 6. Magnetic curve measurements on 30th and 31st too uncertain, owing to return of magnetographs to their original position in the basement of the Observatory. z Indeterminate.

6. ESKDALE OBSERVATORY.

Day.	Potential Gradient, Volts per metre. Factor 5·24.				Charge per cc. × 10 <sup>20</sup> .		Velocities of Ions for 1 volt per centimetre.		Conductivity × 10 <sup>10</sup> .	Air-Earth Current × 10 <sup>16</sup> .		Electric Character of Day.	Magnetic Character of Day.	North Component.			West Component.			Vertical Component.					
	3 h.	9 h.	15 h.	21 h.	+	-	+	-		c <sub>1</sub>	c <sub>2</sub>			Maximum. 15000 γ +.	Minimum. 15000 γ +.	Maximum. 5000 γ +.	Minimum. 5000 γ +.	Maximum. 45000 γ +.	Minimum. 45000 γ +.						
	v/m.	v/m.	v/m.	v/m.	E.-m.U.	E.-m.U.	cm/sec.	cm/sec.		E.-m.U.	Amp/cm <sup>2</sup> .			h m	γ	h m	γ	h m	γ	h m	γ	h m	γ	h m	γ
1	55	159	21	138	—	—	—	—	—	—	—	2 c	0	5 33	1018	994	3 29	3 33	177	134	22 3	16 20	258	248	4 28
2	35	314	—	—	—	—	—	—	—	—	—	—	1	20 50	1021	987	21 50	12 40	164	132	20 41	20 22	260	249	10 8
3	—	—	-948	-284	—	—	—	—	—	—	—	2 c	0	6 50	1015	995	12 43	13 33	162	142	20 8	14 20	257	251	8 42
4	111	422	560	249	—	—	—	—	—	—	—	1 b	2	10 44	1019	n 945	19 12	17 50	170	n 66	19 18	19 17	z 304	250	10 47
5	235	512	360	457	—	—	—	—	—	—	—	0 a	1	5 22	1022	976	12 38	7 50	177	125	24 0	16 6	270	248	5 28
6	539	124	464	512	—	—	—	—	—	—	—	0 a	0	6 13	1013	989	10 57	13 43	161	122	0 12	+	+	+	+
7	83	104	83	124	—	—	—	—	—	—	—	1 a	1	21 27	z 1056	985	19 2	21 24	173	127	22 37	+	+	+	+
8	422	540	256	124	—	—	—	—	—	—	—	0 a	0	6 18	1023	1001	14 44	11 56	165	142	23 22	22 50	257	246	6 20
9	76	-76	104	104	—	—	—	—	—	—	—	2 b	1	16 16	1019	984	19 0	18 21	161	127	19 7	19 19	263	250	7 57
10	104	118	131	124	—	—	—	—	—	—	—	1 a	0	17 52	1015	996	10 54	12 45	165	147	9 16	15 38	258	252	10 20
11	83	48	207	111	—	—	—	—	—	—	—	1 b	0	6 35	1016	1001	11 42	13 32	156	145	4 10	14 27	257	250	9 35
12	69	55	187	346	—	—	—	—	—	—	—	1 b	0	18 51	1019	1000	21 0	14 10	161	130	20 50	21 2	263	250	10 45
13	200	z	-62	90	—	—	—	—	—	—	—	1 b	0	18 43	1014	1001	11 49	13 22	160	143	20 36	21 50	258	250	10 15
14	111	138	62	249	—	—	—	—	—	—	—	1 a	0	23 13	1014	993	16 8	15 59	168	143	23 35	18 10	259	247	10 37
15	111	138	111	-14	—	—	—	—	—	—	—	1 b	—	+	+	+	+	+	+	+	+	+	+	+	+
16	z	131	237	380	—	—	—	—	—	—	—	1 b	—	+	+	+	+	+	+	+	+	+	+	+	+
17	588	353	471	353	—	—	—	—	—	—	—	0 a	0	18 6	1016	1005	11 52	13 20	160	146	0 11	16 30	259	251	10 45
18	152	221	166	242	—	—	—	—	—	—	—	0 a	0	19 55	1022	1005	11 35	13 10	166	133	22 20	17 50	258	251	10 10
19	124	194	464	471	—	—	—	—	—	—	—	0 a	1	9 0	1018	979	14 42	14 43	181	137	22 27	16 30	263	249	9 28
20	318	332	332	408	—	—	—	—	—	—	—	0 a	0	19 32	1014	1000	0 50	13 47	157	143	0 33	16 30	260	252	10 55
21	152	284	242	367	—	—	—	—	—	—	—	0 a	0	22 44	1018	1003	11 54	12 43	158	138	23 7	21 45	258	253	10 25
22	159	249	166	270	—	—	—	—	—	—	—	0 a	0	10 7	1018	1002	18 15	19 0	161	145	0 44	20 22	259	249	10 54
23	173	-118	118	256	—	—	—	—	—	—	—	1 b	0	19 52	1015	1004	3 7	12 53	157	146	21 23	{ 0 1 } 21 43	256	251	10 32
24	111	256	270	464	—	—	—	—	—	—	—	0 a	0	20 10	1017	1004	11 17	13 10	160	146	2 26	19 0	255	249	10 28
25	159	-173	118	-581	—	—	—	—	—	—	—	2 c	1	5 40	1038	966	21 14	10 59							

7. Tables of Wind Components in metres per second at fixed hours, together with the mean velocity (horizontal movement) in metres per second for the hour with the maximum hourly run for each day, or the greatest velocity attained in a gust and the time of its occurrence.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust., Time of Gust., and Date, 3 h., 9 h., 15 h., 21 h., Vel. in Max. Hourly Run., Time of Max. for HOLYHEAD and DEERNES.

Table with columns for Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust., Time of Gust., and Date, 3 h., 9 h., 15 h., 21 h., Max. in a Gust., Time of Gust. for SCILLY and GREAT YARMOUTH.

The velocities at fixed hours are means for the interval from 30 minutes before to 30 minutes after the hour. The hours are numbered 1 h. to 24 h. Time is referred to Greenwich Mean Time. \* No record. † Robinson Cup Anemometer; Arms 0.61 m.; Diameter of Cups, 0.229 m.; Factor 2.2. ‡ Dines Pressure Tube Anemometer. At Great Yarmouth, Holyhead, and Scilly the readings at fixed hours are taken from the Robinson Anemometer; the maxima quoted are the greatest winds in a gust as recorded by the Dines Pressure Tube. The direction given is that from which the air is moving. Thus an entry of 10 under S. and 10 under W. indicates a wind of 14 m/s from S.W.

8. The Lower Layers of the Atmosphere from the Surface to 3000 metres (10,000 ft.) above Mean Sea Level.  
Soundings by Kites (K.) and Pilot Balloons (P.).

ESKDALEMUIR. P. 1. December 16. 11 h. 58 m. to 12 h. 3 m. G.M.T.								ESKDALEMUIR. P. 2. December 16. 13 h. 4 m. to 13 h. 8 m. G.M.T.								ESKDALEMUIR. P. 3. December 17. 14 h. 33 m. to 14 h. 42 m. G.M.T.							
Soundings with Pilot Balloons.	Height above M.S.L.	Wind.			Vertical Velocity of Balloon.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.			Vertical Velocity of Balloon.	Cloud Observations and Remarks.	Height above M.S.L.	Wind.			Vertical Velocity of Balloon.	Cloud Observations and Remarks.					
		Direction.	Velocity.	Components.				Direction.	Velocity.	Components.				Direction.	Velocity.	Components.							
				W.-E.						S.-N.						W.-E.			S.-N.	W.-E.	S.-N.		
Greatest height.	metres.	Degrees from N.	m/s.	m/s.	m/s.	m/s.	metres.	Degrees from N.	m/s.	m/s.	m/s.	m/s.	metres.	Degrees from N.	m/s.	m/s.	m/s.	m/s.					
	860	287	22.9	+21.9	-6.7		874	...	...	...	...		950	290	3.0	+2.8	-1.0						
	750	289	18.7	+17.7	-6.1		750	305	16.2	+13.2	-9.4	Balloon entered st.-cu. cloud.	750	244	1.6	+1.4	+0.7						
100 m. above ground.	500	293	15.1	+13.9	-5.9	2.3	500	301	8.5	+7.2	-4.4	2.5	500	184	1.3	+0.1	+1.3	1.6					
Ground level.	340	...	...	...	...		340	...	...	...	...		340	...	...	...	...						
Computed for M.S.L.	0	316	24.9	+17.3	-17.9	...	Lift 18 gm.	0	299	26.1	+22.7	-12.7	...	Lift 28 gm.	0	330	6.8	+3.4	-5.9	...	Lift 5 gm.		
ESKDALEMUIR. P. 4. December 18. 12 h. 53 m. to 13 h. 2 m. G.M.T.								ESKDALEMUIR. P. 5. December 20. 13 h. 0 m. to 13 h. 9 m. G.M.T.								ESKDALEMUIR. P. 6. December 22. 13 h. 7 m. to 13 h. 13 m. G.M.T.							
Greatest height.	1164	...	...	...	...		Balloon entered st. cloud.	960	279	12.0	+11.8	-1.9		Balloon entered st. cloud.	770	259	10.0	+9.8	+1.9		Balloon entered low st. cloud.		
	1000	207	3.8	+1.7	+3.4			...	...	...	...			...	...	...	...						
100 m. above ground.	750	228	3.9	+2.9	+2.6	1.6		750	267	8.4	+8.4	+0.5	1.6		750	258	10.6	+10.4	+2.2				
Ground level.	500	242	2.2	+1.9	+1.0			500	251	5.2	+4.9	+1.7			500	250	7.8	+7.3	+2.6	1.6			
	340	...	...	...	...			340	250	3.6	+3.3	+1.2			340	260	6.0	+5.9	+1.0				
Computed for M.S.L.	0	Station near centre of high pressure area.				Lift 5 gm.	0	Station near centre of high pressure area.				Lift 5 gm.	0	260	11.1	+10.9	+1.9	...	Lift 5 gm.				
ESKDALEMUIR. P. 7. December 23. 12 h. 51 m. to 13 h. 3 m. G.M.T.								ESKDALEMUIR. P. 8. December 30. 12 h. 51 m. to 13 h. 3 m. G.M.T.								ESKDALEMUIR. P. 9. December 31. 12 h. 44 m. to 12 h. 54 m. G.M.T.							
Greatest height.	1836	...	...	...	...		Balloon entered high mist and was lost to view.	1955	46	14.2	-10.2	-9.9		Balloon entered high mist and was lost to view.	1705	265	8.5	+8.5	+0.7		Balloon was lost in mist.		
	...	...	...	...	...			1750	40	15.7	-10.0	-12.1			...	...	...	...					
100 m. above ground.	1500	276	17.8	+17.7	-1.8	2.1		1500	45	18.6	-13.1	-13.1	2.5		...	...	...	...					
Ground level.	1250	280	15.9	+15.7	-2.7			1250	49	16.0	-12.0	-10.6			1250	274	11.2	+11.2	-0.7	2.6			
	1000	285	13.1	+12.7	-3.4			1000	40	15.3	-9.7	-11.7			1000	263	11.4	+11.3	+1.4				
	750	277	7.5	+7.4	-0.9			750	16	18.4	-5.1	-17.6			750	263	7.6	+7.6	+0.9				
	500	272	5.5	+5.5	-0.2			500	358	10.2	+0.3	-10.2			500	263	3.9	+3.8	+0.5				
	340	260	4.2	+4.1	+0.7			340	359	7.2	+0.1	-7.2			340	270	0.2	+0.2	0.0				
Computed for M.S.L.	0	280	11.4	+11.2	-2.0	...	Lift 12 gm.	0	40	17.8	-11.4	-13.6	...	Lift 24 gm.	0	Station near centre of high pressure area.				Lift 28 gr.			

