



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

Heights above Mean Sea Level:—Station, H = 5.5 m. Barometer, H_b = 10.4 m.

Heights above Ground:—Thermometers, h_t = 3.0 m. Rain-gauge, h_r = 0.5 m. Sunshine Recorder, h_s = 14.3 m. Cups of Anemometer, h_a = 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 (8=E, 16=S) and Velocity (metres per second), Cloud Amount and Weather, Rain 24 hours beginning 10h, Sunshine, Solar Radiation (Watts per cm²), 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_b = 237.1 m.

Heights above Ground:—Thermometers, h_t = 0.8 m. Rain-gauge, h_r = 0.3 m. Sunshine Recorder, h_s = 1.5 m. Vane of Anemometer, h_a = 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 (8=E, 16=S) and Velocity (metres per second), Cloud Amount and Weather, Rain 24 hours beginning 10h, Sunshine, Solar Radiation (Watts 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.

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.	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.	Longitude, 1° 1' W.	13.0	156	228	-2		
BASE OF STRATOSPHERE, } 7.9 km.	337 mb.	220° A.	Height above M.S.L., } 150 m.	12.0	181	226	-2		
				11.3	200	225	-2		
Type. No. I.			PLACE OF FALL, Iekleton.	11.0	211	224	-1		
			Distance, 89 km.	10.0	245	223	-1		
			Orientation, 62°.	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	8		
				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	...	...
					1000	...	...
				Ground	968	278	...		
				M.S.L.	987	...	...

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.	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.	Longitude, 8° 41' W.	9.0	298	225	7		
BASE OF STRATOSPHERE, } 9.0 km.	298 mb.	225° A.	Height above M.S.L., } 15 m.	9.0	300	225	7		
				8.0	347	232	8		
Type. No. ?			PLACE OF FALL, Thurles.	7.0	399	240	8		
			Distance, 37 km.	7.0	400	240	7		
			Orientation, 85°.	6.0	459	247	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	...	...
					1000	...	...
				Ground	...	274.5	...		
				M.S.L.	1001	...	...

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.).

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

Heights above Mean Sea Level :—Station, H = 5.5 m. Barometer, H_b = 10.4 m.

Heights above Ground :—Thermometers, h_t = 3.0 m. Rain-gauge, h_r = 0.5 m. Sunshine Recorder, h_s = 14.3 m. Cups of Anemometer, h_a = 21.3 m.



Table with 28 rows of daily weather data for Kew Observatory, Surrey. Columns include 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 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_b = 237.1 m.

Heights above Ground :—Thermometers, h_t = 0.8 m. Rain-gauge, h_r = 0.3 m. Sunshine Recorder, h_s = 1.5 m. Vane of Anemometer, h_a = 15.2 m.

Table with 28 rows of daily weather data for Eskdale Observatory, Dumfriesshire. Columns include 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 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.

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

DEERNES. †

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 sub-tables for S+N&W+E and S-N&W-E.

SCILLY. †‡

Height of Head above—Ground 9·8 m., M.S.L. 40·7 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 sub-tables for S+N&W+E and S-N&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 sub-tables 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.



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	271.5	-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	...	...	...	...	Balloon lost in mist. Day very misty. Balloon could not be seen from outstation, therefore one theodolite only. Vertical velocity assumed.			
	1000	905.8	268	6	70	2.9	1.176	65	14			500	215	17.1	+9.8	+14.0	2.9							
100 m. above ground	500	964.9	271	8	90	4.8	1.238	55	14			250	209	11.5	+5.6	+10.1	2.9							
Ground level	250	995.6	273	5	70	4.3	1.268	45	10			100	195	6.5	+1.7	+6.3	3.0							
	150	1008.1	273.5		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.	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.						
Greatest height	1488	...	...	...	...	Balloon lost in mist. Two theodolites. Sudden change in vertical velocity is quite in order. The altitude readings of both theodolites were affected similarly and simultaneously.	1250	...	...	...	...	Balloon seen from home station only. Dense ground haze, but sky visible directly overhead. Surface wind light and variable.	1640	...	...	...	...	Disappeared in haze. Flight very erratic, almost spiral. No definite surface wind.
	...	...	...	...	...		...	...	...	...	...		1540	48	6.0	-4.5	-4.0	1.7
	1440	228	16.4	+12.2	+11.0	1.8*	1000	160	5.0	-1.7	+4.7	2.9 (assumed).	1250	61	6.0	-5.2	-2.9	3.1						
	1000	218	18.9	+11.5	+15.0	3.2	750	158	3.2	-1.2	+3.0		1000	113	3.8	-3.5	+1.5	2.1						
	500	200	14.6	+4.9	+13.7	3.5	500	206	2.6	+1.1	+2.3		800	103	6.9	-6.7	+1.5	3.9						
Ground level	100	184	12.0	+0.9	+12.0	3.3	250	159	2.2	-0.8	+2.1		500	217	2.5	+1.5	+2.0	2.5						
	30	170	6.0	-1.0	+5.9	...	100	174	2.0	-0.2	+2.0		100	252	1.6	+1.5	+0.5	2.7						
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	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 3 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						
	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						
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.)—continued.

