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The Weather of 1937

From the somewhat incomplete data at present available it appears that the year 1937 was generally dull, wet in England and Wales and dry on the whole in Scotland.

Among notable features of the weather of the year were the exceptional rainfall experienced in England and Wales during the run of five consecutive wet months January to May, the heavy snowstorms of February 27th–28th and March 11th–13th, the severe floods in the Fenlands around the middle of March, the coldness of March, the marked deficiency of sunshine in April and July, the deficiency of rainfall in England and Wales during the six successive dry months June to November, the occasional severe thunderstorms during the summer months, the frequent and sometimes thick fog in November and the considerable frost and snow of the period December 4th–21st.

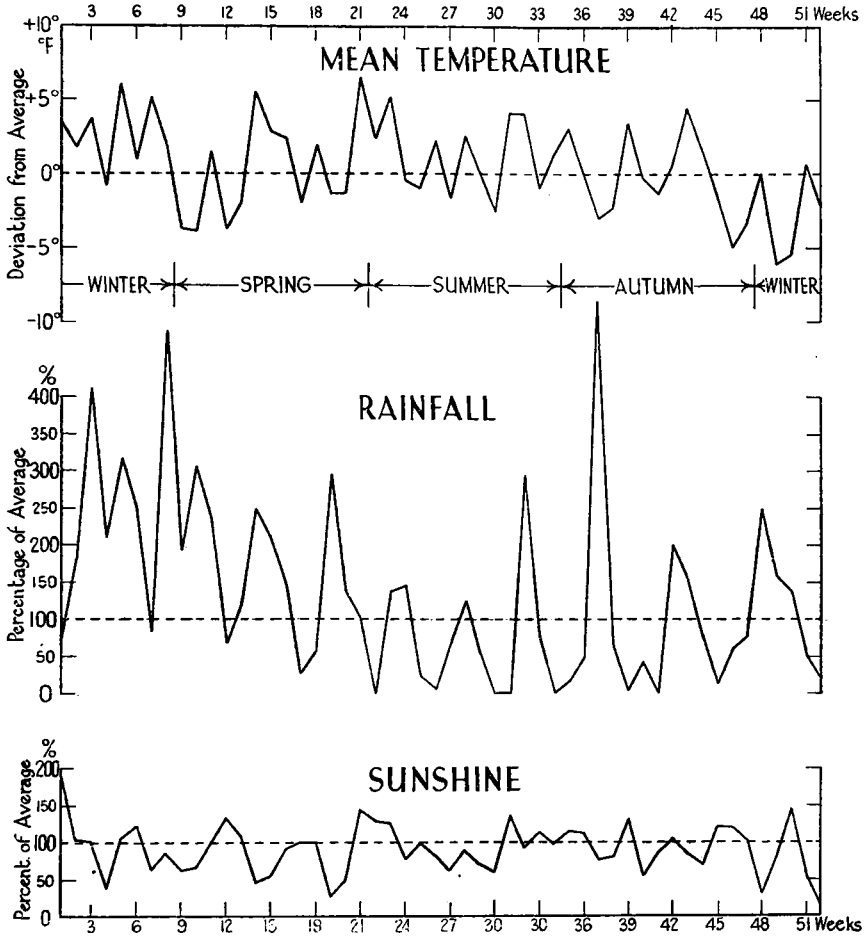
Considering the British Isles as a whole the months January to May inclusive and July were wet, while September received about the average rainfall. January and February were exceptionally wet, the total for the two months exceeded that for any similar period back to 1870. The greatest deficiencies occurred in August and November; August was unusually dry in parts of England (at Oxford it was the driest August since 1822) and November was exceptionally dry in Scotland, where it was the driest November on record at a number of widely separated stations and at Edinburgh it was the

driest in a record covering 160 years. The incidence of rainfall in England and Wales was remarkable; the total rainfall of the first five months was greater than in any similar period back to before 1870 while a deficiency was recorded in each of the next six months. An unusual number of absolute droughts were experienced in this dry period—for example, at Oxford from July 25th–August 11th, August 17th–31st and October 7th–21st. A detailed account of the rainfall of the year is given in a subsequent article. The snowfall of the year deserves comment. The storms of January 29th–31st were severe in some parts; undrifted snow was 15 inches deep in Aberdeenshire and 10 inches deep in Fife. The snowstorm of February 27th–28th was noteworthy; it was accompanied by a northerly gale which caused deep drifts and many roads were blocked; on the 28th undrifted snow was reported to be 14 inches deep at Macclesfield and roughly 24 inches deep at Buxton. In March, sleet and snow were exceptionally frequent and the storms of the 11th–13th were severe in the north of England, south Scotland and Northern Ireland. They were accompanied by strong north-easterly winds and deep drifts accumulated; practically all the roads in the province of Ulster were impassable for wheeled traffic and in Scotland also roads in all parts of the country were blocked. Again in December snow fell frequently between the 4th and 21st; in many parts the falls were heavy at times and roads were rendered impassable; the condition was aggravated by frost.

Mean temperature for the year very slightly exceeded the average in England and was about average elsewhere. Of the individual months March and December were cold generally while November was cold over most of England; over Scotland as a whole March was the coldest month of that name since 1919, and the period December 5th–20th was unusually cold generally. A screen minimum temperature of 0°F. was registered at Braemar on March 8th and at Dalwhinnie on December 13th. In the remaining nine months, mean temperature on the whole exceeded the average though the differences were slight in July and September; the excess was greatest in April and August. February was very mild in southern England, and May in Scotland. A warm spell occurred generally in the last 8 or 9 days of May and temperatures approaching or somewhat exceeding 80°F. were registered at a number of stations in England on the 25th, 29th and 30th. The highest temperature of the year was recorded generally in the early part of August; the absolute values registered in standard screens in the constituent countries were:—(England and Wales) 92°F. at Canterbury and Tunbridge Wells on August 7th; (Scotland) 84°F. at Ruthwell on August 1st; (Ireland) 82°F. at Hazelhatch on August 2nd.

Sunshine was almost everywhere deficient, the deficiency being greatest in Ireland and eastern England; at Birr Castle, Cranwell, Shoeburyness and Aldergrove it was the dullest year since observations

were first taken in 1881, 1921, 1919 and 1927 respectively, and at Phoenix Park, Dublin, it was the dullest year apart from 1912, since records were started in 1881. In general, with respect to the average the sunniest months were February, May and August and the dullest April and July. Considerable variations, however, occurred in different districts; February was very sunny in Scotland and



THE WEATHER OF 1937 IN SOUTH-EAST ENGLAND

Weekly variations from long period averages computed from observations at five representative stations.

decidedly dull in south-west England; in March there was a large excess in the extreme north and west of Scotland and in north-west Ireland and a marked deficiency locally in north-east England. May and August were notably sunny in the west and north; in September there was a considerable deficiency in Ireland and a decided excess on the east coast of Scotland. In November, the pronounced variations in England were doubtless due to the incidence

of fog; in south-east England, the percentage of the average ranged from 66 at Greenwich to 161 at Wye, Kent. In the closing month of the year a marked excess of sunshine was enjoyed over most of Scotland and a substantial deficiency occurred, for the most part, in England.

Gales occurred frequently in the west and north during January and February. January was one of the stormiest months on record in the Orkneys and Shetlands. On February 28th a gust of 107 m.p.h was registered at Holyhead.

The diagram on page 279 shows the weekly variations in temperature, rainfall and sunshine in south-east England in 1937. The variations are given in the form of deviation from the average of temperature and percentages of the average of rainfall and sunshine. The district value is the arithmetic mean of the values for the following stations:—Kew Observatory, Margate, Hastings, Southampton and Marlborough.

L. F. LEWIS.

The Rainfall during 1937

Over England and Wales the incidence of rainfall during 1937 was unprecedented. The rainfall of each of the five months January to May exceeded the average, while the following six months June to November were all relatively dry. There is no other year in the series back to 1727 giving such a well marked change during the year. The total rainfall during the five months January to May was as much as 21·2 in. or 8·6 in. in excess of the average. This total exceeded by 2·8 in. the next wettest January to May since 1870. The six months June to November gave 13·6 in., a deficiency of 5·1 in. A similar run of six consecutive dry months occurred only in 1919 and 1901 since 1870.

On the other hand over Scotland dry months predominated during 1937. The eight months March to May and August to December each gave less than the average, although the deficiency was marked only in November, which had less than one-third of the average. Over Ireland there were six wet months, viz., January to April, July and September and the totals approximated more closely to the average.

The two wettest months of the year in each country were January and February. The driest month was June over England and Wales, November over Scotland, while over Ireland May and June were equally dry with 2·2 in.

General values for each month are set out in the following table, both as percentages of the average and in actual inches of rainfall.

