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Conditions of the winds on the western and southern shores of the Sea of Galilee.

BY D. ASHBEL, P.D.

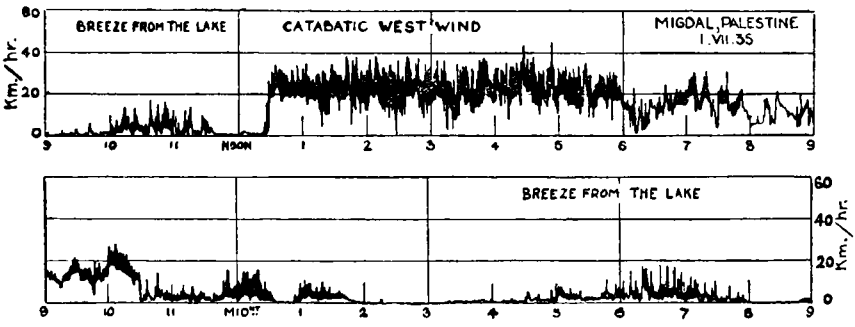
Hebrew University, Jerusalem.

The Sea of Galilee is a lake in the form of a pear, 23 Km. long and 14 Km. wide at the most. It is widest between Migdal (the village) and the Persian orange grove on the eastern shore. At Degania it is narrowest. Its area is 171 Km^2, and despite being so small, it has interesting local winds forming around it. The particular location of the Sea of Galilee in the Jordan Valley surrounded by the following mountains: the mountains of Upper and Lower Galilee to the west and to the north, the plateaux of the Golan and Bashan to the east—and the considerable difference in height between the bottom of the valley and the mountain tops cause great differences in the temperature of the air and a strong fall in the barometric pressure towards the valley from the distant neighbourhood, especially from the Mediterranean, and from the lake to its close neighbourhood.

In the summer, a western Mediterranean wind forms in the afternoon hours, due to the difference between the barometric pressure of the valley and that of the Mediterranean. And the difference in pressure between the lake and its near environment produces in the forenoon hours a wind from the water surface of the lake toward the land around it. Two sea-breezes in one day. The fall in the barometric pressure brought on as a result of the considerable warming of the

air of the entire Jordan Valley induces a stream of cool air from the Mediterranean towards the valley. The greater the distance between the valley and the Mediterranean, the later is the western wind in reaching the valley. In the northern part of the valley, the western wind arrives early, whereas in the southern part it arrives about sunset. The distance between the Sea of Galilee and the Mediterranean is 50 Km. in a straight line and the western wind reaches the sea in the summer between noon and 2 p.m. Upon reaching the line of the valley, it falls from the mountains and when arriving at the bottom of the valley it is warm, dry, strong and gusty. The coolness and the high relative humidity of the Mediterranean air, particularly in regions where it rises on the western mountain slope for instance, disappear entirely when the air descends into the valley. This is due to the fact that the air contracts when descending several hundred metres below sea level. In this way, the air becomes warm and the relative humidity is reduced.

This wind is not a laminary wind of an uniform and continuous flow of air, but is gusty, the gusts attaining 30–50 Km. per hour. However, these gusts last only for some minutes ; each is followed by a short, minute-long pause till the strong gusts are again renewed, and so on. The appended figure illustrates clearly the structure of



this catabatic wind. This wind, occurring in the afternoons in the summer, agitates the lake. Since ancient times the storms of the Sea of Galilee have been famous, yet cannot be compared with storms on the open seas or on the ocean. They are especially dangerous to canoes and sail-boats in the corners of mountains on the western shore. The cape called " Kalaat el Rul " (the fortress of devils), between Tiberias and the settlement of Kinereth, has the worst reputation.

The above mentioned catabatic wind generally lasts till 10 or 11 p.m., and after that everything is quiet.

Plantations suffer from such a strong and continuous wind abundant during several successive months (from April till October), particularly if their leaves are hypersensitive, as are those of the banana-plantations. The citrus plantations suffer greatly from this wind, as well. The farms along the entire Jordan Valley, from Kfar

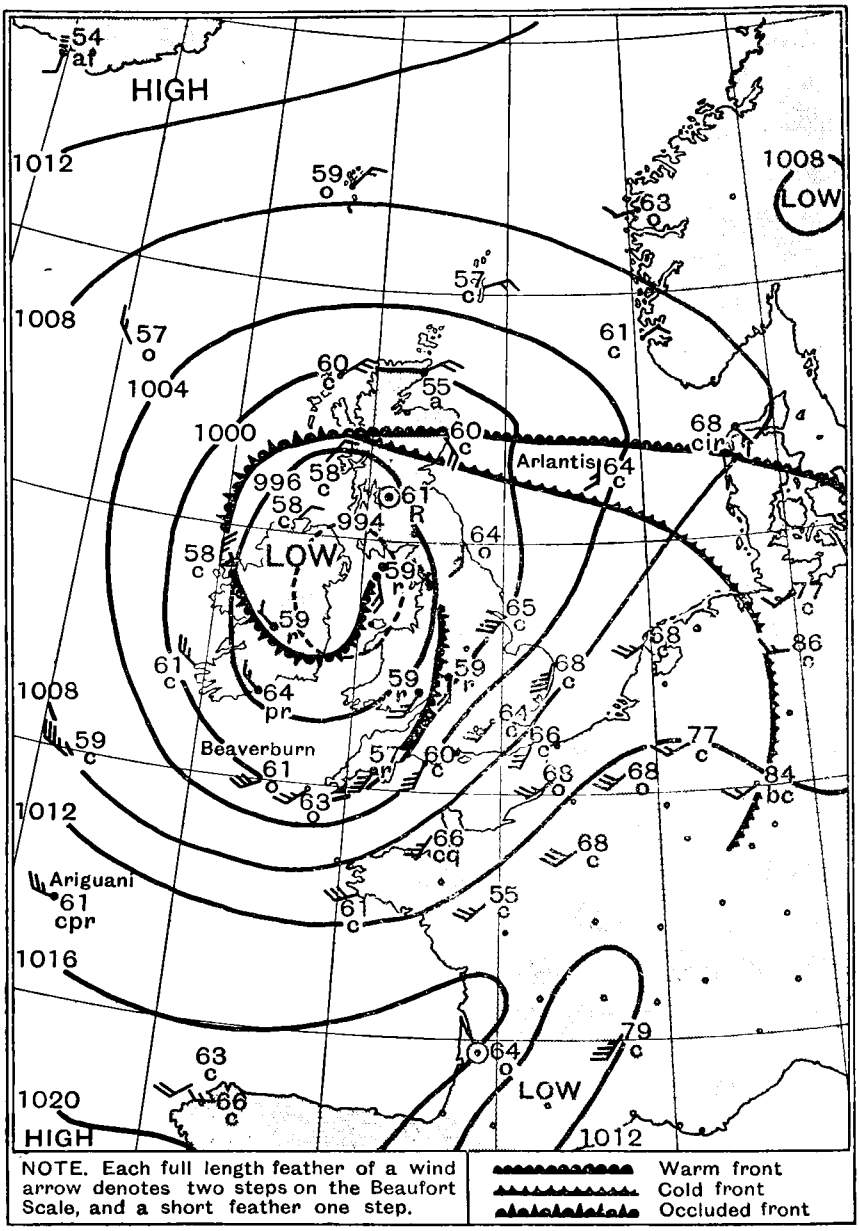
Gilady to the Dead Sea, need strong wind-breakers for the protection of the plantations.

Local winds.—Along the western and west-southern shores of the Sea of Galilee, blow in the summer in the forenoon and at dawn local winds which are less developed here than in the Dead Sea, the area of which is ten times larger than that of this lake. At night and at sunrise blows a south-easterly to south-south-westerly land wind in the southern part of the Sea of Galilee, from the surface of the valley toward the surface of the lake. In the morning and forenoon hours blows a northerly to north-easterly wind, sometimes more easterly, along the south-western shore of the lake. This wind arises from the water surface of the lake to the land. In the southern part of the lake it blows more from the north and in the western part from the east. We lack observations on the northern part of the sea and on its eastern shore, but judging from our experience on the Dead Sea it can safely be assumed that here also a soft southern wind blows towards the northern shore and a weak western wind towards the eastern shore. The wind from the water, which blows in the summer in the morning and forenoon, is cool, humid and refreshing in the hot valley. It should be greatly considered in the establishment of settlements and buildings.

Winter winds.—These winds do not differ from those in other parts of the country, as they are not specific of one zone only, but cover very extensive areas. It may well be that only the direction of the wind is a bit deviated in the Jordan Valley on windy days in accordance with the shape of the mountains or the valley. The ones that matter principally are the winds coming from the south and south-west during the period of rainfall, on cloudy and rainy days. At the end of the barometric minimum, they turn to the west, or north-west. The warm easterly winds are generally less abundant in the Jordan Valley than in the mountain zone. The cold winds from the east or north-east, however, are common here in the winter and are most severe.

The Gale of July 18th, 1936.

