THE METEOROLOGICAL MAGAZINE

M.O. 441

AIR MINISTRY : METEOROLOGICAL OFFICE

Vol. 74 September–October 1939 Nos. 884–885

FOREWORD

The publication of the *Meteorological Magazine* for September 1939 was unavoidably delayed. Fortunately it is now possible to resume, though on a somewhat reduced scale, and in order not to break the continuity, the present issue is regarded as a double number, 884 and 885, representing both September and October. It is hoped to continue with the regular monthly issues at least until the end of the current volume, when the position will be reviewed.

The monthly table of Rainfall, and the Climatological Table for the British Empire, both of which have formed part of the Magazine for many years, are being retained, but not the table of daily readings at Kew Observatory.

The Editor will be pleased to receive contributions, and he relies on observers and contributors to keep alive the widespread interest in meteorology. As one of our rainfall observers remarked: " Observations will be carried on as usual, unless the Boches drop a bomb on the rain gauge.—P.S. Even then, I have a spare gauge!"

THE AMATEUR FORECASTER

With the passing of " The Air Ministry's Weather Forecast " the amateur meteorologist is thrown back on his own resources. The professional forecaster has at his disposal a series of weather charts based on simultaneous observations of barometer, wind, weather, etc., at a large number of places. With these he can watch the movements of barometric depressions, anticyclones and other systems which control our weather. Observations at a

single point obviously cannot be a complete substitute for this elaborate organisation; nevertheless the intelligent watcher can often form a fairly accurate picture of the changing distribution of pressure over a large part of the country merely from his own observations of pressure, wind, cloud, etc.

The first thing to remember is Buys Ballot's Law, which states that if you stand with your back to the wind, the lowest pressure is on your left hand. Actually it is a little in front of your left hand, especially in inland districts where the wind is light. Secondly, most barometric situations can be classified roughly as cyclonic or anticyclonic. While no exact limits can be given, a reading of 30 inches or 1,016 millibars at sea level can be taken as a rough dividing line. High pressure generally brings fine weather, but it must not be rashly assumed that because the barometer climbs to " Set Fair " a long spell of fine weather is imminent. One of the golden rules of meteorology is: " long foretold, long last; short notice, soon past ", and if the barometer rushes rapidly upwards after a storm it may merely indicate the approach of a wedge of high pressure between two depressions, which will give one day of glorious weather, but rarely more. It is when the barometer rises slowly but steadily for several days that we can recognise the real slow-moving anticyclone and safely leave our umbrellas at home. Fine weather is then likely to persist until a considerable fall of the barometer has again occurred. Then, especially if the wind be southerly, one should look out for signs of an approaching barometric depression or " low ".

The simplest picture of a depression is a centre of low barometer round which the winds circulate in the opposite direction to the hands of a clock, but this simple structure is usually complicated by " fronts " between air currents coming from different regions, or by distortions and " secondaries ". Depressions in our neighbourhood generally move roughly from west to east, so that the winds at any one place go through a fairly regular sequence, depending on whether the centre passes to the

southwards or, as is more usual in England, to the northwards. In the latter case the course of events is somewhat as follows: As the barometer falls, the wind freshens from south-east, veering to south or south-west, while wispy cirrus thickens to form a continuous sheet of lower cloud, from which steady though not heavy rain falls. There often follows a short period of better weather, during which the barometer remains fairly steady, though low. This is terminated by a sudden squall in which the wind shifts to west with heavy rain and perhaps thunder; at the same time the barometer begins to rise and the temperature falls. Other showers occur from time to time, becoming progressively less intense, until finally the weather clears entirely.

If the centre passes to the south of the observer, the wind will *back* from south-east to north-east, and one of two things may happen. In winter, and in cool summer weather, a period of uninterrupted steady rain will probably set in, and last for many hours before it clears gradually as the barometer rises. As the proverb has it: " Rain from the east, two days at least ". In eastern Britain the most prolonged rains are of this type, but in the western hills persistent rain is usually brought by steady west or south-west winds, and is preceded by the muffling of the hill-tops in cloud. In south-east England, after hot summer weather, a south-easterly wind backing to east with a falling barometer may bring a spectacular series of thunderstorms. But every depression is a law to itself.

For the man who has no barometer, the most fruitful source of short-term weather forecasts is the sky, where almost literally, " coming events cast their shadows before ". Thus the proverb:—

" Red sky at night is the shepherd's delight;
Red sky in the morning is the shepherd's warning "

was investigated, as regards London, by the late Spencer Russell, who found that rain during the night is more probable after a yellow sunset than after a red, while rain during the day is more probable after a red sunrise

than after a yellow one, but rain is still more likely to follow a sunrise or sunset which is entirely overcast or grey.

Clouds in general make a fascinating study for the amateur forecaster, but would need a volume for adequate treatment. Cirrus is often supposed to be a sign of rain or wind, but is not very reliable. Cumulus clouds, which form on many fine summer afternoons, should be watched carefully. So long as they remain of moderate size and disintegrate towards evening, the weather will probably remain settled, but if they grow immoderately big and high, there is a risk of thunder, which becomes imminent if the cloud develops a flat-topped fringe of " false cirrus ", giving it the shape of a wedge or anvil; this is the cumulo-nimbus. Another thundery type is mammato-cumulus, heavy cloud with rounded protuberances beneath. Alto-cumulus castellatus, aptly named " turret clouds ", small high clouds with castellated tops resembling small cumulus, arranged in groups or lines moving from south or west in fine weather, are often followed by thunder within 24 hours. On the other hand, strato-cumulus, a fairly low layer of large rolls or connected masses with blue sky or lighter cloud between, generally spells settled weather.

Connected with clouds are halos, rings of 22° or, more rarely, 46° radius round the sun or moon, caused by the light shining through a high layer of minute ice crystals. More than half the halos seen in London or Oxford are followed by rain within 12 hours and nearly three-quarters by rain within 24 hours.

These brief notes have barely scratched the surface of a subject to which the amateur meteorologist might well devote his attention in the chartless days ahead. Ingenious little instruments can be bought, in which dials are set at the appropriate barometric readings, winds, etc., and the forecast is worked out mechanically, but it is more interesting to do the thinking for oneself, even at the cost of some glorious failures. The student will find a great deal of information about the prognostic aspects of weather in some of the well known text books.

THEORETICAL METEOROLOGY

By R. C. Sutcliffe

Due primarily but not entirely to the demands made by aviation, meteorology in general, and English meteorology in particular, is to-day showing greater activity than ever before in its history. According to a recent announcement, the staff of the Meteorological Office, Air Ministry, now numbers no less than 800; the Admiralty also controls through its Meteorological Branch another large body of professional meteorologists, while further numbers are to be trained as recognised sections of the Volunteer Reserves of both the Royal Navy and the Royal Air Force. In view of this impressive demonstration of the importance of meteorology applied to the public service, it is particularly pleasant to be able to record less spectacular but none the less significant activity in the academic world. Almost simultaneously three events have been announced: Professor David Brunt has been elected to Fellowship of the Royal Society, his department at the Imperial College has been augmented by the establishment of a new readership and, thirdly, the second edition of his well known textbook has appeared.*

As everyone who knows the original will naturally make a point of examining this new edition of a unique and now standard work, there is little purpose to be served by a cataloguing of the few new features, corrections or omissions. The remarks on the mechanism of the condensation and freezing processes peculiar to the atmosphere are very welcome and could perhaps be elaborated, the complete revision of the large section on turbulence will certainly appeal to some—although the present writer, being no doubt prejudiced, cannot quite see why this subject should be allowed so much elbow

* *Physical and Dynamical Meteorology* (2nd edition) by David Brunt. 10¼ × 6¾, pp. XXIV + 428 illus. Cambridge University Press, 1939, 25/- net.

room in a general text-book—but these are personal reactions of little interest and it will be of more value if we take this opportunity of drawing attention again to the general character of the book in the hope of encouraging any who so far have fought shy to make its aquaintance.

In the first place it is the only formal text-book on theoretical meteorology published in English, and so cannot be ignored by anyone who claims to be anything of a meteorologist. But it is more than this, it is methodical in development and lucid in style, a model of the university text-book comparable with the best in other branches of physics. The previous knowledge assumed in the reader is, as regards physics, hardly more than of matriculation standard, for the author finds it possible to develop almost everything from first principles, and as regards mathematics, if a little more advanced, at least quite straightforward. A mathematician himself, Professor Brunt does not regard a meteorological text-book as the proper medium for demonstrating his facility with any special mathematical tool; the avoidance of vector analysis, to take a particular point, although perhaps at the sacrifice of some economy and elegance, does also avoid frightening away the uninitiated. There is, in fact, very little to deter anyone with a modest scientific equipment from reading and understanding. If one were justified in criticising in any way such an important part of our literature, one might perhaps point out that the ground covered is a little more restricted than might be anticipated from the title or preface. Actually, attention is almost confined to the thermal and dynamical aspects of general atmospheric processes (adiabatic changes, radiation, turbulence and the changes of physical state of water in the atmosphere) together with a survey of the structure of large scale circulations. This " Physical Meteorology " does not therefore include any reference to atmospheric electricity, magnetism or meteorological optics, and even in this narrowed field one might observe that the index contains, curiously enough, no entries for dew, fog, stratocumulus

cloud, dust storms, visibility, glazed frost or rime, to pick out just a few terms from our familiar vocabulary. Partly this is due to the inadequacy of the index, one may spend quite a few minutes hunting down something which one well remembers having read somewhere in the book, but it is nevertheless true that in some 400 pages of concise text, with no readable padding whatever, meteorology is hardly taken beyond its fundamentals. Of most observed " phenomena " the physics is quantitatively so uncertain, or the mathematics so involved, that theory may be little more than conjecture, but, even so, it would be very helpful to be able to " look up Brunt " for a pronouncement on the theoretical position with regard to the many special problems of weather.

