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Visibility on Cloudy Nights.

By CAPT. WILLIAM H. PICK, B.Sc.

THE visibility at night is at present determined either by making use of distant lights as equivalents to the objects for the determination of visibility during the day, or just by estimation without the aid of any objects at all.

In practice, the first method is found of little avail, as a meteorological station, even in the neighbourhood of towns, is indeed fortunate to find lights of any sort at the various distances required by the visibility scale ; and even if the lights be there, exactly positioned, they naturally vary in intensity according to their type. For meteorological stations in rural situations lights do not exist at all. The method of simple estimation is thus left as the sole means of determining night visibility ; and its great drawback is that it calls for a large amount of experience on the part of the observer, an experience which is not always available.

The following experimental method of determining night visibility is proposed as an attempt to overcome the difficulties put forward. It is the Grease Spot Photometer of Bunsen calibrated in accordance with the visibility scale at present used at the distributive stations of the Meteorological Office.

The grease spot is made by allowing a drop or two of molten grease to fall from a lighted candle upon the centre of a sheet of ordinary writing paper, and then pressing the

grease into the paper by the aid of a hot knife blade. The sheet of paper is mounted into a suitable support and the photometer is ready. The only other apparatus required is a candle lantern and a tape measure. The candle carried in the lantern should be for the greatest exactitude a sperm standard one, as used in laboratory photometric determinations; these, however, are expensive, and in ordinary practice a household candle is sufficiently accurate.

The Grease Spot Photometer is set up with its spot at the height of the observer's eye, and the candle lantern at a fixed distance behind the spot and in the same horizontal line as the spot. The observer then walks away from the spot, keeping in the same straight line as the spot and candle, but on the side of the spot remote from the candle. He faces the spot and notices the exact position at which the spot of grease becomes indistinguishable from the paper. The distance between the position of indistinguishability and the spot is then measured. The process of measurement is much facilitated if a permanent marking in feet be laid down on the ground by means of white marks or by a knotted line.

Once such a distance has been obtained for one accurately estimated visibility, the other distances may be calculated from that one. But, clearly, everything depends upon the distance of the candle from the spot. For each such distance of candle from spot a different standard of distance of indistinguishability for the same visibility is obtained, and hence a whole series of tables of other values.

It is recommended that two tables be prepared, one with the candle 10 to 15 feet behind the spot to serve for visibilities of 4 and upward, and the other with the candle 2 to 3 feet behind the spot to serve for the lower visibilities.

To construct the table below the candle was placed 15 feet behind the spot, and it was found that the distance of indistinguishability was 40 feet when an accurate estimate of visibility was 16,000 metres. The other distances of indistinguishability are calculated in accordance with the following:—

Let x be the distance of indistinguishability required for a visibility of 7,000 metres.

Then, as a distance of 40 feet corresponds with a visibility of 16,000 metres, we have

$$\frac{x^2}{40^2} = \frac{7000^2}{16000^2}$$

giving the photometric distance of distinguishability of the grease spot as 17·5 feet for a visibility of 7,000 metres.

Working out similarly for the various distances, the visibility scale comes out as in the following Table :—

Description.	Specification.			Distance of Indistinguishability in Feet.
X	Objects visible at	0 but not at	25 metres	< 10
A	" "	25	50	
B	" "	50	100	
C	" "	100	200	
D	" "	200	500	
E	" "	500	1,000	
F	" "	1,000	2,000	
G	" "	2,000	4,000	
H	" "	4,000	7,000	
I	" "	7,000	12,000	
J	" "	12,000	20,000	10-17.5
K	" "	20,000	30,000	17.5-30
L	" "	30,000 and above	-	30-50
Exceptional.	Exceptional visibility.			50-75
				> 75

This table has been confirmed by the various experiments which have been carried out at night, the distance of indistinguishability found for the estimated visibility falling in each case within the theoretical limits as shown by the table.

Visibility is generally good at Cranwell and there has been no opportunity to calibrate the apparatus for the lower part of the scale with the candle at the nearer distance.

The method is only applicable on moonless and cloudy or overcast nights; but it is just on such nights that the ordinary methods of simple estimation fail.

The cheapness of the apparatus and the fact that it can be made in a few minutes at any station are advantages; and it can be fixed up permanently on two stands by providing the lantern and the photometer with waterproof covers. The distances may be also marked out either as distances or directly as visibilities by using a cord stretched on the ground as a permanent feature and carrying labels at the various intervals.

[The correspondence of the letters X, A, B, &c., with Code V for Surface Visibility and Fog of the "Convention relating to International Air Navigation," 1919 (Cmd. 266), is as follows :—

X	A	B	C	D	E	F	G	H	I	J	K	L
8f	7f	6f	5f	4f	1v	2v	3v	4v	5v	6v	7v	8v.—Ed. M.M.]
ov					3f		2f		1f			

OFFICIAL NOTICES.

Issue of Meteorological Reports by Wireless Telegraphy.

FROM June 1st, 1920, general inferences based upon the 7 h. and 18 h. charts have been issued from the Air Ministry Wireless Station in plain language at 9 h. 15 m. and 20 h. G.M.T. on a wave length of 1,400 metres (C.W.). The synoptic report in code which was previously issued at 9 h. 15 m. is now being issued at 8 h. 45 m. G.M.T.; the synoptic reports issued at 3 h. 15 m. and 20 h. 15 m. G.M.T. continue as before.

The issue of synoptic reports from Aberdeen Wireless Station is made at 2 h. 30 m. and 14 h. 30 m. G.M.T. on a wave length of 3,300 (C.W.).

From August 2nd, 1920, the code for the Collective Weather Reports for London and England, S.E., has been slightly modified. Particulars will be found in the revised copy of the M.O. Form 2622.

Official Publications.

Geophysical Memoirs No. 16. Aids to Forecasting Types of Pressure Distribution, with Notes and Tables for the fourteen years 1905-1918. By Lt.-Col. E. Gold, M.A., F.R.S., D.S.O. Price 2s. 6d.—The objects of this memoir are indicated in the following extract from the Preface:—

“At the present stage of the science and practice of forecasting, the forecaster who is confronted with a meteorological situation which is at all doubtful feels the need for reference to some previous situations of a similar character, so that he may see what developments occurred. . . . Experience is very largely conscious, or sub-conscious, memory of types or of decisive factors in the charts; and to a certain degree the value of experience increases with its length; but it is not possible for every forecaster to have had long experience, and, even if it were, the human mind is limited and retains by no means all the impressions which the daily charts produce upon it.

“Some classification, therefore, of the charts for preceding years is practically essential, both for the forecaster who is learning his job and for the experienced forecaster who wishes to make progress in accuracy and in length of time to which his forecasts can extend.”

The classification adopted is based on fifteen types of pressure distribution with a number of sub-types, and the morning chart for each day in the period 1905-1918 has been allotted to its appropriate class. A second table shows all occasions on which each type occurred in the several months.

As an example of the use of the tables it may be noted that Type IXA, an anticyclone beyond the Hebrides and a "low" over Flanders occurred in August on nine occasions. It persisted for the first three days of August 1917, at the beginning of the battle of Ypres, when there was heavy rain in the area north of Arras. On this occasion, as in somewhat similar circumstances in 1911, the following type was No. XIII with areas of low pressure forming over the British Isles. On two other occasions the depression moved northwards, whereas on three others the depression filled up. Discrimination between the causes of these movements is not attempted in the Memoir, but it will be seen that the problem to be solved by the forecaster is more clearly defined than hitherto, and that must be regarded as a considerable step forward in such an empirical science.

