# Symons's Meteorological Magazine.

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## THE RAINFALL OF JULY, 1908.

The summer months, and July in particular, are liable to very irregular rainfall, on account of the frequency of thunderstorms which bring heavy falls to small areas. Consequently we notice without surprise, the characteristic "patchiness" of the rainfall map of the region shown in our frontispiece. The irregularity appears to culminate in the neighbourhood of London, but that is probably due, in some degree, to the very numerous stations in that area allowing us to draw the lines with greater precision. It will be noticed that a tongue of comparatively low rainfall (less than 3 inches) followed the river Thames from the west to the east of London, while both to the north, the south and the east there were areas with more than 4 inches in the immediate vicinity. A large area with less than 2 inches occupied the centre of the Thames valley, and similar dry patches occurred at intervals along the south and east coasts, and over practically the whole of Sutherland and Caithness, as well as in the west of Ireland. For the rest there were areas of excessive rainfall in the naturally wet high ground of the west of Great Britain, but Wales and the Lake District were on the whole more liberally watered than the Highlands or the Irish mountains.

Taken as a whole, England and Wales had 2 per cent. less than the average rainfall for the month, in Scotland there was a deficiency of about 6 per cent., and in Ireland a deficiency of about 9 per cent, for although the first fortnight proved wet at almost all stations, and very wet indeed at some, there was an absolute drought curiously similar to that of June in the second half of the month.

As regards the rainfall for the first seven months of 1908, it appears that in England and Wales there was on the whole exactly the average, in Scotland an excess of about 8 per cent., and in Ireland an excess of about 5 per cent.; the general rainfall of the British Isles showing an excess of 3 per cent. above the average.

# METEOROLOGY AT THE FRANCO-BRITISH EXHIBITION.

By L. C. W. BONACINA, F.R.Met.Soc.

## I.

IN an exhibition of the produce—taking that word in a wide sense—of two such great nations as Great Britain and France, well to the fore in almost every branch of intellectual and commercial activity, the various branches of modern science, pure as well as applied, will naturally to a greater or less extent be represented. The science of chemistry with its innumerable and extensive practical applications and enormous mercantile importance, must, of course, take a prominent place in one direction or another in such an exhibition, but even meteorology plays an important part in the life of a nation—to wit, in the forecasting of weather, the warning of storms dangerous to shipping, etc., and in supplying an industry for the manufacture of those delicate instruments of precision which furnish the data upon which weather forecasts and storm warnings are based. Now the difficult question which each science must answer for itself is not *what* to exhibit but *how* to exhibit it. In the first place, it is clear that since it is not the province of a great exhibition to provide instruction in the rudiments of the various sciences to the uneducated or unscientific sections of the public, labour and pains need not be spent by scientific exhibitors in serving up their exhibits, whatever form these may take, in a form such as might be palatable to, or easily understood by, elementary students in a class-room. Thus the chemist in exhibiting a series of difficultly produced organic compounds will not attempt to explain what is meant by the "structural formula" which he indicates of each compound; whilst the meteorologist will take it for granted that all well-educated men, especially all scientific men, have an intelligent notion as to the meaning, for instance, of an isobaric chart. It is obvious, therefore, that scientific exhibitors should so arrange their material as on the one hand to be intelligible to persons of broad general education, and on the other hand to present in sufficient detail the most recent progress in any particular branch of science to specialists in that branch as well as to those who might be disposed to assist it financially or advance it commercially. In the present series of articles it is proposed to offer a criticism of the meteorological department of the British Science section of the Franco-British Exhibition, and an opinion as to what extent it is fulfilling its proper function as above outlined. The exhibits, with the names of the exhibitors, are catalogued in a number of sections representing more or less all branches, or all representable branches, of meteorology, but it will be convenient for the present purpose to divide them into (1) instrumental, (2) cartographical and photographic, (3) tabular and statistical.

Division (1), to which this first article will be confined, includes the various types of instruments in general use on land and sea, specimens of kites and *ballons-sondes* employed by Mr. Dines in the investigation of the upper air, and complicated instruments of special construction. There is a Dines' Pressure-Tube Anemometer in the actual working, and there is no reason why anyone interested should fail from a study of it, and its records upon a revolving drum, to comprehend the theoretical and mechanical principles upon which this valuable type of anemometer is based. An instrument known as the "Callendar Bolometric Sunshine Receiver," whose function is to record the total quantity of the vertical components of the radiation from the whole sky as well as from the sun, by means of the differential action of that radiation upon two flat platinum thermometers, one blackened and the other bright, placed in an hermetically-sealed glass vessel, is peculiarly pleasing from a purely physical point of view ;* one would relish, however, a few more details as to its uses upon a meteorological scale, together with some typical results in different types of weather. The fiercest total radiations in summer probably occur not so much when the sky is absolutely cloudless, as when there are numerous clouds so situated as to leave the sun unobscured for practically the whole day, and to reflect or radiate excessive quantities of energy to the earth.

In connection with the exhibition of a small model of a "climatological station," I think that a note should be appended as to the purport of that much maligned instrument—or "*bête noir*" as it has been styled in a recent number of this Magazine—the black and bright thermometer bulbs in vacuo.

Meteorologists, of course, know what they *are* measuring, or *trying* to measure, with this instrument ; but the whole difficulty respecting its use arises in my opinion from an insufficiently clear notion or close agreement as to what they *ought* to be measuring. Taking up Dr. Dickson's "Meteorology," I find that the "maximum recorded by the black-bulb, minus the maximum temperature of the air, is taken as a measure of the maximum heating intensity of the sun's rays for the day." From this it may be concluded that the function of the "bulb-in-vacuo," assigned to it by meteorologists, is to afford a comparison from day to day of the *absolute* or *potential* heating intensity of the sun's rays, that is to say, of the amount of radiant energy received in unit time by bodies upon the surface of the Earth, and not, apparently, the *effective* heating intensity of the sun's rays, or their ability to raise in unit time the surface temperature of such bodies a certain amount. But what is the *natural* function of the instrument? This surely (as, indeed, the words *heating intensity* would seem to imply) is to afford a comparative measure of the diathermancy of the atmosphere from day to day. Now, if this natural function be

* As well as from the point of view of enthusiastic professors of chemistry, who are never so happy as when discoursing upon the uses to which the precious metals may be put.

not the assigned function, I fail to see of what use the indications of the black or bright bulb-in-vacuo thermometers are.

If we want, as it seems that we ought, to compare the relative heating effect of the sun's rays from day to day—in other words, to determine the temperature "in the sun"—it is quite clear that bulbs-in-vacuo should be discarded altogether, and that in their stead thermometers should be employed with their bulbs freely exposed to both sun and air. For the heating effect upon objects, including, of course, thermometer bulbs or the surface of the human body, of the sun at a given altitude above the horizon, depends upon two conditions (1) the diathermancy or transparency of the whole atmosphere, (2) the windiness of the lower atmosphere in contact with the objects, when, as is always the case, the temperature of the air at the time the sun is shining is far below that to which the given sun would raise the exposed surfaces of the objects if placed in vacuo, or even in a dead calm. Everyone knows that leaving out of consideration, or making allowance for, that part of the temperature of a wind that may be due to transported heat, it is always cooler in sunny weather, the sun's rays being felt far less on a breezy day than on a calm day, for the simple reason that on a windy day the different layers of air are always equalising the temperature by intermingling one with another, and by taking up the temperature of those surfaces over which they flow which get hotter by direct solar radiation than the air.

To put it briefly: if with a given atmospheric diathermancy, the sun's rays are to raise the surface of an object on the ground to a given temperature, the time required will be longer in wind than in calm, it being supposed that the wind has been blowing long enough to impart its temperature to that surface.

This subject has been discussed at some length in the hope that readers of the Magazine will give their views as to the significance to be attached to the readings of the black bulb thermometer, and its companion in adversity the bright bulb. I have never yet come across an intelligent person who received the ordinary instructions about the black or bright bulb with contentment, and think that in a great national Exhibition these instruments should be allowed to hold their own ground, or else that they should be withheld from view altogether.

The next article will treat of some subjects connected with the cartographical and photographic exhibits.

(*To be continued.*)

## ROYAL METEOROLOGICAL SOCIETY.

THE last meeting for the present session was held at the Society's rooms, 70, Victoria Street, Westminster, on Wednesday afternoon, June 17th, Dr. H. R. Mill, President, in the Chair.

Mr. R. H. Hooker read a paper on "An elementary explanation of Correlation." This was an account of an important method of dealing with statistics, which the author illustrated by records of rainfall, and the depth of water in a well at Cirencester.

