M.O. 294.

The Meteorological Magazine

Air Ministry :: Meteorological Office

Vol. 62

Dec. 1927

No. 743

LONDON: PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE

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The Storm of October 28th—29th, 1927

By J. CRICHTON, M.A., B.Sc.

On October 27th, 1927, a depression was indicated in the neighbourhood of the Azores. Observations at 1h. on the 28th indicated that the depression had approached our south-west coasts but the observations did not give any idea of its intensity, this being largely due to the lack of observations in the area where it was developing. More observations, however, were received at 7h. and from these it became evident that the depression was a vigorous one and that it would deepen and cause widespread gales as it moved northeastwards across the British Isles. The weather map on page 250 gives the position of the depression at 18h. on the 28th and in addition shows the track of its centre, the times and dates corresponding with the positions of the centre at the hours of 7, 13 and 18 on the 28th and of 1, 7 and 13 on the 29th. It will be seen that the depression traversed the British Isles in less than twenty-four hours.

A preliminary examination of the autographic records indicates that the depression had a decided warm sector as it approached Ireland and that, although this sector partially remained as it crossed the British Isles, the centre of the depression during its passage was occluded. The warm front ran throughout practically east and west and passed Valentia, Scilly and Plymouth between 3h. and 4h. on the 28th, arrived at Calshot about 5h.,

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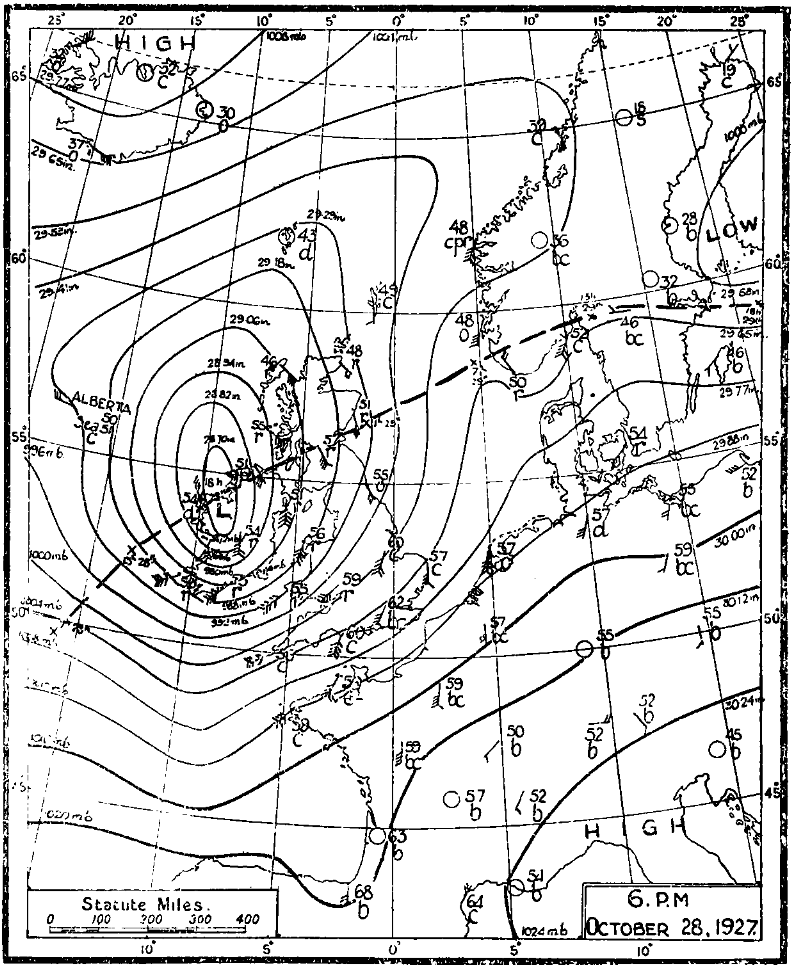
Chester, Cranwell and Bircham-Newton between 11h. and 12h., Aldergrove between 12h. and 13h. and Leuchars and Renfrew about 16h. The cold fronts were not so well marked, the air in the rear of the depression being very mild and dry. The times of passage of what might be termed the main cold front were as follows : at Valentia between 13h. and 14h., Scilly 14h. 30m.,



Plymouth 14h. 45m., Ross-on-Wye and Chester 16h., Aldergrove 16h. 40m., Calshot 17h. 30m., Renfrew 18h., Cranwell 18h. 10m., Bircham Newton 19h. 15m. and Leuchars about 21h. It will be seen that the cold front progressed more rapidly northeastwards than eastwards and resulted in the depression becoming quickly occluded. By 7h. on the 29th the depression was entirely occluded, the occlusion ran southsoutheast from its centre, skirted the coast of Denmark, turned towards west and ran through Holland, Belgium and northern France to the Bay

of Biscay. The cold fronts were very numerous and some of the later ones were more intense as regards wind changes. They did not, however, produce much change in temperature. On the barographic records the warm and cold fronts were ill-defined and scarcely traceable.

The rise of the barometer in the rear of the depression was phenomenal and at Valentia it was a record for the station; there the rise was at the rate of 14·5 mb. during 3 hours. As a consequence of this rapid rise the gales were most intense and destructive in the rear of the depression; the passage of each cold front was marked particularly in Ireland and Scotland by large and sudden increases in the velocity of the wind. The records of the wind velocity at Valentia and Quilty (Co. Clare), shown in the figure facing p. 249, clearly indicate these rapid changes. At Valentia between 16h. 35m. and 16h. 40m. on the 28th the wind veered sharply from SW by W to W, and the mean velocity jumped from 26 m.p.h. to 52 m.p.h.

The following very interesting report was received at the Meteorological Office, Air Ministry, from the Captain of the SS. *Aluania*, "At 12h. 50m. G.M.T. approximate position 51° 28′ N, 14° 4′ W, wind was S, force 6, barometer having fallen steadily to 28·69 in. [971·5 mb.]. At 13h. 20m. G.M.T. in approximate position 51° 26′ N, 13° 52′ W wind suddenly shifted to WNW and increased to force 11, the barometer rising rapidly until now at 14h. 50m. G.M.T. Lat. 51°, 9′ N, Long. 13° 18′ W, it stands at 29·00 in. [982·0 mb.]. The wind maintained its direction and force." This report, assuming the barometer is correct, indicates approximately the position of the centre of the depression at 13h. on the 28th and also probably the greatest depth the depression reached.

The passage across northwest Ireland of the centre was also distinctly marked by the lightness of the winds. At Dunfanaghy Road, Co. Donegal, the wind between 18h. 30m. and 21h. did not average more than 5 m.p.h., it started to increase in velocity at 21h. and by 22h. 50m. it was averaging more than 50 m.p.h., and at 23h. 35m. there was a gust of 74 m.p.h. This sudden increase of wind was responsible for the destruction of many small fishing craft and the loss of life to a number of fishermen. The following extracts, taken from *The Times* of October 31st, 1927, illustrate this :—

> "Several fishing boats engaged in the herring fishery in Lackan Bay, Co. Mayo, put to sea about a quarter to six, when the night was fine and starry. They dropped their nets about 250 yards from the shore, and had made an excellent catch when the storm suddenly broke over them. The fishermen immediately tried to reach the shore, but two of the boats were dashed against the rocks by the squall and

broken into pieces, and their entire crews (ten in all) were drowned."

"Another disaster occurred in Cleggan Bay, about eight miles north of Clifden, County Galway. A number of boats put off from Rossadelisk on Friday evening and cast their nets. About 7 o'clock a fierce squall struck them and all were swamped, except one boat, which cut its nets adrift and made for safety."

The destructive gale did not confine itself to Ireland but all the British Isles south of the track of the centre suffered. Many lives were lost through buildings, etc., being blown down and much general damage was done to property. Telephonic and telegraphic communication was seriously interrupted as many land lines were down. In Morecambe Bay, Fleetwood suffered severely on account of the giving way of the sea wall and for days the town and surrounding country remained flooded.

Below, a few of the maximum gusts in miles per hour are given, illustrating the intensity and extent of the storm :—

Southport	96	Sealand	82	Scilly	77	Spurn Head	74
Weaver Point	89	Cranwell	80	Falmouth	75	Eskdalemuir	74
Quilty	85	Valentia	79	Newcastle	75	Edinburgh	60
Holyhead	85	Fleetwood	78	Aldergrove	74	Kew	53

At Southport the mean velocity for the hour 23h. 30m. on the 28th to 0h. 30m. on the 29th was 70 m.p.h., while at Sealand between 22h. and midnight on the 28th the wind velocity ranged between 4 and 80 m.p.h.