Professional Notes No. 8. Temperatures and Humidities in the Upper Air conditions favourable for thunderstorm development, and Temperatures over Land and Sea. By Capt. C. K. M. Douglas. Price 2s. net.—The observations recorded in this note were made by pilots of "Meteor Flight" stationed at Berck in N.E. France during the last year of the War. The work of these pilots, and especially of Captain Douglas, is already well known through the beautiful series of photographs of clouds which has been published.

The first part of the note is devoted to a discussion of the conditions favourable to the development of thunderstorms. The thunderstorms of 1918 are grouped in three classes:—

- (a) Those due mainly to heated surface air in fine sunny weather.
- (b) Those associated with powerful upper currents from S.W., the surface wind being light and variable or south-easterly.
- (c) Those associated with low temperature aloft on the south of cyclonic depressions.

The storms of classes (b) and (c) may occur by night, whereas those of class (a) are likely to be in the afternoon. The principal distinction between classes (b) and (c) is that in the latter case the westerly current prevails at the surface as well as above. Full details of the distribution of temperature and humidity before and after storms of all three classes are set out in the note.

It is of some interest, however, to note that the principal storms which occurred in this country in May and June of the present year were associated with currents from S.E., and do not appear to fall in any of Captain Douglas's classes.

The concluding pages of the note are devoted to temperatures over land and sea, and provide useful material for the discussion of land and sea breezes.

Correspondence.

To the *Editors*, "*Meteorological Magazine*."

Black Rain in Devonshire.

ON June 16th 0·03 in. of rain fell here which was perfectly black, though we are some hundreds of miles from the nearest manufacturing town. On the 17th there occurred a great darkness at about 18 h. 30 m. G.M.T. and at 18 h. 55 m. very heavy rain commenced to fall. On measuring at 20 h. 25 m. I found 1·23 ins. in the gauge, and at 9 h. next day the rainfall totalled up to 1·70 ins.

The points to observe are (1) the fall was quite local, the totals on that day being 0·96 in. at Manaton (only 4 miles away) and only 0·02 in. at Ipplepen (Newton Abbot) about 12 miles distant, (2) during the first 60 minutes rain must have fallen at the rate of one inch per hour. For more than half-an-hour the water descended like a solid wall, paths having ruts scored in them and plants being damaged, (3) notwithstanding the volume of water, it was still black and dirty, like the insignificant quantity of the day before, (4) the wind, which had been E. or S.E. for the previous week, became N.W. during the storm, (5) no lightning or thunder was observed.

D. W. HORNER, F.R.Met. Soc.

Moretonhampstead, Devon, July 6th, 1920.

A Local Katabatic Current.

DURING weather experienced in the northern sector of anti-cyclones during the spring and summer months I have repeatedly noticed a tendency of the wind at nightfall in this district to cease to blow from a westerly point and to become a light air from south-east. This continues throughout the night and may attain a force of about 5 miles per hour. About 7 h. G.M.T. on the morning following the wind begins to veer and by 8 h. it is usually back at about south-west, at the same time freshening to about its normal diurnal velocity of force 4.

Is it possible that this south-easterly current is a katabatic flow from off the tableland of the Peak District, distant about 20 miles away in an E.S.E. direction?

It would be interesting to learn if any observers to the west of this district experience similar phenomena.

FRANK EDWARDS.

95, Clarendon Road, Whalley Range, Manchester, 13th July 1920.

Apparent Cirrus below Stratus.

THIS effect is often present as a mere optical illusion. I had an excellent example of it when reading the instruments here on July 19th at 9 h. G.M.T. The sky was partly covered with drifting masses of cloud, which it was difficult to classify, as they seemed low for cumulus and high for stratus. Some of these were large and dense, approaching cumulus in appearance, others thin, fleecy and transparent. They were drifting rapidly from S.W. to N.E. In the clear intervals could be seen numerous bright wisps and threads of true cirrus, which *appeared* to be moving in the opposite direction. Alignment with the points of the lightning-rod on the Observatory dome, however, showed that they had no motion perceptible in several minutes watching. Now, when masses of the thin drifting lower cloud passed over these, the illusion that the cirrus threads were much below the stratus was so persistent that it was very difficult to dispel. It was only by patient watching for a considerable time that I was able to satisfy myself that it was only an illusion. This was, of course, a totally different class of phenomenon from that mentioned by Mr. J. S. Dines. WM. F. A. ELLISON.

Armagh Observatory.

I WONDER if the "Cirrus below Stratus" described by Mr. J. S. Dines in the July *Meteorological Magazine* is similar to a cloud I observed on May 11th of this year. A curious cirrus-like cloud formed below patches of alto-stratus which were rapidly filling the sky. Wavy gossamer sheets were interspersed with feathery wisps of a beautiful delicacy. In the evening the sun shone through the alto-stratus from the western horizon, lighting the cirrus with golden tints, plainly showing that it was far below the upper cloud sheet which now practically covered the sky. Some parts were exactly like cirrus uncinus, large tufts appearing with flowing tails, others were rippled like cirro-cumulus. The cloud was moving from SW. over an easterly surface current; I am inclined to believe it was formed by mixing of the two currents, being just what one would expect under these conditions. I saw this cloud again on May 16th, but not since. On the latter occasion also a SW. current was crossing an easterly one.

R. FRANCIS GRANGER.

Lenton Fields, Nottingham, 5th August, 1920.

The Moon and the Wind.

I AM too far off for controversy, but I shall be glad if you will allow me to make a few comments upon your notice of a short paper of mine dealing with a possible lunar influence upon the velocity of the wind at Kimberley.

First of all, I did not show more enthusiasm for my "discovery" for the simple reason that the particular point I set out to find, *i.e.*, a tiny semi-diurnal oscillation of wind velocity due to the moon, eluded me. I did find a large fourth harmonic term in the sine series, which may be of some importance, and I should have been glad of your comments upon it, since it may mean a sliding away of the air (if the matter may be put that way) down the gradients of pressure set up by the lunar atmospheric tide.

Next, your criticism that no allowance has been made for the influence of the sun on the wind, in separating moon south from moon north, will not stand in the form in which you state it. It is quite wrong that the diurnal variation of wind at Kimberley is greater in summer than it is in winter. On the contrary the range in summer (December and January) and the range in winter (June and July), deduced from 20 years of observation, are exactly the same, namely, 3·8 mi/hr. The hourly means are set out below.

WIND SPEED AT KIMBERLEY IN MILES PER HOUR,
1900-1910.

Hours ending—	1	2	3	4	5	6	7	8	9	10	11	12
Mid-Summer -	5·0	4·9	4·7	4·4	4·2	4·2	5·5	6·8	7·3	7·3	7·4	7·4
Mid-Winter -	3·2	3·0	2·8	2·8	2·7	2·6	2·5	2·6	3·5	4·9	5·7	6·2
Hours ending—	13	14	15	16	17	18	19	20	21	22	23	24
Mid-Summer -	7·5	7·7	7·8	8·0	7·9	7·5	6·5	5·4	5·2	5·2	5·1	5·1
Mid-Winter -	6·3	6·2	5·9	5·3	3·8	2·6	3·1	3·5	3·6	3·5	3·3	3·3

Apart from that, the actual range from highest hourly mean to lowest does not come into the argument. What is involved is the matter of the differences in velocity about twelve hours apart, *e.g.*, say the velocity at noon to 13 h. minus the velocity at midnight to 1 h. If these differences be used it looks as if your argument could be used to emphasise rather than to contradict my result. Put it this way:—

1. Moon south and close to the sun in summer :

Wind speed at lunar noon = V .

” ” midnight = V'

2. Moon south and opposite the sun in winter :—

Wind-speed at lunar noon = v

” ” ” midnight = v'

Then if your argument were true—

$$V - V' > v' - v$$

$$\text{or } V + v' > V' + v,$$

and the resulting curve would show a maximum wind-speed at lunar noon. But if $V - V' \nless v' - v$?! and it is not.