Put into simple language correlation is simply the measure of the similarity of two curves representing the variation, with time, of two different phenomena. The eye can usually tell whether the curves are, on the whole, like or unlike, but an exact method is required to show just how like they are, and consequently what the probability is that the two phenomena are related, either by cause and effect, or as effects of a common cause. The first essential is to find the average, but this, so far from being the end, is only the beginning of the discussion of the figures. The second essential is to find the variability of the observations in the series from the average, and this may be expressed by the *mean deviation* which is simply the mean of the deviations from the average, irrespective of sign; but a better test is the *standard deviation* which is the square root of the mean of the sum of the squares of all the deviations in the series, and is represented by $\sigma$. It is a fact in statistics that practically half the number of observations in any series, differ from the average by less than two-thirds of the standard deviation, and it is also the case that values differing from the average by more than three times the standard deviation, very rarely occur. To measure the degree of correlation between two curves, we multiply the deviation of one curve from its mean at certain points, by the deviation of the other curve from its mean at the same points, say of time; then, when both deviations are positive or both negative, the product will necessarily be positive, but when one is positive and the other negative (*i.e.* when the curves at the point are strikingly divergent) the product is negative. The more coincidences either above or below the mean, the larger is the total sum, and the more divergences, the smaller is the total sum, so that a large positive figure means that there is a high degree of resemblance between the two curves. Denoting deviations from the mean in one curve by $x$, and deviations in the other curve by $y$, then the sum of the products obtained is $x_1y_1 + x_2y_2 + x_3y_3 + \ldots + x_ny_n$, there being $n$ values of each of the two variables measured. Or, generally, this may be expressed as $\Sigma(xy)$, *i.e.*, the sum of all quantities like $x$ multiplied by $y$. So the more our curves are alike the bigger is $\Sigma(xy)$. The greatest possible value of this quantity is $n\sigma_x\sigma_y$, and accordingly the *correlation coefficient*, as it is called, is obtained by dividing $\Sigma(xy)$ by $n$ times the product of the standard deviations ($\sigma_x$ and $\sigma_y$) of the two curves, *i e.*,

the correlation coefficient $r = \frac{\Sigma(xy)}{n\sigma_x\sigma_y}$. It can be proved mathematically that:—(1) $r$ always lies between the limits $\pm$ 1. (2) If the two curves are so alike that they both rise and fall together, and always in the same proportion, $r = +1$ exactly. (3) If when one goes up the other always goes down, and also always in the same proportion, $r = -1$ exactly. (4) If there is no correspondence whatever between the two curves, *i.e.*, if a big positive deviation in one is accompanied sometimes by a big positive deviation in the other, sometimes by a negative, and sometimes by no deviation, then $r = 0$. Hence the more one curve is dependent upon the other and resembles it, the greater is $r$, positive if an increase in the one causes an increase in the other, and negative if an increase in the one causes a decrease in the other.

A paper on the "Hongkong Typhoon of September 18th, 1906" by Mr. Lawrence Gibbs, was, in the absence of the author, read by the Secretary. The fact which brought this typhoon into prominence was the failure of the Hongkong, Manila, and Zikawei observatories to give adequate warning, and the consequent heavy damage to shipping in Hongkong harbour which was accentuated by the fact that the typhoon centre passed to the north of the harbour, thus causing a north-westerly gale backing to southerly The harbour is much less sheltered from the west than from any other quarter, and consequently, 45 merchant vessels were either badly injured, stranded, or foundered, 80 steam launches out of a total of 256 were permanently or temporarily disabled, and a great number of lighters, junks, and small craft broken up. Sixteen Europeans lost their lives; 2,385 Chinese were reported missing, but it is probable that this figure was considerably exceeded. Judged by anemometer records the typhoon was by no means severe, the highest average hourly wind velocity being 70 miles. The Observatory of Zikawei came more nearly than any other to an adequate forecast. The Hongkong Observatory did not consider the observations available on the 16th and 17th justified the issue of any typhoon warnings, but as at 8 a.m. on the 18th it was found that the barometer was falling rapidly, and the weather appearing threatening, orders were given to hoist the Black Drum—the weather signal indicating that a typhoon was within 300 miles to the eastward of the Colony, and at 8 a.m. the typhoon gun was fired, indicating that a strong gale of wind was expected to blow. This was only about an hour before the storm was at its worst. The author says that there is no doubt that it was the small area covered by this typhoon which caused the failure of the forecast. We dealt with the question of the forecast in our January number (vol. **42**, p. 240).

Mr. H. C. V. Baines, Mr. J. N. Hood, Mr. B. F. E. Keeling, M.A., Mr. V. C. Large, the Hon. C. S. Rolls, M.A., and Capt. T. S. Weston were elected Fellows of the Society.

At the Royal Agricultural Society's Show recently held at Newcastle-on-Tyne, the Royal Meteorological Society had a very interesting and attractive exhibit presenting information which is useful not only to those engaged in agricultural pursuits, but also to the general public.

There were a large number of diagrams relating to rainfall, temperature, sunshine, the influence of weather on crops, health, etc., and also a very fine collection of photographs illustrating meteorological phenomena. Various patterns of self-recording and other meteorological instruments were shown, and as some of these were at work, the visitors saw the weather changes which were taking place.

The methods adopted for obtaining information on the meteorological conditions prevailing in the upper regions of the atmosphere were fully illustrated. A large kite with a meteorograph, and also a *ballon-sonde* carrying a small meteorograph, were suspended from the roof of the building.

In a railed off enclosure, on the ground adjoining the Agricultural Education and Forestry Exhibition, a fully-equipped climatological station was arranged, with the various instruments in position, and at this station an address was given each day by Mr. W. Marriott on "Meteorology in Relation to Agriculture."

The Prince and Princess of Wales, when they visited the Show, spent some time in this exhibit, and were much interested in the upper air investigation.

## THE WEATHER OF JULY, 1908.

By Fred. J. Brodie.

The fine dry weather experienced over a large portion of the country in the latter half of June continued through the opening days of July. On the 2nd or 3rd of the month the thermometer in the shade rose to between 80° and 85° in nearly all the inland districts, and as far north even as the northern highlands of Scotland. At Camden Square, Poltalloch (Argyllshire) and Clifton it reached 87°, and at Barnet 88°, while at Dumfries it touched 91°; the weather over the country as a whole being warmer than at any other time during the present summer.

On the 3rd and 4th a change was heralded by the appearance in many places of thunderstorms and heavy rains, followed by a rapid decrease in temperature. Thenceforward to about the middle of the month or a little later a very disturbed condition of the atmosphere was produced by numerous cyclonic areas which advanced over the kingdom, mostly from the westward or southward. Rain was frequent, and in all the northern, eastern and central parts of England it was often very heavy, and temperature was, as a rule, below the average, the coolest weather occurring with a brisk northerly breeze which swept over the country on the 16th and 17th. On those days the shade maxima were below 60° in many districts, and slightly below 55° at some northern stations. Ground frost was experienced

at several places in the western and northern parts of Great Britain between the nights of the 5th and 7th, the exposed thermometer falling to 25° at Crathes, 28° at Balmoral and 29° at Llangammarch Wells.

On the 12th, when a shallow cyclonic system advanced from the west of France to the south-east of England, some remarkable oscillations in barometrical pressure were observed at our south-eastern stations and in many neighbouring parts of the Continent.*

After the 18th of the month the weather in all but the extreme northern and north-western parts of the United Kingdom was influenced mainly by anticyclonic systems, and was therefore again fair and dry, the only important interruption occurring on the 24th and 25th, when a "V-shaped" depression came in from the Atlantic and produced a little rain in the western and northern districts generally. The brilliant sunshine which prevailed so widely was accompanied as a rule by cool breezes, and it was only in the eastern, central and southern parts of England that the thermometer ever touched 80°, readings slightly above that level being recorded locally at various times between the 21st and 25th, and again on the 29th and 30th. On the 30th the shade maxima were as high as 86° at Barnet and 84° at Camden Square and Epsom.

The effect of the summer heat which prevailed at the beginning and end of the month was counterbalanced by the coolness of the intervening period, and over the country generally the mean temperature of the month was slightly below the average. The deficiency of warmth was greater in the daytime than at night. At the official London station in connection with the Meteorological Office the thermometer did not once fall below 50°, an event that has occurred in only two other Julys of the past 36 years, viz., in 1899 and 1904.

## REVIEWS.

*The Observer's Handbook.* Meteorological Office. A new and revised edition of Dr. R. H. Scott's Instructions in the Use of Meteorological Instruments. Published by the Authority of the Meteorological Committee. London. Printed for H.M. Stationery Office. 1908. Price 3s. Size 9½ × 6. Pp. 134.

