

# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

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## THE CLIMATE OF THE BRITISH EMPIRE DURING 1886.

WE this month publish our fifth annual table of the climate of the British Empire, giving a summary of the daily observations at sixteen stations distributed over the whole of the globe.

We believe that many of our readers, if they would give a few minutes' thought to the subject, would more fully realize the interest and value of these tables. They give, to a great extent, a record of the weather of the world for a whole year. They contain the results of more than 100,000 readings made by scientific men, many of them under circumstances of extreme discomfort if not difficulty.

How many of those who read these lines can appreciate a shade temperature of  $112^{\circ}\cdot4$ , or of  $-44^{\circ}\cdot6$  ( $76^{\circ}\cdot6$  below zero), or an average shade maximum for a whole month of  $-5^{\circ}\cdot0$  ( $37^{\circ}\cdot0$  below zero)—a month in which the temperature never rose within  $8^{\circ}$  of the freezing point? Is it a wonder that in such months the hygrometrical values are sometimes curious? Let our observers think of the difficulty they often have with their wet bulbs, even with our slight frosts.

Although we have published only five annual abstracts, we can lengthen the period to twelve years by referring to the tables which were previously published in *The Colonies*, thus obtaining such a basis for comparison as is, we believe, nowhere else to be found.

In the summary, we select the extreme values recorded for 16 of the chief meteorological elements, and, as would naturally be expected, the greater number of these unenviable distinctions are monopolized by two or three stations. Nine stations appear in the list—Adelaide and Winnipeg exhibit four extremes each (Winnipeg would have five but that there is no grass minimum thermometer there), Barbados exhibits two extremes, and the other six stations one each.

Adelaide has always exhibited the highest maximum in shade, but this year it "beats record" with  $112^{\circ}\cdot4$ , the highest reading in any of the summaries; this station, as might be expected, had also the highest maximum in sun and the lowest humidity, but both these values have been exceeded in other years. It has also the smallest rainfall ( $14\cdot42$  in), and the drought of the past summer in England

will give us a feeble idea of how the people of Adelaide must rejoice in a shower.

Winnipeg claims our attention next with a gruesome minimum in shade of  $-44^{\circ}6$ ; a range of shade temperature of  $147^{\circ}6$ ; a mean daily range of  $24^{\circ}7$ ; and a mean daily temperature of  $33^{\circ}2$ ,  $1^{\circ}2$  above freezing point for the average temperature of the whole year summer and winter! Withal the temperature is variable, but it may be a consolation for it to run up  $87^{\circ}6$  degrees (more than the range in London in the year) in four days; especially when we consider that it ran up from  $-41^{\circ}6$ .

As a contrast, Barbados appears comfortable with a range of  $21^{\circ}0$  in the year, and a mean temperature of  $76^{\circ}7$ .

The other extremes do not call for special comment. Colombo must be uncomfortable with a mean temperature of  $81^{\circ}0$ , and the rainfall of Bombay,  $99\cdot74$  in. ( $79\cdot24$  in. in two months), must seem heavy to anyone but a dweller in the wettest part of the Lake district. Malta commends itself for its clear skies.

London appears for the first time in the table of extremes with the greatest relative humidity.

It is curious to note that the highest shade temp. (at Adelaide) and the lowest (at Winnipeg) were recorded within a week, and that at Bombay the extreme range occurred within six weeks from February 3rd to March 14th.

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### SUMMARY.

*Highest temperature in shade:*  $112^{\circ}4$  at Adelaide, on January 4th.

*Lowest temperature in shade:*  $-44^{\circ}6$  at Winnipeg, on January 9th.

*Greatest range in year:*  $147^{\circ}6$  at Winnipeg.

*Least range in year:*  $21^{\circ}0$  at Barbados.

*Greatest mean daily range:*  $24^{\circ}7$  at Winnipeg.

*Least mean daily range:*  $9^{\circ}5$  at Barbados.

*Highest mean daily temperature:*  $81^{\circ}0$  at Colombo, Ceylon.

*Lowest mean daily temperature:*  $33^{\circ}2$  at Winnipeg.

*Driest station:* Adelaide, mean humidity 56.

*Dampest station:* London, mean humidity 80.

*Highest temperature in sun:*  $174^{\circ}5$  at Adelaide.

*Lowest temperature on grass:*  $-27^{\circ}0$  at Toronto.

*Greatest rainfall:*  $99\cdot74$  inches at Bombay.

*Least rainfall:*  $14\cdot42$  inches at Adelaide.

*Most cloudy station:* Auckland, average amount 6·3.

*Least cloudy station:* Malta, average amount 3·8.

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1886.

STATIONS.	ABSOLUTE.				AVERAGE.						ABSOLUTE.		TOTAL RAIN.		AVER- AGE.
	Maximum.		Minimum.		Max.	Min.	Mean.	Dew Point.	Humidity	Max. in Sun.	Min. on Grass.	Depth.	Days.		
	Temp.	Date.	Temp.	Date.											
<i>Those in Italics are South of the Equator.</i>															
England, London	88·4	August 30	19·4	February 10	57·1	42·4	49·8	42·7	80	133·4	8·3	27·01	176	5·9	
Malta .....	94·4	July 26	40·2	March 12	71·5	58·6	65·1	56·1	76	149·0	35·5	23·69	89	3·8	
<i>Mauritius</i> .....	88·4	February 1, 11	57·7	August 14	79·5	68·7	74·1	63·5	72	143·6	48·2	29·74	194	5·5	
Calcutta .....	103·5	April 14, 20	46·7	February 6	86·8	71·0	78·9	70·1	78	167·0	35·2	65·20	128	4·8	
Bombay .....	95·7	March 14	58·1	February 3	85·4	74·8	80·1	71·6	76	150·6	45·9	99·74	110	4·3	
Ceylon, Colombo.	94·8	March 14	67·0	February 4	86·7	75·3	81·0	72·2	74	153·0	56·2	87·01	169	5·8	
<i>Melbourne</i> .....	104·1	February 19	28·1	July 8	66·5	48·4	57·5	47·0	71	150·9	20·8	24·00	128	6·0	
<i>Adelaide</i> .....	112·4	January 4	35·6	June 26	72·5	53·0	62·8	46·2	56	174·5	27·5	14·42	141	4·6	
<i>Wellington</i> .....	79·0	January 25	32·0	July 27, Aug. 28	60·5	48·4	54·5	47·8	79	150·0	27·0	54·47	165	4·3	
<i>Auckland</i> .....	82·0	January 22	36·0	August 28	65·4	52·9	59·1	50·7	74	153·0	28·0	32·64	165	6·3	
Jamaica, Kingston	96·4	October 1	62·2	January 26	89·1	71·0	80·1	70·6	79	...	...	67·80	...	5·3	
*Barbados .....	87·0	September 22	66·0	March 31	81·4	71·9	76·7	70·9	78	147·0	...	88·29	200	6·0	
Toronto .....	89·5	July 6	-22·8	February 5	51·7	35·1	43·4	38·0	77	...	-27·0	35·07	166	6·1	
Fredericton .....	89·3	July 6	-24·0	January 13	50·3	29·9	40·1	35·0	74	...	...	38·53	158	5·5	
Winnipeg .....	103·0	August 24	-44·6	January 9	45·5	20·8	33·2	28·2	78	...	...	14·64	118	4·9	
Victoria .....	85·0	July 18	17·0	January 21	56·7	41·4	49·1	...	...	...	...	27·59	130	...	