My own impression is that a discussion of the velocities for perigee and apogee should give the best result. I said in my paper that I hoped to attack this later on. I am undertaking it, not by using speeds, which are unsuitable in this case, but by means of departures from the monthly means, thus eliminating the effect of the solar diurnal oscillation altogether. But life is short.

J. R. SUTTON.

Kimberley, South Africa, 18th May 1920.

[It must be admitted that Dr. Sutton's figures, which show for Kimberley remarkable persistence of the wind during summer nights, dispose of the simple explanation of the apparent lunar tide put forward in this magazine. The complete elimination of the solar effects is evidently desirable, but not to be undertaken lightly. If the further investigation which is promised confirms the existence of the lunar tide with a 24-hour period the result will be of great interest. The diurnal tide should theoretically vary as the sine of twice the moon's declination, changing sign as the moon crosses the equator and so far agreeing with Dr. Sutton, but the magnitude of the effects which he computes far exceeds what would be anticipated on theoretical grounds. It is therefore to be hoped that similar studies will be undertaken for other stations in the tropics.—F. J. W. W.]

Line Squall of July 4th.

THE following description of a line squall which passed over this district on Sunday last may be of interest to your readers.

About 13 h. 38 m. G.M.T. my attention was attracted by an intense darkness in the room in which I was sitting. I looked out of the window to ascertain the cause of it, and saw an inky black cloud approaching rather rapidly from the north-west. The weather at the time was overcast and calm. Suddenly a violent gale sprang up which was quickly followed by a heavy shower of rain. The wind blew with such fury for a few minutes that trees were

bent double and windows were rattled in their frames. During the height of the squall a tremendous clap of thunder occurred, which continued rumbling for some seconds, and then all was calm again. The thunder returned at 13 h. 55 m. G.M.T. even louder than before, also from the north-west, and heavy showers fell frequently during the afternoon and evening.

At Iford, some 4 miles E.N.E. of here, the squall was accompanied by torrential rain and hail, so violent that the driver of the Lymington-Bournemouth motor-bus was compelled to pull up as he was not able to see. The squall extended to Lymington, 17 miles E.N.E. of Bournemouth, but seemed to have spent most of its force by then, and was characterised chiefly by thunder and wind. I have not been able to trace it further than this, and it would be interesting to know if it was recorded by any observers in the Isle of Wight.

S. HYL A GREVES.

Rodney House, Bournemouth, July 9th, 1920.

Reversal of Wind Aloft.

I had a good opportunity of observing the thunderstorm on June 12th from Little Gaddesden, near Berkhamstead, Herts, and noted some unusual features which are perhaps worth recording. At about 9 h. a thunderstorm developed to south-west and moved away in a W.N.W. direction. Shortly afterwards the surface wind changed from east to west, and, except for occasional calms, it remained westerly or north-westerly for about seven hours up to the top of the Chilterns at 800 feet. All the time the lower clouds, which were certainly not more than 3,000 feet above sea level, were moving from E.S.E. All the clouds up to the cirrus were moving from a south-easterly direction, and this is confirmed up to 16,000 feet by a pilot balloon ascent at Shoeburyness at 11 h. The cirrus continued to move from south-east for three days afterwards.

There was much large cumulus and some cumulo-nimbus all morning, and a shower at 11 h. During the afternoon there was distant thunder to south from thunderstorms moving in a W.N.W. direction. There was a good deal of false cirrus up to the cirrus level, and some dense mammato-cumulus above 10,000 feet. A large mass of cumulo-nimbus up to the cirrus level was visible on the E.S.E. horizon at about 14 h. 30 m., joined in a continuous chain to the thunderstorms to the south. The storm to E.S.E. approached rather rapidly,

and arrived overhead two hours later. Low clouds developed at various levels in front of it, showing remarkable wave structure. The rain was exceptionally heavy for the first few minutes, and was mixed with half melted hail. The heaviest rain was accompanied by a cold squall from the south, and was preceded by a very dark cloud in a band from E.N.E. to W.S.W. The storm was violent for half an hour, and it was followed by a series of other storms of less intensity until 20 h., all moving from about E.S.E. at a velocity estimated at thirty miles per hour. After the storm the surface wind was light and easterly.

The most unusual feature connected with the storm was the westerly surface wind with the E.S.E. current above it. The synoptic chart at the Meteorological Office for 13 h. on that day shows a west wind at Kew, Benson and South Farnborough, and an east wind on the east and south-east coasts, resulting in marked convergence. Simultaneously with the approach of a secondary depression from France a narrow belt of low pressure appeared to develop across England with converging surface winds. By evening the two disturbances had merged into one. Normally when secondaries move up from the south and cause thunderstorms the surface wind becomes east or north-east in front of it, and the thunderclouds up above move from a more southerly point.

C. K. M. DOUGLAS.

Deep Isothermal Layers in the Atmosphere.

The frequency of occurrence of truly isothermal layers of considerable thickness in the atmosphere is very low. It is, however, more common to find a thick layer which is very nearly isothermal owing to a slight temperature inversion inside the layer. The upper air temperature records for June 9th 1920 made in an aeroplane at South Farnborough, and supplied by Mr. R. A. Watson Watt, may be quoted here as an illustration :—

Height in Thousand Feet.	Gd.	1	2	3	4	5	6	7	8	9	10	11
Temperature in Degrees absolute above 200a.												
June 9th, 1920.												
5h. 0m. - -	79·0	79·5	77·5	78·5	79·0	78·5	79·5	78·0	76·0	75·0	-	-
6h. 15m. - -	81·0	79·0	78·5	78·5	79·0	79·0	79·0	78·5	76·0	75·0	74·0	72·0

Mr. Watt remarks that the records "are of interest on account of the surprisingly uniform temperature up to 7,000 feet." It will be noted that, owing to the slight inversion at 4,000 feet level, the whole layer between 2,000 feet and 7,000 feet is practically isothermal at 279a.

All the available upper air temperature graphs for Martlesham Heath and South Farnborough have been examined with a view to extracting cases similar to that quoted by Mr. Watt. Defining the "base" as the level at which the temperature lapse ceases, cases were selected in which the height of the inversion measured from the base up to the level where the base temperature was repeated was not less than 2,500 feet. Details are given in the following table.

Date.	Time, G.M.T.	Base of Layer.	Top of Layer.	Thickness of Layer.	"Base" Tem- perature.	Range of Inversion.
	h. m.	Ft.	Ft.	Ft.	a.	a.
MARTLESHAM HEATH.						
1917—Jan. 7 -	9 48	8,000	11,200	3,200	258·0	1·0
Jan. 25 -	15 0	0	4,200	4,200	281·0	0·5
Feb. 27 -	16 0	5,600	9,800	4,200	268·0	1·5
May 25 -	6 0	0	4,000	4,000	284·5	0·5
Sept. 15 -	10 40	4,400	9,800	5,400	279·0	1·5
Dec. 19 -	9 35	800	6,400	5,600	274·5	0·25
1918—Feb. 15 -	12 0	800	6,000	5,200	273·5	1·5
Feb. 17 -	9 30	2,300	6,200	3,900	271·0	1·0
Feb. 25 -	16 0	8,800	12,000	3,200	262·5	0·5
Nov. 15 -	10 0	4,400	8,200	3,800	274·0	0·25
Nov. 22 -	10 15	2,200	7,400	5,200	278·5	1·5
Dec. 12 -	14 50	3,400	6,000	2,600	281·5	1·0
SOUTH FARNBOROUGH.						
1918—Feb. 11 -	11 0	2,800	5,400	2,600	280·5	1·0
Feb. 16 -	9 50	0	6,100	6,100	274·5	1·0
1919—June 17 -	4 50	3,200	6,000	2,800	283·5	1·5
1920—June 9 -	5 0	2,500	7,000	4,500	278·5	1·0
June 9 -	6 15	2,000	7,000	5,000	278·5	0·5

The range of inversion is the maximum excess above the base temperature.