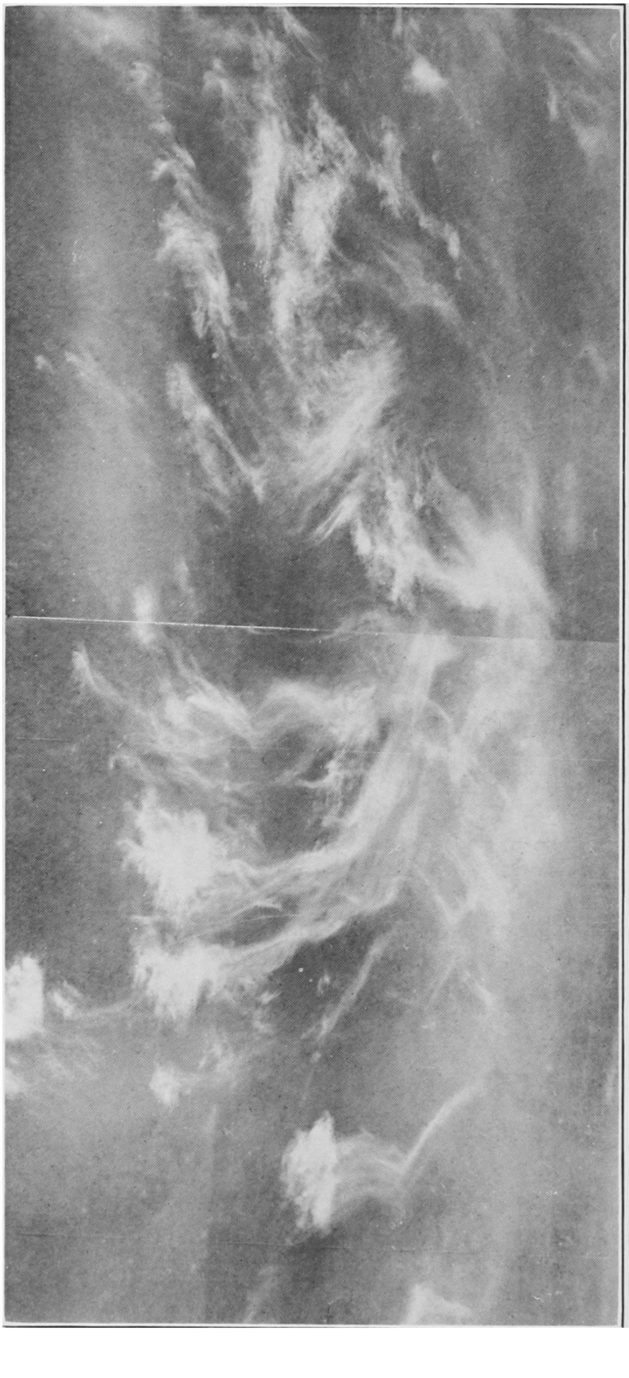
Professor Brunt writes primarily for post-graduate students at the University and we may assume that the book meets their requirements admirably, but he also modestly hopes that " it may be useful to those engaged in the profession of meteorology ". It is a curious feature of this profession that, in our country at any rate, it is hardly possible amongst the hundreds of personnel to find one who has studied the subject at a university. This is not the place to explain the fact or discuss the prospects of improving the position, that meteorology is almost a State monopoly is a relevant consideration and one may feel confident that both official and academic authorities are alive to the problem, but at present it is true that most working meteorologists can only fill in the necessary theoretical background to their routine professional duties at the sacrifice of private leisure after a heavy official day. To them, even more perhaps than to his own pupils, Professor Brunt has done a great service in providing a text-book systematizing and summarizing an enormous amount of work, previously available often only in original papers. Experimental or observational skill comes with practice, descriptive meteorology makes pleasant armchair reading, but theoretical quantitative meteorology demands from most of us a special effort so great that without a text-book as

guide, few could ever cover the ground. Professor Brunt deals with just those essential matters which it is so tempting to slide over and which if not tackled early seem to get more and more beyond one's grasp. It is, then, the new recruit to the profession more than any other who should make up his mind to worry through this book. A year or two spent in this way, rather than in trying to jump abreast of the research worker and see his own name on a published paper, will repay him not only in self-satisfaction but in valuable time. Every professional man must at least strive to keep touch with modern advances and the ability to discard the trivial and to recognise the significant contribution amongst the volume of current literature is a talent to be gained only by building up a sound theoretical background against which the novel idea may be judged.

To the hope that no professional meteorologist will allow this text-book to remain unread may we add the hope that our small but active group of academic workers will continue their service to the profession by providing further treatises equally lucid and equally authoritative on other theoretical aspects of our science.

OFFICIAL NOTICE

SUMMER TIME, 1939. Observers are reminded that "Summer time" will continue until the night of November 18th–19th, 1939.



Photographer: R. M. Poulter.

TUFTED CIRRUS CLOUD, JUNE 21ST, 1938.

LETTERS TO THE EDITOR

Tufted Cirrus Cloud

Interesting tufted cirrus cloud of zigzag pattern was observed here at 11h. 15m. to 11h. 30m. G.M.T. on June 21st, 1938. Photographs were taken at 11h. 30m. G.M.T.

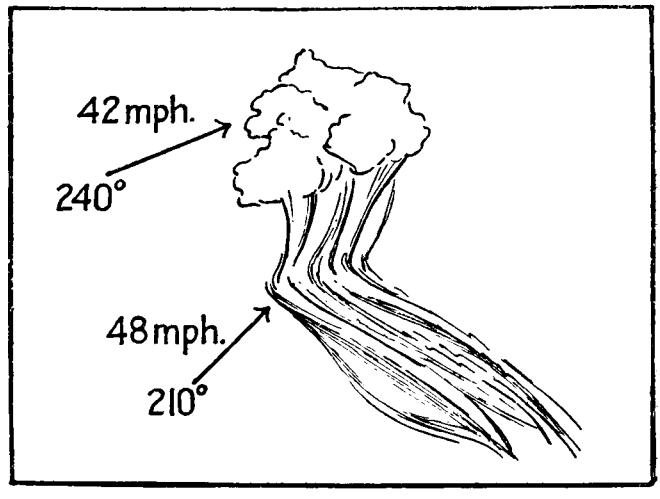


DIAGRAM OF TUFTED CIRRUS CLOUD

The tufts appeared to be moving from 240° at 42 m.p.h. and the trailing zigzags from 210° at 48 m.p.h.

R. M. POULTER.

South Farnborough, Hants.
July 4th, 1938.

Prediction of Minimum Temperatures at Habbaniya, Iraq

In the May issue of the *Meteorological Magazine*, 1934, Mr. Gold asked if his formula for the prediction of minimum temperatures, viz.,

$$T - M = 5{\cdot}5 + 0{\cdot}15T + 0{\cdot}4\ (T - D)$$

where T = 15h. temperature in ° F.

M = minimum temperature in ° F.

D = dew point temperature in ° F.

was applicable (under conditions of relative calm and clear nights) in Iraq. A test was made, using 12h. G.M.T. (15h. L.T.) observations taken at Habbaniya, and it was found that the calculated values agreed to within 2° F. of the actual value in 80 per cent. of the limited number of cases in the winter months November to February. In the summer months, however, T - M as found from the above formula was consistently above the actual value, and in one particular case when the temperature was 120° F. and the actual minimum 84° F., the formula gave 68° F.

Owing to the paucity of observations at 12h. G.M.T. here it was not possible to derive a satisfactory formula, and it was decided to turn attention to 15h. G.M.T. (18h. L.T.) readings instead. By the Method of Least Squares the following formula was obtained:—

$$T - M = 1 + {\cdot}25T + 0{\cdot}1\ (T - D)$$

$$[T - M = 1 + \tfrac{1}{4}T + 1/10\text{th}\ (T - D)]$$

or, ignoring constant 1°,

$$M = 0{\cdot}65T + 0{\cdot}1D$$

$$[M = 13/20\text{th}T + 1/10\text{th}D]$$

and this was found to apply with a sufficient degree of accuracy throughout the year.

Forecasting minimum temperatures has not the same practical value as at home since there is only an average of 17 days of frost per year. However, it is interesting to note that Mr. Gold's formula, based on 15h. L.T. readings, gives reasonably satisfactory results here in the winter months.

The thermometer screen at Habbaniya is in an enclosure covered with rather coarse grass in winter, but this dries and withers with the arrival of the hot weather.

The enclosure is almost exactly on the boundary between open sandy desert to SW and irrigated country with the Euphrates to NE.

G. G. MACDONALD.

Habbaniya.
June 6th, 1939.

A note by Mr. C. V. Ockenden states that "large departures from the normal diurnal range of temperature are comparatively infrequent in this country, except during periods of disturbed weather conditions in winter and spring. It follows that, in practice, a fairly good estimate of the minimum temperature likely during the ensuing night can be derived by subtracting a quantity which varies from about 20° in mid-winter to 36° in September from the day maximum temperature."

NOTES AND NEWS

An Observation of the End of a Waterspout.