8. The Lower Layers of the Atmosphere from the Surface to 3000 metres (10,000 ft.) above Mean Sea Level.—*continued.*

## Soundings by Kites (K.) and Pilot Balloons (P.).

ABERDEEN. P. 74. December 3. 11 h. 20 m. G.M.T.

Soundings with Pilot Balloons.	Height above M.S.L.	Wind.				Vertical Velocity of Balloon.	Cloud Observations and Remarks.
		Direction.	Velocity.	Components.			
				W.-E.	S.-N.		
Greatest height.	metres. } 1760	Degrees from N.	m/s.	m/s.	m/s.	m/s.	Balloon entered top of isolated cumulus cloud. Two theodolites at first, then lost to outstation. Vertical velocities assumed as shown to fit in with altitudes found. (See note attached).
	...	...	...	...	...	...	
	...	...	...	...	...	...	
	...	...	...	...	...	...	
	...	...	...	...	...	...	
	...	...	...	...	...	...	
	1700	254	30.9	+29.7	+8.4	2.6	
	1500	256	24.4	+23.7	+5.7	3.1	
	1000	251	23.0	+21.7	+7.6	3.0	
	500	236	27.3	+22.7	+15.2	2.9	
	100	238	14.0	+11.9	+7.4	2.4	
Ground level.	30	225	13.2	+9.3	+9.3	...	
Computed for M.S.L.	0	260	21.0	+20.7	+3.7	...	Lift 60 gm.

ABERDEEN P. 75. December 5. 11 h. 30 m. G.M.T.

Soundings with Pilot Balloons.	Height above M.S.L.	Wind.				Vertical Velocity of Balloon.	Cloud Observations and Remarks.
		Direction.	Velocity.	Components.			
				W.-E.	S.-N.		
Greatest height.	metres. } 4330	Degrees from N.	m/s.	m/s.	m/s.	m/s.	Two theodolites to 4330 m. when balloon was lost in high haze. The balloon followed a most erratic course both in azimuth and in altitude, especially in the latter during the second half of the flight.
	...	...	...	...	...	...	
	4250	307	20.1	+16.1	-12.0	2.7	
	4000	308	15.7	+12.4	-9.6	2.8	
	3500	310	13.4	+10.3	-8.6	4.6	
	3000	313	15.0	+10.9	-10.2	3.6	
	2500	322	9.7	+6.0	-7.6	2.1	
	2000	323	12.4	+7.5	-9.8	2.6	
	1500	331	11.3	+5.5	-9.8	3.2	
	1000	320	12.3	+7.9	-9.4	2.9	
	500	313	15.5	+11.4	-10.5	2.8	
	100	296	11.5	+10.4	-5.0	3.2	
Ground level.	30	294	7.1	+6.4	-2.9	...	
Computed for M.S.L.	0	330	15.7	+7.9	-13.6	...	Lift 57 gm.

ABERDEEN. P. 76. December 10. 10 h. 50 m. G.M.T.

Soundings with Pilot Balloons.	Height above M.S.L.	Wind.				Vertical Velocity of Balloon.	Cloud Observations and Remarks.	
		Direction.	Velocity.	Components.				
				W.-E.	S.-N.			
Greatest height.	metres. } 1210	Degrees from N.	m/s.	m/s.	m/s.	m/s.	Two theodolites used until balloon vanished in Fr.-Cu. cloud at 1210 m. At 11 h. a measurement was made by nephoscope of some Ci.-Cu. cloud seen between the lower St.-Cu. and Fr.-Cu. masses. Assuming an altitude of 6000 m. (the type was normal), this would give components of:—W.-E. = +15.6 m/s.; S.-N. = -15.6 m/s. so that a further veering of the wind in the upper regions is shown.	
	...	...	...	...	...	...		
	1000	295	24.4	+22.2	-10.2	3.6		
	750	291	23.5	+21.9	-8.5	3.3		
	500	284	19.6	+19.1	-4.6	3.3		
	300	286	18.0	+17.3	-4.9	2.6		
	100	284	11.5	+11.2	-2.7	3.5		
Ground level.	30	270	9.0	+9.0	0.0	...		
Computed for M.S.L.	0	309	18.6	+14.5	-11.7	...		Lift 54 gm.

ABERDEEN. P. 77. December 12. 10 h. 55 m. G.M.T.

Soundings with Pilot Balloons.	Height above M.S.L.	Wind.				Vertical Velocity of Balloon.	Cloud Observations and Remarks.
		Direction.	Velocity.	Components.			
				W.-E.	S.-N.		
Greatest height.	metres. } 1010	Degrees from N.	m/s.	m/s.	m/s.	m/s.	Balloon entered loose Nb.-base of low type of Cu.-Nb. Two theodolites used. (See note attached).
	...	...	...	...	...	...	
	925	289	16.1	+15.2	-5.1	2.9	
	750	287	22.0	+21.0	-6.4	2.2	
	500	286	21.6	+20.8	-5.8	2.0	
	340	282	21.3	+20.8	-4.4	0.6*	
	250	283	21.3	+20.7	-4.8	1.8	
	100	282	13.5	+13.2	-2.8	3.0	
Ground level.	30	290	13.0	+12.2	-4.4	...	
Computed for M.S.L.	0	300	16.2	+14.1	-8.1	...	

ABERDEEN. P. 78. December 17. 11 h. 15 m. G.M.T.

Soundings with Pilot Balloons.	Height above M.S.L.	Wind.				Vertical Velocity of Balloon.	Cloud Observations and Remarks.	
		Direction.	Velocity.	Components.				
				W.-E.	S.-N.			
Greatest height.	metres. } 970	Degrees from N.	m/s.	m/s.	m/s.	m/s.	Two theodolites used. Balloon was lost in a patch of cloud of stratus, cumuliformis type. The rate of ascent was considerably accelerated as balloon entered the cloud.	
	...	...	...	...	...	...		
	880	322	10.1	+6.2	-7.9	3.5		
	700	318	8.2	+5.5	-6.1	2.7		
	500	311	7.9	+5.9	-5.2	2.4		
	250	317	6.8	+4.6	-4.9	2.7		
	100	303	4.0	+3.4	-2.2	2.6		
Ground level.	30	286	2.2	+2.1	-0.6	...		
Computed for M.S.L.	0	327	4.7	+2.6	-3.9	...		Lift 46 gm.

ABERDEEN. P. 79. December 19. 12 h. 25 m. G.M.T.

Soundings with Pilot Balloons.	Height above M.S.L.	Wind.				Vertical Velocity of Balloon.	Cloud Observations and Remarks.
		Direction.	Velocity.	Components.			
				W.-E.	S.-N.		
Greatest height.	metres. } 2430	Degrees from N.	m/s.	m/s.	m/s.	m/s.	Balloon was lost in a high haze. Balloon followed a spiral path upwards, and was lost to home station at about 650 m., by passing directly overhead. The rate of ascent for the first 650 m. was quite uniform, and this rate is assumed for the rest of the flight.
	...	...	...	...	...	...	
	2250	267	6.5	+6.5	+0.3	...	
	2000	291	5.1	+4.7	-1.8	...	
	1500	17	3.2	-0.9	-3.0	...	
	1000	37	2.5	-1.5	-2.0	...	
	650	41	1.1	-0.7	-0.8	2.6	
	350	189	2.0	+0.3	+2.0	2.6	
	100	249	3.4	+3.2	+1.2	2.6	
Ground level.	30	240	2.2	+1.9	+1.1	...	
Computed for M.S.L.	0	Station near centre of high pressure area.				...	Lift 47 gm.

Note attached to P. 74:—At 13 h. a band of high Ci.-Cu. was measured with the nephoscope. Assuming 6000 m. as its altitude, the components would be:—W.-E. +27.0 m/s.; S.-N. +15.6 m/s. At 10 h. a similar band had been measured and gave components (at 6000 m.):—W.-E. +21.4 m/s.; S.-N. +21.4 m/s., so that the upper air currents were veering.

Note attached to P. 77:—Balloon was sent up just as a sudden and violent squall passed over Aberdeen. The great variations in the vertical velocity are quite in order, being obtained from the readings of two theodolites. (For example, that at 340 m. marked \* was so low that independent calculations for readings of each theodolite were made, and these gave in one case 34 m., and in the other 38 m., as the amount of rise of the balloon in one minute). At the end of the flight the balloon shot very rapidly upwards into the cloud. During the ascent the surface wind at Aberdeen was of a gusty character.

9. The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. December 4. 6 h. 23 m. G.M.T.	SOUNDING No., 19, 1913.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
				Reading.	Fall per Km.	
Height above M.S.L.	PLACE, MANCHESTER.	km.	mb.	°A.	°C.	
GREATEST HEIGHT, } 8.7 km.	Latitude, 53° 28' N.	8.4	300	225.5		
	Longitude, 2° 14' W.	8.0	320	225.5		
LOWEST TEMPERATURE, } 7.0 km.	Height above M.S.L., } 40 m.	7.0	376	225.5	0	
BASE OF STRATOSPHERE, } 7.0 km.	PLACE OF FALL, Deepcar, near Sheffield, Yorks.	6.6	400	227	5	
Type No. 2.	Distance, 44 km.	6.0	439	230.5	8.5	
	Orientation, 91° from N.	5.1	500	238		
		5.0	508	239	8.5	
		4.0	585	247.5		
		3.8	600	248.5	7	
		3.0	670	254.5		
		2.7	700	257.5	6.5	
		2.5	716	259.5		
		2.0	767	261		
		1.7	800	268	12	
		1.5	820	...		
		1.0	875	...		
		...	900	...		
		0.5	931	...		
		Ground M.S.L.	988	280	...	
			...	...	...	

From observations at Station.	at 7 h.	at 18 h. G.M.T.
PRESSURE (M.S.L.), . . . . .	992 mb.	1002 mb.
TEMPERATURE, . . . . .	276° A.	276° A.
VAPOUR PRESSURE, . . . . .	...	...
GRADIENT WIND :—Direction, . . .	285°	310°
Velocity, . . . . .	21.3 m/s.	33.1 m/s.
Correction for Curvature, . . . .	0.0 m/s.	0.0 m/s.
Final Components, { W. to E. . . . .	+ 20.6 m/s.	+ 21.3 m/s.
{ S. to N. . . . .	- 5.6 m/s.	- 25.4 m/s.

Time is expressed in the hours 1 to 24 of civil reckoning.

Temperatures are expressed in degrees absolute (273° A. = 0° C.).

Pressure is given in millibars (1000 mb. = 1 C.G.S. atmosphere = 750 mm. approximately).

Heights are given in kilometres (km.).

Gradient Wind is taken to be tangential to the isobar and is computed by the formula  $\gamma = 2 \omega \rho V \sin \phi$ .