An examination of the Daily Weather Report shows that on all the dates mentioned in the table anticyclonic conditions prevailed.

S. N. SEN.

30 July 1920.

A Mock Sun and Rainbow Colours after Sunset.

ON July 11th, shortly after sunset (20 h. 13 m. to 20 h. 35 m. G.M.T.), a remarkable colouration of the sky occurred. The clouds at the time, which covered about nine-tenths of the sky, were all Fr. St. Cu., and they did not change materially for two hours. Just as the green light—the greenish sky often seen at sunset, but more brilliant—was disappearing, an image of the sun, yellow surrounded by red, appeared on the clouds in the eastern horizon. The cliffs of France then drew attention by changing from white to pink and to a brilliant luminous carmine. The sun image faded and the colouration of the clouds became a brilliant pink, and about 50° above the horizon, in the same azimuth as the image which had gone, there appeared a portion of an arc of rainbow colours. The surrounding clouds were of different shades of purple and paynes-grey, and there was a large V-shaped cloud a pure white in the north-east. On the south horizon a replica of the irisation occurred, including the rainbow colouring. The cliffs of France changed to a thin purple line and the irisation gradually faded, and nearer the zenith a light brown colouring of the clouds took place. The phenomena lasted 20 minutes.

The weather following was overcast to continuous thunder, with lightning and rain. The rain reading on Monday 12th was 0·45 inches.

A. E. NICHOLS, Borough Engineer.

Folkestone.

[The observations of Mr. Nichols are of great interest, as the phenomena seem to differ from any described in the treatises on Meteorological Optics.—Ed. M.M.]

NOTES AND QUERIES.

Daily Weather Report, British Section.

ARRANGEMENTS having been made with various steamship companies on cross-channel and coastal services, reports of sea and air temperature and of the weather in home waters are now being received at the Meteorological Office each morning. Since July 1st such observations have been published in the Daily Weather Report.

Another feature introduced in the Report for August 1st is a small map showing barometric tendency. For many years telegraphic stations provided with barographs have reported the change in pressure during the three hours preceding the hour of observation, and the familiar remarks such as “barometer falling slowly” are based on this information. Maps of isallobars have been used with success in forecasting by Continental Meteorologists; an account of pioneer work

in this direction is given in *Forecasting Weather*, chapter XV. The new D.W.R. map gives the barometric change from 4 h. to 7 h. as a multiple of the half-millibar, that unit having been found convenient for reading the barograms and adopted for telegraphic reporting. The isallobars of positive tendency (rising barometer) are drawn slightly thicker than those of negative tendency (falling barometer).

Weather at Health Resorts.

At the suggestion of the Press Association arrangements have been made for the issue by the Meteorological Office of accounts of the morning weather at certain health resorts in time for inclusion in the evening newspapers. About 20 health resorts have been invited to contribute reports for this purpose, and it is anticipated that it will be necessary to confine the list to that number.

Geostrophic Wind Scale.

IN order to meet the requirements of the Daily Weather Report in its new form with isobars at intervals of 2 or 4 millibars, scales for measuring the geostrophic wind speed in miles per hour have been constructed. The scales are printed by a photographic process on transparent celluloid, and directions as to the necessary corrections to be applied to the readings are also shown on the celluloid.

The scales are on sale, price 2s. 6d. each, postage extra. Applications should be made to the Meteorological Office, South Kensington.

The New Form of the Norwegian Daily Weather Report.

THE Norwegian weather report for the 1st July is issued in a form different to that previously adopted. The chart, which is issued without tables, is drawn on a mean scale of $1 : 10^7$, and the actual scale, which varies from $0.97 : 10^7$ in Lat. 45° to $1.08 : 10^7$ in Lat. 70° , is shown for every 5° in the margin.

Isobars are drawn for every 5 millimetres (which is surprising in the country of one of the strongest advocates of the millibar, Professor V. Bjerknes).

The weather is shown by slight modifications of the conventional symbols, and the area in which precipitation is occurring at the time of the report is shaded.

The leading new feature, however, is the inclusion in the chart of a line indicating the "polar front," along which are placed arrows to indicate the direction in which the polar front is moving. The polar front indicates the line

separating the polar air from the warmer air of the temperate zone, and it was recently the subject of an interesting article by Professor Bjerknes, who regards the polar front as fundamental in the solution of the meteorological problems of these latitudes. For July 1st the polar front is shown as extending from the south of Ireland to the Alps and passing up the western side of the Baltic. Across the British Isles it is the southern boundary of a rainbelt where the air on the east of a depression is presumably rising over the polar air. The evidence for the other parts of the line is not so obvious.

'A Conference at Bergen.

TO STUDY the new methods of forecasting which are exemplified by the Norwegian D.W.R., and which has been developed by the Meteorological Staff of the Geographical Institute, a delegation of the Meteorological Office, headed by Sir Napier Shaw, left London on July 17th and visited Bergen on the invitation of Prof. Bjerknes. Some account of the visit will be printed in the September *Magazine*.

Aurora in Low Latitudes.

THE aurora of March 22nd-23rd, 1920, which was observed in all parts of the British Isles, was remarkable as being visible as far south as Switzerland. The Reverend M. Dechevrens, observer at St. Louis Observatory, Jersey, calls attention to the rarity of aurora at that station, and mentions that the last previous occasion was August 22-23, 1916. On March 22nd, 1920, the aurora was first observed at St. Louis at 19 h. 40 m., the N.E. sky being a brilliant red; further north there was seen a vividly white segment, the axis of which coincided sensibly with the vertical of the Polar Star. At 20 h. 5 m. a primary beam of vivid light sprang from the horizon, rising to within 2° of the Pole Star and then dividing into several other less brilliant beams. At 20 h. 30 m. the phenomenon was reduced to the white segment, the maximum height of which was estimated at 15° . Observations were not continued after 21 h., but subsequent examination of the earth current record indicated that the maximum perturbation of the magnetic storm was from 23 h. on the 22nd to 5 h. on the 23rd.

According to a note by J. Maurer, *Met. Zeitschrift*, May 1920, the last previous appearance of aurora in Switzerland was on Sept. 9th, 1898. Appearances of aurora have been remarkably scanty since 1875, as compared with an almost unbroken series of observations in the previous 45 years. A similar alternation occurred in the years 1630 to 1700.

The Dimensions of a Waterspout.

PARTICULARS have been received from Mr. V. H. Rozier of a fine waterspout observed by him on December 28th, 1919, while on board the s.s. "War Hermit" on her voyage from Singapore to Suez. The ship's position at the time was south of Cape Comorin, in lat. $6^{\circ} 46' N.$, long. $77^{\circ} 23' E.$ A gentle breeze was blowing from the north and the sea was smooth to rippled. Cirro-cumuli and fracto-cumuli occupied the greater part of the sky. At the north-west point there was a cumulo-nimbus of a russet-grey colour, and at 14 h. 7 m. local time the waterspout formed between this cloud and the sea, at a distance from the ship estimated by means of a rangefinder to be 8,500 yards. The waterspout was of a neutral dove-grey colour, but the middle of the column was transparent, and the sides, which were sharply defined, of a slate-grey hue. After persisting for 13 minutes it broke up and appeared to retire upwards into the cloud. The estimated distance at this time was 7,500 yards.

The following approximate measurements have been derived from observations made with a sextant. At the beginning of the phenomenon the distance between the base of the cloud and the surface of the sea was 4,600 ft., the width of the column tapering from 500 ft. at its junction with the cloud to 150 ft. at the sea. Spray was thrown up to a height of more than 300 ft. over a region 250 ft. in diameter.

