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Radiosondages over the North Atlantic

At International Meetings during the past year the Representatives of the National Meteorological Office of France stated that a French ship, *Carimare*, had been stationed in the North Atlantic to collect and retransmit meteorological information from ships and—an entirely new departure—to make radiosondages and transmit the information so obtained for the benefit of meteorological services on both sides of the Atlantic. This is a new and exciting meteorological enterprise.

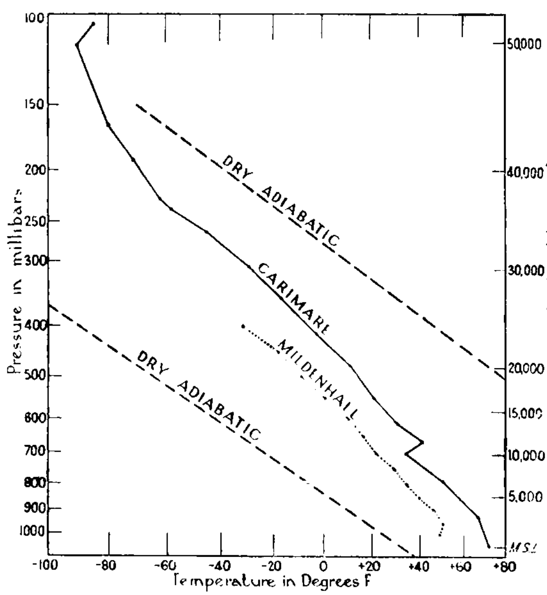
The term "radiosondage" is a convenient term which is used to denote the following procedure:—

A large free balloon which ascends at a rate of about 1,000 ft./min. carries beneath it a wireless transmitter; this instrument transmits wireless signals from which the value of the pressure and the temperature in the atmosphere at the height of the balloon at the moment when the transmission is made, can be evaluated immediately. Thus, within about half an hour of the time of release of the balloon there is available at the receiving station information of the temperature of the atmosphere from the surface up to about 30,000 ft.

On some occasions the balloon rises higher than 60,000 ft. and on these occasions—which it is anticipated will become practically daily—a knowledge of the temperature conditions of the atmosphere throughout the troposphere and well into the stratosphere is rendered available to the meteorologist.

There are many different types of instrument designed to do this. In the instrument used in France the transmitter is making a continuous transmission which is modified intermittently by the instrument giving the pressure and the temperature. The actual values of pressure and temperature are deduced from the relative times at which these interruptions are made.

A record was produced at Salzburg at the meeting of the Commission for Synoptic Weather Information in September, 1937, showing the results obtained by a number of ascents from the *Carimare*, one of which reached 25 Km. or 82,000 ft. That was of great interest to all the synoptic meteorologists present. But it is of even greater interest to receive a message from the *Carimare* giving the actual results at the moment at which the message is transmitted. Such a message was received in the Meteorological Office, London, on November 1st, giving the results of an ascent which reached 16 Km. (about 52,000 ft.). At that height the barometric pressure was 105 mb. and the temperature was —85° F. The results of the ascent are shown in the diagram, and the results of the simultaneous ascent at Mildenhall are shown for comparison. An outstanding feature is the inversion of temperature at a height of 11,000 ft. The stratosphere was reached at a pressure of 117 mb. or a height of 15 Km. (about 50,000 ft.). At the time of the ascent the *Carimare* was in a position Lat. 39° 54′ N.; Long. 38° 92′ W. about 500 miles W. by N. of the Azores. The pressure distribution over the Atlantic at the time of the ascent was briefly: a high pressure south of the Azores (pressure at centre 1,020 to 1,025 mb.) and a low pressure with two centres, one about 1,000 miles due north of the Azores (pressure at centre below 980 mb.) and the other centre about 500 miles further west with pressure at centre about 970 mb. The position of the *Carimare* was in the south-west current on the north-east side of the high pressure area.

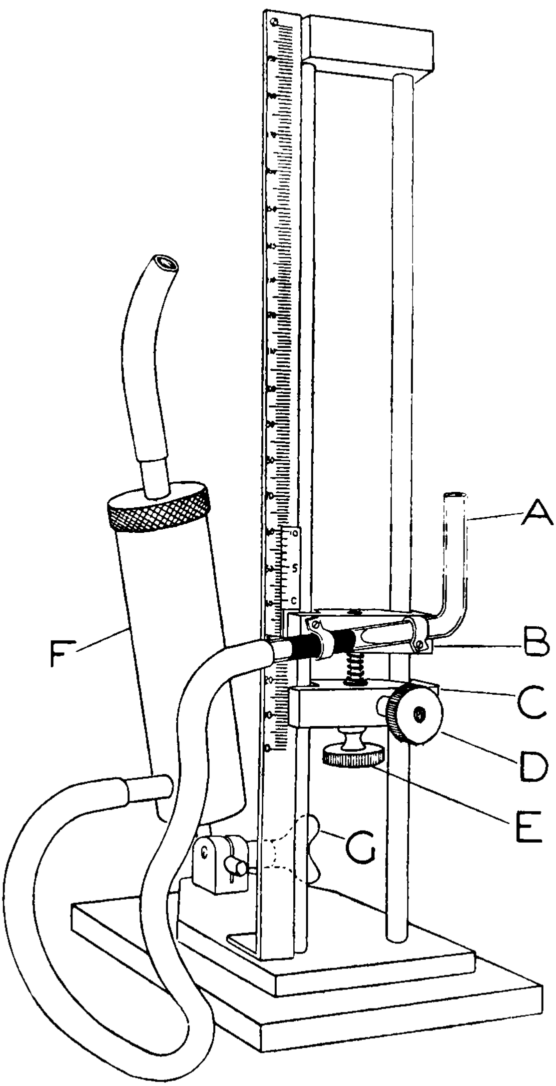


E. GOLD.

A New Manometer

By R. Cranna, M.A., B.Sc.

The small portable manometer described below has been designed primarily to meet the requirements of Meteorological Office inspectors in the periodic testing of pressure tube anemometers, though it is capable of a much wider application. It is simple and rapid to use and capable of an accuracy of ± 0·1 mm. water. Pressure is measured by raising one limb of the manometer until the liquid returns to a fixed mark in the normal way. This method was chosen as it avoids the double setting or scale contraction of any of the modified U tube manometers, and is consequently more likely to yield accurate results. The elaborate zero adjusting mechanism which is frequently a drawback of this type of manometer has been avoided by the use of a tilting reservoir which simplifies construction and at the same time provides a very effective means of adjustment.



The movable limb of the manometer consists of a glass tube A, ¼ in. internal diameter, carried on a brass block B which moves on two vertical guides. In order to magnify the movement of the surface of the liquid the tube A is inclined at 10° to the horizontal, the upper end being bent upwards to form a safety chamber. This angle was chosen as giving a sufficient degree of magnification while retaining a meniscus which can be easily set to a mark on the tube. Any decrease in the angle would require a tube of narrower bore and a consequent increase in the effects of capillarity and stickiness. With the dimensions used an increase of pressure of 0·1 mm. produces a movement along the tube of 0·4 mm.

The mechanical arrangement for setting can be seen clearly on the sketch. The two slides B and C can be moved up and down as one unit. The lower slide C can then be clamped in any position by means of the screw D, the final adjustment being made by the screw E, which passes through a clearance hole in C into a tapped hole in the slide B carrying the tube and vernier. A spiral steel spring between the blocks takes up the backlash, and ensures that the shoulder on E is always in contact with the under surface of the slide C. The second limb of the manometer, which is flexibly connected to A by a length of rubber tubing, consists of a copper reservoir F, 1 in. in diameter. This reservoir can be tilted about a horizontal axis, providing the zero adjustment of the instrument, and can be clamped in position by means of the wing nut G. The surface of the liquid in the reservoir is approximately 1¾ in. above the horizontal axis with the reservoir in the vertical position.

To use the instrument the zero of the vernier is first set against the zero of the scale which runs parallel to the vertical guides. With the reservoir in a vertical position the liquid used is slowly poured into F until the surface of the liquid is slightly above the setting mark on the sloping tube A. The meniscus is then brought back to that mark by slowly tilting the reservoir. When the zero is finally set the reservoir is clamped in position by the wing nut G. The apparatus can then be used in the normal manner, the rough adjustment being made by moving the two slides up or down together, and the final setting by clamping C and using the screw E. To prevent liquid being blown out of the manometer a clip should be fitted on the tube between the source of pressure and the manometer, and the instrument set to approximately the correct value before the pressure is admitted.

It was originally intended to use distilled water as the liquid in the manometer, but it was found that the meniscus in the sloping tube showed a tendency to stick in the bore of the tube after a few days use, no matter how thoroughly the tube was cleaned. This difficulty was overcome by using 90 per cent alcohol which can apparently be used indefinitely without any sluggishness developing. The use of alcohol involves an occasional check to ensure that the specific gravity remains within certain limits depending on the accuracy required, but this can easily be done, either by means of a hydrometer or a check setting against an accurate standard manometer.

OFFICIAL PUBLICATION

The following publication has recently been issued :—

PROFESSIONAL NOTES

No. 82. Ice accretion on aircraft. Notes for pilots. By G. C. SIMPSON, K.C.B., F.R.S. (M.O. 420 b).

The increased amount of flying within clouds now carried out by all types of aircraft has raised in an acute form the problem of issuing warnings of ice accretion on aircraft. A short description of the physical processes connected with the deposit of ice on aircraft is first given, from which it is seen that for ice accumulation to become dangerous it is necessary that there should be an abundance of water in the liquid state at air temperatures below the freezing point. These conditions are met with only in clouds or in rain, and the meteorology of ice accretion, which is next discussed, is mainly concerned with the formation of clouds, the formation of rain and the temperature.