On the morning of Tuesday, July 14th, a depression was centred south of Newfoundland with lowest pressure approximately 1010 mb. This depression moved eastwards across the Atlantic and deepened, eventually giving rise to the gales experienced in south England on Saturday, July 18th. The 13h. synoptic map for July 18th is reproduced below and the position of fronts in the vicinity of the British Isles is shown on it. An interesting feature of this map is that the steepest pressure gradient is to be seen ahead of an " occluded front " which runs from the centre of the disturbance to south-west England. This front is the occluded end of the main frontal system



SYNOPTIC MAP FOR 13H., JULY 18TH, 1936.

of the depression. At some earlier stage in the history of the depression this end of the occlusion had been outrun by the centre of the depression and subsequently " bent back " to the position seen at 13h. by the circulation round the centre. Thus, although the centre of the depression travelled from the south of Ireland to north-east Scotland and the warm and cold fronts moved from south-

west to north-east across the whole country, the gales were confined to south England, travelling with the " bent-back " occlusion across the southern counties. At Calshot wind of gale force was recorded from 17h. to 20h., the highest gust being 59 m.p.h.

Compared with winter storms the duration of the gale and the strength of the wind were not remarkable but gales occur infrequently in July in the south of England. During recent years winds have reached gale force in that month only in 1922, 1925, 1927, 1929 and now in 1936. Of these, the gale of 1922 was the most severe; it lasted for ten hours at Calshot and a gust of 66 m.p.h. was recorded. During the 30 years 1871–1900, which have been analysed by Brodie,* eleven gales occurred on the south coast of England in July, but only in seven separate years. In one of these years—1879—no fewer than three gales were experienced in the month.

M. T. SPENCE.

Visibility and Wind Direction at Manston.

The material used in this investigation consists of hourly observations over a period of two years, May 22nd, 1934, to May 21st, 1936, from 9h. to 16h. G.M.T. daily. All cases when precipitation was falling at the time of observation have been excluded. The average visibilities for the sixteen compass points are shown in the diagrams (Fig. 1) for light winds (force 2 and 3) and moderate or strong winds (force 4–9), and for summer and winter separately (April to September and October to March respectively). The total number of observations for any one wind direction varies from 16 for strong ESE. winds in summer to 238 for strong SW. winds in winter.

The variation with wind direction is very marked with light winds in winter. Visibility is best with winds from NE. and NNE., directions which have an open sea exposure; while winds from SW. to S. also show relatively good visibility after passing over the 15–30 miles of open country after leaving the English Channel. The lowest visibility occurs with winds from W. and WNW., and from E. and ESE. The former directions include the London area, the nearer side of which is about 60 miles distant; while the latter directions include Belgium, the nearest point of the Belgian coast being 55 miles distant to east-south-east (Fig. 2). Hence it appears that smoke from both these industrial areas produces a marked deterioration in visibility at Manston. The industrial towns of Gillingham, Chatham and Rochester lie close together due west from Manston at a distance of about 37 miles. Smoke from these would not be sufficient to produce all the observed deterioration, especially as with WNW. winds the smoke would be carried south of Manston. It is noteworthy also that the neighbouring residential towns of Margate and

* *London, Quart. J.R. met. Soc.*, 29, 1903, pp. 151–80.

Ramsgate, 3 to 4 miles away, have little or no discernible influence on the visibility. The poor visibility with winds from NW. to N. is probably mainly due to the transport of foggy or misty air from Essex and the Thames Estuary. Moreover, there must be a certain amount of spreadover of the observations owing to the fact that a wind does not usually maintain the same direction throughout a path of some 60 miles.

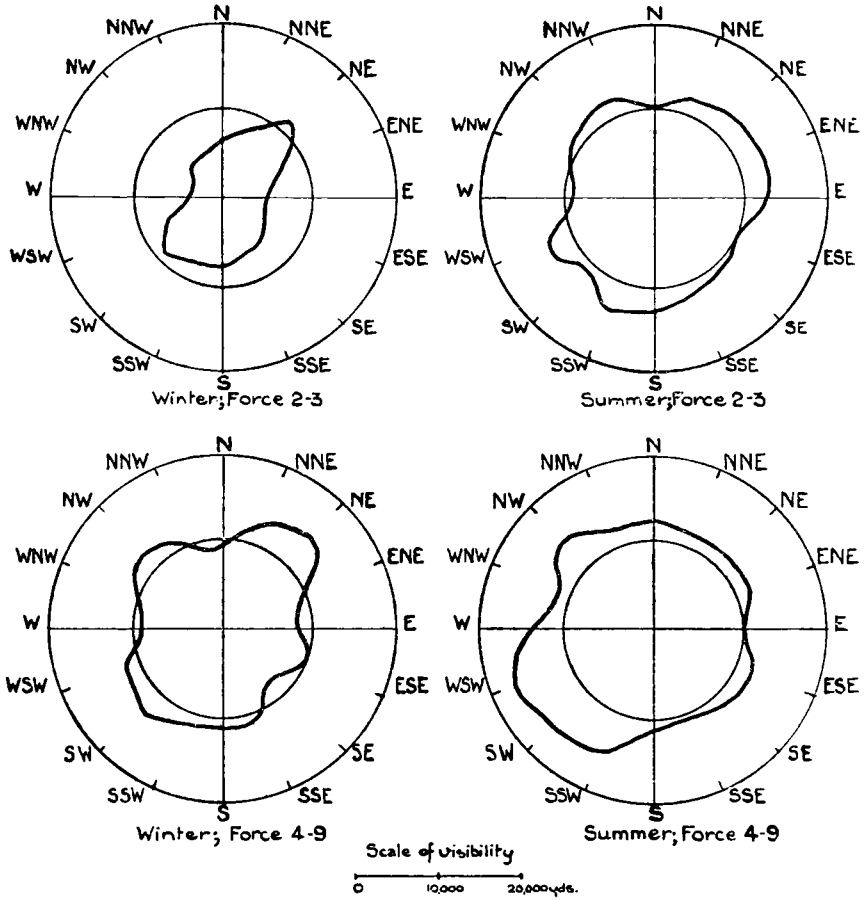


FIG. 1

With strong winds in winter the visibility is improved in all directions, especially with north-westerly winds. With this exception, the general shape of the curve for the strong winds is similar to that for light winds, the lowest visibilities occurring with W., E. and SE. winds.

In summer the light winds show considerably improved visibilities compared with winter. This may be partly due to the decreased smoke from domestic chimneys, but the more intense convection of this season would cause the smoke to dissipate to higher levels and so have less influence at ground level some distance away. Decreased

visibilities with winds from W. and ESE. still remain noticeable. Strong winds in summer between SW. and NW. are associated with still further improved visibility when compared with light winds of this season; on the other hand, visibility with winds from S. to NNE. is about the same or less, for strong than for light winds. Somewhat similar differences are noted between summer and winter. In particular with strong winds from NE. and NNE. visibility is less in summer than in winter. These differences are to be attributed to the comparatively high frequency of fogs over the southern North Sea and Straits of Dover in summer. With light winds the drift of air on-shore is slow enough for the fog to be dissipated on reaching the warmer land, leaving good visibility inland (the sea is not visible from ground level at Manston). With stronger winds this dissipation does not occur so completely and visibility is reduced.

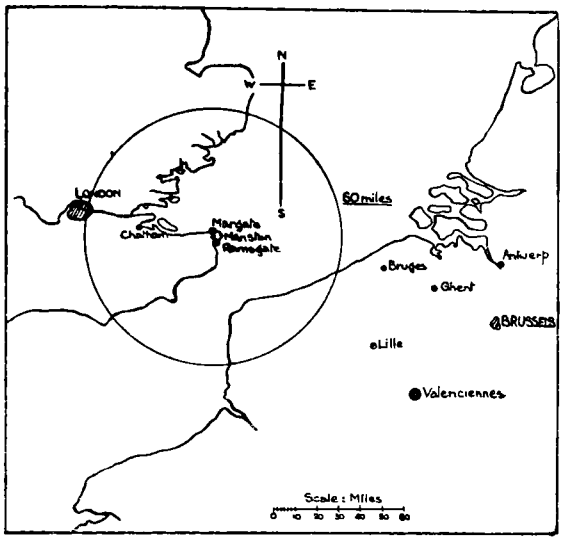


FIG. 2

Conclusion.—It is shown that visibility at Manston is reduced by smoke from London and its outskirts and also from Belgium, the effect being most noticeable with light winds in winter.

A. F. CROSSLEY.
C. WILDE.

Correspondence

To the Editor, *Meteorological Magazine*

Snow in June

On June 3rd the *Daily Telegraph* reported a foot of snow on Carnedd Llewelyn but from information received from the Pass of Llanberis the fall appears to have been local and may have been hail. Also on June 3rd I heard that there was 4 in. of snow on the Brecon Beacons. I saw two men who had seen it at a distance, who said it was snow and not hail and I heard of a man who had motored over the Beacons that day and said the snow had clogged his windscreen. Such an occurrence must be almost unprecedented.

Kentchurch Rectory, Hereford, July 27th, 1936. R. P. DANSEY.

Recurrent Group Lightning Flashes.

