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THE WINTER OF 1919-20.

A Remarkable Season.

By Sir JOHN W. MOORE, M.D., D.Sc., F.R.Met.Soc.

THE long winter of 1919-20 has not yet drawn to a close, if one may judge by the violent S.W. gale which swept over Ireland on Sunday, May 2nd, by the low temperature which has since prevailed, with the exception of a few hours on Thursday, the 6th inst., and by frequent hail showers during the present week.

And yet the winter, if one of the longest, has been one of the mildest on record—a paradox, but a fact. September, 1919, in its first half bore the impress of the fine summer of last year, for the weather was both warm and generally fine and dry. The latter half was less settled and some sharp spells were felt, distinctly autumnal in character and fore-runners of winter. October was a dry cool month, with an unusually high mean atmospheric pressure of 30.22 in. (1023.4 mb.) and a great and persistent prevalence of winds from between NW. and NE. November was cold, cloudy, unsettled. The mean temperature was 5.5° below the average for the 35 years 1881-1915, and only 1.8° in excess of the record low temperature for November which occurred in 1878. The precipitation, which was .34 in. above average, was mainly in the form of hail and snow. Hail fell on ten days and snow on eight. Indeed, snow lay on the ground in the Dublin district from the 12th to the 16th, inclusive—an

unusual feature so early in an Irish winter. The wind, while mainly westerly, had still a good deal of northing in it. With the passing of November came a complete change, and December proved to be a very open month of SW. and W. winds, much cloud, and frequent rain. Large and deep atmospheric depressions, or their secondaries, swept in over the British Isles from the Atlantic. In Dublin the mean temperature of the closing month of 1919 was $1\cdot4^{\circ}$ above the average ($42\cdot0^{\circ}$) and $4\cdot0^{\circ}$ above that of November.

The first three months of 1920 resembled December, 1919. The weather of January was almost continuously of the oceanic or south-westerly type. Atmospheric depressions of great size and intensity swept past the western shores of the British Isles in quick succession. Like December and January, February was open, with a preponderance of equatorial or oceanic winds (SW. and W.), much cloud, and a moist atmosphere. March proved to be the fourth consecutive month in which the mean temperature was materially in excess of the average. It was an open month of south-westerly winds, much cloud, and frequent, but not especially heavy, rainfall, $2\cdot06$ in. on 19 days.

TABLE OF TEMPERATURE

Showing a comparison of the Season 1919-1920 with that of the Normals for 35 years 1881-1915.

Month.	Normals, 1881-1915.			1919-1920.			Excess.	Defect.
	Max.	Min.	Mean.	Max.	Min.	Mean.		
	$^{\circ}$ F.	$^{\circ}$ F.	$^{\circ}$ F.	$^{\circ}$ F.	$^{\circ}$ F.	$^{\circ}$ F.	$^{\circ}$ F.	$^{\circ}$ F.
September - -	61·8	50·3	56·1	61·6	49·3	55·5	—	0·6
October - -	55·1	44·8	50·0	54·6	43·9	49·3	—	0·7
November - -	50·1	40·9	45·5	44·9	35·1	40·0	—	5·5
December - -	46·9	38·2	42·6	48·8	39·2	44·0	1·4	—
January - -	46·1	37·5	41·8	49·2	38·0	43·6	1·8	—
February - -	47·0	37·6	42·3	50·3	41·0	45·7	3·4	—
March - -	49·2	38·1	43·7	50·8	39·8	45·3	1·6	—
April - -	53·7	41·4	47·6	51·7	41·8	46·8	—	0·8
Mean for Eight Months, Sep- tember-April.	51·2	41·1	46·2	51·5	41·0	46·3	0·1	—

With the coming of April, winter may be said to have returned. Winds from polar points of the compass took the place of the equatorial currents of the winter, and the first complete spring month was cloudy, cold and cheerless, with 27 rain days in Dublin. The mean temperature for the first

time since November fell short of the average by, it is true, only $0\cdot8^{\circ}$. But the mean maximum was $2\cdot0^{\circ}$ in defect owing to absence of sunshine, whereas the mean minimum was $0\cdot4^{\circ}$ above the average in consequence of the clouded state of the night sky.

The mean temperature for the four months December to March inclusive was $2\cdot5^{\circ}$ above average.

The highest temperatures in the screen in each of the past eight months have been $71\cdot9^{\circ}$ on September 10th, $66\cdot4^{\circ}$ on October 6th, $58\cdot0^{\circ}$ on November 23rd, $54\cdot9^{\circ}$ on December 5th, $60\cdot8^{\circ}$ on January 17th, $61\cdot0^{\circ}$ on February 29th, $57\cdot2^{\circ}$ on March 17th, and $58\cdot8^{\circ}$ on April 22nd. The maximal readings in January and February were quite unique for Dublin.

Correspondence.

To the *Editors*, "*Meteorological Magazine*."

The Mild Winter, 1919-20.

THE past winter was so exceptionally mild that I think a few particulars may be of interest.

At Ross-on-Wye the mean temperature for the period December to February (inclusive) was $3\cdot8^{\circ}$ F. in excess of the normal.

The actual temperatures for each month are as follows:—

Month.	Mean Temperature, Winter 1919-20.	Average for 35 years, 1881-1915.	Excess over Normal.
	$^{\circ}$ F.	$^{\circ}$ F.	$^{\circ}$ F.
December -	43·2	40·0	3·2
January -	42·9	38·5	4·4
February	43·8	39·9	3·9

Two very warm weeks occurred about mid-winter, viz., the week ending December 27th and the week ending January 17th, the mean temperature being well over 48° in the latter instance. In both weeks the excess warmth amounted to more than 10° F.

Nearly 50 days had a maximum temperature of 50° or over, whilst in February the mean daily maximum was as high as $50\cdot5^{\circ}$.

The persistent mildness of the winter seems to have been less accentuated in the East and South-East of England than in the West, and, contrary to the usual experience, the highest temperatures were recorded inland, although the prevailing winds, off the Atlantic, often blew with considerable force.

Temperatures around 55° were especially common in the West of England and in Wales. The actual highest temperature here for each month was, in December 55° ; in January 56° ; in February 60° . The last-named reading had not been registered here in February since 1899, and was followed within 48 hours by snow!

Immunity from frost and snow has been a feature of the past winter. The number of nights here with frost in the screen was a dozen or so for the whole three months, the severest frost occurring on January 6th, when the minimum was 22° . This was the coldest day, for in the day-time the thermometer failed to rise above 30° . The next day ended the only really cold spell of the winter, which had begun with the new year. Day temperatures were a little under 40° , though the night readings were seldom below 32° .

In December and February, however, there was not a single instance of a maximum temperature below 40° , the lowest being 41° in the last week of February.

The result of such a mild winter was evidenced by the unusually forward state of vegetation. Many spring flowers were out and many fruit trees were in blossom by the middle of February.

FREDERICK J. PARSONS.

Chasedale Observatory, Ross-on-Wye, 7th May, 1920.

THE remarkable mildness which has prevailed since the beginning of December has been so noteworthy that I venture to trouble you with a few remarks upon the results of the thermometrical readings here. Following the coldest November since 1910, the mean temperature of the combined winter months December to February, inclusive, was as high as 41.2° . During the last 30 years it has been as warm, or warmer, on only five occasions, viz., 1897-8, 41.3° ; 1898-9, 42.6° ; 1902-3, 41.8° ; 1912, 41.2° ; and 1915-16, 41.7° . But the abnormal mildness of March, following these warm months, was even more remarkable, as the mean temperature of that month was as high as 46.3° , which is the highest recorded by me during the 38 years in which I have kept a register. The result of all this warmth, followed by the forcing rains of April (3.60 in. here) has been a forwardness of vegetation beyond what is usual even in warm springs. The hawthorn (*cratægus oxyacantha*) was in bloom on April 15th, which is the earliest date in my register. I find, however, in the Marsham (Norfolk) records that it was in flower in 1779 as early as April 6th, which appears to hold the record. I cut a good bunch of asparagus on April 3rd, and my early peas were in bloom in the garden before the close of the month.

ARTHUR W. PRESTON.

Christchurch Lodge, Eaton, Norwich, 5th May, 1920.

