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Temperature Readings on London Roofs

During the recent spells of hot weather most of the London newspapers published hourly readings of temperature taken on the roof of the Air Ministry, Adastral House. The instrument in use is a mercury-in-steel thermograph, the bulb of which is installed in a Stevenson screen on the roof, while the recorder is in a room on the fifth floor. The same screen contains ordinary maximum and minimum thermometers read daily at 9h. It was found at the end of July that the thermograph was reading about a degree higher than the thermometers in the screen, and the necessary adjustments to the thermograph were subsequently made. The readings quoted in this article are those from the maximum thermometer, not the thermograph.

The readings at the Air Ministry are taken mainly for the purpose of answering the numerous inquiries which are always received during exceptional weather conditions. They are not regarded as being comparable with readings taken under the standard conditions set out in the " Observer's Handbook " and are not included in any Meteorological Office publications. It is, however, a matter of some interest to ascertain how the roof readings compare with those taken at nearby stations on the ground. In London there are now four stations at which thermometer readings are regularly taken in Stevenson screens on

(2973) 32/91 1,000 9/33 M. & S. *Gp.303*

roofs. Particulars of these are as follows :—

Adastral House, Kingsway. Asphalt roof, about 90 feet above street level.

South Kensington (Meteorological Office). Asphalt roof, about 60 feet above street level.

Oxford Street (Selfridge & Co. Ltd.). Screen on grass in roof garden, about 90 feet above street level.

38, *Holborn Viaduct, E.C.*1 (Messrs. Negretti and Zambra). Lead-covered roof, about 80 feet above street level.

For comparison purposes we have four meteorological stations in which the screens are exposed on grass in the standard manner. These are St. James' Park, Kensington Palace, Camden Square and Regent's Park. Further afield there are such stations as Hampstead, Tottenham and Kew Observatory in the suburbs, but we are concerned in this inquiry with conditions in inner London. The maximum temperature recorded on each day of July at all the eight stations is given in the attached table.

Looking first at the mean values for the month, we see that there is surprisingly little difference between the roof stations as a whole and the ground stations as a whole. The mean for the four roof stations (76·1°) is 0·3°F. *lower* than the mean for the four ground stations (76·4°F.). When this investigation was started it was thought that the heated asphalt roof at Adastral House had the effect of raising the readings there above the values appropriate to a normal exposure, but the actual data show that this is not the case, the readings agreeing well with those at Kensington Palace and Regent's Park. The lowest mean value is that for Negretti and Zambra's roof station in Holborn, and the next lowest that for St. James' Park. The "hottest" station is Camden Square, where the surrounding houses probably interfere seriously with the flow of air. It is of interest to add that at Richmond (Kew Observatory) the mean maximum for the month was 75·9°F. in the north-wall screen attached to the Observatory building and 75·8°F. in the Stevenson screen normally exposed on the lawn. These figures differ little from the values for Adastral House, St. James' Park, Kensington Palace, Regent's Park, Oxford Street and Holborn, which seems to dispose of the idea that the use of a north-wall screen results in the publication of abnormally low readings of maximum temperature at Kew Observatory during spells of hot weather.

Further investigation is necessary to explain why the roof at South Kensington is relatively warm and that at Holborn relatively cool. The point of most interest is that the readings taken on the Air Ministry roof do, in general, give a very fair representation of the average conditions in London during a warm period—as good a representation as would be given by a

normal station on the ground. No doubt a very different result would be obtained if a similar comparison were made, using

READINGS OF MAXIMUM TEMPERATURE IN JULY, 1933

Date	Roof Stations				Ground Stations			
	Adastral House	South Kensington	Oxford Street	Holborn	St. James' Park	Kensington Palace	Camden Square	Regent's Park
1	76	78	78	77	75	78	79	79
2	74	75	74	72	73	75	77	77
3	84	85	86	83	84	86	87	87
4	85	85	84	84	83	86	87	85
5	69	70	70	68	68	70	71	71
6	78	77	78	76	77	79	81	79
7	83	84	82	83	82	83	84	84
8	73	75	73	72	70	74	76	75
9	72	73	72	72	72	73	74	74
10	69	71	69	72	69	70	70	70
11	66	67	66	66	66	66	65	66
12	73	72	72	71	71	72	74	73
13	65	65	64	65	65	64	66	65
14	73	74	73	72	72	73	74	73
15	68	69	67	66	66	67	69	69
16	71	71	71	70	72	71	73	71
17	71	70	70	71	70	69	71	70
18	77	78	78	76	77	77	78	79
19	80	82	79	80	79	80	82	81
20	82	83	81	82	80	80	82	81
21	78	79	79	77	80	79	79	78
22	78	79	78	78	78	78	79	79
23	82	83	83	81	83	82	85	82
24	84	85	84	83	83	84	85	85
25	83	83	81	81	80	81	85	83
26	87	89	87	86	86	87	89	88
27	90	91	90	90	90	91	93	93
28	75	75	74	74	75	74	76	75
29	72	72	71	71	72	72	74	71
30	75	75	74	73	74	75	77	75
31	66	66	66	66	66	65	65	66
Mean	76·1	76·8	75·9	75·5	75·6	76·2	77·6	76·3

Mean of four roof stations=76·1°F. Mean of four ground stations=76·4°F.

minimum temperatures during a cold period in the winter. The deduction to be drawn is not that a roof is a suitable site for a Stevenson screen, but that the Stevenson screen is so effective

a radiation-shield that a good approximation to the air temperature can be obtained even on an asphalt roof in hot weather.

Further Records from the northern Pennines

The following abstract gives a further summary of the records of temperature obtained at Moor House, Upper Teesdale, since last September.* The mean difference of temperature between Moor House and Durham is very much what might be expected for the difference in height. Maxima for the period under review average 6·6°F. below those at Durham, minima 3·8°; but the departures from the Durham figures vary considerably in different months. In January, a cloudy month on the moors, the departures were 5·3° and 2·0° only. March as a whole was clear and dry, with large lowland ranges of temperature; the maxima at Moor House averaged 6·2° and the minima 2·4° below those at Durham. It may be mentioned that the greatest daily range occurred on the 26th (59°-31°), and it will be noted that the Moor House minima in this month averaged only 0·7° below those of Appleby, which lies about eight miles to the south-west. The latter station is quite low down in the Eden valley, which is well known locally for the greater severity of its spring night frosts compared with the hillsides a mile or two distant. As a whole, therefore, comparisons are better made with either Durham or Newton Rigg, in assessing the differences between the high moors and the lowlands. I have, however, added the Appleby figures to those given for Durham below, as the station is the nearest to Moor House which provides records of temperature.

It is clear that in calm weather the air temperature on the moorland closely approaches that of the lowlands; *e.g.*, August 11th, 1932, 77° against 78° at Durham and Newton Rigg; and June 4th, 6th, 7th of 1933 each gave 76° at Moor House against 79°, 78° and 78° at Durham. Also a maximum of 57° on March 12th (Durham 57°) may be cited. On the other hand, given a more breezy type of weather the differences are great; during the past very warm July the mean maximum at Moor House was 62·8°, Durham 71·3°; yet on the 4th, Moor House recorded its highest maximum so far (79°)—equal to that recorded in Durham on the same day; in this instance the Durham figure was kept down by the onset of a welcome afternoon sea-breeze. On the previous day a westerly breeze gave 75° at Moor House, but 85° in Durham. It seems clear from this and other instances that the Crossfell plateau lies away from the

* See *Meteorological Magazine*, Vol. 67, 1932, p. 206.

immediate influence of the North Sea; this is, for example, suggested by the figures quoted below for May.

Minimum temperatures have not at any time this year fallen exceptionally low, and May gave a minimum temperature for

TEMPERATURES 1932-3.