The vortex appeared to consist of a hollow tube with uniformly tapering sides and a central column. Each wall, the width of which was about one-sixth of the diameter of the waterspout, was sharply defined, and thought to consist of water moving downwards, being clearly differentiated from the major portion of the column, which consisted of a central (ascending) column of a width about half the total diameter, with an intermediate region of whirls and eddies on either side between it and the wall.

When the waterspout was breaking up the central column as a whole lifted and retired into the cloud; the walls dissipated into spray, part of which fell outward into the sea, the remainder entering the ascending column and being carried upwards. The width of the column as it retreated into the cloud was estimated to be 400 feet.

The weather was fine and the sea smooth to rippled throughout the day. The corrected barometer reading at the time of the occurrence was 29.79 in., and the temperature $82.5^{\circ} F.$

Reviews.

Tropical Control of Australian Rainfall. Commonwealth of Australia, Bulletin No. 15. By E. T. Quayle. Size 12 x 10, pp. 24, and 12 pages of diagrams and maps.

The possibility of forecasting rain upon which so much of meteorological research turns, whilst of importance in the British Isles, becomes a vital problem in the large tropical and sub-tropical land areas, the fertility of which is entirely dependent upon a variable rainy season. Among these the Australian continent is a typical example, and Mr. Quayle's suggestive monograph has therefore an economic value outweighing its abstract scientific interest.

The departure from normal of minimum temperature at various stations and groups of stations in the north of Australia is graphed for the period 1911 to 1916, and it is found that for spells of considerable length the departure is of one sign; there is a high correlation between the values at eastern and western stations in these latitudes, the changes showing some tendency to propagation from east to west. The rainfall of the south of Australia is associated with the passage of depressions, but it is found that it is also related to these departures from normal of the minimum temperature in the north of the continent. Spells of high temperature in the north are favourable for rainfall in the south, whilst cold spells are unfavourable. If this were merely a case of correlation between contemporaneous phenomena it would be of considerable interest, but the advantage from the forecaster's point of view lies in the fact that the warm spells can be identified as soon as they are established. For example, if the minimum temperature at Darwin averages $2\cdot5^{\circ}$ F. above normal for two consecutive nights, it is found that the odds are three to one in favour of the run of warm nights lasting at least three weeks. During such a run the rainfall to be anticipated in Northern Victoria, nearly 2,000 miles from Darwin, is about '06 in. per day, whereas under the opposite condition it is only '03 in. per day. The relations in question are only established for the winter months, the summer rainfall being governed by other circumstances. A detailed study of the progress of the weather during the winters of the years 1911 to 1916 is made the basis of a set of practical rules for forecasting, too technical for quotation here, and these are now being tested in the everyday work of the Commonwealth Weather Bureau.

Weather in the British Isles: July 1920.

With the exception of a brief interval between the 18th and 21st, during which atmospheric conditions were under the influence of an anticyclone which spread in from the Atlantic, the weather of July was dominated by a series of depressions, several of which passed directly across these Islands. As a result the month was wet, cool and cloudy, with a marked deficiency of sunshine.

For a few days about the middle of the month, the day temperature was about equal to the normal, but during the first fortnight and the last week it was decidedly below.

The night temperatures were not particularly low, the persistent cloudiness retarding radiation and making the range less than would have been the case under ordinary fine weather conditions.

At Southport (Lancs) the day temperatures were uniformly cold, and never rose higher than 66° F., while at Totland Bay (I. of W.) the July maximum was the coldest during 34 years, and at Redruth (Cornwall) it was the lowest for at least 20 years.

The warmest days of the month were at the beginning, round about the 20th, and at the end. Although at many stations the thermometer never reached 70°, readings of 77° were recorded in London and Copdock (Ipswich) on the 17th, and at Hull on the 20th. The weather of the 5th, a wet day, with wind from the north in the rear of a depression of moderate depth, was remarkable, there being hardly any variation of temperature for 24 hours in some parts of the country. In many parts of England the maximum temperature for this day was below 55°. At Over Court, Almondsbury, it was as low as 50°, and at Whitby (Yorks) and Princetown (Devon) it was 52°. On this day the temperature at Kew Observatory at midday was 50°, which is more than 4° lower than the normal night reading for July.

Rather low minima occurred in Scotland in the same cold current, the temperatures at Balmoral going down to the freezing point on the 4th and 7th, but very generally the coldest night was towards the end of the month, when the temperature at many places was below 40°, e.g., 37° at Sheepstor (Devon) on the 25th and at Garforth (Yorks) on the 31st, and 36° at Cambridge on the 25th.

Thunderstorms were experienced in most districts at the beginning of the month, locally in Scotland on the 9th, on the Essex and Kentish coasts during the early morning of the 11th, and at Falmouth on the 14th. On the 18th thunderstorms were reported along the East Coast from Yarmouth to Edinburgh, but the rainfall was nowhere very heavy.

Scotland North, alone of all the districts, received an amount of sunshine in excess of the normal. In all other cases the monthly amount was deficient.

During the week ended the 10th, this was very marked, the percentage of the possible being only 14 in the Midland Counties, 17 in England North-East, and 18 in England North-West and South-East. At several stations in the Midland and Southern counties there was less than 2.0 hrs. per day, which represented only about 11 per cent. of the normal.

At some stations there were a good many days on which no sunshine was recorded at all; the greatest numbers of such sunless days were 5 at Birr Castle (King's Co.), 6 at Bidston (Cheshire), and 8 at Cahirciveen (Kerry). Among the largest daily amounts, which occurred mostly around the 19th and 24th, were 14.0 hrs. at Cullompton (Devon) on the 24th 14.3 hrs. at Salcombe (Devon) on the 19th and 24th, and 14.6 hrs. at Copdock (Ipswich) on the 19th.

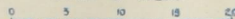
THAMES VALLEY RAINFALL, JULY 1920.



ALTITUDE
SCALE

Below 250 feet	250 to 500 feet	500 to 1000 feet	Above 1000 feet
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SCALE OF MILES



At Totland Bay the sunshine total (150 hrs.) was the smallest on record for July. At Southport the worst previous July was that of 1912 with 147 hrs., when the effects of the volcanic dust from the eruption of Katmai, in Alaska, were being observed, but the total for July 1920 is only 127 hrs.

The rainfall of the month was almost everywhere in excess of the average and exceeded double the average in parts of the southern counties, Lincolnshire, and over a considerable portion of Wales. In the north of Scotland the fall was deficient, and less than 2 ins. fell over Caithness. More than 5 ins. fell over large areas in the west and south of Scotland, over practically all the northern counties of England, the whole of Wales, and considerable areas in the Thames Valley (*see accompanying map*). Areas on Dartmoor and Exmoor had from 8 to 10 ins., and more than 12 ins. fell over Central Wales, the English Lakes, and the wettest parts of the Western Highlands. In Ireland, only a strip of the northern coast had less than 3 ins., whilst Snowdon had no less than 25 ins. More than 5 ins. fell over the greater part of Munster and Leinster, and 9 ins. were reached in the mountains of Connemara. The general rainfall expressed as a percentage of the average was: England and Wales, 161; Scotland, 104; Ireland, 153; British Isles, 143.

In London (Camden Square) it was a dull, cool and showery month. The mean temperature was $60^{\circ}9'$, or $2^{\circ}9'$ below the average. The duration of rain was 74.4 hrs., the highest for July in the past 40 years; the only other July with so much as 60 hrs. duration of rainfall was 1917, with 63.8 hrs. Evaporation, 2.09 ins.

Weather Abroad : July 1920.