THE passing winter may long be remembered as the mildest within the recollection of most modern meteorologists. The months have been all out of place, and in advance of their time, so far as their individual temperatures are concerned. Michaelmas Day gave us the first intimation of winter in a most unusually early slight ground frost down to $29\cdot2^{\circ}$ F. Apart from the thermometer, Nature gave us some object lessons. The last swallows were seen on October 31st instead of waiting until the middle of November. They seemed to have some secret knowledge of the cold November coming. The Isle of Wight is one of the temperate counties, where the extremes of heat in summer and cold in winter of the Midland district are absent. For the winter we may take, not the six dark months, but rather November to April inclusive. Of these six months the coldest is usually February, but this winter it was November. Sweet peas remained in bloom until November 23rd. Runner beans were gathered as late as November 7th; on this date too fuchsia bushes in the open were in full bloom. On October 27th several apple trees were in blossom again, and remained in full bloom until January 7th the coldest day this winter, with a temperature down to $21\cdot9^{\circ}$ F. Of the six winter months, after November had gone, with its mean temperature down to $40\cdot9^{\circ}$ F. ($5\cdot4^{\circ}$ colder than average), all the remaining five winter months were much too warm. December to April was warmer than November. The December minimum in the screen went down to only $31\cdot6^{\circ}$ F. January, like December, was on the whole 2° warmer than usual. The real surprise of the winter was the 60-day period of February and March, which worked out at a mean temperature of $45\cdot6^{\circ}$, or exactly 4° warmer than the average. The first frost on the screen was on November 11th; there had been no screen frost since April 3rd. The last screen frost was on March 9th. The last frost on the grass was also on March 9th. May 5th tried to give us one more frost, but just failed, the grass thermometer going down only to $32\cdot7^{\circ}$ F. But this was sufficient to brown off many of the early hawthorn and elm leaves. During the six months November to April there were only 38 grass frosts and 18 frosts in the air. The absence of any screen frost in February was most remarkable. March 3rd is on the average the coldest night of the winter at Totland; this year on that date the thermometer was down to $32\cdot2^{\circ}$. Swallows were back with us on April 8th. Hawthorn was in full bloom in many places on April 10th; this was three days earlier than my preceding record here on April 13th in 1903. November this winter was colder than any of its predecessors during the past 34 years. While in Yorkshire I noticed elderberry and dog-rose in full

leaf in January during a long succession of westerly winds; it appeared somewhat out of place one morning when on a 17-mile walk the Whitby Wolds were covered with snow at noon. The sun did little to warm through February, but clouds managed to do what the sun left undone. The same might be said of April, but during March the sun did help. Both March and April have only once in 34 years been exceeded in warmth. Mushrooms appeared on the Needles Downs in abundance during the third week in April. The sea usually gets to its coldest about the third week of February, but the lowest temperature this winter was $43^{\circ}2'$ during the third week of November and the 1st week of January. The sea was unusually warm during February, not going below $44^{\circ}2'$, which is 4° warmer than the usual February temperature.

Totland Bay, Isle of Wight, 7th May, 1920.

JOHN DOVER.

THE past winter has been remarkable here for the general high level of the temperature and the absence of any severe frost. The autumn had been a cold one, November exceptionally so, though the extreme minimum, $20^{\circ}8'$, was not remarkable, but the four months December 1919 to March 1920 were all very mild and open, and the mean temperature of the period, $42^{\circ}2'$, was $3^{\circ}1'$ above the average and higher than in any of the previous 44 years, a striking contrast to the winter of three years ago, 1916-17, when the mean for the same four months was only $35^{\circ}3'$. The only winter which compares with the past one for warmth was that of 1883-84, when the mean for the four months was $41^{\circ}8'$. The absence of any sharp frosts has also been remarkable, as the lowest temperature in the four months was $23^{\circ}6'$, and a winter in which the thermometer does not fall below 20° is quite uncommon.

The only snowfall of consequence was on the night of February 19th, when a depth of about 7 inches was attained, and as it was wet and heavy it broke the wires down very badly, but most of it melted next day. There was also a heavy fall of snow and sleet on March 14th and 15th, which, though it did not lie here, disorganised the railway traffic south of Nottingham for some days.

HENRY MELLISH.

Hodsock Priory, Worksop, May 8th, 1920.

The Prolonged Deficiency of Easterly Winds.

As stepping-stones in the direction of the exploration of the fundamental causes of extended meteorological abnormalities, it is desirable to examine intermediate ones, rather than to confine one's attention to the final consequences (such as surface temperature and rainfall).

The keynote of most of 1919 was a very unusual prevalence of north-westerly and northerly winds, including those from nearly all points from west to north-east. Hence the combination of coolness with serious drought, except in central and eastern England.

But throughout the recent winter, southerly to westerly winds have greatly preponderated, as, indeed, they also did for many months immediately preceding 1919. The results are well known!

However, whether north of west or south of west, in one interesting respect the effect has been the same: *due east has been the chief direction to suffer*. At Southport, the net deficiency of easterly winds for the year 1918 was no less than 201 hours. But to this, 1919 added a further shortage of 271 hours; and the aggregate has been augmented during the first quarter of 1920 by another 129 hours. One cannot possibly expect such a state of things to continue much longer; in all probability, the greater proportion of these 601 hours of easterly* winds lost since the beginning of 1918 will have to be made up during the ensuing year or two. An unusual summer and autumn might, of course, do much in that direction, but 1920-21 winter pressure abnormalities of a "great frost" type could easily do more. And, unhappily (as I hope shortly to show elsewhere), exactly then is due a maximum of cold winds of a periodicity into which every severe winter during the last 80 years falls practically perfectly.

Very evidently, behind the mean monthly or annual slope of the isobar (which determines the wind direction) lies the state of the surrounding system of permanent atmospheric action-centres. That is the *vera causa*, so far as we are at present able to go. But there do not exist the long and accurate pressure records for each of those centres, which we should like to possess for mathematical analysis. Hence good wind direction statistics, at intermediate places, form very useful data. But they should be from continuous or hourly records, if possible, and, in any case, be unspoiled by frequent "calms."

JOSEPH BAXENDELL.

An Unusual April.

LAST year drought in the west of England set in about April 1st; this year, just a week earlier there started an exceptionally wet spell. From March 24th to April 22nd, a period of 30 days, as much as 7.99 in. of rain fell here.

Another fact unparalleled in 35 years' temperature observa-

* Throughout this Note the expressions "east" and "easterly" embrace the 45 degrees centring at 90°.

tions is that no frost was recorded, even by the exposed instruments, after March 22nd, till April 29th, a complete immunity from even ground frost for fully five weeks at a time when such visitations are greatly dreaded by the fruit-grower. However, this was not altogether a blessing; a few dry frosts would not have hurt, but the continuous wet rendered the blossom, especially in the case of peaches, so sodden that it dropped off without setting. Though the mean minimum temperature of April was the highest I have ever recorded ($40^{\circ} 1'$), the days were by no means warm, owing to absence of sun, and the reading of 64° recorded on March 30th was never again reached throughout April, the maximum being only 62° on two occasions. As evidence of the mildness and small snowfall of the past winter I may state that when spending a week in the Lake District at the end of April and the beginning of May we did not see a single bed of winter snow remaining, and beds usually do not disappear before June and sometimes later. There was a little snow on the tops above 2,800 feet or so from time to time, and drifts of 2 feet or more, but it was all fresh snow which fell at the time of our visit.

R. P. DANSEY.

Kentchurch Rectory, Hereford, May 6th, 1920.

WHEN a meteorological record has been running for a considerable number of years instances in which the extremes which have been established are exceeded become comparatively uncommon, and it seems therefore worth while calling attention to the very exceptional position of April 1920, in that, though observations have been taken here from 40 to 45 years, these records have been surpassed in each of the different elements of climate.

Thus in the matter of rainfall the total fall, $3\cdot74$ in., and the number of rain days, 24, were larger than in any of the previous 45 years, the nearest approach having been 1877 with $3\cdot43$ in. The peculiarity of the temperature was the mildness of the nights, which were on a par with what we expect in May; both the mean minimum, $41\cdot2^{\circ}$ and the extreme minimum, $31\cdot5^{\circ}$, were higher than we have had before, while the mean daily range, $12\cdot4^{\circ}$ was smaller than in any other year and little more than two-thirds of the normal figure. Sunshine values were even more exceptional; the total, $59\cdot3$ hours, was close to the normal value for February, it was 77 hours less than the average and 25 hours less than in 1888, which had hitherto been our dullest April. Corresponding with this, the amount of Cloud was the highest I have recorded. Finally, the mean pressure, $29\cdot692$ in., was lower than in any of the previous 42 Aprils.