		Mean Max.	*Mean Min.*	*Mean*	*Extremes*			*Mean Max.*	*Mean Min.*	*Mean*	*Extremes*	
Sept.	Moor House	47·5	53·9	41·2	72	29	Durham	53·0	60·3	45·7	75	30
							Appleby	52·0	59·9	44·1	75	28
Oct.	Moor House	40·1	44·8	35·5	54	26	Durham	45·7	52·1	39·3	58	30
							Appleby	44·7	51·5	37·8	59	25
Nov.	Moor House	36·8	40·1	33·6	50	26	Durham	42·5	47·2	37·8	58	26
							Appleby	41·7	46·7	36·7	59	24
Dec.	Moor House	36·6	39·0	34·1	48	26	Durham	41·5	45·6	37·7	56	28
							Appleby	41·1	45·8	36·3	54	25
Jan.	Moor House	31·4	34·9	27·9	47	16	Durham	35·1	40·2	29·9	54	15
							Appleby	34·7	40·1	29·2	53	18
Feb.	Moor House	32·0	35·3	28·7	46	19	Durham	38·0	42·9	33·1	55	25
							Appleby	36·9	42·3	31·6	52	19
Mar.	Moor House	39·2	45·6	32·8	59	29	Durham	43·5	51·8	35·2	65	28
							Appleby	43·0	52·5	33·5	64	26
Apr.	Moor House	40·6	46·2	35·0	57	23	Durham	46·9	53·9	39·8	66	28
							Appleby	46·5	53·9	39·2	63	26
May	Moor House	46·1	52·5	39·7	66	33	Durham	50·2	56·8	43·6	69	34
							Appleby	52·2	60·2	44·2	73	35
June	Moor House	52·5	61·1	43·9	76	32	Durham	57·1	66·3	48·0	79	40
							Appleby	57·7	68·0	47·4	82	33
July	Moor House	56·2	62·8	49·6	79	42	Durham	62·2	71·3	53·2	85	47
							Appleby	61·2	70·4	52·0	83	43

Height of Moor House 1,840 ft., of Durham 336 ft. and of Appleby 440 ft.

the month of 33°. There was practically no snow after the beginning of March; and the big fall at the end of February was not regarded as exceptional at Moor House, although there were very large drifts. The quantity of snow seems to have been heavier further east. It appears that exceptionally low temperatures on the plateau demand a rather rare combination of circumstances; it remains to be seen what the coming winter will bring before coming to conclusions regarding this and many other points.

GORDON MANLEY.

OFFICIAL NOTICE

Discussions at the Meteorological Office

The series of meetings for the discussion of recent contributions to meteorological literature, especially in foreign and colonial journals, will be resumed at the Meteorological Office, South Kensington, during the session 1933-4. The meetings will be held on alternate Mondays at 5 p.m., beginning on Monday,

October 16th, 1933, when Lt.-Col. E. Gold, D.S.O., F.R.S., will open the discussion of a paper by S. K. Banerji and H. M. Wadia, entitled Evaporation and its measurement (1st paper). (Calcutta, India Meteor. Memoirs 25, Pt. 9, 1932, pp. 291-325.)

The dates for subsequent meetings are as follows:—

October 30th, November 13th and 27th, December 11th, 1933; January 15th and 29th, February 12th and 26th, and March 12th, 1934.

The Director of the Meteorological Office wishes it to be known that visitors are welcomed at these meetings.

Correspondence

To the Editor, *The Meteorological Magazine.*

Rain near Centre of Anticyclone

A curious example of rain near the centre of an anticyclone occurred here yesterday, August 4th, between 8 p.m. and 9.30 p.m. B.S.T.

Large drops of rain fell at intervals, amounting on two occasions to a smart shower, the total fall being 1·8 mm. The corrected barometer reading was 30·34 in., and Buxton was near the centre of a large high-pressure system which at the time was moving slowly north-east. The day had been oppressively close and humid (max. temp. 76°F.), and even at this altitude (1,000 feet) the air was stagnant, there being no appreciable wind from any point. There was much haze and some cumulus clouds of no great size or height. About 8 p.m. the sky became overcast, but it was so misty that the character of the cloud could not be determined. It should be emphasised that the rain was definitely of the large drop, thundery type, but no thunder or lightning occurred. The rain was definitely not of the " slight rain " or drizzle type occasionally experienced in anticyclones.

I am unable to account for this fall, having regard to its position in the anticyclone, and the apparent almost complete absence of air movement.

E. C. Rutherfurd.

10, *Grosvenor Mansions, Buxton. August 5th*, 1933.

Heavy Rain at Mangatuna, N.Z.

Perhaps the following may be of interest. It is from my son, H. E. Cave, from Mangatuna, about seven miles from Gisborn, on the east coast of the North Island, New Zealand. " It had been raining quietly and steadily for about 24 hours, and at 9 a.m. on the 26th May we had 2·51 in. for the two previous days. At 6.45 that evening I found . . . the rain-gauge overflowing, holding 4·05 in. An hour and a-half later I went

out again and measured 2·45 in. At 9 a.m. the next morning the rain-gauge was again overflowing with another 4·05 in., making 10·55 in. for the 24 hours, but of course there was actually more, though I have no idea how much. During the next 24 hours we got a further 5·57 in."

There was thus 16·12 in. for two days, and 18·83 in. for the four days. The very heavy rain was rather local, as Gisborne had only about 7½ inches for the two days.

C. J. P. CAVE.

Stoner Hill, Petersfield. August 23rd, 1933.

Cloud

It would be interesting to know the month and year when least cloud has been recorded, on the scale 0-10, at any station in the British Isles. My own observations during 22 years (except for a period during the War) give a minimum of 2·9 at Colchester in July, 1911. Other months with small amounts of cloud in south-east England are April, 1914 (3·7), and September, 1914, (3·6).

Since 1919, in the Midlands, I have never noted less than 4, and this only in spring or autumn months. August, 1933, with 4·8, is unusual.

G. C. WOOLDRIDGE.

Market Harborough. September 2nd, 1933.

[The "Radcliffe Observations" for 1926-30 contain, in the Appendix, a table giving the mean cloud percentage for each month from 1881 to 1930. In this period of 50 years the lowest entry is 35 per cent for September, 1928. The percentage was 39 in July, 1911, 38 in April, 1914, and 44 in September, 1914. It should be mentioned that the Oxford observations refer to the mean of 9h., 12h. and 21h. Mr. Wooldridge does not say to what hour, or combination of hours, his observations refer. In the *Monthly Weather Report*, Table IV, the data in regard to cloudiness are printed separately for each hour of observation, and the importance of specifying the observing hours may be illustrated by the fact that for the year 1932 the mean cloud amount at Kew Observatory was 7·1 at 7h., 7·9 at 13h., 6·9 at 18h., and 6·1 at 23h. (on the scale 0-10). A complete reply to Mr. Wooldridge's question would clearly involve a good deal of research.—ED., *M.M.*]

Unusual Cloud Formation Observed at Weston Zoyland Camp

An unusual cloud formation was observed at Weston Zoyland, Somerset, on Thursday, July 27th, at about 10h. 40m. G.M.T. The sky was about 8/10 clouded with mainly alto-stratus and

cirro-stratus. A patch of cloud (about 1/10) resembling stratus, but showing extraordinary convolutions was noticed a little to the south of the zenith at about 10h. 40m. Further small detached cloudlets were observed forming near this cloud and resembled the column portion of a waterspout. The column was pointed at the lower end and broadened towards the top where there was a small tuft of cloud. The lower end of the column appeared to be at about 2,000 ft., while the top of the cloud reached to 2,500-3,000 ft. The top of the column was carried along more quickly than the bottom, with the result that the column soon assumed a roughly horizontal position, though by then it was considerably distorted. These merged into the cloud increasing the convolution effect already observed. The cloud was moving from south to north, and by about 10h. 50m. had passed beyond the zenith. To the north and in advance of the convoluted cloud, further " waterspout " cloudlets were forming, while to the south of the zenith a patch of cloud (about 2/10) showing a mammato formation, had developed. The further cloud formation to the north soon died out and by 11h. 5m. the phenomenon was over and the clouds described had assumed a fracto-stratus formation against an alto-stratus background.

During the early part of the morning (7h.-10h.) the weather was hot and oppressive with a light variable wind. The sky was nearly clear at first but later clouded over with cirro-stratus and alto-stratus. The temperature rose to 78°F. then fell to 75°F. by 11h. A shallow depression centred near the Scilly Isles at 7h. was moving in a north-north-easterly direction.

The peculiar cloud formation was presumably due to the inflow of cooler air as the depression advanced, causing violent ascending currents of warm air which produced the clouds observed. Unfortunately, or perhaps fortunately, no aircraft were flying in the vicinity of the cloud so no reports of " bumpiness " are available.

D. DEWAR.

Weston Zoyland Camp, Somerset. August 22nd, 1933.

