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THE VOLCANIC PHENOMENA IN NEW ZEALAND.

WE have been favoured with such full accounts of the great seismic disturbance which commenced about 2 a.m. on June 10th as to cause an *embarras de richesses*. One of our New Zealand correspondents, besides his own personal narrative, has sent us various numbers of the *Wellington Evening Post*, with coloured lithograph views and maps of the district affected, and also the special edition of the *Auckland Evening Star*, with an eight page supplement crammed with lithographic reproductions of photographs, a map, and sketches of the disaster. Besides these there have been accounts (nearly all different) in most of the daily and weekly papers. We may, however specially notice the *Illustrated London News* of August 7th, *Nature* of July 29th and August 5th, *Science* (New York) of July 23rd, and the *Pictorial World* of August 5th. Of course by far the easiest course would be to pick out a series of paragraphs from these papers and re-print them, but that is not our notion of an editor's duty. What we have tried to do is to make ourselves acquainted with the various reports and statements, each of course reporting the facts merely as they appeared to one person from one place, and then to write the description in as near as we can chronological sequence, and as viewed from a safe height above the district, say four or five miles—below that, a blow from a piece of pumice might have been experienced.

Locality.—Near the intersection of the line of longitude 176° E. of Greenwich with that of 38° latitude S. and about 20 miles inland from the shore of the Bay of Plenty on the N.E. coast of the N. Island of New Zealand lies a district long celebrated as one of the wonders of the world. This is near the centre of an area of about 30,000 square miles, extending North-eastward from a mountain called Ruapehu (9,850 feet high), past Tongariro (7,800 feet), Lake Taupo with an area of about 200 square miles and 1,175 feet above sea level, crossing the valley of the river Waikato, and then coming on the gem of the whole, the hot springs and lakes of Rotomahana, Tarawera, Roto Rua, and Roto Iti, and the celebrated Pink and White Terraces.

Previous state —We give first one of the best general accounts which we can find :—

The physical formation of the whole region at once betokens its volcanic origin. In the centre was the beautiful lake Tarawera, whose winding shores were fringed by bold mountains with conical peaks, over which spread a rich growth of giant-like vegetation, while picturesque headlands, deep bays, broad valleys, and weird gorges came before the view at every turn. At the southern end of this lake, Mount Tarawera rose a thousand feet above the surrounding country in the form of a colossal truncated cone. From time immemorial it has remained in a quiescent state, until suddenly, as if awakened into a new life, it has sent forth its showers of ashes and rivers of mudlike lava for a distance of sixty miles over the surrounding plains. Mount Tarawera was, before the eruption occurred, connected with Lake Rotomahana by a bold range of volcanic hills, from whose valleys and sides issued at all times vast volumes of steam and sulphurous vapours. The lake itself, about a mile in diameter, with its hot green water, lay in the centre of towering mountains. Everywhere around one could see the wondrous workings of fire and water in the geysers, mudholes, and fumaroles that lined its shores. Every miniature island and jutting point had its cluster of boiling springs, every valley its waving cloud of steam, while the very waters of the lake sent up bubbles of heated gases from the depths below. In describing this curious lake, in his book on *The King Country*, Mr. Kerry-Nicholls states :—"We entered a rocky desolate gorge, seamed and fissured in every direction with streams of hot water, while jets of hissing steam bursting from its sides marked the site of subterranean fires. The heated quaking soil was covered with thick deposits of silica, sulphur, oxide of iron, pumice, obsidian, scoria, and other volcanic products, and with its sulphurous atmosphere, fierce heat, and shrieking sounds, it appeared as if we had entered by a short cut to Pandemonium. The high hills on each side of the gorge rose up in quaint fantastic shape, and their rugged sides, composed of shattered volcanic rock, sent forth water and jets of steam from a thousand fissures, while all the huge rocks, boulders, and stones had been pitched and tossed about by the tremendous action of fire and water into a wild and endless confusion. One of the most remarkable wonders of this region was Te Ana Taipo, or the "Devil's Hole," a deep circular aperture in the rocky gorge, from which a column of transparent steam burst from a small aperture at the bottom of the deep funnel-shaped hole with a deafening screeching sound like the voices of a thousand fiends. Never was heard anything so wild and so dismal as the human-like wailings of Te Ana Taipo ; and as the thrilling noise went echoing over the hills one expected to see an army of evil spirits spring up around, headed by his Satanic Majesty himself. We came suddenly upon Ngahapu, an intermittent boiling geyser, which burst forth with a loud noise from the farther side of an oval-shaped basin about a hundred feet in circumference, and in which the heated, steaming water, in a constant state of ebullition, kept rising and falling in great hot waves which lashed themselves into fury against the rugged sides of the cauldron with a loud hissing sound, as a column of boiling water shot high into the air. Right above this spring, on the side of a hill, a transparent jet of steam burst forth from a narrow fissure with a loud, screaming noise, as if anxious to escape from its rock-bound prison-house, and blow up the surrounding country. It blew, whistled, steamed, and hissed and shrieked away like a fifty horse-power engine, and the terrific pressure acting in some way upon the rocks below made them send forth a sound like the 'thud' of a great steam-hammer."