HENRY MELLISH.

Hodssock Priory, Worksop, 7th May, 1920.

Mock Suns observed at Cranwell, March 27th, 1920.

Two mock suns were observed here at 7h. 25m. on the morning of the 27th inst. The sky was clear except for a little Cirro-stratus in which the mock sun seemed to be bedded. The sun's position at the time of observation was azimuth, $113^{\circ}4'$, elevation, $14^{\circ}3'$ as measured by a theodolite; and the positions of the two mock suns, which were visible simultaneously, were (a) azimuth, $89^{\circ}0'$; elevation, $14^{\circ}5'$, and (b) azimuth, $137^{\circ}1'$; elevation, $14^{\circ}0'$.

In each case the mock sun was coloured red on the side nearest the sun; no other colours were distinctly discernible. In each case, too, a pointed white tail extended on the sides remote from the true sun, parallel to the horizon. These streamers extended outward for about 6° . The mock sun (a) persisted until 8h., whilst (b) disappeared at 7h. 45m. The sky became cloudy at 13h., overcast at 15h., and rain fell at 16h. The barometer rose slightly from 7h. to 8h., and fell slowly, very slowly, thenceforward. W. H. PICK.

Cranwell, Lincs., March 31st, 1920.

[It will be remembered that mock suns are explained by the refraction of light through crystals which are hexagonal and flat; as such crystals settle down through the air they keep horizontal. The rays concerned pass with minimum deviation through faces inclined at 60° . The angle between the sun and the mock sun for the elevation $14^{\circ}3'$ is given by Pernter as $22^{\circ}5'$.—ED. M.M.]

Formation of Cumulus.

I SHOULD esteem it a favour if any of your readers could throw any light on the formation of cumulus cloud during the prevalence of a strong wind. During the last week when the breeze was often strong from some southerly point, I repeatedly noticed the sky filled with heavy cumulus clouds, and wondered how columns of warm air could exist sufficient to form such clouds with such a general movement of the air. Do these columns move with the surface wind, or are the clouds formed other than true cumulus. The most beautiful forms of cloud are, of course, seen on a still day when both the temperature and the humidity are high and there is a tendency for thunderstorms. I may say that during my stay in Macedonia I never witnessed such grand cloud scenes as one frequently sees in this more interesting climate of ours. From a meteorological point of view, I think the British Isles have no equal in the variety of weather features to be met with. E. HARRISON.

36, Rosemont Road, Richmond, Surrey, March 29th, 1920.

OFFICIAL NOTICES.

Aeronautical Research and Education.

THE report of a Committee appointed by the Secretary of State for Air to consider future arrangements for Aeronautical Research and Education was recently issued as Command Paper 554. The Committee, which was presided over by Sir Richard Glazebrook, recommended that the present Advisory Committee for Aeronautics should be replaced by an Aeronautical Research Committee in connection with the Air Ministry. Such an Aeronautical Research Committee has now been constituted.

The Chairman of the Committee is Sir Richard Glazebrook, now Zaharoff Professor and Director of the School of Aviation in the Imperial College of Science and Technology, whilst Lieut.-Colonel Gold is appointed by the Controller-General of Civil Aviation, for meteorology. Mr. G. I. Taylor, who also has special knowledge of that subject, is appointed as a representative of science.

Approval has been given for the provision of a grant from public funds towards the cost of the Department of Aeronautics at the Imperial College of Science, and the organisation and staffing of that Department under the direction of Sir Richard Glazebrook is now proceeding. The appointment of Dr. Leonard Bairstow, F.R.S., C.B.E., as Professor of Aerodynamics has been announced. Instruction in meteorology is to be provided for all students of aeronautics at the College.

Circulation of Forecasts by Wireless Telegraphy.

Collective Weather Reports for London and S.E. England.

FROM February 20th, 1920, hourly reports of meteorological information, prepared by the Forecast Service of the Meteorological Office, have been sent out from the wireless station at the Air Ministry. The message is given in a code form, which is practically the same as prescribed in Annex G of the "Convention relating to International Air Navigation," Paris, 1919. The forecasts, which are being issued eight times a day, are based on observations taken about half an hour before the time of issue.

Detailed explanation of the code can be obtained on application at the Office.

Climatological Stations.

Whitby.—Mr. T. Woodhouse Parkinson having left Whitby, Captain D. S. Ramsdale has taken over the charge of the station.

Formula for Rising Velocity of Pilot Balloons.

IN computing the rate of ascent of pilot balloons for the one theodolite method, the use of the simple formula $V = q L^{\frac{1}{2}} / (W + L)^{\frac{1}{2}}$ is customary. In this formula V is the upward speed of the pilot balloon, L is the net free lift in grammes, W is the dead weight of rubber and attachments, and q is a constant.

In September, 1919 (M.O. Circular No. 27), the following values of the constant were adopted for stations under the Meteorological Office:—

$$q = 84 \text{ for } V \text{ in metres per minute,}$$

$$q = 275 \text{ for } V \text{ in feet per minute.}$$

It is now announced that with balloons having a free lift less than 150 grammes, the same value of q is to be used for night ascents with lantern, as for day ascents without lantern.

Weather Map at the Air Ministry.

DURING the month of April, 1920, a new device for making the meteorological reports rapidly available to the public has been evolved in the shape of a large Weather Map which is exhibited daily in one of the front windows on the ground floor of Empire House, Kingsway. All the principal reporting stations in the British Isles as well as a few neighbouring Continental ones are marked on the chart, which is on the Mercator Projection and is 10 ft. high and 6 ft. wide. The information on the chart is changed at about 3h., 8h. 30m. and 14h. 30m., G.M.T., the data exhibited referring to observations made at 1h., 7h. and 13h., G.M.T.

Arrows painted black fly with the wind, the speed being shown in miles per hour, violet figures indicate the visibility in miles, red figures denote temperature in degrees Fahrenheit, and the state of the weather is written in black letters; e.g., HEAVY SNOW, THICK DRIZZLE, DENSE FOG, CLOUDLESS.

The chart has attracted a great deal of interest since it was first exhibited. Some of the eager enthusiasts do not at first realize that the map represents the reported weather at the time specified, and not the meteorologists' estimate of the weather to be. Such an estimate is indicated separately by the exhibition of the latest *forecasts*.

Official Publications.

Geophysical Memoirs No. 14.—Soundings with Pilot Balloons in the Isles of Scilly. By Capt. C. J. P. Cave, M.A., and J. S. Dines, M.A.

In this Memoir the authors have discussed the results of 41 pilot balloon soundings made at Scilly during the months of November and December, 1911. The object of this series of observations was to study in detail the structure of the free atmosphere uninfluenced by land masses, and the memoir can be regarded as a sequel to Captain Cave's "Structure of the Atmosphere in Clear Weather." Owing to the favourable geographical position of Scilly and the small size of the islands a pilot balloon soon reaches a height where complexities introduced by the presence of the land are negligible, so that the set of observations is probably representative of the normal structure of the free atmosphere over the sea. The authors have compared these results with those obtained at Ditcham Park and discussed in Captain Cave's book already mentioned, and many other points of theoretical interest have been investigated.

The pressure distribution during the winter of 1911 differed very little from that of the normal winter in the region of the British Isles, and the pilot balloon observations at Scilly, which were happily undertaken at a time when winter conditions were becoming established, are therefore of special interest as illustrating the sequence of upper air movements during the transition from Autumn to Winter.

Geophysical Memoirs No. 15.—The climate and weather of Falkland Islands and South Georgia. By C. E. P. Brooks, M.Sc.

The Falkland Islands and South Georgia lie in the South Atlantic Ocean between latitudes 40° and 60° S. and longitudes 20° and 60° W. This region is within the same latitudes in the Southern Hemisphere as the British Isles are in the Northern.

Hitherto the meteorology of these islands has not been studied in detail. The author has collected information from various sources, principally MS. returns, and has presented it with suitable discussion. The Memoir is well illustrated with maps and diagrams. The representative meteorological station for the Falkland Islands is Cape Pembroke; for South Georgia, Grytviken. Meteorological data from other stations are also available, but they are not so full and detailed as those from the two stations already mentioned.