The phenomenon described at Goff's Oak, Herts, by Mr. Donald L. Champion in the *Meteorological Magazine* for July, pp. 140–1, was reported also by Mr. D. S. Hancock as seen from Greenways School, Bognor Regis, on June 19th, between 9 p.m. and 10 p.m., B.S.T. "A heavy bank of cumulonimbus lay over the Downs to the north of the town, too distant for thunder to be audible. A series of flashes from near the western end of the cloud bank was followed, at almost the same interval on each occasion, by a fainter flash at the other end of the cloud."

Miss Cicely M. Botley of 17, Holmesdale Gardens, Hastings, has also written to say that she "noticed an analogous phenomenon about 21h. G.M.T. on June 19th; about 3 centres in the storm cloud kept flashing regularly. The storm (or storms) on the 19th was the most severe of the series June 17th, 18th, 19th, 21st. At 22h. there were one or two vicious overhead discharges and minor damage was done in the district."

Peculiar Cloud Formation seen from Catterick.

At 14h. 40m. G.M.T., on July 9th, 1936, a black elongated projection was observed hanging from the base of a heavy cumulonimbus cloud to the east of Catterick. This projection which had the appearance of a tail was first observed at 14h. 35m., and was then observed to be growing; it attained its maximum length at 14h. 40m., and afterwards slowly dissolved, appearing to be gradually drawn back into the cloud. The projection disappeared completely at 14h. 50m. with the exception of the tip which was rather ragged and which seemed to dissolve quickly and then reform; the projection was extremely well defined.

Thunder was heard at 14h. 50m., and lightning was seen at 15h. 3m., while the rain started at Catterick at 15h. 38m.

J. H. Brazell.

Meteorological Station, R.A.F., Catterick, Yorkshire, July 21st, 1936.

Funnel Cloud seen from Hastings.

A short funnel cloud from a large black-based cumulus at 8h. 55m. G.M.T., was observed over the sea here on July 10th. It was only seen for five minutes, for at 9h. it quickly dissolved when cloud appeared to fall rapidly from the outer margins of the funnel and disappear as it did so; this process continued until the whole funnel had dispersed, the base of the cloud assuming the normal smooth horizontal form. During the time it was watched it was in rapid motion and at one time elongated remarkably and appeared as though it would descend to the sea. When first observed it was almost due south over the sea. The weather was stormy at the time and thunder had been heard for about two hours previously.

Other features of the day in question were the immense banks of black cloud with heavy rain falling over the land between 12h. and 13h. 30m., where heavy thunder occurred, particularly between 12h. 40m. and 13h. 15m., the greatest activity being between north-west and north. Little rain was experienced here during the day though a smart shower occurred at 14h. 15m. Distant thunder was heard at intervals all the forenoon from about 6h. 30m. onwards.

A. E. MOON.

39, Clive Avenue, Clive Vale, Hastings, July 13th, 1936.

A Remarkable Rainstorm

On Tuesday afternoon, July 7th, an extraordinary rainstorm occurred here resulting in what I am informed is a record fall for the period. I was away in London at the time and had no opportunity of examining the gauge, which is at the bottom of my garden, north of the house, until at 8.30 a.m. next morning, when I measured exactly 3·09 in. The morning before I had examined the gauge and found it empty. I am informed by several people here that practically the whole of this rain fell in about half an hour between 4.5 and 4.35 p.m., no other rain falling earlier that day and the night being fairly fine. Thunder and lightning accompanied the rain but were not at all severe compared to the rain. The storm was apparently moving in a north-westerly direction, for a party which reached Sandy Lodge Golf Club at 4 p.m. just before it began, reported that their train had passed through a heavy storm at Kenton and parts of the golf links there were under water.

Here within a few minutes after the rain suddenly commenced, torrents of water rushed down a gravel slope and through the back door flooding the kitchen.

I find on inquiry that the gauge at Sandy Lodge Golf Club a short distance away only recorded 1·40 in. during the storm, but this gauge is much sheltered by bushes. Under such exceptional conditions two neighbouring gauges might record very differently. The rainfall was not nearly so severe at Rickmansworth. Mr. Hawke, at Caenwood, Rickmansworth, had 0·56 in., and Mr. Grimmett, at the Rickmansworth and Uxbridge Valley Waterworks, nearer Sandy Lodge, had 0·62 in. At Watford, Mr. E. A. Robins tells me that he recorded 1·06 in.

The total rainfall here this month has reached 6·12 in.

H. LANGFORD LEWIS.

The Fairway, Sandy Lodge, Northwood, Middlesex, July 25th, 1936.

[*British Rainfall* classifies intense falls of rain under three categories: "noteworthy", "remarkable" and "very rare". New limits in this classification were brought into use in January 1936, and are set out in the *Meteorological Magazine* for April, 1936, p. 58. The fall at Northwood, Middlesex, on July 7th described above, comes under the category "very rare". During the latter half of June

and the first half of July, heavy falls of rain in short periods of time have been so widespread and so frequent that it is interesting to note some of the heaviest while the memory of the storms is still clear. The following table gives the place and date of occurrence of a number of intense falls of rain classified according to whether they were " noteworthy ", " remarkable " or " very rare ".

Date.	Place.	Rainfall.	Duration.	Type of Fall.
1936		in.	min.	
June 20th	South Farnborough ...	0·79	26	Noteworthy.
June 21st	Crickhowell (Brecon-shire).	0·91	about 30	Noteworthy.
June 22nd	Rothamsted	1·50	30	Remarkable.
June 25th	Ashbourne (Derby-shire).	2·33	90	Remarkable.
June 29th	Bristol (Horfield) ...	1·50	60	Remarkable.
June 29th	Bristol (Waterworks, Clifton).	1·95	20	Very rare.
June 29th	Bodmin	2·98	60	Very rare.
June 30th	Florencecourt (Co. Fermanagh).	3·20	180	Remarkable.
July 7th	Northwood (Sandy Lodge).	3·09	about 30	Very rare.
July 10th	Eastbourne	1·97	60	Remarkable.

In most of the cases cited above, the details have been communicated to the Meteorological Office direct but in a few, they have been taken from reports in the Press. Descriptions of some of the thunderstorms have already been published in the *Meteorological Magazine* for July, 1936. An important feature of a number of the heavy rainstorms was the heavy hail which accompanied them. In the thunderstorm at Rothamsted on June 22nd some of the hailstones were nearly an inch in diameter.—L. F. LEWIS.]

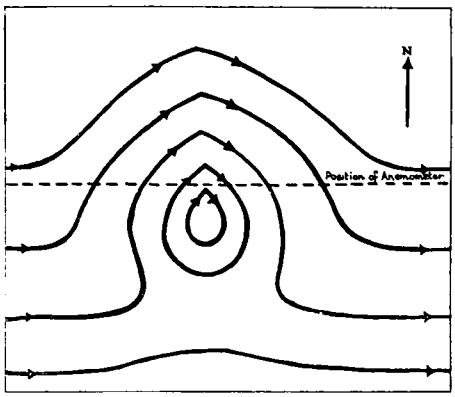
Sand Devil, Heliopolis

One of the best developed sand devils which has passed near the Meteorological Office, Heliopolis, occurred at 11h. 57m. G.M.T. on May 29th, 1936.

Fresh cold air had arrived late on the previous afternoon (maximum on the 28th, 105°F., on the 29th, 84°F.) and the wind was about 20 m.p.h. from the west, the range of gustiness being 6–38 m.p.h. At 11h. 57m. G.M.T., the sand devil passed slightly to the south side of the anemometer—all open doors were slammed violently, the barograph and microbarograph showed an instantaneous fall of pressure of 0·8 mb. and about 2-3 seconds after the doors slammed, a gust of 55 m.p.h. was recorded. Just before the passage of the devil, the wind veered suddenly NW.—a change which probably resulted in the slamming of the doors—and at the passage the wind

backed to SW. and then veered again to W. or NW. The direction of rotation was clockwise, height about 500 ft. and diameter about 40 ft.

The devil was observed five minutes later about 1,500 yards to the east and then it appeared to have a much larger diameter and a funnel-shaped top. The speed of travel, 1,500 yards in five minutes, is about 10 m.p.h., which is about half the average wind speed at the time.



The sequence of events at the anemometer may be explained in a general way by the attached air flow diagram. Here the devil is represented as an eddy moving along in but not necessarily with the speed of the air stream; the eddy has not been drawn as a circular one so that the rapid or instantaneous change from NW. to SW. with the accompanying strong gust may be explained.

J. DURWARD.

Meteorological Station, R.A.F., Heliopolis, Egypt, June 4th, 1936.

NOTES AND QUERIES

A New Series of Meteorological Memoirs from Germany.

The political changes that have taken place in Germany in recent years have had their repercussions in the meteorological activities in that country and have led to a reorganisation of the meteorological services. Formerly each of the constituent states of the federal Empire had its own service and the Directors in many cases were University professors responsible for advanced teaching of the subject as well as for the organisation of their services. The Seewarte at Hamburg was the only meteorological institution directly dependent on the Imperial Government, being a department of the German Admiralty. Since the reorganisation, the public services have been united under the control of the German Air Ministry, but the Universities which are independent of the Ministry still have their Meteorological Institutes which continue their teaching and research activities.