The Colour of Moonlight

With reference to Dr. Simpson's article in the current *Meteorological Magazine*, which I am pleased to see, may I, on an incidental point he refers to, point out that clouds and sky occasionally take on a violet hue at midday in midwinter, as well as towards evening at other seasons.

I have often observed this at midday in December, but never, I think, outside that month.

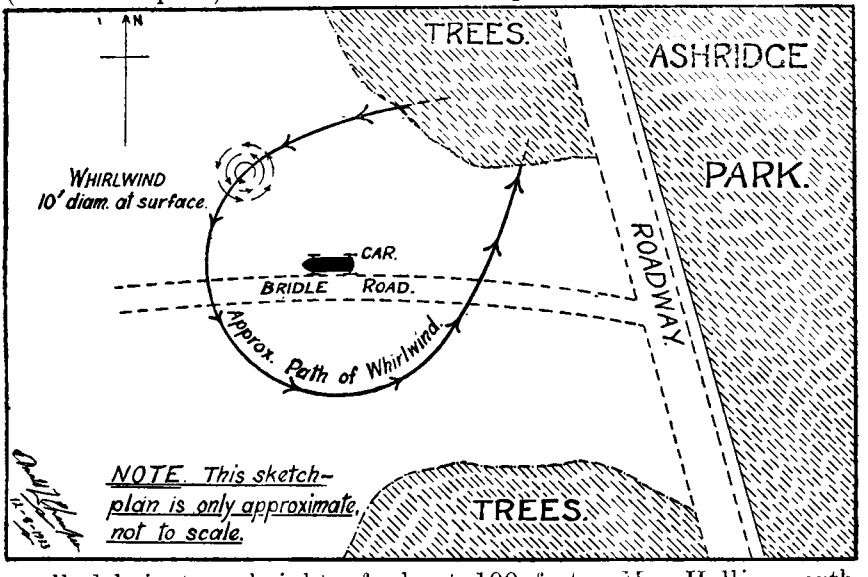
L. C. W. BONACINA.

35, *Parliament Hill, London, N.W.*3. *August 22nd*, 1933.

Whirlwind near Great Berkhampstead

I am indebted to Mr. J. Hollingworth, A.M.I.C.E., for the following details of a whirlwind which he observed on May 13th, 1933, the day before a similar phenomenon was seen at Eskdalemuir.

At 5.30 p.m. B.S.T., his car was parked on Berkhampstead Common, at a point about 550 ft. above M.S.L., two miles due north from Great Berkhampstead, Herts. The sky was fairly clear, apart from a few isolated cumuliform clouds, and the air was dead calm. Suddenly a great noise "like the rush of escaping steam" was heard in the adjacent trees of Ashridge Park, and a well-defined whirlwind approached from the east and circled, in a radius of 35 or 40 feet, around the car and passed away almost at the point from which it first appeared (see sketch plan). The whirl carried pieces of paper and other



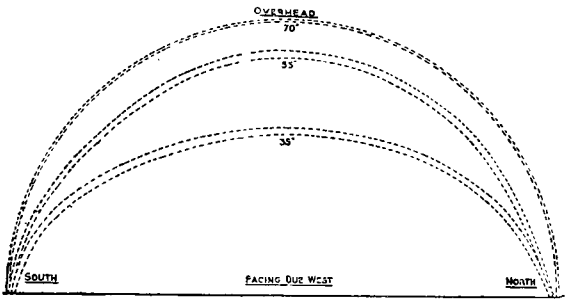
small debris to a height of about 100 feet. Mr. Hollingworth states "a paper bag drawn up rotated in corkscrew motion, and the higher it rose the wider the turning circle appeared. Thus starting at, say, 10 feet in diameter, at a height of 50 feet it might have been 40 or more feet across the turning circle; but the pitch of the corkscrew motion was also varying, thus at the ground it was small, but higher up greater. This would appear to conform with the law of a true vortex."

The rotation of the whirl, and also its motion about the car, was definitely cyclonic, and the time taken in its circuit round the car was about 10 or 12 seconds. After the whirlwind had passed away into Ashridge Park, the air again became dead calm.

DONALD L. CHAMPION.

Luminous Night Cloud

During the evening of July 24th, 1933, an unusual cloud formation of cirrus was seen at Westcliff-on-Sea, Essex. At 21h. 20m. G.M.T. a belt of cirrus cloud was observed stretching across the western sky at an elevation of 35°, from north to south, forming a bow, and moving in an easterly direction. This was rapidly followed by a second belt, and between 21h. 20m. to 21h. 50m. eight belts of cloud travelled across the sky from due west to east, the eighth belt disappearing at 21h. 50m. at an elevation of 105°. None of the belts appeared from the west until at an elevation of 35°, probably because the western sky was too bright at the time to allow of any contrast at lower elevations, nor were any visible after reaching the elevation at 105°. At 21h. 30m. four belts were visible simultaneously at elevations of 35°, 55°, 70° and 105° from west. All the belts were approximately 1½° in width, the width being even throughout their length.



The belts of cloud were whitish in appearance, the three lower being very clear, whilst that which had passed overhead was considerably less clear. The brilliancy of the belts was similar to that of the Milky Way on a clear moonless night. As the belts of cloud travelled across the sky they presented a striking appearance. As each attained the 70° elevation and beyond, stars in the path of travel were plainly seen through the cloud, which clearly denotes that the cloud belts were very tenuous.

The sky during the time of observation was very translucent, no other clouds were visible; in fact, a perfect summer night, and a calm.

Weather conditions during the preceding two or three days had been very fine.

E. J. Horrex.

32, *Ceylon Road, Westcliff-on-Sea. August 22nd*, 1933.

NOTES AND QUERIES

The Effect of Warm Water on Soil Temperature

Mr. G. M. Meyer has raised the question, if a plot of soil were treated with warm water, to what extent would the soil temperature be raised and how long would the effect be noticeable. A theoretical answer to this question presents difficulties, but

Mr. F. J. Scrase kindly made the experiment at Kew Observatory, with the following result:—

On July 20th, at 14h. G.M.T., a generous amount of water at a temperature of 93°F. was poured on a plot of soil containing a bulb of the autographic recorder at a depth of 4 inches. Just previous to adding the water the temperature at 4 inches was 74·0°F. The application of the water caused a rise in temperature on the record of 4·9°F. The warm water was applied at 14h. G.M.T., and by 20h. G.M.T. the effect had disappeared. There was practically continuous sunshine from 11h. G.M.T. until sunset.

Campbell-Stokes Sunshine Recorder, "Universal" Pattern

In the "tropical" pattern of Campbell-Stokes sunshine recorder, the sphere is rigidly held in place by means of screws at the two opposed points on the polar axis. By making provision for adjusting the position of the axis and bowl to suit the latitude the same type of support can be used in temperate latitudes. Recorders designed in this way are catalogued by several firms under the description "universal pattern."

It has recently come to the notice of the Meteorological Office that sunshine recorders of this pattern, but fitted with the tropical type of bowl, are sometimes used in this country, and it seems desirable to utter a warning as to the unsuitability of such bowls for use outside the tropics. In temperate latitudes during the summer months the sun will be above the horizon for much more than 12 hours; a duration of burn of 15 hours is not uncommon in the British Isles. In the tropical pattern of bowl the card is only supported for a length corresponding with 12 hours of time, and in consequence the ends of the British summer cards are unsupported for a considerable length if used in this bowl. These unsupported portions of the card will not lie at the correct distance from the centre of the sphere, so that the sun's rays will not be focussed upon them and a good deal of early morning and late evening sunshine will be lost from the record. The standard bowl for temperate latitudes is so cut that support is given to the summer card almost to the extreme end, and it is essential to use this type of bowl in the British Isles if accurate records are to be obtained.

Hurricane of June 27th in Trinidad

As mentioned in the *Meteorological Magazine* for July, p. 149, a severe hurricane passed across the south of Trinidad on June 27th. Local newspaper cuttings kindly lent by the West India Committee contain a good description of the changes of wind direction experienced by Mr. H. Fahey at a well-exposed point

near Siparia, close to the south coast, which adds considerably to our knowledge of this unusual storm. The hurricane winds began from north about 7 p.m. and maintained this direction until 8.30, gradually increasing in force. Most of the derricks were destroyed, the broken clocks registering about 8.10. From 8.30 to 9.30 the wind veered from north to due east; high woods and some derricks that had survived the northerly gale fell towards west. After 9.30 the wind shifted from east to south-east by south, blowing from the latter direction at 10.30 p.m. when the hurricane ended. The final stages were accompanied by very heavy rain with a few violent gusts.