With the Meteorological Section, R.A.F. Reserve at Cranwell

On Monday, October 3rd, 1927, there came into being a new and interesting addition to the activities of the Royal Air Force, when a small group of 16 members of the Royal Air Force Reserve, Meteorological Section, assembled at Cranwell, Lincs, for the first period of reserve training. Of this number, 12 were members of the staff of the Meteorological Office, the remaining 4 being R.A.F. Reserve personnel with meteorological experience, chiefly in the Near East. The total force comprised 2 Officers, 10 Corporals and 4 Leading Aircraftsmen. Fortunately, most of the new arrivals had become acquainted previously during the course of their civilian duties, and the "shaking down" was pleasant and not without its humourous side; one arrival in the "wee sma' hours" of the Tuesday morning left none of the assembled company long in doubt as to his place of origin. The 14 "other ranks" had been allotted a roomy and comfortable hut to themselves for their sojourn in these strange surroundings, and a regular R.A.F. Sergeant had been detailed as mentor. Any possible misgivings as to the nature of their reception were speedily dissipated by the tactful manner in which this sergeant discharged his friendly duties. Excellent arrangements had been made for the comfort of everybody concerned, and it was not long before the amenities of the camp were discovered. It was agreed generally that the food was very good.

It took some little time to comply with the service formalities, and to collect uniform and kit; but on Wednesday morning the transformation was complete, and 14 meteorological airmen appeared at 8 a.m. for parade and half an hour's squad drill under the tactful sergeant. This daily parade was an enjoyable feature of the training, during which no comments were heard anent the well-known property of a sergeant's heart to resist fracture, in spite of the fact that one diminutive corporal had to learn that the command "Left turn" referred to his "other left." By 9 o'clock the company had assembled at a vacant hangar, which they proceeded to transform into Meteorological Headquarters.

After this, things proceeded smoothly and comfortably; from 9 a.m. onwards we were no longer concerned with the routine of the regular forces; in our own hangar and on the adjacent aerodrome things meteorological were the order of the day. A second order station was set up, and the company divided into three groups, two working outside, with the third working inside on the charts. The prevalence of mist and light winds necessitated, however, that the grouping should be flexible, and it was arranged that everyone should receive practice in the routine with which they were least familiar from others who had had wider experience. In this way, for example, those unfamiliar with pilot balloon observations were enabled to gain useful knowledge. Regular observations were taken, involving the use of air meters for wind speeds and directions, and the incidental duties of fixing visibility objects and the making of barometer correction cards were carried out. The work was not, however, free from interruption; at 10 a.m. a travelling canteen created a diversion; the dinner time break from 12 noon to 2 p.m., and the cessation of duty at 4 p.m. were points to be observed with unfailing regularity. There were also three pay parades in twelve days! In addition to the practical work, the theoretical side was not forgotten. The theory of various types of balloon ascents and of the method of computation and compilation of artillery telegrams were dealt with in a series of lectures, and those responsible for these lectures were especially gratified at their immediate success and popularity and at the interest shown in the theory of operations which otherwise might tend to become merely mechanical routine.

Sleaford, Lincoln and Nottingham supplied attractions for after-duty hours, in addition to those to be found in and around the camp, a not inconsiderable fact, when it is recalled that Wednesday and Saturday afternoons were free, and that troops without bayonets were not required at Church Parade on Sunday, and that late passes were the general order.

It was unanimously agreed that the twelve days' course had been a thoroughly enjoyable and useful experience. Our thanks are due to the Officers and Non-Commissioned Officers with whom we were brought into contact for the manner in which things were made to run smoothly for us at all times, and the fact that the course coincided with the best weather of the "summer" guarantees us a hearty welcome next year.

F. H. DIGHT.

Discussions at the Meteorological Office

October 10th, 1927. *Recent researches on lightning in America.* *Opener*—Dr. G. C. Simpson, F.R.S.

The Director, in opening the first discussion of the new session, took as his subject a number of papers which have recently appeared in the technical journals of American electrical engineers. These papers deal mainly with the surges produced by lightning on high voltage transmission lines. The effects of such surges are always serious, as they put voltages on the electrical installation which they cannot withstand. The provision of lightning arresters minimises the actual damage done; but many surges put the lines out of action, and this is a serious matter for the machinery to which they supply power. The engineers of the Westinghouse Electric and Manufacturing Company have made a special study of surges, and Messrs. J. F. Peters, J. H. Cox and J. W. Legg have done particularly valuable work.

In order to determine the frequency of surges and to obtain some idea of the magnitude of the voltages induced in the lines, an interesting self-recording instrument, called the Klydonograph, has been developed. Three or four rods, each connected to one of the transmission lines, rest point down on a roll of photographic film, which is slowly drawn under them. When the potential on a line, due to a surge, rises to a certain value, an electrical discharge takes place from the point of the rod in contact with the film. Each discharge leaves a record, similar to the well-known Lichtenberg figures, from which a considerable amount of information can be deduced regarding the sign of the surge, its intensity and whether it occurred abruptly or relatively slowly.

Klydonographs have been in use on a number of transmission lines in America during two summers, and Mr. Cox has discussed the results. The number of positive and negative surges, and their relative intensity, are given in the following table, a positive surge being one which would be produced if the line received an excess of positive electricity.

NUMBER OF SURGES.

Intensity	1	2	3	4	5	6
Positive	446	51	29	19	12	6
Negative	5	6	10	6	10	11

In addition, there were a large number of surges, the polarity of which was both positive and negative, due to the oscillations set up across the lightning arresters.

Mr. Cox draws attention to the large number of positive surges compared with the small number of negative surges, and explains this in the following way. The negative surges are, as the table shows, mainly strong, more than half being of strengths 4, 5 and 6, and Mr. Cox considers that these were due to direct hits on the lines. When a lightning flash does not strike the line, but goes to earth near to the line, it induces a surge of the opposite polarity, and, of course, of much less intensity ; in this way positive surges are set up. Mr. Cox concludes from this that only discharges from negatively charged clouds produce surges on transmission lines. He explains this result by pointing out that according to the mechanism of a lightning flash recently described by Dr. Simpson in a paper " On Lightning," a negative discharge is much more intense and abrupt than a positive discharge. Hence, the induced surges, which depend on the rate at which the electrical field changes, are much larger in the case of negative than of positive discharges, thus accounting for the absence of negative surges due to positive discharges.

In the subsequent discussion, Dr. Simpson criticised Mr. Cox's explanation of the relative frequency of positive and negative surges. He said, that according to his examination of over 400 photographs of lightning, positive lightning discharges occurred at least four times as frequently as negative discharges. If, therefore, Mr. Cox was right in ascribing all the negative surges to direct hits from negative flashes, there should be at least four times as many direct hits from positive discharges. He also pointed out that on theoretical grounds it is very unlikely that an induced surge can ever be sufficiently intense to cause the large surges recorded by the Klydonograph. Dr. Simpson was therefore of the opinion that practically all the surges recorded were due to direct hits from lightning flashes, and that the relative number of positive and negative surges represents the relative frequency of flashes from positively and negatively charged clouds. When it is remembered that a positive discharge is always branched, and the end of any branch may strike the line, while every negative discharge has its full intensity in one stem at ground level, the relative frequency of weak positive discharges is explained.

The subject for discussion for the next meeting will be :—

January 16th, 1928. On the solar curve as dating the ice age, the New York moraine, and Niagara Falls through the Swedish time-scale. By G. de Geer (Geog. Ann. Stockholm 8, 1926, pp. 253-285), and other papers. *Opener*—Dr. C. E. P. Brooks.

Royal Meteorological Society

The Council of the Royal Meteorological Society has awarded the Symons memorial gold medal for 1928 to Professor Dr. Hugo Hergesell, Director of the Aeronautical Observatory, Lindenberg, for distinguished work in connexion with meteorological science. The medal, which is awarded biennially, will be presented at the annual general meeting on January 18th, 1928.

The monthly meeting of the Society was held on Wednesday, November 16th at 49, Cromwell Road, South Kensington, Sir Gilbert Walker, C.S.I., F.R.S., President, in the chair.

C. E. P. Brooks, D.Sc.—The Influence of Forests on Rainfall and Run-off.

Of the water vapour which is condensed as rainfall over the land, about two-thirds is provided by evaporation over the oceans, and the remaining third by evaporation and transpiration over the land. The latter contribution is made up of the evaporation of rainfall intercepted by foliage, evaporation from the soil, and transpiration, and estimates are made of these three factors for forests, crop or grass land, and bare soil. The figures are expressed as percentages of an average rainfall of 30 inches a year ; for forests they give : interception, 15 ; evaporation from soil, 7 ; transpiration, 25 ; total, 47 per cent. For crops : evaporation from soil, 17 ; transpiration, 37 ; total, 54 per cent. For bare soil : evaporation, 30 per cent. Thus, the replacement of forests by crops would tend to increase the supply of moisture to the air, and, therefore, the general rainfall slightly ; replacement by bare soil would decrease the general rainfall slightly. The changes in the run-off are likely to be more noticeable ; replacement of forests by crops would decrease the run-off by 15 per cent., and make it less regular ; replacement by bare soil would increase the run-off, but would make it highly irregular. A forest 30 feet high may be considered as adding about 30 feet to the effective height of the ground, and this should increase the local orographical rainfall by one or two per cent. Data obtained in various localities were examined in detail: at Mauritius, deforestation has resulted in a decrease by two or three per cent., while in Sweden, Germany and India the rainfall at forest stations is about one per cent. greater than that at neighbouring stations in the open, after making allowance for differences of exposure. The question of fog and dew was also examined, and it was found that under average conditions their total effect is slight.

