

The Fernley Observatory, Southport : report and results of observations for the year 1921 / Borough of Southport Meteorological Department.

Contributors

Southport (England). County Borough Council. Meteorological Department.
Baxendell, Joseph, 1870-

Publication/Creation

Southport, 1922

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County Borough



of Southport.

METEOROLOGICAL DEPARTMENT.

THE FERNLEY OBSERVATORY,
SOUTHPORT.

REPORT,
AND
RESULTS OF OBSERVATIONS,
FOR
THE YEAR 1921;

BY
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The Fernley Observatory, Southport.

REPORT OF THE METEOROLOGIST, FOR THE YEAR 1921.

I.—THE JUBILEE OF THE OBSERVATORY.

The Fernley Meteorological Observatory was erected during the Spring, and inaugurated during the Summer, of 1871. The year now under review accordingly witnessed its Jubilee. On the anniversary of its formal opening (July 5th), the following kind telegram was received by the Mayor (Councillor W. H. Potts):—
 “Hearty congratulations to you and the Borough Meteorologist on the accomplishment of 50 years’ valuable work by the Fernley Observatory, and best wishes for future progress.—From the Director and Staff, Meteorological Office.” By a happy coincidence, H.R.H. the Prince of Wales was at the time paying a public visit to Southport. The following telegram was despatched by the Mayor:—
 “To the Director and Staff, Meteorological Office, London.—Many thanks for your congratulations, which we much appreciate, and are glad that Southport has been able to do work of this character in conjunction with your Office.”

The Press of the district (which has invariably accorded the Observatory its fullest support), published extended accounts of the origin and development of the institution; and the following extracts, of a historical character, taken from the best of these notices and slightly corrected, may perhaps be allowed to be suitable for reproduction here, the only source of some of the information being, indeed, the old files of the newspapers themselves—notably of the *Southport Visitor*:—

“The Fernley Meteorological Observatory—the Borough Observatory of Southport—is the longest municipally-maintained meteorological station, and the best equipped of that class, in the British Isles. The first set of instruments, and the original structure on the top of the highest knoll in Hesketh Park, were presented to the town by the late Mr. John Fernley, J.P., of Manchester, and ‘Clairville,’ Birkdale, Southport; and on July 5th, 1871, and therefore half-a-century ago, the gift was publicly conveyed to the Borough by Lord Skelmersdale (afterwards the well-known first Earl of Lathom), some eminent scientists taking part in the ceremony. Of these, the late Dr. J. P. Joule, F.R.S., (the discoverer of the mechanical equivalent of heat), remarked in a speech proposing the toast

of Mr. Fernley's health at a banquet which followed, that the gift was 'a great honour to the town, a very useful piece of work, and highly important to the place.' It had been Mr. Fernley's wish that the equipment should be in advance of any existing elsewhere at that time, except at the First-Order Observatories of the Government (with which he had no desire to compete). It was, accordingly, specially designed for him by Dr. Joule, the late Mr. J. B. Dancer, F.R.A.S., of Manchester, and the late Mr. Joseph Baxendell, F.R.S. At Mr. Fernley's request, the last-named gentleman undertook to superintend the records at Southport, and to prepare the results for publication; and this arrangement was subsequently confirmed by the Corporation, and continued in force until Mr. Baxendell's death in 1887, when his son, the present Borough Meteorologist, was appointed his successor."

"When the Observatory had been in existence a quarter-of-a-century, its equipment was largely renewed and also augmented, a number of autographic instruments (including some rather costly patterns and new inventions) being acquired through the generosity of the Trustees of the [to-day, unhappily, extinct] Fernley Residuary Trust Fund, the late Mr. John Geddes, and others. The Marshside Anemograph Station, and a small station on the Moss beyond Woodvale, Ainsdale, were added. In 1901 the Astronomical Observatory was presented to the Corporation, this last benefaction (unlike the others) being intended mainly for educational purposes."

"The scientific work of the Fernley Observatory has been much restrained by the absence of any research-endowment or suitable fund other than the Rates of the Borough; but the Meteorologist has often had the moral support of able and sympathetic Chairmen of the Parks Committee of the Corporation—notably (amongst those now deceased), Alderman Sir George Pilkington, D.L., Alderman Dr. Thomas Isherwood, M.A., Alderman Richard Nicholson, J.P., and Alderman E. J. Rimmer, J.P. Two or three new instruments have been invented, and several older patterns improved, at the Observatory; while the fragments of time that remained have always been devoted to research-work, mainly within the domain of statistical meteorology. The institution has made many friends amongst scientific meteorologists, but probably the most helpful assistance it has received has been that constantly rendered by the late Director of the Meteorological Office, Sir Napier Shaw, D.Sc., F.R.S., and to his recommendation is due the adoption of its annual volume as an official publication of the Air Ministry."

II.—OFFICIAL INSPECTIONS.

On August 3rd, the Hesketh Park and Marshside equipments were officially inspected, for the Meteorological Office, by Richard Corless, Esq., O.B.E., M.A., Superintendent of the Instruments Division. Before leaving, the Inspector was good enough to make the following entry in the Visitors' Book :—

" Inspected the Fernley Observatory, and the Marshside Anemograph Station, on behalf of the Meteorological Office. I have known for a long time of the good work which is being done at Southport, but the excellence and completeness of the equipment, coupled with the careful attention which it receives at the hands of the Observer, exceeded my anticipations."

[Signed] " R. CORLESS."

The official Certificate of the Inspection, bearing the signature of the Director (Dr. G. C. Simpson, C.B.E., F.R.S.), was subsequently received.

On August 26th, a visit was paid by Sir Napier Shaw, D.Sc., F.R.S., now Professor of Meteorology at the Imperial College of Science and Technology, whose retirement from the Directorship of the Meteorological Office of the Air Ministry has in no way terminated the active interest he has for many years kindly taken in our work; and who, through his Chairmanship of the Advisory Committee on Atmospheric Pollution, retains also even an official association with this Observatory.

III.—INSTRUMENTS, AND METHODS.

Daily Maximum and Minimum Temperature Determinations.—At the commencement of April, by desire of the Director of the Meteorological Office, the method now generally known as the " Day Maximum and Night Minimum " system of Temperature registration, was adopted at the Fernley Observatory. Under it, the daily maximum temperatures entered in the permanent records are those occurring between the morning observing hour and one some time in the early evening—at Southport these times are 9h. and 17h. respectively, L.M.T.; and the daily adopted minima are those registered between the previous early-evening observing hour and the morning one of the day to which they are entered. The latter half of the arrangement (*i.e.*, that relating to minima) had already been in use at this Observatory, for several years, in the case of the minimum temperature *on the grass*, the object being to avoid single cold nights being counted as two. The extension of the application of the principle to the registrations *in the shade* (*i.e.*, in the Stevenson-Screen), and to those of the *maximum*, in addition to the minimum, temperatures, is one which has my thorough approval; but, in the opinion of both the Administrative Assistant-Director of the Meteorological Office, Mr. R. G. K. Lempfert, C.B.E., M.A., and myself, it is extremely desirable that Stations which possess a long history should always retain strict continuity of observational methods, or else at least determine with some approximation to accuracy, the effects of any changes. Accordingly, the maximum and minimum thermometers in the Screen at Southport have been both read and " set " twice daily, *viz.*, at 9h. and 17h., L.M.T., since the beginning of April, 1921, and the readings tabulated by each of the two systems. It had previously been ascertained that, by the 24-hour method, it was really immaterial

—especially considering the year as a whole—whether the once-daily “setting” of the two registering thermometers was made at 9h. or at 21h. Fortunately, as regards the conventional “Mean Temperature,” $\frac{1}{2}$ (Max. + Min.), the Day-Maximum and Night-Minimum innovation proves to be similarly undisturbing. But, as was anticipated, and, indeed, desired, the mean Daily Range of Temperature is diminished, practically throughout the year, and in winter very materially, by the discontinuance of the practice of crediting to two days many a brief southerly warmth-wave only lasting a few hours, or the cold of a single pressure-ridge night or of a short interval of clear sky in winter. (No extreme is *lost*, all abnormal night-time maxima and daytime minima being tabulated, and taken into account in preparing the *absolute* extremes for each month.) The effects of the change, on the means of Temperature and Daily Range, during the first twelve months of the comparisons, were as follows:—

	A.			B.			Differences, B—A.		
	From Max. & Min. for 24 Hours (“Climatological Day”).			From “Day-Max.” and “Night-Min.”					
	Mean Temp.	Mean Daily Range of Temp.		Mean Temp.	Daily Range.		Mean Temp.	Daily Range.	
1921-22.	°	°		°	°		°	°	
April.....	46·6	...	14·9	...	46·6	...	14·8	...	0·0 .. - 0·1
May	51·5	...	13·8	...	51·4	...	13·5	...	- 0·1 ... - 0·3
June.....	57·3	..	14·0	...	57·1	...	13·4	..	- 0·2 ... - 0·6
July	63·2	...	14·7	...	63·1	...	14·5	...	- 0·1 ... - 0·2
August	58·8	...	9·2	...	58·9	...	8·9	...	+ 0·1 ... - 0·3
September	56·8	...	13·4	...	57·0	...	13·3	...	+ 0·2 ... - 0·1
October.....	56·3	...	11·5	...	56·2	...	10·8	...	- 0·1 ... - 0·7
November.....	40·5	...	9·7	...	41·0	...	7·6	...	+ 0·5 ... - 2·1
December.....	44·4	...	8·7	...	44·2	...	6·1	...	- 0·2 ... - 2·6
January	38·8	...	8·2	...	38·7	...	6·5	...	- 0·1 ... - 1·7
February	40·1	...	9·1	...	40·2	...	8·7	...	+ 0·1 ... - 0·4
March	40·9	...	11·3	...	40·8	...	11·0	...	- 0·1 ... - 0·3
Mean of 12 months	49·6	...	11·5	...	49·6	...	10·8	...	0·0 ... - 0·8
		(11·54)			(10·76)				

It will be seen that, except in the abnormally cold November of 1921, the monthly differences between the Mean Temperature results obtained by the two methods never exceeded 0·2 degree, Fahr., and that in the course of 12 months the positive and negative amounts exactly balanced each other; but that in the case of the Mean Daily RANGE of Temperature the differences were generally larger, and, during the winter, considerable. As regards the latter element, the comparisons with other places are materially affected, and therefore in the tables of Comparative Statistics given at the end of this Report a distinction is now

made between Stations that have adopted the new, and those that retain any of the old, methods of maximum and minimum temperature observation. At present the former class consists mainly of Telegraphic Reporting, and Health Resort Stations (for making an alteration of procedure at which there was an ulterior reason), but I hope that the new system may eventually become generally adopted in this country, for it is obviously preferable to others. Ten years have elapsed since Mr. Lempfert suggested it. The only practical difficulty is that a single visit daily to the instruments, at 9h., at the smaller Stations, would no longer suffice. On the other hand, the latterly noticeable gradual abandonment of so inconveniently late an hour as 21h. (9 p.m.) for the second observation daily, at the more active Stations, is a change essentially favourable to the introduction of the new system at those places.

Dines Mercurial Barograph.—The corroded steel float of this instrument was removed on April 22nd, and a glass one substituted. The latter had been kindly suggested by Mr. W. H. Dines, F.R.S., and was constructed in a convenient form (from a design by Mr. F. L. Halliwell), by Messrs. Negretti & Zambra.

The Anemograph Station [Marshside].—The triplication of the recording-drum part of the Direction portion of the Dines-Baxendell Anemograph at the coastal Station, rendered necessary by the agreements with the Meteorological Office and the Preston Corporation, as mentioned in previous Reports, was finally completed on May 12th. The alteration involved more new mechanical work than had been anticipated, but Messrs. Negretti & Zambra kindly accepted cost price only, foregoing all usual further charges and profits as their contribution to the Observatory's Jubilee celebrations. The provision of a much-needed new Vane, of the standard post-War pattern, and of considerably increased leverage, was postponed until the next financial year. The new, streamline Vane, mounted in 1920 at Hesketh Park, has greatly improved the records at that Station.

The iron tubular mast at Marshside was overhauled and refitted, and it and the Anemograph room and fixtures repainted, in June. The wire-rope re-guying, however, at both Marshside and Hesketh Park, was postponed a year.

Pluviographs.—A duplicate "Fernley-pattern" Recording Rain Gauge was acquired; and it was brought into use, close to the other, on June 28th.