DURING the first part of the month anticyclonic conditions existed in the Baltic region and over the Azores, France, and Spain, while a series of depressions passed from the Atlantic in a north-easterly direction near the British Isles. The Netherlands, Denmark, and parts of France were affected by these depressions and their secondaries, and early in the month there were thunderstorms in France and the Netherlands, and heavy rain in Switzerland.

Shallow depressions formed occasionally in the Mediterranean region, but caused no intense cyclonic conditions. When the Azores anti-cyclone was dominant in S.W. Europe there was fine weather, accompanied by high day temperatures. On the 7th the temperature at Clermont reached 95° F.

After the 11th, pressure conditions altered in the North. The area between Greenland and Norway, originally under low pressure, now became covered by an anticyclone which had moved westward from Scandinavia, where pressure now became low. A secondary depression caused a thunderstorm in Paris on the 12th, but after this, the Azores anticyclone spread over France and Italy, while anticyclonic conditions prevailed in Germany and West Russia. In the South of France temperature rose to nearly 90° F. at this period.

The depressions in the neighbourhood of the British Isles continued to cause unsettled conditions in N.W. Europe, but later on they took a more northerly course and ceased to affect the mainland of Europe (with the exception of Scandinavia), leaving the Azores anticyclone again dominant in Southern Europe.

On the 22nd the anticyclone near Greenland moved further west, and the depressions from the Atlantic began to follow more southerly courses. Rainy, unsettled conditions again set in over France and Germany, and gales were frequent in the Baltic region. On the 22nd there were thunderstorms in Sweden and 42 mm. of rain fell at Haparanda.

Rainfall Table for July 1920.

STATION.	COUNTY.	Aver. 1875— 1909.	1920.		Per cent. of Av.	Max. in 24 hrs.		No. of Rain Days.
			in.	mm.		in.	Date.	
Camden Square.....	London	2·57	4·06	103	158	·89	21	16
Tenterden (View Tower)....	Kent	2·21	3·50	89	158	·62	23	19
Arundel (Patching)	Sussex	2·46	5·89	150	240	1·19	4	15
Fordingbridge (Oaklands) ..	Hampshire ..	2·14	5·50	140	257	·74	5	25
Oxford (Magdalen College) ..	Oxfordshire ..	2·43	4·23	107	174	·70	5	21
Wellingborough	Northampton ..	2·54	3·01	76	118	·48	26	24
Hawkedon Rectory	Suffolk	2·51	3·61	92	144	·53	3	19
Norwich (Eaton)	Norfolk	2·93	3·16	80	108	·52	21	20
Launceston (Polapit Tamar) ..	Devon	2·74	5·02	128	183	1·05	25	26
Lyme Regis (Rousdon)	"	2·68	5·02	128	187	·69	25	24
Ross (Birchlea)	Herefordshire ..	2·75	4·11	104	149	·93	3	22
Church Stretton (Wolstaston) ..	Shropshire ..	2·58	6·29	160	244	1·49	3	25
Boston (Black Sluice)	Lincoln	2·35	3·18	81	135	·73	3	21
Worksop (Hodsock Priory) ..	Nottingham ..	2·35	2·93	74	125	·45	25	21
Mickleover Manor	Derbyshire ..	2·57	4·13	105	161	·79	3	26
Southport (Hesketh Park) ..	Lancashire ..	2·92	4·73	120	162	·74	25	24
Wetherby (Ribston Hall) ..	York, W. R. ..	2·56	5·97	152	233	1·05	3	17
Hull (Pearson Park)	" E. R. ..	2·39	4·31	110	180	·61	25, 31	27
Newcastle (Town Moor)	North'land ..	2·90	4·29	109	148	·97	2	25
Borrowdale (Seathwaite) ..	Cumberland ..	8·91	10·50	267	118	..	..	..
Cardiff (Ely)	Glamorgan ..	3·26	5·92	150	182	·99	25	30
Haverfordwest	Pembroke ..	3·39	6·79	172	200	1·32	25	25
Aberystwyth (Gogerddan) ..	Cardigan ..	4·03	8·55	217	212	1·36	29	21
Llandudno	Carnarvon ..	2·52	5·41	137	215	1·31	25	23
Dumfries (Cargen)	Kirkcudbrt. ..	3·20	4·87	124	152	·66	16	30
Marchmont House	Berwick	3·30	4·07	103	123	·87	2	20
Girvan (Pinmore)	Ayr	3·73	3·75	95	101	·45	8	26
Glasgow (Queen's Park)	Renfrew	2·91	2·91	74	100	·60	1	28
Islay (Eallabus)	Argyll	3·41	4·45	113	130	·46	8	27
Mull (Quinish)	"	4·12	5·47	139	133	1·27	14	24
Loch Dhu	Perth	4·69	5·70	145	122	1·00	9	19
Dundee (Eastern Necropolis) ..	Forfar	2·84	2·11	54	74	·33	18	22
Braemar	Aberdeen ..	2·65	2·65	67	100	·36	9	24
Aberdeen (Cranford)	"	3·00	3·81	97	127	·73	5	23
Gordon Castle	Moray	3·25	2·70	69	83	·57	6	23
Drumnadrochit	Inverness ..	3·37	1·59?	40	47	·29	27	28
Fort William	"	4·92	6·20	158	126	·80	15	28
Loch Torridon (Bendamph) ..	Ross	5·35	5·12	130	96	·84	29	18
Stornoway	"	2·94	2·77	70	94	·41	29	24
Dunrobin Castle	Sutherland ..	2·91	1·49	38	51	·40	5	15
Wick	Caithness ..	2·67	1·80	46	67	·59	6	18
Glanmire (Lota Lodge)	Cork	2·73	5·09	129	186	·79	7	24
Killarney (District Asylum) ..	Kerry	3·53	3·79	96	107	·78	29	28
Waterford (Brook Lodge) ..	Waterford ..	3·13	5·20	132	166	1·11	7	24
Nenagh (Castle Lough)	Tipperary ..	3·02	5·30	135	175	1·07	1	29
Ennistymon House	Clare	3·57	..	..	..	..	..	..
Gorey (Courtown House)	Wexford	2·90	5·50	140	190	1·04	25	22
Abbey Leix (Blandafort) ..	Queen's Co. ..	2·99	5·26	134	176	1·77	25	25
Dublin (FitzWilliam Square) ..	Dublin	2·60	5·12	130	197	1·35	25	25
Mullingar (Belvedere)	Westmeath ..	3·16	4·37	111	138	·98	26	25
Woodlawn	Galway	3·48	5·54	141	159	·78	25	24
Crossmolina (Enniscoe)	Mayo	3·26	4·31	110	132	·58	14	22
Collooney (Markree Obsy.) ..	Sligo	3·36	4·85	123	144	·65	17	25
Seaforde	Down	3·32	3·59	91	108	·68	8	22
Ballymena (Harryville)	Antrim	3·44	4·95	126	144	·67	10	26
Omagh (Edenfel)	Tyrone	3·34	4·81	122	144	·67	10	27

Supplementary Rainfall, July 1920.