A comparison of the general values for the British Isles for 1937 with those for earlier years brings out the following interesting points. 1937 adds another wet January to the sequence, which

commenced about 1918, during which wet months predominate. The wet February of 1937, on the other hand, stands out in marked contrast with recent Februarys, those of 1932 and 1934 having only 13 and 24 per cent. respectively. June, 1937, continued the sequence which commenced about 1913 in which dry Junes predominated.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	%	%	%	%	%	%	%	%	%	%	%	%
England and Wales	185	218	139	152	136	71	84	46	97	83	62	108
Scotland ...	162	136	77	71	78	103	126	91	85	81	30	76
Ireland ...	178	158	109	113	80	78	141	76	133	66	61	71
British Isles ...	176	182	115	122	107	81	109	63	101	80	54	93
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
England and Wales	5·5	5·6	3·7	3·2	3·1	1·7	2·4	1·5	2·5	3·3	2·2	4·2
Scotland ...	7·9	5·7	3·1	2·1	2·3	2·9	4·7	4·1	3·4	4·0	1·6	4·5
Ireland ...	7·2	5·6	3·7	3·1	2·2	2·2	4·8	3·2	4·2	2·7	2·6	3·5
British Isles ...	6·7	5·9	3·7	3·1	2·8	2·1	3·5	2·5	3·1	3·4	2·3	4·4

The rainfall of August, 1937, was similar to that of recent Augusts, being less than the average. The rainfall of September, 1937, was again above the average. It will be recalled that wet Septembers predominated during the period 1870 to 1887 and dry Septembers from 1905 to 1917. Since then there has been a reversion to wetter Septembers. Of recent years October, November and December have generally given less than the average. October, 1937, is the second consecutive dry October; of the last six Novembers, four have been dry and of the last thirteen Decembers as many as ten have been dry.

Provisional estimates of the general rainfall for 1937 over the countries generally are given below in actual inches and as percentages, together with the corresponding values for 1936.

	1937		1936	
	in.	%	in.	%
England and Wales	39·0	111	38·4	109
Scotland	46·3	92	47·3	94
Ireland	44·9	104	45·5	105
British Isles	43·5	105	43·5	105

The values for 1937 are remarkably similar to those for 1936. Over England and Wales 1937 was not as wet as 1935; over Scotland 1937 was drier than any year since 1902, with the one exception

of 1933; over Ireland 1937 was not as wet as either 1936 or 1934.

The rainfall was less than the average over most of the Pennines and region to the west, most of Wales, north Devon and near Grimsby. Falls of rather less than 80 per cent. occurred in the English Lake District. Falls of more than 120 per cent. were confined to a large area in the south-east of England extending to Dartmoor, Wellingborough and Doncaster. Some of the largest percentage values were 151 at Shoeburyness, 135 at both Totland Bay, Isle of Wight, and Royston in Hertfordshire. The total of 38·57 in. recorded at Totland Bay was the largest since the record commenced there in 1888, the next largest being that of 37·33 in. in 1915.

Over Scotland falls exceeding the average were confined almost entirely to the eastern half of the country and to the south of the Moray Firth, with 120 per cent. in the neighbourhood of Dundee and Montrose. There was less than 80 per cent. over most of the area to the north-west of the Caledonian Canal.

Over Ireland the rainfall was more uniform. In general it was below the average in the northern half and above the average in the southern half and in the extreme north-east. As much as 110 per cent. occurred near Belfast, Dublin, Waterford and Valentia Observatory.

J. GLASSPOOLE.

Fog over the Christmas Holiday 1937

Anticyclonic weather in winter is usually either dull with persistent low cloud sheets or the sky is almost cloudless with widespread early morning fog which often persists once it has formed. The weather over the Christmas holiday proved no exception to this general rule. At 0700 G.M.T. on Christmas Eve an anticyclone was centred over France, and the British Isles lay within an extensive mild south-westerly air current with high dew points, cloudy skies and drizzle. At the same time a cold front was orientated NE–SW just off the western Irish coast. This front moved quickly south-eastward across the country, and behind it there was a rapid rise of pressure and a decrease in the pressure gradient over England. Dew points in the new air supply were of the order 40°–45°F.; with light winds and clear skies prevailing behind the cold front, temperatures fell to 29°–38°F. in the Midlands and widespread radiation fog developed in the early morning of Christmas Day. At 0700 G.M.T. on that day the cold front was located east to west along the southern counties of England and its rate of travel had decreased to about 10 m.p.h. Mist or moderate fog had already developed during the night in the mild moist air in advance of the front, and the thickening of the fog in the London area was partly due to a fall of temperature associated with clearing skies just before sunrise behind the front, and probably also due to mixing of the two air currents in the slowly moving frontal zone. The rapid rise of pressure behind the

front caused the anticyclone to move northwards, and by 1300 G.M.T. on Christmas Day the central area covered most of England and north and central France.

On Christmas morning the fog in London and the Home Counties was, as usual, patchy and while some places enjoyed bright sunshine artificial lighting was necessary in others. The fog was also drifting slowly so that places that had been clear in the morning became foggy after midday. Conditions became worse as temperatures fell during the afternoon, and by dusk visibilities of 5 yards or less were common over a large part of England. In many parts road traffic was brought to a standstill, trains were delayed and shipping was affected in the Thames and also in the Straits of Dover. Several Football League matches had to be postponed or abandoned. Another outstanding feature was the partial clearance in southern districts towards midnight. This was brought about by the coagulation and deposition of the minute water droplets, caused by drizzle falling from a cloud layer, which had spread in over the fog, associated with a warm front which at 1800 G.M.T. extended from north-east Ireland to Devon and was moving slowly north-east.

By 1300 on the 26th the anticyclone had become established over the southern Baltic but still covered the British Isles. Fog was again widespread but generally not so dense as on Christmas Day and the advent of a drier easterly current from the Continent kept the south free from serious fog. There was fog again on the third day of the holiday but this was local and chiefly confined to the Midlands and north of England.

Fog during some part of the Christmas period has been a feature of the past six years in England. It is fortunate in some respects that the worst visibilities occurred on Christmas Day 1937 rather than on Christmas Eve, as happened in 1935, although the inquiries received at the Meteorological Office testified to the large number of stranded motorists.

W. H. Bigg.

A Cause of Error in Self-Recording Rain-Gauges

All autographic rain-gauges are provided with a device which returns the recording pen to zero after it has reached the top of the chart; most gauges employ a form of automatic syphon. Every type of automatic syphon gauge suffers from the common defect that precipitation which falls during the time occupied in emptying the float chamber is lost. The actual loss depends on the type of syphon, the capacity of the float chamber and the intensity of rainfall.

The present writer has recently investigated this point, with special reference to the Dines Tilting Syphon gauge, and the results are given here as being of interest to all rainfall observers, especially at Meteorological Office stations. It should be remembered in all

that follows, that the general principles are applicable to all automatic syphon gauges, and are not confined to any one instrument.

In the Dines Tilting Syphon rain-gauges constructed according to the Meteorological Office specification, the syphon empties the float chamber in 15 to 20 seconds (measured while no water is entering the receiver). The " travel " of the recording pen represents 5 mm. of rainfall.

The losses of record which occur at each syphoning during rainfalls of various intensities can be deduced from these two facts :—

Let t seconds be the syphoning interval, measured while no rain enters the receiver. Then water is removed from the float chamber at a rate equivalent to $300/t$ mm./min. of rainfall. But if rain is falling simultaneously into the receiver at the rate of x mm./min., the effective rate at which water is removed is $(300/t) - x$ mm./min., and the time (T seconds) occupied in emptying the chamber becomes

$$T = \frac{300}{\frac{300}{t} - x} \text{ seconds.}$$

The loss of precipitation (L mm.) during syphoning is therefore

$$L = \frac{300}{\frac{300}{t} - x} \times \frac{x}{60} \text{ mm.}$$

$$= \frac{5x}{\frac{300}{t} - x} \text{ mm.} \quad \ldots \quad \ldots \quad (1)$$

In order to construct the " characteristic curve " showing the variation of L with different rates of rainfall for any given instrument, it is only necessary to find the time (t seconds) occupied in syphoning while no water enters the receiver, and to substitute this value in equation (1), using varying values of rainfall (x mm./min.).

Characteristic curves for $t = 15$, 17 and 20 are shown in Fig. 1 for values of x between 0 and 8 mm./min. Experiments were made to test the accuracy of these curves, using a gauge whose t interval was 17 seconds.

Water was led into the receiver at a controllable rate, and the times taken (t_a seconds) for the pen to rise from zero to 5 mm. on the chart and (t_b seconds) to return to zero were noted. The rate of rainfall (x mm./min.) represented by the flow of water is given by $x = 300/t_a$ mm./min., while the loss during syphoning (L mm.) is given by $L = 5t_b/t_a$ mm. Several observations were made, varying the flow of water each time, and the values obtained are plotted (thus :—o) in Fig. 1. It will be noted that, while the points are in good general agreement with the $t = 17$ curve, there is considerable " scatter". This is due mainly to variations in the pressure of the water mains. It was unfortunately impossible owing to limited time to obtain a complete series of readings.