Atmospheric Pollution Deposit Gauges.—A partially successful attempt to overcome the difficulties caused by the disintegration of the enamel on the cast-iron collecting basins, and by their too large volume of water for satisfactory handling for analysis, was made during the year 1921-22, by the Advisory Committee on Atmospheric Pollution. A much smaller gauge (about 1 foot in diameter), and constructed of stoneware, coated with acid-proof enamel, was designed by Dr. J. S. Owens, C.E. To reduce the cost, this was of a simple catchpit type,

without any outlet, and was intended to be merely placed upon, or sunk partially into, the ground. At the close of the year, one was purchased for use at our Station on the Moss, near Woodvale, Ainsdale. [This has given satisfactory results during 1922, except for excessive inblown refuse and insects; but the gauge is fragile, and also decidedly inconvenient in use, and a much superior one, of the same size, but with outlet, strainer, and iron stand, has since been evolved. I had ventured to strongly recommend the Advisory Committee to revert to the "outlet" principle.]

Sunshine Recorders.—A new Sunshine Recorder was kindly lent to the Observatory by the Meteorological Office in October, but on mounting it close to the two in regular use, it was found that no appreciable deterioration of the latter had occurred.

IV.—MISCELLANEA.

Publication of Statistical Results.—The necessary daily, weekly and monthly Returns were supplied, without interruption, to the Meteorological Office, and results derived from them appeared regularly in the official *Daily*, *Weekly*, and *Monthly Weather Reports*, the *Annual Summary*, the *Meteorological Magazine*, *British Rainfall*, and, from June, in *Daily Readings at Stations of the First and Second Orders*. "Health Resort" information was also published in a number of London and provincial morning newspapers; and during the summer months an additional telegram was despatched to the Meteorological Office, earlier in the day, to enable information to be inserted in *evening* newspapers.

The results of the observations of the Atmospheric Pollution, prepared by the Public Analyst, Mr. Herbert E. Davies, B.Sc., F.I.C., were forwarded monthly to the Advisory Committee on that subject, and are published in the Annual Reports of the Committee. Special Tables have again been prepared for my present Report. The pollution at the Southport stations, although still very light under several heads, was unfairly increased—and in some respects materially—by the defective condition of the surface of the old Deposit Gauges.

The issue of this Report for 1920 was published in two editions, and the copies of the official one were distributed by the Meteorological Office, as in the case of the previous year.

Locally, a pretty full service of weather summaries was maintained for the *Southport Visiter*, and the *Southport Guardian*. Monthly reports were also supplied elsewhere.

In the Tables contained in the present publication, a few minor changes will be found to have been made.

Ribble Estuary Anemograms.—The supply to the Ribble Navigation Engineer of the Preston Corporation, of daily, original, Wind Direction and Velocity Anemograms, from the autographic instruments at the Marshside Anemograph Station, was continued throughout the year.

Display of Autographic Records.—The daily exhibition to the public of curves from the large-scale recording instruments was duplicated from midsummer, the second set being shown in a window of the Official Information Bureau, at the Town Hall, together with a diagram and card of eye-readings.

Educational Astronomical Facilities.—The number of persons admitted to the Astronomical Observatory during the year (exclusive of private parties) was 87.

Extra-Routine Work.—New monthly Normals from 50 years' observations of the principal meteorological elements, and Averages for from 20 to 30 years in the remaining cases, were partially prepared during 1921, and will, it is hoped, be published with next year's Report; probably accompanied by certain fresh Hourly Averages.

The Amount and Duration of Rainfall for every month, under each of the eight different Wind-Direction groups, have now been compiled, by my Assistant, Mr. Alfred Goodwill, from the individual hourly tabulations, for the last ten years (1912-21); and a Table giving the Averages for that period, with a few additional computed and comparative results, forms a short Appendix to the present Report. It will be seen that winds from Southerly points are pre-eminently Southport's rainy ones, whereas on the East coast a totally different state of matters obtains. [The Appendix should be examined in the light of Mr. J. S. Dines' interesting "Note on the effect of a Coast-line on Precipitation," published on pp. 357-360 of the *Quarterly Journal of the Royal Meteorological Society* for October, 1922; support for which is also obtainable from Mr. H. J. Bartlett's results for Aberdeen Observatory, given in the October, 1914, issue of the same publication.]

A considerable amount of time was devoted during the year, by Mr. Charles Baxendell, to the computations involved in the investigation of meteorological periodicities. The reality of the cycle of nearly 5.1 years had previously been thoroughly established. Similarly strong evidence has now been found in support of Mr. C. E. P. Brooks' periodicity of nearly 2.2 years, which can be traced backwards so far as the oldest records of rainfall and barometric pressure extend; in the latter element the mean of 60 of its periods forms a beautifully symmetrical, and therefore simple-sine, curve, of larger amplitude than the 5-year and some other clearly indicated cycles; and it is interesting to learn from Mr. G. Udny Yule, F.R.S., and Dr. J. Brownlee of the National Institute for Medical Research, that it is probably identical with the infantile mortality period (caused largely by measles). The 5-year cycle, on the other hand, is the chief north-east wind periodicity; its phase-angle, and therefore times of maxima and minima, in

rainfall, are almost exactly opposite to those in atmospheric pressure (heavy rainfall coinciding with low pressure, and *vice versa*); the maxima of strong Atlantic winds occur about a year later than those of the same periodicity in rainfall, and than the minima in air pressure. The period of 3.1 years apparently ranks next in order of permanence and intensity in this country, but it is not found in all data, and there is probably some complication in connection with it. Various minor cycles seem likely to be real, (1.9, 2.4, 4.4, 5.5, 6.2, and 8.2 years, are each well supported, as also a few shorter, and a number of longer, ones); but in the Southport and district rainfall, during the last half-century, nothing has exhibited quite so large an amplitude as the 2.85-year term which I mentioned in my last Report. That of 5.1 years comes next, in intensity; and, in older records elsewhere, is more important than the 2.85, (as, indeed, also are the 2.2- and 3.1-year terms). Of much longer English rainfall periodicities, that of about 53 years is the chief.

V.—THE WEATHER OF THE YEAR 1921.

This was undoubtedly the most remarkable year during the half-century's existence of the Fernley Observatory; and older neighbouring records indicate that the description applies with equal truth to a much greater length of time.

Fortunately, in spite of its drought, 1921 was not, in this north-western part of England, nearly so dry a year as several previous ones. Though very brilliant, it was by no means the most sunny of merely the last twenty. Only by a small and therefore doubtful fraction of a degree, does it appear even to have been the warmest, in the local records. But for a *combination* of all these, and other fine-weather factors—such as great calmness, there is no known predecessor to equal it. Still, it was not for its fine character that it was chiefly remarkable, meteorologically, in the North. Its outstanding feature, underlying and probably occasioning most of the others, was a phenomenally high mean atmospheric pressure.

The deviation from normal of the mean air pressure for the complete year was an excess of no less than 4.1 millibars (*i.e.*, 0.120 inch), whereas the largest previous positive deviation during the 50 years was only 2.8 millibars (0.084 inch), which was the value for 1896. In London the excess of pressure was almost the same, and it had only once before been nearly equalled (*viz.*, in 1834), and never surpassed, during the 147 years in which barometrical observations had been recorded in the Metropolis.

The 1921 abnormal high-pressure, however, commenced (and quite abruptly) with August, 1920. So also, exactly, did the drought. Both, too, were very pronounced during the remainder of that year; and, indeed, the deficiency of rainfall at Southport was far greater than during any similar length of time in 1921. It is interesting to note that a minimum of the now well-established

5.1-year rainfall periodicity was due in 1920; as also one of that of 3.1 years, and some others of less importance.

The year under review was apparently the warmest during the 50 years' history of the Observatory; but only by a quarter-of-a-degree, the mean temperature of 1884 having been 50.2 degrees. The great heat of 1921 over much of England, and especially from the Midlands to the South and East Coasts, did not extend to Southport, where on but a single day was a maximum of 80 degrees or upwards registered in the shade. The year's high mean temperature was produced mainly by the abnormal mildness of January and December, and the unprecedented warmth of October. Only two months, however, were cooler than usual—August slightly, and November decidedly.

After the opening quarter, sunshine was abundant in almost every month except August, and the total duration for the year was unusually large, though not unprecedentedly so. The continuous brilliance of the weather during April, May, June, and July, will long be remembered; and also the beauty of the autumn. 1921 was one of the calmest twelvemonths on record, December alone being notably windy, and January and March rather so.

The year was, of course, a dry one; but the total deficiency of four inches of rainfall is trivial in comparison with the extraordinary drought over South-eastern England. Indeed, quite a number of drier years are on record at Southport, and in 1887 the shortage amounted to more than twice that of 1921. Nevertheless, at the end of July, the effects upon vegetation had become very serious, and fires were in progress in many directions; the situation was, however, locally saved by the abundant rains of August; and the effect of these upon the public health was probably still more valuable. The underground water-level remained extremely low until the substantial winter rains in the latter part of December.

As in the previous year, scarcely a trace of snow was experienced; and there was less hail than then. In spite of the warmth, thunder also was infrequent.

VI.—MAIN FEATURES OF THE MONTHS OF 1921.

January.—This was an exceedingly mild month, but very rainy, winds from between south and west prevailing almost continuously. Many days were stormy. Cloudiness was excessive, and temperature unusually equable. There was, however, a good deal of evaporation—presumably owing to the wind; and ozone was very abundant. The subsoil water level rose materially, but was still much lower than usual. The mean air temperature was so high as 45 degrees, or $6\frac{1}{2}$ degrees above the average. The soil was less warm. Rain fell on 25 days, or eight more than the normal number; and the total precipitation was 4.31 inches, or 1.68 inches above the average. There was a deficiency of $8\frac{1}{2}$ hours of sunshine.

Frost was confined to the 14th and 15th. There was no fog. Hail fell on the 14th and 18th, but snow was entirely absent. There was ice on the lake in Hesketh Park on one day only. Gales occurred on five days, and occupied altogether 36 hours; during the principal one (on the 18th), momentary gusts at the rate of 77 miles per hour were recorded, from the west-north-westward.

February.—This was one of the calmest months of its name on record, easterly and south-easterly anti-cyclonic airs largely predominating—the former to an exceptional degree. Air pressure was very high and steady, and rainfall practically confined to two nights. The stagnant atmosphere, however, was humid, and there was naturally a marked deficiency of ozone. During the earlier half of the month, temperature was generally low; afterwards, the days were much warmer, but some further cold nights occurred. The ground and water were, relatively, much less cool than the air; and the amount of evaporation was, therefore, nearly normal. The opening week or so was very dull, but subsequently many bright days occurred. The mean temperature of the month was 40.6 degrees, or just a degree above the average. Only 0.38 inch of rain fell, or 1.71 inches less than the normal quantity. There were 63 hours of sunshine, or a deficiency of 7 hours. Wind movement was only 277 miles a day, or no less than 135 miles per day below the average. No gales or even high-winds occurred. Frost was registered in the screen on eight days, and ground frost on ten days. There was much haze, but actual fog was only reported on two occasions.

March.—This month, like January, formed a welcome interval between the spells of easterly winds which for many months had been so frequent. From the last week of February to the first week of April (a stretch of some six weeks in all), mild, dull, and remarkably showery conditions very generally predominated; winds from all the southerly points (but veering at times to due west), being most unusually prevalent, for springtime at Southport. Temperature was equable; and ozone plentiful. The mean temperature of March was 45.2 degrees, or 3.7 degrees above the average. Bright sunshine, however, only occupied 101 hours, or 20½ fewer hours than the normal number. Rain fell on 24 days, or nine more than usual; but the total quantity did not quite reach 2.8 inches, and was little more than half-an-inch above the average. The underground water-level remained low. The notable scarcity of gales (ever since May, 1920, with the exception of January, 1924) continued, only one being experienced in the month under review. Ground-frost was limited to three nights. Hail also fell on three dates. A slight thunderstorm occurred on the 26th.

April.—This was essentially a month of north-westerly to north-easterly and easterly winds, and the duration of those from the north-eastward was more than double the Southport normal for April. Scarcely any currents from southerly points were experienced. The air, therefore, was drier than usual, and the sky clearer. Much sunshine resulted, numerous days being brilliantly fine; while the number of clear starlight or moonlight nights was quite exceptional. Hence the

daily range of temperature was excessive, and frosty nights (in the open) were frequent; while, on the 28th and 30th, maxima of 71 and 70 degrees respectively, were registered in the shade. Although the winds were light, humidity was low, and there was more evaporation than usual. The mean temperature of the air was 46.6 degrees, or 0.9 degree above the average. The ground and water were, relatively, warmer. As many as 212 hours of bright sunshine were recorded, the normal duration being exceeded by 37 hours. Rain fell on only ten days, or three fewer than the average; and the total amount was 1.42 inches, implying a shortage of 0.38 inch. The subsoil water fell to a rather low level. Ground-frost occurred on 12 nights; on the 8th and 16th the minimum temperature on the grass was 20 degrees. There was only one gale (on the 14th). Fog was confined to the 2nd and 3rd. Hail fell on the 14th and 15th. There was an entire absence of thunder.