These observations clearly show that the storm centre passed to the south of the observer travelling in a direction a little south of west. Observations at Cedros, near the south-western point of Trinidad, show that the centre also passed to the south of that village, where many buildings were demolished including the school. Actually the centre is said to have passed over a tanker at the mouth of the San Juan river, on the coast of Venezuela to the west-south-west of Cedros. Thus it must have been very near the south coast of Trinidad. On the opposite coast of Venezuela the mangroves were damaged for only a few miles inland, and Mr. Fahey estimates the diameter of the storm as only 35 miles.

The storm travelled westward for about 100 miles, and then turned towards the north-west. On the morning of June 29th, the centre was about lat. 13°N., long. 70°W., and on the 30th it passed south of Jamaica. Its further course was described in the *Meteorological Magazine* for August, p. 173.

Although this occurrence reminds us that the zone of West Indian hurricanes includes Trinidad, they are very rare so far south, and the only previous records of severe visitations in the island refer to 1884 and 1810. That of February 23rd, 1884, blew down a number of large trees near Port of Spain in the north of Trinidad, but does not seem to have been severe. The hurricane of May 12th, 1810, was more serious; houses were blown down and shipping destroyed, but as in 1884 the damage was confined to the northern part of the island. The hurricane of June 27th, 1933, is thus outstanding for the extreme southerly position of its track as well as for the violence and long life of so small a centre.

Hurricane in the eastern U.S.A.

A hurricane of tropical origin traversed the Atlantic coast of the United States on August 23rd and 24th. It was first recorded on August 17th as a disturbance of considerable intensity centred in about lat. 18°N., long. 50°W., to the eastward of the Lesser Antilles, moving westward. By the morning of August 18th,

it had advanced to 54°W. and was accompanied by gales. Its track had already begun to curve towards the west-north-west, and on the 19th it was centred about 22°N., 61°W. On the 20th it lay about 200 miles south-south-east of Bermuda, and the following day it travelled north-westward passing 150 miles west of Bermuda and began to affect the weather on the coast of the United States. On the 22nd it lay about midway between Bermuda and Cape Hatteras, but its movement had become slow and irregular and there was a chance that it would dissipate without doing serious damage. This hope was not fulfilled, for next day the north-westward advance was resumed and the centre crossed the coast at Cape Hatteras. A violent gale with wind velocities of 60 to 80 miles per hour swept the seaboard from Norfolk, Virginia, to New York; several vessels were driven ashore, and high waves destroyed houses, piers and pavilions in the coastal resorts. The winds caused unusually high tides, and several towns, including a large part of Philadelphia, were flooded.

The storm centre passed over Washington on the evening of the 23rd. It was decreasing in intensity, but was still very severe, and according to reports in the Press the barometer fell to 980 mb.; telephone and telegraph wires were broken and many trees uprooted. During the day nearly 7 inches of rain fell in the city, which was extensively flooded, the main electric power station being put out of action. Large areas were flooded in Maryland, Virginia and Pennsylvania, and thousands of people were made homeless. During the passage of the storm along the coast 47 lives were lost and the material damage was estimated at ten million dollars. On the 24th it continued its path northwards towards Canada, but by the 25th its intensity was so greatly diminished that no serious damage was done north of New York.

Duststorm at South Farnborough

During dry spells and with a fresh southerly or northerly wind small duststorms have been frequently observed in the Long Valley, Aldershot. A similar occurrence during the passage of a front on the afternoon of July 27th, 1933, was, however, on a much greater scale than any hitherto noticed.

The dust was first observed at 14h. 35m. G.M.T. being carried along by a SSW. wind. By 14h. 43m. the wind had increased during the passage of the front to a mean speed of 35 m.p.h. with a maximum gust of 44 m.p.h. The dust had now encroached on to the western side of the aerodrome, obscuring Pyestock woods and reducing visibility to about 800 yards in this direction, and probably to a much less amount in the track of the dust. It appeared to present a solid wall about 100-200 feet

high. There was no general movement of the dust front eastwards across the aerodrome, and as the wind decreased to 25 m.p.h. at 14h. 48m. so the duststorm subsided. A considerable diffusion of dust must have occurred as all objects and papers in the main building of the Royal Aircraft Establishment became covered with a fine layer. A pilot flying at the time reports that the dust extended to a height of 1,000 to 1,200 feet, and conditions were very bumpy up to 3,000 feet. Heavy rain was experienced at 5,000 feet, but little of this found its way down to the surface. Most of what was recorded occurred after the passage of the squall.

The front appears to have moved quickly eastwards in the strong wind prevailing above 1,000 feet. It passed Worthy Down at about 14h. 15m., where a gust of 38 m.p.h. was recorded, and was observed at Guildford a few minutes after passing Farnborough. No change occurred in the wind direction at the surface, which remained SSW. The barograph, however, rose about 2 mb. from 14h. 30m. to 14h. 45m., remained steady for about half-an-hour, and then fell about 3 mb. during the ensuing hour. Temperature fell gradually from 82°F. at 14h. 30m. to 73°F. at 15h. 15m. G.M.T., at which time the sky, which had been covered with nimbo-stratus and alto-stratus above 6,000 feet, had begun to clear in the west. No thunder was reported in this locality although it had been expected.

W. H. Bigg.

(*Note on the above*)

The cold front moved rapidly across southern England accompanied by widespread slight showers and a little local thunder. The absence of any general or severe outbreak of thunderstorms may be attributed to the low humidity and the correspondingly high level of the clouds. The lapse rate of temperature at Duxford was abnormally high, the mean lapse rate up to 6,700 feet at 12h. 30m. G.M.T. being equal to the dry adiabatic rate. The figures were 93°F. at the ground (100 feet above M.S.L.), 57°F. at 6,700 feet and 42°F. at 10,360 feet. The horizontal temperature gradient was also large, the maximum temperature on July 27th being 99°F. at Paris and 94°F. at Margate, but only 63°F. at Renfrew and 59°F. at three stations in northern Ireland.

At London (Kingsway) the squall arrived at 15h. 5m. G.M.T. and the maximum gust was 35 m.p.h. Temperature on the roof fell from 90°F. to 78°F. in under two hours, but afterwards recovered to 80°F. The barograph behaved almost exactly as at Farnborough, and this suggests that most of the fall of temperature was due to the evaporation of the rain and the cessation of sunshine. A second cold front passed during the night, the wind at Kingsway veering from SW. to NW. at about midnight.

This was really the main cold front, and the fall of temperature was probably large at 1,000 feet, though small at the ground owing to the time being midnight. This front caused no rain at any reporting station in the south-east. The rainfall for the 24 hours was trifling over nearly the whole of England and adjacent regions of the Continent. There was, however, considerable rain and in places also thunderstorms over a large area in Ireland and Scotland, the rainfall mounting to 1·30 in. at Eskdalemuir, 0·75 in. at Inchkeith, and 0·71 in. at Aberdeen. This rain area moved north-eastwards in the same direction as the associated depression, but considerably to the left of the path of the centre, its south-eastern boundary being at least 120 miles from the centre.

The depression moved quickly north-eastward from the bay of Biscay across Cornwall and the Midlands to the Humber, and thence to the Gulf of Bothnia. It deepened slightly during its passage across England, and more markedly afterwards. The pressure at the centre was about 1,011 mb. at 7h. on the 27th, 1,008 mb. at 18h., 998 mb. at 7h. on the 28th, and 985 mb. at 7h. on the 29th. C. K. M. DOUGLAS.

A new Meteorological Station in Massachussetts

We learn from the Bulletin of the American Meteorological Society, April, 1933, that a new meteorological station has been established on Mount Wachusett (2,018 feet), Princeton, central Massachusetts, under the auspices of Blue Hill Observatory of Harvard University, and in connexion with the work of the International Polar Year. There will be no resident observers. A meteorograph, designed and built by Prof. S. P. Fergusson to run for two or three months without attention will keep the record of wind direction and velocity, atmospheric pressure, temperature and humidity.

The Degree of Accuracy in Estimating Tenths

The sixth volume of the *Geophysical Magazine* of Japan is dedicated to Professor T. Okada in commemoration of his thirty years' service in the Central Meteorological Observatory of Japan, and contains, in addition to a very fine coloured photograph, an account of his work with a list of his publications and a valuable series of papers on geophysical subjects by his friends and pupils. One of these, by S. Ono,* presents some interesting statistics on the accuracy with which a scale division can be mentally sub-divided in estimating fractions.