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

1913. February 21. 15 h. 35 m. G.M.T.				SOUNDING No., R. 223. PLACE, PYRTON HILL. Latitude, 51° 38' N. Longitude, 1° 1' W. Height above M.S.L., } 150 m. PLACE OF FALL, Potterne. Distance, and Orientation, 69 km. 243°.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	Reading.				Fall per Km.		
GREATEST HEIGHT, } 13.4 km.	150 mb.	217° A.		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, } ...	...	...		13.0	160	217	1
BASE OF STRATOSPHERE, } 10.0 km.	252 mb.	211° A.		12.0	185	218	1		
Type. No. I.				11.6	200	217	-2		
				11.0	217	216	-5		
				10.0	252	211	5		
				9.0	295	216	6		
				8.9	300	217	8		
				8.0	344	222	7		
				7.0	399	230	8		
				7.0	400	230	7		
				6.0	461	237	8		
				5.4	500	241	9		
				5.0	531	245	7		
				4.1	600	253	8		
				4.0	609	254	5		
				3.0	696	261	8		
				3.0	700	261	5		
				2.0	793	269	0		
				1.9	800	269	5		
				1.0	898	269	...		
				1.0	900	...	...
				1.2	1000	274	...		
				Ground M.S.L.	1000	274	...		
					1018	...	...

TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

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

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 ² .	Daily Amount.		Duration of Bright Sunshine.		Max. Rate, Milli-watts per cm ² .	Daily Amount.		Duration of Bright Sunshine.		Max. Rate, Milli-watts per cm ² .	Daily Amount.		Duration of Bright Sunshine.		
		Joules per cm ² .	% of Ideal.*	Hours.	% of Possible.		Joules per cm ² .	% of Ideal.*	Hours.	% of Possible.		Joules per cm ² .	% 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	3	...	...	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	38	378	19	0.3	2
30	10	91	11	...	...	41	508	25	0.9	7	41	508	25	0.9	7
31	24	x 416	51	x 5.9	x 66	n 5	n 93	5	...	...	n 5	n 93	5	...	...
Total	...	5087	...	26.6	...	...	8088	...	28.7	...	...	17069	...	72.6	...
Mean	14	R=164	25	H=0.86	10	21	R=289	28	H=1.03	10	38	R=551	33	H=2.34	20	
Ratio of Mean Daily Amount to Mean Duration.			$\frac{R}{H} = 191$				$\frac{R}{H} = 281$					$\frac{R}{H} = 236$				

Note.—1 watt per cm² = 14.35 gramme-calories per cm² per minute. 1 gramme-calorie per minute = 0.7 watt nearly.

If the heat were distributed throughout the atmosphere, 1000 gramme-calories per cm² would be sufficient to raise the temperature 4° C. It would take 245 gramme-calories per cm² 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 cm² 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.



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

Heights above Mean Sea Level :—Station, H = 5.5 m. Barometer, H_b = 10.4 m.

Heights above Ground :—Thermometers, h_t = 3.0 m. Rain-gauge, h_r = 0.5 m. Sunshine Recorder, h_s = 14.3 m. Cups of Anemometer, h_a = 21.3 m.

Table with columns for Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity, Wind Direction in Points (8=E, 16=S) and Velocity, 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 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_b = 237.1 m.

Heights above Ground :—Thermometers, h_t = 0.8 m. Rain-gauge, h_r = 0.3 m. Sunshine Recorder, h_s = 1.5 m. Vane of Anemometer, h_a = 15.2 m.

