

**The Fernley Observatory, Southport : report and results of observations for the year 1904 / Borough of Southport Meteorological Department.**

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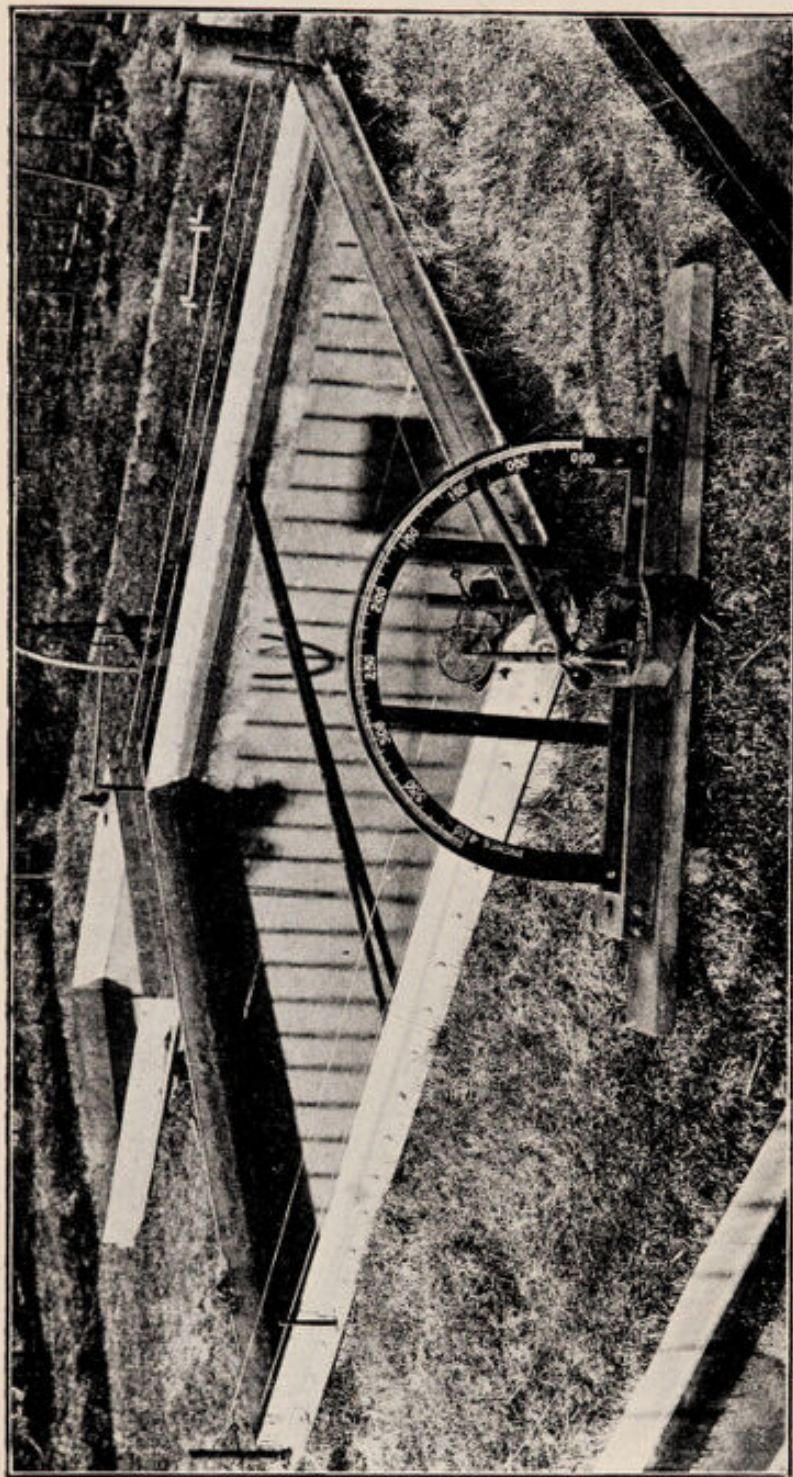
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Evaporation Gauges, etc., at Barton Moss.



*Borough of*



*Southport.*

Meteorological Department.

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THE FERNLEY OBSERVATORY,  
SOUTHPORT.

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# REPORT

AND

RESULTS OF OBSERVATIONS

FOR

THE YEAR 1904.

BY

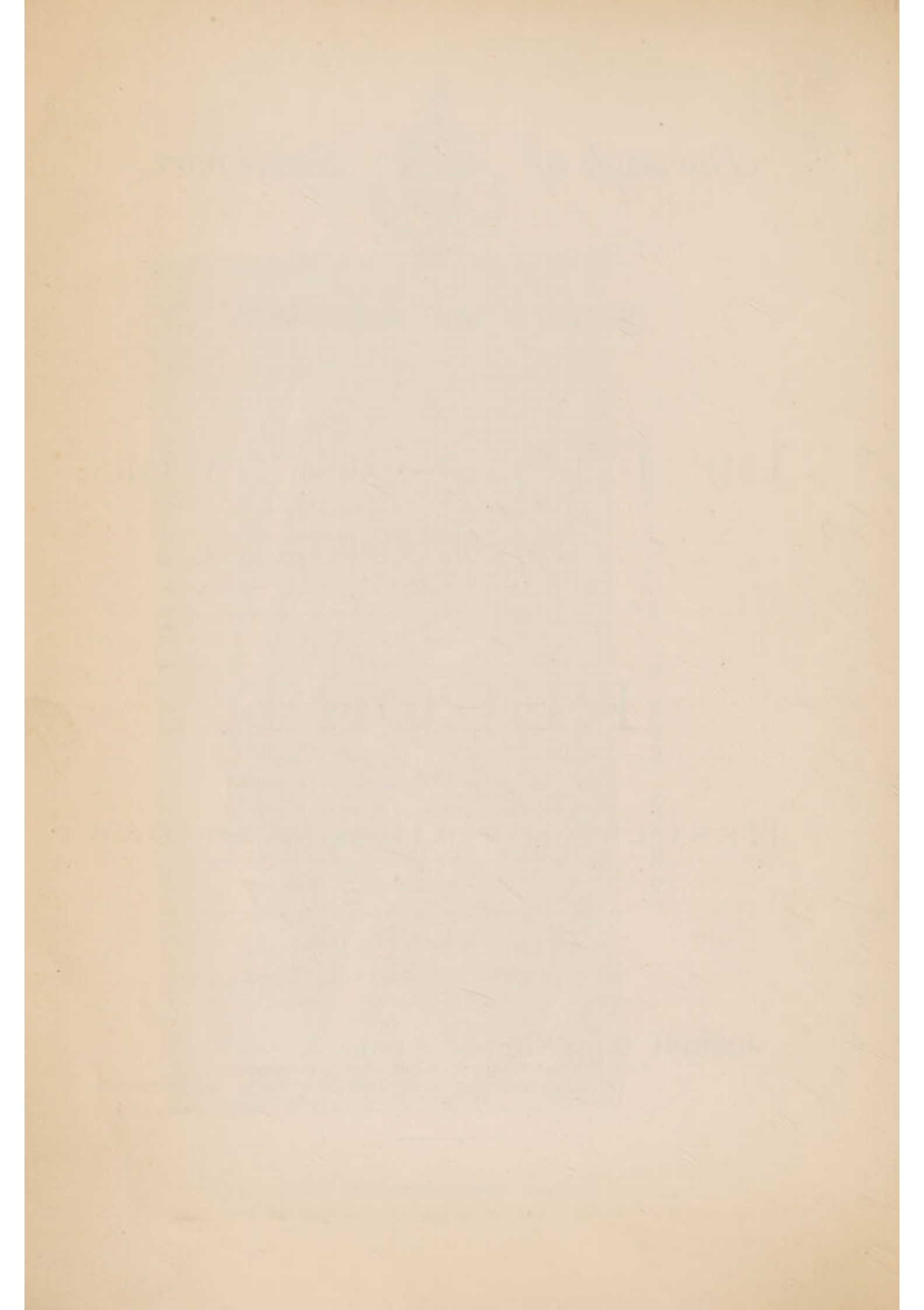
JOSEPH BAXENDELL, *F.R. Met. S.*,

*Meteorologist to the Southport Corporation.*

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"VISITER" PRINTING WORKS, SOUTHPORT.

1905.



# THE FERNLEY METEOROLOGICAL OBSERVATORY, SOUTHPORT.

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## *Report of the Director, for the Year 1904.*

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### I. **Personnel.**

Throughout the year 1904, Mr. F. L. Halliwell continued to fill the position of Chief Assistant; the *evening* meteorological observations also were principally made by him. The year was the fifteenth during which Mr. Halliwell has been associated with this Observatory. The duties of Morning Meteorological Observer, and of Attendant to the 14 Self-Recording Instruments, were performed by Mr. Alfred Goodwill, the Assistant-in-Charge of the Astronomical Educational Observatory. The position of Mr. W. R. Jones, the Relief Observer, remained as before.

Consequent upon the promotion of Mr. James Howard to a Permanent-Way Inspectorship on the Cheshire Lines Railway, some alterations in the working of the so-called Downholland branch Station became necessary in July. Accordingly, the management of the Barton Moss Evaporation, &c., portion of the Station was separated from that of the older Downholland Brook Level Gauge, and while the latter was left in the hands of Mr. Howard (the actual Observer being Mr. R. Waring, Foreman Platelayer at Mossbridge), the Barton Moss Evaporation Station was placed under the care of Mr. J. S. Kennerley, the Pointsman in charge of North Moss Lane Signal Box, his wife, Mrs. M. E. Kennerley, becoming the Observer.

The various observers' returns, the traces made by the self-recording instruments, and the monthly and yearly computations, were all examined and checked by me personally.

### II. **Structures and Instruments.**

The buildings, structures, and instruments were maintained during the year in good repair.

The Stevenson-Screen was repainted in July.