The data were obtained at an exhibition of precise instru-

* On the error of observation reading the decimal fraction of a uniform scale. *Geoph. Mag., Tokyo*, 6, 1932, pp. 387-91.

ments held in Tokyo. Spaces on twelve cards (representing, for example, degree marks on a thermometer) had lines drawn in intermediate positions, and a prize was offered for correctly " reading " the cards to the nearest tenth of a division. The lines were actually drawn in the positions: 0·50, 0·24, 0·33, 0·12, 0·38, 0·72, 0·66, 0·93, 0·40, 0·54, 0·20, 0·80; the correct answers being 0·5, 0·2, etc. There were 4,320 entries, of which 45 were correct and 418 had only one error, while 2,559 had more than half the answers correct. The most accurate estimates were made by government officials and students. It is curious that among the more accurate observers 0·66 was a much greater stumbling block than 0·24.

A number of competitors attempted to give estimates to two places. These were rejected but have also been examined statistically. Certain tendencies were shown. Thus, many competitors appeared to estimate the reading first as a simple fraction rather than directly in tenths. It was also found that values above 0·5 were over-estimated, while values below 0·5 were under-estimated. The investigation throws much light on the psychology of observing and is to be carried further.

Reviews

Nautisk-Meteorologisk Aarbog 1932. The Danish Meteorological Institute, Copenhagen, 1933.

The Danish Meteorological Institute is to be congratulated on the promptitude with which this valuable annual volume is issued. In addition to observations of wind, temperature, salinity and ocean currents in Danish waters, it includes a great deal of valuable information about the North Atlantic and Arctic waters. The summaries of the state of ice in the Arctic are too well known to require description; the series of reports extends back to 1895 and is of very great value in studying variations of the atmospheric circulation and their causes. This year, owing to the presence of several expeditions, the record is unusually complete. Another regular series is continued in the monthly charts of sea surface temperature in the North Atlantic north of 50° and in Davis Strait. All these observations from high latitudes and the corresponding ones for 1933, will be essential when the results of the second International Polar Year come to be discussed. This volume concludes with an index of the contents of the " Nautical-meteorological Yearbook " since 1880, which brings out the great services to oceanography rendered by the Danish Meteorological Institute.

Über Klimatophysiologie. By Prof. Dr. A. Loewy. Size 8½ × 6 in., pp. 77, *Illus.* Leipzig, 1931.

The book is a summary of lectures delivered to medical and

meteorological students. It is in two parts, the first part dealing with climatophysiology in general and the second with the physiological effects of special types of climate.

In the general effect of climate on the body the cooling power of the air is more important than the temperature. No formula for the cooling power is given. Two instruments for measuring it are discussed—the kata-thermometer and frigorimeter. A warning is given that the analogy between these instruments and the human body as subjects for the effect of climate should not be pushed too far; they do, however, give an approximation to the heat demand on the body in varying conditions of climate. A table of cooling powers of six different stations shows that Davos, with an annual mean temperature of only 2·6°C. has a mean cooling power of 9·57 millical./cm.^{2} sec., lower than that of Karlsruhe (mean temperature 9·7°C.), Schreiberhau and Swinemünde.

In the second part the effects of the special types of climate are dealt with rather fully. In the description of "sea climate" it is pointed out that radiation is one of its important characteristics, and ten pages are devoted to recent researches on the effects of the red and violet rays on the body. Under "tropical climate" the importance of acclimatisation is emphasised.

As the lectures are intended for medical students as well as meteorologists, they contain a good deal of physiology and the bodily changes in different climates are dealt with in considerable detail.

Solar Radiation Measurements at Poona in 1931. By S. S. Kohli, M.Sc. Calcutta, India Meteor. Dept. Memoirs, Vol. xxv, Part X, 1932.

This paper forms a useful addition to the data of solar radiation in tropical latitudes. For nine months, February to June, 1931, and October, 1931, to January, 1932, observations were made regularly near noon on sufficiently clear days with an Angström pyrheliometer at normal incidence; during the monsoon from July to September there was too much cloud. Observations were also taken throughout the day on suitable days. In addition to total solar radiation, the amounts in the red and infra-red regions in which water vapour is effective were also measured. The results are discussed in detail, and the effect of the varying turbidity and humidity during the year are clearly brought out. The effect of the gradual rise of the layer of haze over Poona to the level of the instrument is shown by a kink in the diurnal curve for November.

The second part of the paper discusses the total energy received from sun and sky on a horizontal surface, measured by a Callendar Pyranometer. These measurements are analysed and compared with the sunshine records, and it is shown that the

radiation received during the monsoon is much greater than that calculated from the duration of sunshine by Angström's formula.

The latitude shift of the storm track in the 11*-year solar period. Storm frequency maps of the United States, 1883-1930.* By C. J. Kullmer. Washington, D.C. Smithsonian Miscellaneous Collection, Vol. 89, No. 2. 1933.

One of the corollaries of Huntington's theory of the shift of climatic belts was that the storm tracks of temperate regions must swing north and south in response to solar changes, and that a similar effect ought to appear during the sunspot cycle. This question was investigated by C. J. Kullmer about 1913 and answered with a slightly doubtful affirmative. Since then the data for two more cycles have become available, and Kullmer has repeated his investigation, with more decisive results. For each area of $2\frac{1}{2}°$ of latitude by 5° of longitude the number of storm centres for each year is plotted. The sum for the three years about a spot minimum is then subtracted from the sum for the three years about the following spot maximum and the results again plotted. From these maps it appears that near spot maximum there is an excess of storms in the north of the United States and a deficit further south. The results are not quite regular, the last cycle (max. 1927-9, min. 1922-4) having been especially anomalous, but all follow the same general pattern. The paper will repay detailed study.

Books Received

Height of base of clouds in India as determined from pilot balloon ascents. By the late M. V. Narayanan, B.A., and M. P. Manna. India Meteor. Dept., Sci. Notes, Vol. iii, No. 25. Calcutta, 1931.

Falmouth Observatory. Meteorological Notes and Tables for the year 1931, also additional meteorological tables of temperature, rainfall and sunshine, 1880-1931. By W. T. Hooper. Falmouth, 1932.

Bulletin de l'Observatoire de Talence (Gironde). 2nd Series, Nos. 19-20; Talence, 1932; and 3rd Series, Nos. 1-4, 1933.

Obituary

We regret to learn of the death on August 24th, 1933, at the age of 82 years, of Mr. W. G. James, who retired from the Meteorological Office Staff on December 31st, 1919, after 50 years' service in the Marine Division.

News in Brief

The photograph, accompanying the note on a tornado at Peshawar which appeared on p. 117 of the June number of this magazine, was reproduced by the courtesy of Mr. R. Pleasants.

The Weather of August, 1933

Pressure was above normal over western and central Europe, (except for most of Scandinavia), over most of the North Atlantic, also over south-western and central Canada and California; the greatest excess was 3·4 mb. at the Scilly Isles. Pressure was below normal over eastern Europe, most of Scandinavia, Spitsbergen, Madeira and also over Greenland, Iceland, northern and eastern Canada and the United States, except the extreme west and the Lake Region. The deficiency was greater than 5 mb. over south Greenland, Iceland and Spitsbergen. Temperature was above normal over western and central Europe and Spitsbergen, while rainfall was generally deficient except at Spitsbergen, being less than half the normal in southern and central Sweden.