\* The humidity at this station for January, 1886, was 76, not 60 as printed.

## THE THUNDERSTORMS OF AUGUST 16TH AND 17TH, 1887.

As mentioned in our last issue, the thunderstorm which occurred over the Metropolis on the evening of August 17th was one of exceptional intensity, and the most severe for several years.

At Camden Square thunder was first heard about 5.30 p.m., and a storm appeared to be brewing in the N. Lightning was seen about 6.30; heavy rain commenced about 6.50, and till 8 p.m. the storm continued with unusual violence; it then gradually passed off to southward, the lightning being still frequent, and the rain steady till 9 p.m.

The statements as to the direction from which the storm arrived and in which it passed off are very contradictory, though all agree that it travelled slowly, and the times given for the commencement and termination agree very closely for the whole of London. An observer at Highgate states that it commenced at 6 p.m. in the N. and travelled southward; and one at Brixton (8 miles almost due S.) states that it commenced at 6 p.m. in the S.E. and travelled N.W. All agree that it lasted with unusual violence from about 6.45 to 8.45 p.m.

Fourteen authenticated cases of injury have been reported, and two or three cases which appear to be unfounded.

A man crossing Carlton Bridge, Harrow Road, was struck and killed on the spot, and a man passing along Clifton Road, Maida Vale, was killed as he emerged from under a tree; a friend a few paces in front of him is said to have had his face lacerated. It was also reported that a man sheltering under a tree in Portsdown Road, Maida Vale, was rendered insensible and died shortly afterwards, but as his name did not transpire and no details of the inquest appeared, the report was either altogether unfounded or the man was not seriously injured. The three places mentioned are all within an area of one square mile.

A servant at the Lyric Club, Bond Street, was rendered insensible.

Christ Church, Endell Street, was struck twice; first between 7.30 and 8. when a stone about 10 ft. from the top of the steeple, weighing 1 cwt, was thrown down, with smaller fragments; this fortunately created such consternation that the officiating clergyman at once dismissed the congregation, for later on the lightning struck the roof, making a large hole and igniting the woodwork; it was, however, extinguished by the heavy rain.

A few minutes after 7 the tower of St. John's Church, Walham Green, was struck, some of the brickwork of the N.W. pinnacle being displaced and thrown over to the southern side of the church.

Holy Trinity Church, Tulse Hill, was said to have been struck, but the report was not confirmed.

At St. Paul's Road, Canonbury, the lightning struck a house, throwing down the chimney stack, and making a large hole in the roof and another in the ceiling of the top room. A very similar acci-

dent occurred in Vidal Road, Brixton, the roof and top ceiling being pierced.

A serious fire occurred at a workshop in Gill's Yard, Hampstead Road, which is believed to have been caused by lightning, and an erection at Lord's Tennis Ground was also fired.

A tavern at Leverton Street, Kentish Town, was struck, a cement ornament was broken, the plaister was damaged in various places, and bell wires and pipes were fused. Very similar damage was done at another tavern in Lismore Circus, Gospel Oak, and the stonework of a tower at some schools in Wilkin Street, Kentish Town, was broken. Lightning also passed down the chimney of a house in the Strand and loosened the fire grate.

All these 14 cases of injury occurred west of a line running N. and S. through St. Paul's Cathedral; only one (Vidal Road, Brixton,) is south of the Thames, and ten are within a radius of two miles from the centre of Regent's Park; it is therefore evident that the storm was most severe over the N.W. of London.

The amount of rain was great over the western half of the Metropolis, but in most directions decreased very rapidly, the fall at Hackney, within a mile of one of the houses struck, being only .27 in. The following are the values for several of the Metropolitan and Suburban Stations:—

Station.	in.	Station.	in.
Wimbledon .....	2.08	Brixton.....	.97
Regents Park .....	1.92	Spring Gardens ..	.92
Teddington .....	1.43	Old Street, City .....	.85
Camden Square .....	1.42	Hampstead .....	.65
Isleworth.....	1.25	West Norwood .....	.50
Holland House .....	1.17	Highgate .....	.35

At Camden Square, rain commenced at 6.50 p.m. and ceased at 9.15 p.m.

In 1 hour from 7	p.m. to 8	p.m. 1.24 in. fell.
„ 30 min. „ 7	„ „ 7.30	„ .45 „ „
„ 30 „ „ 7.30	„ „ 8	„ .79 „ „
„ 22 „ „ 7.42	„ „ 8.4	„ .66 „ „
„ 10 „ „ 7.45	„ „ 7.55	„ .50 „ „

Considerable inconvenience was caused by flooding. About 7.15 a sewer between Baker Street and Portland Road, on the Metropolitan Railway, burst, and the line was flooded, traffic being stopped, from 7.30 to 11.30 p.m., the water rose at Baker-street within an inch of the level of the platform. The line belonging to the Midland and Great Northern Railways where it passes under the Metropolitan at Farringdon Street was also blocked for several hours.

Richmond Station was flooded, as is usual during heavy rains, but the trains were able to pass through. In Brixton Road the water accumulated so that the trams stopped running between 7 and 8 p.m., reports stating that at the station the road was covered with from 12 to 18 inches of water. At Wandsworth and Battersea large numbers of basements were flooded.