On January 1st, an Evaporation Tank three feet square, fixed near to the standard 6-ft. one, was brought into use, a series of comparative observations



between the two instruments being commenced. It is believed that the comparison will decide some rather important points hitherto in dispute.

In February, a new and very effective clutch for the Dial-pattern Non-Oscillating Pressure Plate Maximum Anemometer was designed, and fitted to that instrument.

### III First-Order Results.

Hourly measurements\* of the traces† from the Dines Mercurial Barograph, and the Dines Thermograph, were made from January 1st; and Hourly Means of Pressure and Temperature for each month, and for the year, accordingly appear for the first time in the annual Results of Observations appended to this Administration Report.

The double diurnal variation of Barometric Pressure is very clearly shown in the hourly means for the year; but it approximates more closely to the type of variation met with at low-level inland Stations, than to that regarded as characteristic of seaside ones.

The diurnal variation of Air Temperature is of the type usually experienced at Stations situated fairly near to the sea.

The preparation of Hourly Totals or Means for other meteorological elements has been continued, and the usual Tables will be found following the newly-introduced ones just described.

The Table of Diurnal Variation of Frequency of Winds from Different Directions once more exhibits a most striking maximum of sea winds by day, and a correspondingly marked one of land airs by night.

In regard to Rainfall, the west-coast night, or, rather, early morning, maximum, was unusually pronounced during 1904.

### IV. Returns and Reports.

Second-Order and Extra Returns were supplied throughout the year to the Royal Meteorological Society; Third-Order Reports (both daily and weekly) to the Meteorological Office; and Rainfall Returns, and other information, to the Editor of *British Rainfall* and *Symons's Meteorological Magazine*.

The usual Weekly and Monthly Reports were furnished to the local Press; as were also notes, at different times, with regard to exceptional weather, or special phenomena.

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\* Made from base lines automatically drawn on the daily charts by the instruments named.

† Corrected by control readings of standard instruments.



During the summer months, Daily Reports were prepared for eleven morning, and thirteen evening newspapers, published in Liverpool, Manchester, Bolton, Preston, Blackburn, Bradford, Leeds, Sheffield, and Birmingham. The *Liverpool Echo* was supplied with Reports throughout the year; and, in the autumn, similarly continuous services were commenced to the *Liverpool Daily Post and Mercury*, and the *Liverpool Express*.

## V. **Miscellanea.**

Commencing on May 14th, the Sunshine cards, and the charts removed in the forenoon from the Barograph, the Thermograph, the Anemograph, and the Pluviograph, were exhibited to the public daily (Sunday excepted), in a glazed frame fixed on a stand in a prominent position in Lord Street.

Coincident with the introduction into this annual publication of Hourly Means of Barometric Pressure, the recommendation of the International Meteorological Congress that all barometer readings should be corrected for the effect of the difference between the force of Gravity at the Station and that at Latitude 45°, has been adopted. The average amount of the correction applied for this purpose is stated at the foot of the first Table.

In other Tables appended to this Report, monthly results from the Non-Oscillating Pressure Plate Maximum Anemometer have now been inserted; as, also, Evaporation values from the new, smaller (*i.e.*, 3-ft.) Tank. Comments upon these statistics may, with advantage, be deferred until the data for 1905 are available.

The Table of Comparative Statistics, which concludes this pamphlet, has been reconstructed, and values for several *large Towns* have been added. I am indebted to Dr. W. N. Shaw, M.A., F.R.S., the Secretary of the Meteorological Council, for much assistance in connection with the preparation of this Table.

## THE ASTRONOMICAL EDUCATIONAL OBSERVATORY.

The total number of persons who viewed Celestial Objects through the 6-inch refracting Telescope, during the year 1904, was 168. In addition, many visited the Observatory who did not actually use the instruments.

From the commencement of the season 1904-5, the Observatory was opened to the "General Public" on *three* evenings weekly, in place of two only, the tickets kept on sale by the Assistants, and at the usual Stationers' and Chemists' Establishments in Southport and Birkdale, being made available "on the first starlight Monday, Wednesday, or Friday evening convenient to the holder, between September 1st and April 15th."



The Honorary Astronomical Assistant (the Rev. Robert Killip, F.R.A.S.) made many solar, and several planetary and cometary observations during the year. On six occasions he lectured within the Borough on astronomical subjects; and, from October to December, he conducted a weekly class of the associated students of a local astronomical course of University Extension Lectures, in preparation for the Extension Examination in December. Twice Mr. Killip took these students to the Observatory for practical lessons; and although only seven eventually presented themselves for the examination, it is gratifying to be able to state that all of these passed, and that four of them gained special distinction.

The performance of the Sidereal Chronometer, which is lent to the Observatory, continued to be satisfactory.

### **In Memoriam.**

I cannot conclude this Report without alluding to the heavy loss sustained by the Observatories Department in the year under review, through the death, on January 13th, of the Chairman of the Parks and Cemetery Committee, Alderman Thomas Isherwood, M.A., LL.D., D.C.L., Barrister-at-Law, F.R.S.E., F.C.S., J.P. As Mayor of the Borough in 1900-1, Dr. Isherwood formally opened the Astronomical Observatory; and, during his subsequent all-too-brief Chairmanship of the Committee having control of the Fernley Observatories, although seriously unwell, he took a keen, appreciative, and solicitous interest, not only in the popular and educational features of the work of the Department, but also in our more strictly scientific labours. To me personally, he extended unique consideration, which I shall ever remember with gratitude.

JOSEPH BAXENDELL.

*The Fernley Observatory,  
Southport, England.  
April 4th, 1905.*

SOUTHPORT  
METEOROLOGICAL OBSERVATORY.




RESULTS OF OBSERVATIONS

MADE DURING

THE YEAR 1904.





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# The Fernley Observatory, Southport.

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The Geographical Position of the Hesketh Park or principal Station of the FERNLEY METEOROLOGICAL OBSERVATORY is:—Latitude,  $53^{\circ} 39' 24''$  N. ; Longitude,  $2^{\circ} 59' 3''$  W.

The Fernley Single-louvred Structure, a rectangular wooden building (painted white), 12 feet in length by 9 feet in width, and from 8 to 10 feet in height, is erected upon an asphalt platform, on the summit of the highest knoll in Hesketh Park. In and about this structure are placed the Fortin-Standard and Kew-pattern-Station Barometers, the Richard Aneroidograph, the older set\* of Shade Thermometers, the Richard Thermograph, the Richard Hair Hygrograph, the Public Shaded Thermometer, the Wind Direction Dial, the Recording portion of the Baxendell Anemoscope, the Sight-Indicating tubes of the Dines Anemometer, and the Ozone Test Papers. At various heights above the roof, up to a maximum of 52 feet from the ground in the case of the "head" of the instrument to be mentioned last in this sentence, are mounted the Campbell-Stokes and Jordan Sunshine Recorders, the Robinson Cup\* Anemometer, the Vane of the Baxendell Recording Anemoscope, and the upper part of the Dines Sight-Indicating Pressure Tube Anemometer. Twenty-five feet to the Southward of the building, over a plot of grass, are fixed the three Solar Radiation Thermometers. The Stevenson-Screen, the Terrestrial Radiation and Underground Thermometers, and the various Rain Gauges, are planted to the N.W. of, and somewhat below, the top of the knoll, in an extensive and open, but not unduly exposed, green. The larger Stevenson-Screen, containing the Dines Thermograph, stands on the higher part of the green. The Dines Mercurial Barograph is mounted in the Computing Room underneath the Astronomical Observatory.

The several non-recording Barometers, Thermometers, and Rain Gauges, have been verified at Kew Observatory, and the readings are all corrected for instrumental errors, including, in the case of the Thermometers, gradual *zero displacement*.

The cisterns of the Barometers are 51 feet above the mean level of the sea.

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\* The publication of the results of the observations of temperature made in the Fernley Louvred-Structure, as also those of wind movement made with the Robinson Cup Anemometer, terminated with the values for the year 1901.



The Bulbs of the Dry, Wet, and Minimum Thermometers in the Stevenson-Screen are four feet above the grass; the Maximum is slightly lower. The Screen is of the Royal Meteorological Society's pattern; it is repainted white (both outside and inside) annually, in the spring. Distilled water is used for the Wet-bulb.

The Hygrometrical Results are deduced from the *daily* readings of the Dry-bulb and Wet-bulb Thermometers, by means of the eighth edition of Glaisher's Tables.

The Underground Thermometers are suspended by chains in iron tubes sealed (except in the case of the 20-foot Thermometer) at the lower ends, and closed above the grass by copper caps. The instrument suspended 20 feet beneath the surface is one of Messrs. Negretti & Zambra's patent slow-acting Thermometers, having a specially open scale, and divided on the stem to tenths of degrees.

The bulbs of the Solar Radiation Maximum Thermometers are placed five feet above grass. To the readings of the Blackened-bulb Thermometer *in vacuo*, a *special* subtractive correction is applied, for the purpose of rendering the indications of the instrument comparable with those of the Kew Observatory's *present* standard Black-bulb Thermometer *in vacuo*.

The *sensitive* Terrestrial Radiation Minimum Thermometer is one of Messrs. Negretti & Zambra's Link-bulb pattern. The shield-tube over the stem is hermetically sealed.

The Minimum Thermometers in the shade are occasionally placed for 12 hours in vertical positions, bulbs downwards; and those on the grass are left in a similar position (in padded metal wells) every day during the summer months, from 9 a.m. until about 6 p.m. No spirit therefore collects in the upper parts of the tubes.

The photographic traces of the Jordan Sunshine Recorder are "fixed" *before* being measured. The Campbell-Stokes instrument is, however, adopted as the standard Sunshine Recorder of the Observatory.

The Direction of the Wind is given according to *true*, and not to magnetic, bearings. When the air is practically calm at the time of observing, the point at which the Vane is standing is noted, and entered as the approximate Direction.

The Ozone Test Papers and Scale used are Moffat's, and are obtained from Messrs. Negretti & Zambra, London.