Thus, it comes about that we have received the first four numbers of a new series of meteorological memoirs entitled *Veröffentlichungen des Meteorologischen Instituts der Universität Berlin,* edited by H. Ertel and H. von Ficker. The first two memoirs, respectively by H. Ertel and K. Stampf are mathematical. Dr. Ertel deals with the theory of the variation of a pressure field from the

dynamic and advection point of view, while Dr. Stampf discusses the probabilities of chance coincidences in periodicities found in long series of observations. The third memoir by O. Schneider takes us into the realm of terrestrial magnetism and discusses the influence of the sun on the lunar variation of the earth's magnetism. The fourth memoir is from the pen of Professor von Ficker himself and is more descriptive in character. It deals with the rôle played by inversions of temperature in determining the circulation in the Atlantic trade winds. It will be seen, therefore, that the new memoirs are intended to cover a wide field and we look forward to the receipt of future numbers with much interest.

R. G. K. LEMPFERT.

Beit Fellowship for Research in Meteorology

The Trustees of the Beit Fellowships have awarded, amongst others, an extension of his Beit Fellowship at the Imperial College of Science and Technology during the academic year 1936–7 to Mr. E. W. Hewson, of the Mount Allison University, Sackville, Canada and the University of Toronto, for the continuation of his research in meteorology under the direction of Prof. D. Brunt, more especially the detailed structure of discontinuities between air masses as occurring in England and Canada.

The Heat Wave of July 13th, 1808

Mr. J. E. Clark has called attention to a passage in the Diary of Thos. Shillitoe, 2nd ed., 1839, Vol. 1, pp. 80–1. Shillitoe, then aged 54 years, was engaged on one of his many journeys for religious service, and on July 13th was walking from Lower Heaford to Hinckley, in Leicestershire, along the old Watling Street. He notes: "About 9 o'clock the sun shone out very hot, exceeding anything I had before experienced . . . By 12 o'clock the air became so affected in the shade that I felt as if I was surrounded every way by heat from a fire." His strength gave out, and although he was a practised walker he suffered severely from heat, thirst and exhaustion in that almost deserted region before reaching an inn. He concludes: "The gooseberries on the trees next morning appeared, where they were exposed to the sun, as if they had been in an oven or saucepan in the fire. Near 50 horses, it was reported, had dropped down dead on the North Road and many people, who were working in the fields. It was supposed to have been the hottest day known in this nation."

Actual observations for 1808 are few and not very reliable, but it is interesting to note that two weather diaries both show July 13th as a day of great heat. That at Sunbury Vicarage, Middlesex, gives 105° F. as the greatest thermometer reading, but this was apparently a thermometer exposed to the sun, for a marginal note states: "In the shade 94". A glance through the book shows no

other reading exceeding 100° F. during the whole period from 1795 to 1839. The Meteorological Journal at the apartments of the Royal Society gives as the greatest heat recorded by Six's thermometer, 93½° F. The readings of the Royal Society thermometers are not strictly comparable with those obtained in recent years under more standard conditions, but some idea of the meaning of these figures may be obtained from the mean annual maxima (obtained by finding the highest daily maximum in each of a series of years and forming the mean). For the ten years 1800–6, 1808–10 the mean annual maximum at the Royal Society was 84° F. For the twelve years 1910–21 the mean annual maximum at the Royal Observatory, Greenwich, was 89° F. If we add the difference, 5° F., to the reading of 93½° F. on July 13th, 1808, we obtain a value of 98½° F., which approaches the famous reading of 100° F. at Greenwich on August 9th, 1911. It seems probable therefore that in London the heat of July 13th, 1808, was not very different from that of August 9th, 1911.

Strong Vertical Current

A pilot balloon ascent, by tail method, made at Abbotsinch at 12h. 10m. G.M.T. on September 21st, 1935, revealed a very remarkable upward vertical current existing from about 8,000 to 23,000 feet.

A large size balloon (90 in.), with tails at 25 and 100 feet, inflated for the normal lift of 500 feet per minute, was used.

In the computation of the ascent, shown below, it will be seen that the balloon made a fairly steady rise of 500 feet per minute for the first 14 minutes, followed by a more rapid rise at a mean rate of 700 ft./min. for the next 5 minutes, and then the normal rate was resumed for 5 minutes. At this height, 12,000 ft. (by tail) reached in 22 minutes, a very strong upward vertical current commenced resulting in the balloon ascending 11,500 ft. in 12 minutes. The most rapid rise occurred between the 22nd and 27th minute when the balloon rose at a mean rate of 1,300 ft./min., indicating a vertical current of 13 ft./sec. The readings of the tail were taken at frequent intervals during the ascent as soon as the computation showed that something unusual was happening. After 34 minutes the balloon was abandoned as the tail was no longer distinguishable and a uniform rate of ascent could not be assumed in view of the fluctuations in lift.

During the ascent the sky was completely covered with cirrostratus cloud in the east, gradually lowering to altostratus in the west. The pressure distribution on the 13h. synoptic chart shows a shallow depression off southern Ireland with a warm front across central England running from east to west. Another shallow depression was developing near the mouth of the English Channel, afterwards deepening considerably while moving north-east to Yorkshire and later to Norway. This depression was centred near Spurn Head at 7h. on the 22nd and the rainfall from the 21st to 22nd was very

heavy particularly in Yorkshire and Lancashire. Only slight rain occurred at Abbotsinch in the following 24 hours.

This case shows that pilot balloon ascents may give rise to very unreliable data occasionally unless the ascent is made using tails or double theodolite method throughout the ascent. It is obvious that an assumed lift of 500 ft./min. in this ascent would give a resultant velocity of only one-third of its actual value (apart from error in height) in some parts of the result. Tail readings at great heights should frequently show this convection but readings cannot be obtained except when the wind lower down is of a strength similar to that in the ascent described.

The following are the details of the ascent :—

FREE LIFT 500 FT./MIN.

Minute.	Tail Reading.	Height.	Vertical Velocity.	Resultant Wind.	
				Direction.	Speed.
		ft.	ft./min.	°	m.p.h.
1	25	510	+ 10		
2	13	1,070	+ 60	211	15
3	8·4	1,710	+ 140		
4	6·8	2,090	— 120	211	10
5	5·1	2,740	+ 150		
6	17·0	3,250	+ 10	202	9
7	14·7	3,750	0		
8	12·7	4,300	+ 50	208	10
9	11·4	4,800	0		
10	10·0	5,300	0	212	15
11	8·8	5,800	0		
12	7·8	6,200	— 100	205	19
13	7·1	6,620	— 80		
14	6·6	6,900	— 220	195	15
15	6·0	7,600	+ 200		
16	5·6	8,200	+ 100	192	17
17	5·1	9,000	+ 300		
18	4·85	9,550	+ 50		
19	4·4	10,500	+ 450	189	16
20	4·15	11,000	0		
21	4·0	11,500	0		
22	3·85	12,000	0	191	18
23	3·4	13,500	+ 1,000		
24	3·1	14,900	+ 900	203	21
25	3·0	15,400	0		
26	2·75	16,900	+ 1,000	209	33
27	2·5	18,500	+ 1,100		
28	2·4	19,500	+ 500		
29	2·3+	20,400	+ 400	230	34
30	2·2	21,200	+ 300		
31	2·1	22,000	+ 300		
32	—	(22,800)	+ 300		
33	1·85	23,500	+ 200	223	46

Nephoscope observations on the 21st :—

At 7h. cirrus 270°, 75 m.p.h. At 17h. cirrus 230°, 80 m.p.h.

R. T. ANDREWS.

Spreading of Burns on the Cards of Campbell Stokes Sunshine Recorders

In the Campbell Stokes sunshine recorder the sun's rays are concentrated by a glass sphere and burn the card, the duration of the burn being taken as a measure of the duration of bright sunshine. The strength of the burn varies from a faint mark on the surface of the card, when the sun is shining faintly, to a charred channel burnt through the thickness of the card in bright sunshine on a clear day. It occasionally happens on occurrence of bright sunshine that considerable spreading of the burn takes place and the customary straight channel, which is burnt in the card, may in such cases expand in places into a circular hole measuring about $\frac{1}{4}$ in. in diameter. An example of these " blobs," as they are termed, is shown in the figure facing p. 168. Captain J. Durward, Superintendent of the Meteorological Office, Heliopolis, reported in the spring of 1932 that blobs had been unusually frequent at stations in the Middle East Area, and made a suggestion that the cause might be the burning of the resin which is contained in the composition of the card. This led to an inquiry into the whole subject. It is noticeable that when a card is burnt, a considerable amount of resinous compound is driven out and accumulates on the bowl behind the card. It seemed at least possible that the sun's rays might set fire to an accumulation of resin, thus burning a hole in the card.

Mr. E. G. Bilham, who considered the matter, did not feel that this explanation was altogether satisfactory and suggested that the spreading might occur on occasions when the sun's rays were of unusual intensity, owing to the card itself becoming ignited, and that other favourable conditions would be high temperature and low humidity, rendering the card " bone dry " and a dead calm favouring temporary accumulation of hot air near the burn.