Thunderstorms were general over England on the afternoon and night of Tuesday, August the 16th, and in the early morning of the 17th, and in some places occurred during the day and night of the 17th; it is therefore difficult to say on which day some of the following accidents occurred, but the great majority were during the afternoon and night of the 16th-17th.

At Birmingham, two men in a hut built against the chimney of a brick-kiln were killed. The shaft, which is 120 feet high, had no lightning conductor and was practically uninjured, only three small pieces of brick being forced out at distances of about 20 feet apart.

At Rotherham a tree under which two colliers were sheltering was struck, one man being killed and the other rendered insensible. A policeman at Tinsley near Sheffield was also injured.

A man was killed by lightning at Risely, in Bedfordshire.

At Gornal, near Sedgely, a man was killed as he entered an out-house; a tree and buildings also were damaged.

Near Hinckley, two horses were killed in a field at Barwell and one at Some. One was killed at Willenhall, near Wolverhampton, and near Nuneaton several trees were struck, and a horse was killed at Griff and another at Falleshill. At Dorking also a horse was killed. Two cows were killed at Auchenrodden in Dumfriesshire, and a haystack was burnt at Annanbank.

At Leeds, a chimney-stack was thrown down and a woman was injured by the falling bricks. At Moor Park, Rickmansworth, an oak was struck and four sheep were killed.

At Chichester, the bell turret of the police-station was partly thrown down and the roof of a coach factory was damaged. Houses were struck at Brimington, near Chesterfield (2), Monmouth (1), Dudley (1), Mutley, near Plymouth (1), and a stack was fired at Rudgwick, near Horsham, Sussex; near Colchester some farm buildings were burnt, believed to have been fired by lightning.

On the afternoon of the 17th, a little before the storm in London, a house at Oxford was struck and the roof fired, and some of the streets were flooded by the heavy rain. At Kingston-on-Thames, also, a shop was struck and set on fire.

Heavy hailstorms were reported from several districts as accompanying the thunderstorms, but none of such exceptional violence as to break glass.

The rain which accompanied the storms, though generally heavy, was, as a rule, not remarkable, the following list giving all the falls exceeding one inch reported from the 250 stations whose records we have received:—

#### TUESDAY, AUGUST 16TH.

Hoar Cross, Burton, Staffordshire..... 1·19 in.

#### WEDNESDAY, AUGUST 17TH.

Hythe, Kent ..... 1·05 in.

Magdalen College, Oxford ..... 1·09 „

Southend, Essex ..... 1·13 „

North Esk Reservoir, Edinburghshire..... 1·40 „

# M. HERVÉ-MANGON'S PLUVIOSCOPE.

It is nearly thirty years since M. Hervé-Mangon first described his Pluvioscope, and somehow the instrument is still very little known. But we can see no reason why it should not be as popular as a sunshine recorder. At present, to judge from the note in the *Annuaire Soc. Mét. de France* for Feb., 1887, it is in a transition state and a new pattern will shortly be ready for sale. On the present occasion, therefore, we note only the general principles; perhaps in a month or two the new pattern may be issued and we may be able to give an engraving of it.

*Object.*—A rain gauge gives the volume of water which falls, and if it be read frequently, or especially if it be a self-recording gauge, some indication of the character of the rain. The Pluvioscope is *not* intended to show the amount of rain, but its character—large drops or small drops, drops close together or drops far apart.

*Principle.*—Paper previously treated with oak-gall and sulphate of iron if subsequently moistened becomes black. M. Hervé-Mangon's description of the apparatus (*Annuaire Soc. Mét. de France*, Tome X p. 47) is not accompanied by an engraving, but we gather from it that a circular sheet of prepared paper was made to revolve in 24 hours under a circular lid, of which a part of the upper periphery, or at any rate of the part near to the circumference, had been removed. Then when rain falls the portion of paper then under the slit is pitted with rain drops, and the size of the marks and their proximity one to another indicate the character of the rain. In damp, misty weather all the paper under the slit becomes dark, but it is uniformly so, and not so black as when wetted by rain.

*Recent Improvement.*—The old circular diagrams were about 2ft. in diameter, say 6ft. in circumference, therefore the paper travelled under the slit at the rate of an inch in 20 minutes, but probably owing to the absence of definite markings M. Hervé-Mangon says that it is impossible to read it closer than to five minutes. He now intends using endless paper, which can of course be run out at any velocity desired. We venture to suggest whether it would not be well for the paper to have a jumping motion (say each five minutes) rather than a continuous one.

*Results.*—In the *Annuaire Soc. Mét. de France* for Feb., 1887, M. Hervé-Mangon gives the summary of nearly ten years' records (Sept. 1860 to July, 1870) at Paris with one of these instruments.

The following are among the principal results of the voluminous data thus obtained:—

Average number of days on which rain fell	...	...	188
" " " separate falls of rain by day	...	...	662
" " " " " night	...	...	576

Average relation of duration of rain to total time, by day, 0·055, or  
 „ „ „ „ „ about  $\frac{1}{16}$ th.  
 „ „ „ „ „ by night, 0·049.  
 „ „ „ „ „ or about  $\frac{1}{20}$ th.

(That is to say, on the average there is about  $1\frac{1}{4}$  hours of rain out of the 24 hours, and as we see above that rain on the average fell on only 188 days, it follows that the average duration on the days on which any rain fell was about two hours and a half.)

The average duration of a shower was 21 minutes.

The longest continuous fall was 10 hours, on Jan. 16th, 1887.

The longest interval without rain was 26 days—Sept. 11th to Oct. 6th, 1865 ; there were also other instances—1 of 25 days, 1 of 20, 2 of 16, and 3 of 15 consecutive dry days.

The largest number of consecutive wet days was 18—Oct. 3rd to 20th, 1867.

There are many other interesting details in the paper, but the above sufficiently illustrate its nature.