Base of Stratosphere.—TYPE 1.—When the stratosphere commences with an inversion, the height and temperature of the first point of zero temperature gradient are given.

TYPE 2.—When the stratosphere begins with an abrupt transition to a temperature gradient below 2° per km. without inversion, the height and temperature of the abrupt transition are given.

TYPE 3.—When there is no such abrupt change of temperature gradient, the base is taken to be where the mean fall of temperature for the kilometre next above is 2° or less, provided that it does not exceed 2° for any subsequent kilometre. If some other position for the base seems to the tabulator to be more suitable, it is noted in the column for "Remarks."

## 10. Solar Radiation at South Kensington.

Day.	OCTOBER.					NOVEMBER.					DECEMBER.					REMARKS.
	Max. Rate, Milli-watts per cm <sup>2</sup> .	Daily Amount.		Duration of Bright Sunshine.		Max. Rate, Milli-watts per cm <sup>2</sup> .	Daily Amount.		Duration of Bright Sunshine.		Max. Rate, Milli-watts per cm <sup>2</sup> .	Daily Amount.		Duration of Bright Sunshine.		
		Joules per cm <sup>2</sup> .	% of Ideal.*	Hours.	% of Possible.		Joules per cm <sup>2</sup> .	% of Ideal.*	Hours.	% of Possible.		Joules per cm <sup>2</sup> .	% of Ideal.*	Hours.	% of Possible.	
1	47	731	45	3.8	33	25	x 389	40	0.9	9	14	84	14	0.0	0	
2	37	513	32	2.6	23	32	362	38	0.9	9	13	108	18	0.0	0	
3	53	x 756	48	3.8	33	31	384	41	2.2	23	15	138	23	0.1	1	
4	48	509	32	1.2	11	26	378	41	2.7	29	20	x 258	44	2.5	31	
5	35	447	29	0.1	1	27	x 389	43	3.3	35	x 23	163	28	1.0	13	
6	x 55	655	43	3.7	33	x 42	336	37	1.3	14	5	77	14	0.0	0	
7	42	407	27	2.1	19	24	334	38	3.3	35	4	59	10	0.0	0	
8	45	450	31	1.1	10	30	299	34	3.0	33	15	176	31	0.0	0	
9	50	677	47	3.7	33	20	233	27	0.4	4	12	77	14	0.0	0	
10	45	651	46	3.0	27	13	174	21	0.0	0	7	88	16	0.0	0	
11	10	145	10	0.0	0	28	310	38	3.7	41	8	97	18	0.0	0	
12	42	692	50	x 5.7	x 52	24	258	32	0.8	9	14	88	16	0.0	0	
13	40	564	42	2.1	19	n 8	88	11	0.0	0	13	217	40	x 4.4	x 56	
14	47	598	45	0.4	4	25	206	26	2.6	29	14	194	36	2.2	28	
15	41	524	40	3.7	35	33	353	46	x 4.9	x 56	5	57	11	0.0	0	
16	39	558	43	4.4	42	18	226	30	0.0	0	16	177	33	3.5	45	
17	38	708	56	5.2	49	25	248	33	2.0	23	13	72	13	0.1	1	
18	38	665	54	5.3	50	28	204	28	1.4	16	12	106	20	0.0	0	
19	38	556	46	4.1	39	20	294	41	4.6	53	8	109	20	0.0	0	
20	33	393	33	0.4	4	9	114	16	0.0	0	13	134	25	0.0	0	
21	11	134	11	0.0	0	10	129	18	0.0	0	4	58	11	0.0	0	
22	40	703	61	5.0	49	18	244	36	3.5	41	7	52	10	0.0	0	
23	32	443	39	1.5	15	10	n 86	13	0.0	0	n 3	n 50	9	0.0	0	
24	23	360	32	1.2	12	29	183	27	0.7	8	13	185	35	2.9	37	
25	25	360	33	2.0	20	19	172	26	0.3	4	10	127	24	0.0	0	
26	n 8	n 59	5	0.0	0	13	134	21	0.0	0	8	95	18	0.0	0	
27	38	323	31	0.8	8	10	93	14	0.0	0	15	151	28	0.7	9	
28	30	416	40	2.1	21	18	219	35	4.5	55	15	151	28	0.6	8	
29	34	504	50	4.2	43	26	253	41	3.3	40	10	82	15	0.0	0	
30	45	452	45	1.6	16	11	89	14	0.0	0	13	210	39	3.5	45	
31	32	490	50	5.0	x 52						14	201	37	2.9	37	
Total	...	15443	39	79.8	24	...	7181	31	50.3	19	...	3841	23	24.4	10	
Mean	37	R=498		H=2.57		22	R=239		H=1.68		11	R=124		H=0.79		
Ratio of Mean Daily Amount to Mean Duration.				$\frac{R}{H} = 194$					$\frac{R}{H} = 142$					$\frac{R}{H} = 157$		

Note.—1 watt per cm<sup>2</sup> = 14.35 gramme-calories per cm<sup>2</sup> per minute. 1 gramme-calorie per minute = 0.7 watt nearly. 1 Joule = 0.239 gramme-calories.

If the heat were distributed throughout the atmosphere, 1000 gramme-calories per cm<sup>2</sup> would be sufficient to raise the temperature 4.1 C. It would take 245 gramme-calories per cm<sup>2</sup> to raise the temperature of the whole atmosphere 1 C.

N.B.—The values of Solar Radiation at South Kensington are obtained from the records of a Callendar Instrument which depends upon the difference of temperature between a black and a bright wire exposed horizontally to radiation from the whole of the sky. The values may be taken as representing the total radiation and the maximum rate of radiation per cm<sup>2</sup> received by a horizontal surface. If it is desired to compare the values published for Kew and Eskdalemuir in Tables 3 and 4 with the simultaneous value recorded by the Callendar Instrument the former must be multiplied by the cosine of the zenith distance of the sun at the time of observation. The duration of sunshine in this table is obtained from a Campbell-Stokes Recorder.

For values January to March see p. 14; April to June see p. 46; July to September see p. 66.

\* The "Ideal" intensity of radiation at any instant is taken to be a function of the Sun's altitude only. It is approximately the highest intensity recorded at South Kensington for the corresponding elevation of the Sun. The "Ideal" amount for the day is found by integrating the "Ideal" intensity from sun-rise to sun-set: it is the amount which could be recorded on a day when the atmosphere was in its most transparent state from sun-rise to sun-set. A memoir dealing with the subject is in preparation.

METEOROLOGICAL OFFICE OBSERVATORIES.

## G E O P H Y S I C A L J O U R N A L , 1 9 1 3 .

## A N N U A L S U P P L E M E N T .

**Summary of the Records of Registering Balloon Ascents and Data for  
Additional Ascents not included in the Monthly Issues.**

IN all, during the year sixty-one more or less successful ascents of registering balloons were obtained, and the more prominent features of each ascent are given in Table I.

Instead of being at Crinan, as in previous years, the ascents during the international week were at Eskdalemuir; and since a south-easterly type of weather prevailed which carried the balloons to the North-West and North, these ascents were very successful.

Nine ascents were also made at Farnborough by Mr. A. Ryan during the period December 1912 to February 1913. The results were worked up by Mr. J. S. Dines and are published herewith.

The positions and heights of the different stations from which results have been published are shown in the following table:—

Place.	Latitude.	Longitude.	Height above M.S.L.
			metres.
Pyrton Hill . . . . .	51° 38' N.	1° 0' W.	150
Manchester . . . . .	53° 28' "	2° 14' "	40
Mungret College . . . . .	52° 38' "	8° 41' "	15
Eskdalemuir . . . . .	55° 19' "	3° 12' "	240
Farnborough . . . . .	51° 15' "	0° 45' "	75

Very fair success in the matter of finding the balloons attended the investigation until November, but out of five balloons from Pyrton Hill in November and December none were recovered.

It will be seen from Table I. that a very large proportion of the ascents were in May, the date of the international week. There were none reaching 9 km. in March and December, and this distribution causes a difficulty in calculating the mean annual temperature. The plan adopted has been as follows:—The mean for each month has

TABLE I.