The prevailing ocean currents in this region sweep up a considerable number of icebergs from the Antarctic. The

wind, which is generally between W. and N.W., blowing over the ice-laden sea, controls to a great extent the temperature of the Islands. At Cape Pembroke "there is "astonishingly little variation in the mean temperature from "year to year," and the annual range at Grytviken is only 4° F.

Humidity is very high, but the rainfall, although distributed over a large number of days, is not excessive, about 30 inches a year.

A sunshine-recorder has been in operation at Stanley, in the Falkland Islands, since 1906, and it is found that the duration of sunshine averages 3·8 hr. per day throughout the year. This is a little below the normal for Kew Observatory—4·0 hr. per day. The highest proportion of possible sunshine occurs in February, *i.e.*, subsequent to the solstice, whereas in England May is usually the sunniest month.

A set of wind-roses illustrates the difference between the dry warm Föhn wind which reaches Cape Pembroke from the N.W. and the cooler and damper winds from other quarters.

As a contribution to the study of the general movement of the atmosphere the directions of motion of upper clouds are summarised. The distribution differs but little from that of the surface winds, N.W. being the most frequent direction (31 per cent. of the observations) and E. the least frequent (4 per cent.).

Geostrophic Wind over London; June, 1881-1915.

FREQUENCY OF STRENGTH AND DIRECTION.

Estimates based on the D.W.R. charts (8h., 1881-1908; 7h., 1909-1915).

Direction.	5 m/s. 11 mi/hr.	10 m/s. 22 mi/hr.	15 m/s. 33 mi/hr.	20 m/s. 44 mi/hr.	Over 20 m/s. Over 44 m.i./hr.	Total Frequency of Directi.n.
N.	31	24	6	1	2	64
NE.	35	40	26	4	2	107
E.	16	33	21	8	2	80
SE.	11	14	3	—	—	28
S.	18	15	6	2	—	41
SW.	35	51	29	9	—	124
W.	32	87	47	12	4	182
NW.	22	49	31	15	1	118
Total Frequency of strength	200	313	169	51	11	744*

* Indeterminate—506.

Royal Meteorological Society.

THE usual monthly meeting of the Society was held on the 21st March, Mr. R. H. Hooker, President, in the chair.

A description of the Night Sky Recorder recently brought into use at the Royal Observatory, Greenwich, was given by Mr. W. W. Bryant. The object of the instrument is to supplement the daily sunshine record in so far as it gives an indication of the amount of cloud at night. It consists of a small fixed camera pointing to the pole of the heavens. The lens is a single component of a doublet of eight-inch focal length, and 0.4 in. aperture, working at $f/20$. It is found that this aperture in conjunction with plates of "ordinary" speed will give good star tracks even at full moon. Measurements are made by means of a photographic scale. The camera must only be open when the sun is sufficiently below the horizon, and it was suggested that the opening in the evening could be conveniently carried out by an observer and the shutting by an alarm clock. The precise time for any portion of the trace is obtained by an original adjustment of the plate and checked when the evening is clear at the time of opening. It is found convenient to utilise the trace of a neighbouring star δ *Ursae Minoris* rather than that of the Pole Star, which gives much the smaller arc. The trace examined under the microscope appeared to give a thickness varying more with the relative clearness of the sky than the sunshine recorder trace.

Lieut. N. L. Silvester read a paper entitled "Local Weather Conditions at Mullion, Cornwall," in which he gave a detailed analysis of the local meteorological elements over a period of about twelve months. The ordinary autographic records used were supplemented by a complete series of hourly eye observations. Ratios of gradient to surface wind had been computed and analysed from the results of over four hundred pilot balloon ascents by the one theodolite method. It had been possible to make comparisons between two very different exposures at a small distance apart. These had at least shown unmistakable evidence of the marked friction and turbulence affecting the wind near the surface in the vicinity of large buildings such as air-ship sheds. Much useful information relating to the local occurrence of fogs, subdivided into (1) radiation fog, (2) sea fog, (3) coast mist and drizzle and unusual visibility, had been tabulated. Another feature was the collection in tabular form of local signs of approaching bad weather.

Mr. J. Edmund Clark gave an account of the Surrey

hail-storm of July 16th, 1918. This storm differed from other similar British visitations by the fortunate absence of much wind and by coming after midnight. The track of serious damage rarely exceeded a half mile in width and was $16\frac{1}{2}$ miles long, the hail beginning at 1h. 55m., G.M.T., to the west of Holmwood station and ending near North Bromley station at about 2h. 30 m., G.M.T. Rain and hail ceased sharply beyond the south-east margin, near which the fall was heaviest. At Purley, 1.37 in. fell in 11 minutes. Vivid, almost incessant lightning accompanied the hail; the noise of the latter, however, rendered the thunder inaudible. About 25 per cent. of the hail consisted of jagged chunks of ice, some up to two or three inches long. Greenhouse roofs and some windows were smashed and crops destroyed, in places reduced to pulp. The total damage amounted to at least ten thousand pounds. The associated thunderstorm over the south-east of England, and the temperature, pressure, wind and upper air conditions were considered in the paper.

The following candidates were elected fellows of the Society:—H. F. Bentley, G. R. Collinson, C. W. Dean, Lieut. S. Fielder, O.B.E., R.N.R., J. Hammond, F. E. Lee, Miss W. A. Quennell, J. R. Roberts and W. C. Waugh.

NOTES AND QUERIES.

Intense Rainfalls in 1919.

FOR more than fifty years an article has appeared annually in *British Rainfall* dealing with the recorded instances of notably intense rainfalls in short periods of time during the year under review. The limits above which any record is regarded as sufficiently noteworthy to be included were defined in 1908, and have been adhered to rigidly since that date. These limits were slightly more stringent than those adopted during the previous forty years. At the same time a means was found for defining those rainfalls which might reasonably be labelled as "remarkable" and "very rare," respectively, and these were specially indicated in the lists.

During the preparation of *British Rainfall*, 1919, the whole of the available information in regard to that year has been collated, and the curious fact has been brought to light that, in spite of the largely increased number of observers, the number of instances of intense rainfalls reaching the limit for quotation is smaller than in any year since 1885, and that

the year 1919 was the first since 1869 with no recorded instances of rainfalls reaching the "remarkable" limit. The number of records quoted must naturally depend in some measure upon accidental factors, but so remarkably short a list as that for 1919 must clearly be traceable to the great absence of thunderstorms which was one of the characteristics of the year, a fact borne out by the comments of observers in all parts of the country.

It would be a great satisfaction in putting this unusual phenomenon on record if any observers who have self-recording raingauge records for 1919 would examine the traces with a view of extracting details of any exceptionally intense rainfalls. Any observers who obtained such records by means of ordinary rain gauges and have not yet sent them to Camden Square are particularly requested to do so at an early date.

C. S.

Formation of Mercury Globules in Barometers.

MR. A. J. BAMFORD has sent to the Meteorological Office an interesting photograph of a Kew-barometer showing globules of mercury above the main column. The photograph was taken at Puttalam, in Ceylon, by Mr. Evans.

Mr. Bamford writes:—

"The most visible globules are all on the front, but there are others behind which are partly hidden by the glint on the left of the tube. This is by no means an isolated phenomenon. I have met it more than once, particularly at Puttalam, a station on the west coast north of Colombo, with an average diurnal range of temperature of 12.7° F. The bubbles join up quite rapidly with the main column when the instrument is tilted, but form again before the next inspection, *i.e.*, in a few months. I remember talking to some of the others at the Paris Conference about it, and finding that some of them had met it too, but I do not remember seeing any notes about it in any book. There it no serious change of index error."

Mr. Bamford is seeking for an explanation of the phenomenon.

The tradition of the Meteorological Office is that it occurs only in barometers exposed to the sun. Direct experimental evidence from observers who have noticed it would be welcome.

Exceptional Balloon Ascents.

IN the course of experiments on the use of light filters in observing pilot balloons, two exceptional one-theodolite ascents have been obtained at South Farnborough. In one case (November 26th, 1919) the balloon was followed for 152 minutes and the nominal height reached was 25 kilometres, the final distance 95 kilometres. In the other case (January 9th, 1920) the nominal distance was 84 kilometres.

Recourse was had to laboratory experiment for evidence on the probability of the results. A balloon from the same batch was examined for relation between inflated diameter, internal pressure, and rate of leak. It developed a pinhole at the diameter which would normally be attained at a height of 14 kilometres. Computation from normal values of pressure temperature and density in the upper air indicate that, allowing for the leak, this balloon would probably have been at a height of 26.5 kilometres at the end of a 152-minute ascent.