### THREE WHIRLWINDS.

#### WEAK.

HAMPSTEAD, Aug. 14th, 1887.—At about 1·15 p.m. I saw a perfect little whirlwind. As shown by the dust it raised, it was about 9 ft. in diameter at the bottom and rather more higher up ; the dust went up about 30 feet, and some pieces of paper about 50 ft. Wind N.W. and very slight ; the whirlwind moved nearly S.E., but perhaps not quite in a straight line, and at about four or five miles an hour. It appeared to rotate against the sun.—*H. Sharpe.*

#### STRONGER.

ASH, KENT, Aug. 15th, 1887.—Some tradesmen on the road between Canterbury and Sandwich, saw, for a few minutes, a whirlwind of some violence. Heaps of dust, grit, and stones were whirled round at a furious pace, and sheaves of corn were lifted up in the air.—*Sussex Express.*

#### STRONGEST.

BURNAGE, MANCHESTER, Sept. 6th, 1887.—About 5.45 p.m., during a strong S.W. wind and rain, a whirlwind passed along a track about a mile long and from 50 to 100 yards wide. Hay stacks were carried away and several roofs were damaged. Probably the strongest evidence of force was the breaking of an ash tree where the trunk was 7 inches in diameter, and the transport of the whole top, (about 16 ft. long), 150 feet—over the roofs of some cottages and over the church, which, however, it did not quite clear as it struck the roof and then, rising a little, carried away the stone cross on the eastern gable of the nave ; it then went over the roof of the schools, and fell point downwards in the school-yard beyond.



# THE BRITISH ASSOCIATION AT MANCHESTER.

(Concluded from page 123.)

## ON THE EFFECT OF CONTINENTAL LANDS IN ALTERING THE LEVEL OF THE ADJOINING OCEANS.

BY PROFESSOR EDWARD HULL, LL.D., F.R.S.

The effect of the attraction of continental land upon the oceanic waters adjoining, seems to have been very much overlooked by British physical geographers. That some slight effect arises in the direction of elevating the surface of the ocean in proximity to the coast is generally admitted, but the amount of rise is considered to be small, perhaps insignificant. The prevalence of these views was attributed by the author to the widespread influence of Lyell's hypothesis of the uniformity of the ocean-surface all over the globe.

The author's attention had been called to the subject by the perusal of the works of the German geographers Suess\* and Fischer,† especially the latter; and he had received great assistance in his investigations from Professor G. G. Stokes, Pres. R.S., and from the Rev. Maxwell H. Close, F.G.S., which assistance he gratefully acknowledged.

In attempting to determine the relative levels of the ocean surface along the margins of continents as compared with those of mid-oceanic islands, the German authors above quoted had based their results on observations of the length of the second's pendulum. Many years ago (1849) Stokes had shown that the force of gravity must be greater in such islands than on continental stations,‡ and Airy had corroborated this conclusion by showing that it corresponded with actual observations on the length of the second's pendulum at stations all over the globe.§ The formula of Suess and Fischer based on these was to the effect that the difference in the level of the ocean between two such stations was found in *mètres* by multiplying the difference in the number of daily oscillations in the second's pendulum by 122. This in the case of the stations of California (or Mexico?) in lat.  $21^{\circ} 30'$  and of the Sandwich Islands would amount to 4,520 feet; a very startling result if correct.

The author proceeded to discuss the effect of continental lands, showing that this was in the first instance divisible under two principal heads: The effect (1) of the unsubmerged, and (2) of the submerged masses. In the former case, where the mass rose above the surface, one component of the attraction acted in a more or less vertical direction; in the second case all in a lateral direction, but both had the effect of elevating the surface of the ocean. The horizontal distance to which the vertical effect extended owing to the curvature of the earth's surface was then considered; and it was shown that, where continental lands rise from a deep ocean, the effect of the lateral attraction far exceeds that of the vertical attraction of the unsubmerged mass. Professor Stokes had furnished the author with a hypothetical case, in which the elevation of the ocean was estimated to reach 400 feet above the mean geodetic surface of the earth.

For the purposes of illustration three cases were selected, viz. :—

- (1) The table-land of Mexico, between lats.  $18^{\circ}$  and  $26^{\circ}$  N.
- (2) The table-land of Bolivia, „  $19^{\circ}$  and  $26^{\circ}$  S.
- (3) The Andes of Chile, „  $26^{\circ}$  and  $35^{\circ}$  S.

\* Suess, *Das Antlitz der Erde* (1887).

† Fischer, *Untersuchungen über die Gestalt der Erde* (1886).

‡ Stokes, *Cambridge Philosophical Transactions*, vol. viii. pp. 672-695.

§ Airy, "On the Figure of the Earth," *Encyclop. Metropolitana*.

The mean elevations, distances from the ocean, and extent having been determined, the mean density of the crust being taken at 2.6 for emergent, and 1.6 for submerged lands, the results of the attraction of the mountain masses in each case were as follows :—

(1) Mexico, 230 feet ; (2) Bolivia, 301 feet ; (3) Chile, 63 feet ; the elevations being calculated above a mean geodetic surface.

To the above results, due to the gravitation-potential of the elevated masses, were to be added those due to the following factors :—

(a) The marginal plain or emergent tract on either side of the mountain mass.

(b) The high lands both to the north and south of the special sections above dealt with.

(c) And lastly, and most important, the submerged continental mass.

To provide for the sphericity of the earth deductions of various amounts, according to circumstances, were made from the numbers obtained from the formula which Mr. Close had arrived at by a double process, and which is given at length in the paper itself.

Combining these results with those given above, we obtain as the whole rise of the ocean surface as follows :—

(1) Mexico, 780 feet ; (2) Bolivia, 2,159 feet ; (3) Chile, 1,582 feet.

In all the above cases the coast was taken as descending to a depth of 15,000 feet at a gradient of about  $\frac{1}{44}$  to  $\frac{1}{60}$ , the comparatively low results in the case of Chile being due to the narrowness of the mountain range, 30 miles in mean breadth, as compared with 300 miles in the case of Bolivia.

The above results, which are probably rather under than over estimates, fall considerably short of those to be drawn from Suess and Fischer's formula, but are probably much in excess of the views held by British physical geographers generally ; and the conclusion was drawn, that if the same processes of reasoning and calculation were applied to all parts of the world, it would be found that the ocean waters were piled up to a greater or less extent all along our continental coasts, producing very important alterations in the terrestrial configuration as compared with an imaginary ellipsoidal, or geodetic, surface, to which all these changes of level must necessarily be referred.

## ON THE DIFFERENT KINDS OF THUNDERSTORMS, AND ON A SCHEME FOR THEIR SYSTEMATIC OBSERVATION IN GREAT BRITAIN.

BY HON. RALPH ABERCROMBY, F.R.MET.SOC.