One most important point was, however, brought out; the instrument functioned perfectly until the rate of flow of water was increased to above 5 mm./min. At rates in excess of this value the syphon would empty the float chamber, but having done so would not " break", but continued to dribble the water out as fast as it poured in. Rainfall of more than this intensity however, is not likely to occur in nature, at least in this country. It can therefore be stated with a degree of certainty that the Dines Tilting Syphon rain-gauge will record rainfall of intensities up to 5 mm./min. (nearly 12 in./hr.) with losses at each syphoning varying as shown in Fig. 1.

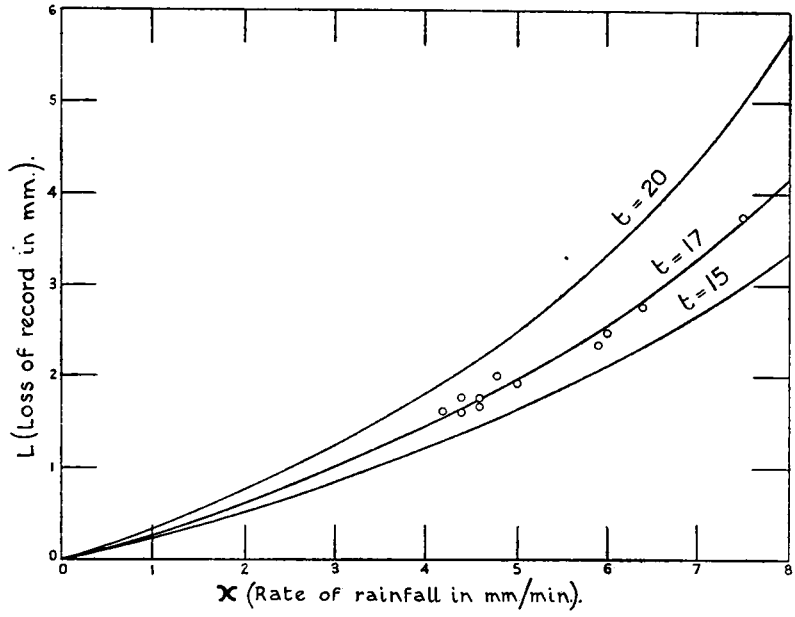


FIG. 1.—CHARACTERISTIC CURVES OF LOSSES FOR DINES TILTING SYPHON RECORDING RAIN-GAUGE, USING A FUNNEL OF DIAMETER 11·3 IN.

The foregoing discussion relates to the standard instrument which is fitted with a funnel of diameter 11·3 in. It is suggested that in tropical and other countries where rainfalls exceeding 5 mm./min. may be expected, the gauge could be modified by fitting an 8-inch funnel, i.e. one whose area is one half that of the standard. The instrument would then record 10 mm. of rainfall between the syphoning operations, so that the losses during syphoning would be only half as frequent. They would also be individually less in amount, for applying reasoning similar to that shown above, the loss at syphoning is given by

$$L = \frac{10x}{\frac{600}{t} - x} \text{ mm.}$$

The characteristic loss curves for gauges fitted with 8-inch funnels

are shown in Fig. 2, for $t = 15$, $t = 20$. The only disadvantage in fitting a funnel smaller than the standard is that the recorder would not be so sensitive in slight rainfalls. On the other hand, the gauge would record rainfall of intensities up to 10 mm./min. (nearly 24 in./hr.).

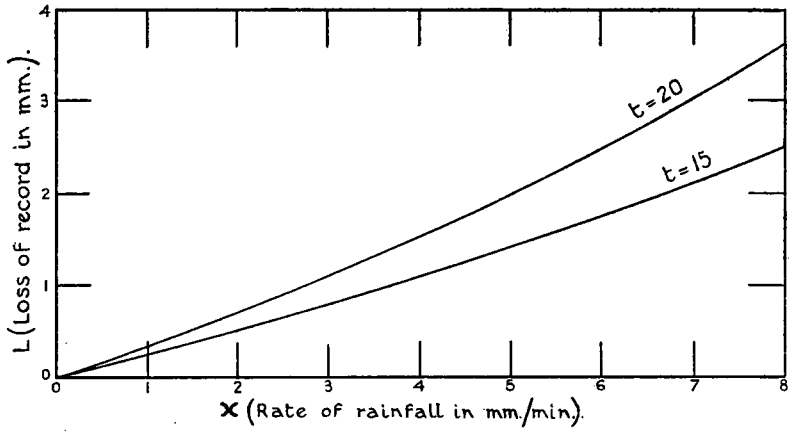


FIG. 2.—CHARACTERISTIC CURVES OF LOSSES FOR DINES TILTING SYPHON RECORDING RAIN-GAUGE, USING A FUNNEL OF DIAMETER 8 IN.

It is of interest in connexion with the above discussion to note that Mr. J. L. Galloway writes from Basra Airport that a Dines Tilting Syphon gauge is in operation there, and that it is 15 ft. 3 in. away from a standard 8-inch M.O. gauge, both being set in concrete. After a storm early in the morning of November 22nd, in which the mean wind speed was 24 m.p.h., with a maximum gust of 49 m.p.h., 29·0 mm. of rain was found in the check gauge. The Dines Tilting Syphon gauge had recorded only 25·2 mm.; of this, 16 mm. was recorded on the chart in 12 minutes, and during this time the gauge syphoned four times. It syphoned again later during rainfall at the rate of about 5 mm./hr. Mr. Galloway concludes that the discrepancy of 3·8 mm. was mainly due to losses occurring during the first four syphoning intervals, and suggests that a device be added whereby the rain caught during the period of syphoning is held and admitted to the float chamber only when the syphoning is finished. He found on experiment that the syphoning interval for the gauge (t in the above discussion) was about 17 secs.

Referring to Fig. 1, it will be seen that the whole loss of 3·8 mm. can be accounted for by assuming that the rate of rainfall during syphoning was about 2·8 mm./min. This is excessive in view of the figures quoted. Part of the discrepancy however, is probably due to the different amounts of insplashing and turbulence which would occur in high winds with gauges exposed with their rims at different heights, especially above concrete (see *British Rainfall*, 1910, p. 75 and the *Meteorological Magazine*, 66, 1931, p. 153).

It would be interesting to learn at what heights the rims of the gauges are set.

The writer is indebted to Mr. J. S. Dines for his advice on the preparation of this note.

L. S. MATTHEWS.

Discussions at the Meteorological Office

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

January 31st, 1938. *On the influence of pressure changes upon weather.* By P. Sieber. Beitr. Phys. frei. Atmos., Leipzig, 23, 1936, pp. 249-74. (In German.) *Opener.*—Dr. A. G. Forsdyke.

February 14th, 1938. *The return of radio waves from the middle atmosphere.* By R. A. Watson Watt, A. F. Wilkins and E. G. Bowen. London, Proc. roy. Soc., 161 (A), 1937, pp. 181–96. *Opener.*—Dr. G. M. B. Dobson, F.R.S.

Royal Meteorological Society

The monthly meeting of the Society was held on Wednesday December 15th at 49, Cromwell Road, South Kensington. Dr. F. J. W. Whipple, F.Inst.P., President, was in the Chair.

The following papers were read and discussed :—

C. W. B. Normand, M.A., D.Sc.—On instability from water vapour.

This paper summarises the general criteria for the stability of a particle and of a layer in the atmosphere under conditions when condensation may bring the latent heat of water vapour into play. It discusses briefly the relationship between "Feuchtlabilität" (Refsdal), latent instability (Normand) and convective instability (Rossby), and gives the reasons for the introduction in India of the classification based on latent instability. The conditions for latent instability are defined with the aid of the tephigram, and an example is given to show how by generating latent instability within a closed system, e.g., by raising the wet-bulb temperature in the lower layers and leaving all else unchanged, the energy available for transformation into kinetic energy may rise from zero to the equivalent of a wind of 50 m.p.h. throughout the system, without taking account of the energy that may become available from the evaporation of raindrops in descending air. If, however, evaporation from raindrops takes place in the descending air in a thermo-dynamically efficient manner, the available energy in the closed system of the chosen example is nearly trebled, i.e., the equivalent average velocity rises to more than 90 m.p.h.

C. W. B. Normand, M.A., D.Sc.—Kinetic energy liberated in an unstable layer.

Kinetic energy is released when an unstable super-adiabatic layer of constant lapse-rate $\varepsilon\Gamma$ rights itself (where Γ is the adiabatic

lapse-rate and $\varepsilon > 1$). The average kinetic energy can be computed analytically by Margules's method or graphically on the tephigram. By Margules's method, a good approximate formula for the resulting average velocity is shown in this paper to be

$$v = \text{constant} \times \Delta p/\Pi \sqrt{(\varepsilon - 1)\,\Theta}$$

where Π and Θ are the mean pressure and temperature of the column and Δp is the pressure difference between the top and bottom of the column. The method of the tephigram gives the average energy to be equivalent to one-sixth the area of a parallelogram of which the diagonals are the initial and final temperature curves of the column. Some examples are numerically evaluated by these methods and the results show close agreement with values previously calculated by a longer and more laborious method by Littwin.