An experimental determination was also made of the angle subtended by an object just capable of detection by the theodolite in the conditions of illumination prevailing during the ascent. It was found that an object subtending 1.7 seconds of arc could be detected. This corresponds to a diameter of 80 cm. at 95 kilometres, and the actual diameter of the balloon at the end of the ascent was probably between 110 and 130 cm. It is to be observed that detection of the brightly illuminated balloon is easier than the resolution of the corresponding angle. The resolving power of the $1\frac{7}{8}$ -in. objective used would, on the simple theory of resolving power, be 2.7", but the empirical rule derived from astronomical experience indicates a better performance, say, 2.4". A 115-cm. balloon at 95 kilometres would be just on the limit of resolution.

Thus experimental evidence supports the probability that a height of 25 kilometres and a distance of 95 kilometres were attained on November 26th. Examination of the results of the ascent show that the minimum horizontal velocity was found at 10.5 kilometres, *i.e.*, where it would be expected, the boundary of the stratosphere in November being at 10.8 kilometres, and, further, that the angular elevation of the balloon was increasing at the 110th minute, a very improbable circumstance if appreciable leakage had occurred.

R. A. W. W.

South Farnborough.

A Correction.

The notice concerning Mr. Harries' retirement in the last issue of the Magazine requires correction. Mr. Harries served

in the Marine Division under Lieut. C. W. Baillie, R.N., as well as under Capt. Toynbee and Capt. Campbell Hepworth. From Capt. Hepworth's death on February 25th, 1919, Mr. Harries was in charge of the Marine Division. He was appointed Acting Superintendent on May 1st.

Obituary.

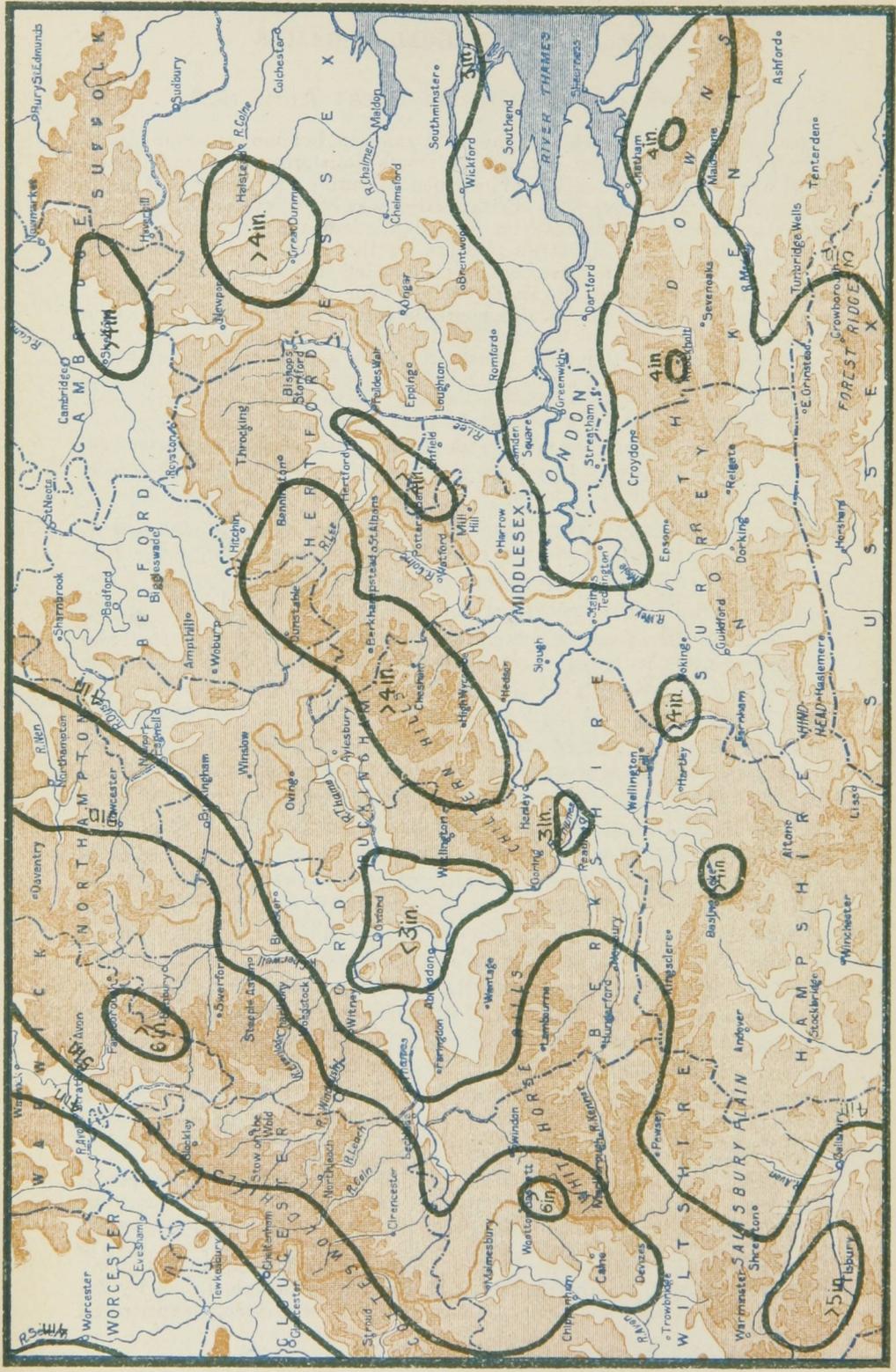
John George Bartholomew, LL.D., F.R.S.E., F.R.G.S. (22nd March, 1860—13th April, 1920).—News of the death of Dr. J. G. Bartholomew, the great cartographer, will be received with universal regret and by his personal friends with deep sorrow. Never a physically strong man, he had been for several years in very indifferent health, but a three months' rest in Portugal appeared to have somewhat strengthened him, and his death at Cintra was as unexpected as it was peaceful.

Dr. Bartholomew possessed the soul of an artist and the mind of a man of science; he followed the course of geographical discovery and research with an exact and eager interest; his invention of the layer system of contouring in orographical maps resulted in work of unsurpassed delicacy and effectiveness; and the award to him in 1905 by the Royal Geographical Society of the Victoria Medal in consideration of "his successful efforts to raise the standard of cartography," was in effect a considered judgment that the work of the Edinburgh Geographical Institute had eclipsed that of the great map-makers of Gotha. The various sets of maps and admirable atlases issued by his firm are familiar to us all, and doubtless most of them were profitable projects; but Dr. Bartholomew's friends were aware that he was never chiefly concerned with the commercial success of any venture, and he laid meteorologists under a lasting obligation by the publication of the great "Atlas of Meteorology" in the preparation of which considerable capital was sunk with no certainty of any return. On the great "*Times* Survey Atlas of the World," now in course of publication, he had been engaged for more than 15 years.

Dr. Bartholomew was primarily the founder of the Royal Scottish Geographical Society; for a time on the Councils of the Royal Society of Edinburgh and of the Scottish Meteorological Society; a consistent supporter of the British Rainfall Organization, for which he specially prepared various working maps, and a member of many foreign scientific societies.

A. W.

THAMES VALLEY RAINFALL APRIL, 1920.



ALTITUDE SCALE

Below 250 feet	250 to 500 feet	500 to 1000 feet	Above 1000 feet
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SCALE OF MILES



Weather in the British Isles: April 1920.

FROM the first day, which was dull and rainy in London and many other parts of Great Britain, to the last, on which hailstorms were widespread, April was unsettled, showery, and inclement. During the greater part of the period the weather over the British Isles was of a cyclonic type, and depressions passing eastwards from the Atlantic kept the air-pressure low, so that at some stations the mean pressure for the month was the lowest on record for April. With these conditions rain fell frequently, and numerous stations had as many as 28 rain-days. On some of the days, however, the sunshine records were good, Cahirciveen, for instance, registering 11·2 hr. on the 4th, Nairn 12·4 hr. on the 20th, and Malin Head 14·0 hr. on the 30th; but commonly these sunny conditions were only temporary and confined to limited areas. In some localities the lack of sunshine was very marked, the mean daily amount at Kew Observatory and Nottingham being only about two hours and a half, and only half the normal duration for April.