There are at least three well defined types of thunderstorms in Great Britain.

1. Squall thunderstorms, or those associated with simple squalls. These are usually formed on the sides of primary cyclones and move nearly in the direction of the surface wind.

2. Secondary thunderstorms, so called because they are developed in secondary cyclones. Nothing is known of their motion, but they are not associated with much wind of any kind and often advance in opposition to the surface wind.

3. Line thunderstorms, so called because they take the form of long narrow strips of rain and thunder moving nearly broadside on across the country.

Such a storm might stretch north and south for 200 miles, and yet be but 5 or 10 miles wide, while the whole system might travel towards the east at a rate of 40 miles an hour. These storms are often formed where isobars totally fail to show any signs of disturbance, though they (the storms) are sometimes found along the troughs of cyclones and V-shaped depressions. In all cases these storms are preceded by a very violent squall.

A scheme for the systematic observation of thunderstorms in England has been elaborated, which it is hoped will be in operation next year. The primary object is to try and discover the nature of the aerial, circulation, or eddying, which is undoubtedly the origin of all kinds of thunderstorms.

#### THE DIRECTION OF THE UPPER CURRENTS OVER THE EQUATOR IN CONNECTION WITH THE KRAKATOA SMOKE-STREAM.

By PROF. E. DOUGLAS ARCHIBALD.

The author said that from observations in Africa and America, supplemented by a comparison of the logs of vessels, it was pretty clear that the vapours ejected at the recent eruption passed from east to west round the earth for at least two revolutions, travelling at a rate varying from 65 to 80 miles an hour. The height of the stream above the Equator was about 120,000 ft., its width after the first revolution covering a region extending 12 deg. north and south from the latitude of Krakatoa (6 deg. south). After the second revolution this had increased to 24 deg. in each direction.

Sir William Thomson, in the discussion which followed, said that the motions of the atmosphere and of the luminiferous ether at great altitudes occupied his thoughts day and night.

The President reminded his hearers of the extreme purity of the sky at the time of the glows caused by the eruption, and said he had observed the new moon one night when it was only 22 hours old.

Mr. G. J. Symons, in reply to an enquiry, said that every effort was being made to secure the publication of the Report of the Krakatoa Committee of the Royal Society, in November next.

#### ON SOME VARIATIONS IN THE LEVEL OF THE WATER IN LAKE GEORGE, NEW SOUTH WALES.

By H. C. RUSSELL, F.R.S.

This was a description of records obtained by a self-recording gauge at the south end of Lake George, about 100 miles from Sydney, New South Wales. The phenomena—known on the Swiss lakes as *Seiches*—are there reproduced, but at present no complete explanation is forthcoming; the amplitude of the waves is about 4 inches, and their period about 2 hours 11 minutes.

#### OBSERVATIONS OF ATMOSPHERIC ELECTRICITY.

By PROF. L. WEBER.

This was a short paper giving an account of experiments made with a kite flown from the summit of the Schneekoppe.

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1887.

STATIONS.  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days	
	Temp.	Date.	Temp.	Date.									
	°		°	°	°	°	0-100	°	°	inches		0-10	
England, London .....	57·5	27	22·4	14	45·8	32·2	34·1	85	100·4	17·4	1·65	12	6·5
Malta.....	73·7	16	46·2	6	64·5	53·2	51·1	81	128·3	38·1	·29	4	5·3
Cape of Good Hope .....	101·3	24	44·3	27	81·2	56·2	...	73	...	...	·26	4	4·6
Mauritius .....	83·6	4	68·4	21	81·7	73·0	70·4	82	135·5	60·8	12·76	26	6·5
Calcutta .....	95·4	24	63·7	27	89·6	70·7	67·8	70	152·5	56·5	3·25	5	1·9
Bombay.....	88·6	18	69·0	8	84·6	72·4	69·6	74	143·8	57·1	·00	0	1·1
Ceylon, Colombo ... ..	91·2	30	68·6	7	88·2	73·0	69·4	68	147·5	62·0	1·66	5	2·8
Melbourne.....	93·0	6	42·0	28	76·1	55·6	53·0	66	142·0	33·0	·78	7	4·6
Adelaide .....	99·8	6	48·4	27	80·3	57·7	50·1	51	150·1	35·4	·32	7	3·6
Wellington .....	75·0	4, 12	45·0	29	69·0	54·8	55·0	79	140·0	40·0	1·90	12	3·7
Auckland .....	78·5	25	50·0	29	74·3	60·1	63·8	89	143·0	40·0	·80	7	6·4
Falkland Isles.....	...	...	33·4	18	...	40·6	45·3	85	119·2	27·2	1·82	18	6·1
Jamaica, Kingston.....	90·1	30	58·3	12	86·8	64·3	64·9	73	...	...	·43	...	...
Barbados .....	81·0	15	66·0	3, 4	78·0	68·0	66·6	75	146·0	...	1·41	9	5·0
Toronto .....	44·9	2	4·0	5	31·9	17·6	19·8	76	...	— 1·0	1·51	15	6·1
New Brunswick, Fredericton .....	47·2	15	— 19·5	4	33·3	15·3	21·0	74	...	...	4·48	18	5·9
Manitoba, Winnipeg ...	43·0	11	— 36·5	4	23·5	— 3·5	12·0	84	...	...	·93	8	5·0
British Columbia, Victoria .....	59·0	22	24·0	4	49·4	38·9	...	...	...	...	5·36	15	...

u And 8.

## REMARKS, MARCH, 1887.

MALTA.—Mean temp. 57°·7; mean hourly velocity of wind 11·4 miles. Sea temp. rose from 59°·0 to 62°·0 J. SCOLES.

Mauritius.—Rainfall 5·31 in., and mean temp. of dew point 0°·7 above the average; mean temp. of air 1°·0 below the average; mean hourly velocity of wind 9·8 miles; extremes 20·9 miles on 9th and 0·0 mile on 21st; prevailing direction E. by N. L on 7 days, T on 6 days. C. MELDRUM, F.R.S.

COLOMBO.—TSS on 5 days, L on 22nd, T on 23rd. F. C. H. CLARKE, LT.-COL. RA.