General rules for avoiding the dangers of ice accretion are given, followed by a discussion of the situations in which ice accretion may be encountered. The paper ends with an account of the "Warnings of ice accretion" now issued to pilots, which contain information regarding the height at which the conditions are most favourable for ice formation, and the two heights above and below which danger does not exist.

Discussions at the Meteorological Office

The subjects for discussion for the next two meetings are :—

November 29th, 1937. *On the deviations of wind from the geostrophic wind in the free atmosphere.* By F. Möller and P. Sieber (Ann. Hydrogr., Berlin, 65, 1937, pp. 312–22) (in German). *Opener,* Mr. R. Frith, M.A., Ph.D.

December 13th, 1937. *Forecasting the dissipation of fog and stratus clouds.* By I. P. Krick (New York, J. aero. Soc. Amer. 4, 1937, pp. 361–71). *Opener,* Mr. A. L. Maidens, B.Sc.

Correspondence

To the Editor, *Meteorological Magazine*

Nocturnal wind sounding by photographic means

In his note on "Pilot Ballooning at Night" in the *Meteorological Magazine* of September, 1937, Dr. F. J. W. Whipple refers to my method of photographic sounding described in the April–May, 1937, number of the *Bulletin of the American Meteorological Society,* and states that the method has "the obvious drawback that it takes time to develop the plate and make a set of measurements with a microscope before the bearings of the flashes can be ascertained."

I regret that my original article gave the impression that the evaluation of the photographic record was made with the aid of a microscope. This would, of course, be a tedious and lengthy process, as Dr. Whipple suggests. Evaluation of my records, however, is actually carried out by simply projecting the negative and throwing the image on to a screen as is done with a normal lantern slide. The screen carries the calibration chart, and bearings of the flashes, therefore, can be read off immediately. As far as the time of development of the plate is concerned, that still remains, but as the record consists purely of black dots on a light field and no gradation of tones is required, a very quick and, therefore, high contrast developer is used, and in practice the plate can be developed, fixed and dried in alcohol within a space of ten to fifteen minutes.

Dr. Whipple states further in his article that another disadvantage of my method is that "the fuse cannot be relied on to produce flashes at equal intervals, so an observer must stand by and time all the flashes during the ascent of the balloon." Numerous tests have shown that the fuse I have been using maintains, to a high degree of accuracy, its rate of burning. This rate, however, does vary with atmospheric pressure, and, therefore, with elevation (as is well known in the case of the fuses utilized in armaments) ; but this variation of burning rate with atmospheric pressure may be readily established and taken into account in the spacing of the magnesium flashes. Tests have shown that this is practicable.

ATHELSTAN F. SPILHAUS.

New York University, University Heights, New York, U.S.A., October 14th, 1937.

A green moon : Wimbledon Common, October 16th, 1937

Of all the phenomena of meteorological optics there is none that I less expected to see myself than a green moon. However, on Saturday, October 16th, 1937, at about 5.30 p.m., I saw this phenomenon from the banks of Beverley Brook, on the outskirts of Wimbledon Common. With my companion I had been admiring the brilliance of the clouds in the west, long cirrus streaks and altostratus, when we happened to glance at the moon, and noticed with surprise that it appeared to be pale green. I suggested that it might be pale blue, but was confirmed in my impression that it was definitely green. Green it looked when seen through the tube made by my bent fingers, and green it looked when we peered through the trees of a gloomy thicket. The gibbous moon, at an elevation of about 20°, was covered by rather thick cloud, probably altostratus. In the course of five or ten minutes, as the ruddy colours faded in the west, the moon resumed its normal white. An hour later, when it was dark, the moon shone through similar cloud ; it looked yellow, as did the cloudy aureole, and there was a very poor corona. The dull red at the edge of the aureole was about half a degree from the moon.

The circumstances indicate that, in this case at any rate, the green moon is to be regarded as an effect of contrast. There was nothing abnormal about the atmosphere; the air was fairly clear, before sunset we could see about four miles, and, moreover, there was no change in air or cloud when the green was disappearing. With the brilliant red illumination of landscape and of the cloud in the south-east, our eyes regarded the pink-tinged cloud as white or grey, and the pure white of the moon ranked as green. It would be interesting to learn whether other observations of green moons have been consistent with this explanation.

F. J. W. WHIPPLE.

Kew Observatory, Richmond, Surrey, October 18th, 1937.

Haze and Sunshine Recorder

The following note by Mr. R. A. Jubb, of this Office, on the effect of haze on the Campbell Stokes sunshine recorder at Goetz Observatory, Bulawayo, Southern Rhodesia, may be of interest:—

" I have seldom known visibility to be as bad as it has been recently. At 6·15 a.m. this morning I examined the sunshine recorder and, although the sun made a small spot on the chart, there was not sufficient heat to burn a trace. The sun shone feebly through the smoke as if shining through thin altostratus. The trace only started at about 7 a.m.—the evening trace stopped about three-quarters of an hour too early as well.

" Pilot balloons are extremely difficult to follow after about ten minutes. The Captain of the South African Air Mail has just informed me that from Livingstone to here, flying at 9,000 ft., the visibility was four miles. The Captain who brought General Smuts up on the morning of the 3rd said the same."

NOEL P. SELLICK.

Meteorological Office, Salisbury, Southern Rhodesia, September 15th, 1937.

Halo Complex

This afternoon about 13h. 20m. G.M.T., there was noted in cirrus (with much interruption from lower clouds) the following:—

Halo of 22°.

Parhelia of 22° well coloured and bright.

Parhelic circle, that, allowing for obstruction by lower clouds extended from parhelion to parhelion. At one time the existence of the parhelion of 120° was suspected.

CICELY M. BOTLEY.

Guildables, 17, Holmesdale Gardens, Hastings, September 21st, 1937.

Systematic Records of British Snowfall

In reply to Mr. Tinn's letter in the October issue, may I point out that the Association for the Study of Snow and Ice is at present engaged in devising a plan for the survey of the amount, duration and extent of the upland snowfalls of Great Britain. I very much agree that systematic records all over the country would be of great value. It is however in the uplands that little information, other than of a very general character, is available, and on behalf of the Association I may say that we hope to make a series of records available from representative upland districts at no distant time. We should very greatly welcome the co-operation of readers who live on, or frequently visit the higher hills above 1,000 ft. Further, records carefully kept on Mr. Tinn's or a similar plan at intermediate levels (500–1,000 ft.) would indeed be valuable inasmuch as it is probably at these levels that the greatest fluctuations occur over periods of years.

GORDON MANLEY.

School of Geography, c/o University Offices, Durham, November 5th, 1937.

The excellent suggestions of Mr. A. B. Tinn, in the October issue of this magazine, regarding the acquisition of more detailed observations of the depth of snowfall, days of snow and days with snow lying, deserve much encouragement. The interesting reports on snowfall in this country, contributed by Mr. L. C. W. Bonacina, in *British Rainfall*, 1936, would be much enhanced if accompanied by maps showing the distribution of snow-days and days of snow lying. Such maps would be of particular interest in the data for the northern suburbs of London and, indeed, for all the home counties, because the effect of height and of wind direction would probably be even more pronounced in these areas than it is in the case of rainfall.

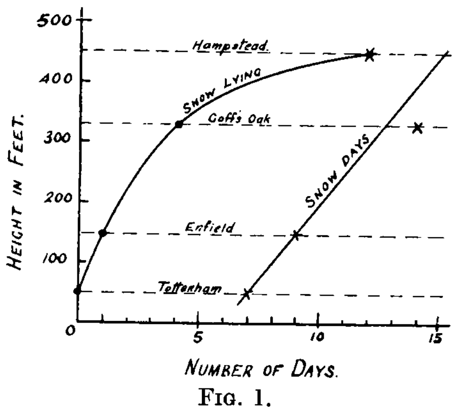


FIG. 1.

Snowfall in the home counties is noticeably fickle and erratic in its distribution, and detailed maps of snowfall in the north London area would furnish some interesting and instructive features.

As an instance, on Sunday, March 14th, 1937, there was, in the morning, fairly heavy "dry" snowfall at this station, yet in a twenty-minute bus journey to Waltham Cross—a distance of but 3½ miles or so, the effect of height was brought out most distinctly. Goff's Oak is at an elevation of 330 ft. above ordnance datum, but on reaching a point about 1½ miles away, at about 250 ft. above M.S.L., the snow was turning to sleet, and at Waltham Cross, at 70 ft. above M.S.L., the precipitation was at least 75 per cent rain.

The number of days each winter during the past three years, on which sleet or snow has fallen, and on which snow was observed to lie at this station (Goff's Oak), is shown below :—

Season.	Days of Sleet or Snow.	Days of Snow Lying.
1934–5	14	6
1935–6	15	12
1936–7	19	5

The depth of snow lying was seldom more than one inch, only three days during this period having exceeded this limit viz :—January 27th, 1935, 4·25 in ; January 17th, 1936, 4·00 in ; and March 7th, 1937, 2·50 in.

Data regarding the snowfall of March, 1937, at Enfield, Tottenham and Hampstead, extracted from the *Monthly Weather Report*, together with the data from this station are given in the attached table, and these values, plotted against height above sea level in Fig. 1, clearly show the effect of height on the snowfall of the northern suburbs of London.

Station.	Height above Sea Level.	Days of Snow.	Days of Snow Lying.
Hampstead	450	12	12
Goff's Oak	330	14	3
Enfield	148	9	1
Tottenham	51	7	0

If the British Group of the International Snow Commission were to supply post cards for entering daily snow data, somewhat on the lines of the cards recently issued by the Meteorological Office for the Fog and Mist Investigation, doubtless they would meet with the response of a high percentage of the thousands of rainfall observers distributed throughout the British Isles.

The results of only five years' observations would surely merit the trouble taken to amass the data.

DONALD L. CHAMPION.