On July 11th, 1939, two waterspouts were seen several miles at sea from Perranporth, Cornwall, about 16h. G.M.T. One of these was hanging from the base of a cumulo-nimbus, reaching about halfway to the sea. It was almost vertical and the part of the sea below the spout was hazy with thrown-up spray. The waterspout lasted about fifteen minutes after it was first sighted. For most of the time it was apparently stable, but after about ten minutes it seemed to get thinner as if it had a hollow core. Then, as it began to get shorter, the lower end gradually receding towards the cloud, the motion of the individual parts of the lower 300 or 400 feet could be followed quite easily using prismatic binoculars. Apparently there was a considerable decrease in the rotatory motion, at the lower end at least, as whiffs of vapour could be seen appearing at the end and growing inside the main thickness of the spout whilst rising in it. Although the shape of these nebulous nuclei altered rapidly, many of them could be followed quite easily for about 300 feet. In general, it seemed as if the inside

of the lower end of the dying spout was formed by this vapour which appeared to be rising much more noticeably than it was rotating; but on the outside of the column small round-shaped bulges were in continual process of protruding and receding into the general column. Several large bulges were actually seen to move downward on the outside of the column much in the same way as on the sides of large cumulus whose vertical growth has proceeded beyond an inversion.

The base of the cloud was about 4,000 feet. There was a slight drift of the clouds from the north-west, while on shore there was a sea-breeze of about 15 m.p.h. The air was of polar origin moving slowly south-east around an anticyclone which lay to the south-west of Cornwall.

C. J. M. AANENSEN.

Some Observations on Rainfall in the Tropics.

Mr. Robert S. Tyndale-Briscoe contributes some interesting notes on rainfall in Jamaica. During a survey by Compass Traverse over a number of years he noticed at certain times large deflections in the needles and came to the conclusion that this was due to the presence in the vicinity of finely serrated leaves over which wind was passing, the most effective being the bamboo.

This led him to consider whether this phenomenon, which he thought indicated the presence of fields of static electricity but which Dr. Whipple suggests may have been due to magnetic storms, had any influence on the rainfall. Reference to the " Rainfall Atlas of Jamaica " by Maxwell Hall showed that where rainfall at one station was greater than that of a nearby station the former was situated in an area where bamboo flourished.

He developed the theory before the Water Commission at Kingston and again at the Government Farm School at Hope. On each occasion he received corroboration from residents. The Hon. A. G. Nash, Chairman of the Water Commission, stated that the Parish of St. Mary " was one of the wettest parishes but now that they have cut down the bamboo and planted bananas they are always complaining of droughts."

Mr. Tyndale-Briscoe cites a case from his own district, the mountains of Jamaica, which are noted for a dry exhilarating climate. Within two miles of his residence is a house standing high and open to the winds, which are strong and frequent; yet the house is damp and even in the worst drought the rainwater tank is said never to be dry; it is surrounded by hedges and groups of bamboo.

Again, the parishes of Hanover and Westmoreland at the west end of Jamaica have rain nearly every day, the neighbouring hills are the lowest in the island but are clothed with bamboo on the lower slopes; on the other hand the Santa Cruz and Manchester Mountains are considerably higher, and have a much lower rainfall and bamboo is not found there.

He cites a third example, that of Moortown in the Parish of Portland in the upper valley of the Rio Grande river with an annual average rainfull of 227 inches.

" The Rio Grande Valley is a mass of bamboo from which an enormous field of static will be constantly produced; the moisture laden east trade winds coming in from the Atlantic meet the John Crow range, which runs north and south, and are forced up 2,000 ft., there they encounter the electric field and discharge some of the heaviest rain in the world. This may also explain the fact of its not being uncommon in that part of the Island for heavy rain to descend suddenly out of an apparently clear sky."

In addition to bamboo, he states that the deflection of the compass needle is apparently produced by any plant with abundance of finely serrated leaves, such as the " cutting grass " of the swamps, certain types of palm and young sugar canes.

He concludes by suggesting that an investigation of these electric fields, which apparently influence dews and humidity as well as rainfall, could profitably be undertaken, and that such investigation would be of great benefit to agriculturists in tropical countries subject to drought.

Severe thunderstorm at Troon on July 15th, 1939.

Disturbed weather prevailed over Scotland during the third week of July, and thunderstorms were frequent, especially over the southern counties. The storms were not generally severe, but that on July 15th was noteworthy for the intensity of the rain at Troon on the Ayrshire coast and for the remarkably sharp demarcation of the area of heavy rainfall.

The storm seems to have spent itself almost entirely in the immediate vicinity of Troon. Mr. M. S. Brodie, the Burgh Surveyor, reports that the morning was dull and overcast. Thunder and lightning commenced at 10h. G.M.T. and this was followed by rain of great intensity from 10h. 45m. to 11h. 35m. About 2 inches of rain fell during this period. The rate of fall, 2·40 inches per hour, qualifies for inclusion in the list of falls of " very rare " intensity. For some hours rain continued to fall, though less heavily, and the total amounted to 3·22 inches.

Considerable flooding took place and business in the centre of the town was dislocated for several hours. Over 20 shops in the main street had water in them to a depth of 2 feet and in Station Road the flood water was 4 feet deep. The portion of the municipal golf course lying between the clubhouse and the old railway line presented the appearance of a large lake. The flooding was said to be the worst due to heavy rain in living memory, although worse flooding, due to high tides, is recalled in 1912. At Prestwick, 4 miles to the south, the rainfall measured 1·66 inch—about half the Troon total—but even so Prestwick experienced the heaviest flooding for years.

In striking contrast to the Troon downpour were the small falls recorded immediately to the north of the very wet area. Kilmarnock, 8 miles north-east of Troon, registered ·38 inch, while Ardrossan, on the coast and less than 10 miles to the north-west, had only ·11 inch. Three miles further north there was no measurable rain. The falling off in other directions was less marked. From

available information it would appear that the area which received more than an inch of rain extended some 15 miles south and south-east of Troon but less than 10 miles on the east side.

H. E. CARTER.

Floods at Canterbury in September, 1271.

Walter de Hemingburgh thus describes these events: In the year of our Lord 1271, on the fourteenth of the calends of October, there was at Canterbury such a flood of rain, with thunder, lightning and tempest, such that two very old men had never heard or seen anything like it for prolonged thunder, for it was as if one horrible clap sounded for the whole of the aforesaid day and night, and such a flood of water followed that trees and hedges were overthrown, whereby to proceed was not possible to men or horses, and many were imperilled by the force of the waters flowing in the streets and in the houses of the citizens. A very great famine followed throughout the whole Kingdom.

Although this account gives September 18th as the date, an earlier writer records it on the 11th of the month.

C. E. BRITTON.

Rainfall in Surrey.

The County Engineer for Surrey, Mr W. P. Robinson, C.B.E., M.Inst.C.E., M.I.T., has published a summary of the "Rainfall Statistics for the County" for 1938. The summary is based on records from twenty stations (maintained by sixteen different authorities) each station being equipped with an autographic rain-gauge and a standard rain-gauge. As two more authorities installed recording rain-gauges during 1938, it is hoped that records from at least eighteen out of a possible total of twenty-eight authorities in the County will be available for 1939.

The statistics are presented in the form of six tables and a map showing the distribution of rainfall over the

county during 1938. The first four tables give the total rainfall, the monthly rainfall, the monthly duration of rainfall and the mean monthly rate of fall at each station, presented in a similar manner to that used in *British Rainfall*. The last two tables give the classification of intensity of rainfall for falls of short duration and for falls of long duration and are based on limits used in *British Rainfall*. It is interesting to note that the annual totals bear a marked relationship to the topography of the county. This distribution is shown also in the classification of heavy falls of rain within specified times. The most interesting of these heavy falls were those on August 11th, during a thunderstorm, when as much as 1·90 inch was recorded at Kingston Vale in five hours, ·40 inch of this being recorded in five minutes.

It is interesting to note that Mr. E. G. Morgan of the Highwway and Bridges Department of the Surrey County Council has recently published a book on "Stream and Channel Flow". It is hoped that the further work of the Surrey County Council will add to our knowledge and provide generalisations as to the run-off following intense rains which will prove of practical importance.

G. R. B.

Meteorology of Eastbourne.

The annual report of the meteorological observations at Eastbourne for 1938, has recently been published. It is the twentieth report prepared by Mr. A. H. Hookham, F.R. Met. S., Borough and Recording Meteorologist. Under the direction of Dr. W. G. Willoughby, who recently retired from the position of Medical Officer of Health, the reports have attained a high standard, both in the manner of presenting the information and in the amount of detail given.

The report contains not only a summary of the observations made at 9h., 17h. and 21h. each day during 1938, but also details of records maintained at Eastbourne since 1888, as well as comparisons with similar observations made at other places in the British Isles.

The report gives a number of interesting facts of which the following may be referred to:—

(1) The mean air temperature and the mean sea temperature have exceeded the average during the last six years, whereas the total sunshine has failed to reach the average during the last four years.

(2) The highest screen maximum temperature ever recorded at Eastbourne was 89·5° F. on July 22nd, 1911, and the lowest minimum 17·0° F. on January 5th, 1894.

(3) The largest amount of rain recorded on any one day was only 2·23 inches, which occurred on July 9th, 1936.

(4) In 1911 the total duration of bright sunshine was as much as 2,158 hours (almost 6 hours per day), and this is claimed to be the largest annual total on record for any station in the British Isles.

The observations are of particular interest because Eastbourne is largely protected from the prevailing south-west and west winds by Beachy Head and the South Downs. Continuous records of temperature are maintained so that the information is also available for a further study of the effect of land and sea breezes. In this connection it is interesting to recall that Mr. E. G. Bilham used the Eastbourne records in a paper on *The sea breeze as a climatic factor,* published in the Journal of State Medicine, London, 1934.