Place.	Date.	Time.	Type.	H <sub>b</sub> .	T <sub>b</sub> .	H <sub>t</sub> .	T <sub>t</sub> .	P <sub>s</sub> .	P <sub>9</sub> .	T <sub>m</sub> .	D.	B.
		h. m.		km.	°A.	km.	°A.	mb.	mb.	°A.	km.	°
Pyrton Hill	Jan 1	15 0	2	10.9	210	14.7	211	1011	298	250	154	35
Pyrton Hill	" 3	7 0	1	10.0	14	12.3	15	1011	301	53	77	41
Limerick (Mungret College)	" 8	7 15	?	9.0	25	9.8	19	1001	300	53	37	85
Farnborough	" 8	17 0	1	9.7	20	16.5	19	1018	303	50	260	339
Farnborough	" 12	16 45	1	7.7	26	17.5	25	1002	286	45	87	83
Pyrton Hill	" 20	10 20	1	7.9	20	13.5	29	987	284	48	89	62
Farnborough	" 30	17 15	1	10.9	14	15.4	10	1002	304	55	580	112
Pyrton Hill	Feb. 6	7 0	1	11.4	04	12.3	08	1014	303	53	67	75
Pyrton Hill	" 7	7 6	1	10.4	09	11.0	10	1016	303	52	113	80
Manchester	" 8	7 0	2	8.2	29	14.9	25	1014	296	48	185	121
Farnborough	" 10	17 15	...	...	...	7.3	40	1030	...	...	87	83
Farnborough	" 11	17 18	...	...	...	7.5	39	1038	...	...	16	130
Pyrton Hill	" "	15 30	1	10.8	09	11.2	12	1034	314	54	19	105
Pyrton Hill	" 21	15 35	1	10.0	11	13.4	17	1018	295	45	69	243
Farnborough	" 22	18 0	1	10.7	08	12.3	9	1031	295	42?	?	?
Pyrton Hill	Mar. 25	16 50	?	?	?	8.0	32	1023	?	...	80	270
Pyrton Hill	Apr. 4	7 2	1	9.6	16	12.4	?	1015	295	47	63	285
Pyrton Hill	May 5	18 55	1	10.5	16	15.2	17	1003	300	52	31	147
Manchester	" "	7 0	1	10.4	24	17.1	27	1004	292	50	22	173
Eskdalemuir	" "	7 5	2	7.9?	26	15.2	20	1011	300	49	34	42
Eskdalemuir	" "	18 37	1	9.6	17	15.0	20	1008	300	52	29	60
Limerick (Mungret College)	" "	7 0	?	9.4	17	11.3	?	1008	297	49	94	130
Pyrton Hill	" 6	6 53	?	9.6	17	10.0	21	1000	300	53	51	360
Pyrton Hill	" "	19 0	1	8.5	21	14.4	21	999	291	46	67	355
Manchester	" "	19 30	1	9.5	20	16.3	21	1000	284	48	103	324
Eskdalemuir	" "	7 5	2	10.3	14	13.2	24	1004	300	51	84	334
Limerick (Mungret College)	" "	7 12	1	8.2	25	15.0	26	999	291	45	20	30
Pyrton Hill	" 7	6 45	1	9.1	26	10.0	28	1001	295	47	47	76
Pyrton Hill	" "	18 55	?	9.0?	26	9.2	26	1002	296	47	173	77
Manchester	" "	6 0	1	9.1	22	16.5	21	1002	289	47	42	353
Eskdalemuir	" "	7 0	1	9.0	19	10.6	24	1003	296	48	102	315
Eskdalemuir	" "	19 0	1	8.1	17	15.0	18	1005	291	45	55	351
Limerick (Mungret College)	" "	7 7	1	7.8	23	10.5	?	991	288	45	60	0
Pyrton Hill	" 8	6 52	1	10.5	13	11.7	17	1000	303	54	112	28
Manchester	" "	6 0	1	10.4	19	12.1	22	1000	294	52	95	16
Eskdalemuir	" "	7 0	1	9.5	17	14.2	21	1004	297	50	72	0
Pyrton Hill	" 9	6 52	1	10.0	19	11.0	22	1000	300	52	120	4
Pyrton Hill	" "	18 53	2	9.1	20	10.0	20	1001	297	50	123	1
Manchester	" "	19 0	1	9.9	21	12.8	22	1001	296	51	174	343
Eskdalemuir	" "	7 0	1	9.1	20	15.2	25	1004	297	49	120	340
Eskdalemuir	" "	19 3	1	9.1	19	12.0	23	1005	297	49	219	335
Limerick (Mungret College)	" "	7 13	1	7.3	22	14.2	30	989	287	45	98	327
Ditcham Park	" "	7 0	?	?	?	7.7	?	1003	?	...	131	3
Pyrton Hill	" 10	6 53	2	9.5	23	14.2	24	1005	292	44	116	6
Manchester	" "	5 53	1	8.5	30	14.9	29	1004	297	55	162	344
Ditcham Park	" "	7 0	2	9.0	23	10.6	25	1006	293	49	141	10
Pyrton Hill	June 5	7 0	1	10.3	22	17.0	25	1005	305	58	75	351
Limerick (Mungret College)	July 3	7 17	1	11.9	07	15.3	?	1026	319	60	86	192
Pyrton Hill	" 29	19 56	1	12.0	14	17.6	20	1017	317	61	93	304
Pyrton Hill	Aug. 5	19 30	1	11.3	18	12.9	20	1015	307	55	90	118
Manchester	" 7	19 45	?	?	?	6.5	42	1016	?	...	80	150
Pyrton Hill	" "	6 53	1	10.2	22	14.6	28	1016	311	58	90	130
Pyrton Hill	" 8	6 55	1	10.1	21	11.5	20	1012	304	54	48	125
Pyrton Hill	Sept. 4	9 0	1	10.5	18	14.6	?	1017	315	59	32	337
Manchester	" "	5 40	1	11.4	14	12.0	21	1022	309	60	41	314
Pyrton Hill	" 15	16 22	1	8.4	26	14.5	27	1000	296	49	59	345
Pyrton Hill	Oct. 2	6 55	1	9.7	19	12.4	23	1009	305	54	66	277
Limerick (Mungret College)	" "	17 50	2	11.0	21	14.6	20	1011	310	59	124	210
Pyrton Hill	" 13	15 53	1	12.5	01	14.8	04	1028	317	59	41	100
Manchester	Nov. 7	6 5	1	8.8	15	19.6	11	1002	283	43	111	155
Manchester	Dec. 4	6 23	2	7.0	26	8.7	26	988	276	42	44	91
Means	...	...	...	9.65	18.7	13.0	20.4*	1007	298.3	50.9	94	...
Corrected Means	...	...	...	10.2	16	...	...	1013	...	...	...	...

H<sub>b</sub> denotes the height in kilometers of the base of the stratosphere.  
 T<sub>b</sub> " the corresponding temperature in degrees absolute (273° A. = 0° C.).  
 H<sub>t</sub> " the maximum height (height of the top).  
 T<sub>t</sub> " the corresponding temperature.  
 P<sub>s</sub> " the pressure at mean sea-level in millibars.

P<sub>9</sub> denotes the pressure at 9 km.  
 T<sub>m</sub> " the mean temperature of the air column between 1 and 9 km.  
 D " the distance the balloon travelled in km.  
 B " the bearing in degrees from north of the falling place.

\* The cases where T<sub>c</sub> is missing are excluded from this mean.



been formed from such ascents as are available, and the annual mean has been formed from the twelve monthly values. There being no suitable ascents for March and December, the two ascents of Mr. Ryan have been utilised from the previous year, and the case of March has been met by assuming that its temperature at each height lay midway between those of the two neighbouring months. The plan cannot be considered altogether satisfactory, but is perhaps the best available.

The means have been carried to a height of 14 kilometers in accordance with previous usage. Where an ascent has not reached this height, but has penetrated well into the stratosphere, it has been assumed that a truly isothermal column of air has been reached. The great number of high ascents that have been recorded prove that this is an allowable assumption, for almost all such records show that after the inversion or cessation of gradient has been passed, a uniform temperature sets in. This consideration also allows us to take the mean temperature at 14 km., as also the mean for any height between 14 km. and 20 km. For heights beyond about 20 km. reliable information is lacking.

## MEAN ANNUAL TEMPERATURE.

	Ground.	1 km.	2 km.	3 km.	4 km.	5 km.	6 km.	7 km.	8 km.	9 km.	10 km.	11 km.	12 km.	13 km.	14 km.
	°A.	°A.	°A.	°A.	°A.	°A.	°A.	°A.	°A.	°A.	°A.	°A.	°A.	°A.	°A.
1908-1911	282·6	77·0	72·6	67·7	61·7	55·5	48·9	41·8	35·0	28·9	23·1	19·6	19·5	19·8	20·0
1912	80·1	75·6	70·9	65·8	60·0	53·9	46·2	39·8	32·1	26·1	21·2	21·4	21·6	21·8	22·0
1913	81·8	76·9	71·9	66·3	60·3	54·0	46·1	38·1	30·2	24·9	19·8	17·0	17·9	18·2	18·6

The means for previous years have been given for comparison, and in view of the paucity and irregular distribution of the observations, the agreement is perhaps better than could be expected.

In the annual summary for 1912 the low value of  $H_c$  for that year was pointed out. The low value was continued in 1913, the crude uncorrected mean of the fifty-six observations being 9·65. But two things go far to explain this low value: thirty of the observations were concentrated into one week in May, and the low value of  $H_c$  was one of the prominent features of this week. Secondly, the mean surface pressure on the days of the ascents was very low, very low that is for a mean of sixty-four observations taken at random, and after allowance is made for this at the rate of 90 metres per millibar of pressure, the corrected value of  $H_c$  becomes about 10·2 km.

The falling points of the balloons are arranged thus:—

In the N.E. quadrant	.	.	.	20
„ S.E. „	.	.	.	14
„ S.W. „	.	.	.	4
„ N.W. „	.	.	.	22

These figures do not represent the usual state of affairs, for it is established beyond dispute that the centre of the falling places of balloons in Europe lies in the S.E. quadrant. The preponderance in the N.W. and N.E. quadrants is due to the prevalence of a southerly type of weather during the international week in May.

The standard deviations and the correlation coefficients are as follows:—

	$P_s$	$T_m$	$P_s$	$H_c$	$T_c$
Standard deviation	9·7 mb.	4·6 C.	8·3 mb.	1·20 km.	6·0 C.

These values are almost identical with those of the preceding year, but the values for  $P_s$ ,  $P_s$ , and  $H_c$  are below the average.

## CORRELATION COEFFICIENTS.

	$P_s$	$T_m$	$P_g$	$H_c$	$T_c$
$P_s$ . . .	1.00	.48	.73	.69	-.59
$T_m$ . . .	.48	1.00	.96	.73	-.34
$P_g$ . . .	.73	.96	1.00	.77	-.70
$H_c$ . . .	.69	.73	.77	1.00	-.75
$T_c$ . . .	-.59	-.34	-.70	-.75	1.00

These values are of the usual character, and differ from those referring to 1912, which were all very low. It is very exceptional to find any coefficient between  $T_c$  and the other quantities other than negative, the value of +.03 between  $T_m$  and  $T_c$  for the preceding year being the only instance so far calculated.

## NOTES.

## 1. Tables of Upper Air Results.

**Time** is expressed in the hours 1 to 24 of civil reckoning (noon = 12 h.).

**Temperatures** are expressed in degrees absolute ( $273^\circ \text{ A.} = 0^\circ \text{ C.}$ ).

**Pressure** is given in millibars (1000 mb. = 1 C.G.S. atmosphere = 750 mm. approximately).

**Heights** are given in kilometers (km.).

**Gradient Wind** is taken to be tangential to the isobar, and is computed by the formula  $\gamma = 2\omega\rho V \sin \phi$ .

**Base of Stratosphere.**—**TYPE 1.**—When the stratosphere commences with an inversion, the height and temperature of the first point of zero temperature gradient are given.

**TYPE 2.**—When the stratosphere begins with an abrupt transition to a temperature gradient below  $2^\circ$  per km. without inversion, the height and temperature of the abrupt transition are given.

**TYPE 3.**—When there is no such abrupt change of temperature gradient, the base is taken to be where the mean fall of temperature for the kilometre next above is  $2^\circ$  or less, provided that it does not exceed  $2^\circ$  for any subsequent kilometre. If some other position for the base seems to the tabulator to be more suitable, it is noted in the column for "Remarks."

## 2. Cloud Observations at Aberdeen, pp. 93 to 97.

1. The time of the observations is given only when other than  $13^{\text{h}}$ . The nearest hour is usually stated (e.g. if taken at  $12^{\text{h}}45^{\text{m}}$ , entered as  $13^{\text{h}}$ , etc.).

2. The velocity is computed from the time in seconds occupied by cloud in passing over the 2.5 cm. radius of middle circle on Fineman's Nephoscope. The formula used is  $\frac{1000 V}{H}$ , which is  $\frac{1000 \times 2.5}{h \times t}$  where  $h$  is height of pointer;  $t$  is time in seconds of cloud passing, as above mentioned. The pointer is maintained at a height of 10 cm. whenever possible, so that the formula becomes  $V = \frac{250}{t}$ , where  $V$  is the velocity in m/s at the assumed height of 1000 m.

3. Direction is given in degrees from  $0^\circ$  to  $360^\circ$ ; reckoned from N. through E. [ $N = 0^\circ$ ,  $E = 90^\circ$ ,  $S = 180^\circ$ ,  $W = 270^\circ$ ]. The components are positive when the motion of the cloud is *from* the directions W., S.

The Remarks give additional information and the time of observation in cases where this differs from  $13^{\text{h}}$ .

The nomenclature used is that approved for international use. It is explained in the *Observer's Handbook*, M.O. 191, pp. 43 to 46, where illustrations of certain types of cloud are also given.