7, Robinson Avenue, Goff's Oak, Herts, October 21st, 1937.

The plan for systematic snowfall observations, illustrated with reference to Nottingham, which Mr. Tinn proposes in the October issue seems to me admirable and if taken up at many places would furnish just the material which, as pointed out by Mr. Champion, is needed to give more precision and detail to my annual snowfall reports on a descriptive basis. There can be no question that the Meteorological Office's system of recording days with "snowlying" according to some accepted definition which apparently first came into use about fifty years ago, is the only satisfactory method of studying snow-cover on comparative lines, though information on the depth of snow may give useful supplementary information. The depth of snow, however, is affected by the notorious variability in the consistency of snow, and still more by drifting which in exposed hilly country takes place on such a large scale as to raise rather troublesome questions as to where the snow really falls. It is satisfactory to be able to report that organized research to extend our knowledge of snowfall in these islands is already being planned, and it is hoped that the first active steps will be taken at the higher levels in Scotland during the coming season.

Mr. Champion's figures showing the relation of snow to altitude in the northern suburbs of London are reasonably clear considering that they only relate to the single month of March, 1937. In so short a period they might easily have been more affected by erratic factors. Nevertheless, the date, Sunday March 14th, 1937, which he selects for illustrating the effect of altitude on a single snowfall is ill-chosen because on that morning London lay in a transition belt between warm and cold air and a rapid change was proceeding. Thus at Hampstead thick snow was falling at 7.0 a.m. which by 9.0 a.m. had turned completely to rain, a very puzzling change since the wind remained NE. and the thermometer kept well below 40°F. The day was rather mild south of the Thames with a maximum of 50°F. at Tunbridge Wells, suggesting that warmer air was climbing over the cold surface NE. wind, whereas to the north in the south Midlands the day remained quite cold, and Mr. Hawke in the Chilterns recorded thick snow all day. Events at Hampstead, therefore, show that Mr. Champion's altitude changes were probably marked by this important time change.

L. C. W. BONACINA.

15, Christchurch Road, London, N.W.3. October 31st, 1937.

A hair-raising experience

Thunderstorm theories have made us familiar with the electrification resulting from the division of water drops, and it is known that large potential gradients are to be found near waterfalls. The same effect is also produced by the discharge of steam from a railway engine for instance, but how great the electric field can be is perhaps not realised.

I was crossing the bridge outside East Croydon Railway Station yesterday evening at the same time as a stationary engine on the track below was producing a cloud of steam, and the wind took this across only a foot or two above my head. I was hatless at the time, and as I passed under the steam I had the feeling that a shower of sparks was falling through it. On looking upwards I realised this could not be so, since the sensation was only on my scalp and not on my face. I found that what was happening was that some of my hair was actually standing on end owing to the strong electric field resulting from the positively charged steam. Had there been less artificial lighting I might even have appeared to onlookers to have been crossing the bridge wearing a halo of St. Elmo's fire!

C. J. BOYDEN.

Meteorological Station, Airport of London, Croydon, September 16th, 1937.

NOTES AND QUERIES

Typhoon at Hongkong, September 2nd, 1937

A typhoon which is described as the most severe on record since the foundation of the Observatory in 1883 struck Hongkong on the night of September 1st-2nd. By the courtesy of Mr. C. Fowler and Mr. T. E. Pearce we are permitted to reproduce a photograph of the anemograph and barograph records obtained at the Hongkong Electric Co., Ltd., as the frontispiece of this number of the magazine. The anemograph recorded a maximum velocity of 164 miles per hour and while no details are available as to the instrument, there appears to be no reason to doubt the approximate accuracy of the record. Details of the typhoon were supplied by an eye-witness, Mr. R. V. Bootle, Chief Officer, R.F.A., *Ebonol.*

The typhoon formed east of Manila and moved rapidly towards Hongkong. The first warning of its approach was given just before 1 a.m. on September 1st. The wind reached gale force about 8 p.m., by which time heavy rain had begun to fall. From 10 p.m. on the 1st to 2 a.m. on the 2nd the wind blew from north-west steadily increasing in velocity. The centre of the typhoon reached Hongkong about 2 a.m., when the wind veered to north, with squalls of phenomenal intensity, exceeding 125 miles per hour which is the limit of the anemograph at the Royal Observatory. After midnight the barometer fell rapidly, reaching 958·3 mb. (28·298 in.) about 3 a.m., the lowest reading ever recorded at the Royal Observatory. According to the anemometer record, the maximum wind velocity occurred about 3.30 a.m. After a short lull, the wind veered with extreme rapidity to the south-east, continuing to blow violently until 4 a.m., after which it gradually subsided. The total rainfall for the 24 hours ending at 10 a.m. was 5·93 in. The typhoon caused great damage to shipping in Hongkong Harbour and to the town itself, while a typhoon wave which swept inland caused many deaths.

Sand Devils

The best examples of this phenomenon I have yet observed occurred near Baghdad west station on June 24th, 1937. My attention was directed to what appeared to be a smallish cumulus cloud (a sufficiently rare phenomenon in itself in summer to warrant the attention of non-meteorologists); the "cloud" was in fact dust which had been carried to a height of about 2,500 ft. by some previous disturbance.

A sand devil appeared on the ground, the spin appearing from the airport about $\frac{3}{4}$ mile distant to be very violent and anti-clockwise, and almost immediately a thin rotating column of sand appeared from this devil to the base of the "cloud". The rotation could be observed at two or three points of the column as being violently anti-clockwise but the main movement of the sand was upwards. The bottom 1,500 ft. was almost vertical and the top was bent back towards the north.

After a few minutes the devil on the ground disappeared and the whole rotating column likewise vanished suddenly; a few minutes later another disturbance appeared on the ground somewhat further towards the south or south-east, also spinning violently anti-clockwise and the amazing thing was that almost immediately a thin rotating column of sand appeared between this disturbance and what had been originally mistaken for a cumulus cloud.

The interesting feature of these disturbances were (*a*) their great height (*b*) the very violent anti-clockwise movement near the ground and at various points of the trunk and (*c*) the rapidity with which the space between a smallish cloud of dust at 2,500 ft. and a disturbance on the ground became occupied with sand. If the sand composing the column was rising from the ground there must have been an area 3 or 4 ft. in diameter where the upward movement of the air was of the order of 4,000–5,000 ft. per minute.

Another very violent disturbance occurred over the aerodrome itself about ten minutes later. In this case the motion was clockwise but the dust and sand did not rise to any great height, although the quantity involved in the disturbance was very great.

J. DURWARD.

Altocumulus type cloud formed by an aeroplane

I was interested in the account of " Altocumulus type cloud formed by an aeroplane " given by Mr. D. Dewar in the May 1937 number of the *Meteorological Magazine* and am grateful to him for placing the occurrence on record. It is very unusual to find conditions favourable for this cloud formation through a vertical thickness of 6,000 ft., and I should like to emphasize that Mr. Dewar does not imply that the formation of cloud was possible through the whole vertical extent of this layer.

Mr. J. S. Smith and myself, have investigated a considerable number of these occurrences over a series of years, and they include only a few cases of aeroplane cloud formation through a considerable vertical thickness but in every case the formation has been restricted to a series of formations through relatively narrow vertical strata. Mr. Dewar has been good enough to give me further details of his observations which confirm that in this case also the formation occurred at various levels through the 6,000 ft. of height. When a series of cloud formations occur at varying heights it is invariably in the rear or " clearing sector " of complex depression systems, and the *International Section of the Daily Weather Report* confirms that Mr. Dewar's observations were made in these circumstances.

In the more usual cases artificial cloud formation occurs only at one level through a vertical thickness rarely exceeding 1,000 ft. and often much less although as various accounts in this magazine have shown, the horizontal extent of a layer may be such as to give continuous cloud streaks extending for many miles*. As to the causation of the altocumulus type cloud we are satisfied that it is due to condensation caused by the pressure reductions in the slip stream of the aircraft and is normally in evidence at a relatively short distance behind the airscrew. This implies that an aircraft when climbing should more easily produce cloud in suitable conditions and observation confirms this.

F. H. DIGHT.

Auroral Notes

It was expected that there would be frequent aurorae at this time of increasing solar activity, exemplified by the size and number of the sunspots, and recent reports are in agreement with this expectation. There is no record of aurorae in June, July or August, since the sky is never then sufficiently dark in the northern latitudes, where they are most frequently seen, but displays were observed on twelve nights in September. Aurora was noted as far south as Holyhead and Boscombe Down in the early morning of September 11th. At Holyhead three rays, reaching an elevation of about 20°, were seen to move slowly north from north-north-east between 0h. 30m. and 1h. 10m. G.M.T. A little later, from near Boscombe Down, Mr. Kinge noted streamers which attained an elevation of nearly 40° at about 3h.† The glow at times assumed a pinkish hue, and varied considerably in intensity.

Other displays which occurred during the middle of the month were less remarkable, but an exceptionally bright aurora was observed by Mr. Seton Gordon from Duntulm, Skye, around 22h. 45m. G.M.T. on September 30th. The glow stretched from west to east-north-east and reached to south of the zenith, where there were pulsating clouds of light. Rays were also noted. The general brightness was such that it was easily possible to see the time by a watch.

Three nights later, on October 3rd–4th, the finest aurora for many years occurred. From Shetland the display was observed from midnight to 5h., the sky from the zenith to the southern horizon being "ablaze with shifting and coloured beams of light, greens, blues and mauves predominating, pinks and reds less noticeable."

Mr. H. H. Lamb, from near Montrose, watched the commencement of the display. From 21h. to 23h. 30m. G.M.T. only a quiescent glow was present. Arcs, associated with coloured rays, then developed, and activity increased after midnight, when the colour was pale green.

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* *London, Met. Mag.* 71, 1936, p. 19.