The report is accompanied by a coloured chart which shows in diagramatic form the daily rainfall, barometric pressure, maximum and minimum temperatures, sea temperature, sunshine and general wind direction. This is a feature of the report which is greatly appreciated by the inhabitants and visitors to Eastbourne, who can also see the diagram for the present year up to date displayed for their information.

J.G.

County Borough of Eastbourne: Annual Report of the Meteorological Observations for the year 1938. 8½ × 6, pp. 48. Eastbourne, 1939.

A Constant Level Water Apparatus for Wet Bulb Hygrometers.

The value of the readings of a wet bulb thermometer depend to a great extent on the rate of supply of moisture to the muslin cover of the bulb. If the water level is too far away from the thermometer, and in particular, if it is too low, the water supplied to the muslin may be insufficient, especially in warm, dry climates, and the temperature of the wet bulb thermometer will give a reading higher than the true temperature of evaporation.

In order that values of humidity may be comparable, it is essential that the methods used for moistening the wet bulb should not differ from one station to another. It has been recommended by the International Meteorological Organisation (*I.M.O., Regional Commission No. 1,* Pub. 32, 1937, Res. 27, p. 56) that the method used for moistening the wet bulb should give results equal to those obtained by maintaining the surface of the water constantly one centimetre below the level of the bulb of the thermometer and to the side.

In Egypt a special glass receptacle is used for the water —a bird fountain† (" Handbook of Instructions for Meteorological Observers in Egypt and the Sudan ", 1929, p. 14)—and this ensures a constant distance between the bulb of the thermometer and the level of the water.

This type of water reservoir was also in use at a number of stations in the Sudan, but it has been found to suffer from two great disadvantages.

(i) the position of the reservoir opening in which the wick is inserted cannot be fixed.
(ii) the receptacle is difficult to clean.
(iii) it is liable to be broken.
(iv) it is difficult to fill with water.

The receptacle was seldom replaced in its previous position after being refilled with water, and isolated cases

† It is understood that the originator of the idea was Mr. G. W. Grabham, O.B.E., Geological Adviser, Sudan Government.

were noted where the water level was 10 cm. *above* or *below* the wet bulb and others 20 cm. *away*, while cleaning frequently resulted in a breakage of the reservoir.

To overcome these difficulties the Sudan Meteorological Service has produced a water reservoir apparatus consisting of two parts, a reservoir in glass and a metal base consisting of a connecting tube for the reservoir and an opening for the wick of the wet bulb. Full details are given in accompanying diagrams.

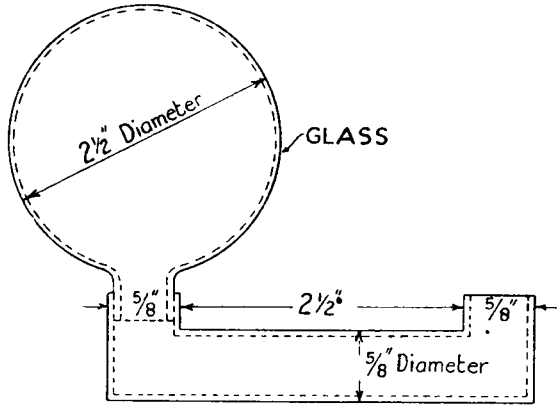


FIG. 1

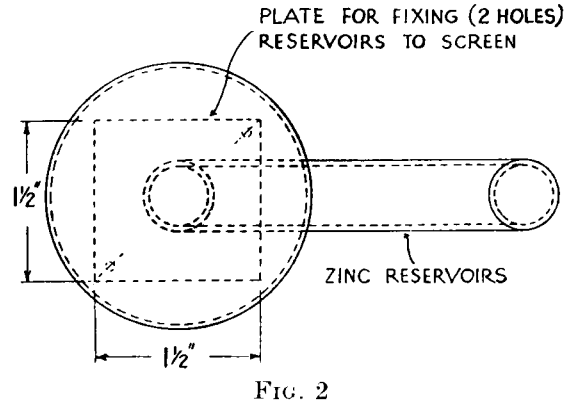


FIG. 2

This apparatus has the following advantages over the glass bird fountain.

(i) the position of the water level relative to the wet bulb thermometer can be fixed by screwing the metal base to the instrument screen.

(ii) the observer can refill the reservoir without interfering in any way with the position of the water surface relative to the wet bulb thermometer.

(iii) glass reservoir has no projection to be broken and, in view of (i), it cannot be knocked over.

(iv) the reservoir is easily cleaned.

(v) the reservoir is easily filled with water.

Further, this type of apparatus can be used in connection with the wet and dry bulb recording hygrometer as for this purpose it is only necessary to construct a metal holder with a different shaped opening for the water surface.

The apparatus complete has been supplied by Messrs. C. F. Casella & Co., Ltd., at a price of 3/-.

WILLIAM D. FLOWER.

Sunshine, August and September, 1939

The distribution of bright sunshine for the months was as follows:—

	Total hrs.	Diff. from average hrs.		Total hrs.	Diff. from average hrs.
AUGUST					
Stornoway ..	204	+76	Chester ..	172	+13
Aberdeen ..	127	—13	Ross-on-Wye ..	169	— 3
Dublin ..	139	—15	Falmouth ..	205	+ 9
Birr Castle ..	160	+23	Gorleston ..	202	+ 5
Valentia ..	200	+52	Kew	174	— 9
SEPTEMBER					
Stornoway ..	113	+ 3	Chester ..	121	— 9
Aberdeen ..	106	—20	Ross-on-Wye ..	141	+ 5
Dublin ..	89	—41	Falmouth ..	189	+31
Birr Castle ..	98	—21	Gorleston ..	—	—
Valentia ..	133	+ 6	Kew	163	+17

Kew temp., Aug., mean, 63·7° F. diff. from average +1·0°F.
,, ,, Sept., ,, 59·9° F. ,, ,, ,, +1·4°F.

Remarkable drought in the Thames Valley on October 10th, 1114.

A number of writers allude to the extraordinary desiccation of the Thames and Medway on this date. The earliest contemporary account is that of Simeon of Durham, who records "In this year, the river which bears the name of Medway, for a distance of some miles, receded so far from its bed, on the sixth day before the ides of October, that in the very middle of it not even the smallest vessel could make the slightest way. On the same day, the river Thames was also sensible of a similar decrease; for between the bridge and the royal tower, and even under the bridge, so greatly was the water of the river diminished, that an innumerable multitude of men and boys forded it on foot, the water scarcely reaching their knees. This ebb of the tide continued from the middle of the preceding night until dark on the following night. We have heard also on good authority that on the same day a similar low tide happened at Girvemuth [i.e., Yarmouth] and other places throughout England."

C. E. BRITTON.

General Rainfall for August and September 1939

AUGUST	Per cent.
England and Wales	87
Scotland	51
Ireland	50
British Isles	70

SEPTEMBER	Per cent.
England and Wales	53
Scotland	78
Ireland	74
British Isles	63

REVIEWS

The Cyclone Season 1935—36 *and* 1936–37. By N. R. McCurdy. The Royal Alfred Observatory, Mauritius: Misc. Pubs. Nos. 19 and 20. Port Louis, 1937.

The present publications, which form part of the excellent series started in 1928, describe the storms which occurred in the western region of the South Indian Ocean during the cyclone seasons of 1935–36 and 1936–37. The cyclone season extends from November 1st to May 15th. The storms are described in a few pages of text and illustrated by means of synoptic charts. The latter are based on information obtained from the logs of ships which call at Mauritius, from weather reports broadcast by wireless telegraphy and from reports received in manuscript.

Both seasons are described as quiet. In 1935–36 there were five cyclones, none of which reached any considerable intensity except the cyclone of December 1935. This was a cyclone of small dimensions which occurred in the area between Madagascar and Réunion. The weather was extremely bad near its centre, and a ship in the vicinity recorded a pressure as low as 966 mb. and winds of hurricane force.

The six cyclones of the following season 1936–37 likewise did not develop beyond a moderate intensity, the term " moderate " apparently implying that the winds associated with the cyclones did not exceed gale force. A probable exception, however, is the cyclone of January 1937 in the Mozambique Channel where a ship 60 miles from the centre reported a wind of force 10.

The cyclone of February 1937 which developed near Rodrigues is remarkable for the exceptionally high speed of travel which it possessed in the later stages of its course. Its later positions are based on the information published in the *Marine Observer* for January 1938 from the ship *Essex* which was crossing the South Indian Ocean at this time. The speed of movement of this cyclone increased rapidly as it moved away towards the

south-east and when it reached latitude 40° S. it was travelling at the rate of 42 miles per hour. We may recall in this connexion that the speed of movement of depressions near the Falkland Islands in similar southerly latitudes is frequently of the same order of magnitude.*

The cyclones of February 1936 and January 1937 travelled in an unusual direction, namely towards the east. The author remarks, however, that the increased number of observations available nowadays shows that the tracks of cyclones are less regular than they have been believed to be hitherto.

J. WADSWORTH.

The Art of Soaring Flight. By Wolf Hirth. Translated from the German by Naomi Heron-Maxwell. London. *The Sailplane and Glider.* 1939. 8vo., pp. 214. Price 5*s.* net.

The recent decision by Government to provide training in gliding for a number of those who will use power-driven aeroplanes will increase general interest in the problems of soaring; and this book contains many accounts of adventurous experiences, which will provide vivid ideas of the currents that are to be encountered. As an example may be taken that of H. Huth in a thunderstorm (pp. 105–7) in which the plane plunged "like a wild horse" with a forward speed varying between 60 m.p.h. and zero, the pilot was "at one moment lying on the edge of the cockpit and the next hanging from the safety belt." At 10,000 feet the rain was replaced by hail falling like pebbles and finally a lightning flash produced temporary unconsciousness. The pilot showed some skill in making a safe landing, for the leading edge had been perforated by hail and the gliding angle thereby spoiled.