C. K. M. Douglas, B.A.—The Secondary Depression on the night of January 28th-29th, 1927.

The discontinuities associated with this intense and deepening secondary depression were examined in detail by means of autographic records at a number of stations, some of which are reproduced in the paper. The results have a bearing on the recent work of Dr. J. Bjerknes, who has shown that the polar air behind a cold front is frequently warmed dynamically by descending movement until it is about as warm as the air in the "warm sector." About 70 miles behind the first cold front there was a "dry front," with a rise of temperature and sharp fall of relative humidity, separating air kept cold and damp by the rain, and air behind the rain area which had been warmed at the dry adiabatic rate when it descended. Near the centre of the secondary depression a "secondary warm sector" was developed after the original warm sector was "occluded," *i.e.*, displaced entirely from the lower layers of the atmosphere.

E. Kidson, D.Sc., F.Inst.P.—The Circulation of the Atmosphere over Melbourne.

It has been shown that it is possible to obtain estimates of wind velocity at high levels by means of nephoscope observations with accuracy sufficient at least for most purposes, both practical and theoretical. No other means is at present available for securing a comparable amount of data for the same levels in a climate such as that of Melbourne. These upper winds are freed from the purely local effects which make the treatment of surface winds so difficult. Much information can, therefore, be deduced from them regarding the general circulation. On the other hand, it is clear that large-scale local effects are still of great importance, so that the conclusions which can be drawn from the observations at one station are very limited. An attempt is made to find some relationship between the cirrus velocities and component values of cirrus velocities, and a number of other elements. Amongst these elements are the latitude variation of the travelling anti-cyclones of Australia, rainfall, pressure and wheat yield. The relationships are not simple, and the author confesses that so far he has been unable to obtain a clear mental picture of the processes involved.

Correspondence

To the Editor, *The Meteorological Magazine*

Fog of November 26th—27th, 1927

I have often observed considerable variations in the density of fog over short distances, and I was therefore impressed by the comparative uniformity of the fog this morning at Golders Green (about 10 a.m. on November 26th). I made almost continuous observations in walking a distance of over a mile from ground at an altitude of 300 feet to ground at an altitude of about 250 feet. The distance of visibility varied only between 14 yards and 18 yards. (The distance of visibility when I arrived in Victoria Street was well over 100 yards, and in Kingsway about 100 yards.) When I returned to Golders Green at 1 p.m. the visibility was only 7 yards on the low ground : higher up it was more variable : in some places it was 18 to 20 yards, and in others only 8-10 yards. The daylight was reasonably good : the objects observed were small trees and lamp-posts, and the ordinary criterion of visibility was used. The passage from non-visible to visible was comparatively sharp.

E. GOLD.

The time and space relationships of the fog in the London district were very interesting, and the following observations should be read in the light of my note in the *Meteorological Magazine* for February, 1925.

At 8.30 a.m. on November 26th, on the lower slopes of Hampstead Heath, the fog was very dense and damp, and there was hoar frost on the grass.

On reaching about the 300-foot contour, I rapidly walked out of the fog into brilliant sunshine and a light mild southerly breeze on the summit of the Heath at 450 feet. I anticipated this change, since the fog below, though dense, was young, and, therefore, probably shallow. This result agrees with that of the balloon reported to have been sent up at Richmond, though, of course, the thickness of a fog in the free air might quite well be different from that in the vicinity of a hill. The temperature, which was 36° down below, was certainly higher at the top, but, unfortunately, I omitted to visit the Hampstead Observatory to verify this. So striking was the contrast in the scene between the lower and higher slopes of the Hampstead ridge, that I could hardly believe it was not a time change instead of merely a space change. That it was entirely the latter, however, is proved by the fact that, on descending, I rapidly re-entered the fog at about the level of the Hampstead Tube station. The fog henceforth remained dense along the whole of my walking route to South Kensington. In the open district of St. John's Wood the fog was extremely dense, but, as I anticipated would be the case, it thinned noticeably in the close-built business thoroughfare of Baker Street, where the pavements which hitherto had been wet were quite dry. The colour had also changed from white to yellow.

As I got near Marble Arch, the vicinity of Hyde Park was making itself felt, for great woolly banks of vapour were rolling down the side streets. In Hyde Park—always a great pool of fog when there is any about—it was just as dense as on the lower slopes of Hamsptead Heath, and the temperature was even lower. Here, also, there was hoar-frost on the grass, though the trees were not in either place laden with rime, as the temperature of the air was above freezing.

As the day wore on there was no disposition for the fog to disperse, at all events north of the Thames, and at 1 p.m. the temperature in Hyde Park was still 34°, and the fog both thick and dense. In Knightsbridge about that time, although this is a close-built business street, there was some disposition for the fog to roll in the way that is so embarrassing to traffic. At King's Cross terminus, about 2 p.m., I observed a number of belated expresses arriving impressively through the gloom of a great and widespread winter fog. On returning to Hampstead at 3 p.m. I found the summit of the Heath enveloped ; that is to say, the fog had grown upwards during the day. Apparently it is only close to the Winter Solstice, say a month on either side between November 21st and January 21st, that a fog has a good chance to grow during the daytime. The extension of the fog in height towards evening appears to have acted as a screen to radiation during the ensuing night, preventing it from becoming thick at low levels ; for on the following morning of Sunday, November 27th, the distribution at Hampstead was the opposite of the previous morning, the fog being dense, with drizzle on the summit, but nothing more than a light mist below.

I should like once again to emphasize the importance in the discussion of London fogs of keeping the conception of the water element and the smoke element separate. It does seem to be the case that, as compared with the nineteenth century, the fogs of Central London are diminishing in severity as regards both water and smoke elements, consequent upon better drainage on the one hand, and upon smoke abatement on the other. We know little in London proper of the really severe water fogs, raw, damp, freezing, that they get down in the Essex marshes along the Thames Estuary by Muck Flats, Canvey and Foulness.

Finally, may I remark that it would be much better not to use the term " fog " for the night-like darkness of November 23rd. " Smoke-haze " is the proper term for that.

L. C. W. BONACINA.

27, Tanza Road, Hampstead, N.W. 3. November 29th, 1927.

Winter Thunderstorms

In October last an appeal* was made to readers of the *Meteorological Magazine* for reports of any thunder or lightning they might observe between October, 1926, and March, 1927. Efforts were made to secure the co-operation of observers in all parts of the British Isles. I am very much obliged to the large number of observers who were good enough to supply information.

During the period thunderstorms occurred somewhere in the British Isles on 96 days out of 182, as indicated in the following table :—

	England.	Wales.	Scotland.	Ireland.	British Isles.
1926					
October ...	16	11	10	9	21
November ...	18	11	10	12	20
December ...	5	1	4	0	8
1927					
January ...	14	8	16	14	23
February ...	6	1	3	2	7
March ...	14	5	3	7	17
TOTAL ...	73	37	46	44	96

The main stormy areas in England and Wales were in Devon and Cornwall, Sussex and Surrey, the Lake District, south-west Yorkshire and the Severn Valley. In Scotland the central part of the west coast was particularly disturbed. The prominent belt free from thunder stretching from Dorset to The Wash, which has been almost an annual feature of the storm distribution maps, was again marked.

The storm census is being continued during the present winter, and I shall again be grateful to any readers who may be good enough to send me reports of any thunder or lightning they may observe before April 1st next. A note of the place, date and time of the occurrence, with the direction in which the lightning was seen, especially at night, will be very valuable. Additional information concerning the duration, movements and severity of the storm, the accompanying weather conditions and temperature changes, will be extremely welcome.

S. MORRIS BOWER.

Langley Terrace, Oakes, Huddersfield. October 31st, 1927.

Minimum Temperatures on "Radiation Nights"

With "winter" defined as the months October to March (inclusive), and a "radiation night" as one in which the mean cloud

* *Vide Meteorological Magazine* 61 (1926), p. 217 and p. 237.

amount at 18h., 1h. and 7h. was 4/10ths or less, this note endeavours to find the relation between the screen minimum and grass minimum temperatures (both measured at 7 h., and both thermometers having standard and very good exposures) that has existed at Cranwell, Lincolnshire, which is 240 feet (approx.) above sea level, during the period October 1st, 1920, to March 31st, 1927, "winter" only being considered, on "radiation nights."

In determining the equations representing the relationships (using the usual graphical method) a three-fold differentiation was made with regard to wind speed during the night, as measured by a Dines anemometer whose head is 43 feet above ground level, taking the average of the readings at 18h., 1h. and 7h. as criteria.

Using T as the screen minimum temperature, and G, the grass minimum temperature, the three equations found were as follow :—

Mean Wind Speed.	Equation.	No. of Cases available.
8 m.p.h. or less	$T=0{\cdot}84\,G+11$	75
8 m.p.h. to 15 m.p.h.	$T=0{\cdot}89\,G+8$	94
15 m.p.h. or more.	$T=0{\cdot}94\,G+5$	50

In each case the closeness of the points on the graphs to the lines represented by the above equations was most striking.

W. H. Pick.
J. Paton.

R.A.F. Station, Cranwell, Lincolnshire, October 7th, 1927.