May.—The unusually clear weather of April was continued throughout May, with, however, the further advantage that a large excess of due westerly winds occurred, the northerly to easterly currents so prevalent in the former month being greatly reduced in frequency. The sea winds, however, were light in force, and the air was dry and warm in spite of them. So beautiful and thoroughly pleasant a May had not been experienced for many years. The rainfall, though light, took the form of frequent brief showers, most of which came in the night. This much assisted vegetation; but evaporation was greater than usual, and the ground-water was at a low level and fell steadily. Ozone was very abundant. The mean temperature of the air was $51\frac{1}{2}$ degrees, or three-quarters of a degree above the average. The ground, and water, were considerably warmer (owing to the sunshine, and absence of stormy winds and heavy rains; the cooler but light sea breezes having little effect upon the earth and lakes). The duration of sunshine amounted to $251\frac{1}{2}$ hours, or $40\frac{1}{2}$ hours above the local normal. Only 1.45 inches of rain fell, or 0.64 inch less than the average. In Birkdale the deficiency was greater. Ground-frosts were confined to the 3rd and 5th, but were then rather severe. Hail and thunder were each merely reported once. No gales occurred.

June.—This was the driest June at Southport since the local records commenced in 1871, and, in all probability, since 1868. The unusually brilliant weather that had characterised April and May, continued, and on so many as six days bright sunshine was recorded for 15 hours or upwards. A considerable excess of north-westerly "sea breezes" by day, however, and a less marked one of north-easterly airs in the night, kept temperature, as a rule, quite moderate; winds from all southerly points being largely in defect. Only one brief outburst of real heat occurred, *vis.*, on the 25th, when a maximum of 84 degrees was registered—the highest reading at Southport since the memorable summer of 1911. Nearly all the month was, therefore, bracing, and extremely pleasant, except for the serious accentuation of the drought. Relative humidity was low, and the amount of evaporation very considerable; the ground-water fell to a level to which it rarely descends so early in the summer. Air pressure was high. The

mean temperature of the whole month was $57\frac{1}{4}$ degrees, or merely $\frac{3}{4}$ of a degree above the average. Yet no fewer than 255 hours of bright sunshine were recorded, the normal duration being exceeded by 45 hours. Only 0.46 inch of rain fell, implying a deficiency of 1.83 inches. Following the heat of the 25th, a rather prolonged thunderstorm occurred on the early morning of the 26th, and this produced more than half of the month's small rainfall. A gale of moderate force occupied several hours on the 9th and 10th. In Hesketh Park ground-frost was restricted to the 6th, but in the surrounding country it was experienced on three additional nights.

July.—This was the warmest of the fifty-one Julys for which records at Southport are available. Yet—in marked contrast to the great heat experienced at very many other English stations—the maximum thermometer on no occasion rose to 80 degrees. The normal westerly winds of the month were replaced by light, coastal, “land-and-sea-breezes.” The air was very dry, the amount of evaporation extremely large, and the level of the sub-soil water considerably lower than in any previous July. The first thirteen days formed at once a climax and conclusion of the brilliantly fine and generally dry weather that had prevailed from early in April. An “absolute drought” of 16 days’ duration, was terminated on the 13th. A very material reduction of sunshine followed, and slowly and intermittently the weather broke down. The mean temperature was 63.2 degrees, or 3.8 degrees above the average. Only 1.70 inches of rain fell, or 1.35 inches less than the normal amount. There were 237 hours of sunshine, or a surplus of 28 hours. Slight thunderstorms occurred on three days.

August.—This was the wettest month of *any name* since March, 1919; it was also unusually dull. More than three-fourths of the rainfall was experienced during the first twelve days—the principal part of the holiday season; but though a temporary dry spell occurred later on, from the 17th to the 24th, only three of those eight days were sunny. Fortunately, the prevailing winds were westerly and northerly, not southerly, and there was a considerable deficiency of easterly ones. Temperature was therefore very equable; and Southport escaped the severe thunderstorms that visited many places. The nights were warm, but the days cool, only two maximum readings exceeding 70 degrees, and 75 degrees never being reached. After the 8th, except on two or three days there was very little wind-force, and with the shortage of sunshine the month's amount of evaporation was also small. Ozone was abundant. The mean temperature equalled 58.8 degs., or merely 0.3 deg. below the average. No fewer than 4.91 inches of rain fell, the normal being exceeded by 1.34 inches. The duration of sunshine amounted to only 146 hours, implying a deficiency of 39 hours. Gale-force was confined to one hour on the 27th. No frost occurred on the grass. Fog prevailed early on the 19th. Thunder was merely heard on the 2nd and 3rd, and lightning seen on the 29th.

September.—Except at its commencement, and for some days about the second week, this was an exceptionally dry, calm, and beautiful, early autumn month. A feature throughout was an almost total restriction of the rainfall to the night-time. The days—especially the afternoons—were warm and sunny; the nights much cooler, and often fine, but without any frost, even on the grass, the air then being very humid, and either rain or mist, and sometimes fog, developing occasionally during the later hours, or in the early mornings. The prevailing winds were from west and east. The mean temperature of the air was 56.8 degrees, or 1.4 degrees above the average. Ground temperatures, however, were only normal. There were 174 hours of sunshine, or 32 hours more than the average. Rain fell on nine days only, or five fewer than usual; and the total amount for the month was 1.84 inches, or 1.17 inches less than the local normal. Wind movement was 53 miles per day below the average; and evaporation also was deficient. The subsoil water-level continued very low. There were neither gales nor thunderstorms. Beyond generally short-lived fogs on four dates, no occasional phenomena of any description were reported.

October.—This was much the warmest October that has occurred since the Fernley Observatory was established in 1871. Its mean air-temperature was practically identical with that of the preceding month (September, 1921), and was a couple of degrees above the normal value for *September*. The ground, however, was considerably cooler than the air, the difference being interesting, for the days and nights were equally mild. Atmospheric pressure was very high, only two higher October mean values being on record during the 50 years. Most of the month was therefore unusually quiet; and the rainfall was below, and the sunshine above, the respective averages. The underground water-level was exceptionally low. The mean temperature in the screen was 56.3 degrees, or no fewer than 7.3 degrees above the local normal, and 1.9 degrees above the value for the warmest previous October (*viz.*, that of 1908), during the half-century's records. The total rainfall amounted to 2.88 inches, which implies a deficiency of 0.88 inch. There were 110 hours of sunshine, or 16 more than usual. Wind movement was 68 miles a day below the average. Frost only occurred once (*viz.*, on the 24th), whereas maximum temperatures of from 70 to 74 degrees were registered on six days. A brief thunderstorm was experienced on the evening of the 6th, and thunder was heard on the 19th. Fog prevailed on the early morning of the 9th. Slight gales occurred on the 29th and 31st.

November.—So predominantly south-easterly a November had never before been experienced during the fifty years' existence of the Southport Observatory. Indeed, a greater frequency of winds from that direction has only twice been recorded in any month whatever during the half-century, *viz.*, once in October and once in December. The largeness of the day-to-day changes of mean temperature was equally exceptional, some of the south-easterly surface winds being warm parts of the circulatory systems of Atlantic low pressure areas, and others being cold outflows from the Continental anti-cyclone. On the whole,

however, temperature was low; this formed, indeed, the one cold month of the year. Sunshine was nearly normal, but was almost all condensed into the first thirteen days; while storms, sea winds, and ozone were practically restricted to the opening week, and rainfall largely so. From the 9th, light airs from the eastern semi-circle, but chiefly from the south-eastward, persisted with great monotony to the month's close; and the weather was extremely hazy. The mean temperature was $40\frac{1}{2}$ degrees, or $2\frac{3}{4}$ degrees below the average. Sunny hours numbered 55, or only $1\frac{1}{2}$ fewer than usual. The rainfall amounted to 2.64 inches, or 0.52 inch below normal. Wind movement was deficient to so large an extent as 92 miles a day. There was a great shortage of ozone. Frost occurred on 12 days, slight gales on four, fog twice, and very slight snow and hail once each only. There was no thunder.

December.—The first five days formed a continuation of the rather cold easterly weather of November. The wind then veered to the south-westward, and general westerly conditions afterwards persisted, almost uninterruptedly, to the year's close. The earlier half of the month was mainly quiet, with a humid atmosphere, but with seldom more than small amounts of rain. From the 17th to the 31st, however, wind speed was frequently very considerable, and the atmosphere was much drier, but several substantial falls of rain occurred. The outstanding feature of the month as a whole was abnormal mildness. The mean temperature was $44\frac{1}{2}$ degrees, or $4\frac{3}{4}$ degrees above normal. There were 43 hours of sunshine, or eight more than the average number. The total rainfall, however, amounted to 3.87 inches, which implied a surplus of 0.70 inch. The ground water-level was exceedingly low until the 27th, but then rose rather sharply. December's high normal wind movement was exceeded by no fewer than 74 miles per day. Ozone was very abundant. Gales (all of which were off the sea) occupied 68 hours, distributed amongst eight days; but none of them was of notable violence. Frost in the shade was restricted to two nights, and ground-frost to seven nights. There was no snow, and very little fog. Thunder did not occur. Hail fell on three days. A noteworthy example of smooth glazed-frost was produced on the morning of the 5th.

VII.—EXTREMES, AND MEANS OR TOTALS, FOR 1921.

Barometric Pressure.—The greatest Air Pressure, at sea level, during the year, was 1044.8 millibars (or 30.85 inches of mercury), on February 26th, at 9 p.m. The least was 983.7 millibars (or 29.05 inches of mercury), on January 12th, at 6 p.m. The mean Pressure for the entire year, (corrected for diurnal variation), was 1017.8 millibars, or no less than 4.1 millibars above the local normal, and 1.2 millibars above the highest annual mean (*viz.*, that for 1896) recorded during the 50 years' previous existence of the Observatory.

Air Temperature.—The highest Temperature of the Air, (at the standard height of four feet above short grass, and in a Stevenson-Screen), was 84 degrees Fahrenheit (or 302 degrees on the Absolute-Centigrade scale), on June 25th. The lowest was 26 degrees Fahr. (or 270 a.), on November 9th, 11th, and 12th. The mean temperature of the warmest entire civil-day (*i.e.*, the mean of 24 separate hourly values, ending at midnight), was 70.3 degrees, on June 25th. That of the coldest day was 30.7 degrees, on December 4th. The greatest difference between the mean temperatures of any two consecutive civil-days was an increase of 15.2 degrees, from December 5th to 6th. The greatest Range of Temperature, in the Screen, within one day, was 32 degrees, on June 7th.

The Mean Temperature of the complete year, (derived from the daily maximum and minimum temperatures), was 50.5 degrees, or 2.3 degrees above the average, and 0.3 degree above the value for the warmest of the previous 50 years, *viz.*, 1884. The Mean for 1921 *from hourly readings* was 50.3 degrees.

Ground, etc., Temperatures.—The highest and lowest 9 a.m. Temperatures of the Hesketh Park Lake water, and of the Ground at various depths below the surface, were as follows:—

	Highest. ° F.	Date. 1921.	Lowest. ° F.	Date. 1921.
Lake-Water,				
6 ins. below the surface ...	73.1 ...	July 11th	... 33.8 ...	Nov. 13th
Ground,				
1 foot below the surface ...	71.6 ...	July 11th	... 35.6 ...	Feb. 11th
4 feet ,, ,, ,, ...	63.4 ...	July 21st	... 41.2 ...	Feb. 12th to 14th.
10 ,, ,, ,, ,, ...	57.0 ...	Sep. 5 & 6	... 45.1 ...	Feb. 22 to Mar. 20
20 ,, ,, ,, ,, ...	51.9 ...	Nov. 22 to 24	... 48.0 ...	Apr. 26th & 27th.

The greatest thickness of Ice on the Lake was merely 0.3 inch, on February 10th and 11th.

The lowest Temperature on the Grass was 16 degrees Fahrenheit (or 264 degrees Absolute), on November 11th.

Sunshine.—The greatest Duration of Sunshine, on one day, was 15.6 hours, on June 6th. The total duration for the year was 1683 hours, or 130 hours more than a 20 years' local average.

Wind.—The highest Speed of the Wind for one hour, on the coast at Marshside, was 53 miles (or 24 metres per second), on January 18th, for 6 p.m.; the Direction was W.N.W. The rate during the strongest gusts was 77 miles per hour (or 34 metres per second), on the same occasion, the Direction being W.N.W. The largest Wind Movement in one civil day was 1107 miles, on January 18th, from a mean Direction of W.N.W.

The mean Speed of the Wind for the entire year was 14.4 miles per hour (or 6.4 metres per second), which was 1.3 miles per hour below the average.