It was on the fiery borders of this remarkable lake, and on the slopes of fern-clad hills that sloped gently down to its brink, that the marvellous Pink and White Terraces, now unfortunately destroyed by the force of the eruption, delighted the beholder, as he gazed in wonder on their chaste and singular design. The same author thus writes of Te Tarata, or the White Terrace :—"As we looked upwards the whole outline of the terrace assumed a semicircu-

lar form, which spread out at its base in a graceful curve as it sloped gently down to the margin of the lake. Then broad, flat, rounded steps rose tier above tier, white and smooth as Parian marble, and above them terrace after terrace mounted upward, rounded and semicircular in form. All were formed out of a delicate tracery of silica, which appeared like lacework congealed into alabaster of the purest hue. Each lamination or fold of this beautiful design, was clearly and marvellously defined, and as the glittering warm water came rippling over them in a continuous flow Te Tarata sparkled beneath the sun as if bedecked with diamonds and myriads of other precious gems. Crystal pools, shaped as if to resemble the form of shells and leaves, and filled to their brims with water, blue and shining as liquid turquoise, charmed the eye as we mounted to every step, while around the edges the bright crystals of silica had formed encrustations which made them appear as if set in a margin of miniature pearls."

The crater of Te Tarata was formed of a milk-white circular basin of two hundred feet in diameter, filled to overflowing with brilliant transparent water. Here the hissing liquid in a constant state of ebullition bubbled and hissed in the form of a boiling fountain from which a waving cloud of steam floated constantly upward.

The Pink Terrace rose majestically from the shining green waters of the lake with rounded edges and waving curves, the buttress-like masses which supported the fringed edges of the terraces bent over and formed miniature grottoes, resplendent with festoons of pink-tinted silica and rose-coloured stalactites, which appeared to have been woven together by nature and crystallised into their present shape, while innumerable pools or salmon-coloured basins, all exquisitely and quaintly formed with curling shell-shaped margins, were resplendent with water of the purest and darkest blue.

The steaming cauldron was formed by a round alabaster-like basin about a hundred feet in diameter. Here the deep dark blue water, within a few degrees of boiling point, lay without a ripple upon its surface, which shone with the brilliancy of transparent crystal, and beneath which the silicious deposits which encrusted the sides of the crater assumed all the marvellous and fantastic designs of a coral grove, tinted in glowing colours of yellow, blue, and pink.

We need not add much to the foregoing except a few measurements, which may give distinctness to the description, all distances being measured in straight lines.

ROTO ITI, the most northerly lake, is about twice the breadth of Windermere and about its length, say two miles, from N. to S. and nine from E. to W. and at an average distance of 15 miles N.N.W. of Tarawera.

ROTO RUA, south-east of Roto Iti and almost adjoining it, is an approximately rectangular lake about five miles by four miles and 17 miles N.W. of Tarawera.

ROTO RUA township, on the south shore of the lake is the principal place in the district, and just 15 miles N.W. of Tarawera.

WAIROA.—The Maori settlement is about eight miles S.E. of Rota Rua, seven miles W.N.W. of Tarawera, and on a stream joining a little lake (Roto Kakahi, about two miles by one mile) to the large lake Tarawera, so called after the mountain which rises to the east of it.

TARAWERA lake is irregular in shape, but approximately square, and about 20 square miles in area. It was fed at the S.E. corner by two streams.

ROTO MAHANA, the most southerly lake which need be mentioned was a hot-water lake feeding Tarawera, and close to it were the Pink and White Terraces with which everyone who has seen them has been so charmed. These were about three miles S.W. of Tarawera.

We have, therefore, to picture to ourselves an area about equal to that of England from London to Hull and from Yarmouth to Hereford very thinly peopled, with many large lakes, many mountains of from 1,000 to 10,000 feet in height, all more or less volcanic in character, but nearly quiescent except an area of rather more than half the size of Leicestershire, where hot springs and lakes, geysers, and other phenomena gave constant proof of subterranean energy, yet as no violent eruption had occurred for many years none was expected.

The Outburst.—About 1 a.m. on June 10th the earthquake rumblings with which the residents are familiar gave place to more serious ones, and at 2.10 a.m. there was one of terrific force, after which a rush of fire and dust proclaimed the opening of Mount Tarawera as an active volcano. "In about an hour craters opened in and around Lake Roto Mahana and vomited enormous quantities of heavy mud, which with hardly conceivable rapidity spread disaster for miles round. Fifteen active fumaroles belching forth stones have been counted on the site of Roto Mohana, and one of the largest occupies the place where the Pink Terrace once was." The few buildings at Wairoa suffered severely, being crushed by the weight of mud thrown upon them.