Table with columns for Day, Pressure at Station Level, Air Temperature in Degrees Absolute, Humidity, Wind Direction in Points (8=E, 16=S) and Velocity, 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 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.



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-tables 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 GREAT YARMOUTH. †§. Includes sub-tables 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. † 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.



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

Heights above Mean Sea Level :—Station, H = 5.5 m. Barometer, H_b = 10.4 m.

Heights above Ground :—Thermometers, h_t = 3.0 m. Rain-gauge, h_r = 0.53 m. Sunshine Recorder, h_s = 13.3 m. Cups of Anemometer, h_a = 19.81 m.

Table with columns for Day, Barometer at 27th A. Mean Sea Level and Standard Gravity (Lat. 45'), Air Temperature in Degrees Absolute (9 h., 21 h., Max., Min.), 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.

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

Heights above Mean Sea Level :—Station, H = 242.0 m. Barometer, H_b = 237.0 m.

Heights above Ground :—Thermometers, h_t = 0.9 m. Rain-gauge, h_r = 0.40 m. Sunshine Recorder, h_s = 1.5 m. Vane of Anemometer, h_a = 15.0 m.

Table with columns for Day, Barometer at 27th A. Mean Sea Level and Standard Gravity (Lat. 45'), Air Temperature in Degrees Absolute (9 h., 21 h., Max., Min.), 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.

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.

Table for Kew Observatory with columns: Day, Potential Gradient, Charge per cu., Velocities of Ions, Conductivity, Air-Earth Current, Electric/Magnetic Character of Day, Horizontal Force (Maximum, Minimum, Range), and West Declination (Maximum, Minimum, Range). Includes a note about magnetograph removal on the 28th.

* 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.

6. ESKDALE OBSERVATORY.

Table for Eskdale Observatory with columns: Day, Potential Gradient, Charge per cu., Velocities of Ions, Conductivity, Air-Earth Current, Electric/Magnetic Character of Day, North Component, West Component, and Vertical Component. Includes a note 'Instrument out of order' for days 14-31.

* 24 days. See note above.

z Indeterminate.

An explanation of the Headings of the columns is given in the Preface. x denotes the maximum and n the minimum value in the column.

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.

International Seismological Centre

HOLYHEAD. †§

Height of Head above—Roof 8.8 m., Ground 13.7 m., M.S.L. 13.2 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. 5.3 m.

Main table for Holyhead and Deerness stations, containing columns for Date, 3h, 9h, 15h, 21h, Max. in a Gust, Time of Gust, and wind components (S, N, W, E) for each hour.

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, containing columns for Date, 3h, 9h, 15h, 21h, Max. in a Gust, Time of Gust, and wind components (S, N, W, E) for each hour.