Road Mirages

To the motorist nowadays, the road mirage is a commonplace occurrence ; in fact, on some days the mirages are so numerous as to become almost a source of annoyance when driving. Probably the best effects are seen by the passenger in the low-built sidecar of the modern combination. It is a curious fact that no particular notice seems to have been taken of these mirages until comparatively recently, the first published description of a mirage appearing on a road in this country which I have been able to trace is by Alexander Rumage in the *Proceedings of the Royal Society of Edinburgh* in 1918. No doubt these mirages are due to the manner in which the road surface is now treated with tar and small stones or sand ; personally, I have never observed a mirage on an untarred macadam surface, but tarred roads were quite common before 1918.

The phenomenon was first brought to the notice of the general public during the hot summer of 1921 by the press, and for some time it was a lunch time amusement of the Londoner to lie on his stomach by Admiralty Arch in order to observe the mirage in the Mall.

A point regarding these road mirages, which has always seemed somewhat inexplicable to me, is the fact that they do not appear to be disturbed by passing traffic. I know of a stretch of main road in south-west London, where, looking from the top of the hill, a very good mirage may be observed on almost any warm and sunny day in the summer. There are tram lines laid along this road, with a fairly frequent tram service running, and a constant stream of buses and cars passing up and down. The traffic along the road is particularly heavy at week ends as it is one of the main ways out into Surrey, used by the small car owner and the motor cyclist. Yet on some Saturdays and Sundays I have known a mirage to persist nearly all day long.

The formation of a mirage must be due to a certain temperature distribution close to the ground surface, and one would think that the passage of a constant stream of vehicles of all descriptions would so stir up the air as to destroy this distribution. Even assuming that the mirage is due to the temperature distribution for a very short distance above the road surface only, the turbulence produced actually on the ground by the passage of a motor car is very considerable, if one is to judge by the effect on small pieces of paper, leaves, &c.

T. W. VERNON JONES.

The Fouling of Barometer Tubes

In the introductory remarks of a paper entitled " On the Union of Helium with Mercury," by J. J. Manley, M.A., in the *Philosophical Magazine* for October, 1927, the following statement occurs :—

" It is well known that when a barometer tube containing its normal column of mercury is moved up and down, electric charges are generated upon the glass. If a little gas be present within the tube a feeble glow is produced, and this is usually accompanied by chemical action, and a consequent decrease in pressure. In many cases also the glass walls become stained and ultimately coated with solid matter ; this readily happens when the experiment is made with oxygen, nitrogen or air."

It has been shown that dirt in the vicinity of the top of the mercury column will cause the meniscus to vanish and result in positive errors of reading of about 1 mb. (Geophysical Memoirs, No. 27). During a recent inspection tour I came across several more barometers which exhibited similar symptoms, *e.g.* no meniscus and readings too high. In the time available during inspection, it was impossible, of course, to determine the range of tube fouling in each case. It seems possible that Manley's experiments may throw some light on the processes causing the fouling of barometer tubes. Assuming the presence of a minute quantity of air in a tube, the rise and fall of the mercury during atmospheric changes may generate minute charges on the glass and give rise to chemical action. Under such conditions the fouling would take a very long time. It would be interesting however, to know whether marine barometers become afflicted in this way more frequently owing to pumping action at sea than station barometers.

N. H. SMITH.

R.A.F. Station, Bircham Newton, Norfolk, November 3rd, 1927.

Waterspout over southern North Sea

At my request Squadron Leader Livock, D.F.C., of this station, has written out an account of the unusual weather he and his passengers experienced on a long endurance trip over the North Sea. I thought it would make interesting reading, especially in view of the article published in the August number of the Magazine, "Waterspout on Loch Leven." The account is set out below.

"Southampton Flying Boat N.218 left Felixstowe at 9h. 30m. on August 25th, 1927, for an endurance and wireless test over the North Sea. The course followed was Felixstowe—Hook of Holland—Flamboro' Head—Felixstowe.

"The weather at the start was hazy, with thin clouds at 700 feet, wind W., 10 m.p.h. The flying boat kept above the thin clouds for the first hour or so, when it became necessary to descend to within 400 feet of the water owing to the increasing density of the clouds.

"Shortly afterwards, at 11h., and roughly in a position 15 miles west of Schouen Island, whilst skirting a heavy rain storm, my attention was drawn by the pilot (Flight-Lieut. Sawyer) to what appeared to be a complete waterspout about 5 miles south of us, reaching from a layer of clouds at about 1,000 feet to another layer at about 300 or 400 feet. This lower cloud seemed to reach right down to the water. The upper cloud was very dark and thundery looking; the lower one looked like a thick haze. The waterspout had the appearance of a very definite and clear-cut column of black cloud, thicker at the top and bottom than in the centre, and having a decided regular bend in the middle—like a bow.

"This phenomenon remained for fully five minutes, after which a layer of low cloud hid it from view, and it was not seen again. I do not think it could possibly have been a streak of cloud, as it was so sharply defined and clear cut at the edges. It looked exactly like some photographs I have seen recently in various periodicals of waterspouts during tornadoes in Florida.

"During the rest of the flight the weather was also extraordinary. Mostly it was clear and sunny, but frequent and very heavy rainstorms were met all the way from Holland to the Yorkshire coast. The rainstorms were exceptionally heavy—in fact, some of them were quite tropical in their intensity. All these rainstorms were very local, some only being a few hundred yards in diameter. The wind during most of the flight was constantly changing force and direction. The weather, in fact, generally was very similar to that experienced in the Straits of Malacca during the so-called wet season, or the Indian Ocean during the period immediately following the south-west monsoon. I have never before seen these conditions in the North Sea, at any rate in such a pronounced form In fact, the conditions, except of course from the temperature point of view, were entirely tropical."

The remarks by F. E. at the conclusion of the article on "Waterspout on Loch Leven" would appear to apply to the present case. He states that, in accordance with Mr. Giblett's view, waterspouts are associated with line squall phenomena, and in particular the region of strong air convergence immediately below the squall cloud which marks the forward edge of the advancing cold air.

The 7h. synoptic chart for August 25th shows a ridge of high pressure extending north-eastwards across the British Isles from an anticyclone off our south-west coasts. During the day the ridge moved south-eastwards, and a depression centred to the north-west of Iceland moved away north-eastwards.

Associated with this ridge, a very definite tongue of cold air can be identified on the maps. Continuing to move south-eastwards, this advancing air must have reached a position off the west of Denmark about 10h. in the morning, where strong air convergence, due to the cold air undercutting the warm air, would give rise to the waterspout phenomena on the lines indicated by Mr. Giblett. C. W. LAMB.

Felixstowe, September 14th, 1927.

NOTES AND QUERIES

Heavy Rainfall in Rhodesia

The *Meteorological Report of Southern Rhodesia* for the year ending June 30th, 1926, contains particulars of abnormally heavy rainfalls during September, 1925, January and March, 1926.

September was the wettest on record except for 1901. The precipitation occurred mostly in the form of thunderstorms and hailstorms. In October the rainfall was only slightly below normal, but in November and December the totals were so small that the planting season was a difficult one. There has been only one previous November on record during which the average rainfall was lower, viz., November, 1912, when the mean was 0·46 in. It was in January, in eastern Mashonaland, that the most continuous heavy rain occurred. Here the average rainfall was 33·90 in. as compared with a normal of 12·97 in. The maximum falls occurred at Brackenbury and Springvale, both in the Melsetter District, and constituted new records for the Colony, the previous highest monthly total having been 54·10 in. at Mount Selinda in January, 1918. The daily records given below indicate the abnormal rainfall between the 6th and 20th.

Date	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th	13th	14th
Brackenbury	—	1·10	—	—	0·86	3·76	3·90	4·20	4·25	3·65	4·10	3·80	3·80	4·60
Springvale ...	—	—	0·13	0·19	0·54	2·04	1·03	0·26	1·32	3·02	1·13	2·05	9·17	3·07

Date	15th	16th	17th	18th	19th	20th	21st	22nd	23rd	24th	25th	26th-30th	31st	Total
Brackenbury	4·22	3·99	3·91	4·32	3·03	3·10	—	—	0·65	—	0·26	—	0·67	62·17
Springvale ...	3·04	5·53	4·58	7·04	5·01	7·19	—	—	—	—	—	—	—	56·81

Continuous heavy rain was also experienced between January 9th and 20th in the Umtali district, when totals of 29·76 in. and 26·59 in. were recorded for the 12 days at Stapleford and Chimeze respectively. Owing to these heavy rains "abnormal floods were experienced along the eastern border, which resulted in extensive washaways on the railway between Umtali and Beira. The damage was so serious that communication was not resumed until April."

A storm of unparalleled intensity occurred at Tjompani, in Bulalima-Mangwe district, on the night of March 7th, 1926. The observer (Mr. F. Rayner) states: "At 7 p.m. on the 7th, a black heavy cloud a few miles north-west from here assumed a funnel shape and started in this direction; lightning was very vivid and continuous. The waterspout burst near here, and a wall of water came against a light south-east wind. We got it at 8 p.m., and in 40 minutes 6 inches fell. It passed on then to the mission and Plumtree direction. It was followed by a gentle rain. Storm was only about 3 miles wide; much lighter south-west from here, where only 1 inch fell."