The several Wind Direction Duration aggregates for the year, and their deviations from normal, were as follows:—

	Total Hours.	Difference from the Average.		Total Hours.	Difference from the Average.
N.	510	— 82	S.	856	— 140
N.E.	503	— 144	S.W.	1266	+ 127
E.	967	— 97	W.	1932	+ 222
S.E.	1343	— 70	N.W.	1383	+ 184

Rainfall.—The heaviest aggregate Rainfall, in one “rainfall day” (*i.e.*, 24 hours beginning at 9 a.m., L.M.T.), was 1.05 inches, by the 8-in. gauge, (26.8 millimetres, by the 5-in. gauge), on December 27th. The greatest similar “day’s” *Duration* of Rainfall, was 15.2 hours, on January 12th.

The Total Rainfall for the complete year was 28.65 inches, by the 8-in. gauge, (728 millimetres, by the 5-in. gauge); or 4.19 inches below the local normal. Days with Rain numbered 182, or 6 fewer than usual.

Evaporation.—The largest amount of Evaporation in one day, from a 3-ft.-square tank in the ground, was 0.21 inch, on July 13th. The year’s total was 17.50 inches, or 1.48 inches above the average.

Phenomena.—Snow was again almost absent, even minute quantities only falling on 2 days. Gales, too, were once more exceptionally infrequent. Thunder only occurred on 10 days, or 2 fewer than the normal number. Fog was reported on 13 days; but for the present Meteorological Office definition of this phenomenon, no average for past years is yet available.

JOSEPH BAXENDELL.

*The Fernley Observatory,
Southport,
England;
November 21st, 1922.*

SOUTHPORT
METEOROLOGICAL OBSERVATORY.



TABULATED
RESULTS OF OBSERVATIONS
MADE DURING
THE YEAR 1921.

The Fernley Observatory, Southport.

GENERAL DESCRIPTIVE NOTES FOR 1921.

The principal Meteorological Station of the Fernley Observatory is situated in the eastern portion of Hesketh Public Park, Southport, approximately half-a-mile inland from High-Water Mark. Its Geographical Position is:—Latitude, $53^{\circ} 39' 24''$ N.; Longitude, $2^{\circ} 59' 3''$ W. The cistern of the Fortin-Barometer is 42 feet above Mean Sea Level (Ordnance Datum). The rims of the Rain Gauges are one foot above grass, and 38 feet above Mean Sea Level. The Duration of Rainfall is ascertained from the records of Fernley-pattern Recording Gauges.

The Marshside Anemograph Station is situated close to a very open and level portion of the coast, over a mile to the N.N.E. of the Hesketh Park Observatory. A Dines-Baxendell Anemograph is employed there; its head is 62 feet above the ground, and 48 feet above the roof of the hut containing the recording apparatus; it is 80 feet above Mean Sea Level.

Local Mean Time—which is 12 minutes after G.M.T.—is employed for the eye-readings, Local Apparent Time for the Hourly Sunshine values, and Greenwich Mean Time for all the other Hourly results. Summer Time is not used. The Hourly means of Temperature refer to the exact hour. For this element, values are given for both the initial and final midnights; and the monthly means for the 24 hours have been computed according to the formula $\frac{1}{24} \{ 1 + \dots + 23 + \frac{1}{2} (0 + 24) \}$. The hourly tabulations have been measured from base-lines drawn automatically on the daily charts of a large Dines Thermograph. Corrections prepared from control eye-readings of standard instruments have been applied. The Hourly statistics of Sunshine, Wind Direction and Velocity, and Rainfall Duration and Amount, all refer to the period extending from 30 minutes before, to 30 minutes after, the exact hour.

The Averages used in the preparation of the Tables on the succeeding pages are for the 45 years 1871-1915, in all cases except the following:—Level of Subsoil Water, 25 years; Underground Temperature at 4 feet, Sunshine, and Wind Velocity and Direction, 20 years; Rate of Rainfall, and Amount of Cloud at 9 a.m., 15 years; and Evaporation, 5 years only.

Tabular Meteorological Statistics, 1921.

Air Pressure.

Barometer, and Standardised Barograph, Results.

1921.	MEAN PRESSURE.		Difference from the Average. (At 9 a.m. and 9 p.m.).	Mean of Daily Observed Oscillations.†	Difference from the Average.	Absolute Extremes of Pressure. ‡			
	At M. S. L., & Gravity of Lat. 45°.					At M. S. L., & Gravity of Lat. 45°.			
	Mean of 24 Hours.*	Mean at 9 a.m. and 9 p.m.				Highest.		Lowest.	
						Height.	Date.	Height.	Date.
	MILLIBARS.	INCHES.	INCH.	INCH.	INCH.	MILLIBARS.		MILLIBARS.	
January ...	1011.3	29.870	- 0.104	0.308	+ 0.049	1029.5	21st	983.7	12th
February	1026.2	30.310	+ .374	.167	- .078	1044.8	26th	992.6	1st
March ...	1014.1	29.952	+ .052	.268	+ .033	1028.4	31st	988.4	29th
April	1021.5	30.174	+ .242	.183	- .013	1035.6	8th	991.6	17th
May	1014.0	29.947	- .051	.177	+ .013	1028.6	1st	994.2	8, 30
June	1023.0	30.213	+ .212	.152	+ .003	1032.5	2nd	1009.2	9th
July	1017.5	30.047	+ .079	.140	- .010	1027.7	21st	992.9	29th
August ...	1012.5	29.907	- .030	.197	+ .027	1023.8	30th	998.8	5th
September	1019.9	30.122	+ .123	.143	- .032	1031.7	27th	1002.0	10th
October ...	1020.5	30.148	+ .246	.185	- .035	1035.5	15th	999.0	22nd
November	1017.8	30.065	+ .159	.168	- .083	1034.1	10th	986.8	6th
December	1015.6	30.000	+ 0.133	0.314	+ 0.037	1031.1	13th	990.3	28th
Year	1017.8	30.063	+ 0.120	0.200	- 0.008	1044.8 (30.85)	FEB. 26th	983.7 (29.05)	JAN. 12th

* From Observations at 9 a.m., 3 p.m., and 9 p.m.; corrected for Diurnal Variation.

† From Observations at 9 a.m. and 9 p.m. only.

‡ At any time during the 24 hours. || Inches of Mercury.

Air Temperature.

Stevenson-Screen Results.

1921.	Mean Daily Max.* Temp.	Mean Daily Min. † Temp.	Mean Temperature.		Difference from the Average. (Mean of Max. & Min.)	Mean Daily Range of Tempera- ture.	Difference from the Average.	Absolute Extremes of Temperature.			
			Mean of Daily Max. & Min	Mean of 24 Hourly Values.				Highest.		Lowest.	
								Temp.	Date.	Temp.	Date.
January...	48.7	41.5	45.1	45.1	+6.4	7.2	-1.1	54	4 & 9	29	15th
February	45.2	36.0	40.6	40.6	+1.0	9.2	-0.1	56	23rd	28	10th
March ...	50.2	40.1	45.2	44.9	+3.7	10.1	-1.0	57	24th	27	7th
April	54.0	39.1	46.6	46.3	+0.9	14.9	+1.5	71	28th	30	16th
May	58.4	44.6	51.5	51.4	+0.7	13.8	-0.1	70	25th	31	5th
June	64.3	50.3	57.3	57.1	+0.7	14.0	+0.4	84	25th	41	28th
July	70.5	55.8	63.2	62.9	+3.8	14.7	+2.8	79	13 & 15	45	4 & 5
August ...	63.4	54.2	58.8	58.4	-0.3	9.2	-2.9	74	18th	43	31st
September	63.5	50.1	56.8	56.1	+1.4	13.4	+0.8	78	7th	40	25th
October ...	62.0	50.5	56.3	55.5	+7.3	11.5	+0.3	74	6 & 9	32	24th
November	45.3	35.6	40.5	40.8	-2.7	9.7	+0.2	55	4th	26	9,11,12
December	48.7	40.0	44.4	44.5	+4.7	8.7	+0.1	54	6 & 26	27	4th
Year	56.2	44.8	50.5	50.3	+2.3	11.4	+0.1	84 (302†)	JUNE 25th	26 (270†)	NOV. 9,11,12

* 24 hours beginning at 9 a.m. ‡ Absolute or Kelvin scale of degrees.

† 24 hours ending at 9 a.m.

NOTE.—For Number of Days with Frost, and Lowest Monthly Temperature on the Grass, see Table headed "Miscellaneous Observations."

Ground Temperatures ; Insolation ; and Radiation.

1921.	Mean Underground Temperatures at 9 a.m.				Difference from the Average.		Mean Daily Max. Temps. in Sun.			Mean Excess of Blackened bulb in Vacuo over Bright bulb in Vacuo.	Mean Nightly* Min. on Short- Grass or Snow.
	1 foot.	4 feet.	10 feet.	20 feet.	1 foot.	4 feet.	Blackened bulb in Vacuo.	Bright bulb in Vacuo.	Black-glass bulb in Open Air		
January ...	42.2	43.1	46.4	49.81	+5.0	+1.8	61.4	53.2	50.9	8.2	37.7
February ...	39.8	42.2	45.6	48.90	+1.6	+1.9	70.6	54.8	50.4	15.8	32.5
March	43.9	44.1	45.2	48.35	+3.3	+2.4	87.4	64.2	56.8	23.2	36.5
April	47.7	47.5	46.6	48.07	+1.6	+2.1	104.4	74.9	65.2	29.5	32.0
May	56.0	52.9	48.5	48.09	+2.5	+2.1	113.7	81.5	71.3	32.2	37.5
June	62.2	58.0	51.6	48.54	+1.9	+1.8	117.3	87.9	77.5	29.4	45.4
July	67.2	62.3	54.5	49.31	+3.5	+2.5	119.6	93.2	83.3	26.4	51.5
August.....	62.0	61.6	56.5	50.26	-0.6	+1.0	109.6	84.7	75.2	24.9	51.1
September	58.0	59.3	56.8	51.09	+0.1	+0.9	106.3	82.9	73.9	23.4	45.8
October ...	54.5	56.4	55.8	51.65	+4.2	+2.8	94.5	76.7	68.7	17.8	44.7
November	41.9	48.4	53.4	51.86	-1.4	+0.4	61.2	53.7	48.5	7.5	32.3
December	41.6	44.8	49.7	51.41	+2.7	+1.0	58.8	53.6	50.9	5.2	36.7
Year	51.4	51.7	50.9	49.78	+2.0	+1.7	92.1	71.8	64.4	20.3	40.3

* For the period of 15 hours (from April, 16 hours) ending at 9 a.m.

Sunshine ; Cloud ; and Ozone.

1921.	SUNSHINE. Per Campbell-Stokes Recorder.						CLOUD.			OZONE.	
	Total* Bright Sun- shine.	Difference from the Average.	Per- centage of Possible	Most Sunshine in One Day.		Num- ber of Sun- less Days.	Mean Amount.			Difference (at 9 a.m.) from the Average.	Mean Daily Amount. †
				Amount.	Date.		9 a.m.	3 p.m.	9 p.m.		
January	HOURS. 35.3	HOURS. - 8.4	% 14	HOURS. 5.2	22nd	15	0 to 10. 8.7	0 to 10. 7.7	0 to 10. 8.1	0 to 10. + 1.2	0 to 10. 4.7
February	63.4	- 7.2	23	9.1	26th	10	7.1	6.8	7.3	- 0.5	2.3
March	101.3	- 20.5	28	10.0	24th	6	7.7	6.9	6.9	+ 0.9	4.7
April	211.8	+ 37.1	51	13.6	24th	1	5.8	5.0	4.5	- 0.6	4.1
May	251.5	+ 40.4	51	14.6	21st	0	6.1	5.0	5.5	- 0.8	4.7
June.....	255.4	+ 44.9	50	15.6	6th	3	5.9	4.9	4.9	- 0.8	4.9
July	237.0	+ 28.3	47	14.8	11 & 12	1	6.2	5.5	5.9	- 0.9	4.2
August	145.7	- 39.0	32	12.7	30th	3	7.2	7.6	7.0	0.0	4.4
September	173.7	+ 32.1	46	10.9	24th	2	6.9	5.0	6.1	+ 0.1	3.3
October	109.7	+ 16.0	34	8.3	1 & 9	4	7.2	7.2	6.5	0.0	3.7
November	55.0	- 1.5	21	7.7	8th	13	7.8	7.4	6.9	+ 0.5	1.5
December	42.7	+ 8.0	18	5.6	13th	12	7.5	7.4	7.6	- 0.1	4.8
Year.....	1682.5	+ 130.2	38†	15.6	JUNE 6th	70	7.0	6.4	6.4	- 0.1	3.9

* For the expression of these values in the form of Daily Means, see p. 27.

† The test-papers are changed at 9 a.m.

‡ Derived from the Year's Total Duration of Sunshine.

Humidity; and Wind Velocity.