The upper edge of the receiver of the Rain Gauge (a Meteorological-Office-pattern one, eight inches in diameter, and constructed of copper) is one foot above the surface of the ground, and 38 feet above mean sea level. A 5-inch Snowdon Rain Gauge, similarly placed, is employed for weekly and monthly check observations. The Duration of Rainfall is obtained from the charts of the



Halliwell (Float-pattern) Standard Self-Recording Rain Gauge; the rim of this instrument is 1 foot 6 inches above the ground, and 39 feet above mean sea level. The older Casella-Halliwell (Balance-pattern) Self-Recording Rain Gauge is also retained in use.

The Fog and related Results are derived from observations of the visibility of objects and lights at definite distances from the Observatory Hill.

The Averages, with which a number of the results for 1904 are compared in the accompanying Tables, are those for the following periods:—

Barometric Oscillations .....	}	30 years, 1872-1901 inclusive.
Relative Humidity .....		
Underground Temperature .....		
Amount of Cloud .....		
Wind Direction .....		
Total Rainfall .....		
Days with Rain .....	}	15 years, 1889-1903 inclusive.
Mean Temperature .....		
Daily Range of Temperature .....	}	12 years, 1892-1903 inclusive.
Barometric Pressure .....		
Amount of Ozone .....	}	7 years, 1897-1903 inclusive.
Stokes Sunshine .....		
Wind Velocity .....	6 years, 1898-1903 inclusive.	

It seems scarcely necessary to add that the sign + in the columns headed "Difference from the Average" signifies that the 1904 value *exceeded* the average by the amount following the sign, and that the sign — similarly indicates that the result for 1904 was *below* the average to the extent stated.

### Marshside Anemograph Station.

The Geographical Position of this Station is:—Latitude, 53° 40' 18" N.; Longitude, 2° 58' 23" W. It is situate on the coast, over a mile to the N.N.E. of the Hesketh Park Observatory, viz., in the direction of the estuary of the Ribble; and is in an extensive reclaimed marsh, adjoining the beach.

The vane of the one-inch-pattern Dines-Baxendell Anemograph is 61 feet above the ground, and 51 feet above the roof of the Marshside Fog Bell brick hut. On, and revolving around, the same standard, at a height of 55 feet above the ground, is the new Non-Oscillating Maximum Pressure Plate Anemometer.

The vane of the *older* Dines Recording Pressure Tube Anemometer is 50 feet above the ground. This instrument is now mainly employed for experimental and comparative purposes, and no ordinary results derived from its traces are, as a rule, published.



## Barton Moss Evaporation Station.

(Adjacent to Formby Moss, but in the Parish of Downholland).

The Geographical Position of this Station is:—Latitude,  $53^{\circ} 34' 37''$  N.; Longitude,  $3^{\circ} 1' 12''$  W. It is situate 3 miles inland from the sea, and is about  $5\frac{1}{2}$  miles to the S.S.W. of the Hesketh Park Observatory. The Station has an exceptionally open exposure in all directions.

The rims of the various instruments are from 14 to 15 feet above Ordnance datum.

The Rain Gauge is a Snowdon-pattern one, 5 inches in diameter; its rim is 9 inches above the ground.

The Standard Evaporation Tank is one of Symons's pattern, 6 feet square and 2 feet deep, and its rim is 3 inches above the ground. The height of the water is measured daily, at 9 a.m., by means of a Halliwell Float-and-Index-Finger Gauge.

A second Evaporation Tank, only 3 feet square, but in all other respects similar to the standard one just described, is temporarily in use for comparative purposes.

The Downholland-Brook level Gauge is fixed some distance away, under the railway girder bridge spanning that watercourse, about a quarter of a mile to the N.W. of Mossbridge Station, on the Southport and Cheshire Lines Extension Railway.

At all the Stations, Greenwich Mean Time is employed for the First-Order Results; and Local Mean Time for the Second-Order Observations.

The Hourly values of Barometric Pressure, and of Air Temperature, are the corrected measurements of the Dines traces, in each case at the exact hour. The Hourly values of Wind Frequencies and Wind Velocity, and of Rainfall Duration and Amount, all refer to the period extending from 30 minutes before, to 30 minutes after, the exact hour. The Wind Velocities are Actual.



## Barometric Pressure.

1904.	MEAN PRESSURE.* For Gravity of Latitude 45°† At 32 deg., and Station Level.		Difference from the Average (At Sea Level).	Mean of Daily Observed Oscillations.†	Difference from the Average.	Observed Monthly Range.*	Extreme Monthly Range.†
	INCHES.	INCHES.					
January ...	29·829	29·886	-0·091	0·268	+0·014	1·921	2·020
February	29·499	29·556	-·384	·306	+·074	1·594	1·650
March ...	29·959	30·016	+·131	·213	-·014	1·251	1·285
April .....	29·863	29·919	-·036	·223	+·032	1·046	1·050
May .....	29·898	29·954	-·084	·169	+·005	0·737	0·790
June .....	30·038	30·093	+·070	·168	+·009	0·822	0·890
July .....	30·002	30·057	+·054	·106	-·045	0·621	0·650
August ...	29·970	30·025	+·076	·193	+·022	0·679	0·750
September	30·043	30·099	+·106	·154	-·027	0·610	0·635
October ...	30·074	30·130	+·250	·213	-·008	1·172	1·230
November	30·023	30·080	+·086	·207	-·045	1·130	1·140
December	29·869	29·926	+0·070	0·252	-0·021	1·698	1·715
Means.....	29·922	29·978	+0·021	0·206	0·000	1·107	1·150

\* From Observations at 9 a.m. and 9 p.m. daily; no correction being applied for diurnal variation.

† Gravity correction employed = + 0·023 inch.

‡ From the records of the Dines Mercurial Barograph.

## Temperature; and Humidity.

### Stevenson-Screen Results.

1904.	Mean Tempera- ture.*	Difference from the Average.	Mean Daily Range of Tempera- ture.	Difference from the Average.	Absolute Extremes of Temperature.				Mean Relative Humidity of the Air.		Difference (at 9 a.m.) from the Average.
					Highest.		Lowest.		9 a.m.	9 p.m.	
	°		°	°	Temp.	Date.	Temp.	Date.	%	%	%
January ...	39·9	+1·2	7·9	-0·3	54·6	27th	26·2	22nd	92	90	+4
February...	38·0	-0·9	8·7	-1·2	52·1	21st	22·8	29th	89	88	+2
March .....	39·7	-2·0	12·0	+0·7	54·7	20th	24·8	12th	84	88	0
April .....	47·2	+1·3	10·8	-3·1	62·7	19th	36·0	9th	81	85	+2
May .....	51·4	+0·3	13·2	-1·3	69·8	16th	35·3	10th	77	87	+1
June.....	56·1	-1·2	14·4	+0·4	75·9	30th	40·6	28th	75	85	-1
July.....	61·6	+2·1	15·2	+3·4	82·4	11th	46·1	8th	74	83	-4
August.....	59·1	-0·1	13·2	+1·6	80·4	3rd	43·0	24th	79	85	-1
September	55·5	-0·5	14·9	+2·4	69·2	18th	41·0	19th	80	87	-2
October ...	50·5	+1·7	11·2	-0·2	62·6	11th	32·3	14th	86	89	+1
November	43·0	-1·2	9·6	+0·2	55·6	9th	22·0	27th	88	90	0
December	39·2	-0·4	8·7	+0·2	56·0	4th	24·3	22nd	90	90	+2
Means .....	48·4	0·0	11·7	+0·2	HIGHEST. 82·4	JULY 11th	LOWEST. 22·0	NOV. 27th	83	87	0

\* Mean of the daily indications (each for the 24 hours ending at 9 p.m.) of the Maximum and Minimum Thermometers in the Screen.

NOTE.—For "Number of Days with Frost," see Table headed "Miscellaneous Phenomena."



## Underground Temperatures; and Solar and Terrestrial Radiation.

1904.	Mean Underground Temperatures at 9 a.m.				Difference (at 1 foot) from the Average.	Mean Daily Max. Temps. in Sun.			Mean Excess of Blackened bulb in Vacuo over Bright-bulb in Vacuo.	Mean Daily Min.*on Short- Grass or Snow.
	1 foot.	4 feet.	10 feet.	20 feet.		Blackened bulb in Vacuo.	Bright bulb in Vacuo.	Black-glass bulb in Open Air		
January ...	37.1	40.3	45.8	50.30	-0.1	58.1	47.2	45.6	10.9	30.3
February ...	36.9	39.9	44.5	49.45	-0.7	63.6	48.1	45.9	15.5	28.1
March .....	38.6	40.2	43.5	48.53	-1.6	76.2	54.6	51.4	21.6	26.5
April .....	47.3	45.4	44.6	47.91	+1.5	98.1	67.6	60.8	30.5	36.9
May .....	53.8	50.9	47.5	47.74	+0.6	104.1	73.2	67.5	30.9	39.6
June .....	59.4	55.7	50.4	48.06	-1.0	112.7	80.4	74.2	32.3	43.9
July .....	64.7	59.7	53.3	48.80	+0.9	117.0	86.3	81.1	30.7	49.0
August .....	62.2	60.3	55.4	49.69	-0.5	110.4	81.9	76.6	28.5	47.9
September	56.7	57.9	55.7	50.50	-1.5	101.1	76.0	71.2	25.1	41.5
October ...	50.5	53.2	54.1	50.96	+0.1	86.3	66.2	62.6	20.1	39.0
November	43.4	48.5	52.0	51.00	-0.4	66.3	53.1	51.0	13.2	33.0
December	38.1	42.4	48.6	50.65	-0.6	56.6	46.8	45.2	9.8	29.7
Means .....	49.1	49.5	49.6	49.47	-0.3	87.5	65.1	61.1	22.4	37.1

\* From the indications of a sensitive Minimum Thermometer.