† See *London, Met. Mag.* 72, 1937, p. 212.

Bright rays from east and west met south of the zenith, and the arcs broke up "into irregular curtains." Flame aurora was also observed: "Flickering ripples of light appeared, two to three a second, across the north at about 20° elevation, and mounted the sky to beyond the zenith, ending near the eastern and westernmost shafts which arched the sky. There the ripples seemed to reflect back again as far as the zenith. The time from the appearance of a ripple to its disappearance at the zenith was estimated at 2 seconds or slightly over." The aurora was still at this development when the observations were given up at 0h. 30m.

Apparently the display continued to develop, for Mr. Chamberlain writes from H.M. Coastguard Station at Brixham, Devon, that he saw aurora from 2h. 30m. to 3h. 10m. on October 4th, of an intensity he had previously observed only when at Lerwick, Shetland. He describes the display as consisting of dull red shafts of light from north-east to west-north-west and reaching an elevation of about 20°, being most brilliant between 3h. 0m. and 3h. 5m. *The Times* reports that this aurora was also seen from a trawler off the Cornish coast, "the first time for 20 years that the lights have been seen there."

This aurora was probably associated with a large group of sunspots, visible to the unaided eye; on October 5th the group was centred at approximately 20° W. and very near the equator.

Other days on which aurora was observed, mostly from Scottish stations, were September 1st; 2nd; 9th; 10th; 13th; 15th; 18th; 20th; 22nd; 29th.

F. E. Dixon.

A new series of Memoirs from Japan

We welcome the appearance of the first numbers of the *Meteorological Notes* of the Meteorological Research Institute of the Imperial University of Kyoto. These are printed in Japanese, but each includes a full summary in English on separate duplicated sheets.

The first memoir, by Tatsutoshi Takahashi, discusses the phenomenon of "Sudden rise of air-temperature near ground during the night at the Basin of Kyoto". Several examples of sharp rises at low level but not at high level stations are illustrated and explained by autographic records.

The second note by Shiichi Aoki discusses two examples of typhoons consisting of two different circulatory systems, a "main typhoon" and a "secondary typhoon". This view was first put forward in connexion with the great "Muroto Typhoon" of 1934, described in the Memoirs of the College of Science, Kyoto University, and the present note supplements that paper.

The third note by Tadao Simeno examines two remarkable examples of rapid barometric disturbances, due to the passage of troughs, and discusses the weather situation associated with them.

Old Books on Meteorology

Included in a parcel of meteorological literature recently presented to the Meteorological Office, Edinburgh by Dr. Hill Buchan, son of Alexander Buchan, are two items of interest. One is a small volume entitled " A Companion to the Weather Glass ", published anonymously at Edinburgh in 1796, the contents being " selected from the most approved authors ". The book is a model of conciseness, every paragraph helping the reader " to become acquainted with the nature, construction and use of the instruments herein described and so generally useful ". The instruments mentioned are the barometer, thermometer and hygrometer. More space is devoted to the use of the barometer as an altimeter than to its use as a weather glass, the section on this point being a reprint of Halley's observations, which are noteworthy for the ingenuity of his explanations.

The section on the thermometer includes a long list of boiling points, melting points, climatic extremes and favourable temperatures for different plants. One item inconsistent with the results of recent research* is the reference " —40(°F) Fahrenheit's experiments with freezing mixtures."

A variety of hygrometers are described, using the expansion of wood, the twisting of fibres and the variation in weight of a sponge. Aqueous meteors are then briefly explained, followed by a " form of a register of the weather " strongly reminiscent of M.O. Form 3203. The only strange feature is the wind scale. " By 0 is denoted a perfect calm ; by 1 such a small wind as scarce moved the leaves of trees ; by 4 a hurricane ; and by 2, 3, intermediate forces."

Finally, to make the book of use to readers who have no barometer, the last 10 pages are a summary of the Shepherd of Banbury's well known " Rules to judge the changes of the weather ".

The other item deserving of mention is a larger and older work— " Astro-meteorologica or Aphorisms and Discourses of the Bodies Coelestial, their Natures and Influences ", by J. Goad, published in London in 1686. The dedication to King James II has tempted a cynic to add a pencilled note suggesting that he would have written rather differently 3 years later ; the same pencil has added on another page " the Dedication shows how much he loved it (Holy Writ) by speaking truth ".

Mr. Goad had a rather tedious style but his 500 folio pages include much useful information—prognostics, lists of frosts, earthquakes, comets etc. and weather diaries. Data are extracted from many authors but most of the weather diaries are those kept by the writer himself, though at what place there is no explicit evidence. No kind of numerical wind scale was used.

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* In *Nature, London,* March 6, 1937, pp. 395-8 it is suggested that 0°F was the lowest temperature attained experimentally by Fahrenheit.

At first sight the diaries seem to be in a curious order, sections being scattered throughout the volume. This is due to the astrological method adopted, the weather being analysed at each principal conjunction and opposition in an endeavour to determine the nature of the influence of each planet on our weather. The possible influence of the moon is also investigated. The results are not very convincing though Mr. Goad had a scientist's technique, answering possible objections before announcing his conclusions.

F. E. DIXON.

[The observations of the Rev. John Goad contained in his " Astro Meteorologica", cover a period 1652–1686. From 1652 until 1660 Goad was living at or near Oxford as he held the living at Yarnton. In 1660 he removed to Tonbridge, Kent, on appointment as headmaster of Tonbridge School. In July, 1661, he became headmaster of Merchant Taylors School and lived in or near London until his death in 1689. The great bulk of the extracts from his weather diary are later than 1661 so that these will mostly refer to London. However, he managed to hold his living at Yarnton until his death, despite the fact that he openly professed Roman Catholicism in 1686. No doubt he would occasionally be in residence there and some of his data would refer to that neighbourhood. The dedication to James II was no doubt inspired by Goad's own popish tendencies. He was suspected of popery in 1681 and was dismissed his headmastership at Merchant Taylors School although probably other influences were at work as well.—C. E. Britton.]

REVIEWS

Grundlagen und Methoden der Periodenforschung. By Dr. phil. Karl Stumpff. $9\frac{1}{2}$ in. × $6\frac{1}{2}$ in. pp. vii + 332. *Illus.* Berlin, Julius Springer, 1937.

The idea that meteorological phenomena are periodic, popularly expressed in the conception of "weather cycles," developed very early in meteorology, partly no doubt by analogy with astronomy and tidal movements. As early as 1842 Luke Howard announced a weather cycle of 18 years in Great Britain but the statistical basis for this periodicity—a series of observations covering just 18 years—was somewhat inadequate. Later in the century periodicities were multiplied almost indefinitely, but the methods employed were cumbersome and critical tests of reality were rarely applied. The credit for first placing the discovery of hidden periodicities on a sound mathematical basis belongs to Sir Arthur Schuster, who in 1898 described the technique which is now generally known as the Schuster periodogram. Since that date the literature dealing with the critical examination of series of data for periodicities whether " hidden " or of known length, has grown rapidly and somewhat confusedly, scattered through a wide range of scientific periodicals.

In 1934, the Institute for the Investigation of Periodicity which is associated with the Meteorological Institute of the University of Berlin, and of which Dr. Stumpff is Director, set to work to collect, systematise and improve upon this enormous mass of literature, and especially to make it available for the investigation of meteorological periodicities. The exhaustive and valuable book now under review presents the first-fruits of the investigation.

The first chapter lays down the groundwork of the subject in a discussion of various types of series leading up to purely periodic functions. One of the difficulties of the subject is that natural phenomena, even when they are essentially periodic, are in the great majority of cases made up of component periodicities of incommensurable length, so that the series of observations never repeats itself exactly. This chapter includes some useful remarks on interpolation and smoothing, including the limits to which smoothing may permissibly be carried and the ratio in which it reduces the calculated amplitude.

The second chapter deals with harmonic analysis in practice. Simple schematic tables set out methods of calculating the various harmonic components from different numbers of observations. The calculation of waves from a network of observations and their synoptic representation are fully discussed in view of the bearing of these studies on both short-range and long-range weather forecasting, as exemplified in the work of Weickmann and others on symmetry in daily weather charts.

The third chapter introduces the subject of the periodogram proper as developed by Schuster, and this is explored with typical thoroughness. The great disadvantage of harmonic analysis is that the periodicities tested are necessarily integral fractions of the whole series; the great advantage of the spectrum periodogram is that it avoids this difficulty, though special methods may be required to separate periods which differ only slightly in length. The Schuster type of periodogram has, however, its own difficulties, chief among which is its laboriousness, and Stumpff gives us some hints for saving work. This leads to a discussion of the method of phase diagrams and other refinements, including the use of the Hollerith calculating machine, and the chapter ends with an account of aberrant forms of the periodogram and the analysis of broken series.

Chapter 4 deals with the statistical treatment of problems of periodicity, and begins with expectancy and the theory of errors. Distribution in two dimensions introduces the "point-cloud" and the combined treatment of amplitude and phase as a vector, which has interesting applications leading up, for example, to the auto-correlation periodogram. The practical possibilities of this powerful new weapon are, however, less thoroughly discussed than are those of older and better known methods, especially as regards the use of partial correlation.

The fifth chapter describes other analytical methods of determining periodicity. One class of these consists in transforming a curve or series of observations by some operation such as repeated differentation into a series of as many equations as there are unknown periodicities : these equations are then solved algebraically. Many varieties of this type are described, some of them highly ingenious but the author leaves us with the impression that straightforward methods are generally the best. The second class of analytical methods aims at emphasising the differences between the amplitudes of different periodicities so that the larger ones can be readily picked out. The orthodox methods of periodogram analysis are so laborious that it is a great advantage to be able to pass over the uninteresting parts of the spectrum and concentrate on those which are most likely to produce results. The most frequent line of attack is by integration or smoothing.