*See *Meteor. Mag.* 61, 1926, page 195.

Faith in the possibilities of soaring flight is making steady progress. Seventeen years ago it was held that although in the tropics birds could habitually climb in " thermals," or columns of heated air, the conditions in Europe were inadequate for sailplanes which could not describe small enough circles to keep within the limited regions of ascending currents. However there has by degrees been developed the art of soaring not only under cumulous clouds and in cold fronts, but also in thermals: improvements in design and in the handling of sailplanes have reacted on each other and have gone far towards destroying our inferiority to such magnificent soarers as vultures. This progress seems to be acknowledged by the birds themselves; for Mr. P. A. Wills found in South Africa not only that the vultures served him as useful indicators of up-currents but that they appreciated him in the same way. " If ever I found a thermal on my own I would in half a minute or so be joined by one or more large brown birds with nasty looking faces, and we would all circle up together, though around 2,500 feet the birds would usually leave me. Evidently this is about their useful range of vision for spotting carrion on the ground."

The technique of soaring within an invisible ascending current of comparatively small diameter depends largely on watching the " variometer," an instrument to indicate the rate of rise or fall; but a very skilful pilot can fly by " feel " or by " natural senses "; surprising though it is, the sound within an up-current is different from that in a down-current.

It is true that much has been learned about air movements from routine observations at observatories, but under existing conditions a knowledge of the actual currents produced by turbulence or in the regions controlled by " cells " can only be obtained by going there; and perusal of such a book as that of Wolf Hirth is really essential for every student of atmospheric conditions.

G. T. W.

An Introduction to the Study of Air Mass Analysis. By Jerome Namias (4th edition, enlarged and revised); including *Characteristic properties of North American air masses* by H. C. Willett, and *The Norwegian wave-theory of cyclones,* by B. Haurwitz. 9 × 6, pp. vi + 122, illus. American Met. Soc., Milton, Mass. 75 cents.

The authors have not found it necessary to make any substantial changes in the fourth edition of this popular booklet, which was produced as " a brief, authoritative and inexpensive ' first reader ' " in those branches of meteorology which are closely related to forecasting.

After a section to acquaint the reader with the essential differences that can exist between air masses and how their identification depends on the conservation of certain properties, there follows a useful explanation of the Rossby diagram. It is unfortunate, particularly from the point of view of British meteorologists, that the limitations of space prohibit a section giving examples of the diagram in daily use. Next comes an elementary and clearly written account of fronts and the structure of the Norwegian depression, together with concise extracts from Burgeron's " Physics of fronts ". (A minor point which was noted here is that the American practice appears to be to give the name " occluded front " to the trough of warm air in an occluded depression, and a line vertically below it is drawn on charts as the "occluded front at the ground."). A valuable recent addition to this series is an article by Haurwitz on waves at the surface between two fluids, with deductions and analogies to indicate the effect of the earth's rotation in producing the depressional waves of the atmosphere. In spite of the mathematical nature of this subject, it is discussed in the same clear and readable fashion as the rest of the publication, and is quite palatable to the general reader.

Following this is a section on the tephigram as a device for forecasting showers and thunderstorms in a homogeneous air mass, and then a short but comprehensive account of the synoptic aspects of thunderstorms.

To the more serious reader perhaps the most valuable

part of the booklet is the bibliography, containing over 150 references to publications of a fairly general nature, mainly in English, and of which the majority are by American writers.

The final one-third of the book is occupied by a fuller version of Willett's article in this series on "Characteristic properties of North American air masses". Any attempt by the general reader to deduce from this the characteristics of European air masses might be dangerous, and its value lies rather in the assistance it gives to the British forecaster in the fascinating study of the beginnings of our own depressions.

The editor rightly stresses the fact that the title of the booklet covers only part of the field of synoptic meteorology, and it can be said to have achieved its object very successfully. At the same time some readers will regret that no mention is made of anticyclones. Depressions are always respected because of their activity, but an anticyclone is so often regarded as the isobaric nonentity between them. Rises of pressure which do not represent merely a recovery from a departing depression are often of great importance, particularly in detailed short-period forecasting, and it is to be hoped that the cold anticyclone at least will be afforded a section in later editions of this work.

C. J. BOYDEN.

Bibliographie Météorologique Internationale. Tome IV, Année 1936. $10\frac{1}{2} \times 7\frac{1}{4}$, pp. 358, Paris, 1939. Price 15*s.* 0*d.* net.

The annual International Meteorological Bibliography regularly compiled at Paris since 1921 has been steadily growing in completeness. The enterprise has now been officially recommended by the International Meteorological Organisation to all meteorological services for their co-operation, and in the volume for 1936 no fewer

than 26 countries are listed as contributing material. This volume is for the first time classified by subjects, according to the International Decimal Classification, the alphabetical arrangement by authors being continued in the index; this dual arrangement is a great improvement. The titles are given in the original language with French translations where necessary, and nearly all the more important papers have abstracts, also in French. The entries are printed on one side of the page only, to allow of cutting up to form a card index, though with over 2,500 items this would be a formidable task. The whole volume is a most valuable contribution to the organisation of meteorological research, and the price of 15*s*. 0*d*. is very moderate.

OBITUARY

The Rev. Fr. Luis Rodés, S.J.

We regret to learn of the death on June 7th in Mallorca, of the Rev. Fr. Luis Rodés, at the age of 57. Fr. Rodés was for nearly 20 years Director of the Observatorio del Ebro, Tortosa. He was a well known figure at international meteorological meetings and was a member of the Commissions for Aerology, the Study of Clouds, and Terrestrial Magnetism.

William Miller Christy.

We regret to announce the death on August 20th, 1939, of Mr. W. M. Christy, of Watergate, Chichester.

Mr. Christy was keenly interested in meteorology and contributed records of rainfall and sunshine to this office from 1898.

Rainfall: August 1939: England and Wales

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Lond'n	Camden Square.....	3·45	156	*Warw*	Birminghm, Edgbaston	2·62	97
Surrey	Reigate, Wray Pk. Rd.	3·03	124	*Leics* .	Thornton Reservoir...	4·59	164
Kent .	Tenterden, Ashenden.	1·79	78	,, .	Belvoir Castle.....	3·80	145
,, .	Folkestone, I. Hospital	1·93	..	*Rutl'd*	Ridlington	5·86	233
,, .	Margate, Cliftonville..	1·16	60	*Lincs* .	Boston, Skirbeck.....	1·73	72
,, .	Edenb'dg.,Falconhurst	2·76	105	,, .	Cranwell Aerodrome..	3·03	112
Sussex	Compton, Compton Ho	2·58	83	,, .	Skegness, Marine Gdns	1·32	54
,, .	Patching Farm.....	2·75	109	,, .	Louth, Westgate.....	1·27	45
,, .	Eastbourne, Wil. Sq..	1·97	79	,, .	Brigg, Wrawby St....	3·44	..
Hants .	Ventnor, Roy.Nat.Hos.	1·90	95	*Notts* .	Mansfield, Carr Bank..	2·58	92
,, .	Southampton, East Pk	2·04	78	*Derby* .	Derby, The Arboretum	2·33	86
,, .	Ovington Rectory....	1·52	56	,, .	Buxton, Terrace Slopes	2·78	63
,, .	Sherborne St. John...	1·76	73	*Ches* .	Bidston Obsy.....	2·19	71
Herts .	Royston, Therfield Rec	3·10	121	*Lancs* .	Manchester, Whit. Pk.	1·73	50
Bucks .	Slough, Upton.....	2·10	97	,, .	Stonyhurst College...	2·03	40
Oxford	Oxford, Radcliffe.....	1·67	73	,, .	Southport, Bedford Pk	1·76	51
N'hant	Wellingboro,Swanspool	5·34	224	,, .	Ulverston, Poaka Beck	2·89	54
,, .	Oundle	..	..	,, .	Morecambe.....	1·81	45
Beds .	Woburn, Exptl. Farm.	3·43	148	,, .	Blackpool	2·25	63
Cambs	Cambridge, Bot. Gdns.	2·89	123	*Yorks* .	Wath-upon-Dearne...	1·77	74
,, .	March	2·62	110	,, .	Wakefield,Clarence Pk.	1·12	43
Essex .	Chelmsford,CountyGns	2·67	123	,, .	Oughtershaw Hall....	2·75	..
,, .	Lexden Hill House....	3·07	..	,, .	Harrog'te,HarlowMoor	2·06	70
Suff .	Haughley House.....	1·73	..	,, .	Hull, Pearson Park...	3·00	103
,, .	Campsea Ashe, High Ho	2·05	104	,, .	Holme-on-Spalding...	2·78	104
,, .	Lowestoft Sec. School.	3·90	177	,, .	Felixkirk, Mt. St. John	2·03	71
,, .	Bury St. Ed.,WestleyH	3·87	149	,, .	York, Museum.....	2·09	83
Norf..	Wells, Holkham Hall.	1·79	75	,, .	Pickering, Houndgate.	1·62	63
Wilts .	Porton, W.D. Exp'lStn	2·17	96	,, .	Scarborough.....	2·37	85
,, .	Bishops Cannings	2·54	82	,, .	Middlesbrough.....	2·45	89
Dorset	Weymouth, Westham.	2·43	114	,, .	Baldersdale, Hury Res.	3·11	89
,, .	Beaminster, East St ..	2·67	85	*Durhm*	Ushaw College.....	2·83	97
,, .	Shaftesbury	5·14	..	*Norl'd*	Newcastle, Leazes Pk.	2·45	87
Devon.	Plymouth, The Hoe...	3·07	99	,, .	Bellingham, Highgreen	3·24	92
,, .	Holne, Church Pk.Cott	4·53	101	,, .	Lilburn Tower Gdns..	1·22	43
,, .	Teignmouth, Den Gdns	2·07	92	*Cumb* .	Carlisle, Scaleby Hall.	1·80	44
,, .	Cullompton	3·00	98	,, .	Borrowdale,Seathwaite	4·00	37
,, .	Sidmouth, U.D.C.....	2·26	..	,, .	Thirlmere,DaleHeadH.	3·99	51
,, .	Barnstaple,N. Dev.Ath	2·86	87	,, .	Keswick, High Hill...	3·43	66
,, .	Dartm'r,Cranmere P'l	3·85	..	,, .	Ravenglass, The Grove	1·43	31
,, .	Okehampton, Uplands.	..	..	*West* .	Appleby, Castle Bank.	2·74	83
Cornw	Redruth, Trewirgie...	2·67	78	*Mon* .	Abergavenny, Larchf'd	2·21	74
,, .	Penzance, MorrabGdns	2·13	67	*Glam* .	Ystalyfera, Wern Ho..	4·59	74
,, .	St. Austell, Trevarna..	2·53	70	,, .	Treherbert, Tynywaun	5·36	..
Soms .	Chewton Mendip.....	4·05	90	,, .	Cardiff, Penylan.....	3·66	87
,, .	Long Ashton	3·07	87	*Carm* .	Carmarthen,M.&P.Sc.	5·24	109
,, .	Street, Millfield	3·76	140	*Card* .	Aberystwyth	4·22	..
Glostr.	Blockley	1·66	..	*Radn'r*	Bir. W. W. Tyrmynydd	3·29	61
,, .	Cirencester, Gwynfa ..	2·42	81	*Mont* .	Lake Vyrnwy.....	3·10	60
Here .	Ross-on-Wye	1·96	77	*Flint* .	Sealand Aerodrome...	1·35	49
,, .	Kington, Lynhales....	1·92	62	*Mer* .	Blaenau Festiniog....	5·43	53
Salop .	Church Stretton.....	1·15	..	,, .	Dolgelley, Bontddu...	3·75	67
,, .	Shifnal, Hatton Grange	1·65	59	*Carn* .	Llandudno	1·51	54
,, .	Cheswardine Hall	2·43	73	,, .	Snowdon, L. Llydaw 9	7·90	..
Worc .	Malvern, Free Library.	1·87	65	*Angl* .	Holyhead, Salt Island.	2·00	63
,, .	Ombersley, Holt Lock.	1·69	63	,, .	Lligwy.....	1·94	..
Warw	Alcester, Ragley Hall.	2·41	87	*I.Man*	Douglas, Boro' Cem...	1·33	35