## Duration of Sunshine; and Amount of Cloud.

1904.	PER STANDARD RECORDER. (CAMPBELL-STOKES).					PER JORDAN PHOTOGRAPHIC RECORDER.				Mean Amount of Cloud.		Difference (at 9 a.m.) from the Average.
	Total Bright Sun- shine.	Difference from the Average.	Most Sunshine in One Day.		Number of Sun- less Days.	Total Bright Sun- shine.	Most Sunshine in One Day.		Number of Sun- less Days.	9 a.m.	9 p.m.	
	Hours.	Hours.	Hours.	Date.		Hours.	Amount.	Date.		0 to 10	0 to 10	0 to 10.
January ...	34.7	- 9.9	5.5	21st	15	42.0	5.5	21st	15	7.7	7.9	-0.2
February ...	41.9	-28.1	7.4	18th	10	50.8	7.5	18th	9	8.4	7.4	+0.6
March .....	91.8	-29.1	10.2	23rd	11	102.0	10.8	23rd	11	7.5	6.5	+0.2
April .....	167.3	- 6.3	10.8	21st	1	198.8	11.0	21st	1	6.8	5.3	-0.4
May .....	153.6	-69.8	13.9	19th	4	170.7	13.1	19th	3	7.9	7.2	+0.9
June .....	216.5	+ 8.2	14.9	4th	2	231.4	14.5	4th	1	6.6	6.4	-0.5
July .....	211.2	- 3.9	14.2	9th	0	233.5	14.4	9th	0	7.0	6.7	-0.5
August .....	186.9	- 7.0	12.9	3rd	2	204.2	12.6	3rd	1	7.3	6.5	-0.1
September	166.3	+21.9	10.5	18th	3	184.7	11.2	18th	2	6.7	5.1	-0.6
October ...	112.8	+20.9	9.7	12th	5	123.9	10.4	3rd	4	6.8	7.0	-0.7
November	48.3	- 2.3	7.0	12th	12	48.5	7.0	12th	13	7.8	7.6	0.0
December	42.2	+12.8	6.4	8th	13	42.4	5.9	18th	13	7.7	8.0	-0.3
Totals .....	1473.5	-92.6	MOST. 14.9	JUNE 4th	78	1627.9	MOST. 14.5	JUNE 4th	73	MEAN. 7.4	MEAN. 6.8	MEAN. -0.1



## Direction of the Wind.

1904.	DIRECTION OF THE WIND.															
	From Observations at 9 a.m. and 9 p.m. Daily.								Difference from the Average.							
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
January ...	2	2	6	26	25	14	17	8	-4	-2	-3	+2	+6	-2	+1	+2
February...	4	5	20	29	5	16	8	13	-3	-1	+8	+8	-12	0	-7	+7
March .....	7	16	22	12	18	11	7	7	-1	+9	+11	-5	+5	-6	-10	-3
April .....	3	3	4	4	17	21	37	11	-5	-7	-15	-11	+4	+11	+21	+2
May .....	12	6	10	15	13	14	20	10	+4	-3	-7	+5	+2	+2	0	-3
June .....	5	9	20	9	7	13	23	14	-1	+2	+8	-2	-4	-1	-1	-1
July .....	4	7	18	11	13	13	18	16	-1	+3	+11	+3	+2	-5	-11	-2
August.....	9	2	7	16	14	9	25	18	+3	-2	-3	+4	0	-8	+1	+5
September	8	7	16	36	10	5	10	8	+2	+1	+5	+19	-5	-10	-8	-4
October ...	3	9	10	26	11	18	19	4	-6	0	-1	+7	-6	+6	+5	-5
November..	8	8	6	18	9	8	27	16	-1	0	-5	-3	-9	-4	+13	+9
December..	5	0	10	30	20	22	6	7	-2	-4	+1	+7	+2	+7	-10	-1
Means .....	6	6	12	19	14	14	18	11	-1	0	+1	+3	-1	-1	-1	0

## Rainfall, &amp;c.; and Ozone.

1904.	Total Rainfall.*	Difference from the Average.	No. of days† with Rain (0' or in. or more).	Difference from the Average.	Greatest Fall in One Day.†		Total Duration of Rain.‡	Mean level of Subsoil Water.§	OZONE.	
					Amount.	Date.			12-hourly Mean.	Difference from the Average.
	INCHES.	INCHES.			INCHES.		HOURS.	INCHES.	0 to 10.	0 to 10.
January ...	2.86	+0.16	19	+2	0.56	12th	62.3	24.0	1.8	-0.7
February...	3.81	+1.80	20	+5	1.06	3rd	99.7	20.4	2.0	-0.4
March .....	2.02	-0.10	14	-1	0.41	20th	64.0	22.2	1.9	-1.7
April .....	1.69	-0.03	18	+5	0.34	2nd	48.0	26.4	3.6	-0.4
May .....	1.74	-0.33	13	0	0.56	31st	40.7	31.7	3.5	-0.5
June .....	1.12	-1.12	9	-4	0.26	1st	29.5	36.1	3.7	-0.6
July .....	1.02	-2.18	12	-3	0.21	24th	26.2	42.9	3.2	-1.2
August.....	3.10	-0.71	18	+1	0.51	13th	57.3	47.2	3.9	+0.4
September..	2.24	-1.08	9	-6	0.69	6th	36.7	49.0	1.8	-1.1
October ...	1.99	-1.85	12	-6	0.98	16th	49.3	49.7	1.7	-0.5
November..	2.04	-1.27	16	-1	0.40	8th	54.5	48.2	2.8	+0.8
December...	2.38	-0.70	17	-1	0.32	9th	54.3	45.5	1.3	-0.9
Totals .....	26.01	-7.41	177	-9	GREATEST. 1.06	FEBRUARY 3rd	622.5	MEAN. 36.9	MEAN. 2.6	MEAN. -0.6

\* From 9 a.m. on the 1st; including each month the fall during the first nine hours of the succeeding month.

† 24 hours ending at 9 a.m. next day. ‡ From and to 12 midnight each month-end.

§ Mean distance below the surface of the ground. The measurements are made daily.

|| And also on the 17th.



## Miscellaneous Phenomena.

1904.	At one or both of the Chief Observing Hours.*					At any Hour.										
	Thick Fog	Slight Fog and Haze.	Sky Haze.	Clear Air.	Clear Sky.	Gales. †	Solar Halos.	Lunar Halos.	Thun- der Storms ‡	Light- ning only.	Hail.§	Snow.	Total Depth of Snow.	Frost on the Grass.	Frost in the screen	Ice on the Lake.
	No. of Days.	No. of Days.	No. of Days.	No. of Days.	No. of Days.	No. of Days.	No. of Days.	No. of Days.	No. of Days.	No. of Days.	No. of Days.	No. of Days.	INCHES.	No. of Days.	No. of Days.	No. of Days.
January ...	10	15	16	16	7	7	0	1	0	1	3	0	0.0	19	7	7
February ...	2	14	18	9	2	7	1	0	0	0	1	6	4.3	21	10	6
March .....	3	10	18	16	8	1	0	0	0	0	4	2	0.2	25	11	7
April .....	1	1	7	27	11	12	0	1	0	0	2	0	0.0	5	0	0
May .....	0	1	9	19	4	4	4	0	1	0	1	0	0.0	5	0	0
June .....	0	1	11	23	6	3	0	0	1	0	0	0	0.0	1	0	0
July .....	0	1	10	21	6	0	0	0	4	0	0	0	0.0	0	0	0
August .....	0	2	8	25	7	6	2	0	2	2	0	0	0.0	0	0	0
September..	1	5	14	12	7	2	0	0	2	1	0	0	0.0	1	0	0
October ...	1	12	15	19	4	6	1	2	0	1	1	0	0.0	8	0	0
November ..	6	12	14	15	5	7	0	1	0	0	2	1	0.7	14	8	8
December ..	7	20	12	15	3	5	0	1	0	0	1	2	0.6	23	14	11
Totals .....	31	94	152	217	70	60	8	6	10	5	15	11	5.8	122	50	39

\* i.e., 9 a.m. and 9 p.m. † 30 miles or upwards of wind movement in the case of one or more of the ordinary hourly tabulations of the charts from the Dines Anemometer.

‡ Including both Thunder only and Thunderstorms. § Including "Soft Hail."

## Marshside Anemograph Results.

1904.	DIRECTION OF THE WIND. From the Hourly Tabulations of the Charts from the Baxendell Recording Anemoscope.								MOVEMENT OF THE WIND. Per Dines Recording Pressure Tube Anemometer.*				PRESSURE OF THE WIND. †	
	Frequency Percentages.								Mean Daily Mov. m. n.	Difference from the Average.	Max. for 1 Hour.		Extremes.	
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.			Mean Daily.	Absolute Monthly.	Mean Daily Max.	Absolute Monthly Max.
	%	%	%	%	%	%	%	%	Miles.	Miles.	Miles.	Miles.	Lbs. per square foot	
January ...	2	1	6	28	23	18	13	9	367	- 15	23	50	†	†
February ...	7	7	15	29	9	12	11	10	337	- 11	23	44	†	†
March .....	6	16	23	9	18	11	10	7	291	- 67	19	34	2.7	6.1
April .....	4	2	3	8	10	19	41	13	479	+ 135	29	47	5.7	12.0
May .....	10	5	13	11	12	15	22	12	330	+ 31	21	46	3.4	13.4
June .....	5	11	17	11	9	11	21	15	360	+ 76	22	43	3.4	10.2
July .....	3	6	20	14	9	14	22	12	276	- 36	18	29	2.5	4.8
August .....	7	3	5	17	13	10	31	14	343	+ 21	22	48	3.6	12.7
September	5	9	18	28	13	6	14	7	310	- 14	18	37	3.1	6.8
October ...	4	7	10	24	13	12	21	9	317	- 33	22	53	3.4	20.0
November	8	6	5	19	8	10	29	15	378	+ 33	23	45	3.6	11.2
December	5	1	9	32	15	21	8	9	334	- 50	21	50	3.8	15.8
Means .....	6	6	12	19	13	13	20	11	344	+ 6	22	HIGHEST. 53	...	HIGHEST 20.0

\* With one-inch connecting pipes.