The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1912. December 21. 18 h. 0 m. G.M.T.	SOUNDING No., 3.	Height above M.S.L.	Pressure.	Temp.	PLACE, FARNBOROUGH. Latitude, 51° 15' N. Longitude, 0° 45' W. Height above M.S.L., } 75 m. PLACE OF FALL, Cambridge. Distance, 120 km. and Orientation, 30° from N.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
								Reading.	Fall per Km.	
						km.	mb.	° A.	° C.	
GREATEST HEIGHT, } 15.1 km.		117 mb.	213.5° A.			15	119	213.5	1.5	* The duplication of the temperature trace became too faint to follow above 4.5 km.  Inversion at 800 m. Maximum temperature 278° 5. Pressure 924 mb.
LOWEST TEMPERATURE, } 11.9 km.		195 mb.	212.5° A.			14	139	214	0.5	
BASE OF STRATOSPHERE, } 10.9 km.		228 mb.	214.0° A.			13	164	214.5	-1.5	
Type No. 2.						12	192	213		
						11.72	200	213		
						11.0	224	214.5	1.5	
						10.0	262	217	2.5	
						9.10	300	222		
						9.0	305	222.5	5.5	
						8.0	353	229	6.5	
						7.16	400	237	9	
						7.0	409	238	8.5	
						6.0	470	246.5		
						5.57	500	250		
						5.0	538	253.5*	7	
						4.5	576	257, 259.5		
						4.19	600	259, 262	7	
						4.0	616	260.5, 263		
						3.5	657	263.5, 265.5	6 5	
						3.02	700	266.5, 268		
						3.0	701	266.5, 268		
						2.5	747	270, 271.5		
						2.0	795	273.5, 274.5	7 6.5	
						1.96	800	273.5, 274.5		
						1.5	846	276	3.5	
						1.0	900	277		
						0.5	959	277		
						0.13	1000	280	4	
						Ground M.S.L.	1008	281	...	
							1018	...	...	
From observations at Station		at 7 h.	at 18 h. G.M.T.							
PRESSURE (M.S.L.),		1018 mb.	1015 mb.							
TEMPERATURE,		277° A.	281° A.							
VAPOUR PRESSURE,		...	...							
GRADIENT WIND :—Direction,		214°	220°							
Velocity,		7.5 m/s.	12.1 m/s.							
Correction for Curvature,		+0.6 m/s.	+0.8 m/s.							
Final Components, { W. to E.		+4.5 m/s.	+8.3 m/s.							
{ S. to N.		+6.7 m/s.	+9.9 m/s.							
1912. December 27. 7 h. 35 m. G.M.T.	SOUNDING No., 4.	Height above M.S.L.	Pressure.	Temp.	PLACE, FARNBOROUGH. Latitude, 51° 15' N. Longitude, 0° 45' W. Height above M.S.L., } 75 m. PLACE OF FALL, Belgium. Distance, ... and Orientation, ...	Height above M.S.L.	Pressure.	Temperature.	REMARKS.	
GREATEST HEIGHT, } 16.7 km.		93 mb.	219° A.			16.24	100	219		Inversion maximum temperature 277° at 1.2 km. 870 mb.  Isothermal 272° from 2.0-2.3 km. 786-759 mb.
LOWEST TEMPERATURE, } 11.2 km.		220 mb.	214° A.			16.0	103	218.5	-0.5	
BASE OF STRATOSPHERE, } 11.2 km.		220 mb.	214° A.			15.0	123	218	-1	
Type No. 1.						14.0	142	217	-0.5	
						13.0	166	216.5		
						12.0	194	216.5	0	
						11.80	200	216		
						11.0	227	215.5	-1	
						10.0	264	222	6.5	
						9.17	300	229	8.5	
						9.0	307	230.5	6.5	
						8.0	356	237		
						7.17	400	243	7	
						7.0	411	244		
						6.0	472	251	7	
						5.58	500	253.5		
						5.0	538	258	7	
						4.5	576	261	6	
						4.17	600	263		
						4.0	614	264		
						3.5	654	267	6	
						3.0	698	270		
						2.98	700	270		
						2.5	741	271.5		
						2.0	786	272	2	
						1.87	800	272.5	3	
						1.5	838	275.5		
						1.0	890	275		
						.92	900	275		
						.5	946	278		
						.07	1000	278.5	3.5	
						Ground M.S.L.	1000	278.5	...	
							1008	...	...	
From observations at Station		at 7 h.	at 18 h. G.M.T.							
PRESSURE (M.S.L.),		1007 mb.	1006 mb.							
TEMPERATURE,		278° A.	285° A.							
VAPOUR PRESSURE,		...	...							
GRADIENT WIND :—Direction,		235°	225°							
Velocity,		7.1 m/s.	17.6 m/s.							
Correction for Curvature,		+2.3 m/s.	-1.6 m/s.							
Final Components, { W. to E.		+7.7 m/s.	+11.3 m/s.							
{ S. to N.		+5.4 m/s.	+11.3 m/s.							
1913. November 7. 6 h. 5 m. G.M.T.	SOUNDING No., 18, 1913.	Height above M.S.L.	Pressure.	Temp.	PLACE, MANCHESTER. Latitude, 53° 28' N. Longitude, 2° 14' W. Height above M.S.L., } 40 m. PLACE OF FALL, Whittington, Warwick. Distance, 111 km. and Orientation, 155° from N.	Height above M.S.L.	Pressure.	Temperature.	REMARKS.	
GREATEST HEIGHT, } 19.6 km.		51 mb.	211° A.			19.0	54	211	1	
LOWEST TEMPERATURE, } 19.6 km.		51 mb.	211° A.			18.0	62	212	0.5	
BASE OF STRATOSPHERE, } 8.8 km.		291 mb.	215° A.			17.0	74	212.5	1	
Type No. 1.						16.0	88	213.5		
						15.3	100	214		
						15.0	105	214.5		
						14.0	125	215.5	1	
						13.0	150	216.5	1	
						12.0	174	217	0.5	
						11.0	200	217	0	
						11.0	204	217	1.5	
						10.0	239	218.5	-2	
						9.0	283	216.5		
						8.6	300	217.5		
						8.0	329	219	2.5	
						7.0	384	227.5	8.5	
						6.7	400	230		
						6.0	447	236	8	
						5.2	500	242		
						5.0	518	244		
						4.0	594	252.5	8.5	
						3.9	600	253		
						3.0	680	260	7.5	
						2.8	700	261		
						2.5	728	262.5	5	
						2.0	778	265		
						1.8	800	266		
						1.5	831	267.5	6	
						1.0	885	271		
						0.9	900	272		
						0.5	944	275	6.5	
						Ground M.S.L.	999	277.5	...	
							...	...	...	
From observations at Station		at 7 h.	at 18 h. G.M.T.							
PRESSURE (M.S.L.),		1001 mb.	1006 mb.							
TEMPERATURE,		281° A.	281° A.							
VAPOUR PRESSURE,		...	...							
GRADIENT WIND :—Direction,		355°	Pressure							
Velocity,		10.6 m/s.	Distribution							
Correction for Curvature,		0.0 m/s.	Irregular.							
Final Components, { W. to E.		+0.9 m/s.	...							
{ S. to N.		-10.6 m/s.	...							

The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. January 8. 17 h. 0 m. G.M.T.				SOUNDING No., 7.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	Reading.				Fall per Km.		
PLACE, FARNBOROUGH. Latitude, 51° 15' N. Longitude, 0° 45' W. Height above M.S.L., } 75 m. PLACE OF FALL, Hyde, Cheshire. Distance, 260 km. Orientation, 339° from N.				km.	mb.	°A.	°C		
GREATEST HEIGHT, } 16.5 km.	96 mb.	219° A.	16.20	100	219				
LOWEST TEMPERATURE, } 12.0 km.	192 mb.	219° A.	16.0	104	219.5		0.5		
BASE OF STRATOSPHERE, } 9.7 km.	273 mb.	220° A.	15.0	120	220		0.0		
			16.5 km.	96 mb.	219° A.	14.0	141	220	0.0
Type	No. 1.		13.0	164	220		-1		
			12.0	192	219				
			11.71	200	219.5		2		
			11.0	224	221				
			10.0	260	220		-1		
			9.05	300	222.5				
			9.0	303	223				
			8.0	351	229			3	
			7.09	400	235.5			6	
			7.0	406	236			7	
			6.0	467	245			9	
			5.52	500	249			7	
			5.0	536	252				
			4.5	574	254.5			5	
			4.17	600	256				
			4.0	614	257				
			3.5	655	260			6	
			3.0	698	263				
			2.98	700	263				
			2.5	745	266.5			6	
			2.0	795	269				
			1.95	800	269				
			1.5	846	273			9	
			1.0	899	278				
			.99	900	278				
			.5	957	278.5			2	
			.15	1000	280				
			Ground M.S.L.	1009	280				
				1018	...				
From observations at Station				at 7 h.	at 18 h. G.M.T.				
PRESSURE (M.S.L.),			1015 mb.		1014 mb.				
TEMPERATURE,			280° A.		280° A.				
VAPOUR PRESSURE,			...		...				
GRADIENT WIND:—Direction,			189°		170°				
Velocity,			18.5 m/s.		13.3 m/s.				
Correction for Curvature,			+2.7 m/s.		+1.6 m/s.				
Final Components, { W. to E.			+3.3 m/s.		-2.6 m/s.				
{ S. to N.			+20.9 m/s.		+14.7 m/s.				
1913. January 12. 16 h. 45 m. G.M.T.				SOUNDING No., 8.					
PLACE, FARNBOROUGH.									
Latitude, 51° 15' N.									
Longitude, 0° 45' W.									
Height above M.S.L., } 75 m.									
PLACE OF FALL, Rochester.									
Distance, 87 km.									
Orientation, 83° from N.									
GREATEST HEIGHT, } 17.5 km.	80 mb.	225° A.	17.0		87				
LOWEST TEMPERATURE, } 16.0 km.	101 mb.	223° A.	16.05	100	223		-2	The temperatures are duplicated from 6 km. downwards. The pressures given for each height refer to what appeared to be the rising trace.	
BASE OF STRATOSPHERE, } 7.7 km.	347 mb.	225.5° A.	16.0	101	223		2		
Type	No. 1.		15.0	117	225		2		
			14.0	137	227		2		
			13.0	158	227.5		0.5		
			12.0	184	229.5		2		
			11.42	200	230				
			11.0	213	231		1.5	The temperature traces cross each other at 2.1 km.	
			10.0	246	229		-2		
			9.0	286	228		-1	Temperature inversion from 260°.5 - 261° A. at 2-2.2 km. on down trace.	
			8.66	300	226		-2		
			8.0	332	226				
			7.0	385	228		2		
			6.73	400	228.5				
			6.0	446	231		3	Extremely low stratosphere.	
			5.22	500	235, 237				
			5.0	516	236.5, 238.5		5.5 7.5		
			4.5	555	240.5, 242.5		8.5 8.5		
			4.0	597	245, 247				
			3.97	600	245, 247		8 8		
			3.5	639	249, 251				
			3.0	683	253, 255				
			2.82	700	255, 256.5		8.5 5.5		
			2.5	732	257.5, 259				
			2.0	781	261.5, 260.5				
			1.82	800	263, 261.5		7.5 6.5		
			1.5	832	265.5, 264				
			1.0	888	269, 267				
			.89	900	270, 268				
			.5	945	273, 271				
			.02	1000	...		7 8		
			Ground M.S.L.	994	276, 275				
				1002	...				
From observations at Station				at 7 h.	at 18 h. G.M.T.				
PRESSURE (M.S.L.),			1004 mb.		1008 mb.				
TEMPERATURE,			277° A.		276° A.				
VAPOUR PRESSURE,			...		...				
GRADIENT WIND:—Direction,			Pressure		266°				
Velocity,			Distribution		10.4 m/s.				
Correction for Curvature,			Irregular.		0.0 m/s.				
Final Components, { W. to E.			...		+10.4 m/s.				
{ S. to N.			...		+0.7 m/s.				
1913. January 30. 17 h. 15 m. G.M.T.				SOUNDING No., 13.					
PLACE, FARNBOROUGH.									
Latitude, 51° 15' N.									
Longitude, 0° 45' W.									
Height above M.S.L., } 75 m.									
PLACE OF FALL, Speicher, Germany.									
Distance, 520 km.									
Orientation, 112° from N.									
GREATEST HEIGHT, } 15.4 km.	113 mb.	210.5° A.	15.0		119		3.5	Considerable temperature gradient in the stratosphere.	
LOWEST TEMPERATURE, } 15.4 km.	113 mb.	210.5° A.	14.0	140	216		2.5		
BASE OF STRATOSPHERE, } 10.9 km.	227 mb.	214.5° A.	13.0	164	218.5				
Type	No. 1.		12.0	191	217.5		-1		
			11.70	200	217		-2.5	Inversion of 2° at { 4.6 km. 550 mb.	
			11.0	224	215		4		
			10.0	262	219				
			9.09	300	226		8	" " " { 2.5 km. 740 mb.	
			9.0	304	227		8		
			8.0	352	235		8		
			7.10	400	242		8	" " " { 0.7 km. 920 mb.	
			7.0	405	243		8		
			6.0	465	251		8		
			5.47	500	255		6.5	Isothermal layer at { 4.0 km. 600 mb.	
			5.0	532	257.5				
			4.5	569	257		4.5		
			4.10	600	261				
			4.0	607	262				
			3.5	648	264.5				
			3.0	691	267.5		5.5		
			2.90	700	268				
			2.5	736	271				
			2.0	784	272		4.5		
			1.84	800	272.5				
			1.5	834	274				
			1.0	897	276.5		4.5		
			.89	900	277				
			.05	943	276				
			.02	1000	...		3.5		
			Ground M.S.L.	994	280				
				1002	...				
From observations at Station				at 7 h.	at 18 h. G.M.T.				
PRESSURE (M.S.L.),			1010 mb.		999 mb.				
TEMPERATURE,			279° A.		281° A.				
VAPOUR PRESSURE,			...		...				
GRADIENT WIND:—Direction,			Pressure		216°				
Velocity,			Distribution		30.7 m/s.				
Correction for Curvature,			Irregular.		-7.3 m/s.				
Final Components, { W. to E.			...		+13.8 m/s.				
{ S. to N.			...		+18.9 m/s.				