Rainfall: August 1939: Scotland and Ireland

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Guern.	St.PeterP't.GrangeRd.	1·65	70	*R&C.*	Stornoway, C.G.Stn...	2·53	67
Wig .	Pt. William, Monreith.	1·59	41	*Suth .*	Lairg	1·38	44
,, .	New Luce School.....	1·61	36	,, .	Skerray Borgie.....	..	..
Kirk .	Dalry, Glendarroch...	1·85	39	,, .	Melvich	2·28	77
Dumf.	Eskdalemuir Obs.....	2·34	45	,, .	Loch More, Achfary..	2·35	40
Roxb .	Hawick, Wolfelee	1.74	52	*Caith .*	Wick	1·59	58
,, .	Kelso, Broomlands....	1·65	56	*Orkney*	Deerness	1·96	68
Peebs .	Stobo Castle.....	1·62	46	*Shet .*	Lerwick Observatory.	2·96	98
Berw .	Marchmont House....	2·13	64	*Cork .*	Cork, University Coll.	1·58	47
E.Lot.	North Berwick Res...	1·49	47	,, .	Roches Point, C.G.Stn.	2·10	56
Midl .	Edinburgh, Blackfd. H	1·36	42	,, .	Mallow, Hazlewood ..	2·10	68
Lanark	Auchtyfardle	1·52	..	*Kerry.*	Valentia Observatory.	1·91	40
Ayr .	Kilmarnock, Kay Park	2·39	..	,, .	Gearhameen	2·70	36
,, .	Girvan, Pinmore	2·45	55	,, .	Bally McElligott Rec.	1·90	..
,, .	Glen Afton, Ayr San..	1·95	36	,, .	Darrynane Abbey....	2·17	50
Renf .	Glasgow, Queen's Park	1·93	55	*Wat .*	Waterford, Gortmore.	1·95	51
,, .	Greenock, Prospect H.	1·79	35	*Tip .*	Nenagh, Castle Lough.	1·74	44
Bute .	Rothesay, Ardencraig.	1·64	34	,, .	Cashel, Ballinamona..	1·47	42
,,	Dougarie Lodge.....	1·46	34	*Lim .*	Foynes, Coolnanes....	1·93	50
Argyll	Loch Sunart, G'dale..	3·25	57	,, .	Limerick, Mulgrave St.	2·32	65
,,	Ardgour House	4·58	..	*Clare .*	Inagh, Mount Callan..	3·08	..
,,	Glen Etive	..	..	*Wexf .*	Gorey, Courtown Ho..	1·88	56
,,	Oban	3·54	..	*Wick .*	Rathnew, Clonmannon	1·71	..
,,	Poltalloch	2·37	48	,, .	Blessington Rectory..	2·73	..
,,	Inveraray Castle	2·41	37	*Carlow*	BagnalstownFenaghH	1·52	43
,,	Islay, Eallabus	1·70	39	,, .	Hacketstown Rectory.	1·96	48
,, .	Mull, Benmore.....	..	..	*Leix .*	Blandsfort House	1·62	41
,,	Tiree	1·70	40	*Offaly.*	Birr Castle	1·45	38
Kinr .	Loch Leven Sluice....	1·25	33	*Dublin*	Dublin, Phoenix Park.	2·30	73
Fife .	Leuchars Aerodrome..	1·92	62	*Meath.*	Kells, Headfort.....	2·17	52
Perth .	Loch Dhu	2·35	35	*W.M .*	Moate, Coolatore.....	1·75	..
,, .	Crieff, Strathearn Hyd.	1·69	40	,, .	Mullingar, Belvedere..	2·23	53
,, .	Blair Castle Gardens..	1·70	50	*Long .*	Castle Forbes Gdns ..	2·21	54
Angus.	Kettins School.....	1·58	43	*Galway*	Galway, Grammar Sch.	1·76	43
,, .	Pearsie House	..	..	,, .	Ballynahinch Castle ..	2·96	54
,, .	Montrose, Sunnyside..	1·88	67	,, .	Ahascragh, Clonbrock.	2·84	68
Aberd.	Balmoral Castle Gdns.	2·82	93	*Rosc .*	Strokestown, C'node..	1·73	46
,, .	Logie Coldstone Sch ..	..	..	*Mayo.*	Blacksod Point	2·19	48
,, .	Aberdeen Observatory.	1·31	48	,, .	Mallaranny.....	3·63	..
,, .	New Deer SchoolHouse	2.11	71	,, .	Westport House.....	2·03	50
Moray	Gordon Castle	1·67	53	,, .	Delphi Lodge.....	5·14	60
,, .	Grantown-on-Spey ...	..	..	*Sligo .*	Markree Castle.....	2·01	46
Nairn.	Nairn.....	1·33	55	*Cavan.*	Crossdoney, Kevit Cas.	1·66	..
Inv's .	Ben Alder Lodge.....	2·49	..	*Ferm .*	Crom Castle	1·03	25
,, .	Kingussie, The Birches	1·94	..	*Arm'h*	Armagh Obsy.....	1·61	44
,, .	Loch Ness, Foyers....	1.74	57	*Down.*	Fofanny Reservoir ...	3·08	..
,, .	Inverness, Culduthel R	1·88	74	,, .	Seaforde	1·84	49
,, .	Loch Quoich, Loan...	4·56	..	,, .	Donaghadee, C. G. Stn.	2·23	67
,, .	Glenquoich	5·23	64	*Antrim*	Belfast,Queen's Univ .	1·56	42
,, .	Arisaig House	3·01	52	,, .	Aldergrove Aerodrome	2·30	64
,, .	Glenleven, Corrour ...	2·40	44	,, .	Ballymena, Harryville.	2·83	66
,, .	Ft. William, Glasdrum	2.99	..	*Lon .*	Garvagh, Moneydig...	1·69	..
,, .	Skye, Dunvegan	3·93	..	,, .	Londonderry, Creggan.	1·78	38
,, .	Barra, Skallary	2·11	..	*Tyrone*	Omagh, Edenfel.....	..	..
R&C.	Tain, Ardlarach.....	1·74	60	*Don .*	Malin Head.....	1·80	43
,, .	Ullapool	1·12	32	,, .	Dunfanaghy	1·46	39
,, .	Achnashellach	3·96	59	,, .	Dunkineely.....	1·99	..