New Rainfall Record

According to the *Bulletin of the American Meteorological Society,** the record for intense rainfall (2·47 in. in 3 minutes at Porto Bello, Panama, on November 29th, 1911) was broken during

*Vol. 8, 1927, p. 142.

the early morning of April 5th, 1926, at Opid's Camp on the west front of the San Gabriel Range, California, when 1·02 in. of rain fell in one minute. The fall was measured by a Fergusson weighing rain-gauge with a good exposure. "By a lucky chance the observer, John T. Opid, had set up a second gauge of the same pattern in order to compare it with the station gauge previous to its installation at another camp some miles away. Thus it happened that the shower was recorded by two gauges, and the records were practically identical."

Heavy Daily Falls of Rain in France during 1926*

While details of the heavy falls of rain during 1926 in the British Isles are still fresh in our minds, it may not be without interest to refer to the extremes recorded in France. M. J. Sanson (Sous-Chef de Section technique à l'Office National Météorologique) shows that there were 34 records of more than 100 mm. (3·94 in.) in 24 hours in the course of the year. The corresponding number for the British Isles is very close, being 29, but the extreme values are considerably less than those recorded in France. The largest value for these islands was 6·05 in. on July 18th at Abergwesyn (Nantneuadd) in the mountains to the west of Llanwrtyd Wells in Central Wales. In France this amount was exceeded on four occasions, the largest falls being 7·48 in. on September 1st at the Mont-Aigoual (Gard) and 7·39 in. on November 18th at Trigance (Var), both in the extreme south-east of the country. In the British Isles the daily falls exceeding 100 mm. were distributed about equally between summer and winter months, but in France four-fifths of such falls occurred in September, October and November. The heavy falls in the British Isles for 1926 were fairly well distributed, some occurring in each country, and in the plains as well as in the mountain areas, but in France they were mainly confined to the mountains south of latitude 45°, *i.e.*, roughly south of Bordeaux and Valence. In the mountainous south-eastern portion of France between the Rhone and the Alps, the autumn is usually very wet, October being the wettest month of the year.

As the year 1926 was generally very wet in France, the heavy daily falls were not so marked as might have been expected. In the British Isles, with only a slight excess, the number of heavy falls was about the average.

It is interesting to recall that while the largest daily falls available for the British Isles are 9·56 in. at Bruton on June 28th, 1917, and 9·40 in. at Cannington on August 18th, 1924, those in

* *Les grandes pluies en France pendant l'année* 1926. By M. J. Sanson, Météorologie, Paris, 3 (1927) pp. 221, 222.

France have exceeded 10 inches on a number of occasions. Some of the largest amounts are :—

	Inches.
Joyeuse (Ardèche), 9th October, 1827	31·18
L'Observatoire de Perpignan (Pyrénées Orient), 26th October, 1915	17·13
Le Mont-Aigoual (Gard), 20th May, 1917	14·52
Bessèges (Gard), 24th September, 1919	11·81
Orange (Vancluse), 23rd September, 1924	11·33

It will be noticed that all these stations are situated in the extreme south-east of France, and that four out of the five entries occur in the autumn. The largest fall on record was measured 100 years ago, when it rained continuously for 22 hours.

J. GLASSPOOLE.

Air Temperatures during rain at Kimberley

A good soaking rain of some duration, at Kimberley, will, in a few hours, be accompanied by a cooling of the air to a degree which will alter very little until the end of the shower. Immediately afterwards the temperature mostly rises again by day, and often by night. For example—

On March 15th, 1926 :

Hour	14	15	16	17	18
Temperature (°F.)	75·4	56·5	57·3	61·0	61·9
Rainfall (inch)		·710	·060	·060	—

Lowest temperature observed 56°·5, average (mean of mean daily max. and min.) for March, 1926, 72°·3, difference 15°·8.

On January 26th, 1923 :

Hour ...	14	15	16	17	18	19	20	21	22	23	Midt.	1
Temp. (°F.) ...	71·2	64·0	61·0	61·0	61·0	61·0	61·0	61·0	62·0	62·1	62·5	63·5
Rain (inch) ...		·130	·430	·190	·001	·009	·040	·080	·040	·009	·008	·010

Lowest temperature observed 61°·0, average (mean of mean daily max. and min.) for January, 1923, 75°·9, difference 14°·9.

The minimum temperature of the air during these continued showers is, perhaps, of some interest.

Suppose we tabulate for each month of the ten years 1916 to 1925 the lowest temperature reached by the air during each rain spell lasting some hours in which the humidity rises above 90 per cent. Then take the average of these minima for any given month and compare it with the mean temperature of the month. The table below shows that the differences between these monthly averages and monthly means vary progressively from midsummer to midwinter.

For each month of Column A—

Column B gives the number of continued showers satisfying the humidity conditions.

Column C the average of the minimum temperatures reached by the air during these showers.

Column D the lowest, and Column E the highest, of these minima.

Column F the mean temperatures of the air for the months that have the rain. They differ a little from the normal means.

Column G the differences F – C.

According to the table there is a difference in December of more than 13° F. between the mean temperature of the air and the average minimum during rain ; whereas in May the corresponding difference is less than 2°. June has to be left out of account for lack of material.

TEMPERATURE OF AIR DURING RAIN, 1916 TO 1925.

	Frequency	Average Minimum	Lowest Minimum	Highest Minimum	Monthly Mean	Difference F – C
A	B	C	D	E	F	G
		°	°	°	°	°
Jan. ...	7	63·3	59·0	66·8	76·1	12·8
Feb. ...	15	63·3	57·2	66·2	73·4	10·1
Mar. ...	24	61·6	55·5	67·5	69·3	7·7
Apr. ...	7	58·2	54·0	65·1	62·1	3·9
May ...	8	51·7	48·5	53·2	53·6	1·9
June ...	1	39·7	—	—	47·7	—
July ...	4	45·6	41·5	49·8	49·2	3·6
Aug. ...	4	46·6	43·6	51·1	53·9	7·3
Sept. ...	3	52·8	48·9	57·0	61·0	8·2
Oct. ...	5	58·2	53·5	60·2	68·9	10·7
Nov. ...	7	59·0	55·0	61·5	70·9	11·9
Dec. ...	8	61·2	58·0	65·0	74·4	13·2

J. R. SUTTON.

East-Monsoon Forecasting in Java*

The first forecasts of seasonal rainfall in Java were based on the well-known three-year periodicity of barometric pressure at Batavia and Port Darwin.(†) Periodicities are treacherous allies, however, and the method has not been so successful as it promised, and in this paper Dr. Berlage investigates the reasons for the occasional failures ; in doing so he develops a new, empirical method of forecasting. The basis of the formula is the observed fact that the change of pressure at Port Darwin is closely related to the sea temperature south of Celebes ; the winds associated with the pressures also affect the sea temperature, so that " the interaction of air-pressure and temperature...generates regular oscillations of both elements about their normal values if no external causes intervene." The forecasting formula for the rains of the second half of the east monsoon (July to September)

*East-Monsoon Forecasting in Java. By Dr. H. P. Berlage, Jr. *K. Mag. Meteor. Obs. Batavia, Verh. No.* 20. Size 10½×7¼, pp. 42. *Illus.* Batavia, 1927.

† See *Meteorological Magazine* 55 (1920), p. 205.

therefore begins with the pressure at Batavia in the preceding December to February and in the December to February before that (" what will be, does not only depend on what is, but also on what has been ") and air temperature at Singapore, as the best available representative of the sea temperature. This gives satisfactory results in most years, but there are some exceptions. These are allowed for partly by introducing a wind component, which is ingeniously derived from the ratios of rainfalls on different sides of a mountain in south-west Celebes. The rainfalls for west Java calculated by this combined formula have a correlation of ·85 with the observed rainfalls (1879 to 1924). So far only purely local elements have been considered, but a still further improvement is obtained by making use of the observed coincidence that the rare rains of northern Peru, which fall only once in seven (6·8) years, are almost invariably followed by droughts in Java. This relationship is allowed for by deducting 10 cm. from the forecasted rainfall for those years, and the final forecasts have a correlation with observed values of ·86 in west Java, ·81 in central Java and ·72 in east Java. A closer approximation is for the present barred by the fact that sudden rises of pressure and droughts occur exactly at sunspot minima, and it is not yet possible to forecast the minima of sunspots. The paper is an interesting example of the gradual approach to perfection by tracing failures to disturbing causes and so bringing more and more factors into the formula.

Mysore Meteorological Memoirs

The first of the *Mysore Meteorological Memoirs* was published as early as 1901, and contained hourly values of barometric pressure for each of the years 1895-8, but only the monthly means of the hourly values of each of the other elements (dry and wet bulb temperatures, vapour pressure, humidity, rain, wind and sunshine) recorded at the Bangalore Observatory. The second memoir also contained only monthly averages of the hourly means for all elements, including pressure for each of the quadrennial periods 1895-8, 1899-1902 and 1903-6, and for the twelve-year period 1895-1906. Since then the hourly values for each year have been published as separate memoirs, those for 1909-13 (Memoirs V.-IX.) having just been received.

Control readings of a standard barometer are taken ten times a day, and of a standard thermometer six times daily. The pluviograph and anemograph are both of the Beckley type. As it was found that, even with a cloudless sky, the strength of the solar image was insufficient to char the card for half-an-hour after sunrise and half-an-hour before sunset, the maximum period of sunshine between sunrise and sunset has been taken to be an hour less in estimating the percentage of bright sunshine. It is gratifying to note the progress which the Mysore Meteorological Department is making towards bringing their publications up to date.