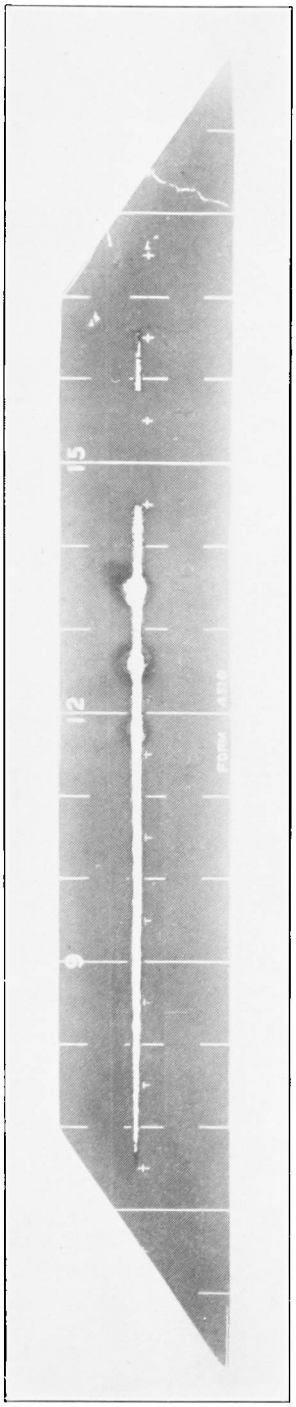
In order that the resin theory might be tested, a sunshine card from the current stock, together with a series of older cards dating back to 1927, were forwarded to the Government Chemist for analysis. In his report he said that there was no important difference in the resin content of the several cards and that if anything, the more recent card had a smaller resin content. He further pointed out that tests with a burning glass had shown that the card could be ignited by concentration of the sun's rays, especially when the test was carried out in a draught. The Government Chemist's report, therefore, supported Mr. Bilham's suggestion that blobs might be due to abnormally strong heating rather than to an accumulation of resinous compound. The suggestion was further made by the Government Chemist that the best means of overcoming the trouble might prove to be by the use of fire-proofed cards. Two sets of cards were accordingly obtained having fire-proof qualities, one printed on a fire-proofed board and the other on a one-sided coated board. The cards were finished with the same blue coloured surface as the standard cards but preliminary test showed that the one-sided

coated cards suffered from the drawback that when the surface was moist, the colour rubbed off very easily. Both sets of cards were subjected to a test during the summer of 1934 in recorders set up (1) on the roof of the Science Museum at South Kensington, and (2) at Heliopolis.

Blobs are not a frequent occurrence in this country and none were experienced either on the standard card or on the two experimental cards during the month of the trial at South Kensington. This part of the trial was therefore directed rather to the testing of the comparability of the records obtained from the experimental cards with those obtained from the standard cards. It was found that the burn produced on the one-sided coated cards was of a lighter colour than normal and that the duration of the record was less, the deficiency for the month being 2 per cent. The total duration obtained on the completely fire-proofed cards was, on the other hand, in excellent agreement with that given by the standard cards. An examination of the individual cards suggested that this must be regarded as being to some extent a fortuitous result. The burn on these cards seemed wider than on the standard cards in bright sunshine with a consequent spread when the burn was interrupted by clouds. Thus the record gave too long duration on days of broken cloud, this being compensated by too short duration when the sun was shining faintly. The trial in Middle East Area did not give any definite information regarding the comparability of the records as the recorders used were not all in perfect adjustment; but here again a broader burn was found on the completely fire-proofed cards. On one occasion spreads were found on a standard card inserted in an old recorder but only slight blobs on a standard card mounted in a new recorder. It was unfortunate that during the greater part of the two months during which the test was continued, no blobs occurred on the standard card. It was only during the last week that blobs were experienced though during this period they were frequent. No blobs occurred on the one-sided coated cards throughout the whole period and one blob only, and this of no great magnitude, on the completely fire-proofed cards. Spreading chars did, however, appear on the back of some of these fire-proofed cards. The fire-proofing thus appears to provide a means of avoiding the occurrence of blobs, but as the records obtained on the fire-proofed cards are not strictly comparable with those of the standard cards, it was decided to make no change in the composition of the cards.

The fire-proofed cards were of the summer pattern only and therefore could not be used after the end of August. The additional recorder which had been set up at Heliopolis for the comparison was, however, used occasionally thereafter with a standard card. Evidence was found that a "spreading char" occurrs with pronounced regularity at about 11h. 15m. and 12h. 45m. which are positions coincident with two holes drilled right through the bowl. In view of this the records for September 27th, 1934, are surprising.

[*facing p. 168*



CAMPBELL STOKES SUNSHINE RECORDER CARD

On that day the standard card in the standard recorder gave the largest blob which had been experienced since the trials commenced, at 12h. 45m. and smaller blobs at 8h. 45m. and 15h. 15m. But on the standard card on the new recorder there was only the very slightest evidence of spreading on the front of the card and on the back there was rather less than the usual amount of " spreading char " at the positions of the holes which are drilled in the bowl of tropical recorders to facilitate the egress of water.

Although the occurrence of blobs spoils the appearance of a card, it has no practical effect on the duration of sunshine measured. The blobs only occur on days of unusually bright sunshine and on such days the burn is generally continuous, so that the measurement is the same whether the record contains a blob or not. It would be only when a blob occurred immediately before or after the sun was obscured by a cloud that the record would be unduly extended, leading to a false measurement of sunshine. As blobs are not a frequent occurrence, such cases must be extremely rare and can have no appreciable effect on the total measurement of duration of sunshine.

OBITUARY

Dr. William James Stewart Lockyer.—We record with great regret the death of Dr. W. J. S. Lockyer, the Director of the Norman Lockyer Observatory at Sidmouth, at the age of 68. Though primarily an astronomer, a great deal of Lockyer's scientific work dealt with meteorology as might be expected when one remembers the outward circumstances of his career. For many years he was on the staff of the Solar Physics Observatory at South Kensington, serving under his distinguished father, the late Sir Norman Lockyer. Now it will be remembered that the Solar Physics Observatory was founded for the express purpose of collecting information about solar changes, which should provide material for working out the details of the connexion between solar activity and terrestrial weather which the elder Lockyer had established in his earlier researches on Indian rainfall in relation to sunspots. The meteorological problem was, therefore, ever present in the minds of those in charge at South Kensington.

Lack of suitable data for attacking the fundamental problems of world meteorology still hampers us, but thirty years ago the situation was very much worse than it is now. Much attention was devoted at the Observatory to the collection of records of long observations and resulted in the publication of a valuable series of pressure records, the forerunner of " World Weather Records " issued some years ago for the Smithsonian Institution acting on behalf of the International Meteorological Organisation. This pioneer work of the Solar Physics Observatory in which Dr. Lockyer took a considerable part also contributed not a little towards making possible the

international enterprise which we now know as the Réseau Mondial.

Many valuable discussions of world meteorology emanated from the Solar Physics Observatory. Dr. Lockyer was particularly attracted by the meteorology of the southern hemisphere where the distribution of land and water renders the problems perhaps rather simpler than they are north of the equator. He contributed valuable papers on surface-air circulation in the southern hemisphere and on Australian meteorology to the memoirs issued by the Solar Physics Committee.

Outside his official work, Lockyer was a keen balloonist and also a photographer. He was particularly expert at cloud photography and had amassed a large collection of beautiful and striking cloud photographs, copies of which he generously presented to the library of the Meteorological Office.

R. G. K. LEMPFERT.

We regret to learn of the death on June 15th, 1936, in his eighty-second year, of Professor Eugène Lagrange, the well known Belgian astronomer, who has also published work on the connexion between solar and meteorological phenomena.

NEWS IN BRIEF

We learn that Professor P. A. Moltchanoff has been appointed Director of the Central Geophysical Observatory, Leningrad, as from June 25th, 1936.

BOOK RECEIVED

Standard scale of solar radiation by C. G. Abbot and L. B. Aldrich Washington, D.C., Smiths.Misc. Coll., Vol. 92, No. 13.

The Weather of July, 1936

Pressure was below normal over Alaska, western Canada, the United States, eastern Canada and across Bermuda and northern North Atlantic to Scandinavia, Germany and France, and also over south-east Europe and south-west Asia, the greatest deficits being 6·5 mb. at Lerwick and 4·7 mb. near Erzerum, near Quebec and at Juneau, Alaska. Pressure was above normal over Mexico, the southern North Atlantic, north-west Africa, Spain, the western Mediterranean and in a belt across Austria and Poland to Russia, the greatest excesses being 3·3 mb. at Moscow and 3·6 mb. at Lisbon. Temperature was generally above normal in Scandinavia, Germany and south-east Europe but below normal in the Netherlands, while precipitation was mainly in excess except near the borders of the Black Sea.