Div.	STATION.	RAIN.		Div.	STATION.	RAIN.	
		in.	mm.			in.	mm.
II.	Ramsgate	2.06	52	XII.	Langholm, Drove Rd.	5.61	142
"	Sevenoaks, Speldhurst	4.70	119	XIII.	Selkirk, Hangingshaw	2.49	63
"	Hailsham Vicarage..	4.36	111	"	North Berwick Res. . .	2.34	59
"	Totland Bay, Aston . .	6.53	166	"	Edinburgh, Royal Ob.	3.86	98
"	Ashley, Old Manor Ho.	5.51	140	XIV.	Biggar.....	3.59	91
"	Grayshott.....	6.08	154	"	Leadhills	6.12	155
"	Ufton Nervet.....	5.82	148	"	Maybole, Knockdon . .	4.48	114
III.	Harrow Weald, Hill Ho.	5.97	152	XV.	Rothesay	4.46	113
"	Pitsford, Sedgebrook..	3.48	88	"	Oban	3.35	85
"	Chatteris, The Priory.	1.99	50	"	Inveraray Castle . . .	4.39	112
IV.	Elsenham, Gaunts End	4.06	103	"	Holy Loch, Ardnadam	6.46	164
"	Lexden, Hill House . .	4.61	117	XVI.	Loch Venachar	4.00	102
"	Aylsham, Rippon Hall	3.10	79	"	Glenquey Reservoir . .	3.60	91
"	Swaffham.....	3.61	92	"	Loch Rannoch, Dall...	3.17	80
V.	Devizes, Highclere . .	5.64	143	"	Coupar Angus.....	1.83	46
"	Weymouth.....	3.93	100	"	Montrose Asylum . . .	2.86	73
"	Ashburton, Druid Ho.	4.93	125	XVII.	Balmoral Castle.....	2.77	70
"	Cullompton	5.31	135	"	Fyvie Castle.....	2.77	70
"	Hartland Abbey	5.81	148	"	Peterhead, Forehill....	3.54	90
"	St. Austell, Trevarna .	5.45	138	"	Grantown-on-Spey . . .	3.33	85
"	North Cadbury Rec. . .	5.09	129	XVIII.	Cluny Castle	2.88	73
"	Cutcombe, Wheddon Cr.	6.04	153	"	Loch Quoich, Loan . . .	13.60	345
VI.	Clifton, Stoke Bishop.	5.16	131	"	Skye, Dunvegan	6.24	158
"	Ledbury, Underdown..	3.45	88	"	Fortrose	2.89	73
"	Shifnal, Hatton Grange	4.09	104	"	Ardross Castle	2.29	58
"	Ashbourne, Mayfield .	5.13	130	"	Glencarron Lodge . . .	6.12	155
"	Barnt Green, Upwood	4.70	119	XIX.	Tongue Manse	2.16	55
"	Blockley, Upton Wold	5.61	142	"	Melvich Schoolhouse . .	1.79	46
VII.	Grantham, Saltersford	2.72	69	"	Loch More, Achfary . .	4.81	122
"	Louth, Westgate	2.41	61	XX.	Dunmanway Rectory . .	5.25	133
"	Mansfield, West Bank	4.52	115	"	Mitchelstown Castle...	5.43	138
VIII.	Nantwich, Dorfold Hall	4.91	125	"	Gearhameen	6.70	170
"	Bolton, Queen's Park.	7.71	196	"	Darrynane Abbey	5.09	129
"	Lancaster, Strathspey.	6.43	163	"	Clonmel, Bruce Villa . .	6.09	155
IX.	Wath-upon-Deane . . .	4.97	126	"	Cashel, Ballinamona . .	4.58	116
"	Bradford, Lister Park.	6.58	167	"	Roscrea, Timoney Pk. .	3.91	99
"	West Witton.....	5.43	138	"	Foynes.....	4.32	110
"	Scarborough, Scalby . .	7.55	192	"	Broadford, Hurdlesto'n	5.45	138
"	Ingleby Greenhow . . .	6.34	161	XXI.	Kilkenny Castle.....	4.58	116
"	Mickleton.....	3.70	94	"	Rathnew, Clonmannon	5.57	142
X.	Bellingham	2.97	75	"	Hacketstown Rectory .	6.70	170
"	Ilderton, Lilburn	4.24	108	"	Ballycumber, Moorock	4.12	105
"	Orton.....	9.07	230	"	Balbriggan, Ardgillan .	5.27	134
XI.	Llanfrehfa Grange . .	5.95	151	"	Drogheda	3.97	101
"	Treherbert, Tyn-y-waun	11.37	289	"	Athlone, Twyford	4.35	110
"	Carmarthen Friary . . .	7.33	186	"	Castle Forbes Gdns....	3.71	94
"	Fishguard	5.50	140	XXII.	Ballynahinch Castle...	5.46	139
"	Lampeter, Falcondale	6.04	153	"	Westport House	3.88	99
"	Abergwngy	7.00	178	XXIII.	Enniskillen, Portora . .	5.84	148
"	Crickhowell, Talymaes	7.00	178	"	Cootehill, Dartrey.....	4.37	111
"	Sennybridge.....	4.82	122	"	Armagh Observatory . .	3.08	78
"	Lake Vyrnwy.....	8.36	212	"	Warrenpoint	3.52	89
"	Llangynhafal, P. Drâw	4.74	120	"	Belfast, Cave Hill Rd. .	3.13	80
"	Dolgelly, Bryntirion..	10.46	266	"	Glenarm Castle	3.91	99
"	Lligwy	6.68	170	"	Londonderry, Creggan .	3.58	91
XII.	Stoneykirk, Ardwell Ho.	3.91	99	"	Sion Mills.....	3.53	90
"	Whithorn, Cutroach . .	3.85	98	"	Milford, The Manse . . .	2.58	66
"	Carsphairn, Shiel	6.71	170	"	Killybegs, Rockmount .	5.67	144

Climatological Table for the

STATIONS	PRESSURE		TEMPERATURE							
	Mean of Day M.S.L.	Diff. from Normal	Absolute				Mean Values			
			Max.	Date	Min.	Date	Max.	Min.	$\frac{1}{2}$ max. and min.	Diff. from Normal
	mb.	mb.	° F.		° F.		° F.	° F.	° F.	° F.
London, Kew Observatory	1023.5	+7.8	58	18	28	5	49.8	36.9	43.4	+3.3
Gibraltar	1020.4	+1.6	65	4, 21	43	1, 5	60.3	51.3	55.8	-0.1
Malta	1021.0	+6.0	66	23	48	9, 10	58.4	50.5	54.5	+0.2
Sierra Leone	1011.1	+0.1	99	24	71	2, 3	90.6	74.3	82.5	+0.2
Lagos, Nigeria	1011.1	+1.0	96	24	70	3	89.4	75.6	82.5	+0.4
Kaduna, Nigeria	1013.4	+4.2	98	22, 23, 24	55	13	88.6	60.4	74.5	-3.7
Zomba, Nyasaland	1009.3	+1.5	88	7	62	4, 27	83.0	64.9	73.9	+2.2
Cape Town .....	..	..	93	2	55	22	80.6	61.4	71.0	+1.0
Johannesburg .....	..	..	86	18	50	3	77.0	56.6	66.8	+1.4
Mauritius	1010.0	-1.0	87	21	67	9	84.0	72.0	78.0	-1.3
Bloemfontein .....	..	..	87	18	54	12	82.8	60.5	71.7	-0.2
Calcutta, Alipore Obsy...	1012.7	-0.6	93	29	51	13	82.1	62.7	72.4	+1.4
Bombay .....	..	..	90	23	62	7	84.0	69.9	76.9	+1.3
Madras .....	..	..	92	29	67	24	87.8	70.9	79.3	+1.6
Colombo, Ceylon	1012.2	+1.6	92	26	65	22	87.9	71.5	79.7	-0.9
Hong Kong	1018.7	-0.1	77	1	49	9	62.4	55.9	59.1	0.0
Sydney	1014.8	+0.8	87	5	54	7	78.0	63.7	70.9	-0.2
Melbourne	1014.8	+0.5	105	16	46	25	80.1	58.3	69.2	+1.8
Adelaide	1015.1	+0.8	107	16	50	7	88.2	60.7	74.5	+0.4
Perth, West Australia ..	1013.4	+0.4	102	8	55	11	84.8	62.4	73.6	-0.4
Coolgardie	1012.6	+0.1	108	14	53	6	91.0	60.5	75.7	-0.3
Brisbane	1013.1	+1.0	93	24	63	11	83.1	66.8	74.9	-1.6
Hobart, Tasmania	1012.3	-1.0	90	16	43	29	72.0	54.6	63.3	+1.0
Wellington, N.Z.	1015.3	0.0	80	9	44	22	69.8	57.0	63.4	+1.0
Suva, Fiji .....	..	..	..	..	..	..	..	..	..	..
Kingston, Jamaica .....	..	..	90	28	64	7	86.6	68.7	77.7	+1.2
Grenada, W.I.	1011.9	-1.5	89	9	70	6, 10	83.2	72.1	77.7	+0.7
Toronto	1017.2	-0.8	46	2	-9	1	28.0	12.3	20.1	-1.6
Fredericton, N.B.	1013.2	-1.8	41	18	-20	1	25.4	7.3	16.3	+1.2
St. John, N.B.	1011.9	-2.2	43	19	-16	1	27.7	13.7	20.7	+0.8
Victoria, B.C.	1024.6	+8.7	53	28	32	9	47.1	36.0	41.5	+1.2