C. S. Durst, B.A., and R. C. Sutcliffe, B.Sc., Ph.D.—The importance of vertical motion in the development of tropical revolving storms.

The problem discussed is that of the mechanism for the eviction of air from tropical revolving storms. By the examination of the equations of motion it is found that this eviction could be explained by the convection of air from layers of greater velocity to those of less velocity.

C. J. Boyden, B.A.—The mechanics of the depression: some criticisms and a contribution.

Attention is called to certain serious gaps and obscurities in our understanding of the birth and development of the depression. The paper concludes with a discussion of the effect of isobaric curvature on wind speeds in different parts of the depression, and the resulting convergence and divergence.

Correspondence

To the Editor, *Meteorological Magazine*

False Minimum Temperature at Goetz Observatory

The thermometric equipment at Goetz Observatory consists of a rather large double louvred screen containing the standard thermometers and a small bimetallic thermograph in which the coil element is quite open and unshielded. The continuous temperature records are obtained from a distance recording mercury-in-steel wet and dry bulb thermograph housed in a tunnel continuously aspirated and the whole protected by a double louvred screen somewhat smaller than the thermometer screen. The former is twenty yards from the latter and nineteen feet from the office.

On November 30th, 1937 the observatory was struck by a thunderstorm at about 13h. 10m. S.A.M.T. The wind velocity reached 58 m.p.h. and 0·68 in. of rain fell in fifteen minutes.

The recording dry bulb trace fell from about 86° F. to 68° F. in

twenty minutes and remained between 68° F. and 67° F. for ten minutes, the wet bulb rose nearly 2° F. at first and then fell from 66° F. to 59·5° F., and remained there for ten minutes running parallel with the dry. The relative humidity therefore remained well below saturation, and the evaporating power of the air was considerable.

The bimetallic thermograph fell at the same time, but continued to 60° F. and recovered very rapidly to 64° F. and the standard minimum recorded 60·2° F. It was perfectly clear that rain had blown right through the screen and wet everything. On the evidence it appears that the small thermograph and minimum recorded wet bulb temperatures and that the minimum temperature 60·2° F. was incorrect.

NOEL P. SELLICK.

Meteorological Office, Salisbury, Southern Rhodesia, December 14th, 1937.

The North Wales Coastal Climate

I believe that many of the public and possibly some meteorologists do not realize what an extremely favourable climate exists on the north Wales coast between Great Orme's Head and Mostyn, and particularly between Llanddulas and Prestatyn. Rhyl and Abergele with average rainfalls of only 25·80 in. and 28·40 in. respectively, and Llandudno with an average temperature of 50·3° F.—the coast eastwards not differing materially—together constitute a remarkable combination of dryness and mildness. I consider that such a combination is probably not exceeded if even obtained elsewhere in Britain. This section of coast has quite the least rainfall of any part of the western seaboard from Cornwall to Caithness. On the east coast of Britain, which is a little drier, it is decidedly colder in every county from Kent to Caithness. Also any coastal places or areas on the west coast which are in winter milder—such as Holyhead, St. Davids Head, north Devon and Cornwall—are all considerably wetter.

On the south coast of England in winter Cornwall is undoubtedly milder, but in Devon it is apt to be as cold, or colder than hereabouts, whilst to the east of Devon night frosts are more frequent, and also more severe than on this coast.

In summer the maxima here and along the coast—though tempered by sea breezes when gradients are not sufficient to produce a land wind—are much higher than at Holyhead, or on the coast of Pembroke, north Devon and Cornwall. In conclusion I may just mention that on the morning of Sunday, November 14th last, when a screen temperature of 17° F. was registered at Manchester, the minimum at Holyhead was 42° F. or no less than 25° F. warmer than Manchester. Even Falmouth and Penzance reported 35° F. and 34° F. as their screen minima that morning.

SYDNEY WILSON.

Tremycoed, Abergele, December 3rd, 1937.

Crepuscular Rays

At 15h. 28m. today I was cycling from Tremeirchion to Rhuallt, on the eastern side of Moel Maen Efa in the Clwyd range of mountains. Visibility was abnormally good and parallel bands of cirrus ran across the sky from north-west to south-east, travelling up from the south-west. One of these bands lay on the north-east horizon, and from a point in this layer diametrically opposite to the setting sun there radiated dark shafts in appearance exactly similar to those commonly seen in the west at sunset.

Reports have been made before of crepuscular rays seen extending to the zenith or even past it, but in this case it was not a continuation of normal rays beginning in the west, as only a part near the north-east horizon was visible. The rays were visible for about fifteen minutes, after which they faded with the onset of dusk.

S. E. ASHMORE.

Llannerch Gardens, St. Asaph, Flintshire, North Wales, December 25th, 1937.

Sunset Phenomenon

The phenomenon described below was observed at Khartoum on November 5th, 1937 and it may be of interest to readers of the *Meteorological Magazine.*

The sky was clear of clouds and at sunset the portion above the eastern horizon below an elevation of about 40° became reddish in colour. This reddish shade gradually spread higher in the sky and finally reached the western horizon. At the same time the colour in the east changed successively to orange, yellow, pale green, dark blue and violet each of which spread upwards in turn. Within less than ten minutes the colours of the spectrum were visible across the sky in bands extending from north to south. The red and orange in the west and the purple in the east were most pronounced while the green and blue were faint.

Subsequently the eastern sky became dark and the colours were gradually effaced as though a hood—" the hood of night "—had been drawn across the sky.

WILLIAM D. FLOWER.

Meteorological Service, Khartoum, A.E. Sudan. December 14th, 1937.

NOTES AND QUERIES

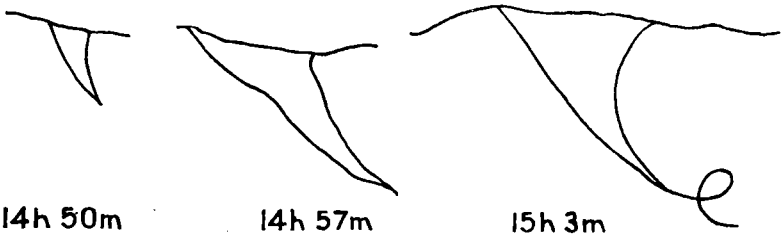
Waterspout at Cranwell, October 25th, 1937

A waterspout or funnel-shaped cloud occurred about two and a half miles south of the Meteorological Office, Cranwell, between 14h. 50m. and 15h. 5m. on October 25th, 1937. It was preceded by vivid lightning, thunder and rain, and it was whilst watching the lightning that the growth and decay of the waterspout were seen by the staff.

When first seen, it was only a small protuberance hanging down

from the front of a cumulonimbus cloud of line squall type, whose base was approximately 700 ft. from the ground. This protuberance rapidly increased in size downwards until it had assumed a well-marked funnel shape. The successive phases of the growth are shown in the following sketches made at the time.

From other observations made by reliable observers, and from inquiries made in the district, the position of the waterspout at the period of maximum intensity has been fixed as being at two and a half miles due south of this office and half a mile south-west of Rauceby. Observers close to the waterspout stated that it was seen to be twisting and turning quickly. The staff here observed that it developed a distinct curl to the tail as is shown in the sketch. At this



stage the pendant thinned considerably and the middle portion floated out almost horizontally behind the upper vertical portion. It then appeared to curl anticlockwise (as seen from above) and drop a tail downwards. At about the same time a black mass, very much like a smoke bomb in appearance, dropped from the main cloud partly down the pendant and remained there for some moments before gradually disappearing. The pendant then became much thinner, the lower part oscillating up and down several times before finally retracting. Then the whole waterspout disappeared. The passage of the waterspout across the comb nephoscope was observed, and it was calculated that the approximate length of the tail below the cloud was, at its maximum, 500 ft., with the end of the pendant at 200 ft. above the ground.

During the accompanying thunderstorm the anemogram showed a distinct veer from SE'E. to SSW., and the velocity dropped for three or four minutes to almost nothing. This storm moved from SSW. to NNE., and the upper wind at 12h. measured 160°, 27 m.p.h. at 1,000 ft.; 185°, 35 m.p.h. at 2,000 ft.; 190°, 43 m.p.h. at 3,000 ft.; and 190°, 45 m.p.h. at 4,000 ft. In general a south-westerly current was superimposed over a surface south-easterly one.