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. 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.		Velocity.
Greatest height.	metres. 600	mb. 939.7	°A. 279.5	°C. ...	% 65	mb. 5.5	mgm/cc. 1.168	Degrees from N. 310	m/s. 12	Half overcast. Cu.-st. Wind very erratic. Kite not sustainable at any definite height. Convection currents.
Ground level	115	996.3	284	9.3	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.				
Greatest height.	metres. 750	Degrees from N. ...	m/s. ...	m/s. ...	m/s. ...	metres. 680	Degrees from N. ...	m/s. ...	m/s. ...	m/s. ...	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.	metres. 840	Degrees from N. ...	m/s. ...	m/s. ...	m/s. ...	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	} 2.9 assumed.		750	349	8.6	+1.6	-8.4	} 3.0 assumed.		
	500	105	2.3	-2.2	+0.6	475	118	19.1	-16.8	+9.0			500	357	8.3	+0.4	-8.3			
	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.						
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.				
Greatest height.	metres. 1930	Degrees from N. ...	m/s. ...	m/s. ...	m/s. ...	metres. 1110	Degrees from N. ...	m/s. ...	m/s. ...	m/s. ...	One theodolite. Balloon entered base of Cu.-Nb. cloud.	metres. 1200	Degrees from N. ...	m/s. ...	m/s. ...	m/s. ...	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	...	...	...	...	} 3.0 assumed.		1000	271	4.9	+4.9	-0.1	} 2.2 assumed.	
	1500	291	7.4	+6.9	-2.6	2.7	1000	217	15.7	+9.5		+12.5		750	267	5.4	+5.4		+0.3	
	1000	309	5.8	+4.5	-3.6	2.5	750	215	17.1	+9.9		+14.0		500	243	3.3	+2.9		+1.5	
	500	277	1.7	+1.7	-0.2	2.9	500	232	10.8	+8.5		+6.7		250	160	4.4	-1.5		+4.1	
	250	108	4.1	-3.9	+1.3	5.0	300	191	13.3	+2.5	+13.1		100	147	5.0	-2.7	+4.2			
	100	106	1.9	-1.8	+0.5	1.6	100	189	15.9	+2.4	+15.7		30	135	2.5	-1.8	+1.8			
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.)—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.	Reading.				Fall per Km.		
GREATEST HEIGHT, } 10.0 km.	253 mb.	228° A.	Latitude, 51° 38' N.	PLACE, PYRTON HILL. 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, } 1 km.	? mb.	? A.	Longitude, 1° 1' W.		10.0	253	228	-2	
BASE OF STRATOSPHERE, } 9.1 km.	289 mb.	226° A.	Distance, 47 km.	8.85	300	226	3		
				8.0	341	229	4		
Type No. 1			Orientation, 76° from N.	7.0	395	233	4		
				6.91	400	234	7		
From observations at Station				6.0	452	240	7		
				5.29	500	245	7		
				5.0	520	247	6		
				4.0	594	253	6		
PRESSURE (M.S.L.),				3.93	600	253	6		
				3.0	680	259	6		
TEMPERATURE,				2.80	700	261	8		
				2.5	...	263	8		
VAPOUR PRESSURE,				2.0	776	267	8		
				1.77	800	268	5		
GRADIENT WIND :—Direction,				1.5	...	269	5		
				1.0	883	272	6		
Velocity, . . . . .				.83	900	273	6
				.5	...	275	6		
Correction for Curvature,				Ground M.S.L.	...	278	...		
Final Components, { W. to E. . . . .				...	1001	...	...
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.	Reading.				Fall per Km.		
GREATEST HEIGHT, } 9.2 km.	? mb.	226° A.	Latitude, 51° 38' N.	PLACE, PYRTON HILL. 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, } 1 km.	? mb.	? A.	Longitude, 1° 1' W.		9.0	296	224	1	
BASE OF STRATOSPHERE, } 9.0 km.	296 mb.	226° A.	Distance, 173 km.	8.90	300	224	1		
				8.0	341	225	7		
Type No. ?			Orientation, 77° from N.	7.0	396	232	7		
				6.92	400	233	8		
From observations at Station				6.0	457	240	7		
				5.35	500	244	7		
				5.0	524	247	8		
PRESSURE (M.S.L.),				4.01	600	255	8		
				4.0	601	255	7		
TEMPERATURE,				3.0	685	262	7		
				2.83	700	263	5		
VAPOUR PRESSURE,				2.5	...	265	5		
				2.0	778	267	7		
GRADIENT WIND :—Direction,				1.79	800	268	7		
				1.5	...	271	7		
Velocity,				1.0	883	274	8		
				.84	900	275	8		
Correction for Curvature, . . . . .				.5	...	278	8
Final Components, { W. to E.				Ground M.S.L.	...	282	...		
					1002	...	...
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.	Reading.				Fall per Km.		
GREATEST HEIGHT, } 11.7 km.	? mb.	217° A.	Latitude, 51° 38' N.	PLACE, PYRTON HILL. 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, } 1 km.	? mb.	? A.	Longitude, 1° 1' W.		11.65	200	217		
BASE OF STRATOSPHERE, } 10.5 km.	245 mb.	213° A.	Distance, 112 km.	11.0	221	214	2		
				10.0	260	216	9		
Type No. 1			Orientation, 28° from N.	9.02	300	225	9		
				9.0	303	225	8		
From observations at Station				8.0	349	233	8		
				7.05	400	242	9		
				7.0	403	242	8		
PRESSURE (M.S.L.),				6.0	463	250	9		
				5.46	500	255	9		
TEMPERATURE,				5.0	529	259	3		
				4.03	600	262	3		
VAPOUR PRESSURE,				4.0	603	262	4		
				3.0	688	266	4		
GRADIENT WIND :—Direction,				2.85	700	266	3		
				2.5	...	268	3		
Velocity,				2.0	780	269	3		
				1.80	800	270	7		
Correction for Curvature,				1.5	...	272	7		
				1.0	883	276	8		
Final Components, { W. to E. . . . .				.85	900	277	8
				.5	...	280	8		
				Ground M.S.L.	...	282	...		
					1000	...	...