† From the indications of a Dines-Baxendell Non-Oscillating Pressure Plate Maximum Anemometer.

‡ Instrument not finally completed.



# Evaporation, &c., at Barton Moss.

(Adjacent to Formby Moss).

1904.	Total Rain-fall.	Total Evaporation. Per Symons' Tanks.		Level of Downholland Brook, near Mossbridge Railway Station.					
		6-feet square.	3-feet square.	Mean Height above Ordnance Datum.	Highest Level.		Lowest Level.		
					Height.	Dates.	Height.	Dates.	
	Inches.	Inches.	Inches.	Ft. Ins.	Ft. Ins.		Ft. Ins.		
January .....	2·80	0·31	0·29	10 3	12 1	14th	9 6		2nd to 7th
February .....	3·77	0·35	0·35	11 4	15 6	4th	10 1		15th
March .....	2·08	0·94	0·96	9 11	11 2	9th	9 4		27th & 28th
April .....	1·33	2·50	2·70	9 5	9 10	1, 3, 4, & 6	9 2		16, 26, 27, 30
May .....	1·88	2·86	3·00	9 1	9 4	2nd	8 11		20th to 24th
June .....	1·14	3·57	3·63	9 2	9 7	15th	8 9		30th
July .....	1·33	3·90	3·94	8 9	8 11	24, 29, & 31	8 9		1 to 6, & 8 to 23
August .....	3·37	3·61	3·60	9 3	9 11	23rd	8 10		3rd & 4th
September .....	2·24	2·24	2·26	9 0	9 5	8th	8 9		23rd to 30th
October .....	1·91	1·15	1·19	8 11	9 10	18th	8 9		15th to 17th
November .....	1·90	0·63	0·61	9 3	10 2	11th	8 9		6th & 7th
December .....	2·74	0·44	0·44	10 1	11 8	17th	9 2		1st to 3rd
Totals .....	26·49	22·50	22·97	MEAN. 9 6	HIGHEST. 15 6	FEBRUARY 4th	LOWEST. 8 9		JUNE, JULY, SEPTEMBER, OCT., and NOV.

## Rainfall in the District.\*

1904.	COASTLINE.								INLAND.		
	Fleet-wood.	Black-pool.	Lytham.	South-port.	Birkdale.	Blundell-sands.	New Brighton.	Hoylelake.	Rufford.	Barton Moss.	Aughton.
	30 ft.	67 ft.	21 ft.	38 ft.	27 ft.	33 ft.	130 ft.	30 ft.	39 ft.	14 ft.	138 ft.
ALTITUDE.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
January ...	3·45	3·70	3·09	2·86	2·77	2·19	2·05	2·38	2·81	2·80	2·87
February ...	3·25	3·77	2·85	3·81	3·93	4·25	3·60	3·58	3·87	3·77	4·29
March .....	1·90	2·25	2·47	2·02	1·89	1·60	1·90	1·53	2·14	2·08	1·90
April .....	2·22	2·22	1·60	1·69	1·64	1·12	0·93	1·05	1·84	1·33	1·47
May .....	2·21	1·94	1·95	1·74	1·89	1·85	1·94	1·97	1·58	1·88	1·91
June .....	0·75	1·22	1·30	1·12	1·09	1·20	1·20	1·29	2·25	1·14	1·42
July .....	1·04	1·31	1·42	1·02	1·38	0·96	1·02	1·34	1·22	1·33	1·27
August .....	2·87	2·87	3·53	3·10	2·85	2·95	3·33	3·44	4·33	3·37	4·30
September	2·40	3·64	2·39	2·24	2·12	2·66	2·11	2·56	2·03	2·24	2·28
October ...	2·56	2·41	2·48	1·99	2·15	1·96	1·73	1·56	2·34	1·91	2·14
November	2·64	2·85	2·25	2·04	2·08	1·70	1·64	1·86	2·31	1·90	2·13
December	2·59	2·68	2·00	2·38	2·40	2·85	2·52	2·37	2·94	2·74	2·89
Totals .....	27·88	30·86	27·33	26·01	26·19	25·29	23·97	24·93	29·66	26·49	28·87

\* The Results from Fleetwood, Blackpool, Lytham, Blundellsands, New Brighton, Hoylelake, Rufford, and Aughton, given in this Table, have been kindly furnished respectively by the Urban District Council of Fleetwood (per Mr. M. S. Gaultier, Sanitary Inspector); the Corporation of Blackpool (per Dr. F. J. H. Coutts, D.P.H., Medical Officer of Health); the Urban District Council of Lytham (per Mr. H. Yates, Assoc. Royal San. Inst., Sanitary Inspector); T. Mellard Reade, Esq., C.E.; W. Bell, Esq., J.P.; the Urban District Council of Hoylelake and West Kirby (per Mr. T. Robinson, Assoc. Royal San. Inst.); G. Hobkirk, Esq.; and Cecil E. Maples, Esq., F.R.Met.S.

The Stations at Southport, Birkdale, and Barton Moss are those of this Observatory.



## Diurnal Variation of

At mean sea level, and

1904.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
January..	29.883	29.882	29.882	29.878	29.875	29.874	29.876	29.882	29.893	29.895	29.895	29.887
February	29.552	29.553	29.551	29.548	29.548	29.546	29.547	29.555	29.557	29.552	29.551	29.546
March ...	30.016	30.015	30.011	30.010	30.011	30.017	30.025	30.029	30.028	30.026	30.022	30.018
April ....	29.895	29.891	29.886	29.889	29.893	29.903	29.914	29.921	29.924	29.926	29.928	29.929
May .....	29.970	29.966	29.962	29.960	29.961	29.967	29.968	29.970	29.965	29.961	29.960	29.959
June .....	30.090	30.089	30.086	30.087	30.087	30.091	30.093	30.097	30.098	30.097	30.098	30.097
July . ....	30.055	30.053	30.048	30.046	30.047	30.049	30.053	30.056	30.056	30.054	30.053	30.053
August...	30.026	30.020	30.016	30.012	30.011	30.012	30.016	30.020	30.022	30.021	30.024	30.025
Septem. .	30.096	30.092	30.089	30.087	30.086	30.091	30.098	30.102	30.101	30.099	30.095	30.090
October..	30.106	30.104	30.100	30.099	30.101	30.106	30.113	30.122	30.132	30.134	30.132	30.129
Novemb'r	30.074	30.074	30.068	30.067	30.068	30.067	30.073	30.083	30.088	30.088	30.090	30.079
Decemb'r	29.904	29.901	29.898	29.897	29.897	29.899	29.904	29.910	29.919	29.927	29.930	29.926
Means ...	29.972	29.970	29.966	29.965	29.965	29.969	29.973	29.979	29.982	29.982	29.982	29.978

## Diurnal Variation

Four feet above grass, and in

1904.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.
	o	o	o	o	o	o	o	o	o	o	o	o
January .....	39.5	39.5	39.6	39.8	39.1	39.1	39.0	39.0	38.8	39.7	40.4	41.0
February .....	36.9	36.6	36.5	36.3	36.2	36.0	36.1	36.2	36.8	38.0	38.9	40.0
March .....	37.1	36.7	36.5	36.4	36.1	35.9	36.1	37.1	38.8	40.4	41.6	43.0
April .....	45.0	44.7	44.4	43.7	43.5	43.8	44.9	46.5	47.6	48.7	49.4	50.4
May .....	47.2	46.6	46.1	45.8	46.0	47.0	48.9	50.6	52.1	53.4	54.2	54.6
June .....	51.5	50.7	50.4	49.9	50.2	51.7	53.5	55.3	56.8	58.5	59.1	60.0
July .....	56.4	55.8	55.5	54.8	55.0	56.2	58.2	60.1	61.9	63.9	64.8	65.6
August .....	55.0	54.5	54.1	53.7	53.5	54.2	55.9	57.3	59.2	60.9	61.8	62.4
September .....	51.2	50.7	50.3	49.6	49.2	49.1	50.1	52.2	55.2	57.5	59.2	60.3
October .....	48.3	47.8	47.5	47.4	47.0	46.9	47.0	47.7	49.4	51.5	52.9	53.7
November .....	41.8	41.6	41.6	41.5	41.2	40.9	41.5	41.7	42.2	43.5	44.6	45.3
December .....	38.8	38.8	38.6	38.2	38.2	38.1	38.2	38.5	38.9	39.5	40.2	41.0
Means .....	45.7	45.3	45.1	44.7	44.6	44.9	45.8	46.9	48.1	49.6	50.6	51.4



# Barometric Pressure.

for Gravity of Latitude 45°

1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	Midnight	Means.
Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
29·877	29·868	29·868	29·866	29·866	29·870	29·875	29·876	29·878	29·877	29·877	29·873	29·878
29·534	29·526	29·520	29·521	29·524	29·533	29·541	29·547	29·557	29·561	29·566	29·569	29·546
30·011	30·003	29·993	29·987	29·988	29·993	30·000	30·004	30·005	30·005	30·004	30·002	30·010
29·927	29·924	29·918	29·916	29·912	29·913	29·912	29·921	29·923	29·923	29·922	29·918	29·914
29·954	29·951	29·946	29·943	29·942	29·945	29·951	29·959	29·967	29·972	29·971	29·970	29·960
30·097	30·093	30·089	30·088	30·082	30·081	30·081	30·083	30·088	30·089	30·089	30·087	30·090
30·050	30·047	30·044	30·044	30·041	30·042	30·045	30·049	30·057	30·062	30·064	30·063	30·051
30·026	30·023	30·020	30·018	30·016	30·015	30·018	30·025	30·028	30·028	30·027	30·027	30·021
30·086	30·081	30·076	30·074	30·073	30·080	30·088	30·096	30·097	30·097	30·096	30·093	30·090
30·124	30·120	30·117	30·115	30·115	30·120	30·123	30·127	30·127	30·127	30·125	30·124	30·118
30·072	30·063	30·058	30·058	30·064	30·067	30·069	30·070	30·072	30·070	30·067	30·066	30·071
29·920	29·915	29·915	29·919	29·920	29·925	29·927	29·929	29·932	29·931	29·932	29·930	29·917
29·973	29·968	29·964	29·962	29·962	29·965	29·969	29·974	29·978	29·979	29·978	29·977	29·972

# of Temperature.

an enlarged Stevenson Screen.