1921.	HUMIDITY.							VELOCITY OF THE WIND.					
	Vapour Pressure.			Relative Humidity.			Difference of Hum (at 9 a.m.) from the Average	Per Dines Recording Pressure Tube Anemometer.					
								Mean Daily Move- ment. *	Differ- ence from the Average †	Absolute Extremes.			
	9 a.m.	3 p.m.	9 p.m.	9 a.m.	3 p.m.	9 p.m.				For one Hour.	Date.	In a Gust.	Date.
	MILLI- BARS.	MILLI- BARS.	MILLI- BARS.	%	%	%	%	MILES.	MILES.	MILES.		MILES PER HR.	
January...	9.2	9.3	9.1	89	86	90	+ 1	466	+ 36	53	18th	77	18th
February..	7.4	8.0	7.6	91	81	89	+ 4	277	- 135	30	15, 16	38	15th
March ...	8.7	8.7	8.6	85	76	86	+ 1	440	+ 36	39	27th	58	28th
April	8.6	9.1	8.6	76	68	83	- 3	316	- 75	44	14th	53	14th
May	10.2	10.5	10.3	73	67	82	- 3	285	- 46	34	31st	50	31st
June	12.0	12.7	12.5	71	67	81	- 5	351	+ 17	42	10th	55	10th
July	14.8	15.4	15.2	69	67	81	- 9	280	- 60	36	23rd	50	23rd
August ...	13.8	14.8	14.6	79	79	88	- 1	342	- 10	39	27th	51	27th
September	13.1	13.5	13.0	83	71	88	+ 2	289	- 53	36	11th	46	11th
October ...	13.0	13.4	12.8	84	76	86	- 1	298	- 68	40	29th	52	31st
November	7.4	7.9	7.5	88	81	87	0	306	- 92	42	1st	57	6th
December	8.9	9.1	8.9	89	85	88	+ 1	491	+ 74	51	30th	71	30th
Year	10.6	11.0	10.7	81	75	86	- 1	345	- 31	53 (24½)	JAN. 18th	77 (34½)	JAN. 18th

* For equivalent values in Metres per Second, see p. 29.

† Metres per Second.

† The Averages used have been adjusted to apply to existing conditions.

NOTE.—For Number of Days with, and Duration of, GALES, see Table headed "Miscellaneous Observations."

Wind Direction.

1921.	DIRECTION OF THE WIND.															
	From the Hourly Tabulations of the Curves from the Baxendell Recording Anemoscope.															
	Duration Percentages.								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 ...	1	3	1	12	17	33	26	7	- 6	- 1	- 8	- 9	+ 4	+ 14	+ 7	- 1
February...	6	6	25	23	3	11	15	11	- 1	- 1	+ 16	+ 2	- 10	- 5	- 2	+ 1
March	3	2	0	10	25	29	24	7	- 6	- 8	- 11	- 3	+ 13	+ 13	+ 6	- 4
April	13	20	16	4	3	8	16	20	+ 6	+ 10	+ 4	- 7	- 6	- 5	- 6	+ 4
May	5	6	10	10	13	12	28	16	- 1	- 4	- 8	- 2	+ 4	+ 1	+ 11	- 1
June	5	13	13	5	1	6	23	34	- 1	+ 4	- 2	- 6	- 7	- 3	+ 1	+ 14
July	4	3	16	12	8	14	17	26	- 1	- 2	+ 5	+ 2	+ 1	+ 4	- 12	+ 3
August	12	6	5	9	9	12	30	17	+ 6	+ 1	- 6	- 4	- 1	0	+ 4	0
September	4	3	18	15	10	11	24	15	- 3	- 4	+ 2	- 4	0	+ 2	+ 6	+ 1
October ...	4	1	5	27	11	13	24	15	- 2	- 8	- 9	+ 5	- 3	+ 2	+ 10	+ 5
November ..	9	6	17	51	5	1	5	6	0	- 1	+ 6	+ 32	- 8	- 12	- 13	- 4
December ..	4	1	9	7	11	22	31	15	- 2	- 4	- 2	- 16	- 5	+ 6	+ 16	+ 7
Year	6	6	11	15	10	14	22	16	- 1	- 1	- 1	- 1	- 1	+ 1	+ 2	+ 2

Rainfall Amount.

1921.	TOTAL RAINFALL.*			DAYS WITH RAIN.†			GREATEST DAILY FALL.‡			TOTAL* RAINFALL NEAR BIRKDALE STATION.
	8-inch Standard Gauge.	Difference from the Average.	5-inch Snowdon Gauge.	0·01 Inch or more. (8-inch Gauge.)	Difference from the Average.	1 Milli- metre or more. (5-inch Gauge.)	Amount by 8-inch Gauge.	Amount by 5-inch Gauge.	Day of Month.	
	INCHES.	INCHES.	MILLI- METRES.	NO. OF DAYS.	NO. OF DAYS.	NO. OF DAYS.	INCHES.	MILLI- METRES.		INCHES.
January ...	4·31	+1·68	109	25	+ 8	20	0·53	13·5	17th	4·48
February ...	0·38	-1·71	10	5	-10	2	0·27	6·8	24th	0·34
March	2·79	+0·57	71	24	+ 9	19	0·35	8·9	13th	2·92
April	1·42	-0·38	36	10	- 3	7	0·58	14·5	13th	1·47
May	1·45	-0·64	37	16	+ 2	11	0·30	7·7	14th	1·26
June	0·46	-1·83	12	9	- 4	3	0·24	6·4	25th	0·50
July	1·70	-1·35	44	12	- 3	8	0·53	13·3	23rd	1·65
August	4·91	+1·34	125	18	+ 1	14	1·02	26·1	1st	4·75
September..	1·84	-1·17	47	9	- 5	6	0·43	11·0	13th	1·97
October ...	2·88	-0·88	73	15	- 3	11	0·52	13·3	22nd	3·01
November..	2·64	-0·52	66	14	- 4	9	0·75	19·4	2nd	2·75
December...	3·87	+0·70	98	25	+ 6	16	1·05	26·8	27th	3·84
Year.....	28·65	-4·19	728	182	- 6	126	1·05	26·8	DECEMBER 27th	28·94

* From 9 a.m. on the 1st of each month, to 9 a.m. on the 1st of the succeeding month.

† 24 hours beginning at 9 a.m.

Rainfall Duration, etc. ; Evaporation; and Water Levels.

1921.	DURATION AND INTENSITY OF RAINFALL.					EVAPORATION.		MEAN LEVEL OF SUBSOIL WATER.		Difference from the Average (at Hesketh Park.)
	Total Duration of Rain.*	Greatest Daily Duration.†		Mean Rate per Rain- fall Hour.	Difference from the Average.	Total, by 3ft. sq. Tank.	Difference from the Average.	At Hesketh Park.	At Birkdale. §	
	HOURS.	Aggregate.	Date.	INCH.	INCH.	INCHES.	INCHES.	INCHES.	INCHES.	INCHES.
January ...	107·0	15·2	12th	0·040	0·000	0·15	+0·12	40·1	31·0	+6·0
February ...	12·8	9·6	24th	·030	- ·011	0·20	-0·02	37·1	34·1	+4·3
March	84·2	11·3	4th	·033	- ·004	0·71	-0·02	38·7	35·1	+6·0
April	38·9	9·8	13th	·037	- ·004	1·85	+0·12	41·0	37·0	+6·6
May	46·4	9·1	11th	·031	- ·010	2·59	+0·17	44·7	39·7	+7·5
June	15·7	3·4	19th	·029	- ·026	3·88	+0·82	49·5	43·3	+8·1
July	29·2	8·2	22nd	·058	+ ·002	3·67	+0·78	54·6	46·7	+9·3
August	88·2	12·3	5th	·056	- ·005	2·01	-0·43	53·3	43·0	+6·0
September..	29·3	7·2	13th	·063	·000	1·43	-0·15	54·6	45·0	+6·4
October ...	52·5	11·9	3rd	·055	·000	0·65	+0·07	55·3	45·2	+8·8
November..	64·3	11·0	2nd	·041	- ·004	0·30	+0·02	50·3	39·5	+8·1
December ..	83·7	13·4	24th	0·046	+0·002	0·06	0·00	48·7	38·3	+10·8
Year.....	652·2	15·2	JANUARY 12th	0·044	-0·003	17·50	+1·48	47·3	39·8	+7·3

* From 9 a.m. on the 1st of each month, to 9 a.m. on the 1st of the succeeding month.

† 24 hours beginning at 9 a.m.

‡ Distances below Well-mouths.

§ Near L. & N. W. Railway Station, Birkdale.

|| Derived from the year's totals of Amount and Duration.

Rainfall with Different Wind Directions.

1921.	AMOUNT OF RAINFALL.*								DURATION OF RAINFALL.*							
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
	INS.	INS.	INS.	INS.	INS.	INS.	INS.	INS.	HRS.	HRS.	HRS.	HRS.	HRS.	HRS.	HRS.	HRS.
Jan. ...	·00	·20	·26	·69	·65	1·14	1·17	·14	0·0	8·2	5·1	15·1	19·1	29·0	26·2	3·9
Feb. ...	·00	·00	·01	·01	·04	·16	·11	·06	0·0	0·0	0·4	0·5	1·9	4·1	1·8	4·5
March. ...	·05	·00	·01	·19	·73	1·17	·41	·21	3·8	0·0	0·4	5·7	22·5	29·0	11·2	11·6
April ..	·19	·02	·00	·19	·25	·20	·49	·08	5·6	0·5	0·0	4·5	8·1	5·3	12·3	2·6
May ...	·06	·04	·16	·28	·21	·29	·36	·10	1·5	2·5	8·7	13·1	5·7	6·5	6·4	2·0
June ...	·01	·16	·02	·00	·06	·12	·09	·02	0·4	4·4	1·3	0·2	0·3	1·8	4·4	2·9
July ...	·18	·01	·15	·25	·18	·81	·04	·07	5·8	0·3	3·7	5·2	3·2	7·3	0·8	2·8
Aug. ...	·32	·30	·22	·52	1·64	·94	·76	·08	8·2	4·5	3·1	14·1	19·3	17·9	14·8	4·1
Sept. ...	·12	·04	·07	·22	·36	·34	·65	·16	2·1	0·6	1·8	4·9	4·4	4·5	10·6	2·7
Oct.	·02	·02	·25	·34	·71	·91	·35	·09	0·8	1·1	9·7	5·7	9·3	14·3	7·3	1·3
Nov. ...	·04	·04	·33	1·35	·29	·30	·34	·07	2·2	0·6	7·4	38·9	3·9	5·9	7·1	1·3
Dec. ...	·08	·00	·02	·62	·76	1·31	·80	·28	1·3	0·0	0·8	9·4	15·4	29·5	22·0	5·3
Year ...	1·07	0·83	1·50	4·66	5·88	7·69	5·57	1·86	31·7	22·7	42·4	117·3	113·1	155·1	124·9	45·0
	Intensity of Rainfall (Rate per Raining Hour.)								Raining Hours per cent. of Total Hours of each Wind.							
Year ...	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	%	%	%	%	%	%	%	%
	·034	·037	·035	·040	·052	·050	·045	·030	6·2	4·5	4·4	8·7	13·2	12·3	6·5	3·3

* From, and to, Midnight, each month-end.

Miscellaneous Observations.

1921.	OCCASIONAL PHENOMENA.											LOWEST MIN. TEMP. ON GRASS OR OVER SNOW.			MEAN TEMP. OF H.P. LAKE WATER.
	GALES. *		SNOW.		HAIL. †	THUNDER. ‡	Fog.	ICE. On H.P. Lake.	In the Screen.	FROST.		Fahr.	Abs'Tt.	Date.	
	Force 8 and above.	Duration of same.	Snow-falls.	Depth of all falls.						Ground Frost. §	On the Grass.				
	NO. OF DAYS.	HOURS	NO. OF DAYS.	INCHES.	NO. OF DAYS.	NO. OF DAYS.	NO. OF DAYS.	NO. OF DAYS.	NO. OF DAYS.	NO. OF DAYS.	NO. OF DAYS.	°	a.	°	
January ...	5	36	0	0·0	2	0	0	1	2	2	4	21	267	14th	43·2
February ...	0	0	0	0·0	0	0	2	2	8	10	14	20	266	10th	40·3
March	1	5	0	0·0	3	1	0	0	1	3	7	19	266	7th	45·3
April	1	6	1	0·0	2	0	2	0	2	12	16	20	266	8 & 16	50·8
May	0	0	0	0·0	1	1	0	0	2	2	5	22	267	5th	58·6
June.....	2	10	0	0·0	0	1	0	0	0	1	3	30	272	6th	63·1
July	0	0	0	0·0	0	3	0	0	0	0	0	41	278	5th	66·8
August.....	1	1	0	0·0	0	2	1	0	0	0	0	39	277	30, 31	62·1
September..	0	0	0	0·0	0	0	4	0	0	0	0	35	275	25, 29	58·0
October ...	2	4	0	0·0	0	2	1	0	1	1	1	20	266	24th	55·0
November..	4	9	1	0·1	1	0	2	5	12	12	13	16	264	11th	41·5
December..	8	68	0	0·0	3	0	1	2	2	7	8	19	266	4th	42·2
Year.....	24	139	2	0·1	12	10	13	10	30	50	71	16	264	Nov. 11th	52·2

* From the Hourly Tabulations of the Dines Tube Anemographs.