Reviews

Climate and Geography. By O. J. R. Howarth. Size $7\frac{1}{4} \times 4\frac{3}{4}$, pp. 61. *Illus.* The Oxford Geographers, Oxford University Press, 1927.

This useful little book is stated to have been written "to supplement where desirable the sections on climate in geographical text-books." In about 50 pages of text it contains a good deal of information calculated to be of value to teachers, including a chart of the annual range of mean monthly temperatures and an account of the "polar front" theory of cyclones. An appendix includes tables of monthly mean temperature and rainfall for a number of stations typical of different climates. The preface states that the book has been written in collaboration with Mr. M. A. Giblett.

The Brückner Cycle of climatic oscillations in the United States. By A. J. Henry, Annals of Association of American Geographers, June, 1927, pp. 60-71. Hamilton, New York.

Professor A. J. Henry has examined a number of long series of meteorological records, especially regional averages for the United States, with a view to determining whether series of warm or cold, or ot wet or dry years occur around the dates given by Brückner as the maxima and minima of his 35-year cycle of temperature and rainfall. He finds that there are such sequences of abnormal years, but that the average interval between them is from 9 to 16 years instead of 35 years. Some of the maxima or minima agree with Brückner's dates, but there is nothing to distinguish them from the other maxima and minima occurring at intermediate dates. This result does not disprove the reality of Brückner cycle, which, as Prof. Henry himself remarks, was supported by overwhelming evidence, and has never been seriously questioned, but it brings out clearly that its amplitude is not large enough to dominate the changes of a few years' duration. In order to demonstrate the existence of the longer cycle, the data must either be analysed into an harmonic series or smoothed by averaging over a period of about fifteen years.

C. E. P. Brooks.

News in Brief

Lieut. Col. E. L. Bond, D.S.O., R.A., has been appointed Representative of the War Office on the Meteorological Committee in place of Lieut. Col. J. U. Hope, D.S.O., R.A., who has been elected Secretary of the Ordnance Committee.

The Academy of Sciences has decided to divide the Nobel Physics Prize for 1927 into two halves, one of which is awarded to Prof. C. T. R. Wilson, of Cambridge, for his method of observing electrified particles. The other recipient is Prof. A. Compton, of Chicago.

According to *The Times,* it is announced in Johannesburg that Dr. Robert Innes, Union Astronomer since 1911, is retiring at the end of the year. Dr. Innes went to South Africa in 1896 as Secretary of the Royal Observatory at the Cape, becoming Director of Meteorology (Transvaal) in 1903.

The Weather of November, 1927

Cold unsettled weather prevailed generally throughout November, with the exception of the first few days, during which the conditions were mild, with moderate to strong southwesterly winds and much rain. Temperatures higher than any previously recorded in November were reported on the 2nd from Eskdalemuir (59° F.), Aberdeen (63° F.), Yarmouth (64° F.) and Tynemouth (67° F.), and on the 3rd, from Kew Observatory (64° F.), where the previous maximum was 63° F. in 1876. Among the largest rainfall amounts were 4·03 in. at Treherbert (Glamorgan) and 2·47 in. at Cardiff on the 1st, and 2·30 in. at Strathspey (Lancaster) on the 2nd. As the low pressure system shifted northeast, the winds became first westerly, then northerly, and increased to gale force locally on the 5th-6th. Sleet, hail and snow fell in the north, and thunderstorms and heavy rain occurred locally, East Ayton (Yorkshire) having 1·73 in., and Llanerchymedd (Anglesey) 1·55 in., both on the 7th. The drop in temperature was very striking. At Kew, for example, the maximum on the 8th was 38° F., 26° F. lower than on the 3rd, while the minimum readings showed similar differences. On the morning of the 9th a screen minimum temperature of 18° F. was registered at West Linton, and a grass minimum of 11° F. at Blackpool. Snow lay on the ground in Scotland and northeast England, and on the 8th was 8 in. deep at Balmoral and 11 in. deep at Slochd (Inverness). Further strong northerly winds and gales occurred on the 7th to 11th, gusts of about 60 m.p.h. being measured at Tiree (Hebrides) and in northwest England, and snow, sleet and hail fell again in various places in both Scotland and England, the depth of snow lying being 17 in. at Slochd (Inverness) on the 11th. The lowest screen temperature of the month (13° F.) was recorded at Balmoral on the 13th. On the 14th the winds backed, and during the next few days somewhat milder conditions prevailed with southerly winds, but between the 18th and 21st the wind shifted to the east and became strong at times, with gales at a few exposed places. From the 22nd to 28th quiet cloudy weather occurred in the southeast and Midlands, with much fog at times, especially on the 26th, when it lasted most of the day. In the north and west the winds were mainly southwesterly in direction and strong in force during most of this time, and the weather unsettled with local rain. On the 29th heavy rain in southeast England, *e.g.*, 1·57 in. at Upton Grey (Hampshire) was associated with a shallow trough of low pressure which passed across these islands in the early morning. In its rear, the weather over the country became cloudy to fine, with much morning mist or fog.

Pressure was above normal in a belt stretching from northern Scandinavia across the Netherlands, British Isles and North Atlantic to Bermuda and Newfoundland, and also in Italy and south-east France, the greatest excess being 7·2 mb. at St. John's, Newfoundland. Pressure was below normal in Spitsbergen, Iceland and most of Spain, France and Switzerland. Temperature was below normal over the whole of Europe except in parts of Switzerland and at Spitsbergen, the deficit amounting to 9°—11° F. in the north-west of Dalecarlia (Sweden). Precipitation was generally above normal in the districts surrounding the North Sea and Spitsbergen and below normal in northern Scandinavia and Switzerland.

Stormy weather prevailed generally over Europe from the 9th to 11th, the gales causing much damage to shipping along the coasts of Spain, Portugal and south France and in the Tyrrhenian and Adriatic seas, while severe floods followed the heavy rains in northern France, western Germany and Switzerland. In Switzerland the floods soon abated somewhat in consequence of a large drop in the temperature and the heavy snowfalls, which occurred after the 10th and which caused the ski-ing season to begin much earlier than usual. The drop in temperature was not confined to Switzerland and between the 13th and 15th trains and trams in Lithuania, Latvia and Estonia were held up for many hours on account of the heavy snow, and owing to the severe cold shipping ceased for the season in the upper Norrland about the 15th, and wolves have been seen in larger numbers than usual on the eastern borders of Poland. Thunderstorms and gales caused loss of life in Spain between the 18th and 21st and snow was reported in Asturias and the Spanish zone in Morocco.

Much of the crops in the citrus orchards in the northern Transvaal were destroyed by hail on the 6th and many animals were killed. As the result of the heavy rain in Morocco, Safi, a port on the Atlantic coast, suffered serious damage on the 23rd owing to the flooding of the river which passes through the town. Torrential rains in western Algeria caused the bursting of the Wad Fergoug dam on the 25th and in consequence about 900 square miles of the low lying Perrégaux, Mostaganen and Ténès districts were flooded. It is estimated that about 2,000 people lost their lives. Villages isolated by the water received food supplies by aeroplane. Heavy rain continued to fall until the 30th when the Wad Chélif also overflowed its banks. By the 1st the weather had become fine and the floods were abating.

A severe storm swept across Nellore (India) on the 5th followed by floods. Much damage was done and it is believed that about 200 people were killed. Violent storms were also reported from the Arabian Sea and Bombay on the 12th when nearly 5 in. of rain fell at Bombay. Several ships were sunk.

Rains of unprecedented violence occurred during the first few days of the month in the New England States of Vermont, Massachusetts and Connecticut, and these were followed by widespread floods as many of the river dams and reservoirs on the Connecticut river and its tributaries burst. Many villages and small towns were wiped out as the crest of the flood passed down the river. By the 7th the floods had began to subside in Vermont and New Hampshire and by the 8th in the more southern states. Below Hartford the river widens rapidly and the floods were not serious. About 150 people were drowned and the distress of the homeless was accentuated by the severe cold. Relief work was carried out mainly by means of aeroplanes. On the 5th the floods extended northwards to the eastern townships of Quebec where much damage was done and 9 people were drowned. By the 7th these rivers were also returning to their normal level and a drying sun was improving the conditions. On the 17th a violent storm swept across Washington, New York State and parts of Pennsylvania, a rainstorm caused further difficulties in the flooded districts of Vermont, and in the west a blizzard brought 2 in. of snow over northern Illinois, Indiana and southern Wisconsin.

The special message from Brazil states that in the central districts the rainfall was very scarce, being 4·0 in. below normal, in the northern districts the average was 0·5 in. below normal and in the southern districts the distribution was irregular, but the average was 1·6 in. above normal. Six anticyclones passed across the country and depressions were frequent in the south and were associated with abnormally high temperatures in the Argentine and southern Brazil. At Rio de Janeiro pressure was 0·9 mb. above normal and temperature 0·7° F. above normal.