1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	Midn't	Means.
°	°	°	°	°	°	°	°	°	°	°	°	°
41·5	41·6	41·4	41·0	40·6	40·3	40·0	39·9	39·8	39·9	39·8	39·7	40·0
40·6	40·5	40·0	39·6	38·7	38·1	37·5	37·4	37·1	37·0	36·8	36·7	37·7
43·8	43·9	44·0	43·1	42·1	41·1	40·2	39·7	39·2	38·8	38·4	37·9	39·5
50·7	50·5	50·3	49·8	49·1	48·6	47·6	46·6	46·3	45·9	45·7	45·5	47·0
55·4	55·4	55·4	55·1	54·4	53·5	52·4	50·7	49·8	49·4	48·7	48·1	50·9
60·6	60·8	59·9	59·7	59·3	58·6	57·6	55·0	54·6	53·8	53·0	52·2	55·6
66·2	66·4	66·5	65·8	65·1	63·8	62·9	61·1	59·7	58·7	57·7	57·1	60·8
63·0	63·6	63·3	62·7	61·8	61·0	59·7	58·4	57·5	56·9	56·1	55·4	58·4
61·3	61·4	61·3	60·4	59·2	57·2	55·3	54·2	53·3	52·9	52·2	51·6	54·8
54·3	54·4	54·2	53·2	51·7	50·8	50·1	49·4	49·2	48·9	48·6	48·5	50·0
45·9	46·0	45·5	44·7	43·9	43·4	43·3	42·7	42·5	42·3	42·1	42·0	43·0
41·6	41·6	40·8	40·0	39·7	39·4	39·3	39·2	39·0	39·1	39·0	38·8	39·4
52·1	52·2	51·9	51·3	50·5	49·7	48·8	47·9	47·3	47·0	46·5	46·1	48·1



## Diurnal Variation of Frequency of Values for the Year

	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.
	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.
N.	14.5	19.5	21.0	21.5	18.0	21.0	21.0	25.0	18.0	19.0	21.0	16.0
N.E.	27.0	24.5	24.0	23.5	26.0	22.0	18.5	24.5	24.0	22.5	20.0	20.5
E.	54.0	57.5	56.5	61.0	58.5	57.5	58.0	47.0	37.0	31.0	25.5	31.5
S.E.	80.5	86.0	83.5	89.0	86.5	88.0	85.5	81.0	78.0	76.5	72.0	60.0
S.	49.0	43.0	46.0	40.5	37.5	40.0	42.0	45.5	55.0	47.5	48.5	49.5
S.W.	47.5	45.5	41.5	35.5	40.5	39.5	41.0	45.5	47.5	59.5	57.5	60.0
W.	56.0	59.0	60.5	64.5	63.5	63.0	62.5	66.5	69.5	74.5	84.0	94.0
N.W.	37.5	31.0	33.0	30.5	35.5	35.0	37.5	31.0	37.0	35.5	37.5	34.5

## Diurnal Variation (At Marsh-

1904.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.
	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.
January .....	15.3	14.6	14.5	15.0	15.2	15.5	15.1	14.8	14.2	14.8	15.4	15.4
February .....	14.7	14.2	14.2	15.0	15.0	14.4	14.4	15.0	14.1	13.7	13.1	12.9
March .....	11.3	11.3	10.8	11.0	10.6	10.3	10.2	10.6	11.6	12.2	13.2	13.8
April .....	19.5	19.2	20.1	20.8	20.1	19.9	20.5	20.4	20.6	21.5	22.2	21.7
May .....	12.5	12.9	13.2	13.1	13.1	13.3	13.6	14.5	15.0	15.2	15.3	15.0
June .....	12.9	12.8	13.3	13.3	13.6	14.2	15.6	16.5	16.5	16.5	16.9	16.5
July .....	11.2	10.8	10.4	10.1	10.6	10.3	10.2	11.1	11.7	12.5	12.5	12.1
August .....	12.9	12.8	12.7	13.4	13.7	13.9	14.3	15.0	15.3	15.9	16.5	15.9
September .....	11.8	11.4	11.7	11.8	11.4	11.6	11.6	11.7	13.4	14.8	15.6	15.6
October .....	13.1	13.5	13.7	13.4	13.4	13.2	13.5	13.6	13.5	13.5	13.6	14.0
November .....	16.1	16.7	16.2	15.7	15.8	15.9	15.9	15.6	15.6	14.9	14.8	15.1
December .....	13.7	13.9	14.2	14.0	14.0	14.2	14.8	15.5	15.9	15.2	13.7	14.0
Means .....	13.8	13.7	13.8	13.9	13.9	13.9	14.1	14.5	14.8	15.1	15.2	15.2



# Winds from Different Directions.

1904 (At Marshside).

1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	Midn't	TOTALS.
No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.	No. of Hours.
12.0	15.0	15.5	15.0	19.0	27.0	26.0	30.5	24.5	23.5	18.0	15.0	476.5
22.5	20.5	19.0	20.0	17.5	17.0	23.0	22.5	21.5	21.5	25.5	23.5	531.0
23.5	23.5	28.5	29.0	33.5	35.0	42.0	49.0	53.5	56.5	52.5	53.5	1055.0
62.5	54.5	46.5	49.0	52.0	60.0	56.5	57.5	63.5	64.5	70.0	74.0	1677.0
48.5	48.5	52.5	46.5	45.5	41.0	48.0	40.0	43.0	49.0	53.5	55.5	1115.5
52.5	53.0	52.5	53.5	53.5	49.0	46.5	57.0	52.5	47.5	49.0	47.0	1174.5
104.0	99.5	98.0	89.0	86.5	88.5	83.5	73.0	64.5	65.0	60.0	60.5	1789.5
40.5	51.5	53.5	64.0	58.5	48.5	40.5	36.5	43.0	38.5	37.5	37.0	965.0

# of Wind Velocity.

side).

1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	Midn't	MEANS.
Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.	Miles per Hour.
15.3	15.9	15.9	15.4	15.1	15.0	15.5	15.7	15.7	15.8	15.8	15.9	15.3
14.1	14.5	13.8	13.3	13.2	13.1	13.0	13.4	14.4	14.8	14.6	14.4	14.0
14.3	14.7	14.6	14.3	13.4	12.3	11.4	11.5	11.9	11.9	11.9	11.5	12.1
22.0	22.2	21.4	20.3	19.6	18.8	18.6	16.9	17.6	17.7	18.6	18.5	20.0
15.5	15.3	15.0	14.8	14.5	14.8	13.2	12.2	12.1	12.4	11.9	11.8	13.7
17.5	17.3	17.3	16.3	16.7	16.2	14.5	14.0	13.2	13.7	13.7	13.6	15.1
13.5	13.2	13.1	13.5	12.5	12.1	11.6	11.1	10.3	10.2	10.6	10.4	11.5
15.7	15.2	14.8	15.4	14.8	14.8	14.2	13.2	12.8	13.3	13.4	13.3	14.3
16.1	15.9	14.9	14.0	12.8	12.4	11.8	11.9	12.1	11.9	11.8	11.3	12.9
13.7	13.3	13.1	12.6	11.9	12.0	11.9	12.3	13.4	13.7	14.2	13.4	13.2
15.2	15.6	15.6	16.1	15.9	15.5	15.5	15.7	16.0	16.1	16.5	16.5	15.8
14.1	13.1	13.2	12.3	12.8	12.3	12.8	13.0	13.8	14.3	14.7	14.3	13.9
15.6	15.5	15.2	14.9	14.4	14.1	13.7	13.4	13.6	13.8	14.0	13.7	14.3



## Diurnal Variation of

1 foot 6 inches

1904.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.
	Total Hours	Total Hours	Total Hours	Total Hours	Total Hours	Total Hours	Total Hours	Total Hours	Total Hours	Total Hours	Total Hours	Total Hours
January .....	4.4	3.4	2.3	1.9	1.9	0.6	2.2	3.2	5.2	4.1	1.6	2.1
February .....	3.9	4.0	4.7	5.0	7.2	7.4	5.2	3.6	4.5	3.2	1.4	2.6
March .....	3.6	2.2	2.0	1.7	1.6	2.7	4.4	4.8	4.0	2.1	1.9	2.0
April .....	3.7	2.3	3.5	4.0	2.7	3.5	2.1	1.5	2.3	1.4	0.7	0.2
May .....	2.0	1.9	1.4	1.1	1.8	1.3	1.6	0.6	1.0	0.5	0.4	0.6
June .....	1.8	1.0	0.1	0.4	0.3	0.4	1.4	0.8	1.5	1.1	0.8	0.8
July .....	0.1	0.3	0.9	3.2	3.2	3.3	3.4	0.7	0.0	0.5	0.1	0.3
August .....	4.4	6.6	3.6	4.3	3.7	3.4	3.4	2.3	2.5	2.8	2.7	1.2
September .....	1.0	1.0	1.5	2.9	2.4	2.2	3.0	1.3	0.3	0.2	1.0	1.0
October .....	3.5	3.5	3.9	3.2	2.6	6.4	3.8	0.8	0.2	1.3	1.1	0.6
November .....	0.9	2.3	3.9	5.2	3.1	3.0	3.1	2.4	1.6	1.5	1.4	0.7
December .....	3.3	4.3	4.1	3.7	5.7	4.0	3.7	3.5	1.2	2.1	2.2	1.1
Totals .....	32.6	32.8	31.9	36.6	36.2	38.2	37.8	25.0	24.3	20.8	15.3	13.2

## Diurnal Variation of

1 foot 6 inches

1904.	1 a.m.	2 a.m.	3 a.m.	4 a.m.	5 a.m.	6 a.m.	7 a.m.	8 a.m.	9 a.m.	10 a.m.	11 a.m.	Noon.
	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Totals .....	1.57	1.19	1.42	1.58	1.89	1.27	1.25	0.87	1.00	0.85	0.63	0.47

## Duration of Rainfall.

above the ground.