† Including "Soft-Hail."

‡ Including both Thunderstorms, and Thunder-only; but not Lightning-only.

§ At 9 a.m.

§ Meteorological Office's definition, viz., Minimum Temperature on the Grass = 30·4 degs. Fahr. or below.

Diurnal Variation

Four feet above Grass, and in

1921.	Midn't	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.
	°	°	°	°	°	°	°	°	°	°	°	°	°
January ..	44.9	45.0	45.0	44.9	44.6	44.6	44.5	44.4	44.7	44.9	45.5	45.7	46.3
February...	39.2	39.3	39.2	38.9	38.7	38.5	38.1	37.9	37.8	38.4	39.7	41.3	42.6
March.	43.4	43.0	42.9	42.7	42.7	42.6	42.3	42.4	43.1	44.5	46.0	47.0	47.5
April.....	42.7	41.8	41.4	41.1	40.5	40.5	40.8	42.5	44.9	47.2	48.9	50.2	51.4
May.....	48.0	47.4	46.7	46.0	45.4	45.3	46.5	49.0	51.2	52.8	54.4	54.7	55.6
June	53.4	52.6	51.9	51.4	51.1	51.2	52.6	54.3	56.1	58.1	59.8	60.6	61.3
July.....	58.8	58.2	57.7	57.0	56.5	56.4	57.7	59.9	62.5	64.7	66.1	67.0	67.7
August	56.8	56.3	56.0	55.6	55.3	55.0	54.9	56.1	57.6	59.2	60.3	61.2	61.2
September.	53.0	52.5	52.2	52.0	51.7	51.6	51.4	52.3	54.1	56.2	58.6	60.3	61.4
October	53.7	53.5	53.2	52.7	52.5	52.2	52.0	51.7	52.6	54.6	57.1	58.8	60.2
November..	40.7	40.4	40.2	39.7	39.1	39.0	39.0	38.8	38.8	39.1	40.2	41.8	43.1
December..	43.9	43.6	43.6	43.4	43.3	43.4	43.3	43.2	43.5	43.8	44.5	45.0	45.4
Year.....	48.2	47.8	47.5	47.1	46.8	46.7	46.9	47.7	48.9	50.3	51.8	52.8	53.6

Diurnal Variation of

1921.	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.
January	...	...	...	...	...	1.6	3.4	5.4	5.8
February	...	...	...	...	2.2	5.9	8.9	9.0	7.5
March	...	...	...	2.6	7.6	10.9	12.7	12.9	11.4
April	...	1.9	9.8	15.7	18.0	16.2	16.6	19.4	19.7
May	...	7.4	14.6	14.9	16.2	17.7	16.5	17.0	17.8
June	1.3	9.4	12.2	12.3	15.3	18.3	17.4	20.2	20.2
July	0.3	6.1	12.2	15.6	16.0	17.0	19.0	18.1	19.2
August.....	...	1.1	8.7	11.1	14.1	14.6	15.0	12.2	13.0
September	...	...	0.1	4.9	10.6	13.1	15.7	17.2	20.7
October	...	...	...	0.6	7.1	9.5	13.3	16.0	16.3
November	...	...	...	...	1.0	4.4	5.6	9.2	11.7
December	...	...	...	...	...	2.1	5.8	5.7	8.6
Year.....	1.6	25.9	57.6	77.7	108.1	131.3	149.9	162.3	171.9

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	1921.
°	°	°	°	°	°	°	°	°	°	°	°	°	
46.5	46.7	46.5	45.7	45.1	44.6	44.7	44.5	44.5	44.6	44.5	44.5	45.1	January.
43.4	44.3	44.5	43.9	42.9	41.9	41.3	40.9	40.4	40.2	39.8	39.5	40.6	February.
47.9	48.2	48.3	47.7	47.0	45.9	45.0	44.7	44.1	43.8	43.7	43.5	44.9	March.
51.7	52.3	52.6	52.3	51.3	49.7	47.9	46.4	45.2	44.2	43.5	42.7	46.3	April.
55.5	56.0	56.6	56.5	55.9	55.0	53.7	51.8	50.6	49.5	48.8	48.1	51.4	May.
62.0	61.9	62.4	62.2	61.7	60.7	59.7	58.2	56.6	55.4	54.5	53.6	57.1	June.
68.2	68.2	68.2	67.8	67.3	67.0	65.6	63.6	62.1	60.8	60.0	59.1	62.9	July.
61.3	61.4	61.2	61.1	60.8	60.0	59.5	58.6	58.1	57.7	57.3	56.5	58.4	August.
61.9	61.8	61.9	61.0	59.5	58.0	56.7	55.6	54.7	53.9	53.2	52.8	56.1	September.
60.7	60.9	60.0	58.7	57.5	56.5	55.6	55.1	54.7	54.3	54.1	53.9	55.5	October.
43.7	43.6	43.3	42.7	41.9	41.4	41.0	40.8	40.4	40.4	40.3	40.1	40.8	November.
46.1	46.4	46.1	45.7	45.4	45.1	44.9	44.7	44.6	44.6	44.3	44.1	44.5	December.
54.1	54.3	54.3	53.8	53.0	52.2	51.3	50.4	49.7	49.1	48.7	48.2	50.3	Year.

Duration of Sunshine.

1 p.m.	2 p.m.	3 p.m.	4 p.m.	5 p.m.	6 p.m.	7 p.m.	8 p.m.	MONTHLY TOTALS.	DAILY MEANS.	1921.
Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Hours.	Hours.	
6.1	8.1	4.8	0.1	...	...	...	...	35.3	1.14	January.
7.9	8.6	8.1	4.7	0.6	...	...	...	63.4	2.26	February.
9.1	11.3	11.6	7.2	4.0	...	...	...	101.3	3.27	March.
19.0	18.7	19.1	15.6	13.1	7.6	1.4	...	211.8	7.06	April.
18.9	18.4	21.8	19.8	18.8	17.6	13.2	0.9	251.5	8.11	May.
21.3	20.3	19.6	18.7	17.6	16.6	12.6	2.1	255.4	8.51	June.
18.0	17.7	17.6	16.5	16.2	15.5	10.5	1.5	237.0	7.65	July.
12.6	10.1	9.3	9.3	8.2	5.0	1.4	...	145.7	4.70	August.
22.8	20.6	19.2	17.0	10.2	1.6	...	...	173.7	5.79	September.
14.4	14.3	11.2	6.1	0.9	...	...	...	109.7	3.54	October.
9.0	6.6	6.0	1.5	...	...	...	...	55.0	1.83	November.
8.3	8.9	3.3	...	...	...	...	...	42.7	1.38	December.
167.4	163.6	151.6	116.5	89.6	63.9	39.1	4.5	1682.5	4.61†	Year.

† From the Year's Gross Total.

Diurnal Variation of the Duration (At Marsh-

1921.	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.
WHOLE YEAR.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.	Total Hours.
N.	24.5	22.0	23.0	25.0	25.0	30.0	25.0	24.0	27.5	17.5	15.5	12.5
N.E.	24.5	27.5	22.5	24.0	22.5	21.5	26.5	25.5	16.5	19.5	18.0	17.0
E.	47.0	43.0	51.0	50.0	48.5	47.0	47.5	47.5	38.5	32.5	32.0	32.0
S.E.	64.0	69.5	69.5	70.5	73.5	80.5	79.0	76.5	71.0	61.5	51.5	42.0
S.	42.0	41.5	38.0	34.0	38.0	34.5	39.0	33.0	34.5	34.5	35.5	37.0
S.W.	51.0	47.0	47.0	49.5	43.0	43.5	39.5	48.0	52.0	53.5	54.5	54.0
W.	68.0	68.0	65.5	67.0	67.0	65.0	62.0	66.0	74.5	89.0	101.0	109.0
N.W.	44.0	46.5	48.5	45.0	47.5	43.0	46.5	44.5	50.5	57.0	57.0	61.5

Diurnal Variation (At Marsh-

1921.	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	19.2	20.3	21.1	20.6	19.9	19.5	19.7	19.4	18.1	18.6	19.3	19.8
February	11.6	11.4	11.5	11.8	11.6	11.0	10.9	11.2	10.3	10.8	11.4	12.6
March	18.9	18.9	19.0	18.7	18.6	18.3	17.7	18.1	17.8	18.9	19.4	18.8
April	11.5	12.4	11.3	10.9	12.1	11.7	11.8	12.4	12.3	12.9	14.4	14.7
May	10.5	10.5	10.5	10.8	11.5	11.2	11.9	12.8	12.6	12.5	12.7	12.9
June	13.4	13.8	13.6	13.5	13.1	13.0	13.1	13.2	12.9	13.5	14.3	15.9
July	10.4	10.6	10.8	10.2	9.8	10.7	10.2	11.0	11.2	11.9	12.9	12.9
August	14.9	15.4	14.8	15.5	15.2	13.7	12.7	12.7	13.0	13.1	13.6	13.7
September	10.8	11.5	11.9	12.7	12.0	11.3	11.8	12.2	12.4	12.5	12.6	13.0
October	11.8	11.8	12.4	12.8	13.3	12.5	12.3	12.3	12.4	12.0	12.4	12.3
November	13.4	13.9	13.3	13.4	13.6	13.6	13.2	12.9	12.1	12.4	12.0	12.9
December	19.5	20.3	20.3	20.3	20.5	20.6	20.1	20.2	19.9	19.6	20.1	21.3
Year	13.8	14.2	14.2	14.3	14.3	13.9	13.8	14.0	13.8	14.1	14.6	15.1

of Winds from Different Directions.
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	TOTALS.	1921.
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.	WHOLE YEAR.
12.5	8.5	14.5	17.0	21.5	21.5	26.0	24.5	22.0	23.5	21.0	26.0	510.0	N.
16.5	20.5	15.5	14.5	18.0	22.0	20.0	20.0	23.5	23.0	21.0	23.0	503.0	N.E.
27.5	30.5	30.5	33.0	29.0	33.5	38.0	44.5	46.5	47.0	47.0	43.0	966.5	E.
41.5	35.0	34.0	37.0	36.5	41.5	41.0	41.5	47.0	52.0	61.5	65.5	1343.0	S.E.
31.5	31.0	34.5	31.0	33.0	32.5	33.0	36.0	35.0	35.5	39.5	42.0	856.0	S.
50.0	56.5	51.5	57.5	61.0	60.5	62.0	61.0	59.5	63.0	51.0	50.0	1266.0	S.W.
114.5	105.0	103.5	95.5	90.0	81.0	75.5	75.5	75.0	71.0	72.0	71.5	1932.0	W.
71.0	78.0	81.0	79.5	76.0	72.5	69.5	62.0	56.5	50.0	52.0	44.0	1383.5	N.W.

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.		1921.
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.	Metres per Second.	
20.3	20.5	19.8	19.3	18.6	18.5	18.8	18.9	18.5	18.9	19.6	19.0	19.4	8.7	Jan.
18.3	12.3	12.8	11.8	12.0	11.4	10.9	10.9	11.2	11.2	11.5	11.5	11.5	5.1	Feb.
19.0	19.1	19.4	19.1	18.3	17.4	17.5	18.2	16.6	16.5	17.6	18.5	18.3	8.2	Mar.
15.5	15.7	16.2	16.2	16.2	15.3	13.3	12.2	11.3	11.9	12.2	12.0	13.2	5.9	Apr.
13.5	13.5	12.8	13.5	13.5	12.6	12.0	11.2	10.9	10.4	10.3	10.2	11.9	5.3	May.
16.6	16.1	16.6	17.0	16.7	16.8	15.7	15.3	14.4	14.2	14.3	14.2	14.6	6.5	June.
13.3	13.9	13.8	14.4	14.0	13.3	12.5	11.6	11.0	10.3	9.8	9.5	11.7	5.2	July.
15.1	15.3	14.6	14.5	14.0	14.4	14.7	14.3	13.9	13.7	14.2	14.5	14.2	6.3	Aug.
13.5	13.8	13.8	13.3	13.4	12.3	11.4	10.4	10.6	10.7	10.7	10.6	12.1	5.4	Sep.
13.2	13.5	13.0	12.5	12.1	12.3	12.3	12.0	11.6	12.0	12.5	12.7	12.4	5.5	Oct.
13.5	13.3	12.6	12.4	11.9	11.5	11.6	12.3	12.5	12.6	12.6	12.1	12.7	5.7	Nov.
21.9	21.9	21.4	21.3	21.1	20.8	20.0	19.5	19.5	20.6	20.2	19.9	20.5	9.2	Dec.
15.7	15.7	15.6	15.4	15.2	14.7	14.2	13.9	13.5	13.6	13.8	13.7	14.4	6.4	Year.