Melbourne.—Mean temp. of air 1°·3, and of dew point 0°·8, above the average; rainfall 1·39 in., mean amount of cloud 1·0, mean humidity 2, and mean pressure slightly below the average; Prevailing winds S., S.E., and W.; strong on 4 days. Heavy dew on 7 days, H on 1, TSS on 2 days, T or L on 5 other days. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 1°·5, rainfall ·83 in., and pressure slightly below the average. Weather generally seasonable. C. TODD.

Wellington.—Showery during the first part and towards the end; fine during the middle, with light showers at intervals. Altogether fine weather, with little R for the time of year. Prevailing wind N.W., strong on 8 days; rainfall ·92 in. and mean temp. slightly below the average. Fog on 4 days; very slight earthquake on 15th. R. B. GORE.

AUCKLAND.—With the exception of a few slight showers, fine, hot, and dry throughout, with light variable winds. Mean temp. 2° above the average; pressure much above the average; rainfall not one-third of the average. T. F. CHEESEMAN.

KINGSTON.—Rainfall 1·04 in. below the average. MAXWELL HALL.

BARBADOS.—Mean temp. (72°·3) 1°·2 below average; rainfall considerably below average. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,  
SEPTEMBER, 1887.

[For the Counties, Latitudes, and Longitudes of most of these Stations,  
see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger .....	2·95	XI.	Castle Malgwyn .....	3·40
„	Margate, Birchington .....	3·18	„	Rhayader, Nantgwillt .....	4·71
„	Littlehampton .....	2·93	„	Carno, Tybrith .....	4·62
„	Hailsham .....	4·14	„	Corwen, Rhug .....	3·44
„	Ryde, Thornbrough .....	4·11	„	Port Madoc .....	5·14
„	Alton, Ashdell .....	3·06	„	I. of Man, Douglas .....	3·17
III.	Oxford, Magdalen Col. ....	2·10	XII.	Stoneykirk, Ardwell Ho. ....	3·95
„	Banbury, Bloxham .....	2·10	„	New Galloway, Glenlee .....	5·70
„	Northampton .....	1·65	„	Melrose, Abbey Gate .....	5·03
„	Cambridge, Beech Ho. ....	2·01	XIII.	N. Esk Res. [Penicuik] .....	5·70
„	Wisbech, Bank House .....	2·16	XIV.	Ballantrae, Glendrishaig .....	3·59
IV.	Southend .....	2·11	„	Glasgow, Queen's Park .....	3·53
„	Harlow, Sheering .....	3·07	XV.	Islay, Gruinart School .....	4·99
„	Rendlesham Hall .....	2·24	XVI.	St. Andrews, Pilmour Cot .....	4·39
„	Diss .....	2·37	„	Balquhitter, Stronvar .....	5·10
„	Swaffham .....	2·57	„	Dunkeld, Inver Braan .....	3·76
V.	Salisbury, Alderbury .....	2·23	„	Dalnaspidal H.R.S. ....	4·64
„	Warminster .....	2·39	XVII.	Keith H.R.S. ....	4·28
„	Ashburton, Holne Vic. ....	4·75	„	Forres H.R.S. ....	4·49
„	Holsworthy, Clawton .....	...	XVIII.	Strome Ferry H.R.S. ....	3·89
„	Hatherleigh, Winsford .....	...	„	Tain, Springfield .....	...
„	Lynmouth, Glenthorne .....	6·23	„	Loch Shiel, Glenaladale .....	5·23
„	Probus, Lamellyn .....	4·02	„	S. Uist, Ardkenneth .....	2·94
„	Wincanton, Stowell Rec. ....	2·39	„	Invergarry .....	3·78
„	Taunton, Lydeard Ho. ....	3·09	XIX.	Laig H.R.S. ....	1·40
„	Wells, Westbury .....	3·03	„	Forsinard H.R.S. ....	3·50
VI.	Bristol, Clifton .....	3·42	„	Watten H.R.S. ....	2·96
„	Ross .....	2·50	XX.	Dunmanway, Coolkelure .....	3·48
„	Wem, Clive Vicarage .....	2·09	„	Fermoy, Gas Works .....	2·44
„	Cheadle, The Heath Ho. ....	3·22	„	Tipperary, Henry Street .....	2·52
„	Worcester, Diglis Lock .....	1·40	„	Newcastle West .....	...
„	Coventry, Coundon .....	1·74	„	Miltown Malbay .....	6·25
VII.	Melton, Coston .....	2·50	XXI.	Gorey, Courtown House .....	2·50
„	Ketton Hall [Stamford] .....	1·59	„	Navan, Balrath .....	1·40
„	Horncastle, Bucknall .....	2·26	„	Mullingar, Belvedere .....	2·87
„	Mansfield, St. John's St. ....	2·33	„	Athlone, Twyford .....	3·34
VIII.	Macclesfield, The Park .....	3·55	„	Longford, Currygrane .....	2·13
„	Walton-on-the-Hill .....	3·82	XXII.	Galway, Queen's Coll. ....	*6·97
„	Lancaster, South Road .....	4·22	„	Clifden, Kylemore .....	5·32
„	Broughton-in-Furness .....	4·39	„	Crossmolina, Enniscoe .....	5·69
IX.	Wakefield, Stanley Vic. ....	2·22	„	Collooney, Markree Obs. ....	5·34
„	Ripon, Mickley .....	3·77	XXIII.	Rockcorry .....	2·18
„	Scarborough, West Bank .....	3·22	„	Warrenpoint .....	1·99
„	East Layton [Darlington] .....	3·11	„	Newtownards .....	...
„	Middleton, Mickleton .....	4·03	„	Belfast, New Barnsley .....	4·82
X.	Haltwhistle, Unthank .....	5·08	„	Cushendun .....	6·48
„	Shap, Copy Hill .....	5·19	„	Bushmills .....	4·28
XI.	Llanfrehfa Grange .....	2·83	„	Stewartstown .....	3·87
„	Llandovery .....	3·76	„	Buncrana .....	4·41

\* On Sept. 1st 4·93 in. of R fell, much damage by floods.