August was notable for the small rainfall and abundance of sunshine with high temperatures over the greater part of the British Isles. At several stations in the south of England it was the driest and sunniest August on record. At the beginning of the month an anticyclone was spreading over the British Isles from the Atlantic; weather was fine, sunny and warm generally for several days though there was a little rain in north-west England and Ireland. Day temperatures gradually increased until the 6th which was the hottest day; on that day 91°F. was reached at Cambridge and Margate, 92°F. at Tottenham and South Farnborough and 96°F. at Greenwich.* The minimum of 67°F. at Kew on the night of the 2nd-3rd and the maximum of 83°F. at Aberdeen on the 3rd were the highest for the first ten days of August at these stations since 1871. On the 6th a shallow trough of low pressure lay over Scotland and Ireland and thunderstorms occurred at a few stations in Scotland. It was cooler generally on the 7th though still warm. There was rain in Scotland and Ireland on the 7th and 8th and in England on the 11th, when thunderstorms occurred in the south with the advance of a shallow depression from France. On the 10th Jersey recorded 16·8 hours of bright sunshine. There were local thunderstorms on the 13th and 14th particularly on the south coast. From the 14th until the 23rd conditions were rather unsettled due to the passage of depressions to the north of the British Isles, and further thunderstorms occurred on the 20th and 21st. Good sunshine records were obtained, however, during this period especially on the 13th, 16th and 19th. Rainfall was slight and irregular, some fell on most days in Scotland, Ireland and western England and on two or three days in the rest of England. From the 24th conditions were anticyclonic over a large part of the country; in the south and east fine sunny weather prevailed until the end of the month and high day temperatures were again reached; on the 28th 88°F. was recorded at several stations, York recorded 89°F. and Hull 90°F. Greenwich recorded

* In a Glaisher stand.

90°F. on the 29th and 30th. Towards the end of the month, however, Ireland and the north-west of England came under the influence of a depression on the North Atlantic and heavy rain fell on the 27th and 28th; 3·01 in. fell at Aasleagh House and 2·91 in. at Delphi Lodge in Co. Mayo and 2·36 in. at Ballynahinch Castle, Co. Galway, on the 27th, 1·52 in. fell at The Moraine, Borrowdale, and 1·74 in. at Lligwy, Anglesey, on the 28th. The distribution of bright sunshine for the month was as follows:—

	Total (hrs.)	Diff. from normal (hrs.)		Total (hrs.)	Diff. from normal (hrs.)
Stornoway	159	+26	Liverpool	189	+25
Aberdeen	188	+38	Ross-on-Wye	244	+70
Dublin	194	+32	Falmouth	228	+17
Birr Castle	181	+39	Gorleston	241	+35
Valentia	159	+ 4	Kew	250	+63

The special message from Brazil states that rain was scarce in the north, centre and south, the averages being ·83 in., ·16 in., and 1·22 in. below normal respectively. The passage of four anticyclones caused low temperatures. Frosts occurred in the south during the second decade and strong winds during the first decade. The crops were generally in good condition but in the centre and south they were affected by the frost, especially the tobacco and coffee. At Rio de Janeiro pressure was 1·2 mb. above normal and temperature was 0·7°F. below normal.

Miscellaneous notes on weather abroad culled from various sources. A heat wave was experienced generally over southern and central Europe during the first part of the month, 102°F. was recorded at Perpignan on the 7th and at Madrid on the 8th. Violent thunderstorms brought the prolonged heat wave to a close in Austria, Hungary and Switzerland on the 12th, and caused a temporary break in France on the 14th. Lightning and floods caused serious damage in Vienna and the neighbourhood, and in the Interlaken region, where several bridges were carried away; a number of deaths also occurred in Vienna. Forest fires, some caused by lightning, broke out in France on the 13th, 14th and 15th, but were for the most part soon under control, while a hailstorm damaged the crops in the Hérisson district. A break in the heat in northern Italy about the 16th was accompanied by severe storms. Heavy rainfall caused the Kilchenstock to become menacing again. (*The Times*, August 2nd-25th; *and British Daily Weather Report.*)

Severe monsoon weather caused floods in many places early in the month between Rangoon and Mandalay. Heavy rain continued to fall in western India during the first part of the month, and this was followed by serious floods; 15 in. of rain were reported to have fallen in 18 hrs. at Baroda, but the

inundation was not so great as in 1927; two people were killed and about 4,000 rendered homeless. The monsoon was weak outside north-east India during the week ending the 16th, but was active in north-east India, north-west India and the central part of the country towards the end of the month. Flood waters from the Shyok Dam were coming down the Indus on the 28th, but they were subsiding on the 29th, and it was thought that the leak in the Shyok Dam had quickly filled again with ice. Serious floods occurred along the banks of the Yellow River during the later part of the month; thousands of people were drowned in western Shansi and over 300,000 people were rendered homeless in Honan. By the 23rd the floods in western Shantung were subsiding, the rains having ceased for some days. (*The Times*, August 2nd-September 1st.)

Owing to the drought the coffee crop in Kenya is expected to be of poor quality. General rains throughout the Cape and parts of the Orange Free State about the 27th broke one of the worst droughts experienced there. (*The Times*, August 23rd-29th.)

Heavy general rains towards the end of the month broke the drought in South Australia and have been of much benefit to the agricultural and pastoral areas, though the consequent floods did damage to property. (*The Times*, September 1st-2nd.)

Dry, hot weather was experienced generally at first in Canada, followed by fairly general rains near the middle of the month; but there was another period of dry, hot weather before the generous rains at the end of the month which benefited the late crops. A cloudburst occurred south-east of Denver, Colorado, on the 2nd, followed by the bursting of Castlewood Dam, so that Cherry Creek flooded much of the city and surrounding country. A hurricane swept along the Atlantic coasts of the United States on the 23rd and 24th.* Temperature in the United States on the whole was somewhat below normal at the beginning of the month, but became above normal generally in the western districts later, while the rainfall distribution was irregular. Heavy rain on the 15th in Jamaica culminated in a severe thunderstorm early in the morning of the 16th, when many parts of the Island were flooded; about 40 people were drowned and some 10 bridges destroyed. A hurricane struck the Bahamas on the 31st doing considerable damage, and then moved south-south-west towards Cuba. (*The Times*, August 2nd-31st, and *Washington, D.C., U.S. Dept. Agric. Weekly Weather and Crop Bulletin.*)

General Rainfall for August, 1933

England and Wales ...	38	per cent. of the average 1881-1915.
Scotland	75	
Ireland	58	
British Isles	51	

* *See* p. 188.

Rainfall: August, 1933: England and Wales.