The weather of July was generally unseasonable over the British Isles. The outstanding features were a persistence of cyclonic conditions, abnormally heavy rainfall, little sunshine and generally

low day temperatures though minimum temperatures were often above normal. At Valentia Observatory there was no day during the month without rain. At several stations the total rainfall was the highest on record for July while at Birr Castle the total sunshine was the lowest on record for July. Sunshine generally was considerably below normal except in north-west Scotland. Thunderstorms were fairly frequent in the Midlands. July opened with low pressure systems extending across the Atlantic from the British Isles to eastern Canada. From the 1st–4th unsettled conditions prevailed with local heavy rain, 2·52 in. at Hartland, Devon on the 1st and 1·16 in. at Birmingham on the 2nd, but long sunny periods in parts of north England and Scotland, 12·2 hrs. bright sunshine being registered at Cockle Park on the 4th and 11·8 hrs. at Stornoway on the 2nd. Thunderstorms occurred at several places on the 1st and 2nd and coastal mist or fog was experienced locally. A brief interval of more settled weather occurred on the 5th when the anticyclone over central and southern Europe spread north. This was followed by a prolonged spell of cyclonic conditions which lasted until the 22nd. During this time rain occurred almost daily and some heavy falls were recorded especially between the 7th and 10th, 3·09 in. at Northwood, Middlesex on the 7th*, 2·06 in. at Abbeyfeale, Co. Limerick on the 8th, 2·04 in. at Wellingborough, Northants and 1·97 in. at Eastbourne on the 10th. Thunderstorms were reported from several places on the 7th–10th, 14th, 15th and 17th–19th and on the 10th waterspouts accompanying a thunderstorm were observed in the English Channel off Newhaven. Strong winds occurred on a few days mainly in the south and gales were experienced in south England on the 18th–19th. Throughout this time day temperatures were rather low but night minima were frequently above normal, 64°F. was the minimum at Gorleston and Tottenham during the night of the 6th–7th. There was also a general lack of sunshine though on isolated days there were long sunny periods, especially in the north. Tiree had 16·8 hrs. on the 9th, Oban 15·8 hrs. on the 10th, and Hastings 14·6 hrs. on the 16th. A wedge of high pressure crossing the country on the 22nd brought bright weather to most districts but a fresh depression moving from north-west Ireland to the Faroes from the 23rd to 26th caused a renewal of unsettled conditions generally though there was considerable sunshine except in the north. Gales were experienced in western districts on the 24th and thunderstorms occurred generally in England on the 25th while rainfall was heavy locally, 2·56 in. at Fofanny, Co. Down on the 23rd. The 27th was mainly a sunny day, 14·1 hrs. at Aberdeen, but on the 28th–29th a depression in the English Channel brought rain again and thunderstorms occurred locally. On the 30th the Azores anticyclone spread eastwards so that there was sunny weather over most of south England but the unsettled conditions had spread over the country again on the 31st. The

* See p. 161.

distribution of bright sunshine for the month was as follows :—

	Total (hrs.)	Diff. from normal (hrs.)		Total (hrs.)	Diff. from normal (hrs.)
Stornoway ...	163	+15	Chester ...	127	−33
Aberdeen ...	138	−13	Ross-on-Wye ...	125	−63
Dublin	116	−56	Falmouth ...	159	−62
Birr Castle ...	93	−55	Gorleston ...	184	−22
Valentia... ...	148	−10	Kew	139	−56

Miscellaneous notes on weather abroad culled from various sources

Heavy rain in Moldavia and Bessarabia on the 5th caused floods which washed away two railway bridges—6 people were reported to have been killed by lightning. About the middle of the month the crops in the Volga Basin and the Ural Region were suffering from lack of rain. The Great St. Bernard Pass was re-opened to traffic on the 12th. Abnormally wet and cold weather was experienced in Switzerland during the middle of the month and as a result the rivers began to rise and Lake Constance to overflow. In the Canton Grisons several roads were blocked by landslips. Snow fell on the 13th in the Alps down to the 4,000 ft. level. During a storm on the night of the 16th–17th a schooner foundered off Utklippoma, Sweden, and her crew were drowned. Cold stormy weather was again experienced in the Bernese Oberland later in the month. A gale occurred at Venice on the 21st doing damage to crops and trees. Much damage was done by thunderstorms in Constantinople about the 26th and 27th when 2 people were killed and many houses in low-lying districts were washed away. After a series of thunderstorms the temperature dropped in north Italy and 2 ft. of snow fell in the valley near Domodossola. A severe forest fire broke out on the 30th between Vence and St. Paul on the French Riviera and a strong mistral hampered the fire fighters. (*The Times*, July 7th–August 1st.)

A typhoon swept over South Kyushu (Japan) on the 23rd causing extensive floods while much damage was done to shipping. Seventy villages over an area of 20 sq. miles were submerged about the 20th as a result of the flooding of the River Rapti in the Gorakhpur district of the United Provinces. Heavy rain occurred later but by the 27th the floods were slowly subsiding. Further heavy rain on the 28th however seriously increased the floods, and on the 29th the rivers were still rising. A landslip occurred in the Teesta Valley near Darjeeling about the 27th and floods were reported in the hill country of Bengal, Assam and Bihar. (*The Times*, July 22nd–30th.)

The total rainfall for the month in Australia was generally above normal except in Western Australia and parts of New South Wales and Tasmania. (Cable.)

Temperature was generally considerably above normal except in the western Gulf States and at the beginning and end of the month in the eastern States. Rainfall was mainly below normal except in parts of the Gulf States. Great heat and drought caused extensive damage to all crops and pasturage in the prairie provinces

of Canada and in the north and central United States and to a less extent in the south-east States. Extensive hail about the 20th caused losses to crops in Saskatchewan and Alberta. Towards the end of the month heavy rain greatly benefited the crops in eastern Canada and showers and lower temperatures brought some relief to the drought areas generally. A severe thunderstorm accompanied by hail did much damage east of Ottawa on the 28th. (*The Times*, July 6th–31st and *Washington, D.C., U.S. Dept. Agric. Weekly Weather and Crop Bulletin.*)

Daily Readings at Kew Observatory, July, 1936

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	1005·3	S.4	59	70	56	trace	6·7	r_0 24h.
2	1003·7	S.4	57	69	75	0·11	2·1	r_0–r 0h.–10h.
3	1007·7	SSW.3	58	68	66	0·03	1·4	r_0 0h.–5h.; 16h. & 24h.
4	1014·4	SSW.5	59	73	51	trace	4·7	r_0 0h.
5	1017·3	W.3	61	75	59	—	6·9	
6	1014·7	S.3	57	75	60	—	2·2	W early.
7	1008·9	SSE.2	63	75	69	0·01	1·1	t 13h. r_0 15h. pr_0 19h.
8	1011·2	SW.3	56	70	48	—	7·7	pr_0 16h.
9	1008·6	W.2	51	61	91	0·56	0·0	r–r_0 8h.–18h. [24h.
10	1007·5	WSW.2	52	64	74	0·08	1·1	r–r_0 9h.–12h. & 20h.–
11	1010·7	WSW.4	55	65	59	0·12	4·5	r_0 0h.–4h.; pR 13h.
12	1011·0	SW.4	56	66	64	0·21	4·6	r_0 14h.–18h. & 19h.–
13	1007·3	W.4	59	68	56	—	7·3	r_0 3h. [22h.
14	1009·9	SW.5	55	69	55	0·03	5·5	r–r_0 20h.–24h.
15	999·7	WNW.3	54	67	62	0·48	3·0	rR 0h.–8h.; pr_0 21h.
16	1014·0	WSW.3	55	71	56	—	7·4	
17	1009·1	SE.2	54	76	63	0·02	2·8	r_0 0h.–6h.
18	1005·6	S.6	61	69	57	trace	4·8	r_0 19h.–24h.
19	1007·9	WSW.4	58	68	62	0·18	2·0	r 0h.–2h.; R 18h.
20	1006·8	SW.4	55	66	68	0·01	6·5	r_0 12h., 16h. & 17h.
21	1011·9	W.2	54	65	62	0·01	3·1	r 15h.
22	1013·1	NW.1	50	67	59	—	6·5	w early.
23	1003·7	S.4	57	64	91	0·18	0·0	r–d_0 4h.–18h.
24	1008·3	SSW.5	58	68	57	0·01	11·1	r_0 6h.–7h.
25	1010·2	SW.2	58	68	64	0·04	8·9	t 10h. pr during day.
26	1014·9	SW.3	51	65	61	0·01	7·1	r_0 13h., 16h. & 18h.
27	1016·5	S.3	48	68	58	—	9·4	w early. [L 21h.
28	1012·1	SW.2	55	65	86	0·11	0·4	r 12h.–14h.; t 13h.
29	1016·9	N.4	55	64	69	0·04	2·8	r 8h.–10h.; pr 12h.
30	1024·8	WSW.3	49	68	56	—	7·2	w early; r_0 20h.
31	1014·1	SW.4	56	67	87	0·11	0·7	r_0–r 6h.–12h.; r_0 23h.
*	1010·6	—	56	68	65	2·35	4·5	* Means or totals.