So far as has been ascertained, this waterspout does not appear to have caused any damage. This is quite likely to be correct, as the area affected was open fields. It is known that a somewhat similar phenomenon which occurred the same afternoon at North and South Kelsey, some thirty miles north of Cranwell, did cause considerable damage.

G. A. WRIGHT.

Rainfall and Water Supply

Two important contributions have recently been made to the subject of the water resources of this country. In November, Mr. E. G. Bilham read a paper on " Weather and water supply " at the Public Works, Roads and Transport Congress*, and on December 10th the Institution of Water Engineers received the report of its Joint Committee with the British Rainfall Organization and the Royal Meteorological Society, appointed " To consider methods of determining the general rainfall over any area ".

Mr. Bilham briefly analysed the variations of general rainfall over England and Wales from year to year and remarked that we appear to be passing through a period of relatively abundant rainfall. From 1854 to 1858 there were five successive dry years over England, and what has happened once may happen again. He then gave mathematical expressions for the relations between rainfall and run-off in the Thames and Severn valleys, and ended with figures of the smallest rainfalls which can reasonably be expected in various intervals of time.

The report of the Joint Committee was more comprehensive, covering the whole subject of measurement of rainfall and its integration over a definite area.

The various types of rain-gauge are illustrated, the orthodox exposure for the gauge is described and errors due to over- or under-exposure are explained. The principles governing the adequate representation of an area of any size by a network of gauges are set out, and the methods of computing the average annual and monthly rainfall from records of various lengths down to a few months are fully described. The whole report is a mine of information as well as a model of lucid exposition and of illustrations which really illustrate.

REVIEW

The Air Almanac.—Ephemeral sheets for 1937, October 1st to December 31st. Prepared by H.M. Nautical Almanac Office on behalf of the Air Ministry. Size 9½ in. by 6 in. London, H.M. Stationery Office, 1937. Price 2*s.* 6*d.* net.

For many years the Abridged Nautical Almanac has catered for the requirements of the navigator wishing to determine his position by means of the observation of celestial bodies. The surface navigator can afford to spend the time taken by the interpolations and conversions required in the use of the Abridged Nautical Almanac, but the air navigator, working in poor conditions in a fast-moving aircraft, requires his astronomical data directly in the form in which he wishes to use it. The Air Almanac has been produced by H.M. Nautical Almanac Office to the general requirements of the Air Ministry for the purpose of meeting this want.

* Reprinted in *Wat. and Wat. Engng., London*, 39, 1937, p. 603.

For the Sun, Moon, Venus, Mars, Jupiter, Saturn and the fifty brightest stars, the ephemeral sheets of this Almanac provide the Greenwich Hour Angle and Declination, tabulated at convenient intervals of mean time. All the quantities given are for mean time of the meridian of Greenwich, at intervals of one hour for the Sun and Moon, six hours for the planets and two days for the stars. Intermediate tables are provided for determining the values of these quantities at intermediate times. Tables of sunrise, moonrise, etc., are not included as these would not normally be required during flights made by aircraft.

With the development of long-distance flying the appearance of this Almanac is very timely and should prove of great value to pilots on such routes as those lying over the oceans. It is produced in very convenient loose leaf form to meet the requirements of easy reference and compactness.

J. S. FARQUHARSON.

BOOK RECEIVED

Jaarboek, Koninklijk Nederlandsch Meteorologisch Instituut, 1935. A. Meteorologie, B. Aard-Magnetisme (Nos. 97 and 98). Utrecht, 1936.

OBITUARY

We regret to learn of the death on December 26th, 1937, of Mrs. Dines, widow of W. H. Dines, F.R.S., and express our sympathy with her two sons, who are members of the Staff of the Office.

NEWS IN BRIEF

M. Charles Maurain has been awarded 15,000 fr. under the Fondation Villemot for researches in terrestrial magnetism and atmospheric electricity carried out under his direction at the new geophysical observatory at Chambon-la-Forêt, Loiret.

It was announced in the New Year's Honours List that Dr. C. W. B. Normand, Director-General of Observatories, Government of India, has been made a Commander of the Order of the Indian Empire.

ERRATA

JUNE, 1936, p. 105, line 22. The words " the Atlantic " should be deleted, as resultant winds for each two-degree square of the Atlantic are published in De Bilt, K. Ned. Meteor. Inst., Publ. No. 110. Oceanographische en meteorologische waarnemingen in den Atlantischen Oceaan. Kaarten. Amsterdam, 1918, 1922, 1931, Utrecht, 1926.

DECEMBER, 1937, p. 265. Between first and second lines *insert* " above sea level, and our position was lat. 29° 27′ N."

The Weather of December, 1937

The Siberian anticyclone was well developed, pressure exceeding 1030 mb. between 60° and 110° W. and reaching 1034 mb. at Irkutsk. From this centre ridges of high pressure (above 1020 mb.) extended westwards across Finland and Sweden and eastwards along the Arctic coast of Siberia into North America where a secondary anticyclone gave a mean of 1026 mb. Pressure was 10 mb. or more above normal over the White Sea and Arctic Ocean between Iceland and Dickson, the excess reaching 17 mb. at Archangelsk. Over most of Europe pressure was deficient by more than 5 mb. in Switzerland, north-east Italy, Roumania and Southern Russia; elsewhere the departures from normal were small.

Owing to the influence of the northern anticyclone temperature and precipitation were below normal over northern and western Europe and central Siberia, the deficit of temperature reaching — 15° F. at Yeniseisk and — 8° F. at Vitegra. At Yakutsk near the "cold pole" the mean temperature of — 38° F. was however 2° F. above normal, and in southern Russia and south-west Siberia temperatures were mostly well above normal. Temperatures were below 0° F. over most of Siberia north of 60° N. and between 100° and 120° E. they extended as far south as 45° N. In the British Isles the mean temperatures of 37°–43° F. were about 2° F. below normal; rainfall was deficient except on the east coast. In North America temperatures were above normal in the west and north-east but below normal in the interior of Canada. Temperatures below 0° F. were recorded north of about 55° N. except in the west. Heavy rains (48 inches or more) fell in Oregon, British Columbia and the east coast of Newfoundland and Nova Scotia; elsewhere amounts differed little from normal.

No broadcast data were received for India, Australia or New Zealand.

The main feature of the weather of December was the occurrence of two cold spells, one in the early part of the month, and the other about the 18th–20th. In the first there were heavy falls of snow over most of the country, causing serious dislocation of road traffic and disorganising the telephone services in Scotland and the southern counties. Later glazed roads added to the transport difficulties. The last ten days were milder with considerable fog. Sunshine was well below average except in Scotland and locally in south-west England and Ireland. In south Scotland, however, sunshine aggregates were 50 per cent. above average. Rainfall was below normal in Scotland, Ireland and the western districts of England and Wales, but on parts of the east coast exceeded 150 per cent. of the monthly normal. A complex system of disturbances passed slowly eastwards across the country during the earlier part of the month maintaining unsettled weather with gales locally. The 1st was generally mild with maximum temperatures between 50° and

60°F. and minima of 51° F. at Guernsey and 49° F. at Brighton; fog was widespread and rainfall heavy in the south. Temperatures gradually decreased until the 4th over the whole country and heavy rainfalls were recorded on the 2nd, 2·11 in. at Ferriby Sluice, Lincoln and 1·90 in. in east Yorkshire. There was little sunshine except in west Scotland and Ireland where Abbotsinch had 6·2 hrs. on the 3rd and Eskdalemuir 5·2 hrs. Snow fell generally on the 4th and the wind reached gale force in the south-west. Fog developed in many parts of Scotland and the north, and there the snow continued until the 6th. Sharp ground frosts on the 7th caused icebound roads; low temperatures were general, Dalwhinnie recording 8° F. in the screen and 3° F. on the ground, and Lympne 20° F. in the screen and 16° F. on the ground. In the south-west there was much sun, but thunderstorms developed over the Isle of Wight and 4·14 in. of snow and sleet was measured at Newport. Thunderstorms were also reported from Scotland. Snow fell heavily in the south on the 8th and on most days in Scotland and the north until the 11th; the snow causing a serious railway accident near Falkirk on the 10th. Temperatures were low again on the 10th with 12° F. registered at Rhayader. A deep depression moving south-east brought gales at Fort Augustus and in the English Channel, and fog was general. Some sunshine was experienced on the 12th in the north and Midlands, but snow persisted in the east. Temperatures rose in England on the 13th and 14th but fell in Scotland, Dalwhinnie registering a minimum of 0° F.; southern Scotland was swept by a blizzard, drifts of 10 ft. being general. Fog was widespread on the 13th and 14th and rain fell in the south 1·64 in. being recorded at St. Austell, Cornwall. An anticyclone moving south from Iceland on the 16th brought colder weather and sunshine, over six hours being experienced in many parts of the country on the 17th. Fog developed again on the 18th, and occurred daily until the 28th. Temperatures were low and severe frosts were experienced on the 18th–20th; the snow which fell on the 19th froze, giving glazed frosts in the southern districts. A depression moved north-eastwards from Ireland on the 20th and heavy rain fell in the south-west, while north-west Ireland had gales on the 20th and 22nd. Temperature rose about 20° F. generally from the 20th to 24th, when high maxima were recorded, e.g. 57° F. at Sealand and 56° F. at Nairn and Birr Castle. Temperature remained high, and fog developed on the 25th, being particularly dense in the London area, see p. 282. On the 26th an anticyclone extended from south England to the Baltic, and temperatures fell in England on the 27th but remained high in Scotland, the minimum at Fort Augustus being 48° F. The decrease of temperature extended over the whole country by the 29th when a minimum of 24° F. was recorded at Ayr, and on the 30th 27° F. was recorded at Fort Augustus. There was little sun in England during the later part of the month, but west Ireland had 6 hrs. on the 29th, and southern Scotland 5 hrs. on the 31st. Snow fell in southern England