The Upper Air: Soundings by Registering Balloons (R.) and Pilot Balloons (P.).

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. February 10. 17 h. 15 m. G.M.T.				SOUNDING NO., 14.		Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, FARNBOROUGH.	Latitude,	Longitude,			Reading.	Fall per Km.	
GREATEST HEIGHT, } 7.3 km.	400 mb.	240.5° A.	Latitude, 51° 15' N.	51° 15' N.	0° 45' W.	km.	mb.	°A.	°C.	Temperature inversion from surface to 800 m.
LOWEST TEMPERATURE, } ...	...	...	Longitude, 0° 45' W.			7.32	400	240.5		
BASE OF STRATOSPHERE, } Stratosphere not reached.			Height above M.S.L., } 75 m.			7.0	419	242		
Type No. ?			PLACE OF FALL, Rochester.			6.0	480	248	6	
			Distance, 87 km.			5.70	500	250		
			Orientation, 83° from N.			5.0	551	255	7	
						4.5	589	257.5		
						4.34	600	258.5	6	
						4.0	627	261		
						3.5	670	265		
						3.16	700	267		
						3.0	715	268	7	
						2.5	761	272		
						2.09	800	275		
						2.0	810	276	8	
						1.5	861	279		
						1.13	900	281.5		
						1.0	915	282.5	6.5	
						.5	971	283		
						.25	1000	282.5	-0.5	
						Ground M.S.L.	1022	282	...	
							1030	...	...	
From observations at Station			at 7 h.	at 18 h. G.M.T.						
PRESSURE (M.S.L.),			1030 mb.	1031 mb.						
TEMPERATURE,			281° A.	281° A.						
VAPOUR PRESSURE,			...	...						
GRADIENT WIND:—Direction,			247°	208°						
Velocity,			8.0 m/s.	5.9 m/s.						
Correction for Curvature,			+2.0 m/s.	+4.0 m/s.						
Final Components, { W. to E.			+9.2 m/s.	+4.7 m/s.						
{ S. to N.			+3.9 m/s.	+8.7 m/s.						
1913. February 11. 17 h. 18 m. G.M.T.				SOUNDING NO., 15.		7.44	400	239.5		Large temperature inversion from surface to 500 m.
Height above M.S.L.	Pressure.	Temp.	PLACE, FARNBOROUGH.	Latitude,	Longitude,	7.0	424	243		
GREATEST HEIGHT, } 7.5 km.	397 mb.	239° A.	Latitude, 51° 15' N.	51° 15' N.	0° 45' W.	6.0	488	249	6	
LOWEST TEMPERATURE, } ...	...	...	Longitude, 0° 45' W.			5.82	500	249.5		
BASE OF STRATOSPHERE, } Stratosphere not reached.			Height above M.S.L., } 75 m.			5.0	560	255	6	
Type No. ?			PLACE OF FALL, Godalming.			4.5	597	259		
			Distance, 16 km.			4.46	600	259.5		
			Orientation, 140° from N.			4.0	636	263	8	
						3.5	679	267		
						3.26	700	269		
						3.0	723	271	8	
						2.5	769	275		
						2.18	800	277.5		
						2.0	817	278.5	7.5	
						1.5	867	282		
						1.19	900	283.5		
						1.0	920	284.5	6	
						.5	976	286.5		
						.31	1000	285	-5.5	
						Ground M.S.L.	1028	280	...	
							1038	...	...	
From observations at Station			at 7 h.	at 18 h. G.M.T.						
PRESSURE (M.S.L.),			1034 mb.	1037 mb.						
TEMPERATURE,			273° A.	280° A.						
VAPOUR PRESSURE,			...	...						
GRADIENT WIND:—Direction,			206°	Station near						
Velocity,			3.6 m/s.	centre of						
Correction for Curvature,			+0.2 m/s.	Local High						
Final Components, { W. to E.			+1.7 m/s.	Pressure						
{ S. to N.			+3.4 m/s.	System.						
1913. February 22. 18 h. 0 m. G.M.T.				SOUNDING NO., 17.		12.0	184	209		Isothermal from— 3.7-4.7 km. 633-550 mb. Very large temperature gradient below. The calibration of this instrument was somewhat unsatisfactory.
Height above M.S.L.	Pressure.	Temp.	PLACE, FARNBOROUGH.	Latitude,	Longitude,	11.44	200	205.5	-1	
GREATEST HEIGHT, } 12.3 km.	174 mb.	208.5° A.	Latitude, 51° 15' N.	51° 15' N.	0° 45' W.	11.0	215	208	3.5	
LOWEST TEMPERATURE, } 11.5 km.	197 mb.	205.5° A.	Longitude, 0° 45' W.			10.0	253	211.5		
BASE OF STRATOSPHERE, } 10.7 km.	226 mb.	207.5° A.	Height above M.S.L., } 75 m.			9.0	295	218	6.5	
Type No. 1.			PLACE OF FALL ? , France.			8.89	300	219	8	
			Distance, ? km.			8.0	343	226		
			Orientation, ?°.			7.0	397	233	7	
						6.94	400	233.5		
						6.0	458	238.5	5.5	
						5.38	500	242		
						5.0	527	243.5	0.5	
						4.5	566	244		
						4.08	600	244	6	
						4.0	607	244		
						3.5	651	246		
						3.0	698	250		
						2.97	700	250.5	8	
						2.5	747	254		
						2.0	800	258		
						1.5	854	262.5	10	
						1.08	900	267		
						1.0	910	268		
						.5	970	272		
						.26	1000	273.5	8	
						Ground M.S.L.	1020	275	...	
							1031	...	...	
From observations at Station			at 7 h.	at 18 h. G.M.T.						
PRESSURE (M.S.L.),			1033 mb.	1031 mb.						
TEMPERATURE,			274° A.	276° A.						
VAPOUR PRESSURE,			...	...						
GRADIENT WIND:—Direction,			Station near	144°.						
Velocity,			centre of	7.4 m/s.						
Correction for Curvature,			Local High	+2.8 m/s.						
Final Components, { W. to E.			Pressure	-6.0 m/s.						
{ S. to N.			System.	+8.3 m/s.						

## Observations of Cloud Motion by Fineman's Nephoscope.—Aberdeen.

Taken at 13 h. (1 p.m.) G.M.T. [Exceptions are noted in the Remarks column.]