THE book though dull and official in its appearance, and high in price, is a clear and trustworthy compendium of the whole duty of the meteorological observer. Dr. Shaw explains in the preface that in preparing this new edition Mr. Lempfert has revised the tables to bring them into harmony with the decisions of the International Meteorological Conference. The book has been rendered more serviceable to the observer throughout by eliminating many theoretical details and laying greater stress on matters of more direct interest. The earnest desire for uniformity animates the whole work, which we

* See p. 135.

cannot recommend too strongly to the attention of our readers; and Dr. Shaw carries this laudable feeling so far as to expound his proposed system of absolute units the adoption of which would have the great merit of imposing an equal change on all countries.

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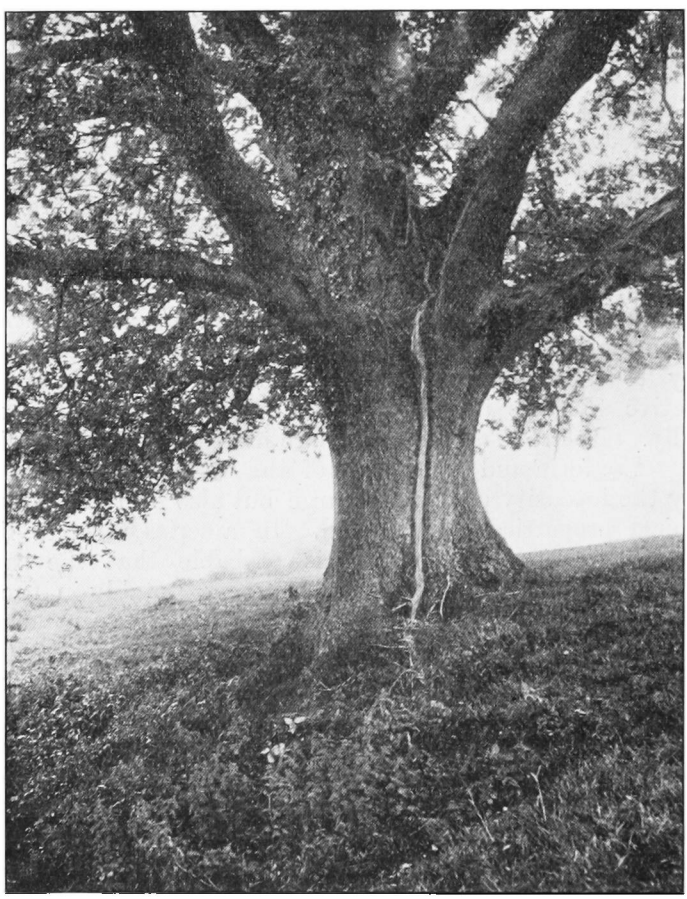
*La Foudre et les Arbres. Etudes sur les Foudroiements d'Arbres constatés en Belgiques pendant les années* [Lightning and Trees, a study of the cases of trees being struck by lightning in Belgium during the years] 1884-1906. Par E. VANDERLINDEN. Bruxelles. Service Metéorologique de Belgique. 1907.

THE results of the discussion as summarised in the original paper are as follows: In Belgium the trees most subject to lightning-stroke are the several species of poplar, the oaks and conifers. It cannot be asserted that any species is entirely spared. The species which in a given region furnishes the most victims is not always that which is most widely distributed, but that which attains the greatest height and grows habitually in an open situation. There is nothing to prove that shape, anatomical features, chemical composition and electric conductivity of wood, nature of soil or proximity to a sheet of water are main factors in conducting lightning *towards* a tree. Proportionally to the number of individuals present lightning is least destructive to trees in forests, woods, copses and compact groups generally. Isolated trees in plains are most susceptible to lightning stroke. The form and dimensions of the wounds are determined not only by the intensity of the discharge but also by the resistance and anatomical properties of the wood. In a series of trees lightning chooses the most elevated. It is probable that the passage of lightning does not always leave visible traces, notably in the case of trees with a smooth bark. The use of trees as lightning conductors is not advisable, for the proximity of elevated and isolated trees augments the risks of injury to buildings. Complete or partial combustion of a tree by lightning is exceptional.

It will be seen that M. Vanderlinden arrives at the conclusion that certain species of trees are more frequently damaged than others by reason of accidental circumstances such as their predominance in a given region, their habit of growing in exposed situations, and their greater height and size, but not by reason of specific qualities of wood or foliage. Thus the great frequency with which poplars are struck in Belgium is attributable to their abundance. On the other hand, alder, service and fruit trees being relatively uncommon and of small stature, are seldom struck. In England there is a widespread belief that the oak is more often struck than other forest trees, and this belief would seem to figure in English literature (King Lear's "*oak*-cleaving thunderbolts," to wit).* But here again the apparent

* We reproduce here an excellent photograph of an oak struck by lightning at Ambersham, near Midhurst, on June 1st or 2nd, 1906, for which we are indebted to Mr. G. H. M. Whish.

susceptibility of the oak is very probably entirely due to the fact that the oak is par excellence *the* tree of England, being found in abundance everywhere except the uplands, where in these latitudes trees hardly grow at all, and the smoke-laden town and manufacturing areas where curiously enough planes and other imported species will endure conditions which the native or long-naturalised forest trees will not. In England also (and this supports the Belgian results) one seldom finds damage done to oaks in wood or coppice, but very



OAK STRUCK BY LIGHTNING.

often to isolated ones in pasture—those creatures perfect in form and beauty, which may be seen dominating a meadow in almost any county, and give so much of character to English scenery.

We have not space here to notice the many interesting questions discussed or opened out by M. Vanderlinden, but quote for the years 1884-1906 the number of cases of lightning-stroke, expressed in percentage of the general total, for the following species of trees :—

| | | | | | |
|---|---|---|---|---|---|
| Poplar ..... ... | 55·6 | Ash ..... | 1·3 | French Chestnut.. | 0·5 |
| Oak ..... | 13·9 | Lime..... | 1·2 | Service..... | 0·5 |
| Elm ..... | 7·0 | Apple ..... | 1·1 | Plum ..... | 0·4 |
| Conifers ..... | 6·8 | Acacia ..... | 1·1 | Sweet or Spanish Chestnut..... | 0·3 |
| Beech ... ..... ... | 3·8 | Cherry ..... | 1·0 | Alder ..... | 0·1 |
| Pear ..... | 2·7 | Walnut ..... | 0.7 | | |
| Willow..... | 1·5 | Birch ..... | 0·5 | | |

L.C.W.B.

# Correspondence.

*To the Editor of Symons's Meteorological Magazine.*

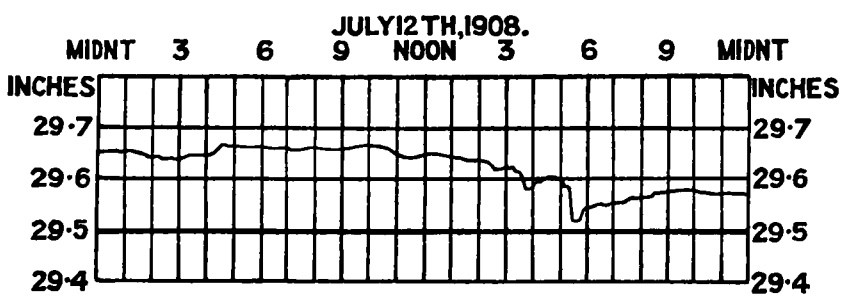
## BAROMETRIC OSCILLATIONS, JULY 12th.

SOME remarkable barometric oscillations occurring here on July 12th, a tracing from the record is sent herewith. They would appear to have been attributable to the formation of thunder-bearing disturbances, as the atmospheric conditions prevailing on the day in question were in a very unstable condition, a marked diversity both of velocity and direction being noticed in the upper and lower currents.

The early morning was overcast, the sky being covered with stratus cloud, a dead calm prevailing with a humid atmosphere. At noon, stratus was visible at a low elevation, moving slowly from N.W., with cumulus clouds at distant levels above, the upper moving from S.W., the lower from N.E., currents in direct opposition therefore prevailing. Thunder-clouds moved up from S. at 1 p.m., but passed over. There was a sharp shower at 2 p.m., followed by heavy rain of a thunder type between 2.55 p.m. and 3.25 p.m., and a further fall from 3.45 p.m. to 5 p.m. At 6 p.m., thunder-clouds were visible in N.W., N. and N.E., with a blue black thunder pall lying to S. and S.E. Heavy distant rolling thunder was heard in S. and S.E., between 6.20 p.m. and 6.45 p.m. The surface winds were calm and light variable airs N. to N.E. to 2 p.m., then veering through E. to S. and S.W.

*Epsom, Aug. 1st, 1908.*

SPENCER C. RUSSELL, F.R.Met.Soc.