on the 30th. The distribution of bright sunshine for the month was as follows :—

	Total (hrs.)	Diff. from normal (hrs.)		Total (hrs.)	Diff. from normal (hrs.)
Stornoway ..	37	+15	Chester ..	25	−16
Aberdeen ..	29	+ 8	Ross-on-Wye	48	0
Dublin	34	−12	Falmouth ..	60	+ 7
Birr Castle ..	37	− 6	Gorleston ..	31	−10
Valentia ..	45	+ 6	Kew.. ..	25	−12

Kew, Temperature, Mean, 38·8, Diff. from average — 2·6.

Miscellaneous notes on weather abroad culled from various sources.

Fog was reported off the north-west German coast on the 1st causing damage to shipping. A storm along the coast of France from the Spanish frontier to the mouth of the Gironde on the 2nd and 3rd caused interruption of navigation. There was heavy snow in Sweden between the 1st and 3rd when 30 in. fell in Stockholm. Snow was reported from Spain on the 14th. Heavy rains persisted throughout Andalusia on the 15th. In consequence of continued heavy rain extensive flooding occurred in Rome in the middle of the month, the Tiber reaching a height of 55·5 ft. on the 17th only 2 in. short of its 1900 record ; the Littorio airport was flooded. Floods were also reported from Naples on the 15th. During a snowstorm on the 22nd 24 lives were lost in a shipwreck in the Bosphorus. Severe frosts were registered in Switzerland on the 28th, Pontresina recording — 14° F. Snowstorms disorganised traffic in Rumania on the 30th and two people were frozen to death. Ice on the rails caused the derailment of a train in the Haute Loire on the 31st and two people were killed. Navigation closed on the 31st in the Vasa district of the Gulf of Bothnia. (*The Times*, December 3rd, 1937–January 3rd, 1938.)

Eight native mineworkers were killed in a Rand mine when lightning struck a wire on the headshaft and detonated charges 4,000 ft. below ground. Heavy rains throughout the Cape Province on the 16th and 17th broke the drought which was becoming disastrous. Nine natives were killed by lightning on the 25th near Johannesburg. (*The Times*, December 13th–28th.)

The total rainfall for the month was generally deficient over Australia except in South Australia, Tasmania and parts of Victoria and New South Wales. The Australian steamer *Saros* was wrecked on Cape Everard, Victoria, in a fog on the 25th. (Cable and *The Times*, December 28th.)

Two days continuous rain caused the washing away of a railway conduit near St. John's, Newfoundland on the 6th—two men were killed. New York State experienced one of the worst blizzards in its history on the 8th–10th, snowdrifts were 15 ft. high, and nine people died as a result of the storm. A cold wave swept over the south-eastern States at the same time and citrus crops were seriously damaged. The Pacific coast experienced a series of storms

and a 70 m.p.h. gale on the 10th made air travel impossible. Navigation closed at Quebec on the 11th. Snow fell heavily in Canada during the first two weeks of the month, Ontario reporting as much as during the whole of last winter. Sleet and drizzle which fell in New York on the 31st turned to ice on the roads, disorganising traffic and causing the death of two people. (*The Times*, December 9th, 1937–January 3rd, 1938.)

Heavy gales on the Atlantic on the 25th caused damage to the liner *Shipper*. Gales and snow were reported in the western Atlantic on the 28th. (*The Times*, December 29th–30th.)

Daily Readings at Kew Observatory, December, 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	1003·9	SSW.3	48	52	85	0·39	0·9	r 5h.–9h. & 15h.–24h.
2	986·4	NE.2	44	46	90	0·84	0·0	r_0–r 0h.–19h.
3	996·4	NNW.4	42	45	83	0·01	0·0	r_0 9h.–10h. pr_0 18h.
4	1007·6	SSW.3	36	40	77	0·20	0·0	rs 14h.–16h. r 24h.
5	994·0	WNW.4	34	43	66	0·07	1·4	r–r_0 0h.–6h.
6	994·4	SSW.2	28	36	85	—	2·1	f till 15h. F 21h.
7	996·3	NE.2	31	37	85	—	0·0	f till 15h.
8	1001·6	NNE.4	35	39	88	0·08	0·0	d_0–r_0 15h.–24h.
9	1000·9	NNW.4	34	38	89	0·16	0·0	r_0 0h.–7h. rs 8h.–9h.
10	1008·9	SSW.3	32	37	87	0·38	0·4	r_0–r 18h.–24h.
11	990·4	SSW.2	37	44	93	0·03	1·2	r_0 9h.–11h.
12	1002·9	W.4	36	39	62	trace	5·9	pr_0 5h.
13	984·1	S.4	32	44	91	0·97	0·0	r_0–r 7h.–24h.
14	983·0	SSE.2	33	39	90	trace	3·2	r_0 to 1h. x 7h. F 21h.
15	997·9	NW.3	32	39	82	trace	0·1	r_0 10h.–13h. x 21h.
16	1009·2	NNW.4	30	40	84	0·01	0·1	s 6h. r_0 11h. and 14h.
17	1019·9	NNW.3	36	41	79	—	0·1	r_0 17h.–18h.
18	1020·1	W.2	29	37	77	—	4·4	x early and late.
19	1016·6	NE.2	27	36	93	0·16	0·0	rs–s 3h–11h. F to 24h.
20	1018·5	SE.2	25	35	97	—	1·1	Fx till 13h.
21	1011·0	SE.2	33	41	92	trace	0·0	id_0 14h. and 18h.–22h.
22	1017·0	SSW.4	41	50	92	—	0·0	d_0 21h.
23	1024·7	W.3	49	52	81	0·03	2·7	d_0 5h.–7h. f 19h.
24	1028·9	SSW.4	38	52	90	trace	0·6	r_0 22h.–23h.
25	1037·1	S.2	47	48	99	trace	0·7	Fe most of day.
26	1039·2	E.2	37	45	97	0·02	0·0	Fe–Fd_0 till 15h.
27	1039·4	NE.3	33	39	76	—	0·0	id_0 13h.–17h. f 15h.
28	1033·7	NW.2	35	43	87	0·01	0·0	
29	1031·3	NE.4	40	42	84	0·02	0·0	id_0 all day.
30	1032·3	NE.3	36	40	77	trace	0·0	r_0 9h.–10h.
31	1029·2	N.3	34	42	88	0·02	0·0	ir_0 14h.–20h.
*	1011·5	—	36	42	85	3·44	0·8	* Means or totals.

General Rainfall, 1937

	Dec.	Year	
England and Wales	108	111	per cent of the average 1881–1915.
Scotland	76	92	
Ireland	71	104	
British Isles ...	93	105	