Date.	Type of Cloud.	Direction from (Deg. from N.).	Computed for 1000 m.			REMARKS.	Date.	Type of Cloud.	Direction from (Deg. from N.).	Computed for 1000 m.			REMARKS.
			Velocity.	Components.						Velocity.	Components.		
				V.	W.						S.	V.	
FEBRUARY													
12	St.-Cu.	258	3.3	+ 3.2	+ 0.7		1	St.-Cu.	328	2.8	+ 1.5	- 2.4	Cu. below from N.W.
13	A.-Cu. to St.-Cu.	228	1.1	+ 0.8	+ 0.7		2	Cu.	314	13.0	+ 9.4	- 9.0	
14	St.-Cu.	191	5.1	+ 1.0	+ 5.0	Day very hazy to foggy. <i>Obs. at 12 h.</i>	3	Cu.	328	11.0	+ 5.8	- 9.4	Cu. very degraded in type.
17	Cu.	105	5.4	- 5.2	+ 1.4		4	Cu.	325	12.5	+ 7.1	- 10.3	Cu. of low type and degraded.
18	St.-Cu.	180	2.0	0.0	+ 2.0		7	Cu.-Nb.	345	6.9	+ 1.8	- 6.7	<i>Apex</i> of cloud measured.
19	St.-Cu.	73	3.5	- 3.4	- 1.0	At 16 h. the St.-Cu. had disappeared, while a higher sheet of A.-Cu. formed from W. Cirro-nebula above, showing no detail. St.-Cu. in afternoon from N.W.	8	Cu.	360	6.4	0.0	- 6.4	
21	Cu.	30	1.8	- 0.9	- 1.6	Coarse Ci.-St. to A.-St. <i>Obs. at 12 h. 30 m.</i>	9	St.-Cuf.	165	19.0	- 4.9	+ 18.4	Stratus cumuliformis type.
25	A.-St.	225	2.8	+ 2.0	+ 2.0	<i>Observation at 12 h.</i>	10	Cu.	200	6.0	+ 2.0	+ 5.6	Degraded cloud. A.-St. sheet above.
26	St.-Cu.	215	6.3	+ 3.6	+ 5.2	Nb. of cumuliformis type. <i>Obs. at 12 h.</i>	11	St.-Cu.	267	3.6	+ 3.6	+ 0.2	St.-Cu. formed from apical portions of Cu.-Nb.
27	Nb.	355	16.0	+ 1.4	- 15.8	<i>Observation at 12 h.</i>	15	Cu.	338	12.0	+ 4.1	- 11.3	Degraded cloud.
28	Cu.	323	3.1	+ 1.9	- 2.5		17	Cu.-Nb.	240	4.0	+ 3.5	+ 2.0	Very degraded cloud.
MARCH													
3	Ci.-St.	235	4.4	+ 3.6	+ 2.5	⊕. In afternoon Ci.-St. developed into Ci.-Cu. in lenticular patches. <i>Obs. at 12 h.</i>	18	Cu.	300	6.1	+ 5.3	- 3.1	Very degraded cloud.
4	Cu.	225	28.0	+ 20.9	+ 20.9	Uniform A.-St. above.	19	Cu.-Nb.	285	6.0	+ 5.8	- 1.6	Central portions of cloud measured.
6	Cu.-Nb.	231	8.3	+ 6.5	+ 5.2	Measurement of <i>apex</i> of cloud.	22	Cu.	343	13.0	+ 3.8	- 12.5	Cu. degraded type.
7	Cu.	293	21.0	+ 19.3	- 8.2	Cu. inclined to Cu.-Nb. form.	26	Cu. to St.-Cu.	330	5.4	+ 2.7	- 4.7	<i>Observation at 19 h.</i> Squalls from N.N.W., 17 m. p.s.
8	Cu.	310	12.5	+ 9.6	- 8.0		28	Cu.	300	4.5	+ 3.9	- 2.3	A transition type of cloud.
10	Fr.-Cu.	288	12.0	+ 11.4	- 3.7		29	Cu.	278	4.2	+ 4.2	- 0.6	Degraded sheet of Cu.
12	Cu.	234	17.0	+ 13.8	+ 10.0	Cu. of degraded type. <i>Observation at 12 h.</i>	30	St.-Cuf.	171	19.0	- 3.0	+ 18.8	Stratus cumuliformis type.
14	Cu.	248	9.3	+ 8.6	+ 3.4		31	St.-Cuf.	157	5.6	- 2.2	+ 5.2	Stratus cumuliformis type.
15	Ci.	260	3.1	+ 3.0	+ 0.5	Rather coarse type cirrus.	AUGUST						
18	Ci.	290	3.0	+ 2.8	- 1.0	Ci. to Ci.-St. ⊕ forenoon.	2	Cu.	275	2.8	+ 2.8	- 0.2	
20	A.-St.	190	1.1	+ 0.2	+ 1.1	Dense Ci.-St. to A.-St.	4	Cu.	336	4.8	+ 2.0	- 4.4	
21	Cu.	217	7.8	+ 4.7	+ 6.2	Cu. of very degraded type.	6	Nb.	343	10.0	+ 2.9	- 9.6	Degraded form of Cu.-Nb.
22	Cu.	225	12.0	+ 8.5	+ 8.5	Cu. changing to Cu.-Nb.	7	St.-Cu.	339	5.0	+ 1.8	- 4.7	
24	Cu.-Nb.	285	1.8	+ 1.7	- 0.5	Degraded Cu.-Nb.	8	Cu.	307	3.8	+ 3.1	- 2.3	
25	Ci.	3	1.0	- 0.1	- 1.0	Hazy indefinite Ci. <i>Observation at 11 h.</i>	9	Cu.	320	2.3	+ 1.6	- 1.9	Degrading Cu.
26	St.-Cu.	171	12.5	- 2.0	+ 12.4	St.-Cu. of thin flat type.	11	Cu.	325	6.2	+ 3.6	- 5.1	
28	Cu.	112	23.0	- 21.4	+ 8.5	Degraded Cu. ; became Nb. later.	12	Cu.	315	2.5	+ 1.8	- 1.8	
31	Ci.	181	5.7	0.0	+ 5.7	Of normal type, very fast, radiating from S.	13	A.-Cu.	332	4.2	+ 1.9	- 3.7	General cloud during forenoon of St. type. <i>Observation at 12 h. 45 m.</i>
APRIL*													
1	Cu.	255	6.1	+ 5.9	+ 1.6		14	Fr.-Cu.	280	3.6	+ 3.5	- 0.6	
2	Cu.	230	5.1	+ 4.9	+ 3.3		15	Fr.-Cu.	187	15.0	+ 1.8	+ 14.6	A.-Cu. above, no motion appreciable.
5	Cu.	5	15.0	- 0.1	- 14.9	<i>Observation at 10 h.</i>	18	Cu.	355	6.8	+ 0.6	- 6.7	
7	Cu.	359	9.6	+ 0.2	- 9.6	Heavy type Cu.	21	St.-Cu.	240	4.2	+ 3.7	+ 2.1	Some Fr.-Nb. below, direction from S.W.
8	Cu.	346	11.0	+ 2.6	- 10.7	Very degraded Cu.	22	Cu. to Cu.-Nb.	262	8.1	+ 8.0	+ 1.1	
9	Cu.	315	14.0	+ 9.9	- 9.9	Heavy degraded Cu.	23	Cu.	245	4.2	+ 3.8	+ 1.8	
10	Cu.	315	10.0	+ 7.1	- 7.1	<i>Apex</i> of Cu.-Nb. measured.	26	St.-Cu.	266	3.9	+ 3.9	+ 0.3	Heavy Cu.-Nb. low in W.N.W.
12	Cu.-Nb.	2	4.0	- 0.1	- 4.0	Degraded Cu. to Cu.-Nb.	27	Ci.	300	1.1	+ 1.0	- 0.6	Feathery type ; no definite radiant point.
15	Cu.-Nb.	218	12.5	+ 7.8	+ 9.9	<i>Base</i> of Cu.-Nb. measured.	28	Ci.-Cu. to A.-Cu.	237	1.5	+ 1.3	+ 0.8	Lenticular patches. Hazy.
16	Ci.-Cu.	190	5.4	+ 0.9	+ 5.3	<i>Base</i> of Cu.-Nb. measured.							
17	Cu.-Nb.	242	8.6	+ 7.6	+ 4.0	St.-Cu. of degraded form.							
18	Cu.-Nb.	227	11.0	+ 8.0	+ 7.5	Degraded cloud ; much high haze. <i>Observation at 12 h.</i>							
22	St.-Cu.	245	5.4	+ 4.9	+ 2.3	Thin St.-Cu. Fr.-St. below.							
24	Fr.-Cu.	178	4.2	- 0.1	+ 4.2	Cloud dispersing 12 h. then rapidly formed sheet of A.-St. 12 h. 30 m. <i>Obs. at 12 h.</i>							
25	St.-Cu.	163	4.2	- 1.2	+ 4.0	Coarse and very rapid. <i>Observation at 12 h.</i>							
26	Cu.	215	9.6	+ 5.5	+ 7.9								
28	Ci.	188	6.3	+ 0.9	+ 6.2								
29	Ci.-St. to A.-St.	189	5.6	+ 0.9	+ 5.5								

\* For observations for May and June, see p. 97.

Observations of Cloud Motion by Fineman's Nephoscope.—Aberdeen.

Taken at 13 h. (1 p.m.) G.M.T. [Exceptions are noted in the Remarks column.]

Date.	Type of Cloud.	Direction from (Deg. from N.).	Computed for 1000 m.			REMARKS.	Date.	Type of Cloud.	Direction from (Deg. from N.).	Computed for 1000 m.			REMARKS.
			Velocity.	Components.						Velocity.	Components.		
				V.	W.						S.	V.	
SEPTEMBER						NOVEMBER							
1	Cu. to St.-Cu.	5	m/s. 6.9	m/s. -0.6	m/s. -6.9	3	Ci.-Cu.	267	m/s. 3.3	m/s. +3.3	m/s. +0.2	In bands; radiant point S. <i>Obs. at 12 h.</i>	
3	St.-Cu.	176	3.6	-0.3	+3.6	4	St.-Cu.	193	4.3	+1.0	+4.2	Mostly A.-St.	
4	Fr.-Cu.	104	6.4	-6.2	+1.5	5	Ci.-St.	175	3.9	-0.4	+3.9		
5	St.-Cu.	85	5.0	-5.0	-0.4	6	Ci.	130	2.5	-1.9	+1.6	Patchy type; cumuliform in places.	
9	Cu. to Cu.-Nb.	310	5.2	+4.0	-3.3	7	A.-Cu.	6	2.0	-0.2	-2.0	Seen above sheets of Fr.-Nb. <i>Obs. at 12 h. 30 m.</i>	
10	Cu.	287	4.5	+4.3	-1.3	8	Ci. to Ci.-St.	215	1.0	+0.6	+0.8	Coarse Ci. to Ci.-St.	
17	St.-Cu.	327	3.3	+1.8	-2.8	11	St.-Cu.	215	3.9	+2.2	+3.2	Very small-flaked, in sheets. <i>Obs. at 12 h.</i>	
19	St.-Cu.	230	4.6	+3.5	+2.9	13	Cu.-Nb.	328	4.2	+2.2	-3.6	Degrading into sheet.	
20	St.-Cu.	345	3.1	+0.8	-3.0	14	Ci.-Cu.	275	2.6	+2.6	-0.2	Flocculent Ci.-Cu. taking lenticular form. <i>Observation at 12 h.</i>	
22	Cu.	125	12.5	-10.2	+7.1	15	St.-Cu.	268	4.3	+4.3	+0.1	Floccular and partly-formed type. <i>Observation at 11 h. 45 m.</i>	
26	Cu.	200	6.6	+2.2	+6.2	17	Fr. Cu.	249	16.0	+14.9	+5.8		
27	St.-Cu.	177	6.6	-0.3	+6.6	19	Ci.-Cu.	287	6.3	+6.0	-1.8	Ci.-Cu. maculate to flocculent.	
30	St.-Cuf.	87	14.0	-14.0	-0.7	20	Ci.-Cu.	255	6.0	+5.8	+1.6	Dispersing. <i>Observation at 12 h.</i>	
OCTOBER						DECEMBER							
1	St.-Cu.	96	6.3	-6.3	+0.7	1	St.-Cu.	275	8.1	+8.1	-0.7	Thin flat type.	
2	St.-Cu.	128	3.1	-2.4	+1.9	2	Fr.-Cu.	267	12.5	+12.4	+0.6	Coarse Ci. to Ci.-Cu.	
4	St.-Cu.	225	1.5	+1.1	+1.1	3	Ci.-Cu.	240	5.2	+4.5	+2.6		
6	A.-Cu.	52	2.5	-2.0	-1.6	5	Cu.-Nb.	327	10.0	+5.5	-8.4	Ci. to high Ci.-Cu. fusing into sheet.	
7	Fr.-Cu.	82	5.2	-5.1	-0.7	6	Ci.-Cu.	308	4.2	+3.3	-2.6	<i>Observation at 11 h.</i>	
8	Cu.	70	10.0	-9.4	-3.4	10	Ci.-Cu.	315	3.7	+2.6	-2.6		
9	Cu.-Nb.	2	6.3	-0.2	-6.3	11	A.-Cu. to St.-Cu.	285	4.1	+4.0	-1.1	Ci. above, lenticular A.-Cu. below, directions different. <i>Observation at 12 h.</i>	
10	Cu.	177	7.1	-0.4	+7.1	12	Ci.	255	2.0	+1.9	+0.5	Very low "scud"; velocities approximate.	
11	Cu.	140	10.0	-6.4	+7.7	16	Fr.-Cu.	295	31.0	+28.2	-13.0		
15	Cu.-Nb.	334	10.0	+4.4	-9.0	17	Nb.	315	42.0?	+30.?	-30.?	Coarse Ci.-St.	
16	Ci.-Cu.	260	2.2	+2.2	+0.4	22	Fr.-Cu.	304	9.3	+7.7	-5.2		
17	St.-Cu.	238	3.0	+2.6	+1.6	23	Ci.-St.	225	3.0	+2.1	+2.1	False Ci. massing into A.-St. sheet.	
18	Ci.	233	3.6	+2.9	+2.2	27	to A.-St.	251	3.3	+3.1	+1.0		
20	Ci.-Cu.	188	6.0	+0.8	+5.9	27	Ci.-Cu.	268	3.7	+3.7	+0.1		
21	A.-St.	188	7.0	+1.0	+6.9	29	A.-St.	1	10.0	-0.2	-10.0		
22	Cu.	269	8.1	+8.1	+0.1	MAY							
23	Cu.-Nb.	305	15.0	+12.1	-8.6	6	Nb.	132	31.0	-23.0	+21.0	<i>Observation at 11 h.</i>	
25	Ci.	265	2.7	+2.7	+0.2	7	Fr.-St.	123	31.0	-26.0	+17.0		<i>Observation at 12 h. 30 m.</i>
27	Ci. to Ci.-Cu.	236	3.0	+2.5	+1.7	8	St.-Cu.	113	5.0	-4.2	+2.7	<i>Observation at 10 h.</i> Nothing but St. except at 10 h.	
28	St.-Cu.	210	6.9	+3.5	+6.0	15	St.-Cu.	340	4.5	+1.5	-4.2		St.-Cu. of thin and flat type.
29	St.-Cuf.	166	21.0	-5.0	+20.4	16	St.-Cu.	297	5.0	+4.5	-2.3	<i>Observation at 12 h.</i> Cloud degrading and fusing.	
30	Fr.-Nb.	198	50.0	+15.5	+47.5	17	Cu.	271	8.1	+8.1	-0.1	Cu. changing to Cu.-Nb.	
31	Ci.-Cu.	247	2.6	+2.4	+1.0	19	Cu.-Nb.	301	16.0	+13.8	-8.3	Apical portions measured; these were changing into St.-Cu.	
JUNE						21	Cu.-Nb.	225	8.6	+6.1	+6.1		
2	A.-Cu.	210	1.8	+0.9	+1.6	22	Cu.-Nb.	271	3.8	+3.8	-0.1	St.-Cu. degrading.	
3	Cu.	276	4.2	+4.2	-0.4	23	Cu.-Nb.	273	6.4	+6.4	-0.3		
7	Fr.-Cu.	257	13.0	+12.6	+3.0	24	St.-Cu.	276	8.0	+8.0	-0.8	Above is very faint Cirro-nebula with ⊕.	
9	St.-Cu.	269	4.0	+4.0	+0.1	26	Fr.-Cu.	265	6.3	+6.3	+0.5	Sheet of coarse Ci.-St.; degraded Cu. below.	
10	Cu.	300	18.0	+15.7	-9.0	29	Ci.-St.	223	2.8	+2.5	+1.3		
11	Cu.	282	5.0	+4.9	-1.1	31	Cu.	227	12.0	+8.8	+8.2		
12	Cu.-Nb.	289	4.2	+4.0	+1.4	JUNE							
14	Ci.-St.	268	1.7	+1.7	+0.1	2	A.-Cu.	210	1.8	+0.9	+1.6	A.-Cu. of lenticular type.	
16	St.-Cu.	205	3.4	+1.4	+3.1	3	Cu.	276	4.2	+4.2	-0.4	Cu. to Cu.-Nb. below, moving from S.W. Velocity varying slightly in different parts of clouds.	
24	Cu.-Nb.	45	5.0	-3.5	-3.5	7	Fr.-Cu.	257	13.0	+12.6	+3.0		
25	Nb.-Cuf.	325	18.0	+10.3	-14.8	9	St.-Cu.	269	4.0	+4.0	+0.1	Apex of cloud measured. Coarse type of Ci.-St. Thin St.-Cu. Cloud degraded.	
27	Cu.	318	7.4	+5.0	-5.5	10	Cu.	300	18.0	+15.7	-9.0		
28	Cu.-Nb.	289	6.9	+6.6	-2.3	11	Cu.	282	5.0	+4.9	-1.1	Coarse Ci. changing to Ci.-Cu. At 16 h. it became rapidly cloudy with St.-Cu. moving from W.N.W.	
30	Ci. to Ci.-Cu.	40	0.6	-0.4	-0.5	12	Cu.-Nb.	289	4.2	+4.0	+1.4		