[We do not reproduce Mr. Russell's barograph, or a very similar one kindly forwarded by Mr. J. H. Tritton, of Lyons Hall, Great

Leigh, Essex, on account of their small size; but give instead a facsimile of the trace of the Redier barograph at Camden Square, which shows the remarkable oscillations referred to with great distinctness. We do not remember to have seen a similar curve on any previous occasion.—ED. *S.M.M.*]

## HEAVY RAINFALL AT HERNE BAY.

A REMARKABLE rainstorm visited Herne Bay early on July 13th, when in about 3½ hours 2·65 in. fell. The downfall started about 5 o'clock in the morning, and is described by the local press as having the appearance of a cloudburst. The torrential downpour continued without any appreciable abatement till nearly 8 o'clock, when it became less steady, and finally at 8.30 ceased for a time. A fresh breeze from the N. blew for an hour or so, the sky continuing very lowering. The wind then gradually backed to W., and light rain fell at intervals till the evening—the measurement, however, since the cessation of the deluge was only a few hundredths of an inch. Everything possible was done to cope with the enormous amount of water, but in spite of the efforts of the engineer at the pumping station many low-lying streets, fields and cellars were flooded. The rains of that week were altogether a record for Herne Bay, as this storm was followed by further heavy downpours on the Thursday, Friday and Saturday, July 16th—18th; thus, from Sunday, 12th, to Saturday, 18th, inclusive, over 4½ inches were measured.

A. IZZARD.

## HEAVY RAINFALL ON JUNE 13th IN SNOWDONIA.

AT Cwm Dyli, rain began to fall on this date at 4.30 a.m., and continued gently all the morning with occasional dry intervals. Up to noon, ·45 in. had fallen. The downpour in the afternoon was much heavier, and from noon to 6 p.m. ·93 in. fell. Afterwards a sleety driving rain continued all the evening until nearly midnight, when it cleared up and the moon was visible. The total rainfall for the 24 hours was 2·02 in.

At Llyn Llydaw rain gauge, a still heavier rainfall was measured. From 9 a.m. to 8 p.m. 5·50 in. fell.

A. LOCKWOOD.

*Cwm Dyli, Beddgelert.*

ERRATUM in July number, p. 122 :—Llanberis, Pen-y-pass, *for* 5·50 *read* 7·34.

# REPORT UPON DRY PERIOD AND RAIN-MAKING EXPERIMENTS AT OAMARU, NEW ZEALAND.

By Rev. D. C. Bates, F.R.Met.Soc.

(*Continued from p.* 111.)

On Sunday, August 18th, the coming of what appeared to be merely a westerly area of low pressure developed into a cyclone, which promised greater rain and sooner than it would have come from the ordinary type, which would have culminated between 19th and 20th. There was a drizzle falling on Sunday morning at Omaru at 4 a.m., and at 9 a.m. ·04 in. was recorded. The day was dull and threatening, and rain set in again at night; ·40 in. was recorded in the morning. At Totara Station in the Kakanui Basin Mr. Macpherson recorded ·73 in. The rain was mostly confined to the sea coast while the barometer was falling. It was 29·99 in. on Saturday and 29·47 in. on Monday at 9 a.m. I expected much more rain would come with the rise of the barometer and the shift of the wind to the south, but as yet hardly any rain had fallen inland. The rain held off, but the skies continued cloudy. The Committee decided to experiment at Raki's Table when they heard no rain had fallen there. We left Oamaru at 12.30 p.m. on the 19th, and as we got out into the country found the roads dry, but "bad" weather was evidently working inland, and there was a very slight drizzle falling as we arrived at Ammore about 1.45 p.m. Corporal Meikle was then making an explosion, which had apparently no effect, though the hygrometer showed that the air was saturated with moisture. Earlier, at 12.30, another shot had been fired, and artillerymen and others affirmed that it drew rain in fifteen minutes, and brought the clouds down on the Table, insomuch that the view of the surrounding country was obscured. We missed the artillerymen on the road, but, in company with Mr. Shand, I at once visited the top of the Table. We found the wind strong and gusty from the S.E. Thy sky was dark and lowering, and two showers fell before the artillerists returned. Raki's Table was then enveloped in a thick Scotch mist, spitting with rain, but heavy showers soon set in and continued to fall at intervals. I regarded these as perfectly natural, and was confirmed in my opinion when I learned that the rain squalls had the same intermittent character long before they reached us. It could hardly be maintained that the explosions would have so marked an effect as this on the rain, 14 miles away and against the sweep of a wind at the Table averaging about 25 miles an hour. While I saw no perceptible difference made in the showers sweeping down upon us and progressing over the country, others were quite as decided in their opinions that the rain thickened heavily after each successive shot.

The barometer continued to rise, and those who watched the instrument agreed there was no fall after the several shots. The

weather continued very raw and wet, but the hygrometer showed the same dew point as before.

The explosions were as follows:—

| | Time. | Guncotton. lbs. | Dynamite. lbs. | Gunpowder. lbs. | Weight of Charge. lbs. | How made up. |
|---|---|---|---|---|---|---|
| (4) | 12.30 p.m. | ... | 50 | ... | 50 | In 5 gall. oil drum |
| (5) | 1.45 p.m. | ... | ... | 50 | 50 | do. |
| (6) | 3.56 p.m. | ... | 50 | ... | 50 | do. |
| (7) | 4.5 p.m. | ... | 65 | ... | 65 | In case. |
| (8) | 4.17 p.m. | 50 | 60 | ... | 110 | do. |
| (9) | 4.30 p.m. | 50 | 100 | ... | 150 | do. |
| | | 100 | 325 | 50 | 475 | |

Rain fell on the 19th and 20th over a very wide area in the South Island, and the falls at this time recorded by the observers of the Meteorological Office are as follows:—

| | Windsor Park. | Otekaike. | Livingstone. | Arnmore. | Kurow. | Waimate. | Oamaru. | Totara. | Kauroo Hill. |
|---|---|---|---|---|---|---|---|---|---|
| 18th ... | ·16 | ... | ... | ·03 | ... | ... | ·40 | ·73 | ... |
| 19th ... | ·53 | 1·15 | ·70 | ·52 | 1·17 | ·03 | ·36 | ·40 | ·10 |
| 20th ... | ... | ·15 | ·53 | ·09 | ·12 | ·50 | ... | ·06 | ·70 |

The falls were very different at the various places, but such widespread and heavy rains could hardly be attributed to artificial means.

On the 22nd everything was ready for a trial upon a larger scale. There was a cloudy sky, a rapidly falling barometer, following a frosty night, and local indications fell in with the wider aspect of affairs—rain before long.

The explosions were as follows:—

RAKI'S TABLE.

| | Time. | Guncotton. lbs. | Dynamite. lbs. | Gunpowder. lbs. | Weight of Charge. lbs. | How made up. |
|---|---|---|---|---|---|---|
| (10) | 3.30 p.m. | ... | 100 | ... | 100 | In 10 gall. oil drum. |
| (11) | 3.40 p.m. | ... | 100 | ... | 100 | do. |
| (12) | 3.50 p.m. | 50 | 150 | ... | 200 | do. |
| (13) | 6 p.m. | ... | 150 | 50 | 200 | In case and keg. |

DALGETY'S HILL, DUNTROON.

| | | | | | | |
|---|---|---|---|---|---|---|
| (14) | 3.30 p.m. | 33 | 67 | ... | 100 | In 10 gall. oil drum. |
| (15) | 3.39 p.m. | 33 | 67 | ... | 100 | do. |
| (16) | 3.49 p.m. | 33 | 67 | ... | 100 | do. |

ROUND HILL, TOTARA.

| | | | | | | |
|---|---|---|---|---|---|---|
| (17) | 3.30 p.m. | 25 | 25 | ... | 50 | In gun-cotton case. |
| (18) | 3.40 p.m. | 25 | 25 | ... | 50 | do. |
| (19) | 3.50 p.m. | 25 | 25 | ... | 50 | do. |
| (20) | 3.55 p.m. | 25 | 25 | ... | 50 | do. |

The charges were primed with dry guncotton and fired by a dynamite detonator attached to a slow-burning fuse. In nearly all cases complete detonation took place, but it would have been much more satisfactory had each case of explosives been connected and the explosions made by electric current. In one instance it was noticed that three cases of dynamite exploded, one upwards and two others sideways, and not quite simultaneously, so that it appeared as if a single cap was not sufficient for complete detonation.

(*To be continued.*)

## METEOROLOGICAL NEWS AND NOTES.

METEOROLOGY AT THE BRITISH ASSOCIATION promises to be well represented, as the President of Section A for the year is Dr. W. N. Shaw, Director of the Meteorological Office. We understand that M. Teisserenc de Bort will open a discussion on the Isothermal Layer of the Atmosphere, that Sir John Moore will discuss the question of change of climate, and that Captain Campbell Hepworth will deal with the relation between the surface water of the Atlantic and the strength of the trade winds. The meeting takes place at Dublin from September 3rd to 10th.