Rainfall: December, 1937: England and Wales

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Lond .	Camden Square.....	3·92	164	*Leics* .	Thornton Reservoir ...	2·45	91
Sur .	Reigate, Wray Pk. Rd..	4·22	133	,, .	Belvoir Castle.....	1·96	80
Kent .	Tenterden, Ashenden...	3·95	127	*Rut* .	Ridlington	2·42	96
,, .	Folkestone, Boro. San.	7·45	...	*Lincs* .	Boston, Skirbeck.....	2·50	116
,, .	Margate, Cliftonville....	4·64	203	,, .	Cranwell Aerodrome...	1·66	75
,, .	Eden'bdg., Falconhurst	3·77	114	,, .	Skegness, Marine Gdns.	2·87	130
Sus .	Compton, Compton Ho.	4·78	114	,, .	Louth, Westgate.....	3·69	132
,, .	Patching Farm.....	3·85	115	,, .	Brigg, Wrawby St.....	4·13	...
,, .	Eastbourne, Wil. Sq....	4·95	142	*Notts* .	Mansfield, Carr Bank...	3·29	113
Hants.	Ventnor, Roy.Nat.Hos.	6·32	192	*Derby*.	Derby, The Arboretum	2·18	80
,, .	Fordingbridge, Oaklnds	3·86	97	,, .	Buxton, Terrace Slopes	4·64	82
,, .	Ovington Rectory.....	4·99	126	*Ches* .	Bidston Obsy.....	2·89	109
,, .	Sherborne St. John.....	3·06	93	*Lancs*.	Manchester, Whit. Pk.	2·33	72
Herts .	Royston, Therfield Rec.	3·08	133	,, .	Stonyhurst College.....	1·89	39
Bucks.	Slough, Upton.....	3·40	135	,, .	Southport, Bedford Pk.	2·02	63
Oxf .	Oxford, Radcliffe.....	1·90	77	,, .	Ulverston, Poaka Beck	...	...
N'hant	Wellingboro, Swanspool	2·21	94	,, .	Lancaster, Greg Obsy.	2·39	55
,, .	Oundle	2·25	...	,, .	Blackpool	2·43	74
Beds .	Woburn, Exptl. Farm...	2·44	104	*Yorks*.	Wath-upon-Dearne.....	3·60	152
Cam .	Cambridge, Bot. Gdns.	2·20	114	,, .	Wakefield, Clarence Pk.	2·02	83
,, .	March.....	3·46	164	,, .	Oughtershaw Hall.....	3·66	...
Essex.	Chelmsford, County Gdns	3·68	166	,, .	Wetherby, Ribston H..	2·25	92
,, .	Lexden Hill House.....	3·72	...	,, .	Hull, Pearson Park.....	4·78	198
Suff .	Haughley House.....	2·27	...	,, .	Holme-on-Spalding.....	3·41	139
,, .	Rendlesham Hall.....	3·37	143	,, .	West Witton, Ivy Ho.	3·89	107
,, .	Lowestoft Sec. School...	4·01	172	,, .	Felixkirk, Mt. St. John.	5·06	210
,, .	Bury St. Ed., WestleyH.	3·14	130	,, .	York, Museum Gdns....	2·42	108
Norf. .	Wells, Holkham Hall...	2·53	123	,, .	Pickering, Hungate.....	4·69	186
Wilts .	Porton, W.D. Exp'l. Stn	3·52	112	,, .	Scarborough.....	4·83	203
,, .	Bishops Cannings.....	2·54	77	,, .	Middlesbrough.....	3·71	191
Dor .	Weymouth, Westham.	3·81	109	,, .	Baldersdale, Hury Res.	2·98	80
,, .	Beaminster, East St....	5·29	111	*Durh* .	Ushaw College.....	6·64	265
,, .	Shaftesbury, Abbey Ho.	4·22	117	*Nor* .	Newcastle, Leazes Pk...	6·25	266
Devon.	Plymouth, The Hoe....	5·24	105	,, .	Bellingham, Highgreen	5·34	147
,, .	Holne, Church Pk. Cott.	7·42	88	,, .	Lilburn Tower Gdns....	5·16	196
,, .	Teignmouth, Den Gdns.	3·85	91	*Cumb*.	Carlisle, Scaleby Hall...	1·93	60
,, .	Cullompton	3·40	78	,, .	Borrowdale, Seathwaite	8·15	53
,, .	Sidmouth, U.D.C.....	3·21	...	,, .	Thirlmere, Dale Head H.	7·23	68
,, .	Barnstaple, N. Dev.Ath	3·92	88	,, .	Keswick, High Hill.....	2·88	43
,, .	Dartm'r, Cranmere Pool	7·20	...	*West* .	Appleby, Castle Bank...	2·10	53
,, .	Okehampton, Uplands.	3·74	53	*Mon* .	Abergavenny, Larchf'd	3·26	73
Corn .	Redruth, Trewirgie.....	4·58	73	*Glam* .	Ystalyfera, Wern Ho....	5·23	63
,, .	Penzance, Morrab Gdns.	5·85	103	,, .	Treherbert, Tynywaun.	7·06	...
,, .	St. Austell, Trevarna...	6·59	108	,, .	Cardiff, Penylan.....	2·24	45
Soms .	Chewton Mendip.....	2·90	54	*Carm* .	Carmarthen, M. & P. Sch.	5·52	93
,, .	Long Ashton.....	2·10	54	*Pemb* .	Pembroke, Stackpole Ct.	4·77	98
,, .	Street, Millfield.....	2·37	72	*Card* .	Aberystwyth	2·97	...
Glos .	Blockley	2·50	...	*Rad* .	BirmW.W.Tyrmynydd	5·40	66
,, .	Cirencester, Gwynfa....	2·24	67	*Mont* .	Newtown, Penarth Weir	...	...
Here .	Ross-on-Wye.....	2·15	72	,,	Lake Vyrnwy	4.80	70
Salop.	Church Stretton.....	3·42	102	*Flint* .	Sealand Aerodrome.....	2·61	...
,, .	Shifnal, Hatton Grange	2·79	109	*Mer* .	Blaenau Festiniog	6·52	57
,, .	Cheswardine Hall.....	4·12	146	,, .	Dolgelley, Bontddu.....	3·73	54
Worc .	Malvern, Free Library...	2·29	83	*Carn* .	Llandudno	1·89	65
,, .	Ombersley, Holt Lock.	1·78	68	,, .	Snowdon, L. Llydaw 9..	14·60	...
War .	Alcester, Ragley Hall...	2·09	85	*Ang* .	Holyhead, Salt Island...	4·01	96
,, .	Birmingham, Edgbaston	2·54	94	,, .	Lligwy	3·63	...

Rainfall: December, 1937: Scotland and Ireland

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
I. Man	Douglas, Boro' Cem....	4·48	91	*R&C* .	Achnashellach	...	...
Guern.	St.Peter P't.Grange Rd.	6·45	158	,, .	Stornoway,C.GuardStn.	2·40	40
Wig .	Pt. William, Monreith.	5·36	118	*Suth* .	Lairg.....	1·94	48
,, .	New Luce School.....	4·09	74	,, .	Skerray Borgie.....	2·63	...
Kirk .	Dalry, Glendarroch.....	3·55	50	,, .	Melvich.....	...	...
Dumf.	Dumfries, Crichton R.I.	2·55	63	,, .	Loch More, Achfary....	2·76	30
,, .	Eskdalemuir Obs.....	4·79	68	*Caith* .	Wick.....	2·20	71
Roxb .	Hawick, Wolfelee.....	4·12	99	*Ork* .	Deerness	2·22	53
Peeb .	Stobo Castle.....	3·10	82	*Shet* .	Lerwick	3·76	84
Berw .	Marchmont House.....	5·95	212	*Cork* .	Cork, University Coll...	2·47	48
E.Lot .	North Berwick Res.....	4·20	195	,, .	Roches Point, C.G. Stn.	2·43	46
Midl .	Edinburgh, Blackfd. H.	2·34	100	,, .	Mallow, Longueville....	2·95	60
Lan .	Auchtyfardle	2·06	...	*Kerry.*	Valentia Observatory...	5·05	76
Ayr .	Kilmarnock, Kay Park	2·67	...	,, .	Gearhameen.....	7·10	57
,, .	Girvan, Pinmore.....	3·35	56	,, .	Bally McElligott Rec...	3·05	...
,, .	Glen Afton, Ayr San....	3·19	50	,, .	Darrynane Abbey.....	3·97	67
Renf .	Glasgow, Queen's Park	2·36	56	*Wat* .	Waterford, Gortmore...	2·51	55
,, .	Greenock, Prospect H..	4·15	53	*Tip* .	Nenagh, Castle Lough.	2·80	61
Bute .	Rothesay, Ardencraig...	3·33	61	,, .	Cashel, Ballinamona....	2·15	50
,, .	Dougarie Lodge.....	2·96	54	*Lim* .	Foynes, Coolnanes.....	...	...
Arg .	Loch Sunart, G'dale....	1·40	16	*Clare* .	Inagh, Mount Callan....	4·54	...
,, .	Ardgour House.....	4·83	...	*Wexf* .	Gorey, Courtown Ho...	2·81	74
,, .	Glen Etive.....		...	*Wick* .	Rathnew, Clonmannon.	2·77	...
,, .	Oban.....	2·20	...	*Carl* .	Bagnalstown,Fenagh H.	2·15	57
,, .	Poltalloch.....	1·88	29	,, .	Hacketstown Rectory...	2·82	69
,, .	Inveraray Castle.....	5·36	54	*Leix* .	Blandsfort House.....	2·12	58
,, .	Islay, Eallabus.....	3·26	55	*Offaly.*	Birr Castle.....	1·94	59
,, .	Mull, Benmore.....	6·40	38	*Kild* .	Straffan House.....	1·77	58
,, .	Tiree	2·61	50	*Dublin*	Dublin, Phoenix Park..	1·74	69
Kinr .	Loch Leven Sluice.....	3·12	79	,, .	Balbriggan, Ardgillan...	...	...
Fife .	Leuchars Aerodrome...	3·19	129	*Meath.*	Kells, Headfort.....	2·14	56
Perth .	Loch Dhu.....	4·60	46	*W.M* .	Moate, Coolatore.....	2·21	...
,, .	Crieff, Strathearn Hyd.	2·65	59	,, .	Mullingar, Belvedere...	2·06	56
,, .	Blair Castle Gardens....	1·66	43	*Long* .	Castle Forbes Gdns.....	...	...
Angus.	Kettins School.....	2·50	76	*Gal* .	Galway, Grammar Sch.	2·89	63
,, .	Pearsie House.....	·74	...	,, .	Ballynahinch Castle....	5·00	67
,, .	Montrose, Sunnyside...	4·12	148	,, .	Ahascragh, Clonbrock.	2·50	53
Aber .	Balmoral Castle Gdns..	3·64	108	*Rosc* .	Strokestown, C'node.....	2·27	61
,, .	Logie Coldstone Sch....	4·70	167	*Mayo.*	Blacksod Point.....	6·43	105
,, .	Aberdeen Observatory.	4·31	134	,, .	Mallaranny	5·87	...
,, .	New Deer School House	3·85	113	,, .	Westport House.....	4·62	80
Moray	Gordon Castle.....	2·81	104	,, .	Delphi Lodge.....	10·49	86
,, .	Grantown-on-Spey	3·40	125	*Sligo* .	Markree Castle.....	3·91	82
Nairn.	Nairn	1·56	70	*Cavan.*	Crossdoney, Kevit Cas..	2·60	...
Inv's .	Ben Alder Lodge.....	2·79	...	*Ferm* .	Crom Castle.....	2·71	65
,, .	Kingussie, The Birches.	1·31	...	*Arm* .	Armagh Obsy.....	2·24	72
,, .	Loch Ness, Foyers	...	...	*Down.*	Fofanny Reservoir.....	8·64	...
,, .	Inverness, Culduthel R.	·97	36	,, .	Seaforde	5·33	129
,, .	Loch Quoich, Loan.....	1·87	...	,, .	Donaghadee, C. G. Stn.	4·52	142
,, .	Glenquoich.....	4·07	28	*Antr* .	Belfast,Queen's Univ....	4·20	114
,, .	Arisaig House.....	1·87	26	,, .	Aldergrove Aerodrome.	...	...
,, .	Glenleven, Corrour.....	2·70	29	,, .	Ballymena, Harryville.	4·45	100
,, .	Fort William, Glasdrum	3·54	...	*Lon* .	Garvagh, Moneydig....	3·51	...
,, .	Skye, Dunvegan.....	4·75	...	,, .	Londonderry, Creggan.	3·15	72
,, .	Barra, Skallary.....	3·47	...	*Tyr* .	Omagh, Edenfel.....	2·82	67
R&C.	Tain, Ardlarach.....	1·01	32	*Don* .	Malin Head.....	2.54	...
,,	Ullapool	1·37	22	,,	Dunkineely.....	3·15	...