The last chapter describes the principles of the various mechanical periodograms, most space being devoted to those of an optical or photomechanical type. Even these, however, require lengthy preparation of the data ; the ideal machine in which the figures are fed in at one end and the periodicities ground out at the other remains a dream. The book ends with a good bibliography containing 319 entries, not however entirely free from errors.

The author in his introduction expresses the hope that the book contains not only instruction and inspiration for the theorist, but also all necessary information for the practical worker. The former hope is certainly justified, the latter less so, for there was not space in all cases to give practical examples of the application of the methods, but a companion volume is planned to contain a collection of auxiliary tables, formulae and examples for practical use.

C. E. P. BROOKS.

Buchan's Days. A modern guide to weather wisdom. By E. L. Hawke, M.A. Size 7½ in. × 5 in., pp. 231. *Illus.* London, Lovat Dickson Ltd., 1937. 5*s* net.

Whether we agree with its main contentions or not, this little book is both interesting and pleasant to read. Mr. Hawke has a great admiration for Alexander Buchan, whom he describes, in dedicating the book to him, as a great man, much misunderstood. Great he certainly was, as the sketch of his life in the first chapter makes abundantly clear, but among meteorologists his greatness was securely established, especially by his magnificent work on the atmospheric circulation and on the Ben Nevis observations, long before the " Buchan periods " had become a common topic of conversation. The " misunderstanding " refers to the difficulties which some meteorologists have felt in accepting the popular interpretation of Buchan's six cold and three warm spells as recurring almost with the regularity of Christmas, but Mr. Hawke himself agrees that Buchan overstated his case in assigning exact dates to his " periods ", which are to be regarded rather as movable feasts like Easter or Derby Day. The reviewer cannot help thinking that Buchan himself would have deprecated the remarkable pictorial representation forming the end pages, but perhaps the reviewer is prejudiced.

Mr. Hawke leads up to his subject skilfully in a chapter on " weather lore " in which he brings out the traditional beliefs that special types of weather tend to occur at certain times of the year. He then describes how Buchan set out to test these beliefs, with the result that he selected the now famous nine periods, with the proviso that " the commencement of each of these more anomalous periods is subject to variation from year to year ". Each period and its variations are then described in detail, and in Chapter IV : " The doctrine to-day ". (" Doctrine " ; does Mr. Hawke regard its acceptance as a test of faith among meteorologists ?) further support is given to their reality by a consideration of the long series of temperature observations at Greenwich and by the cataloguing of some striking agreements in recent years. He goes on to discuss the causes of such quasi-regular recurrences, but admits that explanation is no more possible for these than for other vagaries of the seasons, ending with some tentative thoughts on mass suggestion as a factor on weather, which were obviously written before the coronation.

The second part of the book, " Round the Year ", abandons Buchan except for some casual references and discusses in a chatty knowledgeable way the chequered course of the thermometer, rain-gauge and sunshine recorder through the months, with some excursions into history. The whole book contains a great deal of information rendered readily accessible by an excellent index.

C. E. P. Brooks.

The Atmospheric Pressure at Mauritius—being a survey and discussion of fifty-six years observations made at the Royal Alfred Observatory. By M. Herchenroder, B.Sc. R. A. Observatory Publications No. 18, Port Louis, 1937.

Mr. Herchenroder has set himself the task of reducing the mass of facts accumulated at the Royal Alfred Observatory to some sort of accessible order. This paper follows " La Pluie à l'île Maurice ". It is easy for the critic to sit back and say " This would I have presented differently ", " A discussion of that is unprofitable ". The retort is that the critic continued to sit and do nothing.

The actual data handled are the hourly readings of pressure obtained from the photographic record of a Kew barograph from 1875 to 1930. There are printed and published data for all but four (1911–4) of these 56 years, but the discussion of standards must have involved much wearying search amongst MSS. almost illegible and partly devoured by insect pests. We have presented to us, finally, tables shewing the value of the barometric pressure for each month and year of the 56 years, and mean values for each day of the year and each hour of the day. The diurnal variations have been analysed into Fourier series and twelve terms are given.

This is a good and solid achievement for which Mr. Herchenroder deserves our thanks. His attempts to make out a case for a slow secular change and two cycles of 9 and 17 years are not convincing. The mean departure of the yearly means from the average is 0·40 millibars. After the yearly means have been "corrected" for secular change the figure is still 0·35 millibars.

The constancy of the yearly mean is a more striking fact than its variation, especially considering the large seasonal variation. Those of us to whom meteorology means the six-hourly synoptic chart of the "westerlies" are liable to forget the regularity of seasonal changes over about one half of the earth's surface. In Mauritius at the time the barometer is falling rapidly from September to November, no individual October had a mean pressure as big as the September 56 years average, and no November mean was as big as the October average.

A table of the average pressure for each day of the year must be available for ready reference in Mauritius, but would find little use in England.

R. A. Watson.

Temperatures of the western North Atlantic from thermograph records. By Phil E. Church. Association d'Océanographie physique. Union Géodésique et Géophysique Internationale. Publication Scientifique No. 4, Liverpool, 1937.

Thirteen sea temperature thermographs are now in operation on eight steamship routes between New York, Boston and Halifax and Bermuda, the West Indies and South America. Twelve hundred thermograms were available for the author's work, which is the first published investigation of sea temperatures, so derived, over an extensive oceanic area. For the period November, 1928, to December, 1933, sufficient data were obtained to construct one hundred charts, synoptic in the sense that each was made from data taken within a week, or occasionally ten days.

The work is a valuable contribution to North Atlantic oceanography. The region from latitude 45° N. to the equator is found to be divisible into five thermal sub-areas: the coastal water inside the 200-metre contour, the "slope water" between the coastal water and the Gulf Stream, the narrow "cold wall" of steep temperature gradient bounding the Gulf Stream, the Gulf Stream, the central Atlantic area and the tropical North Equatorial Current, which is subdivided into three belts. Charts of average temperature, range of temperature and maximum and minimum temperatures are given, and the information obtained is related to climatic and weather conditions. Maximum temperatures for the year are found in the neighbourhood of the 26th parallel, which corresponds to Meyer's line of sub-tropical oceanic convergence and to the axis of the permanent anticyclone.

The new information about the Gulf Stream is particularly interesting, notably its width in different latitudes, its lateral wanderings and the development and life-history of the intrusions of warm water which it sends into the region of the slope water. Departures of Gulf Stream temperatures from the average were noted, with simultaneous but smaller departures in the central Atlantic area. The author considers that the latter exert greater influence in producing weather abnormalities along the eastern United States seaboard than those of the Gulf Stream itself.

E. W. BARLOW.

OBITUARY

Sir John William Moore.—It is with great regret that we record the death at the age of nearly 92 of Sir John William Moore, the eminent Irish physician and meteorologist. To the student of meteorological literature he is best known by his "Meteorology, Practical and Applied," first published in 1894, and re-published in a revised and enlarged form in 1910. Though this book is perhaps little known to the younger generation of meteorologists it is an able and substantial work; it contains, in particular, a valuable section on "The influence of season and of weather on disease," much of which was the result of his own research work. He was the author also of numerous papers dealing mainly with the climatology of Dublin, where he was born on October 23rd, 1845, and where he died on October 12th, 1937, within a few days of his ninety-second birthday. He was personally associated with the meteorological work of the Dublin City Climatological Station, Fitzwilliam Square from the date of its commencement, about 1868. Actually his services as a co-operating observer began even earlier, for *British Rainfall*, 1865, contains readings from Dublin, St. Anne's Street, contributed by J. W. Moore, Esq. Sir John Moore was thus a regular meteorological observer for a period of more than 71 years, a truly remarkable record and one that has never been equalled in our annals.

He was among the most distinguished of Irish physicians, and received the honour of knighthood in 1900 at the completion of two years as President of the Royal College of Physicians of Ireland. His manifold activities included the editorship of the *Dublin Journal of Medical Science* from 1873 to 1920. He was an Honorary Physician-in-Ordinary to H.M. the King in Ireland and an Honorary D.Sc. of Oxford University.

E. G. BILHAM.

We regret to learn of the death on October 11th of Dr. J. R. Sutton, formerly Director of the De Beer's Meteorological Observatory of Kimberley in South Africa, Honorary Member of the Royal Meteorological Society and the author of numerous important works on the climatology of South Africa.

NEWS IN BRIEF

We learn that Dr. G. M. B. Dobson, has been elected to an official fellowship at Merton College, Oxford, and has also been appointed to be a member of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

We learn that Captain Georges M. Horsch has been appointed Director General of the National Observatory of Athens.

The Weather of October, 1937

Pressure was above 1020 mb. west of the Azores and in a long belt between about 40° N. and 60° N. from long. 20° E. in central Europe to 110° E. in central Siberia, reaching 1025 mb. north of Lake Baikal; 1020 mb. was also reached in the south of British Columbia. Pressure was below 1000 mb. over the Aleutian Islands and Davis Strait; most of the Arctic was below 1005 mb. and a secondary minimum (1013 mb.) occupied Portugal, Spain and western France. Over Scandinavia there was a steep gradient for south-westerly winds, becoming westerly over northern Russia. Pressure was more than 5 mb. above normal south-east of Newfoundland and in a narrow zone from Denmark to northern Russia; it was 5 mb. below normal over the Aleutian Islands, south Greenland, west Scotland and the Arctic from Spitsbergen eastwards. Elsewhere deviations were slight.