THE ANNUAL METEOROLOGICAL BREAKFAST, which is one of the unofficial features of the meeting of the British Association, will be held this year in Dublin, on Tuesday, 8th September, at 9 a.m. The place of meeting will be the Hall of the Royal College of Physicians of Ireland, by kind permission of the President and Fellows of the College, and Sir John Moore, M.D., will preside. The charge for the breakfast will be 3s. 6d. per head, and to facilitate arrangements it would be a great help if all meteorologists and observers who would like to take advantage of the opportunity of meeting, would intimate their intention to Dr. H. R. Mill, Reception Room, British Association, Dublin, not earlier than September 2nd, and not later than September 5th.

DR. H. R. MILL IS TO LECTURE on "Rain," at Thetford, for the Gilchrist Trust, on Thursday, 24th September.

THE EGYPTIAN DAILY WEATHER REPORT, some copies of which have been sent us by Captain Lyons, by whose Department it is published, contains an isobaric chart for 8 a.m. of the day of issue and of the day before, taking in the South of Europe as far west as Italy, and the country between the Nile and the Red Sea as far south as Mongalla on the confines of the Sudan and Uganda. The fact of daily weather reports being received at Cairo from the immediate neighbourhood of the equator is an impressive mark of progress.

EFFECTS OF THE DROUGHT.—Worried because he could not get the gardens to the perfection he desired, owing to the prolonged spell of dry weather, George Walker, the gardener of Sir George Doughty, committed suicide by taking prussic acid at Waltham. At the inquest yesterday a verdict of Suicide while temporarily insane was returned.—*Daily Mail, 8th July*, 1908.

LOCAL RAINFALL RECORDS IN NEWSPAPERS are fortunately very common and usually remarkably accurate; but the correspondents who have written us eager to vindicate their local paper have missed the point of our note on p. 97. We said that the *Norfolk Chronicle* was distinguished from other papers by printing monthly *records of daily rainfall*, and we are still without evidence that any other paper does so.

## RAINFALL TABLE FOR JULY, 1908.

| STATION. | COUNTY. | Lat. N. | Long. W. [*E.] | Height above Sea. | RAINFALL OF MONTH. | |
|---|---|---|---|---|---|---|
| | | | | | Aver. 1870-99. | 1908. |
| | | ° ′ | ° ′ | ft. | in. | in. |
| Camden Square | *London* | 51 32 | 0 8 | 111 | 2·49 | 3·36 |
| Tenterden | *Kent* | 51 4 | *0 41 | 190 | 2·26 | 2·86 |
| West Dean | *Hampshire* | 51 3 | 1 38 | 137 | 2·62 | 1·34 |
| Hartley Wintney | ,, | 51 18 | 0 53 | 222 | 2·38 | 1·60 |
| Hitchin | *Hertfordshire* | 51 57 | 0 17 | 238 | 2·55 | 2·91 |
| Winslow (Addington) | *Buckinghamshr.* | 51 58 | 0 53 | 309 | 2·77 | 2·07 |
| Bury St. Edmunds (Westley) | *Suffolk* | 52 15 | *0 40 | 226 | 2·91 | 3·42 |
| Brundall | *Norfolk* | 52 37 | *1 26 | 66 | 2·70 | 3·29 |
| Winterbourne Steepleton | *Dorset* | 50 42 | 2 31 | 316 | 2·78 | 2·20 |
| Torquay (Cary Green) | *Devon* | 50 28 | 3 32 | 12 | 2·73 | 1·28 |
| Polapit Tamar [Launceston] | ,, | 50 40 | 4 22 | 315 | 2·93 | 2·55 |
| Bath | *Somerset* | 51 23 | 2 21 | 67 | 2·83 | 2·53 |
| Stroud (Upfield) | *Gloucestershire* | 51 44 | 2 13 | 226 | 2·90 | 1·83 |
| Church Stretton (Wolstaston) | *Shropshire* | 52 35 | 2 48 | 800 | 2·66 | 3·20 |
| Coventry (Kingswood) | *Warwickshire* | 52 24 | 1 30 | 340 | 2·75 | 2·39 |
| Boston | *Lincolnshire* | 52 58 | 0 1 | 25 | 2·44 | 3·23 |
| Worksop (Hodsock Priory) | *Nottinghamshire* | 53 22 | 1 5 | 56 | 2·51 | 2·44 |
| Derby (Midland Railway) | *Derbyshire* | 52 55 | 1 28 | 156 | 2·63 | 2·45 |
| Bolton (Queen's Park) | *Lancashire* | 53 35 | 2 28 | 390 | 4·12 | 5·85 |
| Wetherby (Ribston Hall) | *Yorkshire, W.R.* | 53 59 | 1 24 | 130 | 2·61 | 2·72 |
| Arncliffe Vicarage | ,, ,, | 54 8 | 2 6 | 732 | 4·97 | 6·45 |
| Hull (Pearson Park) | ,, *E.R.* | 53 45 | 0 20 | 6 | 2·50 | 2·44 |
| Newcastle (Town Moor) | *Northumberland* | 54 59 | 1 38 | 201 | 2·91 | 2·85 |
| Borrowdale (Seathwaite) | *Cumberland* | 54 30 | 3 10 | 423 | 9·37 | 8·20 |
| Cardiff (Ely) | *Glamorgan* | 51 29 | 3 13 | 53 | 3·52 | 3·02 |
| Haverfordwest (High Street) | *Pembroke* | 51 48 | 4 58 | 95 | 3·70 | 4·82 |
| Aberystwyth (Gogerddan) | *Cardigan* | 52 26 | 4 1 | 83 | 4·27 | 4·87 |
| Llandudno | *Carnarvon* | 53 20 | 3 50 | 72 | 2·61 | 2·54 |
| Cargen [Dumfries] | *Kirkcudbright* | 55 2 | 3 37 | 80 | 3·30 | 4·26 |
| Hawick (Branxholm) | *Roxburgh* | 55 24 | 2 51 | 457 | 3·34 | 2·69 |
| Edinburgh (Royal Observy.) | *Midlothian* | 55 55 | 3 11 | 442 | ... | 3·32 |
| Girvan (Pinmore) | *Ayr* | 55 10 | 4 49 | 207 | 3·60 | 4·58 |
| Glasgow (Queen's Park) | *Renfrew* | 55 53 | 4 18 | 144 | 3·36 | 2·03 |
| Tighnabruaich | *Argyll* | 55 55 | 5 14 | 50 | 4·33 | 6·11 |
| Mull (Quinish) | ,, | 56 36 | 6 13 | 35 | 4·38 | 4·36 |
| Dundee (Eastern Necropolis) | *Forfar* | 56 28 | 2 57 | 199 | 3·03 | 1·95 |
| Braemar | *Aberdeen* | 57 0 | 3 24 | 1114 | 2·89 | 2·82 |
| Aberdeen (Cranford) | ,, | 57 8 | 2 7 | 120 | 3·02 | 2·31 |
| Cawdor | *Nairn* | 57 31 | 3 57 | 250 | 3·34 | 1·42 |
| Fort Augustus (S. Benedict's) | *E. Inverness* | 57 9 | 4 41 | 68 | 3·10 | 2·01 |
| Loch Torridon (Bendamph) | *W. Ross* | 57 32 | 5 32 | 20 | 6·46 | 2·43 |
| Dunrobin Castle | *Sutherland* | 57 59 | 3 56 | 14 | 2·82 | 1·95 |
| Castletown | *Caithness* | 58 35 | 3 23 | 100 | ... | 1·47 |
| Killarney (District Asylum) | *Kerry* | 52 4 | 9 31 | 178 | 3·99 | 3·56 |
| Waterford (Brook Lodge) | *Waterford* | 52 15 | 7 7 | 104 | 3·10 | 3·86 |
| Broadford (Hurdlestown) | *Clare* | 52 48 | 8 38 | 167 | 2·94 | 3·81 |
| Abbey Leix (Blandsfort) | *Queen's County* | 52 56 | 7 17 | 532 | 3·05 | 2·35 |
| Dublin (Fitz William Square) | *Dublin* | 53 21 | 6 14 | 54 | 2·63 | 2·08 |
| Ballinasloe | *Galway* | 53 20 | 8 15 | 160 | 3·31 | 1·46 |
| Clifden (Kylemore House) | ,, | 53 32 | 9 52 | 105 | 6·15 | ... |
| Crossmolina (Enniscoe) | *Mayo* | 54 4 | 9 18 | 74 | 3·59 | 2·27 |
| Collooney (Markree Obsy.) | *Sligo* | 54 11 | 8 27 | 127 | 3·65 | 2·47 |
| Seaforde | *Down* | 54 19 | 5 50 | 180 | 3·40 | 3·87 |
| Londonderry (Creggan Res.) | *Londonderry* | 54 59 | 7 19 | 320 | 3·47 | 4·18 |