## SEPTEMBER, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which .01 or more fell.	TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth	Date.			Deg	Date	Deg	Date.	On grass.	In shade.
		inches	inches.	in.									
I.	London (Camden Square) ...	1·81	—	·70	·35	16	19	69·5	6	34·3	29	0	2
II.	Maidstone (Hunton Court)...	2·69	+	·38	·85	3	13	...	...	...	...	...	...
III.	Strathfield Turgiss .....	1·98	—	·32	·48	1	19	68·2	5	32·5	30	0	4
IV.	Hitchin .....	2·60	+	·12	·52	1	19	66·0	4, 6	36·0	28	0	...
V.	Winslow (Addington) .....	2·62	+	·14	·42	6	16	69·0	6	30·0	29	3	4
VI.	Bury St. Edmunds (Culford) ...	2·40	—	·38	·38	4	21	69·0	1	28·0	28	2	...
VII.	Norwich (Cossey) .....	2·45	—	·63	·48	13	19	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring) ...	2·73	...	1·02	16	16	68·0	6	38·0	29	0	...	...
IX.	Barnstaple .....	4·78	+	·50	1·20	1	18	69·0	1	39·0	25	0	...
X.	Bodmin .....	5·11	—	·13	1·72	1	16	68·0	1	36·0	29	0	1
XI.	Stroud (Upfield) .....	2·89	—	·36	·65	16	15	69·0	3	34·0	28	0	...
XII.	Churchstretton (Woolstaston) ...	2·35	—	1·12	·56	3	18	64·0	4, 5	38·0	29	0	1
XIII.	Tenbury (Orleton) .....	1·60	—	1·75	·36	1	14	67·8	6	29·7	29	3	4
XIV.	Leicester .....	2·59	...	·38	4	16	69·0	3	32·0	29	1	8	...
XV.	Boston .....	1·47	—	1·14	·35	16	15	71·0	4	30·0	29	1	...
XVI.	Hesley Hall [Tickhill] .....	1·52	...	·25	14	17	67·0	3	30·0	28	1	...	...
XVII.	Manchester (Ardwick) .....	4·59	+	·82	·77	14	17	65·0	3	36·0	28	0	...
XVIII.	Wetherby (Ribston Hall) ...	3·11	+	·03	·76	7	12	...	...	...	...	...	...
XIX.	Skipton (Arncliffe) .....	7·61	+	2·03	1·38	1	18	...	...	...	...	0	...
XX.	Hull (Beverley Road) .....	2·41	—	·34	·32	6	23	...	...	38·0	25	0	0
XXI.	North Shields .....	5·06	+	2·74	1·60	6	21	69·0	1	32·0	28	1	1
XXII.	Borrowdale (Seathwaite) .....	15·58	+	2·36	2·15	9	22	...	...	...	...	...	...
XXIII.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...	...
XXIV.	Haverfordwest .....	3·41	—	1·64	1·01	1	19	66·8	5	34·0	28	0	3
XXV.	Plinlimmon (Cwmsymlog) ...	7·24	...	1·05	4	17	...	...	...	...	...	...	...
XXVI.	Llandudno .....	2·27	—	1·48	·48	28	18	65·0	3	38·5	29	0	...
XXVII.	Cargen [Dumfries] .....	4·53	+	·12	1·01	5	18	65·4	20	30·8	28	1	...
XXVIII.	Jedburgh (Sunnyside) .....	4·87	+	2·23	·69	6	20	62·0	3	30·0	28	1	...
XXIX.	Old Cumnock .....	4·75	+	·26	·64	3	18	68·0	1	31·0	12	1	...
XXX.	Lochgilthead (Kilmory) .....	4·83	—	·93	·65	9	18	...	...	...	...	...	...
XXXI.	Oban (Craigvarren) .....	3·91	...	·77	8	19	66·0	4	41·8	13	0	...	...
XXXII.	Mull (Quinish) .....	3·81	...	1·16	7	15	...	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices .....	3·20	—	·03	·50	2	16	...	...	...	...	...	...
XXXIV.	Arbroath .....	2·89	—	·18	·74	28	10	67·0	1	34·0	28	0	...
XXXV.	Braemar .....	2·89	—	1·05	·76	1	19	65·2	2	28·0	28	1	8
XXXVI.	Aberdeen .....	3·39	...	1·20	1	18	67·0	3	30·0	27	1	...	...
XXXVII.	Lochbroom .....	4·48	...	1·00	2, 9	20	...	...	...	...	...	...	...
XXXVIII.	Culloden .....	3·36	+	·46	...	...	65·0	9	33·0	28	0	3	...
XXXIX.	Dunrobin .....	2·08	...	·62	2	12	64·0	1	34·5	28	0	...	...
XL.	Kirkwall (Swanbister) .....	...	...	...	...	...	...	...	...	...	...	...	...
XLI.	Cork (Blackrock) .....	2·52	—	1·63	1·22	1	12	72·0	9	38·0	27	0	...
XLII.	Dromore Castle .....	4·30	...	1·86	1	14	70·0	19	38·0	28	0	...	...
XLIII.	Waterford (Brook Lodge) ...	1·72	...	·46	1	11	66·0	4, 5a	37·0	8, 28	0	...	...
XLIV.	O'Briensbridge (Ross) .....	2·49	...	·53	4	17	71·0	2	33·0	29	0	...	...
XLV.	Carlow (Browne's Hill) .....	2·07	—	1·19	·32	1, 6	18	...	...	...	...	...	...
XLVI.	Dublin (FitzWilliam Square) ...	1·51	—	·90	·48	1	16	67·4	9	37·9	29	0	2
XLVII.	Ballinasloe .....	2·99	—	·97	1·23	1	14	63·0	3	34·0	19c	0	...
XLVIII.	Waringstown .....	2·72	—	·63	·72	1	18	70·0	1, 3b	35·0	18d	0	2
XLIX.	Londonderry (Creggan Res.) ...	4·73	...	1·03	1	19	...	...	...	...	...	...	...
L.	Omagh (Edenfel) .....	3·34	—	·70	·93	1	18	65·0	1	36·0	20	0	...

a And 9, 11. b And 4. c And 29. d And 23, 27.

+ Shows that the fall was above the average; —that it was below it.

# METEOROLOGICAL NOTES ON SEPTEMBER, 1887.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail, S for Snow.

## ENGLAND.

STRATHFIELD TURGISS.—The first part of the month was remarkable for a succession of strong S.W. gales, accompanied by heavy R, with floods in some of the valleys; the latter part was characterized by fine autumnal weather. The land was still very dry at the close, and more R would be acceptable in our wheat growing districts.