Temperature was below zero in the central regions of the Arctic Ocean, below 10° F. on the coast of Siberia from Cape Chelyuskin to the Lena Delta and below 20° F. over north-eastern Siberia, but south and east Greenland, Bear Island and most of Alaska were above 32° F. Scandinavia was abnormally warm (40–50° F., 5° F. above normal). The British Isles varied from 49° F. in the north to 55° F. in the south; central Europe from 50° F. in the north-east to 55° F. in the west and south; Portugal and the Mediterranean exceeded 60° F. while Malta and Tripoli were above 70° F. and Egypt 75° F. to 90° F. In North America temperature increased from 22° F. on the north coast to 70° F. on the Gulf Coast but western Canada (47–55° F.) was 5–8° F. above normal. Another area of abnormally high temperature included Iceland, east Greenland and Newfoundland, elsewhere temperatures differed little from normal.

Precipitation was from 2 to 4 in. in the British Isles and western France and 1 to 2 in. over northern, central and eastern Europe. In these areas it was generally deficient, but parts of the Mediterranean had abnormally heavy rainfall, exceeding 10 in. at Gibraltar. Most of Siberia had less than an inch. In North America rainfall was generally moderate (1–4 in.) but was excessive on the Gulf Coast.

The main feature in Australasia was an intense anticyclone over New Zealand, exceeding 1020 mb., 10 mb. above normal. Australia differed little from normal. Southern and eastern India were below 1010 mb., and India was generally 2 mb. below normal. Temperature was 1–3° F. below normal in India, but most of Australia was abnormally warm, temperatures of 60° F. and above being recorded on much of the south coast. Rainfall was above normal in central and eastern India and the east coast of Australia including Victoria but deficient over most of the rest of Australia and New Zealand.

The weather over the British Isles during the first part of October was generally mild, and anticyclonic, becoming unsettled with storms and much rain later. Sunshine totals were considerably below normal except in the west; the total of 75 hrs. at Cranwell (Lincolnshire) established a new low record for this station where observations started in 1921. Rainfall was deficient generally except in eastern Scotland and north Wales, while much morning mist or fog was experienced at times. On the 1st, the British Isles lay between two areas of low pressure, one to the north and the other over the Bay of Biscay and rain fell heavily in most districts except the south-east, 1·97 in. was recorded at Scilly. By the 2nd the anticyclone over northern Europe was spreading eastwards and the rain had lessened considerably. Mist and fog were experienced locally on both mornings chiefly in the eastern districts. From then to the 13th pressure was high over the whole country and warm anticyclonic weather prevailed generally though there was considerable cloud on many days. Moderate rain occurred on the south coast of England on the 4th and 5th, in parts of Ireland on the 6th and in north Scotland on the 8th. The 4th and 10th were both sunny days and long periods of bright sunshine were also experienced locally on the 5th, 9th and 11th; 10·8 hrs. at Tynemouth on the 4th and 10·0 hrs. at Scilly and Guernsey on the 5th and Portsmouth, Southsea and Weymouth on the 10th. Mist or fog occurred frequently in the mornings except in the extreme north while maximum temperatures were generally between 55°F and 65°F. From the 14th to 19th pressure was high to the south whilst depressions to the north moving north-east brought mild unsettled stormy weather to the northern districts. Gales were experienced in the extreme north and north-west from the 15th to 18th but generally there was not much rain or sun in the north during this period though considerable cloud. In England the weather was mainly warm and sunny during the day with, however, low minimum temperatures on some nights and from the 16th much morning mist and fog. A maximum temperature of 69°F. was recorded at Bude on the 18th and 10·0 hrs. bright sunshine at Scilly on the same day. On the 20th and 21st pressure was low both to the north and south but mild sunny weather with morning fog continued in the south—in the north and west there was more rain. By the evening of the 21st a complete change of conditions was spreading across the south of the country, putting an end to the drought which had extended since the end of September at some places. On the 22nd a deep depression lay over the country and rain fell heavily both then and on the 23rd, 3·80 in. at Llanerchymedd (Anglesey) on the 23rd and 1·85 in. at Carmarthen on the 22nd. The 24th was generally a sunny day except in the south-west, but from the 23rd to the 26th, strong winds were experienced at times in most parts and gales off the south-west coasts—Scilly reported a gust of 83 m.p.h. and Lizard one of 80 m.p.h. on the 23rd. Thunderstorms were experienced in the west on the 23rd and more generally in the south-west, south and east on the 25th when they were accompanied by hail in some places. The 26th was a sunny day in the south-west but rain continued in the north. On the 27th a ridge of high pressure passed across Ireland and Scotland giving much sun in these countries, 8·8 hrs. at Oban and Tiree and 8·7 hrs. at Valentia and Ballinacurra. From then to the 31st pressure was low, and unsettled weather, with considerable rain at times prevailed and some local morning mist or fog. The distribution of bright sunshine for the month was as follows :—

	Total (hrs.)	Diff. from normal (hrs.)		Total (hrs.)	Diff. from normal (hrs.)
Stornoway ..	62	−15	Chester ..	75	−16
Aberdeen ..	76	−18	Ross-on-Wye	83	−16
Dublin	—	—	Falmouth ..	120	+ 7
Birr Castle ..	95	+ 5	Gorleston ..	81	−34
Valentia ..	95	+ 5	Kew.. ..	82	−14

Kew, Temperature, Mean, 52·6., Diff. from average + 1·0.

Miscellaneous notes on weather abroad culled from various sources.

Torrential rain followed by severe floods was experienced in the Pyrenees during the first 5 or 6 days of the month, and at the same time, severe thunderstorms accompanied by torrential rain which flooded the rivers occurred in Tuscany, doing extensive damage. Heavy rain was also experienced in north Spain early in the month. Dense fog occurred off Cape Finistere on the 20th and off the coasts of Holland and north-west Germany on the 21st. A violent thunderstorm was experienced over Rome and the neighbourhood on the 23rd, causing much damage to the town of Palestrina—2 people were killed. Snow fell, down to the 3,000 ft. level on the Alps, about the 25th, and most of the Alpine passes were closed for vehicular traffic for the winter. Violent rainstorms caused floods which did serious damage to communications in Bosnia (Yugoslavia) about the 25th. A sudden flooding of the Pyrenean rivers about the 28th caused much damage—at Pierresite there was a large landslip and 2 people were drowned. Gales and heavy rain were reported from the Riviera on the 28th, and exceptionally heavy rain in several parts of Spain on the 30th (*The Times,* October 5th—November 1st).

Rain early in the month flooded many parts of Shanghai. Sudden severe floods were experienced in Syria on the 28th to 30th, during which many people were drowned and several villages destroyed (*The Times*, October 8th—November 1st).

A westerly gale blowing at Buenos Aires on the 7th and 8th drove the waters of the River Plate down the estuary causing a water shortage in the city. On the 9th the wind changed and the river returned to normal (*The Times*, October 11th).

Daily Readings at Kew Observatory, October, 1937

Date	Pressure, M.S.L. 13h.	Wind, Dir., Force 13h.	Temp. Min.	Temp. Max.	Rel. Hum. 13h.	Rain.	Sun.	REMARKS. (see vol. 69, 1934, p. 1).
	mb.		°F.	°F.	%	in.	hrs.	
1	1011·9	SSE.2	46	66	63	—	2·9	fe till 9h.
2	1012·1	ENE.2	52	67	63	—	2·0	mw early f 9h.
3	1021·3	N.2	56	60	83	—	0·0	r_0 2h and 8h. f till 9h.
4	1033·3	NNW.3	46	61	55	—	8·0	w early and late.
5	1029·5	N.4	48	59	71	—	0·1	
6	1023·4	NE.4	50	57	61	—	0·2	
7	1014·6	NE.3	51	56	78	0·03	0·0	r_0 1h.–10h.
8	1017·2	NE.3	50	60	66	—	0·1	
9	1028·3	NE.1	51	60	58	—	4·3	w early and late.
10	1030·6	NNW.2	39	58	56	—	4·1	Fe till 9h. fe 19h.
11	1025·6	NNE.4	46	58	70	—	5·5	d_0 21h.
12	1025·1	N.3	51	54	87	—	0·0	d_0 9h, 13h and 14h.
13	1026·8	W.2	49	52	68	—	0·5	m 18h.
14	1022·1	WNW.2	42	59	65	—	0·2	
15	1028·3	NW.3	50	60	53	—	5·1	F 20h.
16	1032·3	SW.2	38	59	70	—	7·1	Fe till 9h.
17	1034·6	SSW.2	43	57	69	—	3·7	Fe evening. [18h.
18	1032·0	SSW.1	36	54	88	trace	2·2	Fe till 12h. and from
19	1023·8	E.3	44	58	70	—	4·4	Fe–f till 9h. and from
20	1016·1	SSW.2	47	59	69	—	5·4	Fe till 7h. f.21h. [18h.
21	1009·8	NW.1	40	55	94	trace	0·0	Fe–f all day.
22	997·4	S.4	43	60	68	0·55	3·0	fe till 9h. r 15h.–22h.
23	975·4	S.4	49	55	63	0·48	2·4	r_0–R 7h–22h.
24	989·7	WSW.4	46	53	53	0·01	5·7	pr_0 7h. r_0 22h.–24h.
25	982·2	SSE.5	48	58	79	0·42	2·3	PR from 10h. TLr
26	997·5	S.2	48	58	69	0·01	2·9	r_0 from 23h. [19h.,20h.
27	1003·9	NE.3	48	55	96	0·56	0·0	r_0–r 0h.–19h.
28	1007·5	S.3	53	61	72	0·08	6·3	r_0–r 19h.–24h.
29	998·2	NNE.1	52	58	83	—	0·0	r_0 0h., 3h., 18 h.
30	1001·3	SW.4	50	58	75	0·01	2·6	r_0 4h.–5h., 9h., 18h.
31	1007·9	ESE.2	47	58	71	0·22	0·8	r_0–r 18h.–22h.
*	1014·8	—	47	58	71	2·37	2·6	* Means or Totals.