Rainfall, November, 1927—General Distribution

England and Wales ..	121	per cent. of the average 1881-1915.
Scotland	106	
Ireland	93	
British Isles	111	

Rainfall: November, 1927: England and Wales

CO.	STATION.	In.	Per-cent. of Av.	CO.	STATION.	In.	Per-cent of Av.
Lond.	Camden Square	2·60	110	*Leics*	Thornton Reservoir	3·76	166
Sur.	Reigate, The Knowle	2·97	102	,,	Belvoir Castle	3·12	140
Kent.	Tenterden, Ashenden	3·02	100	*Rut.*	Ridlington	3·31	...
,,	Folkestone, Boro. San.	3·57	...	*Linc.*	Boston, Skirbeck	3·15	158
,,	Margate, Cliftonville	2·65	110	,,	Lincoln, Sessions House	2·52	134
,,	Sevenoaks, Speldhurst.	3·17	...	,,	Skegness, Marine Gdns.	2·84	131
Sus.	Patching Farm	3·55	100	,,	Louth, Westgate	3·39	131
,,	Brighton, Old Steyne	3·39	106	,,	Brigg	...	...
,,	Tottingworth Park	4·16	112	*Notts.*	Worksop, Hodsock	2·30	117
Hants	Ventnor, Roy.Nat.Hos.	3·55	111	*Derby*	Derby	3·14	145
,,	Fordingbridge, Oaklnds	3·78	111	,,	Buxton, Devon. Hos.	4·77	102
,,	Ovington Rectory	4·48	135	*Ches.*	Runcorn, Weston Pt.	3·82	138
,,	Sherborne St. John	3·84	135	,,	Nantwich, Dorfold Hall	2·86	...
Berks	Wellington College	3·08	120	*Lancs*	Manchester, Whit. Pk.	3·22	122
,,	Newbury, Greenham	3·24	116	,,	Stonyhurst College	5·49	122
Herts.	Benington House	2·54	107	,,	Southport, Hesketh Pk	4·28	136
Bucks	High Wycombe	3·82	153	,,	Lancaster, Strathspey.	5·02	...
Oxf.	Oxford, Mag. College	2·60	118	*Yorks*	Wath-upon-Dearne	2·59	127
Nor.	Pitsford, Sedgebrook	3·00	136	,,	Bradford, Lister Pk.	3·43	117
,,	Oundle	2·55	...	,,	Oughtershaw Hall	7·86	...
Beds.	Woburn, Crawley Mill.	2·17	97	,,	Wetherby, Ribston H.	2·49	106
Cam.	Cambridge, Bot. Gdns.	2·22	115	,,	Hull, Pearson Park	2·47	113
Essex	Chelmsford, CountyLab	2·32	103	,,	Holme-on-Spalding	2·56	...
,,	Lexden, Hill House	2·23	...	,,	West Witton, Ivy Ho.	4·09	...
Suff.	Hawkedon Rectory	2·87	126	,,	Felixkirk, Mt. St. John	3·18	130
,,	Haughley House	2·26	...	,,	Pickering, Hungate	4·30	...
Norf.	Beccles, Geldeston	3·96	170	,,	Scarborough	4·[illegible]6	181
,,	Norwich, Eaton	5·17	201	,,	Middlesbrough	3·73	176
,,	Blakeney	2·59	117	,,	Baldersdale, Hury Res.	4·40	...
,,	Little Dunham	3·44	133	*Durh.*	Ushaw College	2·19	86
Wilts.	Devizes, Highclere	2·62	99	*Nor.*	Newcastle, Town Moor.	2·77	115
,,	Bishops Cannings	2·80	98	,,	Bellingham, Highgreen	3·82	...
Dor.	Evershot, Melbury Ho.	3·77	88	,,	Lilburn Tower Gdns.	3·45	...
,,	Creech Grange	4·13	...	*Cumb*	Geltsdale	4·98	...
,,	Shaftesbury, Abbey Ho.	3·44	106	,,	Carlisle, Scaleby Hall	4·25	142
Devon	Plymouth, The Hoe	4·39	120	,,	Seathwaite M.	...	...
,,	Polapit Tamar	4·08	96	,,	Keswick, High Hill	4·72	...
,,	Ashburton, Druid Ho.	4·41	78	*Glam.*	Cardiff, Ely P. Stn.	5·90	142
,,	Cullompton	4·03	117	,,	Treherbert, Tynywaun	9·69	...
,,	Sidmouth, Sidmount	3·23	104	*Carm*	Carmarthen Friary	5·95	119
,,	Filleigh, Castle Hill	3·81	...	,,	Llanwrda, Dolaucothy.	6·13	104
,,	Barnstaple, N.Dev.Ath.	3·75	95	*Pemb*	Haverfordwest, School	6·83	136
Corn.	Redruth, Trewirgie	5·60	103	*Card.*	Gogerddan	3·27	69
,,	Penzance, Morrab Gdn.	4·02	88	,,	Cardigan, County Sch.	4·99	...
,,	St. Austell, Trevarna	4·60	94	*Brec.*	Crickhowell, Talymaes	5·00	...
Soms	Chewton Mendip	5·03	118	*Rad.*	Birm.W.W.Tyrmynydd	4·41	66
,,	Street, Hind Hayes	2·95	...	*Mont.*	Lake Vyrnwy	7·76	140
Glos.	Clifton College	3·21	102	*Denb.*	Llangynhafal	4·49	...
,,	Cirencester, Gwynfa	2·54	85	*Mer.*	Dolgelly, Bryntirion	6·80	110
Here.	Ross, Birchlea	3·01	119	*Carn.*	Llandudno	5·11	165
,,	Ledbury, Underdown.	3·08	126	,,	Snowdon, L. Llydaw 9	20·46	...
Salop	Church Stretton	4·48	153	*Ang.*	Holyhead, Salt Island.	6·00	145
,,	Shifnal, Hatton Grange	3·11	130	,,	Lligwy	7·47	...
Worc.	Ombersley, Holt Lock.	3·07	135	*Isle of Man*			
,,	Blockley, Upton Wold.	2·95	100		Douglas, Boro' Cem.	5·01	106
War.	Farnborough	3·35	122	*Guernsey*			
,,	Birminghm, Edgbaston	3·83	161		St. Peter P't.Grange Rd	4·40	105

Rainfall: November, 1927: Scotland and Ireland

CO.	STATION.	In.	Per-cent. of Av.	CO.	STATION.	In.	Per-cent of Av.
Wigt.	Stoneykirk, Ardwell Ho	4·71	118	*Suth.*	Loch More, Achfary	8·34	98
,,	Pt. William, Monreith	5·13	...	*Caith*	Wick	3·63	116
Kirk.	Carsphairn, Shiel.	7·80	...	*Ork.*	Pomona, Deerness	4·50	115
,,	Dumfries, Cargen	5·46	121	*Shet.*	Lerwick	6·05	142
Roxb	Branxholm	2·24	68	*Cork.*	Caheragh Rectory	6·08	...
Selk.	Ettrick Manse	5·69	...	,,	Dunmanway Rectory	6·21	100
Berk.	Marchmont House	3·31	110	,,	Ballinacurra	4·04	101
Hadd	North Berwick Res.	1·89	84	,,	Glanmire, Lota Lo.	4·17	97
Midl	Edinburgh, Roy. Obs.	1·40	65	*Kerry*	Valentia Obsy.	4·12	76
Lan.	Biggar	...	...	,,	Gearahameen	9·90	...
,,	Leadhills	...	...	,,	Killarney Asylum	5·64	101
Ayr.	Kilmarnock, Agric. C.	4·93	131	,,	Darrynane Abbey	4·34	87
,,	Girvan, Pinmore	5·74	108	*Wat.*	Waterford, Brook Lo.	3·94	104
Renf.	Glasgow, Queen's Pk.	3·86	103	*Tip.*	Nenagh, Cas. Lough	3·17	79
,,	Greenock, Prospect H.	8·28	129	,,	Roscrea, Timoney Park	2·74	...
Bute.	Rothesay, Ardencraig.	5·44	107	,,	Cashel, Ballinamona	2·54	78
,,	Dougarie Lodge	6·96	...	*Lim.*	Foynes, Coolnanes	2·92	72
Arg	Ardgour House	10·76	...	,,	Castleconnell Rec.	2·50	...
,,	Manse of Glenorchy	8·90	...	*Clare*	Inagh, Mount Callan	3·28	...
,,	Oban	5·42	...	,,	Broadford, Hurdlest'n.	3·20	...
,,	Poltalloch	5·18	92	*Wexf*	Newtownbarry	3·39	...
,,	Inveraray Castle	10·69	127	,,	Gorey, Courtown Ho.	2·97	85
,,	Islay, Eallabus	5·73	106	*Kilk.*	Kilkenny Castle	2·85	93
,,	Mull, Benmore	9·80	...	*Wic.*	Rathnew, Clonmannon	3·28	...
,,	Tiree	4·25	...	*Carl.*	Hacketstown Rectory	3·07	79
Kinr.	Loch Leven Sluice	3·56	99	*QCo.*	Blandsfort House	2·66	80
Perth	Loch Dhu	9·05	103	,,	Mountmellick	3·21	...
,,	Balquhidder, Stronvar.	7·97	...	*KCo.*	Birr Castle	2·48	80
,,	Crieff, Strathearn Hyd.	3·35	77	*Dubl.*	Dublin, FitzWm. Sq.	2·41	90
,,	Blair Castle Gardens	...	...	,,	Balbriggan, Ardgillan	3·63	126
Forf.	Kettins School	3·04	109	*Me'th*	Beauparc, St. Cloud	2·70	...
,,	Dundee, E. Necropolis	2·97	122	,,	Kells, Headfort	2·77	81
,,	Pearsie House	3·33	...	*W.M*	Moate, Coolatore	2·02	...
,,	Montrose, Sunnyside	2·14	81	,,	Mullingar, Belvedere	2·34	69
Aber.	Braemar, Bank	3·01	78	*Long*	Castle Forbes Gdns.	2·38	66
,,	Logie Coldstone Sch.	3·72	121	*Gal.*	Ballynahinch Castle	5·00	84
,,	Aberdeen, King's Coll.	3·99	135	,,	Galway, Grammar Sch.	2·79	...
,,	Fyvie Castle	5·64	...	*Mayo*	Mallaranny	6·33	...
Mor.	Gordon Castle	2·83	98	,,	Westport House	4·24	87
,,	Grantown-on-Spey	3·93	131	,,	Delphi Lodge	10·44	...
Na.	Nairn, Delnies	2·56	108	*Sligo*	Markree Obsy.	3·86	93
Inv.	Ben Alder Lodge	4·85	...	*Cav'n*	Belturbet, Cloverhill	2·52	81
,,	Kingussie, The Birches	3·65	...	*Ferm*	Enniskillen, Portora	3·59	...
,,	Loch Quoich, Loan	...	...	*Arm.*	Armagh Obsy.	3·40	120
,,	Glenquoich	11·79	97	*Down*	Fofanny Reservoir	9·15	...
,,	Inverness, Culduthel R.	2·08	...	,,	Seaforde	3·84	101
,,	Arisaig, Faire-na-Squir	5·31	...	,,	Donaghadee, C. Stn.	3·35	110
,,	Fort William	8·31	102	,,	Banbridge, Milltown	3·42	124
,,	Skye, Dunvegan	7·36	...	*Antr.*	Belfast, Cavehill Rd.	4·35	...
R&C	Alness, Ardross Cas.	3·25	81	,,	Glenarm Castle	5·79	...
,,	Ullapool	5·07	...	,,	Ballymena, Harryville	4·20	104
,,	Torridon, Bendamph	9·55	103	*Lon.*	Londonderry, Creggan	4·64	113
,,	Achnashellach	8·42	...	*Tyr.*	Donaghmore	4·36	...
,,	Stornoway	5·66	97	,,	Omagh, Edenfel	3·97	105
Suth.	Lairg	4·07	...	*Don.*	Malin Head	3·66	112
,,	Tongue	4·83	105	,,	Dunfanaghy	4·25	90
,,	Melvich	5·11	128	,,	Killybegs, Rockmount	6·88	109