Rainfall : September 1939 : England and Wales

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Lond'n	Camden Square.....	1·58	87	*Warw*	Birminghm, Edgbaston	·97	54
Surrey	Reigate, Wray Pk. Rd.	2·03	98	*Leics* .	Thornton Reservoir...	1·00	55
Kent .	Tenterden, Ashenden .	·51	24	„ .	Belvoir Castle.....	·78	42
„ .	Folkestone, I. Hospital	1·79	..	*Rutl'd*	Ridlington	1·03	54
„ .	Margate, Cliftonville..	1·41	72	*Lincs* .	Boston, Skirbeck.....	1·06	60
„ .	Edenb'dg., Falconhurst	·90	40	„ .	Cranwell Aerodrome..	·67	38
Sussex	Compton, Compton Ho	·98	35	„ .	Skegness, Marine Gdns	2·02	112
„ .	Patching Farm.....	1·29	54	„ .	Louth, Westgate.....	1·81	90
„ .	Eastbourne, Wil. Sq..	·78	31	„ .	Brigg, Wrawby St....	·83	..
Hants.	Ventnor, Roy. Nat. Hos.	·94	38	*Notts* .	Mansfield, Carr Bank.	1·00	54
„ .	Southampton, East Pk	2·22	102	*Derby*	Derby, The Arboretum	..	..
„ .	Ovington Rectory....	1·14	50	„ .	Buxton, Terrace Slopes	1·51	47
„ .	Sherborne St. John...	·80	39	*Ches.* .	Bidston Obsy.....	·75	31
Herts .	Royston, Therfield Rec	1·41	75	*Lancs.*	Manchester, Whit. Pk.	1·11	47
Bucks.	Slough, Upton.....	1·81	103	„ .	Stonyhurst College...	1·79	74
Oxford	Oxford, Radcliffe.....	·54	32	„ .	Southport, Bedford Pk	·78	28
N'hant	Wellingboro, Swanspool	·63	35	„ .	Ulverston, Poaka Beck	3·15	74
„ .	Oundle	1·28	..	„ .	Morecambe.....	1·41	46
Beds .	Woburn, Exptl. Farm.	·50	28	„ .	Blackpool	1·44	51
Cambs	Cambridge, Bot. Gdns.	1·74	108	*Yorks.*	Wath-upon-Dearne ..	2·55	161
„ .	March	1·55	86	„ .	Wakefield, Clarence Pk.	1·41	88
Essex.	Chelmsford, County Gns	·91	53	„ .	Oughtershaw Hall....	2·06	..
„ .	Lexden Hill House...	·17	..	„ .	Harrog'te, Harlow Moor	·99	49
Suff .	Haughley House.....	·45	..	„ .	Hull, Pearson Park...	1·02	51
„ .	Campsea Ashe, High Ho	·91	48	„ .	Holme-on-Spalding ..	1·22	70
„ .	Lowestoft Sec. School.	..	..	„ .	Felixkirk, Mt. St. John	2·06	113
„ .	Bury St. Ed., Westley H	2·36	119	„ .	York, Museum.....	1·30	80
Norf. .	Wells, Holkham Hall..	1·53	81	„ .	Pickering, Houndgate.	·85	45
Wilts .	Porton, W.D. Exp'l Stn	1·05	60	„ .	Scarborough.....	1·73	97
„ .	Bishops Cannings....	·92	42	„ .	Middlesbrough	..	..
Dorset	Weymouth, Westham.	..	..	„ .	Baldersdale, Hury Res.	1·30	52
„ .	Beaminster, East St..	1·18	46	*Durhm*	Ushaw College	1·76	88
„ .	Shaftesbury	·95	..	*Norl'd*	Newcastle, Leazes Pk.	1·06	54
Devon.	Plymouth, The Hoe...	·57	22	„ .	Bellingham, Highgreen	1·33	55
„ .	Holne, Church Pk. Cott	·94	26	„ .	Lilburn Tower Gdns..	1·89	80
„ .	Teignmouth, Den Gdns	·95	48	*Cumb*.	Carlisle, Scaleby Hall .	1·30	48
„ .	Cullompton	1·00	44	„ .	Borrowdale, Seathwaite	4·50	48
„ .	Sidmouth, U.D.C.....	1·37	..	„ .	Thirlmere, Dale Head H.	2·62	40
„ .	Barnstaple, N. Dev. Ath	·61	23	„ .	Keswick, High Hill...	1·80	43
„ .	Dartm'r, Cranmere P'l.	2·50	..	„ .	Ravenglass, The Grove	2·31	69
„ .	Okehampton, Uplands.	2·02	62	*West* .	Appleby, Castle Bank.	1·29	51
Cornw	Redruth, Trewirgie...	·96	31	*Mon*. .	Abergavenny, Larchf'd	·79	34
„ .	Penzance, Morrab Gdns	·61	21	*Glam*..	Ystalyfera, Wern Ho..	1·13	26
„ .	St. Austell, Trevarna..	·81	25	„ .	Treherbert, Tynywaun	1·85	..
Soms .	Chewton Mendip.....	1·49	49	„ .	Cardiff, Penylan.....	·80	26
„ .	Long Ashton.....	1·04	44	*Carm.*	Carmarthen, M. & P.Sc.	·90	25
„ .	Street, Millfield.....	1·16	52	*Card* .	Aberystwyth	1·09	..
Glostr.	Blockley	1·36	..	*Radn'r*	Bir. W. W. Tyrmynydd	·83	22
„ .	Cirencester, Gwynfa..	1·24	56	*Mont* .	Lake Vyrnwy.....	1·30	37
Here .	Ross-on-Wye	·57	30	*Flint* .	Sealand Aerodrome...	·51	26
„ .	Kington, Lynhales...	·68	32	*Mer* .	Blaenau Festiniog....	2·74	38
Salop.	Church Stretton.....	·89	..	„ .	Dolgelley, Bontddu...	1·73	41
„ .	Shifnal, Hatton Grange	·55	28	*Carn.*	Llandudno	·60	28
„ .	Cheswardine Hall....	·77	38	„ .	Snowdon, L. Llydaw 9	4·75	..
Worc .	Malvern, Free Library	·44	23	*Angl* .	Holyhead, Salt Island.	1·23	46
„ .	Ombersley, Holt Lock.	·45	25	„ .	Lligwy.....	·95	..
Warw	Alcester, Ragley Hall.	·66	37	*I. Man*	Douglas, Boro' Cem...	2·45	75

Rainfall: September 1939: Scotland and Ireland

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Guern.	St.PeterP't.GrangeRd.	1·72	66	*R&C.*	Stornoway, C.G.Stn...	2·74	73
Wig .	Pt. William, Monreith.	3·71	127	*Suth* .	Lairg	1·85	65
„ .	New Luce School.....	3·47	97	„ .	Skerray Borgie.....	1·70	..
Kirk .	Dalry, Glendarroch...	2·42	66	„ .	Melvich	1·61	57
Dumf.	Eskdalemuir Obs.....	2·88	78	„ .	Loch More, Achfary...	2·45	43
Roxb .	Hawick, Wolfelee	1·63	63	*Caith* .	Wick	1·59	64
„ .	Kelso, Broomlands....	1·00	53	*Orkney*	Deerness	..	..
Peebs .	Stobo Castle.....	2·38	94	*Shet* .	Lerwick Observatory .	1·26	42
Berw .	Marchmont House....	1·55	64	*Cork* .	Cork, University Coll.	1·65	62
E.Lot.	North Berwick Res...	1·54	74	„ .	Roches Point, C.G.Stn.	1·97	66
Midl .	Edinburgh, Blackfd. H	1·48	72	„ .	Mallow, Hazlewood...	2·49	..
Lanark	Auchtyfardle	1·90	..	*Kerry.*	Valentia Observatory.	1·80	43
Ayr .	Kilmarnock, Kay Park	2·34	..	„ .	Gearhameen	2·80	46
„ .	Girvan, Pinmore.....	2·44	64	„ .	Bally McElligott Rec.	1·29	..
„ .	Glen Afton, Ayr San..	1·80	46	„ .	Darrynane Abbey.....	1·28	36
Renf .	Glasgow, Queen's Park	2·59	94	*Wat* .	Waterford, Gortmore..	3·22	118
„ .	Greenock, Prospect H.	3·09	69	*Tip* .	Nenagh, Castle Lough.	1·43	51
Bute .	Rothesay, Ardencraig.	4·78	118	„ .	Cashel, Ballinamona..	1·55	64
„ .	Dougarie Lodge.....	3·44	90	*Lim* .	Foynes, Coolnanes....	1·26	44
Argyll.	Loch Sunart, G'dale..	3·31	53	„ .	Limerick, Mulgrave St.	1·55	59
„ .	Ardgour House	5·31	..	*Clare* .	Inagh, Mount Callan..	2·07	..
„ .	Glen Etive	..	..	*Wexf* .	Gorey, Courtown Ho..	2·74	111
„ .	Oban	..	..	*Wick* .	Rathnew, Clonmannon	3·32	..
„ .	Poltalloch	3·66	80	„ .	Blessington Rectory...	3·09	..
„ .	Inveraray Castle	6·33	99	*Carlow*	Bagnalstown FenaghH	2·31	94
„ .	Islay, Eallabus.....	5·37	128	„ .	Hacketstown Rectory.	3·36	120
„ .	Mull, Benmore.....	..	..	*Leix* .	Blandsfort House	1·29	47
„ .	Tiree.....	..	..	*Offaly.*	Birr Castle	2·25	98
Kinr .	Loch Leven Sluice....	1·92	75	*Dublin*	Dublin, Phoenix Park.	2·89	151
Fife .	Leuchars Aerodrome..	1·69	88	*Meath.*	Kells, Headfort.....	2·13	80
Perth .	Loch Dhu	4·20	73	*W.M.* .	Moate, Coolatore	2·02	..
„ .	Crieff, Strathearn Hyd.	2·98	104	„ .	Mullingar, Belvedere..	2·85	107
„ .	Blair Castle Gardens..	2·83	119	*Long* .	Castle Forbes Gdns....	2·08	72
Angus.	Kettins School.....	2·07	94	*Galway*	Galway, Grammar Sch.	1·50	47
„ .	Pearsie House	1·71	..	„ .	Ballynahinch Castle ..	1·60	34
„ .	Montrose, Sunnyside..	2·22	112	„ .	Ahascragh, Clonbrock.	1·33	43
Aberd.	Balmoral Castle Gdns.	2·30	96	*Rosc* .	Strokestown, C'node..	1·65	61
„ .	Logie Coldstone Sch ..	..	..	*Mayo.*	Blacksod Point	1·78	46
„ .	Aberdeen Observatory.	2·18	98	„ .	Mallaranny.....	2·74	..
„ .	New Deer SchoolHouse	2·53	100	„ .	Westport House.....	..	..
Moray	Gordon Castle	1·88	75	„ .	Delphi Lodge	3·17	42
„ .	Grantown-on-Spey ...	..	..	*Sligo* .	Markree Castle.....	1·51	45
Nairn.	Nairn.....	..	..	*Cavan.*	Crossdoney, Kevit Cas.	2·28	..
Inv's .	Ben Alder Lodge.....	..	..	*Ferm* .	Crom Castle.....	2·19	78
„ .	Kingussie, The Birches	2·10	..	*Arm'h.*	Armagh Obsy.....	1·79	73
„ .	Loch Ness, Foyers....	1·10	37	*Down.*	Fofanny Reservoir....	4·93	..
„ .	Inverness, Culduthel R	1·42	60	„ .	Seaforde.....	2·85	104
„ .	Loch Quoich, Loan...	1·09	..	„ .	Donaghadee, C. G. Stn.	2·41	101
„ .	Glenquoich	3·11	36	*Antrim*	Belfast,Queen's Univ..	2·46	96
„ .	Arisaig House.....	3·31	55	„ .	Aldergrove Aerodrome	3·21	129
„ .	Glenleven, Corrour ...	2·79	52	„ .	Ballymena, Harryville.	3·92	126
„ .	Ft. William, Glasdrum.	..	..	*Lon* .	Garvagh, Moneydig...	2·65	..
„ .	Skye, Dunvegan	3·24	..	„ .	Londonderry, Creggan.	2·81	85
„ .	Barra, Skallary	5·39	..	*Tyrone*	Omagh, Edenfel.....	..	..
R&C.	Tain, Ardlarach.....	1·69	67	*Don* .	Malin Head.....	2·73	84
„ .	Ullapool	1·57	42	„ .	Dunfanaghy	1·82	61
„ .	Achnashellach.....	1·93	27	„ .	Dunkineely.....	2·24	..