Co.	Station	In.	Per-cent. of Av.	Co.	Station	In.	Per-cent. of Av.
Lond .	Camden Square	·58	26	*Leis.* .	Thornton Reservoir ...	·68	24
Kent .	Tenterden, Ashenden...	·86	38	,, .	Belvoir Castle.....	·63	24
,, .	Folkestone, Boro. San .	·87	...	*Rut* .	Ridlington	·73	29
,, .	St. Peter's, Hildersham	...	...	*Lincs* .	Boston, Skirbeck	·40	17
,, .	Eden'bdg., Falconhurst	1·18	45	,,	Cranwell Aerodrome ...	1·21	45
,, .	Sevenoaks, Speldhurst	.79	...	,, .	Skegness, Marine Gdns	·76	31
Sus .	Compton, Compton Ho.	1·17	38	,, .	Louth, Westgate	1·03	37
,, .	Patching Farm	1·23	49	,, .	Brigg, Wrawby St. ...	·35	...
,, .	Eastbourne, Wil. Sq.	1·17	47	*Notts* .	Worksop, Hodsock ...	·31	13
,, .	Heathfield, Barklye ...	1·54	57	*Derby* .	Derby, L. M. & S. Rly.	·75	29
Hants .	Ventnor, Roy. Nat. Hos.	1·09	55	,, .	Buxton, Terr. Slopes	1·41	32
,, .	Fordingbridge, Oaklnds	·65	25	*Ches* .	Runcorn, Weston Pt...	1·66	46
,, .	Ovington Rectory	1·09	40	*Lancs* .	Manchester, Whit Pk.	1·10	32
,, .	Sherborne St. John ...	·37	15	,, .	Stonyhurst College ...	3·17	63
Herts .	Welwyn Garden City...	·47	...	,, .	Southport, Hesketh Pk	1·76	51
Bucks .	Slough, Upton	·70	32	,, .	Lancaster, Greg Obsy.	2·98	66
,, .	H. Wycombe, Flackwell	·49	...	*Yorks* .	Wath-upon-Dearne ...	·27	11
Oxf .	Oxford, Mag. College...	·74	33	,, .	Wakefield, Clarence Pk.	·41	16
Nor .	Pitsford, Sedgebrook...	...	...	,, .	Oughtershaw Hall.....	2·51	...
,, .	Oundle.....	·66	...	,, .	Wetherby, Ribston H.	·53	19
Beds .	Woburn, Crawley Mill	·90	39	,, .	Hull, Pearson Park ...	·52	18
Cam .	Cambridge, Bot. Gdns.	1·10	47	,, .	Holme-on-Spalding ...	·45	...
Essex .	Chelmsford, County Lab	·37	17	,, .	West Witton, Ivy Ho.	·55	19
,, .	Lexden Hill House ...	·45	...	,, .	Felixkirk, Mt. St. John	·45	16
Suff .	Haughley House.....	·87	...	,, .	York, Museum Gdns.	·50	20
,, .	Campsea Ashe.....	1·13	57	,, .	Pickering, Hungate ...	·28	11
,, .	Lowestoft Sec. School	1·02	46	,, .	Scarborough	·41	15
,, .	Bury St. Ed. Westley H.	1·03	40	,, .	Middlesbrough	·52	19
Norf .	Wells, Holkham Hall	·73	30	,, .	Balderdale, Hury Res.	1·19	34
Wilts .	Devizes, Highclere.....	·97	34	*Durh* .	Ushaw College	1·33	46
,, .	Calne, Castleway	1·04	37	*Nor* .	Newcastle, Town Moor	1·70	58
Dor .	Evershot, Melbury Ho.	1·51	48	,, .	Bellingham, Highgreen	1·72	49
,, .	Weymouth, Westham .	·54	25	,, .	Lilburn Tower Gdns...	1·86	66
,, .	Shaftesbury, Abbey Ho.	·95	33	*Cumb* .	Carlisle, Scaleby Hall	2·30	56
Devon.	Plymouth, The Hoe ...	1·43	46	,, .	Borrowdale, Seathwaite	7·00	64
,, .	Holne, Church Pk. Cott.	1·64	37	,, .	Borrowdale, Moraine...	8·67	...
,, .	Teignmouth, Den Gdns.	1·09	48	,, .	Keswick, High Hill...	2·86	55
,, .	Cullompton.....	1·29	42	*West* .	Appleby, Castle Bank	2·10	64
,, .	Sidmouth, Sidmount...	1·54	55	*Mon* .	Abergavenny, Larch...	·35	12
,, .	Barnstaple, N. Dev. Ath	1·37	42	*Glam* .	Ystalyfera, Wern Ho.	1·82	29
,, .	Dartm'r, Cranmere Pool	3·40	...	,, .	Cardiff, Ely P. Stn. ...	1·60	37
,, .	Okehampton, Uplands	1·91	45	,, .	Treherbert, Tynywaun	2·45	...
Corn .	Redruth, Trewirgie ...	3·13	92	*Carm* .	Carmarthen Friary ...	2·01	43
,, .	Penzance, Morrab Gdn.	1·49	47	*Pemb* .	Haverfordwest, School	2·39	57
,, .	St. Austell, Trevarna...	1·97	54	*Card* .	Aberystwyth	1·46	...
Soms .	Chewton Mendip	1·97	44	*Rad* .	Birm W. W. Tyrmynydd	1·51	28
,, .	Long Ashton	1·41	40	*Mont* .	Lake Vyrnwy.....	1·60	35
,, .	Street, Millfield.....	1·00	37	*Flint* .	Sealand Aerodrome ...	1·12	39
Glos .	Blockley	·67	...	*Mer* .	Dolgelley, Bontddu ...	2·27	40
,, .	Cirencester, Gwynfa ...	1·01	34	*Carn* .	Llandudno	1·44	48
Here .	Ross, Birchlea.....	·64	25	,, .	Snowdon, L. Llydaw 9	8·58	...
Salop .	Church Stretton.....	1·03	32	*Ang* .	Holyhead, Salt Island	1·44	45
,, .	Shifnal, Hatton Grange	1·07	38	,, .	Lligwy.....	2·37	...
Staffs .	Market Drayt'n, Old Sp.	·96	29	*Isle of Man*			
Worc .	Ombersley, Holt Lock	·81	30		Douglas, Boro' Cem. ...	1·22	31
War .	Alcester, Ragley Hall..	·70	25	*Guernsey*			
, .	Birminghm, Edgbaston	·77	28		St. Peter P't. Grange Rd	1·51	64

Rainfall: August, 1933: Scotland and Ireland.

Co.	Station	In.	Per-cent. of Av.	Co.	Station	In.	Per-cent of Av.
Wig .	Pt. William, Monreith	1·93	50	*Suth* .	Melvich	3·99	134
,, .	New Luce School.....	3·43	77	,, .	Loch More, Achfary...	11·04	189
Kirk .	Dalry, Glendarroch ...	2·35	49	*Caith* .	Wick	2·57	93
,, .	Carsphairn, Shiel	3·98	59	*Ork* .	Deerness	2·12	74
Dumf .	Dumfries, Crichton, R.I	1·58	41	*Shet* .	Lerwick	3·64	121
,, .	Eskdalemuir Obs.	2·85	55	*Cork* .	Caheragh Rectory	2·20	...
Roxb .	Branxholm	1·67	52	,, .	Dunmanway Rectory .	2·30	49
Selk .	Ettrick Manse.....	2·16	41	,, .	Cork, University Coll.	1·64	49
Peeb .	West Linton	2·17	...	,, .	Ballinacurra	·89	24
Berw .	Marchmont House.....	1·48	45	*Kerry* .	Valentia Obsy.....	4·17	87
E.Lot .	North Berwick Res....	·80	25	,, .	Gearahameen	6·10	80
Midl .	Edinburgh, Roy. Obs.	·84	26	,, .	Darrynane Abbey	2·09	48
Lan .	Auchtyfardle	2·33	...	*Wat* .	Waterford, Gortmore...	1·02	27
Ayr .	Kilmarnock, Kay Pk. .	3·20	...	*Tip* .	Nenagh, Cas. Lough ..	1·71	43
,, .	Girvan, Pinmore.....	3·44	77	,, .	Roscrea, Timoney Park	1·93	...
Renf .	Glasgow, Queen's Pk. .	2·61	74	,, .	Cashel, Ballinamona ...	2·15	61
,, .	Greenock, Prospect H.	3·51	65	*Lim* .	Foynes, Coolnanes.....	1·79	46
Bute .	Rothesay, Ardencraig.	4·58	...	,, .	Castleconnel Rec.....	1·51	...
,, .	Dougarie Lodge.....	4·07	...	*Clare* .	Inagh, Mount Callan...	4·05	...
Arg .	Ardgour House	10·95	...	,, .	Broadford, Hurdlest'n.	2·12	...
,, .	Glen Etive	...	...	*Wexf* .	Gorey, Courtown Ho...	·99	30
,, .	Oban	5·23	112	*Kilk* .	Kilkenny Castle.....	1·91	55
,, .	Poltalloch	5·93	121	*Wick* .	Rathnew, Clonmannon	·70	...
,, .	Inveraray Castle	8·28	126	*Carl* .	Hacketstown Rectory..	1·04	26
,, .	Islay, Eallabus	4·43	102	*Leix* .	Blandsfort House	1·95	49
,, .	Mull, Benmore	17·00	...	,, .	Mountmellick.....	2·29	...
,, .	Tiree	...	...	*Offaly* .	Birr Castle	2·33	61
Kinr .	Loch Leven Sluice.....	·93	24	*Dublin*	Dublin, FitzWm. Sq....	·61	20
Perth .	Loch Dhu	5·10	76	,, .	Balbriggan, Ardgillan.	1·02	30
,, .	Balquhidder, Stronvar	2·76	...	*Meath* .	Beauparc, St. Cloud ...	2·00	...
,, .	Crieff, Strathearn Hyd.	1·23	29	,, .	Kells, Headfort.....	1·34	32
,, .	Blair Castle Gardens...	1·51	45	*W.M* .	Moate, Coolatore	2·34	...
Angus .	Kettins School	·85	23	,, .	Mullingar, Belvedere...	1·93	46
,, .	Pearsie House.....	1·41	...	*Long* .	Castle Forbes Gdns....	2·10	51
,, .	Montrose, Sunnyside...	...	...	*Gal* .	Galway, Grammar Sch.	...	...
Aber .	Braemar, Bank	1·09	32	,, .	Ballynahinch Castle...	6·61	120
,, .	Logie Coldstone Sch....	·75	24	,, .	Ahascragh, Clonbrock.	2·24	53
,, .	Aberdeen, King's Coll.	1·22	45	*Mayo* .	Blacksod Point	5·54	121
,, .	Fyvie Castle	1·15	36	,, .	Mallaranny.....	6·33	...
Moray	Gordon Castle.....	1·56	49	,, .	Westport House.....	3·59	89
,, .	Grantown-on-Spey.....	...	...	,, .	Delphi Lodge.....	11·07	128
Nairn .	Nairn	...	...	*Sligo* .	Markree Obsy.....	3·05	71
Inv's .	Ben Alder Lodge.....	3·00	...	*Ferm* .	Enniskillen, Portora...	...	...
,, .	Kingussie, The Birches	1·32	...	*Arm* .	Armagh Obsy.....	1·53	42
,, .	Inverness, Culduthel R.	1·77	...	*Down* .	Fofanny Reservoir.....	3·74	...
,, .	Loch Quoich, Loan.....	5·65	...	,, .	Seaforde	2·16	58
,, .	Glenquoich	10·61	129	,, .	Donaghadee, C. Stn....	2·25	68
,, .	Arisaig, Faire-na-Sguir	5·01	...	,, .	Banbridge, Milltown...	1·53	44
,, .	Fort William, Glasdrum	6·16	...	*Antr* .	Belfast, Cavehill Rd....	2·93	...
,, .	Skye, Dunvegan.....	7·55	...	,, .	Aldergrove Aerodrome	2·79	77
,, .	Barra, Skallary	...	...	,, .	Ballymena. Harryville	2·78	65
R & C .	Alness, Ardross Castle	1·53	52	*Lon* .	Garvagh, Moneydig ...	2·33	...
,, .	Ullapool	5·52	155	,, .	Londonderry, Creggan	3·24	70
,, .	Achnashellach	6·56	98	*Tyr* .	Omagh, Edenfel.....	2·39	56
,, .	Stornoway	6·08	153	*Don* .	Malin Head.....	3·75	...
Suth .	Lairg	2·52	79	,, .	Milford, The Manse ...	2·49	59
,, .	Tongue	4·76	149	,, .	Killybegs, Rockmount.	3·35	...