General Rainfall for October, 1937

England and Wales ...	83	per cent of the average 1881–1915.
Scotland	81	
Ireland	66	
British Isles	80	

Rainfall : October, 1937 : England and Wales

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Lond .	Camden Square..........	2·21	84	*Leics* .	Thornton Reservoir ...	2·56	91
Sur .	Reigate, Wray Pk. Rd..	3·32	100	,, .	Belvoir Castle...........	2·30	85
Kent .	Tenterden, Ashenden...	3·76	108	*Rut* .	Ridlington	2·40	85
,, .	Folkestone, Boro. San.	2·65	...	*Lincs* .	Boston, Skirbeck.........	2·13	78
,, .	Margate, Cliftonville....	2·78	95	,, .	Cranwell Aerodrome...	2·21	77
,, .	Eden'bdg., Falconhurst	2·89	80	,, .	Skegness, Marine Gdns.	1·38	50
Sus .	Compton, Compton Ho.	4·02	88	,, .	Louth, Westgate.........	2·10	65
,, .	Patching Farm..........	2·58	65	,, .	Brigg, Wrawby St.......	2·45	...
,, .	Eastbourne, Wil. Sq....	3·27	79	*Notts* .	Mansfield, Carr Bank...	3·63	119
Hants.	Ventnor, Roy.Nat.Hos.	2·37	60	*Derby*.	Derby, The Arboretum	1·81	67
,, .	Fordingbridge, Oaklnds	4·33	104	,, .	Buxton, Terrace Slopes	2·86	55
,, .	Ovington Rectory.......	4·29	106	*Ches* .	Bidston Obsy............	2·30	70
,, .	Sherborne St. John......	3·11	88	*Lancs*.	Manchester, Whit. Pk.	1·55	47
Herts .	Royston, Therfield Rec.	2·79	103	,, .	Stonyhurst College......	2·07	46
Bucks.	Slough, Upton............	2·92	104	,, .	Southport, Bedford Pk.	2·25	64
Oxf .	Oxford, Radcliffe.........	2·70	93	,, .	Ulverston, Poaka Beck	2·91	53
N'hant	Wellingboro, Swanspool	2·87	114	,, .	Lancaster, Greg Obsy.	1·77	43
,, .	Oundle	1·90	...	,, .	Blackpool	2·78	75
Beds .	Woburn, Exptl. Farm...	2·75	103	*Yorks*.	Wath-upon-Dearne......	2·98	108
Cam .	Cambridge, Bot. Gdns.	2·24	95	,, .	Wakefield, Clarence Pk.	2·66	93
,, .	March......................	1·84	71	,, .	Oughtershaw Hall.......	3·09	...
Essex .	Chelmsford, County Gdns	1·21	49	,, .	Wetherby, Ribston H..	2·29	76
,, .	Lexden Hill House......	1·41	...	,, .	Hull, Pearson Park......	1·71	57
Suff .	Haughley House.........	1·39	...	,, .	Holme-on-Spalding......	2·27	76
,, .	Rendlesham Hall........	2·00	77	,, .	West Witton, Ivy Ho.	2·91	78
,, .	Lowestoft Sec. School...	1·75	63	,, .	Felixkirk, Mt. St. John.	1·97	68
,, .	Bury St. Ed., Westley H.	1·94	72	,, .	York, Museum Gdns....	2·80	104
Norf. .	Wells, Holkham Hall...	2·24	80	,, .	Pickering, Hungate......	2·54	83
Wilts .	Porton, W.D. Exp'l. Stn	4·46	143	,, .	Scarborough...............	2·95	94
,, .	Bishops Cannings........	4·48	135	,, .	Middlesbrough...........	1·23	41
Dor .	Weymouth, Westham.	4·49	123	,, .	Baldersdale, Hury Res.	2·35	59
,, .	Beaminster, East St....	4·80	108	*Durh* .	Ushaw College............	1·95	57
,, .	Shaftesbury, Abbey Ho.	4·41	113	*Nor* .	Newcastle, Leazes Pk...	2·10	68
Devon.	Plymouth, The Hoe....	3·75	95	,, .	Bellingham, Highgreen	2·65	68
,, .	Holne, Church Pk. Cott.	4·64	70	,, .	Lilburn Tower Gdns....	2·78	75
,, .	Teignmouth, Den Gdns.	3·81	98	*Cumb*.	Carlisle, Scaleby Hall...	1·66	50
,, .	Cullompton	3·65	88	,, .	Borrowdale, Seathwaite	6·0(	53
,, .	Sidmouth, U.D.C........	3·35	...	,, .	Thirlmere, Dale Head H.	6·44	74
,, .	Barnstaple, N. Dev.Ath	2·95	65	,, .	Keswick, High Hill......	3·35	60
,, .	Dartm'r, Cranmere Pool	5·10	...	*West* .	Appleby, Castle Bank...	1·35	39
,, .	Okehampton, Uplands.	4·39	73	*Mon* .	Abergavenny, Larchf'd	4·61	110
Corn .	Redruth, Trewirgie......	3·69	70	*Glam* .	Ystalyfera, Wern Ho....	3·54	51
,, .	Penzance, Morrab Gdns.	3·21	69	,, .	Treherbert, Tynywaun.	4·30	...
,, .	St. Austell, Trevarna...	3·15	60	,, .	Cardiff, Penylan..........	4·09	86
Soms .	Chewton Mendip.........	4·46	93	*Carm* .	Carmarthen, M. & P. Sch.	5·88	100
,, .	Long Ashton............	3·32	88	*Pemb* .	Pembroke, Stackpole Ct.	4·85	103
,, .	Street, Millfield..........	3·80	119	*Card* .	Aberystwyth	3·92	...
Glos .	Blockley	3·48	...	*Rad* .	BirmW.W.Tyrmynydd	4·65	70
,, .	Cirencester, Gwynfa....	3·49	105	*Mont* .	Newtown, Penarth Weir	3·66	90
Here .	Ross-on-Wye..............	3·44	104	,,	Lake Vyrnwy	4·26	75
Salop .	Church Stretton.........	4·48	124	*Flint* .	Sealand Aerodrome......	2·46	...
,, .	Shifnal, Hatton Grange	2·20	78	*Mer* .	Blaenau Festiniog	3·95	42
,, .	Cheswardine Hall........	2·67	86	,, .	Dolgelley, Bontddu......	3·45	57
Worc .	Malvern, Free Library...	2·95	99	*Carn* .	Llandudno	3·24	97
,, .	Ombersley, Holt Lock.	2·47	93	,, .	Snowdon, L. Llydaw 9..	7·85	...
War .	Alcester, Ragley Hall...	2·58	94	*Ang* .	Holyhead, Salt Island...	6·40	160
,, .	Birminghm, Edgbaston	2·67	96	,, .	Lligwy	6·43	...

Rainfall : October, 1937 : Scotland and Ireland

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
I. Man	Douglas, Boro' Cem.	4·47	99	*R&C*	Achnashellach	4·32	54
Guern.	St.Peter P't.Grange Rd.	4·20	93	,,	Stornoway,C.GuardStn.	2·32	47
Wig	Pt. William, Monreith.	2·89	73	*Suth*	Lairg	2·19	59
,,	New Luce School	2·98	64	,,	Skerray Borgie	2·45	...
Kirk	Dalry, Glendarroch	3·74	71	,,	Melvich	2·03	55
Dumf.	Dumfries, Crichton R.I.	4·75	128	,,	Loch More, Achfary	5·93	76
,,	Eskdalemuir Obs	3·87	72	*Caith*	Wick	2·51	85
Roxb	Hawick, Wolfelee	3·12	81	*Ork*	Deerness	2·54	67
Peeb	Stobo Castle	3·44	100	*Shet*	Lerwick	3·13	85
Berw	Marchmont House	3·55	93	*Cork*	Dunmanway Rectory	...	...
E.Lot	North Berwick Res	3·29	111	,,	Cork, University Coll	2·48	64
Midl	Edinburgh, Blackfd. H.	3·87	141	,,	Mallow, Longueville	2·62	73
Lan	Auchtyfardle	4·38	...	*Kerry*	Valentia Observatory	2·50	45
Ayr	Kilmarnock, Kay Park	2·81	...	,,	Gearhameen	3·80	41
,,	Girvan, Pinmore	3·99	80	,,	Bally McElligott Rec	2·44	...
,,	Glen Afton, Ayr San.	4·91	96	,,	Darrynane Abbey	2·33	46
Renf	Glasgow, Queen's Park	4·14	127	*Wat*	Waterford, Gortmore	3·11	79
,,	Greenock, Prospect H.	2·84	53	*Tip*	Nenagh, Castle Lough.	...	...
Bute	Rothesay, Ardencraig	3·12	71	,,	Roscrea, Timoney Park	...	...
,,	Dougarie Lodge	2·73	66	,,	Cashel, Ballinamona	2·64	74
Arg	Loch Sunart, G'dale	4·44	67	*Lim*	Foynes, Coolnanes	1·49	39
,,	Ardgour House	3·75	...	*Clare*	Inagh, Mount Callan	1·91	...
,,	Glen Etive	3·33	41	*Wexf*	Gorey, Courtown Ho.	2·49	70
,,	Oban	3·79	...	*Wick*	Rathnew, Clonmannon.	3·91	...
,,	Poltalloch	4·52	92	*Carl*	Bagnalstown,Fenagh H.	2·78	83
,,	Inveraray Castle	3·94	56	,,	Hacketstown Rectory	2·61	69
,,	Islay, Eallabus	4·43	93	*Leix*	Blandsfort House	3·33	95
,,	Mull, Benmore	11·20	87	*Offaly*	Birr Castle	1·93	66
,,	Tiree	2·23	49	*Kild*	Straffan House	3·96	139
Kinr	Loch Leven Sluice	3·37	98	*Dublin*	Dublin, Phoenix Park	4·45	169
Fife	Leuchars Aerodrome	3·54	136	*Meath*	Kells, Headfort	...	...
Perth	Loch Dhu	3·80	53	*W.M*	Moate, Coolatore	1·59	...
,,	Crieff, Strathearn Hyd.	3·62	92	,,	Mullingar, Belvedere	1·93	62
,,	Blair Castle Gardens	2·62	85	*Long*	Castle Forbes Gdns	1·56	48
Angus	Kettins School	3·28	103	*Gal*	Galway, Grammar Sch.	1·06	29
,,	Pearsie House	3·16	...	,,	Ballynahinch Castle	2·55	43
,,	Montrose, Sunnyside	3·19	116	,,	Ahascragh, Clonbrock.	1·03	28
Aber	Balmoral Castle Gdns.	3·05	85	*Rosc*	Strokestown, C'node	...	...
,,	Logie Coldstone Sch	2·75	85	*Mayo*	Blacksod Point	2·02	41
,,	Aberdeen Observatory.	3·37	112	,,	Mallaranny	2·05	...
,,	New Deer School House	2·50	66	,,	Westport House	·89	20
Moray	Gordon Castle	2·32	73	,,	Delphi Lodge	2·80	29
,,	Grantown-on-Spey	2·08	70	*Sligo*	Markree Castle	1·37	34
Nairn.	Nairn	2·32	99	*Cavan.*	Crossdoney, Kevit Cas.	1·96	...
Inv's	Ben Alder Lodge	2·86	...	*Ferm*	Crom Castle	1·12	35
,,	Kingussie, The Birches.	1·77	...	*Arm*	Armagh Obsy	2·75	101
,,	Loch Ness, Foyers	1·99	59	*Down.*	Fofanny Reservoir	4·53	...
,,	Inverness, Culduthel R.	2·17	89	,,	Seaforde	3·62	102
,,	Loch Quoich, Loan	7·51	...	,,	Donaghadee, C. G. Stn.	3·49	121
,,	Glenquoich	4·26	43	*Antr*	Belfast, Queen's Univ	3·14	95
,,	Arisaig House	3·99	68	,,	Aldergrove Aerodrome.	2·95	98
,,	Glenleven, Corrour	2·38	39	,,	Ballymena, Harryville.	2·99	81
,,	Fort William, Glasdrum	2·83	...	*Lon*	Garvagh, Moneydig	2·34	...
,,	Skye, Dunvegan	2·79	...	,,	Londonderry, Creggan.	1·68	46
,,	Barra, Skallary	3·04	...	*Tyr*	Omagh, Edenfel	1·10	30
R&C	Alness, Ardross Castle.	...	...	*Don*	Malin Head	1·57	...
,,	Ullapool	2·59	53	,,	Dunkineely	1·31	...