This general deficiency of sunshine kept the daytime temperature very low, so that at numerous stations the mean maximum temperature was below the normal. On the other hand, owing to the persistent cloudiness, the nights were unusually warm. At Copdock, Ipswich, the mean minimum for the month (41·7° F.) was the highest April value during 19 years, and at Totland Bay, Isle of Wight, the mean (44·6° F.) was the highest during 34 years. Very generally the 23rd was the warmest day of the month, the highest values being about 65° F.; and the coldest mornings were the 1st, 8th and 30th, minima of 21° F. in the screen and 16° F. on the grass being registered at Eskdalemuir on the last of those dates. On the 10th, when two "lows" were shown on the weather map for 7 h., one over the West and the other over the East of England, the maximum temperatures reported were very remarkable, the reading at Harrogate, for instance, being only 39° F., compared with 62° F. at Raunds (Northants).

Over the British Isles as a whole the rainfall was above the average. Considerable areas in central England and Wales had over twice the average; Scotland had about the average, while Ireland had everywhere above the average, reaching nearly twice the average in Kerry. Less than 2 in. for the month was confined to small areas in the central plain and east coast of Scotland. More than 5 in. fell over considerable areas in England as far east as York, Grantham, Northampton and Marlborough, and over the high land of Scotland and Ireland. Over 10 in. was confined to the uplands of Wales, Cumberland and the south-west of Ireland. At some of the stations the rainfall was very abnormal. At Cheadle (Staffs), where the total for the month was 5·65 in., it was the wettest April for 50 years; Meltham (Yorks) had 7·11 in., the month being the wettest in 40 years; Birmingham 4·63 in., the wettest in 33 years; and Tenbury (Worcester) 4·98 in., the wettest in 26 years. Stations as far apart as Thetford (Norfolk), North Cadbury Rectory (Somerset), Church Stretton (Shropshire), Neston (Cheshire), and Haverfordwest (Pembroke) reported the wettest April for over 20 years. Many stations recorded the greatest number of rain days for April. As a result of heavy rains the Nene and Welland Valleys were in flood during the week which ended on the 10th, and the Teme and the Wye were in flood between the 15th and 17th.

Snow fell infrequently, and was mainly confined to Scotland, the principal falls being those which occurred on the 7th and 10th. Hail was more frequent and often accompanied thunderstorms. On the 9th, there was an especially violent thunderstorm. At Calne "1·78 in. fell from 8 a.m. to 11·15 a.m. (a period of 3¼ hours), causing considerable flooding and damage" in that town; at Lechlade 2·33 in. and Brackley (Northants) 1·46 in., fell on this day. Gales and strong winds were not very widely experienced

(Continued on p. 80)

Rainfall Table for April 1920.

STATION.	COUNTY.	Aver. 1875- 1909. in.	1920.		Per cent. of Av.	Max. in 24 hrs.		No. of Rain Days.
			in.	mm.		in.	Date.	
Camden Square.....	London.....	1.74	3.07	78	176	.37	27	21
Tenterden (View Tower)....	Kent.....	1.77	2.48	63	140	.40	14	21
Arundel (Patching).....	Sussex.....	1.82	3.11	79	171	.39	19	21
Fordingbridge (Oaklands) ..	Hampshire..	1.92	3.11	79	162	.51	14	24
Oxford (Magdalen College) .	Oxfordshire.	1.67	2.81	71	168	.41	8	25
Wellingborough.....	Northampton	1.78	4.10	104	230	.83	9	25
Hawkedon Rectory.....	Suffolk.....	1.63	3.91	99	240	.59	1	24
Norwich (Eaton).....	Norfolk.....	1.77	3.60	91	203	.58	9	25
Launceston (Polapit Tamar)	Devon.....	2.34	4.92	125	210	.73	14	25
Lyme Regis (Rousdon).....	".....	2.39	3.84	98	161	.65	14	22
Ross (Birchlea).....	Herefordshire	2.09	4.56	116	218	.91	15	25
Church Stretton (Wolstaston)	Shropshire..	2.20	6.16	156	280	.66	*8	28
Boston (Black Sluice).....	Lincoln.....	1.57	3.67	93	234	.75	9	25
Worksop (Hodsock Priory)..	Nottingham..	1.62	3.74	95	231	.49	8	24
Mickleover Manor.....	Derbyshire..	1.77	4.19	106	237	.52	8	24
Southport (Hesketh Park) ..	Lancashire..	1.84	4.01	102	218	.57	9	25
Wetherby (Ribston Hall)....	York, W. R..	1.35	3.67	93	198	.50	9	21
Hull (Pearson Park).....	" E. R.....	1.69	3.98	101	235	.53	10	27
Newcastle (Town Moor).....	Northland..	1.84	3.29	84	179	.60	10	21
Borrowdale (Seathwaite) ...	Cumbe. land.	6.91	12.10	307	175	..	..	..
Cardiff (Ely).....	Glamorgan..	2.50	4.95	126	198	.70	14	30
Haverfordwest.....	Pembroke...	2.82	5.74	146	204	.75	8	25
Aberystwyth (Gogerddan) ..	Cardigan...	2.48	7.44	189	300	.76	30	25
Llandudno.....	Cirnaron...	1.79	3.28	83	183	.78	9	26
Dumfries (Cargen).....	Kirkcudbrt..	2.50	3.32	84	133	.47	13	24
Marchmont House.....	Berwick.....	2.28	2.22	56	97	.48	1	18
Girvan (Pinmore).....	Ayr.....	2.81	3.07	78	109	.55	26	20
Glasgow (Queen's Park)....	Renfrew.....	1.86	1.91	48	103	.24	28	22
Islay (Ballabus).....	Argyll.....	2.64	3.23	82	122	.49	15	22
Mull (Quinish).....	".....	2.98	2.02	51	68	.36	18	20
Loch Dhu.....	Perth.....	4.38	3.50	89	80	.30	†6	20
Dundee (Eastern Necropolis)	Forfar.....	1.93	1.76	45	91	.36	19	19
Braemar.....	Aberdeen...	2.30	2.80	71	122	.47	25	17
Aberdeen (Cranford).....	".....	2.23	2.28	58	102	.37	27	17
Gordon Castle.....	Moray.....	1.74	1.80	46	103	.35	1	21
Drumadrochit.....	Inverness...	1.85	2.42	62	131	.50	28	23
Fort William.....	".....	3.65	3.15	80	86	.51	15	19
Loch Torridon (Bendamph) .	Ross.....	4.70	3.47	88	74	.61	27	19
Stornoway.....	".....	2.64	2.96	75	112	.69	27	23
Dunrobin Castle.....	Sutherland..	2.02	2.31	59	114	.35	26	21
Wick.....	Caithness...	1.89	2.01	51	106	.31	27	22
Glanmire (Lota Lodge)....	Cork.....	3.23	5.75	146	178	.87	12	22
Killarney (District Asylum)	Kerry.....	3.46	6.80	173	197	.85	7	26
Waterford (Brook Lodge)....	Waterford..	2.68	4.48	114	167	.75	9	22
Nenagh (Castle Lough).....	Tipperary...	2.54	3.61	92	142	.70	19	25
Ennistymon House.....	Clare.....	2.81	4.14	105	147	.74	19	24
Gorey (Courtown House)....	Wexford.....	2.37	3.34	85	141	.53	30	20
Abbey Leix (Blandsfort) ...	Queen's Co..	2.54	3.67	93	144	.65	9	25
Dublin (Fitz William Square)	Dublin.....	2.03	2.83	72	139	.45	9	27
Mullingar (Belvedere).....	Westmeath..	2.37	2.42	62	102	.62	14	21
Woodlawn.....	Galway.....	2.54	3.49	89	137	.57	13	25
Crossmolina (Enniscoe)....	Mayo.....	3.13	4.11	104	131	.42	26	24
Collooney (Markree Obsy.)..	Sligo.....	2.52	3.55	90	141	.50	15	23
Seaforde.....	Down.....	2.76	2.91	74	105	.52	21	21
Ballymena (Harryville)....	Antrim.....	2.57	2.77	70	108	.35	25	21
Omagh (Edenfel).....	Tyrone.....	2.50	4.39	112	176	1.05	15	25

* Also 15.

† Also 13, 14 15, 24.

Supplementary Rainfall, April 1920.