## RAINFALL TABLE FOR JULY, 1908—*continued.*

| RAINFALL OF MONTH (*con.*) | | | | | RAINFALL FROM JAN. 1. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Diff. from Av. in. | % of Av. | Max. in 24 hours. in. | Max. in 24 hours. Date. | No. of Days | Aver. 1870-99. in. | 1908. in. | Diff. from Aver. in. | % of Av. | Mean Annual 1870-1899. in. | STATION. |
| + ·87 | 135 | ·81 | 16 | 12 | 13·12 | 14·93 | +1·81 | 114 | 25·16 | Camden Square |
| + ·60 | 126 | ·57 | 16 | 12 | 13·81 | 12·53 | —1·28 | 91 | 28·36 | Tenterden |
| —1·28 | 51 | ·54 | 16 | 10 | 15·23 | 13·49 | —1·74 | 89 | 29·93 | West Dean |
| — ·78 | 67 | ·60 | 16 | 9 | 13·97 | 14·28 | + ·31 | 102 | 27·10 | HartleyWintney |
| + ·36 | 114 | ·57 | 14 | 16 | 12·81 | 13·62 | + ·81 | 106 | 24·66 | Hitchin |
| — ·70 | 75 | ·48 | 14 | 13 | 14·05 | 15·23 | +1·18 | 109 | 26·75 | Addington |
| + ·51 | 118 | ·72 | 13 | 12 | 13·23 | 13·82 | + ·59 | 104 | 25·39 | Westley |
| + ·59 | 122 | 1·18 | 13 | 14 | 12·82 | 14·34 | +1·52 | 112 | 25·40 | Brundall |
| — ·58 | 79 | ·90 | 16 | 11 | 19·14 | 14·77 | —4·37 | 77 | 39·00 | Winterbourne Stpltn |
| —1·45 | 47 | ·30 | 16 | 10 | 17·78 | 11·99 | —5·79 | 67 | 35·00 | Torquay |
| — ·38 | 87 | ·79 | 16 | 14 | 18·38 | 18·59 | + ·21 | 101 | 38·85 | Polapit Tamar |
| — ·30 | 89 | ·94 | 8 | 12 | 15·86 | 12·46 | —3·40 | 79 | 30·75 | Bath |
| —1·07 | 63 | ·65 | 16 | 13 | 15·73 | 12·58 | —3·15 | 80 | 29·85 | Stroud |
| + ·54 | 120 | ·66 | 16 | 13 | 16·97 | 18·20 | +1·23 | 107 | 33·04 | Wolstaston |
| — ·36 | 87 | ·53 | 9 | 10 | 15·31 | 14·27 | —1·04 | 93 | 29·21 | Coventry |
| + ·79 | 132 | ·73 | 8 | 17 | 12·20 | 13·62 | +1·42 | 112 | 23·30 | Boston |
| — ·07 | 97 | ·64 | 8 | 13 | 13·32 | 13·21 | — ·11 | 99 | 24·70 | Hodsock Priory |
| — ·18 | 93 | ·55 | 9 | 11 | 14·11 | 13·99 | — ·12 | 99 | 26·18 | Derby |
| +1·73 | 142 | 1·55 | 16 | 15 | 20·87 | 26·38 | +5·51 | 126 | 42·43 | Bolton |
| + ·11 | 104 | ·71 | 8 | 12 | 14·24 | 16·57 | +2·33 | 116 | 26·96 | Ribston Hall |
| +1·48 | 130 | 1·48 | 16 | 18 | 31·44 | 36·76 | +5·32 | 117 | 60·96 | Arncliffe Vic. |
| — ·06 | 97 | ·76 | 8 | 14 | 13·74 | 12·74 | —1·00 | 93 | 27·02 | Hull |
| — ·06 | 98 | ·82 | 8 | 15 | 14·26 | 14·58 | + ·32 | 102 | 27·99 | Newcastle |
| —1·17 | 88 | 2·30 | 16 | 20 | 66·73 | 66·49 | — ·24 | 100 | 132·68 | Seathwaite |
| — ·50 | 86 | 1·02 | 16 | 10 | 20·71 | 16·38 | —4·33 | 79 | 42·81 | Cardiff |
| +1·12 | 130 | 1·41 | 9 | 13 | 23·37 | 21·87 | —1·50 | 94 | 47·88 | Haverfordwest |
| + ·60 | 114 | 1·08 | 9 | 16 | 21·86 | 24·98 | +3·12 | 114 | 45·41 | Gogerddan |
| — ·07 | 97 | ·65 | 9 | 12 | 14·79 | 17·95 | +3·16 | 122 | 30·98 | Llandudno |
| + ·96 | 129 | ·76 | 8 | 16 | 22·05 | 27·47 | +5·42 | 125 | 43·43 | Cargen |
| — ·65 | 81 | ·62 | 8 | 12 | 18·00 | 18·35 | + ·35 | 102 | 34·80 | Branxholm |
| ... | ... | ·68 | 12 | 12 | ... | 14·27 | ... | ... | ... | Edinburgh |
| + ·98 | 127 | ·81 | 16 | 23 | 24·12 | 27·83 | +3·71 | 115 | 48·87 | Girvan |
| —1·33 | 60 | ·74 | 8 | 13 | 18·30 | 19·64 | +1·34 | 107 | 35·80 | Glasgow |
| +1·78 | 141 | 1·08 | 22 | 15 | 28·98 | 35·99 | +7·01 | 124 | 57·90 | Tighnabruaich |
| — ·02 | 100 | ·93 | 29 | 17 | 28·22 | 28·87 | + ·65 | 102 | 57·53 | Quinish |
| —1·08 | 64 | ·37 | 8 | 14 | 15·12 | 11·74 | —3·38 | 78 | 28·95 | Dundee |
| — ·07 | 98 | ... | ... | ... | 17·83 | 19·93 | +2·10 | 112 | 36·07 | Braemar |
| — ·71 | 77 | ·60 | 16 | 14 | 16·71 | 14·46 | —2·25 | 87 | 33·01 | Aberdeen |
| —1·92 | 42 | ·48 | 17 | 8 | 15·26 | 13·34 | —1·92 | 87 | 29·37 | Cawdor |
| —1·09 | 65 | ·52 | 11 | 15 | 22·40 | 24·25 | +1·85 | 108 | 43·71 | Fort Augustus |
| —4·03 | 38 | ·41 | 16, 21 | 15 | 42·50 | 50·88 | +8·38 | 120 | 86·50 | Bendamph |
| — ·87 | 69 | ·70 | 10 | 10 | 16·27 | 21·60 | +5·33 | 133 | 31·60 | Dunrobin Castle |
| ... | ... | ·31 | 10 | 20 | ... | 19·02 | ... | ... | ... | Castletown |
| — ·43 | 89 | ·61 | 15 | 23 | 29·98 | 24·67 | —5·31 | 82 | 58·11 | Killarney |
| + ·76 | 124 | 1·08 | 7 | 13 | 20·29 | 18·04 | —2·25 | 89 | 39·30 | Waterford |
| + ·87 | 130 | ·75 | 12 | 15 | 17·06 | 19·60 | +2·54 | 115 | 33·47 | Hurdlestown |
| — ·70 | 77 | ·50 | 16 | 16 | 18·25 | 17·32 | — ·93 | 95 | 35·19 | Abbey Leix |
| — ·55 | 79 | ·52 | 7 | 13 | 14·51 | 13·81 | — ·70 | 95 | 27·75 | Dublin |
| —1·85 | 44 | ·42 | 16 | 16 | 19·23 | 18·26 | — ·97 | 95 | 37·04 | Ballinasloe |
| ... | ... | ... | ... | ... | 40·44 | ... | ... | ... | 80·23 | KylemoreHouse |
| —1·32 | 63 | ·34 | 16 | 21 | 25·33 | 30·25 | +4·92 | 120 | 50·50 | Enniscoe |
| —1·18 | 68 | ·42 | 11 | 19 | 21·16 | 26·78 | +5·62 | 127 | 41·83 | Markree Obsy. |
| + ·47 | 114 | ·82 | 12 | 14 | 20·32 | 23·39 | +3·07 | 115 | 38·61 | Seaforde |
| + ·71 | 120 | ·78 | 13 | 21 | 20·54 | 24·16 | +3·62 | 118 | 41·20 | Londonderry |