1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	Midn't	TOTALS.
Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Hours.
2.0	2.3	0.4	1.2	2.6	3.2	2.7	3.5	1.6	3.4	3.6	2.9	62.3
1.3	4.9	5.7	5.0	4.9	4.5	3.6	2.6	3.7	3.0	3.7	4.1	99.7
1.5	2.1	1.8	3.2	3.2	2.9	2.6	2.4	2.5	1.8	3.9	3.6	64.0
2.1	1.6	2.1	2.2	2.7	1.4	1.1	1.9	0.6	0.8	1.4	2.2	48.0
1.7	2.9	1.8	2.9	3.7	3.2	1.7	3.0	1.5	1.1	1.4	1.6	40.7
1.2	1.1	2.0	4.3	1.4	1.9	1.1	1.2	2.3	0.7	0.7	1.2	29.5
0.0	0.0	0.0	1.2	1.5	1.8	0.3	1.5	0.8	1.7	0.7	0.7	26.2
1.3	0.4	0.0	1.5	1.4	1.8	1.4	1.0	1.1	1.2	2.2	3.1	57.3
1.3	2.0	3.0	1.4	1.0	1.0	1.8	0.8	1.0	1.7	2.2	1.7	36.7
1.6	1.0	0.1	0.9	0.3	1.5	1.9	1.7	1.7	1.6	3.0	3.1	49.3
1.1	1.9	2.5	1.3	2.0	2.0	3.2	3.7	3.0	2.2	2.1	0.4	54.5
1.2	1.4	1.7	2.3	1.2	1.0	0.2	1.1	0.9	0.8	1.0	2.6	54.3
16.3	21.6	21.1	27.4	25.9	26.2	21.6	24.4	20.7	20.0	25.9	27.2	622.5

## Amount of Rainfall.

above the ground.

1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	9 p.m.	10 p.m.	11 p.m.	Midn't	TOTAL.
Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches.
0.79	0.72	0.82	1.15	1.16	1.21	0.97	1.17	0.88	0.88	1.06	1.21	26.01



## Extremes for the Year.

1904.

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The highest *observed reading* of the Barometer at Southport during the year 1904 (corrected, and reduced to 32 degrees, at mean sea level, for gravity of Latitude  $45^{\circ}$ ) was 30.784 inches on January 22nd, at 9 a.m. The lowest was 28.779 inches on February 14th, at 9 a.m. The (corrected, &c.) *absolute extremes*, as deduced from the Barograms, were, respectively, 30.790 inches on January 22nd, at 11 a.m.; and 28.725 inches on February 9th, at 4 p.m.

The highest temperature registered in the Stevenson-Screen during the year was 82.4 degrees on July 11th. The lowest was 22.0 degrees on November 27th.

The highest reading of a black-glass-bulb solar radiation maximum thermometer in open air was 92.6 degrees on August 3rd. The highest reading of a blackened-bulb thermometer *in vacuo* was 128.4 degrees on July 6th. The greatest difference between the maximum indications upon the same day of the bright-bulb and the blackened-bulb thermometers *in vacuo* was 42.5 degrees on May 1st.

The lowest temperature registered on the grass by a *sensitive* terrestrial radiation minimum thermometer was 13.4 degrees on February 29th.

The greatest general thickness of the ice over the large lake in Hesketh Park was 1.7 inches on November 27th.

The day of highest mean temperature of the air was August 3rd, and the value for that day was 68.7 degrees. The day of lowest mean temperature was December 22nd, and the value for that day was 26.8 degrees.

The greatest range of temperature in the Thermograph Stevenson-Screen upon one civil day was 30.0 degrees on July 19th. The least was 2.2 degrees on February 25th.

The greatest difference between the mean temperatures of any two consecutive days was a decrease of 10.9 degrees from December 17th to 18th.

The lowest and highest 9 a.m. temperatures of the ground, at the depth of *one* foot below the surface, were, respectively, 33.7 degrees on both January 2nd and 4th, and 67.9 degrees on August 4th. The extremes at a depth of *four* feet were 38.7 degrees on March 7th, and 61.3 degrees on August 6th and 7th; those

*ten* feet beneath the surface, 43.2 degrees from March 16th to 22nd, and 55.9 degrees from August 24th to 27th and on September 3rd; and those *twenty* feet underground, 47.72 degrees on May 7th and 8th, and 51.06 degrees from October 25th to 30th.

The lowest relative humidity of the air, at either 9 a.m. or 9 p.m. was 50 on June 29th at 9 a.m. Complete saturation was recorded on 16 occasions.

The greatest duration of bright sunshine, per Campbell-Stokes recorder, upon one day was 14.9 hours on June 4th.

The greatest duration of rainfall upon one civil day was 20.6 hours on August 22nd. The heaviest fall was 0.80 inch on both February 3rd and August 22nd.

The heaviest fall of rain in any one "rainfall day" (*i.e.*, 24 hours ending at 9 a.m. next day) was 1.06 inches on February 3rd.

At the Marshside Anemograph Station, the greatest total movement of the wind in one civil day was 914 miles (actual) on November 8th. The greatest movement in one hour was 53 miles on October 6th at 3 a.m., the direction at the time being W. by N. The rate of movement during the strongest momentary gust was 76 miles per hour on October 6th at 0.37 a.m., the direction being W. The maximum pressure of the wind on a circular plate, one square foot in area, as registered by the new Non-Oscillating Pressure Plate Anemometer, was 20.0lbs. for the square foot on October 6th.

At the Barton Moss Station, the largest amount of evaporation in one day was 0.23 inch on July 19th.



## Main Features of the Months.

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1904.

### JANUARY.

A humid, and rather mild month, with a low barometer, and a deficiency of sunshine. Mean temperature 1.2 degrees above the local average. Frost in the Stevenson-Screen on 7 days; and upon the grass on 19 days. Total sunshine 10 hours below the average. Total rainfall 0.16 inch above the average. Underground water level exceptionally high. Winds normal.

A whole gale from W. by N. on the night of the 14th; a strong gale on the 15th, and moderate or fresh gales on 5 other days. Lightning on the 13th. Hail on the 10th, 15th, and 16th. Hoar-frost (at either 9 a.m. or 9 p.m.) on 3 days. Ice upon the lake in Hesketh Park on 7 days, the greatest thickness being 1.6 inches on the 1st and 2nd. A lunar halo on the 27th. Fog on portions of 10 days.

### FEBRUARY.

An exceptionally wet and cloudy month, the mean atmospheric pressure being exceedingly low. Mean temperature 0.9 degree below the average. Frost in the Stevenson-Screen on 10 days; and upon the grass on 21 days. Total sunshine 28 hours below the average. Total rainfall 1.80 inches above the average. Underground water level remarkably high.

Strong gales on the 13th and 22nd; and moderate or fresh-gales on 5 other days. Slight snow on the 8th, 13th, 15th, 17th, and 25th; and heavy snow on the 26th; total depth for the month, 4.3 inches. Hail on the 16th. Hoar-frost on 10 days. Ice upon the lake in Hesketh Park on 6 days, the greatest thickness being only 0.2 inch on the 29th. A solar halo on the 11th. Fog on the 5th and 10th.

### MARCH.

A quiet, dull, and rather cool month, with a high mean barometric pressure, easterly airs predominating. Mean temperature 2.0 degrees below the average. Frost in the Stevenson-Screen on 11 days; and upon the grass on 25 days. Total sunshine 29 hours less than the average. Total rainfall 0.10 inch below the average. Underground water level still exceptionally high. Remarkably little ozone,



A moderate gale on the 22nd. Slight snow on the 1st and 16th. Soft-hail on the 4th and 6th; and hail on the 29th and 30th. Silver thaw on the 12th. Hoar-frost on 7 days. Ice upon the lake in Hesketh Park on 7 days, the greatest thickness being 0.5 inch on the 1st. Fog on the 12th, and on the mornings of the 15th and 27th.

#### APRIL.

An exceptionally stormy month, west-south-westerly winds greatly preponderating. Mean temperature 1.3 degrees above the average. Frost upon the grass only, on 5 days. Total sunshine 6 hours below the average. Total rainfall 0.03 inch under the average. Underground water level continuing unusually high. Mean daily movement of the wind so many as 135 miles above the average.

Strong gales on the 3rd, 6th, 7th, 9th, and 10th, and moderate or fresh gales on 7 other days. Hail on the 9th and 25th. A lunar halo on the 25th. Fog on the morning of the 8th.

#### MAY.

The most sunless May in the 13 years during which sunshine observations have been made at this Observatory. Fairly normal, however, in nearly all other respects. Mean temperature 0.3 degree above the average. Frost, upon the grass alone, on 5 nights. Total sunshine so many as 70 hours below the average. Total rainfall 0.33 inch under the average.

A strong gale on the 2nd, and moderate or fresh gales on the 3rd, 18th, and 19th. Thunder on the morning of the 31st. Hail on the 18th. Solar halos on the 4th, 5th, 20th, and 25th.

#### JUNE.

An exceptionally windy June, dry, but rather cool. Mean temperature 1.2 degrees below the average. Frost, upon the grass alone, on 1 night. Total sunshine 8 hours above the average. Total rainfall 1.12 inches below the average.