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., 7 (1913).			Height above M.S.L.	Pressure.	Temperature.		REMARKS.
	Height above M.S.L.	Pressure.	Temp.	PLACE, MANCHESTER.					Reading.	Fall per Km.	
GREATEST HEIGHT, } 17.1 km. 84 mb. 227° A. LOWEST TEMPERATURE, } 10.4 km. & 13-15 k.m. { 237 mb. 224° A. BASE OF STRATOSPHERE, } 10.4 km. 237 mb. 224° A. Type No. 1.				Latitude, 53° 28' N. Longitude, 2° 14' W. Height above M.S.L., } 40 m. PLACE OF FALL, Birtles, Cheshire. Distance, 22 km. and Orientation, 173° from N.			km.	mb.	° A.	° C.	Type of Base of Stratosphere not clearly defined. Temperature gradient above 8.3 km. very small.
From observations at Station. at 7 h. at 18 h. G.M.T.						17.0		227	- 3		
PRESSURE (M.S.L.), 1007 mb. 1004 mb.						16.0	100	224	0		
TEMPERATURE, 281° A. 285° A.						15.0	116	224	0		
VAPOUR PRESSURE,						14.0	135	224	0		
GRADIENT WIND :—Direction, Pressure Pressure						13.0	157	224	1		
Velocity, Distribution Distribution						12.0	185	225	0		
Correction for Curvature, Irregular. Irregular.						11.5	200	225	0		
Final Components, { W. to E. S. to N.						11.0	216	225	- 1		
						10.0	251	224	3		
						9.0	292	227	6		
						8.84	300	227	2.5		
						8.0	340	229.5	6		
						7.0	396	235.5	8		
						6.95	400	236	6.5		
						6.0	457	242	8		
						5.33	500	247.5	7		
						5.0	523	250	5.5		
						4.0	597	257	6		
						3.95	600	257	6		
						3.0	685	262.5	6		
						2.85	700	263.5	6		
						2.5	733	265.5	6		
						2.0	784	268.5	6		
						1.83	800	269.5	6		
						1.5	835	271.5	6		
						1.0	889	274.5	6		
						0.90	900	275	6		
						0.5	946	278	6		
						0.05	1000	281.5	6		
						Ground M.S.L.	1001	282	...		
						M.S.L.	1004	...	...

1913. May 6. 19 h. 30 m. G.M.T.				SOUNDING No., 8 (1913).			Height above M.S.L.	Pressure.	Temperature.		REMARKS.
	Height above M.S.L.	Pressure.	Temp.	PLACE, MANCHESTER.					Reading.	Fall per Km.	
GREATEST HEIGHT, } 16.3 km. 91 mb. 220.5° A. LOWEST TEMPERATURE, } 9.5 km. 263 mb. 219.5° A. BASE OF STRATOSPHERE, } 9.5 km. 263 mb. 219.5° A. Type No. 1.				Latitude, 53° 28' N. Longitude, 2° 14' W. Height above M.S.L., } 40 m. PLACE OF FALL, Greenodd, Ulverston. Distance, 103 km. and Orientation, 324° from N.			km.	mb.	° A.	° C.	
From observations at Station. at 7 h. at 18 h. G.M.T.						16.0		220.5	1		
PRESSURE (M.S.L.), 1001 mb. 1000 mb.						15.74	100	221	1		
TEMPERATURE, 281° A. 280° A.						15.0	112	221.5	1		
VAPOUR PRESSURE,						14.0	131	222.5	1.5		
GRADIENT WIND :—Direction, Pressure Pressure						13.0	153	224	1		
Velocity, Distribution Distribution						12.0	180	225	1		
Correction for Curvature, 0.0 m/s. + 1.5 m/s.						11.28	200	225.5	1		
Final Components, { W. to E. - 5.2 m/s. S. to N. + 20.7 m/s.						11.0	209	226	- 2		
						10.0	244	224	- 2.5		
						9.0	284	221.5	6.5		
						8.64	300	222.5	7		
						8.0	331	228	6.5		
						7.0	386	235	7		
						6.77	400	236	6.5		
						6.0	449	241.5	11		
						5.20	500	250	2.5		
						5.0	515	252.5	6		
						4.0	587	255	6		
						3.84	600	255.5	6		
						3.0	671	261	5		
						2.70	700	262	4		
						2.5	719	261	5		
						2.0	769	266	5		
						1.70	800	267	4		
						1.5	822	268	4		
						1.0	877	270	4		
						0.80	900	271	4		
						0.5	934	272.5	4		
						0.00	1000	280	4		
						Ground M.S.L.	996	280	...		
						M.S.L.	1000	...	...