Climatological Table for the British Empire, May, 1937

STATIONS.	PRESSURE. Mean of Day M.S.L. mb.	PRESSURE. Diff. from Normal. mb.	TEMPERATURE. Absolute. Max. °F.	TEMPERATURE. Absolute. Min. °F.	TEMPERATURE. Mean Values. Max. °F.	TEMPERATURE. Mean Values. Min. °F.	TEMPERATURE. Mean Values. ½ Max. and Min. °F.	TEMPERATURE. Mean Values. Diff. from Normal °F.	TEMPERATURE. Mean. Wet Bulb. °F.	Relative Humidity. %	Mean Cloud Am'nt 0–10	PRECIPITATION. Am'nt. in.	PRECIPITATION. Diff. from Normal. in.	PRECIPITATION. Days.	BRIGHT SUNSHINE. Hours per day.	BRIGHT SUNSHINE. Percentage of possible.
London, Kew Obsy.	1016·4	+ 0·5	80	40	63·7	48·4	56·1	+ 1·6	50·0	85	8·5	2·15	+ 0·43	13	5·6	36
Gibraltar	1018·0	+ 1·9	75	52	66·9	57·2	62·1	− 3·4	55·9	79	3·7	0·44	...	5	...	...
Malta	1016·6	+ 2·1	81	56	71·2	60·4	65·8	− 0·1	60·7	78	3·7	0·23	− 0·18	2	9·6	68
St. Helena	1013·1	− 1·4	73	57	68·1	60·7	64·4	+ 2·1	62·3	93	8·1	4·36	+ 1·68	18	...	...
Freetown, Sierra Leone	1011·2	+ 1·7	90	71	86·9	75·0	80·9	...	76·4	79	6·2	8·09	− 3·38	16	...	...
Lagos, Nigeria	1010·7	+ 0·1	91	71	87·3	76·7	82·0	+ 0·2	77·4	84	7·8	10·02	− 0·73	12	7·1	57
Kaduna, Nigeria	1010·0	...	98	69	91·2	72·1	81·7	+ 2·3	73·5	82	7·0	7·02	+ 1·32	16	7·8	62
Zomba, Nyasaland	1015·4	0·0	82	49	76·8	57·1	66·9	+ 1·1	62·4	74	4·5	0·28	− 0·76	2	...	...
Salisbury, Rhodesia	1018·2	0·0	79	37	74·3	47·6	60·9	+ 0·3	53·0	55	1·4	0·03	...	1	8·6	76
Cape Town	1018·9	+ 0·8	91	38	67·0	50·5	58·7	− 0·2	51·8	91	0·6	3·39	− 0·36	12	...	...
Johannesburg	1018·5	− 0·8	76	39	68·2	48·4	58·3	+ 3·9	45·4	40	1·1	0·26	− 0·50	2	9·3	85
Mauritius	1017·0	+ 0·7	84	59	78·6	68·5	73·6	+ 1·0	70·7	81	6·2	11·68	+ 7·76	20	6·3	56
Calcutta, Alipore Obsy.	1003·4	− 0·1	106	72	96·2	79·0	87·6	+ 1·5	79·5	78	5·5	5·47	− 0·09	5*	...	...
Bombay	1007·6	+ 0·2	93	76	90·5	79·4	84·9	− 0·9	77·2	75	3·1	0·00	− 0·55	0*	...	...
Madras	1004·7	− 0·7	106	79	98·0	82·1	90·1	+ 0·3	79·3	65	3·8	0·00	− 1·84	0*	...	...
Colombo, Ceylon	1009·1	+ 0·7	88	73	86·8	77·3	82·1	− 0·7	78·7	82	8·0	18·63	+ 7·69	26	6·1	49
Singapore	1009·1	+ 0·4	88	71	85·6	76·3	80·9	− 1·1	78·2	81	6·7	12·75	+ 6·11	21	5·9	49
Hongkong	1009·4	+ 0·3	90	71	84·0	75·2	79·6	+ 2·2	72·4	69	7·2	11·12	− 0·95	14	5·1	39
Sandakan	1009·4	...	92	74	89·2	76·2	82·7	+ 0·2	77·8	84	7·0	10·90	+ 4·57	14	...	...
Sydney, N.S.W.	1016·2	− 2·4	82	43	68·1	51·6	59·9	+ 1·1	52·4	65	6·5	0·75	− 4·43	7	5·9	57
Melbourne	1015·8	− 3·4	74	35	62·6	47·1	54·9	+ 0·8	49·6	74	7·1	1·25	− 0·91	18	3·7	36
Adelaide	1017·6	− 2·6	83	44	67·0	52·5	59·7	+ 1·7	54·0	71	7·5	3·78	+ 1·06	18	4·2	41
Perth, W. Australia	1016·8	− 1·6	75	46	68·4	54·9	61·7	+ 1·0	59·7	92	7·2	7·34	+ 2·37	21	4·7	45
Coolgardie	1016·7	− 2·4	88	39	69·2	48·3	58·7	+ 1·0	52·9	71	4·1	1·01	− 0·32	5	...	...
Brisbane	1017·6	− 1·0	84	49	75·5	55·1	65·3	+ 0·7	58·3	66	4·3	0·25	− 2·56	5	7·5	69
Hobart, Tasmania	1009·9	− 5·4	73	34	56·7	44·0	50·3	− 0·2	44·7	71	6·1	2·97	+ 1·07	17	4·2	43
Wellington, N.Z.	1013·0	− 2·6	62	39	58·9	46·3	52·6	− 0·2	49·2	85	7·4	3·41	− 1·27	16	3·7	37
Suva, Fiji	1013·3	+ 0·6	87	68	82·4	73·1	77·7	+ 1·2	73·7	87	6·9	16·49	+ 6·42	27	4·3	38
Apia, Samoa	1011·6	+ 0·5	87	69	85·0	74·1	79·5	+ 1·1	75·4	77	5·4	14·86	+ 8·79	17	7·0	61
Kingston, Jamaica	1012·0	− 1·1	89	69	85·6	72·2	78·9	− 0·8	72·2	79	4·0	7·36	+ 2·97	12	5·4	42
Grenada, W.I.	1011·3	− 1·3	89	71	87	73	80	+ 0·3	73	74	4	3·05	− 1·14	15	...	...
Toronto	1014·2	− 0·7	85	37	65·3	47·7	56·5	+ 2·7	48·8	70	6·2	2·90	+ 0·11	13	6·8	46
Winnipeg	1014·0	+ 0·2	87	24	66·5	43·9	55·2	+ 3·2	44·5	83	4·8	2·20	+ 0·20	10	7·8	51
St. John, N.B.	1014·2	+ 0·3	79	34	61·6	43·0	52·3	+ 4·6	47·3	76	6·6	4·52	+ 0·81	15	6·5	44
Victoria, B.C.	1017·6	+ 0·9	71	42	60·6	46·2	53·4	+ 0·4	45·5	84	6·0	0·43	− 0·70	9	8·4	55

* For Indian stations a rain day is a day on which 0·1 in. or more rain has fallen.

(39442) Wt. 20/31 1125 11/37 Hw. G. 377/6