## SUPPLEMENTARY RAINFALL, JULY, 1908.

| Div. | STATION. | Rain inches | Div. | STATION. | Rain. inches |
|---|---|---|---|---|---|
| II. | Warlingham, Redvers Road | 3·82 | XI. | Rhayader, Tyrmynydd | 5·93 |
| ,, | Ramsgate | 3·27 | ,, | Lake Vyrnwy | 5·06 |
| ,, | Steyning | 3·48 | ,, | Llangyhanfal, Plâs Draw | 2·48 |
| ,, | Hailsham | 3·17 | ,, | Criccieth, Talarvor | 3·87 |
| ,, | Totland Bay, Aston House | 1·55 | ,, | Llanberis, Pen-y-pass | 13·88 |
| ,, | Emsworth, Redlands | 1·87 | ,, | Lligwy | 3·77 |
| ,, | Stockbridge, Ashley | 1·51 | ,, | Douglas, Woodville | 3·74 |
| ,, | Reading, Calcot Place | 1·71 | XII. | Stoneykirk, Ardwell House | 2·83 |
| III. | Harrow Weald, Hill House. | 3·71 | ,, | Dalry, The Old Garroch | 4·55 |
| ,, | Oxford, Magdalen College | 1·97 | ,, | Langholm, Drove Road | 4·01 |
| ,, | Pitsford, Sedgebrook | 3·78 | ,, | Moniaive, Maxwelton House | 3·89 |
| ,, | Huntingdon, Brampton | 2·56 | XIII. | N. Esk Reservoir [Penicuick] | 2·75 |
| ,, | Woburn, Milton Bryant | 2·07 | XIV. | Maybole, Knockdon Farm | 2·87 |
| ,, | Wisbech, Bank House | 2·42 | XV. | Campbeltown, Witchburn | 3·75 |
| IV. | Southend Water Works | 3·44 | ,, | Inveraray, Newtown | 5·79 |
| ,, | Colchester, Lexden | 3·08 | ,, | Ballachulish House | 4·75 |
| ,, | Newport, The Vicarage | 2·75 | ,, | Islay, Eallabus | 4·20 |
| ,, | Rendlesham | 4·31 | XVI. | Dollar Academy | 3·74 |
| ,, | Swaffham | 3·38 | ,, | Loch Leven Sluice | 3·28 |
| ,, | Blakeney | 2·75 | ,, | Balquhidder, Stronvar | 5·53 |
| V. | Bishops Cannings | 2·09 | ,, | Perth, The Museum | 2·11 |
| ,, | Ashburton, Druid House | 2·83 | ,, | Coupar Angus Station | 2·05 |
| ,, | Honiton, Combe Raleigh | 2·12 | ,, | Blair Atholl | 2·57 |
| ,, | Okehampton, Oaklands | 2·83 | ,, | Montrose, Sunnyside Asylum | 1·65 |
| ,, | Hartland Abbey | 2·71 | XVII. | Alford, Lynturk Manse | 4·58 |
| ,, | Lynmouth, Rock House | 2·77 | ,, | Keith Station | 4·39 |
| ,, | Probus, Lamellyn | 2·09 | XVIII. | N. Uist, Lochmaddy | 3·33 |
| ,, | North Cadbury Rectory | 1·64 | ,, | Alvey Manse | 2·49 |
| VI. | Clifton, Pembroke Road | 2·18 | ,, | Loch Ness, Drumnadrochit. | 1·70 |
| ,, | Ross, The Graig | 1·64 | ,, | Glencarron Lodge | 2·16 |
| ,, | Shifnal, Hatton Grange | 2·45 | ,, | Fearn, Lower Pitkerrie | 1·16 |
| ,, | Blockley, Upton Wold | 3·12 | XIX. | Invershin | 1·56 |
| ,, | Worcester, Boughton Park. | 1·80 | ,, | Altnaharra | 1·30 |
| VII. | Market Overton | 2·81 | ,, | Bettyhill | 1·79 |
| ,, | Market Rasen | 3·27 | XX. | Dunmanway, The Rectory | 5·64 |
| ,, | Bawtry, Hesley Hall | 2·81 | ,, | Cork | 2·49 |
| ,, | Buxton | 3·89 | ,, | Darrynane Abbey | 4·17 |
| VIII. | Neston, Hinderton Lodge | 2·49 | ,, | Glenam [Clonmel] | 3·10 |
| ,, | Southport, Hesketh Park | 3·49 | ,, | Ballingarry, Gurteen | 2·51 |
| ,, | Chatburn, Middlewood | 5·21 | ,, | Miltown Malbay | 3·01 |
| ,, | Cartmel, Flookburgh | 4·01 | XXI. | Gorey, Courtown House | 3·47 |
| IX. | Langsett Moor, Up. Midhope | 3·40 | ,, | Moynalty, Westland | 2·64 |
| ,, | Scarborough, Scalby | 1·50 | ,, | Athlone, Twyford | 2·28 |
| ,, | Ingleby Greenhow | 2·51 | ,, | Mullingar, Belvedere | 2·48 |
| ,, | Mickleton | 2·10 | XXII. | Woodlawn | 1·89 |
| X. | Bardon Mill, Beltingham | 2·48 | ,, | Westport, St. Helens | 1·94 |
| ,, | Ewesley, Fallowlees | 2·61 | ,, | Mohill | 2·44 |
| ,, | Ilderton, Lilburn Cottage | 2·14 | XXIII. | Enniskillen, Portora | 2·27 |
| ,, | Keswick, York Bank | 3·88 | ,, | Dartrey [Cootehill] | 2·36 |
| XI. | Llanfrechfa Grange | 3·58 | ,, | Warrenpoint, Manor House | 4·26 |
| ,, | Treherbert, Tyn-y-waun | 8·41 | ,, | Banbridge, Milltown | 3·94 |
| ,, | Carmarthen, The Friary | 5·94 | ,, | Belfast, Springfield | 3·77 |
| ,, | Castle Malgwyn [Llechryd]. | 3·79 | ,, | Bushmills, Dundarave | 3·01 |
| ,, | Plynlimon | 10·00 | ,, | Stewartstown | ... |
| ,, | Crickhowell, Ffordlas | 4·20 | ,, | Killybegs | 3·99 |
| ,, | New Radnor, Ednol | 4·16 | ,, | Horn Head | 3·46 |

# METEOROLOGICAL NOTES ON JULY, 1908.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Temp. for Temperature; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow; F for number of days Frost in Screen; f on Grass.

LONDON, CAMDEN SQUARE.—Hot, dry conditions prevailed at the beginning, the mean max temp. for the first three days being 85°·9. On 4th three TSS occurred with heavy R, ·43 in. falling between 2 and 2.30 p.m., and ·29 in. falling in 8 min. at 8.20 p.m. Dull and rainy weather continued to 18th, but the remainder was fine, bright and rainless. Duration of sunshine, 161·5* hours, and of R 44·8 hours. Shade max. 87°·3 on 3rd; min. 47°·2 on 20th. F 0, f 0.

TENTERDEN.—Duration of sunshine, 217·6† hours. Shade max. 79°·0 on 30th; min. 48°·0 on 6th, 20th and 21st. F 0, f 0.

TOTLAND BAY.—Duration of sunshine, 254·3* hours. Shade max. 80°·7 on 2nd; min. 51°·0 on 12th. F 0, f 0.

PITSFORD.—Mean temp. 61°·3. Shade max. 82°·4 on 2nd; min. 44°·0 on 8th.

TORQUAY.—Duration of sunshine, 224·9* hours, or 1·2 hours below the average. Mean temp. 62°·4 or 0°·6 above the average. Shade max. 78°·2 on 30th; min. 51°·3 on 13th. F 0, f 0.

NORTH CADBURY.—A hot, dry beginning, a cool, cloudy and showery spell following, with a brilliant fortnight at the end. Shade max. 89°·2 on 3rd; min. 47°·5 on 7th. F 0, f 0.

BATH.—Shade max. 84°·8 on 3rd; min. 49°·8 on 12th. F 0, f 0.

ROSS.—Shade max. 86°·8 on 3rd; min. 44°·8 on 29th. F 0, f 0.

HODSOCK.—Shade max. 83°·1 on 2nd; min. 39°·5 on 8th. F 0, f 1.

BOLTON.—Mean temp. 57°·6, or 0°·1 above the average. Duration of sunshine, 121·4* hours, or 25·6 hours below the average. Shade max. 81°·9 on 2nd; min. 44°·2 on 8th. F 0, f 0.

SOUTHPORT.—The first July in 12 years with excessive R, the total fall being ·50 above the average of 35 years. The duration of sunshine, 199·4* hours, was normal; duration of R, 55·3 hours. Mean temp 59°·5, or 0°·2 below the average. Shade max. 80°·8 on 3rd; min. 44°·1 on 8th. F 0, f 0.