ADDINGTON.—The month was unsettled throughout. It began with a very heavy gale, doing much damage to the apple crop; on the 8th there was enough frost to blacken tender plants, and frost again on 25th, 28th, and 29th. Fog on 20th. Pressure very low on 2nd, and high on 19th.

CULFORD.—The recent rains have very much improved the crops, and apples and pears are ripening earlier than usual; nights cold, with frost.

LANGTON HERRING.—Rainfall 17 in. below the average; mean temp. at 9 a.m. ( $55^{\circ}0$ )  $3^{\circ}1$  below the average of 15 years, and with the exception of 1882 ( $54^{\circ}7$ ) the lowest for September in that period. Mean min. ( $46^{\circ}1$ ), lower than in any of the last 15 Septembers, and as much as  $5^{\circ}6$  below the average. Mean max.  $2^{\circ}2$  below the average. A great storm on the night of the 1st caused great damage to fruit trees. The total rainfall for the nine months of the year is 8.11 in. below the average of 12 years.

BODMIN.—The heavy rains were most welcome, but the streams and wells had not permanently increased at the close. Mean temp.  $52^{\circ}$ .

STROUD.—S.W. gale all night on 1st; T and one flash of L at noon on 27th; frost on 28th, touching vegetable marrows.

WOOLSTASTON.—A pleasant genial month, with R nearly every day in the first fortnight. Mean temp.  $52^{\circ}$ . Strong gale on the night of the 1st.

ORLETON.—A very fine and pleasant month, but cold. A great wind occurred on 1st and 2nd. From that time to the close a steady low temp. prevailed with northerly wind, though there was a large amount of sunshine. The mean temp. was  $3^{\circ}$  below the average of 26 years, during which period it was only once a little lower, in 1877. The last week was very cold. Fog on 5 days; distant T on 27th and 29th.

HULL.—An unsettled month; gloomy for September; T on 27th.

NORTH SHIELDS.—1.60 in. of R fell in 9 hours from 9 p.m. on 5th to 6 a.m. on 6th, and on 16th 18 in. fell in about five minutes. Two TSS occurred on 27th, and T was heard on 4th, 16th and 28th; L was seen on 12th; H fell on 11th, 13th and 16th.

## WALES.

HAVERFORDWEST.—On the whole a fine, pleasant, cool month, with much bright sunshine. In the first week large quantities of R fell, and wet weather continued till the 16th, R falling principally at night. Fine, bright, cool weather prevailed from 17th to 25th. The last week was again wet, R falling at night. Prevailing winds S.W., N.N.W., and N.E. Very stormy on 4th and 5th; slight TS on 6th. Potato crop splendid; grain of all kinds very good.

## SCOTLAND.

CARGEN.—Almost the whole of the R fell during the first half of the month; the latter half was very dry. Mean temp.  $2^{\circ}7$  below the average.

JEDBURGH.—With the exception of September, 1872, the wettest September during 23 years, with a rainfall exceeding the total of the preceding three months. Crops were, on the whole, secured in good order; potatoes were good and free from disease. The fall of the leaf earlier than for many years past.

BRAEMAR.—A fine month; crops all secured in capital condition.

ABERDEEN.—Rainfall slightly above the average. T on five days; L seen on three nights; aurora on 23rd; H and sleet on 29th.

LOCHBROOM.—An average month as to amount of R and number of wet days, but on the whole fine, though rather wet for the ingathering of the crops, which were good; much corn remained out at the close in this district. Potatoes and turnips were excellent.

CULLODEN.—The month generally was favourable for harvest work. The rainfall was considerable during the first part, but from 15th to 30th fair weather prevailed, favourable for harvesting.

#### IRELAND.

BLACKROCK.—Showery to the 11th, then fine "second summer" weather to the 25th with no R, except a shower of 0·02 in., for 14 days. Mean temp. 54°·6. The rainfall from January 1st is 14·98 in. below the average of 22 years for the same period.

DROMORE.—Fine, with no storms. The ground was so dry that it soaked up nearly all the R. Potatoes were very good, and grass was growing plentifully at the close.

WATERFORD.—Rainfall two inches below the average of 28 years. During the nine months 16·22 in. of R fell, the next driest year being 1864, when 19·91 in. fell in the same period.

O'BRIENSBRIDGE.—A most favourable month for all harvest operations. A considerable fall of temperature occurred towards the close with a touch of frost on one night. The total rainfall for the nine months was 17·46 in., an unprecedentedly small amount in this district, where records have been kept for 40 years.

DUBLIN.—Opening with very unsettled, squally, and showery weather, September, nevertheless, proved a favourable month. It was no doubt very cool, but from the 11th to the 25th conditions were usually anti-cyclonic, and the weather was quiet and dry. The mean temp. (54°·0) was decidedly below the average (56°·0). In the preceding 22 years, September was coldest in 1866 and in 1882 (53°·0), and warmest in 1865 (61°·4). On the night of the 28th, a TS of exceptional violence raged along the coast of the counties of Dublin and Wicklow. Solar halos appeared on 28th. High winds were noted on 8 days, but attained the force of a gale on only two occasions, the 1st and 5th. Fog on 3rd, 21st, 23rd and 24th. Temperature did not reach 70° in the screen on any day, while it fell below 40° on two days. Mean humidity 85; mean amount of cloud 5·1; prevailing winds N.W., W., and N. The rainfall for the nine months was only 54·4 per cent. of the average of 20 years.

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#### BLACK RAIN.

*To the Editor of the Meteorological Magazine.*

SIR,—Referring to Mr. Morgan's letter in the August number of the *Meteorological Magazine*, I may remark that I live in a coal district and very near a railway, so am visited somewhat abundantly with smoke. I have noticed that after a long drought, if a heavy shower falls, the gravel beneath the trees in the avenue shows considerably blacker than elsewhere. I attribute this to the circumstance that during the drought the soot settles on the ground and where not protected by the trees gets washed off by the first shower.

Again I notice that around the stems of the trees (which are not very old) the grass shows more luxuriance than that farther off. This I suppose to be caused by the rain running down the stems and carrying with it the soot that has settled on the leaves and twigs, and thus manuring the ground for a small space.—Yours truly,

HENRY MUIRHEAD.

*Cambuslang.*