Climatological Table for the British Empire, June, 1927

STATIONS	PRESSURE		TEMPERATURE							Relative Humidity	Mean Cloud Am'nt	PRECIPITATION			BRIGHT SUNSHINE	
	Mean of Day M.S.L.	Diff. from Normal	Absolute		Mean Values				Mean			Am'nt	Diff. from Normal	Days	Hours per day	Percentage of possible
			Max.	Min.	Max.	Min.	½ max. and min.	Diff. from Normal	Wet Bulb							
	mb.	mb.	° F.	° F.	° F.	° F.	° F.	° F.	° F.	%	0–10	in.	in.			
London, Kew Obsy.	1013·2	− 3·5	80	43	64·9	49·5	57·2	− 2·0	50·3	78	6·6	2·53	+ 0·38	16	5·4	33
Gibraltar	1016·4	− 1·0	86	59	80·3	64·5	72·4	+ 1·9	63·1	79	5·5	0·19	− 0·29	1	...	...
Malta	1016·2	+ 0·6	91	62	82·5	69·9	76·2	+ 3·5	68·7	71	2·4	0·00	− 0·09	0	11·9	82
St. Helena	1014·7	+ 1·9	73	55	64·2	57·5	60·9	− 0·1	58·3	89	2·9	1·19	− 2·88	13	...	...
Sierra Leone	1013·1	+ 1·1	90	68	86·6	72·0	79·3	− 1·0	75·4	81	6·4	20·46	+ 0·42	25	...	...
Lagos, Nigeria	1011·2	− 1·7	89	70	84·7	74·6	79·7	+ 0·4	75·4	82	5·5	7·08	−11·57	14	...	...
Kaduna, Nigeria	1015·4	+ 1·6	91	...	86·0	...	...	...	71·8	78	...	5·49	− 2·36	14	...	...
Zomba, Nyasaland	1020·4	+ 2·9	80	41	70·1	49·5	59·8	− 3·1	...	76	5·5	0·52	+ 0·04	8	...	...
Salisbury, Rhodesia	1021·7	+ 0·8	76	33	69·1	40·5	54·8	− 2·1	48·6	50	1·9	0·00	− 0·05	0	9·2	83
Cape Town	1021·6	+ 1·5	84	38	69·1	48·1	58·6	+ 2·9	48·4	83	2·8	1·69	− 2·82	5	...	...
Johannesburg	1025·5	+ 2·1	69	32	61·0	40·8	50·9	+ 0·2	40·7	49	1·1	0·00	− 0·14	0	9·2	88
Mauritius	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bloemfontein	...	...	70	21	62·7	31·9	47·3	− 0·3	34·6	58	2·2	0·00	− 0·47	0	...	...
Calcutta, Alipore Obsy.	1000·2	+ 0·5	101	75	92·3	80·2	86·3	+ 1·2	81·1	87	7·5	11·45	− 0·45	11*	...	...
Bombay	1004·6	+ 0·6	93	74	88·2	79·8	84·0	+ 0·1	78·2	83	7·0	32·52	+12·65	16*	...	...
Madras	1003·9	+ 0·1	109	76	99·5	81·2	90·3	+ 0·2	76·4	63	6·9	3·53	+ 1·64	7*	...	...
Colombo, Ceylon	1009·3	+ 0·6	87	73	85·6	77·0	81·3	− 0·4	78·3	80	8·7	8·64	+ 0·67	24	5·3	42
Hongkong	1005·7	− 0·4	91	74	85·9	78·7	82·3	+ 0·9	78·5	84	8·0	11·68	− 4·41	20	6·4	47
Sandakan	...	...	91	74	87·7	74·9	81·3	− 0·4	77·4	89	...	5·56	− 1·74	14	...	...
Sydney	1021·5	+ 3·7	70	39	60·7	45·7	53·2	− 1·4	46·8	79	4·9	4·18	− 0·59	15	4·8	48
Melbourne	1022·0	+ 3·5	65	30	56·6	40·2	48·4	− 2·0	42·9	82	6·4	1·35	− 0·74	15	4·3	45
Adelaide	1021·0	+ 2·0	68	36	60·4	45·8	53·1	− 0·4	46·8	67	6·1	1·56	− 1·59	11	4·0	41
Perth, W. Australia	1015·4	− 2·5	71	41	63·6	48·5	56·1	− 0·7	51·6	75	6·4	7·98	+ 1·06	16	4·4	44
Coolgardie	1017·3	− 1·8	69	33	59·9	41·7	50·8	− 1·9	47·2	74	5·4	1·54	+ 0·31	11	...	...
Brisbane	1020·3	+ 2·2	79	44	69·1	51·6	60·3	+ 0·1	53·5	69	4·6	3·21	+ 0·58	8	6·5	63
Hobart, Tasmania	1019·1	+ 4·8	60	32	50·4	38·7	44·5	− 2·3	39·4	75	5·7	1·16	− 1·04	13	4·2	47
Wellington, N.Z.	1017·9	+ 3·0	57	31	52·8	41·6	47·2	− 2·2	44·9	83	6·5	5·44	+ 0·67	17	3·6	39
Suva, Fiji	1013·9	+ 0·3	88	65	81·1	70·7	75·9	+ 1·0	72·0	83	6·4	9·91	+ 3·76	18	4·6	42
Apia, Samoa	1012·6	+ 1·0	87	72	84·9	75·0	79·9	+ 2·1	76·9	81	6·3	4·10	− 1·06	17	7·1	63
Kingston, Jamaica	1014·2	+ 0·4	91	71	88·9	73·5	81·2	− 0·1	72·1	81	4·0	0·38	− 3·72	5	9·9	75
Grenada, W.I.	1009·5	− 3·6	88	72	85·0	75·2	80·1	+ 1·2	75·9	81	6·3	9·22	+ 0·90	24	...	...
Toronto	1015·0	+ 0·7	95	39	72·2	50·8	61·5	− 1·1	56·1	77	4·5	2·52	− 0·24	10	10·1	66
Winnipeg	1011·9	− 0·6	85	35	71·6	51·2	61·4	− 0·8	53·6	76	4·8	1·79	− 1·47	14	8·3	51
St. John, N.B.	1013·7	− 0·3	76	39	64·3	47·0	55·7	− 0·8	50·9	74	5·1	3·77	+ 0·50	8	8·2	53
Victoria, B.C.	1016·2	− 0·7	82	47	65·0	50·6	57·8	+ 0·8	53·4	77	6·1	0·84	− 0·09	6	8·7	54

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