Climatological Table for the British Empire, March, 1939

STATIONS.	PRESSURE.		TEMPERATURE.							Relative Humidity.	Mean Cloud Am'nt	PRECIPITATION.			BRIGHT SUNSHINE.	
			Absolute.		Mean Values.				Mean.							
	Mean of Day M.S.L.	Diff. from Normal.	Max.	Min.	Max.	Min.	½ Max. and Min.	Diff. from Normal.	Wet Bulb.			Am'nt.	Diff. from Normal.	Days.	Hours per day.	Percentage of possible.
	mb.	mb.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	%	0–10	in.	in.			
London, Kew Obsy...	1016·4	+ 2·6	57	29	48·6	38·3	43·5	+ 0·3	38·6	83	8·5	1·00	— 0·69	13	3·0	26
Gibraltar.....	1017·4	+ 0·3	70	41	60·4	50·1	55·3	— 2·3	48·1	73	4·3	1·78	—	5	8·9	74
Malta.....	1012·0	— 2·2	66	41	58·2	48·3	53·3	— 3·8	47·8	67	5·3	1·12	— 0·36	10	7·5	63
St. Helena	1014·4	— 1·7	72	58	70·0	61·6	65·8	+ 0·7	63·1	91	9·2	5·89	+ 1·87	22	—	—
Freetown, Sierra Leone	1010·8	+ 1·8	92	73	87·9	75·1	81·5	—	72·4	83	6·4	0·02	— 1·14	1	—	—
Lagos, Nigeria	1008·5	— 0·4	89	71	87·2	75·2	81·2	— 2·2	75·7	92	6·9	2·99	— 0·76	8	5·9	49
Kaduna, Nigeria	1007·7	—	99	65	93·6	70·4	82·0	+ 0·4	63·8	55	3·4	1·14	+ 0·60	1	8·4	70
Zomba, Nyasaland....	1005·9	— 3·7	82	58	77·2	64·5	70·9	— 0·4	67·1	84	8·7	11·18	+ 2·10	20	—	—
Salisbury, Rhodesia ..	1010·8	— 1·9	80	50	73·9	57·3	65·6	— 2·6	60·4	80	7·9	11·82	—	20	5·0	41
Cape Town	1014·5	0·0	98	49	79·5	58·4	68·9	+ 0·8	60·1	74	2·8	0·39	— 0·49	3	—	—
Johannesburg	1012·2	— 1·0	79	45	72·3	53·2	62·7	— 0·7	56·0	77	5·6	2·66	— 1·78	12	6·1	50
Mauritius	1009·9	— 2·0	88	71	84·4	74·1	79·3	+ 1·3	76·3	83	7·0	15·22	+ 6·63	22	6·4	52
Calcutta,Alipore Obsy.	1010·0	+ 0·1	101	63	93·4	69·8	81·6	+ 1·4	69·3	74	3·1	0·03	— 1·35	0*	—	—
Bombay	1010·0	— 0·9	92	67	85·3	71·7	78·5	— 1·0	69·8	71	0·9	0·01	— 0·01	0*	—	—
Madras	1010·0	— 0·9	96	65	88·9	71·6	80·3	— 0·8	72·9	75	3·1	0·29	— 0·05	1*	—	—
Colombo, Ceylon	1010·0	— 0·1	92	70	89·0	73·2	81·1	— 0·7	76·1	67	4·5	3·39	— 0·89	6	10·3	85
Singapore	1009·2	— 0·5	92	72	87·1	74·6	80·9	— 0·3	77·3	75	7·2	6·63	— 0·77	14	6·5	54
Hongkong.....	1014·0	— 2·0	78	54	68·4	61·9	65·1	+ 1·8	62·3	89	9·5	3·54	+ 0·60	15	1·4	12
Sandakan	1009·5	—	88	71	85·6	75·1	80·3	— 0·7	76·6	83	8·3	13·21	+ 4·74	12	—	—
Sydney, N.S.W.....	1015·9	— 0·4	90	54	74·6	64·8	69·7	+ 0·4	65·9	80	7·6	10·86	+ 5·88	22	3·9	32
Melbourne	1017·8	+ 0·9	88	48	75·0	56·3	65·7	+ 1·2	58·3	68	5·7	0·79	— 1·39	6	7·4	59
Adelaide	1017·3	+ 0·2	91	50	80·7	57·8	69·3	— 0·6	60·0	51	3·6	1·29	+ 0·27	5	9·1	75
Perth,W.Australia....	1013·9	— 1·4	99	52	84·0	61·1	72·5	+ 1·3	61·3	52	2·4	0·07	— 0·74	1	9·6	78
Coolgardie	1014·5	— 0·4	102	49	84·7	58·5	71·6	— 0·3	60·6	58	3·3	0·00	— 0·94	0	—	—
Brisbane	1012·7	— 1·7	97	59	80·7	67·9	74·3	0·0	69·5	78	6·7	15·72	+ 9·95	21	5·1	41
Hobart, Tasmania....	1018·9	+ 4·7	80	41	66·0	50·9	58·5	— 0·8	52·6	69	7·0	1·69	— 0·01	9	5·2	42
Wellington, N.Z.....	1022·7	+ 5·5	76	44	66·7	53·6	60·1	— 0·5	56·5	77	7·5	1·05	— 2·28	6	6·3	51
Suva, Fiji	1007·8	— 0·6	91	71	84·3	73·7	79·0	— 1·1	74·7	87	7·7	23·06	+ 8·57	24	2·9	24
Apia, Samoa	1008·9	— 0·3	87	73	84·1	74·7	79·4	+ 0·1	76·1	84	7·6	17·95	+ 3·97	23	6·0	49
Kingston, Jamaica ...	1015·3	+ 0·4	87	64	84·3	66·9	75·6	— 1·5	64·8	81	2·1	1·73	+ 0·71	6	6·2	52
Grenada, W.I.	1010·4	— 2·6	88	71	86·0	72·0	79·0	+ 1·2	73·0	74	7·0	6·28	+ 3·62	15	—	—
Toronto.....	1017·5	+ 0·2	52	4	34·8	22·6	28·7	— 0·9	24·0	79	6·0	3·15	+ 0·74	14	4·8	40
Winnipeg	1020·1	+ 0·9	53	−35	23·6	4·7	14·1	— 0·9	8·2	77	7·4	0·06	— 1·10	4	5·8	49
St. John, N.B.	1015·9	+ 1·8	47	−3	32·4	16·7	24·5	— 3·9	19·3	69	5·3	5·92	+ 1·38	14	5·2	44
Victoria, B.C.....	1016·4	+ 0·5	62	30	49·4	38·7	44·1	+ 0·6	41·5	81	7·5	1·18	— 1·25	15	4·6	39

(49106) Wt. 22/31 1,375 10/39 Hw. 377/6