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



TABLE OF HEIGHTS, PRESSURES, AND TEMPERATURES.

Table with 3 columns: Balloon Details (Date, Time, Sounding No., Location, Height, Pressure, Temp), Height/Pressure/Temperature Data (km, mb, °A, °C), and Remarks. Includes three separate sounding entries for Manchester, Eskdalemuir, and Eskdalemuir.



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. PLACE, ESKDALEMUIR. Latitude, 55° 19' N. Longitude, 3° 12' W. Height above M.S.L., } 243 m. PLACE OF FALL, Leith. Distance, and Orientation, 72 km. 0° from N.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	Reading.				Fall per Km.		
GREATEST HEIGHT, } 14.2 km.	133 mb.	221° A.			km. mb.	°A.	°C.	Strong E.S.E. wind. Overcast. Balloon lost in one minute. Isothermal 2.2 to 2.5 km. at 268°. Inversion 256°-257° at 4.2 km.	
LOWEST TEMPERATURE, } 9.5 km.	276 mb.	217° A.			14.0 137 13.0 160 12.0 187 11.56 200 11.0 217 10.0 256 9.0 297 8.98 300 8.0 345 7.0 399 6.99 400 6.0 460 5.41 500 5.0 529 4.07 600 4.0 605 3.0 689 2.88 700 2.5 734 2.0 782 1.82 800 1.5 832 1.0 885 .86 900 .5 941	221 221 222 222 221 218 221 221 229 237 245 249 252 256 265 265 268 269 270 273 276 277 280	0 1 -1 -3 3 8 8 8 8 7 4 9 4 7 8		
BASE OF STRATOSPHERE, } 9.5 km.	276 mb.	217° A.			Ground M.S.L.	...	...
Type	No. 1.								
From observations at Station.				at 7 h.	at 18 h. G.M.T.				
PRESSURE (M.S.L.),			1004 mb.	1000 mb.					
TEMPERATURE,			280° A.	280° A.					
VAPOUR PRESSURE,			...	...			
GRADIENT WIND:—Direction,			146°	151°					
Velocity,			19.1 m/s.	26.5 m/s.					
Correction for Curvature,			0.0 m/s.	0.0 m/s.					
Final Components,	W. to E. S. to N.		-10.7 m/s. +15.8 m/s.	-12.9 m/s. +23.2 m/s.					
1913. May 9.		7 h. 0 m. G.M.T.		SOUNDING No., R. 245 E. 7. PLACE, ESKDALEMUIR. Latitude, 55° 19' N. Longitude, 3° 12' W. Height above M.S.L., } 243 m. PLACE OF FALL, Braco. Distance, and Orientation, 120 km. 340° from N.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	Reading.				Fall per Km.		
GREATEST HEIGHT, } 15.2 km.	116 mb.	225° A.			km. mb.	°A.	°C.	Overcast, raining. Wind E.N.E. squally.	
LOWEST TEMPERATURE, } 9.1 km.	293 mb.	220° A.			15.0 120 14.0 141 13.0 164 12.0 189 11.62 200 11.0 220 10.0 257 9.0 297 8.98 300 8.0 344 7.0 399 6.98 400 6.0 461 5.40 500 5.0 529 4.03 600 4.0 603 3.0 687 2.87 700 2.5 733 2.0 783 1.82 800 1.5 835 1.0 888 .89 900 .5 944	225 224 224 222 222 223 221 220 220 228 237 243 248 251 257 262 263 264 267 268 270 274 275 277 278	-1 0 -2 1 -2 -1 8 9 5 5 7 6		
BASE OF STRATOSPHERE, } 9.1 km.	293 mb.	220° A.			Ground M.S.L.	...	...
Type	No. 1.								
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. S. to N.		-10.4 m/s. +14.3 m/s.	-3.9 m/s. +14.4 m/s.					
1913. May 9.		19 h. 3 m. G.M.T.		SOUNDING No., R. 246 E. 8. PLACE, ESKDALEMUIR. Latitude, 55° 19' N. Longitude, 3° 12' W. Height above M.S.L., } 243 m. PLACE OF FALL, Fort Augustus. Distance, and Orientation, 219 km. 335° from N.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	Reading.				Fall per Km.		
GREATEST HEIGHT, } 12.0 km.	193 mb.	223° A.			km. mb.	°A.	°C.	Overcast, calm. Balloon lost in 3 minutes going N.	