Diurnal Variation of 1 foot 6 inches

1921.	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	5.2	4.1	4.9	5.4	3.0	4.2	4.4	3.4	2.2	3.7	5.0	5.1
February	1.7	0.7	1.0	0.7	0.8	0.9	1.0	1.4	1.0	0.0	0.0	0.0
March	2.4	1.9	1.7	2.4	2.4	4.2	3.7	4.1	1.3	2.4	2.5	2.5
April	1.4	2.2	1.2	1.9	1.9	0.5	1.9	2.0	1.7	2.0	1.5	1.0
May	2.1	3.6	3.4	3.0	4.6	1.2	1.0	1.2	0.4	1.1	2.6	0.5
June	0.0	0.6	0.4	1.5	1.7	0.9	1.1	2.0	0.7	1.7	1.0	0.0
July	1.4	1.1	0.4	0.9	1.5	1.0	1.3	1.1	1.0	0.4	0.9	0.5
August	2.8	3.3	3.3	6.3	3.0	1.3	1.9	2.3	2.0	3.5	1.8	2.7
September	2.7	2.0	2.0	1.2	1.4	1.4	0.8	0.7	1.3	1.0	0.5	0.8
October	2.2	2.3	3.2	1.1	2.3	2.7	1.8	2.2	3.5	3.5	1.8	1.8
November	3.8	3.1	3.8	3.4	3.7	2.9	3.8	4.0	3.0	4.5	3.0	1.0
December	4.2	3.3	5.8	4.1	6.0	4.2	3.9	1.8	1.9	3.2	4.4	4.5
Year	29.9	28.2	31.1	31.9	32.3	25.4	26.6	26.2	20.0	27.0	25.0	20.4

Diurnal Variation of 1 foot 6 inches

1921.	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 Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches
January	.26	.17	.20	.24	.06	.19	.06	.04	.07	.17	.19	.28
February	.06	.10	.04	.03	.01	.01	.02	.03	.01	.00	.00	.00
March	.12	.06	.08	.05	.06	.14	.13	.06	.05	.05	.04	.07
April	.02	.11	.03	.10	.10	.02	.02	.04	.01	.03	.05	.05
May	.11	.10	.04	.09	.17	.04	.06	.02	.00	.03	.06	.09
June	.00	.01	.00	.02	.14	.01	.03	.10	.01	.03	.05	.00
July	.06	.02	.02	.04	.03	.02	.02	.06	.05	.01	.02	.01
August	.17	.12	.18	.32	.10	.07	.03	.08	.27	.14	.05	.06
September	.20	.14	.14	.03	.11	.04	.01	.08	.12	.13	.09	.08
October	.15	.08	.06	.01	.03	.10	.17	.09	.23	.16	.06	.06
November	.08	.03	.07	.15	.15	.10	.14	.24	.25	.21	.12	.03
December	.29	.26	.46	.25	.33	.15	.11	.05	.06	.07	.08	.15
Year	1.52	1.25	1.32	1.33	1.29	0.89	0.80	0.89	1.13	1.03	0.81	0.88

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.	1921.
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.	
4.1	3.6	3.5	5.3	6.6	5.1	4.5	4.0	3.7	4.9	4.7	6.0	106.6	Jan.
0.0	0.0	0.0	0.2	0.6	0.1	0.0	0.0	0.0	0.3	1.2	1.6	13.2	Feb.
3.1	1.8	2.6	3.9	5.7	6.9	5.6	6.7	5.2	4.6	4.2	2.4	84.2	Mar.
0.5	1.2	1.0	1.0	1.3	1.5	1.7	2.2	3.0	2.5	2.1	1.7	38.9	April.
0.5	1.3	0.7	1.3	1.7	2.4	3.1	2.1	2.6	2.2	2.0	1.8	46.4	May.
1.0	0.5	0.0	0.1	0.0	0.8	0.3	0.0	0.2	0.0	0.7	0.5	15.7	June.
1.3	2.1	1.2	1.6	0.9	1.3	0.6	1.2	1.2	1.4	2.4	2.4	29.1	July.
4.0	5.2	6.6	5.3	4.7	5.6	4.1	4.8	3.3	3.0	2.6	2.6	86.0	Aug.
0.0	0.0	0.0	0.5	0.3	1.6	2.1	2.1	1.6	1.7	3.3	2.6	31.6	Sept.
2.8	3.3	1.5	0.3	0.9	1.4	1.3	2.3	2.1	2.2	2.0	1.0	49.5	Oct.
1.8	2.1	2.0	0.2	0.9	2.2	4.1	4.1	3.4	2.2	1.2	3.1	67.3	Nov.
3.0	3.6	3.1	2.1	2.1	2.5	2.6	3.9	3.6	2.6	3.8	3.5	83.7	Dec.
22.1	24.7	22.2	21.8	25.7	31.4	30.0	33.4	29.9	27.6	30.2	29.2	652.2	Year.

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	TOTALS.	1921.
Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Total Inches	Inches.	
.14	.11	.12	.24	.40	.25	.17	.17	.12	.24	.14	.22	4.25	Jan.
.00	.00	.00	.00	.01	.00	.00	.00	.00	.02	.02	.03	0.39	Feb.
.08	.05	.12	.11	.19	.22	.28	.30	.23	.11	.11	.06	2.77	Mar.
.03	.04	.08	.09	.12	.06	.06	.09	.12	.05	.06	.04	1.42	April.
.02	.07	.03	.04	.07	.15	.06	.04	.09	.03	.04	.05	1.50	May.
.03	.01	.00	.00	.00	.02	.00	.00	.00	.00	.01	.01	0.48	June.
.02	.07	.12	.09	.26	.17	.03	.02	.10	.14	.20	.11	1.69	July.
.21	.35	.29	.19	.21	.32	.26	.68	.12	.25	.15	.16	4.78	Aug.
.00	.00	.00	.01	.01	.06	.18	.14	.04	.11	.13	.11	1.96	Sept.
.18	.35	.19	.01	.09	.05	.03	.24	.11	.08	.11	.05	2.69	Oct.
.10	.11	.02	.00	.00	.03	.09	.17	.18	.13	.06	.25	2.76	Nov.
.07	.07	.12	.14	.06	.07	.10	.12	.15	.22	.28	.21	3.87	Dec.
0.88	1.23	1.09	0.92	1.42	1.40	1.26	1.97	1.26	1.38	1.31	1.30	28.56	Year.

Atmospheric Pollution.

Total Deposit of Each Element of Pollution, expressed in Metric Tons per Square Kilometre.
(All columns, except the two concluding ones, refer to *Hesketh Park*.)

1921.	Rainfall (Per Pollu- tion Gauge.) In Milli- metres.	Insoluble Matter.			Soluble Matter.		TOTAL SOLIDS.	Included in Soluble Matter.			WOODVALE MOSS.	
		Tar.	Carbon- aceous, other than Tar.	Ash.	Loss on Ignition	Ash.		Sulph- ate, as (SO ₃).	Chlo- rine. (Cl).	Ammo- nia. (NH ₃).	Rainfall (per P. Gauge.) In Milli- metres.	Pollu- tion. — Total Solids.
January.....	105	0·11	0·68	0·80	1·84	4·74	8·13	1·45	1·37	0·02	82	8·34
February	7	0·00	0·17	0·20	0·22	0·40	0·99	0·18	0·10	0·00	18	1·99
March	70	0·03	0·29	0·45	1·58	1·62	3·97	0·41	1·12	0·00	59	3·23
April	35	0·05	0·53	0·89	0·97	2·11	4·55	0·22	1·02	0·02	31	3·49
May	38	0·05	0·62	0·75	2·11	3·88	7·36	0·30	1·94	0·03	37	2·24
June	13	0·04	0·62	1·10	1·63	3·00	6·37	0·14	1·57	0·02	14	5·81
July	45	0·06	0·84	1·21	2·78	4·46	9·35	0·49	2·14	0·07	32	7·87
August	123	0·06	0·80	0·75	3·37	5·52	10·50	0·84	1·60	0·09	119	15·55
September.....	46	0·03	0·22	0·29	1·71	3·08	5·33	0·46	1·37	0·04	40	8·65
October	72	0·04	0·58	0·62	1·79	3·05	6·08	0·70	0·93	0·04	67	6·21
November	66	0·05	0·46	0·29	1·97	1·97	4·73	0·98	0·59	0·01	55	3·92
December	98	0·12	0·79	0·61	2·44	4·40	8·37	1·00	1·95	0·03	72	7·61
Year	718	0·64	6·55	7·96	22·41	38·18	75·73	7·12	15·70	0·37	626	74·91

Atmospheric Pollution.—Comparative Statistics.

Monthly Means, at various Places, for the Year April, 1921, to March, 1922.
In Metric Tons per Square Kilometre.

STATIONS.	Rainfall, (Per Pollution Gauge.) In Milli- metres.	Insoluble Matter.			Soluble Matter.		TOTAL SOLIDS.	Included in Soluble Matter.		
		Tar.	Carbon- aceous, other than Tar.	Ash.	Loss on Ignition.	Ash.		Sulphate, as (SO ₃).	Chlorine. (Cl).	Ammonia. (NH ₃).
Southport:—										
Hesketh Park	62	0·07	0·65	0·75	1·92	3·33	6·64	0·68	1·26	0·03
Woodvale Moss	58	*	*	*	*	*	6·24	*	*	*
Glasgow:—										
Mean of 7 Stations	67	0·11	1·19	2·67	1·70	2·62	8·29	1·12	0·65	0·14
Newcastle-on-Tyne ...	48	0·28	4·70	8·39	1·42	2·99	17·72	1·33	0·29	0·12
Hull.....	41	0·07	2·67	4·61	1·55	4·45	13·34	1·90	0·58	0·11
St. Helens	60	0·16	2·15	5·13	1·75	3·42	12·60	1·15	1·01	0·04
Liverpool.....	62	0·14	3·43	9·14	1·95	3·61	18·26	1·74	0·73	0·17
Malvern Hills.....	45	*	0·15	0·31	0·49	1·31	2·26	0·62	0·12	0·02
Rothamsted	39	*	0·76	1·41	1·46	2·38	6·01	*	*	*
London:—										
Meteorological Office.	30	0·17	1·67	3·72	1·23	1·75	8·54	0·62	0·82	0·08
Mean of 7 other St'ns.	31	0·12	2·03	4·01	1·23	1·96	9·34	0·83	0·63	0·13

* Not determined.

Climatology.—Comparative Statistics for the Year 1921.

(Compiled exclusively from Meteorological Office data.)

STATIONS.		MEAN TEMPERATURE.			Mean Daily Range of Temp.	TOTAL RAINFALL.		Number of Days with 1 mm or more of Rain.	TOTAL SUN- SHINE.
		The Year.	January and February	July and August.		(In both British and Metric Units.)			
		°	°	°	°	INCHES.	MILLI- METRES.	DAYS.	HOURS.
Southport		50.5	42.9	61.0	10.8†	28.65	728	126	1683
Large Towns:—									
England.	York	50.8	42.5	62.0	14.3	16.01	406	99	1449
	Bradford	49.5	41.7	60.7	13.0	26.72	678	118	1356
	Burnley	48.9	41.4	59.9	13.8	37.35	949	138	1361
	Hull.....	51.1	42.9	62.3	14.8	16.39	417	95	1294
	Huddersfield	50.2	42.1	61.7	13.5	28.66	728	127	1387
	Bolton	50.4	42.4	61.6	13.3	39.02	990	148	1247
	Manchester (Oldham Road) ...	51.8	43.2	63.4	12.7	28.59	727	137	1231
	„ (Whitworth Park) ...	51.4	43.3	62.6	14.0	25.70	655	128	1230
	Sheffield	51.0	42.8	62.3	13.0	22.77	579	108	1513
	Nottingham	51.3	42.4	63.6	14.7†	18.17	462	100	1537
	Norwich	51.5	42.9	64.4	15.0	15.71	399	93	1800
	Birmingham	51.1	42.6	63.0	14.1	17.93	456	95	1437
Wales.	London (Westminster)	53.8	45.0	66.7	15.4	12.40	317	72	1588
	Southampton	52.7	43.4	64.3	16.2	15.96	408	88	1858
	Swansea	53.4	45.0	64.0	12.6	34.07	867	141	1705
	Cardiff.....	52.0	43.8	63.4	13.9	25.94	659	125	1828
Notable Stations:—									
Scotland.	Aberdeen Observatory	48.1	41.6	56.4	10.7‡	16.67	425	110	1471
	Edinburgh (Royal Obs.).....	48.5	41.7	57.6	11.7	24.74	630	110	1545
	Paisley (Coats Obs.)	49.7	42.0	59.4	12.6	48.67	1235	161	1368
	Eskdalemuir Magnetic Obs.	45.7	38.6	55.5	14.8	60.01	1526	181	1350
England.	Lancaster (Gregg Obs.).....	50.3	42.4	60.7	12.2	41.25	1048	150	1450
	Stonyhurst College Obs.....	49.9	42.5	60.8	12.1	48.62	1234	159	1483
	Bidston Observatory	50.9	43.7	61.2	11.0	22.47	571	118	1586
	Hodsock Priory	51.2	42.6	63.3	18.1	16.53	423	86	1459
	Cambridge Botanic Garden	51.5	42.9	64.3	18.1	12.12	308	75	1792
	Rothamsted Agric'l. Exp. Sta	50.4	42.0	63.0	15.9	14.92	378	79	1723
	Oxford (Radcliffe Obs.)	52.0	43.3	64.6	16.2	14.95	380	80	1753
	Benson Aerological Obs. ...	51.1	42.3	64.1	18.6†	13.40	343	80	...
	Camden Sq., N.W. (B.R.O.)	53.6	43.6	67.3	17.6	14.59	370	80	...
	Greenwich (Royal Obs.).....	52.7	43.5	66.2	18.0	12.57	318	80	1761
	Richmond (Kew Obs.)	52.5	43.8	65.6	15.4‡	12.14	309	69	1669
Ireland.	S. Farnboro' Aviation M.O.	51.5	42.0	64.1	19.3†	12.76	325	72	1800
	Armagh Observatory	50.3	43.7	59.7	13.4	28.48	722	148	1313
	Dublin (City) *	52.1	45.5	61.2	11.1	22.74	578	120	1492
	Cahiriveen (Valencia Obs.)	52.6	46.8	60.6	9.0‡	46.15	1172	168	1395

* The Sunshine statistics are for Phoenix Park.