Climatological Table for the British Empire, July, 1937

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....	1016·2	+ 0·4	82	52	70·7	56·8	63·7	+ 0·9	56·8	80	7·7	0·95	— 1·22	10	4·4	27
Gibraltar	1015·6	— 1·2	88	63	77·2	66·8	72·0	— 2·8	65·9	84	3·3	0·00	...	0	...	...
Malta.....	1014·6	— 0·1	95	67	82·7	70·5	76·6	— 1·7	70·0	69	0·7	0·00	— 0·05	0	12·7	89
St. Helena	1016·9	— 0·5	65	53	61·0	55·3	58·1	+ 0·3	55·9	94	9·6	4·95	+ 0·88	23	...	...
Freetown, Sierra Leone	1013·6	+ 2·6	86	69	81·6	72·5	77·1	...	74·8	87	8·2	45·38	+ 9·80	28	...	...
Lagos, Nigeria	1014·9	+ 0·9	85	70	81·7	74·9	78·3	+ 0·3	74·5	89	9·0	18·07	+ 7·57	19	2·8	23
Kaduna, Nigeria	1012·6	...	88	66	83·5	69·6	76·5	+ 2·9	71·3	90	8·5	10·26	— 0·36	19	5·4	43
Zomba, Nyasaland	1017·1	— 1·5	79	47	70·3	52·4	61·3	— 0·7	56·8	72	5·6	0·30	— 0·05	3	...	...
Salisbury, Rhodesia....	1021·9	— 0·5	77	38	68·4	42·0	55·2	— 0·9	46·9	54	2·2	0·00	...	...	9·0	80
Cape Town	1021·9	+ 0·6	73	41	62·7	46·8	54·7	0·0	48·3	86	6·0	5·92	+ 2·30	13	...	...
Johannesburg	1024·4	— 0·5	67	23	58·7	36·3	47·5	— 2·9	37·7	57	0·8	0·06	— 0·27	1	9·3	87
Mauritius	1018·4	— 2·1	79	53	75·4	62·1	68·7	+ 0·4	66·0	78	4·9	2·94	+ 0·66	20	7·1	65
Calcutta, Alipore Obsy.	997·9	— 1·3	93	78	88·9	80·2	84·5	+ 0·8	80·3	89	8·9	10·92	— 1·78	17*	...	...
Bombay	1002·7	— 1·2	87	73	84·5	76·2	80·3	— 1·1	77·4	90	9·4	30·42	+ 6·15	30*	...	...
Madras	1003·6	— 0·9	100	73	94·7	78·2	86·5	— 1·1	75·4	69	8·9	3·70	— 0·14	11*	...	...
Colombo, Ceylon	1009·1	0·0	86	73	84·7	76·9	80·8	— 0·4	77·1	80	7·4	3·98	— 0·45	14	6·1	49
Singapore.....	1009·0	+ 0·1	88	73	85·9	78·2	82·1	+ 0·8	77·3	80	6·9	2·87	— 3·92	13	7·2	59
Hongkong.....	1003·8	— 0·9	91	75	88·0	78·8	83·4	+ 0·9	79·4	82	6·7	19·31	+ 4·89	21	7·7	58
Sandakan	1008·1	...	91	72	89·1	74·9	82·0	+ 0·2	76·9	84	7·7	10·84	+ 4·12	15	...	...
Sydney, N.S.W.....	1023·5	+ 5·2	73	41	62·4	45·0	53·7	+ 1·0	47·0	72	4·0	3·29	— 1·51	11	6·4	63
Melbourne	1023·4	+ 4·5	62	32	56·9	40·4	48·7	0·0	42·9	77	6·6	1·21	— 0·65	10	3·8	37
Adelaide.....	1025·4	+ 5·2	65	38	59·5	43·5	51·5	— 0·4	46·2	77	7·0	1·90	— 0·74	14	4·7	47
Perth, W. Australia ...	1025·2	+ 6·2	73	37	64·2	46·0	55·1	— 0·1	48·4	68	4·0	2·53	— 4·03	11	7·0	69
Coolgardie	1025·4	+ 5·5	69	30	62·5	39·1	50·8	— 0·4	44·8	69	2·3	0·09	— 0·78	2	...	...
Brisbane.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hobart, Tasmania.....	1018·0	+ 4·3	62	33	53·7	41·5	47·6	+ 1·9	41·7	72	5·0	1·09	— 1·09	12	4·2	45
Wellington, N.Z.	1017·3	+ 3·4	59	33	50·5	40·6	45·5	— 2·5	43·7	84	7·0	3·93	— 1·70	16	4·1	43
Suva, Fiji	1014·7	+ 0·7	84	65	78·5	69·7	74·1	+ 0·7	69·8	85	7·7	4·76	— 0·17	27	2·8	25
Apia, Samoa	1011·2	— 0·7	88	71	85·2	74·1	79·7	+ 2·5	75·3	76	4·3	2·02	— 0·96	10	8·4	74
Kingston, Jamaica	1014·3	— 0·4	94	72	90·1	74·3	82·2	+ 0·5	72·5	76	3·6	0·22	— 1·40	4	8·2	63
Grenada, W.I.	1012·0	— 1·3	89	71	86	72	79·0	— 0·2	73	74	6	5·71	— 3·72	20	...	...
Toronto.....	1014·0	— 0·4	95	47	80·6	62·2	71·4	+ 2·3	63·2	77	3·8	2·92	+ 0·08	8	8·9	59
Winnipeg	1012·9	+ 0·6	92	45	80·9	58·3	69·6	+ 3·2	58·5	86	4·9	2·83	— 0·27	9	8·2	52
St. John, N.B.	1013·8	+ 0·2	87	51	73·0	55·0	64·0	+ 3·6	59·6	82	6·3	0·76	— 2·87	11	9·1	60
Victoria, B.C.....	1018·2	+ 0·9	73	50	67·9	52·3	60·1	0·0	55·6	74	4·0	0·01	— 0·41	1	11·7	75

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

(40259) Wt. 20/31 1125 1/38 Hw. G. 377/6