LOWEST TEMPERATURE, } 9.1 km.	294 mb.	219° A.			12.0 193 11.58 200 11.0 219 10.0 255 9.0 297 8.90 300 8.0 344 7.0 397 6.96 400 6.0 459 5.36 500 5.0 527 4.03 600 4.0 603 3.0 689 2.88 700 2.5 734 2.0 784 1.84 800 1.5 825 1.0 886 .88 900 .5 944	223 223 223 219 220 221 230 238 238 243 247 249 256 263 264 266 268 269 271 273 274 278	0 -4 1 10 8 5 6 7 7 5 5 6 7 5 5 10		
BASE OF STRATOSPHERE, } 9.1 km.	294 mb.	219° A.			Ground M.S.L.	...	...
Type	No. 1.								
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. S. to N.		-10.4 m/s. +14.3 m/s.	-3.9 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.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, MUNGRET COLLEGE.	Pressure.	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	3	
			PLACE OF FALL, Youghal.	9.0	297	220		
Type ?			Distance, 94 km.	8.92	300	221	7	
			Orientation, 130° from N.	8.0	344	227	8	
				7.00	400	235	9	
				6.0	461	244	9	
				5.41	500	248	7	
				5.0	529	251	7	
				4.03	600	258	7	
				4.0	604	258	5	
				3.0	687	263	5	
				2.86	700	263	3	
				2.5	732	264	3	
				2.0	781	266	5	
				1.82	800	267	5	
				1.5	833	268	5	
				1.0	889	271	8	
				.91	900	272	8	
				.5	945	275	8	
				Ground M.S.L.	...	280	...	
					1008	...	...
From observations at Station.				at 7 h.	at 18 h. G.M.T.			
				PRESSURE (M.S.L.),	1008 mb.	998 mb.		
				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.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, MUNGRET COLLEGE.	Pressure.	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	-1	
BASE OF STRATOSPHERE, } 8.2 km.	327 mb.	225° A.	Height above M.S.L., } 15 m.	14.0	137	225	0	
			PLACE OF FALL, Killaloe.	13.0	159	225	0	
Type No. 1.			Distance, 20 km.	12.0	184	225	1	
			Orientation, 30° from N.	11.50	200	226	0	
				11.0	217	226	0	
				10.0	251	226	0	
				9.0	291	226	0	
				8.79	300	226	0	
				8.0	336	226	7	
				7.0	388	233	7	
				6.77	400	235	8	
				6.0	448	241	8	
				5.20	500	244	4	
				5.0	515	245	4	
				4.0	592	250	5	
				3.90	600	251	7	
				3.0	677	257	7	
				2.76	700	258	6	
				2.5	724	260	6	
				2.0	773	263	6	
				1.74	800	265	7	
				1.5	825	266	7	
				1.0	883	270	7	
				.83	900	271	7	
				.5	939	274	7	
				Ground M.S.L.	...	279	...	
					999	...	...
From observations at Station.				at 7 h.	at 18 h. G.M.T.			
				PRESSURE (M.S.L.),	1002 mb.	999 mb.		
				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.	Temperature.		REMARKS.
Height above M.S.L.	Pressure.	Temp.	PLACE, MUNGRET COLLEGE.	Pressure.	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	-2	
BASE OF STRATOSPHERE, } 7.8 km.	344 mb.	223° A.	Height above M.S.L., } 15 m.	9.0	288	226	-2	
			PLACE OF FALL, Loughrea.	8.71	300	225	-3	
Type No. 1.			Distance, 60 km.	8.0	335	223	6	
			Orientation, 0° from N.	7.0	388	229	6	
				6.80	400	230	6	
				6.0	449	235	6	
				5.23	500	242	9	
				5.0	517	244	8	
				4.0	593	252	8	
				3.92	600	253	7	
				3.0	679	259	7	
				2.76	700	261	7	
				2.5	724	263	7	
				2.0	770	266	7	
				1.71	800	268	6	
				1.5	823	269	6	
				1.0	877	272	6	
				.80	900	273	6	
				.5	933	275	6	
				Ground M.S.L.	...	280	...	
					991	...	...
From observations at Station.				at 7 h.	at 18 h. G.M.T.			