General Rainfall for July, 1936

England and Wales ...	191	per cent of the average 1881–1915
Scotland	150	
Ireland	197	
British Isles	182	

Rainfall: July, 1936: England and Wales

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av.
Lond.	Camden Square.....	2·98	125	*Leics.*	Belvoir Castle.....	5·46	225
Sur.	Reigate, Wray Pk. Rd..	4·28	190	*Rut.*	Ridlington	5·50	219
Kent.	Tenterden, Ashenden...	4·06	194	*Lincs.*	Boston, Skirbeck.....	4·28	195
,, .	Folkestone, Boro. San.	5·26	...	,, .	Cranwell Aerodrome...	4·63	198
,, .	Margate, Cliftonville....	3·57	180	,, .	Skegness, Marine Gdns.	3·91	179
,, .	Eden'bdg., Falconhurst	4·66	203	,, .	Louth, Westgate.....	3·89	156
Sus.	Compton, Compton Ho.	5·64	199	,, .	Brigg, Wrawby St.....	4·02	...
,, .	Patching Farm.....	4·05	169	*Notts.*	Worksop, Hodsock.....	3·76	166
,, .	Eastbourne, Wil. Sq....	5·36	245	*Derby.*	Derby, L. M. & S. Rly.	3·97	167
Hants.	Ventnor, Roy.Nat.Hos.	3·95	195	,, .	Buxton, Terr. Slopes...	7·20	183
,, .	Fordingbridge, Oaklnds	5·25	262	*Ches.*	Runcorn, Weston Pt....	3·72	135
,, .	Ovington Rectory.....	...	...	*Lancs.*	Manchester, Whit. Pk.	3·67	111
,, .	Sherborne St. John.....	4·30	193	,, .	Stonyhurst College.....	5·07	131
Herts.	Royston, Therfield Rec.	5·53	219	,, .	Southport, Bedford Pk.	2·91	102
Bucks.	Slough, Upton.....	2·95	154	,, .	Lancaster, Greg Obsy.	3·43	98
,, .	H. Wycombe, Flackwell	3·34	166	*Yorks.*	Wath-upon-Dearne.....	3·93	156
Oxf.	Oxford, Mag. College...	3·40	150	,, .	Wakefield, Clarence Pk.	3·69	146
N'hant	Wellingboro, Swanspool	7·88	344	,, .	Oughtershaw Hall.....	6·98	...
,, .	Oundle	5·63	...	,, .	Wetherby, Ribston H..	3·94	158
Beds.	Woburn, Exptl. Farm...	6·42	288	,, .	Hull, Pearson Park.....	3·64	156
Cam.	Cambridge, Bot. Gdns.	5·04	233	,, .	Holme-on-Spalding.....	3·61	139
Essex.	Chelmsford, County Gdns	3·48	163	,, .	West Witton, Ivy Ho.	3·35	127
,, .	Lexden Hill House.....	2·95	...	,, .	Felixkirk, Mt. St. John.	4·53	166
Suff.	Haughley House.....	3·08	...	,, .	York, Museum Gdns....	3·01	119
,, .	Campsea Ashe.....	3·68	160	,, .	Pickering, Hungate.....	3·14	117
,, .	Lowestoft Sec. School...	3·42	151	,, .	Scarborough.....	2·88	119
,, .	Bury St. Ed., Westley H.	4·33	173	,, .	Middlesbrough.....	3·45	135
Norf. .	Wells, Holkham Hall...	5·18	223	,, .	Baldersdale, Hury Res.	2·81	88
Wilts.	Calne, Castle Walk.....	4·54	...	*Durh.*	Ushaw College.....	2·94	105
,, .	Porton, W.D. Exp'l. Stn	3·66	185	*Nor.*	Newcastle, D. & D. Inst.	2·18	90
Dor.	Evershot, Melbury Ho.	6·89	272	,, .	Bellingham, Highgreen	5·27	160
,, .	Weymouth, Westham.	3·16	176	,, .	Lilburn Tower Gdns....	3·18	129
,, .	Shaftesbury, Abbey Ho.	4·66	181	*Cumb.*	Carlisle, Scaleby Hall...	4·65	142
Devon.	Plymouth, The Hoe....	6·52	236	,, .	Borrowdale, Seathwaite	15·50	196
,, .	Holne, Church Pk. Cott.	10·74	305	,, .	Borrowdale, Moraine...	10·85	171
,, .	Teignmouth, Den Gdns.	5·56	239	,, .	Keswick, High Hill.....	6·63	173
,, .	Cullompton	6·29	234	*West.*	Appleby, Castle Bank...	5·07	160
,, .	Sidmouth, U.D.C.....	4·83	...	*Mon.*	Abergavenny, Larchf'd	6·23	250
,, .	Barnstaple, N. Dev.Ath	6·55	243	*Glam.*	Ystalyfera, Wern Ho....	9·83	214
,, .	Dartm'r, Cranmere Pool	15·80	...	,, .	Cardiff, Ely P. Stn.....	7·30	234
,, .	Okehampton, Uplands.	11·23	346	,, .	Treherbert, Tynywaun.	14·26	...
Corn.	Redruth, Trewirgie.....	7·16	235	*Carm.*	Carmarthen, Coll. Rd.	6·56	187
,, .	Penzance, Morrab Gdns.	7·97	293	*Pemb.*	St. Ann's Hd, C.Gd. Stn.	4·34	176
,, .	St. Austell, Trevarna...	8·22	245	*Card.*	Aberystwyth	6·82	...
Soms.	Chewton Mendip.....	7·57	217	*Rad.*	Birm W.W.Tyrmynydd	7·91	193
,, .	Long Ashton.....	5·85	206	*Mont.*	Lake Vyrnwy	8·51	248
,, .	Street, Millfield.....	...	...	*Flint.*	Sealand Aerodrome.....	2·49	...
Glos.	Blockley	4·92	...	*Mer.*	Blaenau Festiniog ...	12.40	159
,, .	Cirencester, Gwynfa....	6·28	243	,, .	Dolgelley, Bontddu.....	10·14	238
Here.	Ross, Birchlea.....	5·80	256	*Carn.*	Llandudno	2·95	132
Salop.	Church Stretton.....	6·03	246	,, .	Snowdon, L. Llydaw 9..	17·50	...
,, .	Shifnal, Hatton Grange	6·24	277	*Ang.*	Holyhead, Salt Island...	3·67	141
Staffs.	Market Drayt'n, Old Sp.	4·39	163	,, .	Lligwy	3·84	...
Worc.	Ombersley, Holt Lock.	5·16	241	*Isle of Man*			
War.	Alcester, Ragley Hall...	5·18	218		Douglas, Boro' Cem....	5·75	188
,, .	Birminghm, Edgbaston	6·59	284	*Guernsey*			
Leics.	Thornton Reservoir ...	5·29	213		St. PeterP't.Grange Rd.	5·45	270