A strong gale on the 1st, and moderate to fresh gales on the 16th and 25th. Thunder only on the afternoon of the 24th.

#### JULY.

A warm and very dry month, anticyclonic conditions prevailing. Mean temperature 2.1 degrees above the average. Mean daily range of temperature 3.4 degrees above the average. Mean relative humidity 4 below the average. Total sunshine 4 hours below the average. Total rainfall 2.18 inches below the average.

Thunderstorms on the 12th and 23rd, and thunder only on the 24th and 25th.



## AUGUST.

A fairly normal month, barometric pressure being, however, rather high. Mean temperature 0.1 degree below the average. Total sunshine 7 hours below the average. Total rainfall 0.71 inch under the average.

Strong gales from the south-westward on the 6th and 15th, and moderate gales on four other days. Thunderstorms on the 4th and 24th, and distant lightning on the 3rd and 14th. Solar halos on the 10th and 25th.

## SEPTEMBER.

A month mainly characterised by an unusual prevalence of easterly and south-easterly winds. Dry generally. Mean temperature 0.5 degree below the average. Frost, upon the grass alone, on 1 night. Total sunshine 22 hours above the average. Total rainfall 1.08 inches below the average.

Moderate or fresh gales on the 9th and 10th. Thunder on the 6th and 7th. Lightning on the 18th. Slight fog on the morning of the 29th.

## OCTOBER.

A dry and sunny month, with an unusually high mean atmospheric pressure. Mean temperature 1.7 degrees above the average. Frost, upon the grass alone, on 8 days. Total sunshine 21 hours above the average. Total rainfall 1.85 inches below the average.

Whole gales from the westward on the 5th and 6th, and moderate or fresh gales on 4 other days. Distant lightning on the 18th. Hail on the 7th. A solar halo on the 10th; and lunar halos on the 23rd and 27th. Fog on the morning of the 24th.

## NOVEMBER.

The ninth consecutive month with a deficiency of rainfall. Mean temperature 1.2 degrees below the average. Mild generally until the 20th, and on the 29th and 30th; very cold during the intervening period. Frost in the Stevenson-Screen on 8 days; and upon the grass on 14 days. Total sunshine 2 hours below the average. Total rainfall 1.27 inches under the average. Underground water level unprecedentedly low for November.

Strong gales on the 7th, 8th, 9th, and 22nd; and moderate gales on the 11th, 20th, and 21st. Snow on the 21st, the total depth lying being 0.7 inch. Hail on the 20th and 21st. Hoar-frost on 6 days. Ice upon the lake in Hesketh Park on 8 days, the greatest thickness being 1.7 inches on the 27th. A lunar halo on the 25th. Fog on 6 days.



## DECEMBER.

An irregular month; mild generally, and unusually sunny, until the 18th; cold, calm, and remarkably foggy from then until the 28th. Mean temperature 0.4 degree below the average. Frost in the Stevenson-Screen on 14 days; and upon the grass on 23 days. Total sunshine as many as 13 hours above the average. Total rainfall 0.70 inch below the average. Underground water level exceptionally low.

A whole gale, veering from south-west to north-west, during the morning of the 30th; and moderate or fresh gales on the 6th, 12th, 17th, and 29th. Slight snow on the 8th and 9th, the total depth lying being 0.6 inch. Hail on the 7th. Silver-thaw, and also glazed-frost, on the 22nd, 23rd, 24th, and 25th. Ice upon the lake in Hesketh Park on 11 days, the greatest thickness, however, being only 0.4 inch from the 24th to 26th. A lunar halo on the 21st. Fog on the 19th, 20th, 22nd, 23rd, 24th, 25th, and 28th.

## THE YEAR.

A very dry year; but, on the whole, sunless, with much fog and haze. Mean temperature exactly equal to the average: no strikingly hot or cold month. Total sunshine 92.6 hours below the average, owing to large deficiencies in February, March, and May; sunniest months (relatively to the average), September, October, and December. Wind movement for the year practically normal, the only features of interest being the calmness of March, and the storminess of April. Total rainfall no fewer than 7.41 inches below the average, every month except January and February showing a deficiency; wet in February; particularly dry in July. Subsoil water at an exceptionally high level during the earlier half of the year, and at an equally unusually low one during the last quarter. Barometric pressure very low in February, but above the average in March and in each of the last seven months. Mean amount of ozone less than in any previous year since the Observatory was established in 1871.

Thunder or lightning on 15 days. Hail on 15 days. Snow on 11 days; the total depth for the year being 5.8 inches. Frost in the Stevenson-Screen on 50 days; and upon the grass on 122 days. Fog on 31 days. Bright sunshine on 288 days.



## Comparative Statistics for the Year 1904.

STATION.	Mean Temperature.*		Mean Daily Range of Temperature.	Total Rainfall.	Total Duration of Bright Sunshine.	Authority supplying the Statistics to the Fernley Observatory, Southport.
	The Year.	June to Sept., inclusive.				
<b>Southport</b> .....	48·4	58·1	11·7	26·01	1473·5	
<b>Other Health Resorts:—</b>						
Keswick.....	47·4	57·3	12·4	53·66	†	Royal Meteorological Society.
Ramsey.....	49·2	57·6	11·6	36·97	†	A. W. Moore, C.V.O., M.A.
Scarborough ...	48·5	57·7	12·0	19·80	1416·1	The Meteorological Office.
Douglas.....	48·0	56·0	10·2	37·76	1540·2	A. W. Moore, C.V.O., M.A.
Harrogate.....	46·8	56·4	12·8	30·51	1371·4	The Meteorological Office.
Ilkley.....	46·3	56·2	12·9	33·70	†	A. Wilson, F.R.Met.Soc.
Blackpool.....	47·9	57·7	12·0	30·86	1539·1	The Meteorological Office.
Hoylake.....	49·0	58·2	11·7	24·93	1448·3	The Corporation of Hoylake.
Llandudno .....	50·1	58·8	10·5	25·98	1611·0	The Meteorological Office.
Buxton.....	44·7	55·3	13·2	43·69	1323·8†	W. Pilkington.
Bettws-y-coed .....	48·2	57·1	13·8	44·26	1289·7	The Meteorological Office.
Cromer.....	49·1	59·1	11·6	19·59	1688·3	The Meteorological Office.
Lowestoft.....	48·5	58·4	10·9	19·46	1654·4	The Meteorological Office.
Aberystwith .....	49·9	58·6	9·1	34·61	1751·0	Royal Meteorological Society.
Malvern.....	49·2	59·4	13·2	23·95	†	A. Mander, F.C.S., F.R.Met.S.
Felixstowe.....	49·4	59·5	10·7	17·62	1770·4	The Meteorological Office.
Cheltenham.....	49·2	59·5	13·2	22·41	1604·0	Royal Meteorological Society.
Clacton-on-Sea.....	49·4	60·0	10·6	15·65	1945·7†	The Meteorological Office.
Margate.....	50·7	60·9	10·8	18·68	1633·1	The Meteorological Office.
Bath.....	49·3	58·9	14·4	24·62	1427·7	The Meteorological Office.
Weston-super-Mare.....	51·1	60·8	12·6	28·81	1553·9	Corpn. of Weston-super-Mare.
Ilfracombe.....	51·5	59·8	8·2	37·19	†	Royal Meteorological Society.
Tunbridge Wells .....	48·8	59·0	14·3	29·32	1737·1	The Meteorological Office.
Folkestone.....	50·0	59·6	10·6	22·25	1800·4†	Dr. M. G. Y. Bateman.
Littlestone-on-Sea .....	48·8	58·4	12·8	18·89	1721·7	The Meteorological Office.
St. Leonards-on-Sea.....	49·9	59·7	10·6	24·59	1796·3	The Meteorological Office.
Brighton.....	51·1	60·8	11·9	24·38	1713·2	The Meteorological Office.
Bognor.....	50·0	59·4	11·2	25·36	1938·3†	The Meteorological Office.
Eastbourne.....	50·5	59·5	9·8	28·36	1761·6	The Meteorological Office.
Sidmouth.....	50·0	58·6	11·7	33·14	1725·3†	Miss C. M. Radford.
Totland Bay.....	50·7	60·1	10·9	27·29	1702·5	The Meteorological Office.
Weymouth.....	51·2	59·9	10·5	28·30	1675·6	I. J. Brown, F.R.Met.Soc.
Ventnor.....	51·3	60·4	10·1	29·78	1711·1	The Meteorological Office.
Torquay.....	51·4	59·6	10·2	33·73	1735·7	F. March, F.R.Met.Soc.
Newquay.....	51·0	58·9	8·6	†	1574·3	The Meteorological Office.
Falmouth.....	51·1	58·7	8·8	45·60	1616·0	The Meteorological Office.
Scilly (St. Mary's).....	52·4	59·3	8·0	34·41	1659·6	The Meteorological Office.
Guernsey.....	51·8	59·6	9·1	37·72	1924·9†	The Meteorological Office.
Jersey.....	52·3	61·1	10·4	37·34	1867·7	The Meteorological Office.
<b>Large Towns:—</b>						
Newcastle.....	47·9	57·3	10·9	20·24	1098·1	The Meteorological Office
Hull.....	48·2	58·0	13·7	21·25	875·1	The Registrar General.
Bolton.....	47·2	56·7	11·0	34·74	951·3	The Corporation of Bolton.
Manchester.....	49·4	59·8	10·6	26·48	1014·1	The Registrar General.
Sheffield.....	48·4	58·1	11·9	27·53	1324·7	The Meteorological Office.
Nottingham.....	48·1	58·6	15·0	19·96	1386·6	The Meteorological Office.
Birmingham.....	48·1	58·1	12·2	21·95	1231·0	The Meteorological Office.
London.....	50·4	61·3	14·5	20·22	1327·6	The Meteorological Office.

\* Mean of daily Max. and Min.

† No Information.

‡ Jordan Recorder.