HULL.—Shade max. 81°·0 on 22nd; min. 40°·0 on 8th. F 0, f 0.

HAVERFORDWEST.—Fine and warm, but with heavy R. A very unusual afterglow on 1st, 2nd and 3rd. Duration of sunshine 206·1* hours. Shade max. 83°·6 on 3rd; min. 43°·4 on 30th. F 0, f 0.

LLANDUDNO.—Shade max. 78°·8 on 3rd; min. 48°·2 on 29th. F 0, f 0.

DOUGLAS.—Apart from the first six days, which were warm and summer-like, the month was gloomy with low temp., and a good deal of R and fog.

DUMFRIES.—Shade max. 87°·0 on 2nd; min. 40°·0 on 29th.

MAXWELTON.—R ·60 in. above the average. Shade max. 90°·0 on 2nd; min. 35°·0 on 8th.

EDINBURGH.—Shade max. 74°·7 on 2nd; min. 45°·7 on 6th. F 0, f 0.

COUPAR ANGUS.—The weather was all that could be desired, and all crops give great promise of abundance. Remarkable refraction of sunlight on 1st and 2nd, when a newspaper was read at midnight, and artificial light was unnecessary for railway signalling. Shade max. 83°·5 on 2nd; min. 37°·0 on 19th.

FORT AUGUSTUS.—Shade max. 72°·2 on 2nd; min. 44°·0 on 26th.

WATERFORD.—Shade max. 82°·0 on 4th; min. 43°·0 on 12th.

DUBLIN.—Shade max. 74°·7 on 4th: min. 49°·0 on 15th and 19th. F 0, f 0.

MARKREE.—Shade max. 78°·8 on 1st; min. 39°·0 on 21st. F 0, f 1.

WARRENPOINT.—Shade max. 75°·0 on 4th; min. 39°·0 on 24th. F 0, f 0.

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* Campbell-Stokes. † Jordan.

## Climatological Table for the British Empire, February, 1908.

| STATIONS. (*Those in italics are South of the Equator.*) | Absolute. Maximum. Temp. | Date. | Absolute. Minimum. Temp. | Date. | Average. Max. | Min. | Dew Point. | Humidity. | Absolute. Max. in Sun. | Min. on Grass. | Total Rain. Depth. | Days. | Aver. Cloud. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ° | | ° | | ° | ° | ° | 0-100 | ° | ° | inches | | |
| London, Camden Square | 54·5 | 17 | 28·0 | 13 | 47·9 | 35·8 | 38·1 | 88 | 84·9 | 24·2 | 1·68 | 15 | 6·5 |
| Malta ... ... ... | 63·5 | 29 | 41·5 | 4 | 57·5 | 49·8 | 43·5 | 74 | 128·0 | ... | 2·44 | 10 | 5·2 |
| Lagos ... ... ... | 92·0 | 3 | 72·0 | 3 | 89·6 | 75·8 | 74·9 | 75 | 154·0 | 67·0 | ·15 | 1 | 7·6 |
| *Cape Town* ... ... | 87·4 | 6 | 51·5 | 9 | 77·2 | 59·1 | 56·5 | 67 | ... | ... | ·33 | 4 | 2·6 |
| *Durban, Natal* ... | 90·9 | 20 | 63·0 | 6 | 83·6 | 68·8 | ... | ... | 154·6 | ... | 3·27 | 15 | 5·0 |
| *Johannesburg* ... .. | 81·9 | 15 | 51·0 | 7 | 77·5 | 56·5 | 54·7 | 72 | 155·2 | 49·3 | 1·98 | 10 | 4·1 |
| *Mauritius* ... ... | 87·9 | 6 | 65·5 | 14 | 84·6 | 71·5 | 69·5 | 76 | 147·2 | 59·0 | 8·12 | 15 | 5·8 |
| Calcutta... ... ... | 94·1 | 28 | 51·3 | 9 | 85·2 | 61·1 | 57·8 | 62 | 146·4 | 42·7 | ·00 | 0 | 1·6 |
| Bombay... ... ... | 90·2 | 8 | 60·4 | 5 | 83·6 | 68·3 | 62·9 | 66 | 138·7 | 52·4 | ·06 | 1 | 0·6 |
| Madras ... ... ... | 92·3 | 16 | 63·9 | 12 | 86·5 | 68·2 | 69·1 | 79 | 141·2 | 59·3 | ·48 | 4 | 2·6 |
| Kodaikanal ... ... | 72·6 | 4 | 42·8 | 9 | 65·2 | 46·3 | 42·7 | 55 | 133·8 | 20·7 | 4·99 | 3 | 3·7 |
| Colombo, Ceylon ... | 93·0 | 8 | 67·0 | 16 | 87·7 | 72·6 | 70·8 | 71 | 161·1 | 63·8 | 1·57 | 3 | 4·0 |
| Hongkong ... ... | 75·2 | 29 | 43·7 | 19 | 62·3 | 54·9 | 51·6 | 76 | 129·1 | ... | 2·83 | 12 | 8·3 |
| *Melbourne* ... ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| *Adelaide* ... ... | 104·0 | 7 | 49·9 | 16 | 87·2 | 62·5 | 53·1 | 47 | 156·0 | 42·6 | ·48 | 5 | 4·3 |
| *Coolgardie* ... ... | 101·0 | 11 | 49·9 | 8, 14 | 86·0 | 59·2 | 51·1 | 46 | 173·9 | 47·0 | ·94 | 5 | 3·0 |
| *Perth* ... ... ... | 100·0 | 21 | 50·5 | 7 | 83·8 | 61·8 | 55·1 | 54 | 157·2 | 47·9 | ·39 | 2 | 3·0 |
| *Sydney* ... ... ... | 91·3 | 8 | 60·0 | 29 | 76·9 | 65·8 | 63·3 | 76 | 130·9 | 54·5 | 6·90 | 22 | 6·7 |
| *Wellington* ... . | 79·0 | 16 | 49·0 | 1, 27 | 68·8 | 55·2 | 52·5 | 71 | 129·0 | 36·0 | ·03 | 1 | 5·0 |
| *Auckland* ... ... | 82·0 | 16 | 56·0 | 1 | 74·3 | 60·8 | 57·3 | 65 | 143·0 | 50·0 | ·54 | 5 | 4·5 |
| Jamaica, Kingston ... | 89·1 | 4 | 64·6 | 16 | 86·7 | 67·9 | 66·4 | 74 | ... | ... | 1·29 | 5 | 4·3 |
| Trinidad ... ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| Grenada ... ... | 85·4 | 17 | 76·0 | 4 | 82·6 | 72·4 | 66·3 | 70 | 152·4 | ... | 1·18 | 11 | 3·4 |
| Toronto ... ... ... | 44·3 | 13 | -17·5 | 4 | 27·3 | ... | ... | 85 | ... | ... | 3·77 | 15 | 6·0 |
| Fredericton ... ... | 49·2 | 15 | -29·0 | 4 | 26·0 | 3·0 | ... | 79 | ... | ... | 2·87 | 5 | 5·4 |
| St. John's, N.B. ... | 50·0 | 16 | -13·2 | 5 | 29·7 | 12·2 | ... | ... | ... | ... | 3·49 | 14 | 4·9 |
| Victoria, B.C. ... ... | 51·2 | 23 | 23·7 | 2 | 45·9 | 36·1 | ... | 84 | ... | ... | 4·32 | 16 | 7·0 |

MALTA.—Mean temp. of air, 53°·3. Average hours of bright sunshine, 5·9.

*Johannesburg.*—Rainfall very deficient. Bright sunshine, 238·4 hours.

*Mauritius.*—Mean temp. of air 0°·9, dew point 1°·4, and relative humidity 1·3 per cent., below, and R 1·43 in. above, averages. Mean hourly velocity of wind, 11·0 miles, or equal average, L on 3 days.

MADRAS.—Mean temp. of air slightly above average. Bright sunshine, 235·9 hours.

KODAIKANAL.—Bright sunshine, 225 hours, TS one day and hoar frost on 3 days.

COLOMBO.—Mean temp. of air, 79°·8 or 0°·4 below, of dew point, 0°·3 above, and R ·53 in. below averages. Mean hourly velocity of wind, 6·1 miles.

HONGKONG.—Mean temp. of air, 58°·3. R 1·08 in. above average. Bright sunshine, 87·4 hours, mean hourly velocity of wind, 14·8 miles.

*Adelaide.*—Mean temp. of air 0°·8 above average, and R about the average.

*Sydney.*—Mean temp. of air 0°·3, and R 2·18 in., above average.

*Wellington.*—Mean temp. of air 0°·3, and R 3·33 in., below average.

*Auckland.*—Unusually dry; R one seventh of the average for 42 years.

# RAINFALL OF THAMES VALLEY AUGUST, 1908.