Div.	STATION.	RAIN.		Div.	STATION.	RAIN.	
		in.	mm.			in.	mm.
II.	Ramsgate	2.17	55	XII.	Langholm, Drove Rd.	4.16	106
"	Sevenoaks, Speldhurst	3.38	86	XIII.	Selkirk, Hangingshaw	2.68	68
"	Hailsbam Vicarage. . .	2.78	71	"	North Berwick Res. . .	1.48	38
"	Totland B. Aston Ho.	2.55	65	"	Edinburgh, Royal Ob.	1.58	40
"	Ashley, Old Manor Ho.	3.79	96	XIV.	Biggar	2.05	52
"	Grayshott	3.56	90	"	Leadhills	4.45	113
"	Ufton Nervet	3.74	95	"	Maybole, Knockdon . .	1.89	48
III.	Harrow Weald, Hill Ho.	3.40	86	XV.	Rothesay	3.32	84
"	Pitsford, Sedgebrook . .	4.85	123	"	Oban	2.33	59
"	Chatteris, The Priory . .	2.69	68	"	Inveraray Castle	5.15	131
IV.	Elsenham, Gaunts End	4.02	102	"	Holy Loch, Ardnadam	3.23	82
"	Lexden, Hill House . .	3.17	80	XVI.	Loch Venachar	2.10	53
"	Aylsham, Rippon Hall	3.50	89	"	Glenquey	3.00	76
"	Swaffham	3.13	80	"	Loch Rannoch, Dall . .	2.03	52
V.	Devizes, Highclere . . .	5.22	133	"	Coupar Angus	1.60	41
"	Weymouth	3.41	86	"	Montrose Asylum	2.42	62
"	Ashburton, Druid Ho.	6.26	159	XVII.	Balmoral Castle	2.72	69
"	Cullompton	4.91	125	"	Fyvie Castle	2.26	57
"	Lynmouth, Rock Ho. . .	5.11	130	"	Peterhead, Forehill . . .	2.21	56
"	Hartland Abbey	4.38	111	"	Grantown-on-Spey	2.48	63
"	St. Austell, Trevarna . .	5.34	136	XVIII.	Cluny Castle	2.79	71
"	North Cadbury Rec. . .	4.77	121	"	Loch Quoich, Loan . . .	8.90	226
VI.	Clifton, Stoke Bishop.	4.40	112	"	Skye, Dunvegan	2.85	72
"	Ledbury, Underdown . .	4.39	112	"	Fortrose	1.78	45
"	Shifnal, Hatton Grange	4.21	107	"	Ardrross Castle	2.80	71
"	Ashbourne, Mayfield . .	4.92	125	"	Glencarron Lodge	5.16	131
"	Barn Green, Upwood . .	3.81	97	XIX.	Tongue Manse	3.10	79
"	Blockley, Upton Wold	5.25	133	"	Melvich Schoolhouse . . .	2.34	59
VII.	Grantham, Saltersford	4.68	119	"	Loch More, Achfary . . .	7.44	189
"	Louth, Westgate	5.02	128	XX.	Dunmanway Rectory . . .	9.50	241
"	Mansfield, West Bank . .	5.30	135	"	Mitchelstown Castle . . .	5.43	138
VIII.	Nantwich, Dorfold Hall	4.34	110	"	Gearahameen	12.50	318
"	Bolton, Queen's Park . .	5.57	141	"	Darrynane Abbey	5.07	129
"	Lancaster, Strathspey . .	4.24	108	"	Clonmel, Bruce Villa . . .	4.84	123
IX.	Wath-upon-Deerne . . .	3.84	98	"	Cashel, Ballinamona . . .	4.08	104
"	Bradford, Lister Park . .	4.22	107	"	Roscrea, Timoney Pk. . .	3.39	86
"	West Witton	5.13	130	"	Foynes	3.44	87
"	Scarborough, Scalby . .	4.34	110	"	Broadford, Hurdlesto'n . .	3.82	97
"	Ingleby Greenhow	3.94	100	XXI.	Kilkenny Castle	3.65	93
"	Mickleton	3.90	99	"	Rathnew, Clonmannon . . .	3.30	84
X.	Bellingham	3.05	77	"	Hacketstown Rectory . . .	4.19	106
"	Ilderton, Lilburn	2.43	62	"	Ballycumber, Moorock . . .	2.42	62
"	Oton	5.47	139	"	Balbriggan, Ardgillan . .	2.94	75
XI.	Llanfrechfa Grange . . .	6.33	161	"	Drogheda	2.64	67
"	Treherbert, Tyn-y-waun	14.00	356	"	Athlone, Twyford	2.48	63
"	Carmarthen Friary	7.24	184	"	Castle Forbes Gdns.	2.89	73
"	Fishguard	5.42	138	XXII.	Ballynahinch Castle	4.61	117
"	Lampeter, Falcondale	8.69	221	"	Westport House	4.03	102
"	Abergwngy	10.35	263	XXIII.	Enniskillen, Portora . . .	3.99	101
"	Crickhowell, Talymaes	6.30	160	"	Cootehill, Dartrey	3.85	98
"	Sennybridge	9.08	231	"	Armagh Observatory	2.89	73
"	Lake Vyrnwy	8.20	208	"	Warrenpoint	4.02	102
"	Llangynhafal, P. Drâw	4.07	103	"	Belfast, Cave Hill Rd. . .	3.03	77
"	Dolgelly, Bryntirion . . .	9.08	231	"	Glenarm Castle	3.66	93
"	Lligwy	3.60	91	"	Londonderry, Creggan . . .	3.33	85
XII.	Stoneykirk, Ardwell Ho.	2.95	75	"	Sion Mills	2.94	75
"	Gatehouse, Cally . . . . .	. . .	. . .	"	Milford, The Manse	3.28	83
"	Carsphairn, Shiel	5.00	127	"	Killybegs, Rockmount . . .	4.80	122

Climatological Table for the

STATIONS Those in italics are South of the Equator	PRESSURE		TEMPERATURE							
	Mean M.S.L.	Diff. from Normal	Absolute				Mean Values			
			Max.	Date	Min.	Date	Max.	Min.	$\frac{1}{2}$ max. and min.	Diff. from Normal
	mb.	mb.	° F.		° F.		° F.	° F.	° F.	° F.
London, Kew Observatory	1008·7	-5·5	57	23	26	27	43·9	34·7	39·3	-4·7
Gibraltar	1016·5	-0·1	69·9	5	46·4	2	64·3	52·9	58·6	-2·0
Malta	1018·5	+0·1	80·2	7	48·0	19	68·0	58·2	63·1	-0·2
Sierra Leone	1012·3	+1·3	99	12	70	5, 6	89·1	73·7	81·4	+0·1
Lagos .....	..	..	88·2	30	70·3	1	86·4	74·3	80·3	-1·0
Kaduna, N. Nigeria	*944·0	..	90	†6	52	25	87·3	58·7	73·0	..
<i>Cape Town</i> .....	..	..	86·2	22	49·1	28	74·3	56·4	65·3	+2·2
<i>Johannesburg</i> .....	..	..	81·9	17	42·8	9	72·2	51·9	62·1	+2·6
<i>Mauritius</i>	1014·8	-1·1	87·8	30	61·0	6	83·8	68·4	76·1	+0·5
<i>Bloemfontein</i> .....	..	..	92·8	19	40·9	9	79·8	52·8	66·3	-2·1
Calcutta, Alipore Obsy...	..	..	..	..	..	..	..	..	..	..
Bombay .....	..	..	91·4	5	69·5	25	88·0	75·9	81·9	+1·5
Madras .....	..	..	90·6	17	70·5	26	86·2	74·4	80·3	+1·7
Colombo, Ceylon .....	..	..	87·1	25	70·2	18	85·2	74·0	79·6	0·0
Hong Kong	1017·5	-0·1	83·7	6	48·5	25	72·7	64·1	68·4	-1·3
<i>Sydney</i> .....	..	..	..	..	..	..	..	..	..	..
<i>Melbourne</i> .....	..	..	94·9	27	45·0	15	73·2	54·6	63·9	+2·6
<i>Adelaide</i> .....	..	..	104·5	25	46·6	14	81·6	57·2	69·4	+2·5
<i>Perth</i> .....	..	..	96·4	22	50·2	1	74·6	56·6	65·6	-0·1
<i>Coolgardie</i> .....	..	..	98·2	30	41·0	1	81·9	55·9	68·9	-2·1
<i>Brisbane</i> .....	..	..	89·6	19	56·5	8	81·1	64·2	72·7	-0·8
<i>Hobart, Tasmania</i> .....	..	..	86·0	8, 16	42·9	11, 20	68·6	50·0	59·3	+2·1
<i>Wellington</i>	1009·1	-3·2	65·8	2	35·8	23	60·8	48·6	54·7	-2·2
<i>Suva, Fiji</i>	1014·3	+1·9	86·0	26	66·2	20	82·2	72·0	77·1	-0·3
Jamaica, Kingston .....	..	..	..	..	..	..	..	..	..	..
Grenada	1010·5	-0·5	89	5, 14	72	†2	84·9	74·4	79·7	+0·4
Toronto	1018·6	+2·0	64·3	1	16·2	27	45·1	31·2	33·1	+0·7
Fredericton	1018·3	..	58·0	30	2·5	29	41·2	26·1	33·7	+0·4
St. John, N.B.	1017·3	+3·0	52·3	18	14·0	29	42·7	31·3	37·0	+0·3
Victoria, B.C.	1017·9	+3·0	55·3	16	29·7	26	46·7	38·9	42·8	-3·1

* At Station Level, height of 2,088 feet. † Also 10, 12, 15, 16, 30. ‡ Also 9, 22, 25, 26.