† From day-max. and night-min. (from March or April), instead of from extremes for 24 hours as elsewhere.

‡ From instruments in North-Wall Screens. That at Aberdeen is also 41 feet above the ground.

|| From instruments exposed in Glaisher's, and Airy's, instead of Stevenson's, Screens.

Comparative Statistics for the Year 1921—continued.

(Compiled exclusively from Meteorological Office data.)

STATIONS.		MEAN TEMPERATURE.			Mean Daily Range of Temp.	TOTAL RAINFALL.		Number of Days with 1 mm. or more of Rain.	TOTAL SUN- SHINE.
		The Year.	January and February.	July and August.		(In both British and Metric Units).			
		°	°	°	°	INCHES.	MILLI- METRES.	DAYS.	HOURS.
Southport		50.5	42.9	61.0	10.8†	28.65	728	126	1683
Other Health Resorts:—									
Scotland.	Banff	47.9	41.3	56.5	12.0†	21.23	539	143	1443
	Nairn	47.3	40.2	56.9	13.7†	20.99	535	128	1447
	Fortrose	47.9	41.3	56.7	12.0	19.34	490	115	1428
	Montrose	47.8	41.0	56.8	12.4†	18.03	458	103	1572
	Carnoustie	48.3	41.3	57.2	12.4	20.28	514	100	1613
	St. Andrews	48.4	41.2	57.6	13.9†	22.41	570	115	1596
	Oban	48.9	42.5	57.6	10.4†	56.69	1441	219	1113
	Helensburgh	49.3	40.9	58.4	13.4	61.93	1573	198	1253
	Rothsay	48.5	42.1	57.0	11.2	57.61	1465	212	1260
Eng. N.E.	Whitby	50.6	43.2	59.7	13.5	17.85	454	91	1512
	Scarborough	51.4	43.8	60.9	11.4†	18.72	475	97	1560
	Bridlington	49.2	41.6	59.6	14.0	18.95	481	94	1543
	Skegness	50.7	43.0	61.7	12.0†	14.70	375	84	1850
Eng. N.W.	Keswick	49.9	42.7	59.6	13.8	53.66	1363	160	...
	Morecambe	50.9	42.5	61.9	11.1†	33.35	849	140	1682
	Blackpool	50.7	43.3	61.0	10.9†	29.68	753	134	1661
	Hoylake	51.4	44.4	61.4	13.3	24.92	633	120	1687
I.O.M.	Douglas	50.2	43.9	58.8	9.4†	39.84	1014	146	1576
Wales.	Rhyl	50.9	44.0	60.6	12.2†	20.77	527	111	1632
	Colwyn Bay	51.6	44.8	61.2	10.9†	24.25	614	121	1715
	Llandudno	51.5	45.1	61.1	11.0†	25.05	636	119	1657
	Aberdovey	52.9	45.4	63.1	10.6	33.00	838	136	1701
	Aberystwyth	51.8	44.6	61.9	9.9†	26.58	676	122	1729
	Tenby	52.4	45.4	62.1	12.5†	29.72	754	125	1790
Midlands.	Harrogate	48.9	41.1	59.6	13.4†	23.59	599	111	1546
	Buxton	47.7	39.7	59.0	13.0	36.98	940	142	1443
	Leamington Spa	50.9	42.8	63.0	16.8†	15.30	389	90	1632
	Malvern	52.0	43.5	63.9	13.3†	18.53	469	94	1773
	Cheltenham	52.2	43.7	64.5	15.6	15.57	393	86	1718
	Ross-on-Wye	51.7	43.4	63.8	16.5†	16.24	414	88	1720
	Clifton	52.2	43.7	64.5	14.6	24.09	612	112	1890
	Bath	52.4	44.3	64.4	15.7†	17.29	439	99	1615

† From day-maximum and night-minimum temperatures (from March or April, 1921); instead of from extremes for 24 hours, as elsewhere.

Comparative Statistics for the Year 1921—continued.

(Compiled exclusively from Meteorological Office data.)

STATIONS.		MEAN TEMPERATURE.			Mean Daily Range of Temp.	TOTAL RAINFALL.		Number of Days with 1 mm. or more of Rain.	TOTAL SUN- SHINE
		The Year.	January and February	July and August.		(In both British and Metric Units.)			
Health Resorts (continued):—		o	o	o	o	INCHES.	MILLI- METRES.	DAYS.	HOURS.
England, E.	Cromer	50.8	42.4	62.4	14.1	12.68	323	71	1803
	Yarmouth	51.2	43.0	62.6	11.3†	14.91	378	76	1969
	Felixstowe Beach	51.5	43.4	63.4	11.8†	12.28	312	71	2027
	Claeton-on-Sea	51.9	43.1	63.8	11.1†	11.21	285	63	1946
	Southend-on-Sea	52.7	43.3	66.0	14.4†	10.65	271	62	1893
England, S.E.	Tunbridge Wells.....	51.8	43.3	63.9	16.4†	16.45	419	80	1798
	Margate	52.8	44.9	64.6	10.1†	9.28	236	60	1800
	Ramsgate	51.7	43.1	63.6	11.7	10.93	278	68	2005
	Folkestone	52.5	44.2	63.7	12.8†	12.96	330	76	1948
	St. Leonards-on-Sea	52.6	44.1	64.1	11.2†	14.19	362	82	2048
	Eastbourne	52.6	44.1	63.6	11.6†	15.79	401	85	2067
	Brighton	52.9	44.5	64.0	11.7†	14.97	381	75	1942
	Worthing.....	52.6	44.1	64.2	12.4†	13.28	340	65	2102
	Littlehampton.....	52.0	43.6	63.3	12.6†	12.57	318	67	1945
	Bognor.....	52.6	44.1	63.6	12.1	15.24	388	78	2006
	Selsey Bill ..	53.1	44.6	64.3	14.5	16.34	416	86	2026
	Southsea	53.7	44.9	65.1	12.9†	14.23	362	77	2065
I.O.Wight.	Bournemouth	52.5	44.3	63.5	15.0	17.64	449	91	1970
	Ryde	52.6	44.8	63.7	13.1	17.99	458	87	1907
	Sandown.....	53.6	45.2	64.4	12.6	18.75	476	93	1992
	Ventnor	53.9	45.2	64.5	11.3	17.56	446	85	1945
England, S.W.	Totland Bay	52.9	44.6	63.5	11.8	15.86	404	78	1989
	Weston-super-Mare	53.2	44.7	65.0	13.3†	19.96	506	109	1752
	Ilfracombe	53.8	46.8	63.4	8.6†	25.31	644	122	1821
	Bude	52.8	46.0	62.5	12.8†	23.87	607	128	1871
	Newquay.....	52.7	45.6	62.3	9.4†	22.15	564	123	1858
	Weymouth	54.4	45.7	65.0	14.3†	15.89	405	93	1936
	Exmouth.....	53.3	45.2	63.6	13.5	14.59	369	91	1839
	Teignmouth	53.9	46.2	63.9	12.1†	18.10	461	89	1848
	Torquay	54.4	46.7	64.1	11.5†	20.77	529	93	2006
	Paignton	53.3	45.9	63.2	13.9†	19.37	493	101	1891
	Salcombe.....	54.1	47.4	63.2	14.1	22.31	567	105	2034
	Plymouth	53.8	46.5	63.1	12.3	20.70	526	122	1868
	Fowey.....	?	46.0	?	?	18.99	481	128	1845
	Falmouth	53.5	45.9	63.1	11.2†	28.90	735	129	1825
	Penzance.....	54.5	47.4	63.5	10.1†	28.87	734	137	1834
Channel Isles.	Scilly Isles (St. Mary's).....	54.5	48.3	63.0	8.3†	21.62	548	116	1804
	Guernsey (Grange)	54.0	45.9	63.6	10.6	17.66	449	93	2174
	Jersey (St. Aubin's)*.....	54.6	46.0	64.9	10.8†	15.88	404	95	2089

* The Sunshine statistics are for St. Helier's.

† From day-max. and night-min. (from March or April), instead of from extremes for 24 hours as elsewhere.

APPENDIX.

Rainfall at Southport under Different Wind Directions.

Averages for the 10 years, 1912-21.

	AMOUNT OF RAINFALL.								DURATION OF RAINFALL.							
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
	INS.	INS.	INS.	INS.	INS.	INS.	INS.	INS.	HRS.	HRS.	HRS.	HRS.	HRS.	HRS.	HRS.	HRS.
Jan. ...	·10	·09	·25	·71	·61	·67	·47	·23	3·2	2·9	7·7	20·1	14·4	15·7	11·0	5·6
Feb. ...	·07	·05	·14	·45	·48	·42	·21	·05	2·1	3·1	4·1	12·8	11·0	11·2	5·7	1·6
March.	·13	·31	·27	·47	·64	·64	·39	·19	3·9	7·3	7·0	14·1	16·1	16·3	8·9	4·9
April ..	·07	·06	·15	·33	·49	·28	·35	·16	2·9	2·7	4·0	7·6	9·6	6·9	11·1	5·4
May ...	·08	·22	·40	·37	·27	·40	·29	·22	1·7	7·1	10·1	8·8	6·0	9·3	9·0	5·9
June ..	·12	·14	·18	·26	·36	·45	·34	·16	2·4	2·6	4·0	4·6	5·9	7·0	6·7	3·1
July ...	·25	·15	·31	·43	·33	·50	·45	·25	4·5	2·7	4·8	9·1	6·1	6·8	7·6	5·1
Aug....	·18	·23	·28	·66	·81	·46	·54	·26	3·7	2·9	6·0	13·0	13·7	8·3	9·9	3·0
Sept. ...	·13	·18	·32	·40	·65	·49	·59	·20	1·8	3·3	6·3	7·6	10·1	7·6	11·1	3·1
Oct. ...	·08	·15	·35	·67	·77	·56	·45	·25	2·4	3·4	7·9	12·1	11·1	8·6	6·5	4·0
Nov....	·05	·14	·20	·46	·53	·63	·45	·12	1·6	4·1	5·2	12·5	10·6	12·8	8·8	2·3
Dec....	·10	·10	·35	·83	·85	·74	·55	·22	2·1	3·2	9·1	19·4	17·3	17·2	13·6	4·7
Year...	1·36	1·82	3·20	6·04	6·79	6·24	5·08	2·31	32·3	45·3	76·2	141·7	131·9	127·7	109·9	48·7
Year...	Intensity of Rainfall (Rate per Raining Hour.)								Raining Hours per cent. of Total Hours of each Wind.							
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.	%	%	%	%	%	%	%	%
Year...	·042	·040	·042	·043	·051	·049	·046	·047	5·7	7·3	7·1	9·8	13·4	10·9	6·3	4·2

Comparison between the West and East Coasts of Northern England.

AVERAGES FOR YEAR.	Amount of Rainfall per Hour's Duration of each Wind.							
	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
	IN.	IN.	IN.	IN.	IN.	IN.	IN.	IN.
Southport	·0024	·0029	·0030	·0042	·0069	·0053	·0029	·0020
Sunderland*	·0051	·0050	·0051	·0046	·0028	·0017	·0010	·0041

* Publications of West Hendon House Observatory, Sunderland, No. IV., p. 81.