LONDON, KEW OBSERVATORY.—13 fogs. GIBRALTAR.—2 gales.

MALTA.—Prevailing wind direction ESE; mean speed, 11.9 mi/hr.

SIERRA LEONE.—1 gale.

LAGOS.—Harmattan ceased on 18th.

British Empire, February 1920.

TEMPERATURE			PRECIPITATION					BRIGHT SUNSHINE		STATIONS
Absolute		Relative Humidity	Mean Cloud Am't	Amount		Diff. from Normal	Days	Hours per day	Per-centage of possible	
Max. in Sun	Min. on Grass									
° F.	° F.	%	0-10	in.	mm.	mm.				
103	20	83	6.3	0.41	10	- 29	9	2.3	23	London, Kew Observatory.
124	37	78	5.7	4.42	112	+ 5	11	..	..	Gibraltar.
124	..	83	6.0	2.83	72	+ 21	13	4.9	45	Malta.
..	..	65	2.3	0.00	0	- 7	0	..	..	Sieffra Leone.
159	42	70	5.6	0.11	3	- 48	1	..	..	Lagos, Nigeria.
..	..	40	1.0	0.00	0	- 5	0	..	..	Kaduna, Nigeria.
..	..	89	8.9	13.29	338	+ 62	25	..	..	Zomba, Nyasaland.
..	..	66	2.9	0.29	7	- 8	3	..	..	Cape Town.
..	50	81	7.4	1.67	42	- 88	10	8.1	62	Johannesburg.
..	63	81	7.7	13.27	337	+124	25	..	..	Mauritius.
..	..	72	6.2	8.20	208	+120	15	..	..	Bloemfontein.
..	43	53	2.1	1.48	38	+ 9	2	..	..	Calcutta, Alipore Obsy.
136	53	67	0.3	0.33	8	+ 7	3	..	..	Bombay.
160	62	73	1.3	0.00	0	- 8	0	..	..	Madras.
160	58	72	2.3	3.36	85	+ 32	5	..	..	Colombo, Ceylon.
..	..	84	9.8	2.64	67	+ 24	14	0.8	7	Hong Kong.
148	50	68	5.0	1.87	47	- 68	12	..	..	Sydney.
156	38	53	3.6	0.60	15	- 28	5	..	..	Melbourne.
164	39	38	2.5	0.06	2	- 14	3	..	..	Adelaide.
164	45	50	2.6	0.01	0	- 11	1	..	..	Perth, West Australia.
159	50	34	3.3	0.70	18	- 1	1	..	..	Coolgardie.
153	59	62	5.0	1.04	26	-142	7	..	..	Brisbane.
148	38	59	5.6	0.25	6	- 31	8	..	..	Hobart, Tasmania.
139	30	73	6.6	5.92	150	+ 67	7	6.5	47	Wellington, N.Z.
..	..	..	..	..	..	..	..	..	..	Suva, Fiji.
..	..	82	2.2	1.26	32	+ 17	4	..	..	Kingston, Jamaica.
139	..	74	3.9	1.40	36	- 36	12	..	..	Grenada, W.I.
78	-11	56	5.4	1.62	41	- 25	12	..	..	Toronto.
..	..	68	5.8	6.89	175	+ 31	17	..	..	Fredericton, N.B.
121	-18	70	7.1	7.90	201	+102	17	..	..	St. John, N.B.
114	25	80	5.1	0.62	16	- 74	6	..	..	Victoria, B.C.

MAURITIUS.—Prevailing wind direction ESE ; mean speed, 6.9 mi/hr.

BLOEMFONTEIN.—Record rainfall for February.

COLOMBO.—Wind direction variable ; mean speed, 4.1 mi/hr. ; 3 thunderstorms.

HONG KONG.—Prevailing wind direction E ; mean speed, 12.8 mi/hr.

On the 27th a deep depression approached and remained in the vicinity of Iceland. Secondaries from this depression, moving eastward, caused a continuation of unsettled weather in North-West Europe up to the end of the month.

In Italy and the Eastern Mediterranean the weather throughout the month was fine and warm, temperatures frequently exceeding 90° F., while at Cairo on the 12th a temperature of 101° F. was reached.

At the beginning of the month very violent storms swept the Cerdaña district in the eastern Pyrenees, with damage to life and property. On the 26th a violent thunderstorm and cloudburst occurred at Barcelona, flooding the city. Six persons were killed.

About the 14th of the month Buenos Ayres was visited by a snowstorm, this being the second experienced within 300 years. A message arriving on the 28th stated that a typhoon had swept over Luzon, the largest of the Philippine Islands. The loss of life was small, but thousands were rendered homeless.

Captain Amundsen arrived at Nome (Alaska) on the 27th, and stated that his ship was still icebound in the Arctic Ocean, but her position was not given. Bering Strait is now open.

As a result of prolonged rainfall splendid crops are now anticipated at Alberta. Great damage has been caused to crops in the Fraser River Valley, B.C., by floods, the late spring mountain snow having melted too quickly. Many thousands of acres have been flooded and scores of settlers rendered homeless. On the 21st Matsqui Dam also gave way, flooding a further ten thousand acres. A thunderstorm associated with the southern portion of a large double depression situated in the east of the Great Lakes caused a very serious accident at Scranton, Penn., on the 3rd. Eighteen persons were killed and a hundred injured as the result of a triple tram-car collision caused by lightning striking a telegraph pole, which fell across the track.

It is not usual for Australia to suffer from excess of rain, but floods in N.W. Australia have done much damage to wheatlands, and heavy rains, followed by destructive floods, have occurred in Western Queensland. New South Wales also suffered, numerous washouts taking place on the railways, but the floods were subsiding on the 6th. The temperature generally has been mild throughout Australia.

A message from Simla states that the monsoon in India continues to blow steadily.

Geostrophic Wind over London; September, 1881-1915.

FREQUENCY OF STRENGTH AND DIRECTION.

Estimates based on the D.W.R. charts (8h., 1881-1908; 7h., 1909-1915).

Direction.	5 m/s. 11 mi/hr.	10 m/s. 22 mi/hr.	15 m/s. 33 mi/hr.	20 m/s. 44 mi/hr.	Over 20 m/s. Over 44 mi/hr.	Total Frequency of Direction.
N.	30	18	20	8	5	81
N.E.	24	23	14	1	1	63
E.	16	35	10	5	1	67
S.E.	21	32	8	4	—	65
S.	38	43	6	—	1	88
SW.	47	63	36	14	8	168
W.	30	82	48	17	7	184
NW.	29	42	23	4	5	103
Total Frequency of strength	235	338	165	53	28	819*

* Indeterminate—231.