GIBRALTAR.—2 thunderstorms, 5 days of gale.

MALTA.—Mean speed of wind, 9·3 mi/hr.

SIERRA LEONE.—8 thunderstorms, 2 days of gale.

LAGOS.—Harmattan appeared on 19th.

Mauritius.—Prevailing wind ESE; mean speed, 7·0 mi/hr.

COLOMBO.—Prevailing wind W.; mean speed, 3·9 mi/hr.

British Empire, November 1919.

TEMPERATURE				PRECIPITATION				Mean Cloud Am't	Bright Sun-shine Hours per day	STATIONS Those in italics are South of the Equator.
Mean Values		Absolute		Amount		Diff. from Normal	Days			
Dew Point	R'tive Humidity	Max. in Sun	Min. on Grass	in.	mm.			mm.		
F.	%	°F.	°F.							
35.7	85	86.7	15.6	1.1	27	- 29	19	7.3	1.50	London, Kew Observatory.
51.4	77	142	38	16.44	418	+ 256	13	5.2	..	Gibraltar.
..	80	124	..	3.66	93	+ 2	5	7.5	5.9	Malta.
73.0	77	..	..	4.51	115	- 25	11	3.1	..	Sierra Leone.
73.1	75	156	57.4	4.66	118	+ 56	5	7.2	..	Lagos.
57.6	60	..	..	0.38	10	+ 9	1	1.2	..	Kaduna, N. Nigeria.
51.6	62	..	..	0.67	17	- 10	5	3.6	..	<i>Cape Town.</i>
50.1	73	..	40.1	5.32	135	+ 36	13	6.1	7.85	<i>Johannesburg.</i>
64.9	69	..	56.8	1.23	31	- 9	12	5.2	..	<i>Mauritius.</i>
47.9	53	..	..	1.95	50	- 8	9	3.9	..	<i>Bloemfontein.</i>
..	..	..	..	..	..	..	..	..	..	Calcutta, Alipore Obsy.
71.2	72	136.5	60.5	0.18	5	- 5	2	2.6	..	Bombay.
73.6	84	158.4	67.3	12.83	326	+ 1	14	6.1	..	Madras.
72.6	82	160.5	64.6	8.89	226	- 48	18	7.2	..	Colombo, Ceylon.
62.1	67	..	..	2.89	73	+ 31	8	5.6	5.86	Hong Kong.
..	..	..	..	..	..	..	..	..	..	<i>Sydney.</i>
50.1	59	153.8	37.0	1.15	29	- 29	13	6.0	..	<i>Melbourne.</i>
49.5	43	166.0	36.4	0.15	4	- 26	6	4.9	..	<i>Adelaide.</i>
52.9	62	156.3	46.6	0.29	7	- 13	9	4.9	..	<i>Perth.</i>
48.6	45	158.2	37.0	1.45	37	+ 25	9	4.6	..	<i>Coolgardie.</i>
60.2	66	147.2	50.7	0.38	10	- 85	3	3.8	..	<i>Brisbane.</i>
44.6	55	156.0	31.1	0.35	9	- 56	10	6.0	..	<i>Hobart, Tasmania.</i>
46	72	143.0	22.5	2.54	65	- 25	11	6.6	6.36	<i>Wellington.</i>
72.7	82	..	..	14.34	364	+ 124	16	8.0	..	<i>Suva, Fiji.</i>
..	..	..	..	..	..	..	..	..	..	Jamaica, Kingston.
72.9	80	143	..	7.96	202	- 1	24	5.5	..	Grenada.
31.3	81	98.0	14.0	1.63	41	- 23	9	7.4	..	Toronto.
28.0	83	..	..	5.51	140	+ 37	8	6.4	..	Fredericton.
32.0	86	102.7	10.2	5.99	152	+ 32	18	6.7	..	St. John, N.B.
39.8	91	107.0	23.0	5.53	140	- 14	22	7.8	..	Victoria, B.C.

HONG KONG.—Prevailing wind ENE; mean speed, 10.4 mi/hr.

Brisbane.—Drought continuing; lowest rainfall on record for November.

Hobart, Tasmania.—With exception of 1868 (0.16 in., 4 mm.) this November has lowest rainfall on record.

Wellington.—3 sunless days, 4 days of frost, 1 thunderstorm, 1 day of hail.

Suva, Fiji.—4 thunderstorms.

GRENADA.—2 thunderstorms.

during the month; the most notable occurring on the 15th and 16th in South-East England on the 20th in Western districts, and on the 21st in Southern England.

The general rainfall expressed as a percentage of the average was:—England and Wales, 204; Scotland, 100; Ireland, 146; British Isles, 153.

The weather throughout the month was very unsettled for flying but visibility was for the most part fair and inland fogs were rare. The thunderstorms at the end of the month were of a local nature and could be easily avoided by aircraft. During the gale of the 15th a wind at 3,000 ft. of no less than 110 m.p.h. was reported from the pilot-balloon station at Lympe.

In London (Camden Square) the mean temperature was 49·3° F., or 1·2° F. above the average. The duration of rainfall, 73·1 hours, was the largest recorded in April since these observations were started in 1881. Evaporation 1·85 inch.

Weather Abroad: April 1920.

THE distribution of pressure over Western Europe during April was unfavourable to fine weather.

Pressure was high over Iceland and a series of depressions, none of them of great intensity, passed slowly across the British Isles. The most severe occurred at the end of the month and caused gales in the Baltic on the 30th. The result was an unsettled month in Western Europe, cold and snowy in Norway, rainy and not particularly mild further south. The considerable totals for the month, well above the average in most places, appear to have been due rather to a large number of wet days than to heavy individual falls, but on the 18th very heavy rain fell in Switzerland—91 mm. at Berne and 75 mm. in Lugano. (These falls were due to a shallow disturbance lying over the Gulf of Lyons and Geneva). At Biarritz 107 mm. fell in three days ending April 22nd.

In America pressure was persistently low off the mouth of the St. Lawrence and high over Central and Western Canada. The advent of spring in the prairie regions was delayed by the cold northerly winds caused by this distribution, causing a great scarcity of fodder. From April 1st to 19th the mean temperature at Edmonton, Alberta, was only 26° F. (mean daily max. 32° F., mean daily min. 20° F.), compared with a normal of 46° F. for the whole of April or of about 38° F. for the first half. Snow was falling as late as mid-April in Alberta. During the first half of the month these low temperatures appear to have extended northwards into the Arctic Ocean, 48 degrees of frost being recorded at Spitsbergen on the 13th, but on the 21st the temperature there rose suddenly to a maximum of 34° F. A tornado was recorded in parts of Mississippi, Alabama and Tennessee on April 20th, damaging several townships and causing a score or more of deaths.

Unusually wet weather appears to have prevailed in New Zealand and in Northern and Eastern Australia. But it happens that this phenomenon is regarded with very different feelings in the two countries. Australia being constitutionally short of rain, any excess above normal is regarded as a blessing, fertilising the soil and ensuring abundant pasture. On the other hand, New Zealand normally has rather more rainfall than its rivers can dispose of satisfactorily, and any excess, as in this case, results in floods, destruction of bridges and heavy damage to roads, buildings and cattle.

On April 23rd a violent cyclone passed over Manikganj, a small town in Bengal, killing 93 persons.