Climatological Table for the British Empire, March, 1933

STATIONS	PRESSURE		TEMPERATURE							Relative Humidity	Mean Cloud Am'nt	PRECIPITATION			BRIGHT SUNSHINE	
	Mean of Day M.S.L.	Diff. from Normal	Absolute		Mean Values				Mean Wet Bulb			Am'nt	Diff. from Normal	Days	Hours per day	Percentage of possible
			Max.	Min.	Max.	Min.	½ max. and min.	Diff. from Normal								
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0—10	in.	in.			
London, Kew Obsy. ..	1014·1	+ 0·7	63	28	54·5	37·9	46·2	+ 3·8	38·6	88	5·7	2·17	+ 0·48	12	5·7	49
Gibraltar.....	1018·9	+ 1·8	70	47	64·8	51·0	57·9	+ 0·3	51·3	86	5·3	4·95	+ 0·21	14	..	..
Malta	1017·3	+ 3·1	66	46	60·1	52·4	56·3	— 0·8	51·8	76	7·5	0·20	— 1·28	8	5·3	44
St. Helena	1011·2	— 0·5	73	61	70·2	62·9	66·5	+ 0·2	63·0	91	8·7	2·31	..	20	..	..
Freetown, Sierra Leone	1012·0	+ 1·3	92	72	89·3	76·3	82·8	+ 0·4	76·5	83	4·5	0·21	— 0·95	2	..	..
Lagos, Nigeria	1009·4	+ 0·5	93	73	89·4	79·0	84·2	+ 0·8	78·0	83	6·5	4·67	+ 0·92	4	5·5	46
Kaduna, Nigeria	1009·3	— 2·6	99	61	95·3	68·7	82·0	+ 0·9	66·2	50	4·0	0·74	+ 0·20	1	6·4	53
Zomba, Nyasaland ..	1009·6	— 0·1	87	59	80·0	64·6	72·3	+ 1·0	67·2	76	6·8	8·48	— 0·60	16	..	..
Salisbury, Rhodesia ..	1011·7	+ 0·1	85	50	81·0	57·0	69·0	+ 0·8	61·3	67	3·8	0·34	— 4·36	4	8·9	73
Cape Town.....	1015·2	+ 0·7	90	50	74·9	57·7	66·3	— 1·8	57·7	76	4·2	0·37	— 0·51	4	..	..
Johannesburg	1011·8	+ 0·2	84	45	77·8	56·5	67·1	+ 3·7	56·0	60	3·9	5·13	+ 0·69	11	8·9	72
Mauritius	1011·7	— 0·3	87	70	83·1	73·2	78·2	+ 0·2	75·4	78	6·6	7·48	— 1·89	23	7·1	58
Calcutta, Alipore Obsy.	1009·8	— 0·1	100	59	93·3	70·6	81·9	+ 1·7	70·6	80	1·9	0·06	— 1·32	0*	..	..
Bombay	1010·1	— 0·8	100	69	88·2	73·0	80·6	+ 1·1	71·1	70	0·6	0·00	— 0·02	0*	..	..
Madras	1010·7	— 0·2	89	65	86·6	71·4	79·0	— 2·1	74·9	85	3·5	3·42	+ 3·08	3*	..	..
Colombo, Ceylon	1010·1	0·0	89	69	87·2	73·6	80·4	— 1·4	76·6	74	5·0	2·40	— 1·88	4	9·0	74
Singapore	1009·0	— 0·7	92	68	87·7	72·9	80·3	— 0·9	77·0	80	5·4	10·97	+ 3·57	20	5·7	47
Hongkong	1016·1	+ 0·1	82	48	69·6	59·7	64·7	+ 1·4	59·5	75	6·7	1·01	— 1·93	9	4·3	35
Sandakan	1009·8	..	88	71	85·9	75·0	80·5	— 0·5	76·7	84	7·6	13·82	+ 5·35	19	..	..
Sydney, N.S.W.	1013·8	— 2·5	90	49	74·5	63·6	69·1	— 0·2	64·6	74	6·6	2·26	— 2·72	13	6·2	50
Melbourne	1013·7	— 3·2	92	43	75·8	53·1	64·5	0·0	57·6	60	4·8	1·49	— 0·69	7	7·7	62
Adelaide.....	1014·9	— 2·2	97	44	78·6	57·6	68·1	— 1·7	57·8	47	5·7	1·33	+ 0·30	7	7·0	57
Perth, W. Australia ..	1013·9	— 1·4	101	50	81·3	61·7	71·5	+ 0·3	62·8	65	3·8	1·15	+ 0·34	6	8·9	72
Coolgardie	1013·6	— 1·2	103	41	85·9	58·6	72·3	+ 0·4	58·7	49	4·7	1·04	+ 0·10	5	..	..
Brisbane.....	1012·1	— 2·3	97	61	85·3	68·1	76·7	+ 2·4	69·1	66	5·9	0·55	— 5·22	6	8·0	65
Hobart, Tasmania....	1010·1	— 4·1	87	40	66·4	49·9	58·1	— 1·2	51·3	63	5·8	2·11	+ 0·41	15	6·2	50
Wellington, N.Z.	1016·5	— 0·7	76	44	68·3	54·9	61·6	+ 1·0	57·3	71	6·5	2·10	— 1·23	5	7·6	61
Suva, Fiji	1008·1	— 0·3	91	72	86·3	75·3	80·8	+ 0·7	76·9	84	7·0	28·09	+ 13·60	29	4·8	39
Apia, Samoa	1008·9	— 0·3	88	72	85·3	74·3	79·8	+ 0·5	77·1	81	7·3	11·41	— 2·57	22	5·1	42
Kingston, Jamaica ..	1014·2	— 0·7	91	66	86·1	69·1	77·6	+ 0·5	67·3	79	4·2	0·82	— 0·20	6	9·8	82
Grenada, W.I.	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Toronto	1015·2	— 2·1	50	9	36·6	26·6	31·6	+ 2·0	27·0	70	7·0	1·22	— 1·19	8	3·7	31
Winnipeg	1020·4	+ 1·2	48	—19	27·4	6·8	17·1	+ 2·1	..	..	4·3	0·20	— 0·96	1	6·1	51
St. John, N.B.	1010·5	— 3·6	46	4	34·7	21·1	27·9	— 0·5	22·8	75	6·0	2·59	— 1·95	5	4·4	37
Victoria, B.C.	1015·4	— 0·5	55	34	48·7	39·3	44·0	+ 0·5	40·6	48	7·1	1·90	— 0·53	15	4·8	40