### Seismology at Eskdalemuir Observatory, 1913.

The seismological equipment consists of two Galitzin pendulums for recording the horizontal components of movement and one for vertical movements: one twin boom Milne type of instrument for horizontal movements; one Weichert inverted vertical pendulum giving two horizontal components; and one Omori horizontal pendulum set to record the N.S. horizontal component.

Of these the Galitzin and Milne instruments are photographic, the Weichert and Omori record on smoked paper.

All are placed on concrete piers separated from the floors of the rooms. In the case of the Milne the pier is carried down to solid rock and is separated from the superimposed boulder clay. The other piers are shallow and based on the clay only.

All the more sensitive instruments are alike affected by high winds, which are shown on the Galitzin records as continuous irregular oscillations of periods ranging from 1 minute downwards to about 20 seconds. This wind disturbance constitutes a drawback to the seismological station at Eskdalemuir, the tabulation of earthquakes in the winter months being rendered difficult and in some cases impossible.

It seems possible that the disturbance may be caused by the wind pressure on the observatory building producing slight changes of slope in the subsoil beneath; the pier which rests on the rock is affected in this manner as well as the others.

The microseismic movements recorded are in general much greater than those experienced at the Russian observatories, where instruments of the Galitzin type are installed. This also tends to render the elucidation of earthquake phases more difficult in the winter months, when these movements are greatest. These two causes between them make it impossible to detect many of the smaller earthquakes during the winter.

All the instruments have been in regular operation during the year, with the exception of the Weichert, which was discontinued in the Autumn as sufficient information is given by the photographic recorders. The Omori is in operation in case of any loss of record in the photographic instruments. The Omori records are not regularly tabulated. Local vibrations of a rapid nature are shown more clearly on the Omori instrument than on any of the others. The regular microseismic movements of period 9 s. and under are also well shown by it.

The records from the Galitzin instruments have been regularly examined and tabulated, and the results published in the *Geophysical Journal*. The method of tabulating the magnitude and period of microseismic movements adopted since the beginning of the year conforms to that used by the Russian seismological stations.

To determine accurately the constants of the Galitzin instruments, a somewhat elaborate method needs to be employed. This is described at length in *Vorlesungen über Seismometrie*, Chapter VII., by Prince B. Galitzin, or more briefly in *Modern Seismology*, Chapter IV., by G. W. Walker, F.R.S. It was unfortunately not found possible to carry out the necessary experiments during 1913 in the case of the horizontal instruments. Values were available, determined by Mr. Walker in May 1912. The next full determination was made in June 1914, a partial one having been made in January 1914.

These all agreed very well with the 1912 figures, and it is felt that no serious error has been introduced by using Mr. Walker's figures, obtained in May 1912, for the year 1913.



The constants were as follows :—

20th MAY 1912.

North Pendulum.	West Pendulum.
$T = 23.7$ s.	$T = 24.7$ s.
$T_1 = 24.6$ s.	$T_1 = 24.8$ s.
$\mu^2 = -0.05$	$\mu^2 = -0.03$
$k = 42.2$	$k = 42.2$
$A = 1000$ mm.	$A = 1000$ mm.
$l = 118$ mm.	$l = 118$ mm.

24th JANUARY 1914.

North Pendulum.	West Pendulum.
$T_1 = 24.7$ s.	$T = 22.3$ s. (approx.)
	$T_1 = 24.8$ s.
	$\mu^2 = +0.15$ (approx.)
	$k = 43.2$
	$A = 1000$ mm.
	$l = 118$ mm.

13th JUNE 1914.

North Pendulum.	West Pendulum.
$T = 22.9$ s.	$T = 23.4$ s.
$T_1 = 24.7$ s. (assumed)	$T_1 = 24.8$ s. (assumed)
$\mu^2 = -0.02$	$\mu^2 = +0.02$
$k = 43.0$	$k = 44.1$
$A = 1000$ mm.	$A = 1000$ mm.
$l = 118$ mm.	$l = 118$ mm.

Here  $T$  is the period of undamped free oscillation of the pendulum, and  $T_1$  that of the galvanometer.  $A$  is the length of the beam of light from the galvanometer mirror to the recording drum.  $\mu^2$ ,  $k$ , and  $l$  have the meaning set out in either of the works referred to above.

The period  $T_1$  of the galvanometer hardly varies from year to year, but  $T$ ,  $\mu^2$ , and  $k$  vary slightly from time to time and need periodical determination.

The formula used for the determination of the scale value was

$$\frac{A k T_p}{\pi l} \cdot \frac{1}{(1+v^2)^2} = \text{magnification of record,}$$

where  $v$  was taken as equal to  $\frac{2 T_p}{T + T_1}$ , and  $T_p$  is the period of the earthwave considered.

This simplified form of the complete formula

$$\frac{A k T_p}{\pi l} \cdot \frac{1}{(1+u^2)(1+u_1^2) \sqrt{1-\mu^2 f(u)}}$$

where  $u = \frac{T_p}{T}$  and  $u_1 = \frac{T_p}{T_1}$ , and  $f(u)$  is of the form given by Galitzin,\* was quite sufficiently accurate for computing microseisms with the particular constants of the instruments at the time.

The Galitzin seismograph for recording vertical movements was standardised for the first time in March 1913, but owing to the changes of temperature in the seismograph room, the pendulum could not be maintained at an undamped period equal to that of the galvanometer (13 seconds). The period of the pendulum was therefore reduced, and until the constant has been determined, the records of vertical motion are qualitative only. Even so they are of fundamental value in the determination of epicentres.

\* *Loc. cit.*

The Milne records have been regularly tabulated and the results sent to the British Association Seismological Committee.

An experiment was tried of fitting an oil damper to one of the Milne booms for a time, but the results were not promising owing to the loss of sensitivity incurred.

A comparison between the Milne and Galitzin types of seismograph has been prepared at the Observatory and published by the Seismological Committee of the British Association (Report to Australian Meeting, 1914).

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### Errata in the Geophysical Journal for the Year 1913.

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Page 7.—Table 1.—The figures in each pair of columns should be reversed.

- „ 21.— „ 1.—7th, 12 h., for “0.4” read “0.5,” and for “5” read “4.”  
 „ 25.— „ 2.—For “Mean Sea” read “Station.”  
 „ 26.— „ 3.—For “Mean Sea” read “Station.”  
 „ 48.— „ 4.—12th, Remarks, for “21” read “9.”  
 „ 72.—No. R. 262 at 9.0 km., for “417” read “317.”
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### Electrical Character of Day.

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The electrical character of the day at Eskdalemuir was determined for 1913 in accordance with the following scheme, which differs in regard to character 2 from the explanation given in the Introduction.

- “0” denotes a day (from midnight to midnight G.M.T.) during which no negative potential was recorded.  
 “1” denotes a day on which there were one or more excursions of limited duration to the negative side of the scale.  
 “2” denotes a day on which negative potential occurred for a period, or periods, extending in the aggregate over **3** hours or more.