				PRESSURE (M.S.L.),	994 mb.	994 mb.		
				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. PLACE, MUNGRET COLLEGE.	Height above M.S.L.	Pressure.	Temperature.		REMARKS.	
	Height above M.S.L.	Pressure.				Temp.	Reading.		Fall per Km.
GREATEST HEIGHT, } 14.2 km.	133 mb.	230° A.	Latitude, 52° 38' N.	km.	mb.	°A.	°C.	Overcast. Wind S.E. 4.	
LONGEST TEMPERATURE, } 7.3 km.	368 mb.	222° A.	Longitude, 8° 41' W.	14.0	139	230	1		
BASE OF STRATOSPHERE, } 7.3 km.	368 mb.	222° A.	Height above M.S.L., } 15 m.	13.0	159	231	0		
Type No. 1.			PLACE OF FALL, Oughterard.	12.0	186	231	0		
			Distance, 98 km.	11.48	200	231	0		
			Orientation, 327° from N.	11.0	215	231	-1		
				10.0	248	230	-2		
				9.0	287	228	-3		
				8.70	300	227	-3		
				8.0	331	225	-1		
				7.0	384	224	-1		
				6.76	400	226	10		
				6.0	448	234			
				5.25	500	241	10		
				5.0	517	244	9		
				4.0	592	253	9		
				3.90	600	254	7		
				3.0	677	260	7		
				2.75	700	261	6		
				2.5	723	263	6		
				2.0	772	266			
				1.71	800	268	6		
				1.5	823	270			
				1.0	877	272			
				.79	900	273	6		
				.5	733	275			
				Ground M.S.L.	...	278	...		
					989		
From observations at Station.									
			at 7 h.	at 18 h. G.M.T.					
PRESSURE (M.S.L.),			992 mb.	993 mb.					
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.	
GREATEST HEIGHT, } 7.7 km.	? mb.	? A.	PLACE, DITCHAM PARK.	km.	mb.	°A.	°C.	Isothermal 1.8 to 2.1 km. at 271°.	
LONGEST TEMPERATURE, } ? km.	? mb.	? A.	Latitude, 50° 57' N.	7.00	400	236 ?	8		
BASE OF STRATOSPHERE, } not reached			Longitude, 0° 56' W.	6.0	460	244			
Type No. ?			Height above M.S.L., } 168 m.	5.42	500	248	7		
			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			
				2.0	780	271			
				1.85	800	272	6		
				1.5	832	273			
				1.0	884	277			
				.91	900	278	6		
				.5	943	280			
				Ground M.S.L.	...	282	...		
					1003		
From observations at Station.									
			at 7 h.	at 18 h. G.M.T.					
PRESSURE (M.S.L.),			1003 mb.	1003 mb.					
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.	
GREATEST HEIGHT, } 10.6 km.	? mb.	225° A.	PLACE, DITCHAM PARK.	km.	mb.	A°	A°		
LONGEST TEMPERATURE, } 9.0-10.0 km.	? mb.	223° A.	Latitude, 50° 57' N.	10.0	256	223	0		
BASE OF STRATOSPHERE, } 9.0 km.	293 mb.	223° A.	Longitude, 0° 56' W.	9.0	293	223	0		
Type No. 2.			Height above M.S.L., } 168 m.	8.85	300	223	3		
			PLACE OF FALL, Sharnbrook.	8.0	341	226	6		
			Distance, 141 km.	7.0	396	232	6		
			Orientation, 10° from N.	6.95	400	232	8		
				6.0	459	240			
				5.40	500	245	8		
				5.0	528	248	7		
				4.06	600	255			
				4.0	605	255			
				3.0	689	263	8		
				2.90	700	264	7		
				2.5	736	267			
				2.0	784	270			
				1.85	800	271	7		
				1.5	837	274			
				1.0	888	277			
				.83	900	278	4		
				.5	947	279			
				Ground M.S.L.	...	281	...		
					1006		
From observations at Station.									
			at 7 h.	at 18 h. G.M.T.					
PRESSURE (M.S.L.),			1006 mb.	1008 mb.					
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° 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° .

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).

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.).