Rainfall: July, 1936: Scotland and Ireland

Co.	Station.	In.	Per cent of Av.	Co.	Station.	In.	Per cent of Av
Wig .	Pt. William, Monreith.	5·92	211	*Suth* .	Tongue	4·53	148
„ .	New Luce School	...	...	„ .	Melvich	5·12	183
Kirk .	Dalry, Glendarroch	...	...	„ .	Loch More, Achfary	6·61	124
Dumf.	Dumfries, Crichton R.I.	4·23	137	*Caith* .	Wick	4·77	181
„ .	Eskdalemuir Obs	6·87	168	*Ork* .	Deerness	3·79	147
Roxb .	Hawick, Wolfelee	5·93	192	*Shet* .	Lerwick	3·45	151
Selk .	Ettrick Manse	6·89	155	*Cork* .	Dunmanway Rectory	4·76	122
Peeb .	West Linton	6·78	...	„ .	Cork, University Coll	5·67	209
Berw .	Marchmont House	2·37	78	„ .	Ballinacurra	4·61	165
E.Lot .	North Berwick Res	3·57	138	„ .	Mallow, Longueville	5·35	214
Midl .	Edinburgh, Blackfd. H.	4·36	155	*Kerry.*	Valentia Obsy	4·69	124
Lan .	Auchtyfardle	3·71	...	„ .	Gearhameen	9·20	160
Ayr .	Kilmarnock, Kay Pk	6·09	...	„ .	Bally McElligott Rec	4·44	...
„ .	Girvan, Pinmore	7·43	204	„ .	Darrynane Abbey	4·90	129
Renf .	Glasgow, Queen's Pk	5·10	175	*Wat* .	Waterford, Gortmore	6·37	200
„ .	Greenock, Prospect H.	6·66	170	*Tip* .	Nenagh, Cas. Lough	6·80	216
Bute .	Rothesay, Ardencraig	5·66	...	„ .	Roscrea, Timoney Park	8·56	...
„ .	Dougarie Lodge	5·11	...	„ .	Cashel, Ballinamona	7·10	248
Arg .	Ardgour House	8·41	...	*Lim* .	Foynes, Coolnanes	7·26	236
„ .	Glen Etive	...	...	„ .	Castleconnel Rec	6·30	...
„ .	Oban	4·82	...	*Clare* .	Inagh, Mount Callan	12·05	...
„ .	Poltalloch	5·12	124	„ .	Broadford, Hurdlest'n.	6·94	...
„ .	Inveraray Castle	6·58	132	*Wexf* .	Gorey, Courtown Ho	5·89	200
„ .	Islay, Eallabus	4·09	120	*Wick* .	Rathnew, Clonmannon.	6·57	...
„ .	Mull, Benmore	11·60	115	*Carl* .	Hacketstown Rectory	7·67	222
„ .	Tiree	...	...	*Leix* .	Blandsfort House	8·78	280
Kinr .	Loch Leven Sluice	4·78	166	*Offaly.*	Birr Castle	6·14	208
Fife .	Leuchars Aerodrome	...	...	*Dublin*	Dublin, FitzWm. Sq.	5·63	220
Perth .	Loch Dhu	6·85	142	„ .	Balbriggan, Ardgillan	...	...
„ .	Balquhidder, Stronvar.	7·95	...	*Meath.*	Beauparc, St. Cloud	6·47	...
„ .	Crieff, Strathearn Hyd.	4·84	163	„ .	Kells, Headfort	7·71	242
„ .	Blair Castle Gardens	4·99	195	*W.M* .	Moate, Coolatore	7·04	...
Angus.	Kettins School	3·11	120	„ .	Mullingar, Belvedere	6·67	210
„ .	Pearsie House	4·94	...	*Long* .	Castle Forbes Gdns	6·77	217
„ .	Montrose, Sunnyside	4·12	157	*Gal* .	Galway, Grammar Sch.	...	...
Aber .	Braemar, Bank	3·14	122	„ .	Ballynahinch Castle	4·64	112
„ .	Logie Coldstone Sch	...	...	„ .	Ahascragh, Clonbrock.	6.43	185
„ .	Aberdeen, Observatory.	4·67	166	*Mayo.*	Blacksod Point	5·09	162
„ .	Fyvie Castle	4·53	139	„ .	Mallaranny	6.86	...
Moray	Gordon Castle	4·20	131	„ .	Westport House	5·15	166
„ .	Grantown-on-Spey	5·02	164	„ .	Delphi Lodge	11·16	168
Nairn.	Nairn	4·65	173	*Sligo* .	Markree Castle	6·22	181
Inv's .	Ben Alder Lodge	4·53	...	*Cavan.*	Crossdoney, Kevit Cas.	5·78	...
„ .	Kingussie, The Birches.	4·45	...	*Ferm* .	Newtownbtlr, Crom Cas.	5·89	169
„ .	Loch Ness, Foyers	4·92	163	„ .	Enniskillen, Portora	...	...
„ .	Inverness, Culduthel R.	3·66	...	*Arm* .	Armagh Obsy	5·89	203
„ .	Loch Quoich, Loan	6·45	...	*Down.*	Fofanny Reservoir	11·02	...
„ .	Glenquoich	6·03	94	„ .	Seaforde	6·44	202
„ .	Glenleven, Corrour	5·50	133	„ .	Donaghadee, C. G. Stn.	5·60	200
„ .	Fort William, Glasdrum	6·75	...	*Antr* .	Belfast, Cavehill Rd	6·56	...
„ .	Skye, Dunvegan	3·15	...	„ .	Aldergrove Aerodrome.	5·81	207
„ .	Barra, Skallary	2·87	...	„ .	Ballymena, Harryville.	7·05	206
R&C .	Alness, Ardross Castle.	4·74	156	*Lon* .	Garvagh, Moneydig	6·96	...
„ .	Ullapool	4·51	142	„ .	Londonderry, Creggan.	9·62	262
„ .	Achnashellach	5·19	101	*Tyr* .	Omagh, Edenfel	8·17	240
„ .	Stornoway, Matheson	3·74	123	*Don* .	Malin Head	5·22	...
Suth .	Lairg	6·16	197	„ .	Killybegs, Rockmount.	4·45	...

Climatological Table for the British Empire, February, 1936

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....	1006·8	— 9·2	53	23	42·6	32·9	37·7	— 3·0	34·3	87	6·5	1·61	+ 0·07	13	2·6	26
Gibraltar	1012·5	— 7·5	67	43	59·8	52·1	55·9	...	53·1	88	6·3	10·89	...	19	...	...
Malta.....	1009·8	— 6·3	76	41	60·3	51·6	55·9	+ 0·6	51·1	77	6·5	0·72	— 1·48	6	5·5	51
St. Helena	1012·7	+ 0·5	71	57	68·0	59·9	63·9	— 2·0	60·6	90	9·5	1·54	— 1·14	15	...	...
Freetown, Sierra Leone	1011·5	+ 2·4	94	72	87·2	74·5	80·9	— 1·4	75·0	78	6·4	0·02	— 0·28	1	...	...
Lagos, Nigeria	1009·9	+ 0·2	92	74	88·7	77·8	83·3	+ 0·8	77·3	88	6·4	1·54	— 0·36	6	7·1	60
Kaduna, Nigeria	1008·1	— 2·6	97	54	93·4	61·9	77·7	+ 0·8	60·2	50	2·1	0·08	+ 0·06	1	9·1	77
Zomba, Nyasaland	1007·4	— 0·5	83	53	79·6	64·3	71·9	— 0·1	70·6	87	8·3	18·50	+ 7·85	24	...	...
Salisbury, Rhodesia...	1009·2	— 1·0	83	56	79·4	61·4	70·4	+ 1·6	63·9	77	8·5	6·41	— 0·41	18	5·3	42
Cape Town	1014·7	+ 1·3	96	46	76·8	58·1	67·5	— 2·8	58·1	70	4·1	0·36	— 0·22	6	...	...
Johannesburg	1009·9	— 0·7	84	48	75·8	55·9	65·9	+ 0·3	58·7	73	5·3	3·56	— 1·66	14	8·1	62
Mauritius	1011·1	+ 0·1	88	70	85·8	73·4	79·6	+ 0·3	75·9	75	5·3	6·92	— 1·48	20	9·0	70
Calcutta, Alipore Obsy.	1012·5	— 0·8	94	55	83·6	61·3	72·5	+ 1·3	63·1	89	3·9	1·05	+ 0·06	1*	...	...
Bombay	1012·2	— 0·5	90	65	82·8	68·6	75·7	0·0	67·9	78	2·9	0·07	+ 0·04	0*	...	...
Madras	1011·6	— 1·3	88	68	85·4	73·2	79·3	+ 1·6	74·5	84	6·2	2·53	+ 2·23	7*	...	...
Colombo, Ceylon	1011·3	+ 0·5	89	69	86·4	73·1	79·7	— 0·7	75·1	70	4·3	4·07	+ 2·13	10	9·8	82
Singapore.....	1010·5	+ 0·3	90	73	87·7	75·2	81·5	+ 1·3	76·9	80	5·9	1·12	— 5·50	9	7·1	59
Hongkong.....	1016·0	— 2·6	76	46	64·1	55·9	60·0	+ 0·9	56·7	85	9·2	3·35	+ 1·52	20	1·7	15
Sandakan	1011·2	...	92	72	88·5	74·8	81·7	+ 1·5	77·5	81	7·0	1·62	— 9·35	5	...	...
Sydney, N.S.W.....	1015.1	+ 1·2	82	58	75·1	64·6	69·9	— 1·4	65·5	74	8·7	5·05	+ 0·85	16	5·1	40
Melbourne	1014·6	+ 0·1	93	46	79·4	57·4	68·4	+ 0·8	60·8	61	5·5	0·58	— 1·13	8	7·9	60
Adelaide.....	1014·9	+ 0·7	101	52	83·6	60·6	72·1	— 1·9	60·6	44	5·5	0·82	+ 0·10	4	9·0	68
Perth, W. Australia ...	1013·4	+ 0·4	104	52	84·2	62·9	73·5	— 0·6	61·1	48	3·1	0·00	— 0·45	0	10·6	80
Coolgardie	1011·4	— 1·1	109	50	89·9	61·7	75·8	— 0·4	63·7	53	2·2	0·12	— 0·73	1	...	...
Brisbane.....	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hobart, Tasmania.....	1015·4	+ 2·2	92	45	72·5	53·6	63·1	+ 0·8	55·7	59	5·2	0·28	— 1·20	7	7·2	52
Wellington, N.Z.	1014·5	— 1·3	79	49	67·5	55·0	61·3	— 1·3	57·8	75	7·4	9·90	+ 6·76	14	5·8	42
Suva, Fiji	1007·7	— 0·1	91	73	87·7	76·3	82·0	+ 1·7	77·2	83	5·8	9·14	— 1·58	20	7·7	61
Apia, Samoa	1007·2	— 1·2	87	74	85·3	76·1	80·7	+ 1·7	77·4	82	7·3	11·72	— 3·57	20	5·7	45
Kingston, Jamaica	1014·4	— 0·9	89	66	85·0	68·0	76·5	0·0	65·8	83	1·4	0·55	— 0·05	4	5·4	47
Grenada, W.I.	1011·4	— 2·1	87	76	85	73	79·0	+ 1·9	73	57	4	1·35	— 1·43	14	...	...
Toronto.....	1018·2	— 0·2	47	— 3	24·7	10·2	17·5	— 3·6	...	...	6·5	2·79	+ 0·41	13	4·0	38
Winnipeg	1023·0	+ 1·2	18	—43	—4·9	—23·1	—14·0	—14·1	...	...	4·1	1.40	+ 0·66	11	5·2	52
St. John, N.B.	1012·5	— 1·4	42	—10	23·7	8·3	16·0	— 3·9	12·5	69	6·0	0·50	— 3·40	2	5·4	52
Victoria, B.C.....	1012·7	— 3·9	49	9	37·5	28·8	33·1	— 7·4	30·2	79	9·6	3·95	+ 0·69	11	3·2	31

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

(33210) Wt. 19/32 1050 8/36 Hw. G.377