Deaths.—The schoolmaster and four children were killed, and at one of the hotels a visitor shared the same fate. It is not known how many Maoris were killed, but certainly upwards of 100.

Darkness.—Tauranaga, 40 miles distant, was placed in total darkness by the thickness of the cloud of dust and ash, though the blaze of the volcano was visible in the S.E.

Dust.—It is not easy to distinguish between dust and mud, for great winds and rains were produced by the eruption, and after all mud may be but pumice dust mixed with water—but it is only at places near to Tarawera that this difficulty exists. Dust fell on vessels 130 miles away. At Tauranaga (40 miles) it was about $\frac{1}{4}$ in. deep; at Taheke (18 miles) 4 in.; at Te Ngae (15 miles) 9 in.; at Tikitapu (8 miles) 3 ft.; at Rotokakahi (6 miles) a 4 ft. fence was nearly buried.

Mud.—The area covered with indisputable mud seems to be about 15 miles square = 225 square miles, and over about 36 square miles it seems to have the enormous thickness of 20 to 30 ft. At Te Ariki it is said to be 20ft, and near Okaro lake 25 to 30 ft. The telegraph line man at Rotorua reported the wires to be coated with mud to the thickness of candles, and that the mud on the tops and insulators of each pole averaged 50 lbs. in weight.

Noise.*—The eruption was heard at Christchurch, 300 miles S.S.W of Tarawera.

* We have a note that the explosion was heard at Sydney at 11.50 p.m. Sydney time, which would correspond to about 1.30 a.m. at Roto Rua Sydney is, however, more than 1,000 miles distant.

Dust Column.—This was seen even from the other side of the island—from New Plymouth, distant 150 miles, the height of the top being estimated at 22,000 ft., or 4¼ miles.

Cuttings—We are indebted to the Hon. Minister of Mines for the following telegram, giving a complete analysis of the volcanic dust so plentifully distributed on the East Coast.—Silica, 62·2; alumina, 14·2; sesquioxide of iron, 6·2; lower oxide of iron, 2·3; oxide of manganese, trace; lime, 8·7; magnesia, 0·4; potash, 0·9; soda, 1·5; combined phosphoric acid, 0·04; combined sulphuric acid, 0·08; combined chlorine, 0·1; combined carbonic acid, 0·3; organic matter, 2·4; moisture, 0·4; total, 99·72. *Notes.* (1) Above 20 per cent. free angular quartz; (2) the phosphoric acid is low; (3) potash, fair proportion for soil; (4) lime, nearly insoluble, combined with silica; (5) no value as to dressing except to open heavy clay; (6) no permanent value as soil; (7) may from its state of fine division yield at first some benefit.—*Wellington Evening Post.*

"Latest accounts as to the New Zealand volcanic convulsions state that an area of 2,000 square miles is covered with three inches and more of dust. About 20 miles square is covered mostly to the depth of 3ft. and more. For 400 square miles at the outside the country is totally destroyed, and 1,600 square miles is much damaged, the result depending on the problem of the fertilizing qualities of the deposit."—*Melbourne Argus.*

Conclusion.—We venture, in conclusion, to congratulate our New Zealand fellow-subjects on two things: (1) on the vigour and ability of their newspapers; (2) on having in their service so skilled a geologist as Dr. Hector, F.R.S., whose instant despatch to the locality was a credit to the Government and a benefit to science. We cannot better conclude this note than by reproducing

Dr. Hector's explanation of the phenomena—

"The Tarawera mountain, which was formerly a volcano, had been for ages heavily capped with obsidian, forming, as it were, an enormous glass dome, hermetically sealing it. The pent forces have now blown this dome away. The tremendous explosion has shattered the tubes, or the piping of the pink and white terraces, which probably led thousands of feet into the superheated regions of the earth. This let down the whole of Lake Rotomahana, and generated an inconceivable body of steam, which simply blew the entire valley and the adjoining river into the air. What was formerly the lake is now occupied by numerous mud volcanoes, some of them 600ft. high and 300ft. across, belching forth mud and stones to a height of 100ft. or more. If this volcanic activity continues unabated, the district will, perhaps, afford in the future greater attractions to the tourist than even the vanished terraces, with all their matchless beauty."

A SHOWER OF SNAILS.

To the Editor of the Meteorological Magazine.

SIR,—Having heard that a fall of shell snails had taken place a few miles from here, I visited the place and found from a man who lived on the spot, that at about 9 p.m., just as it was nearly dark, what appeared to be a very black thunder cloud rose from the west,

and he went in for shelter. Next morning, on going to work, the roads, fields and stone hedges were plentifully strewn with small living shell snails, the fall extending over about three acres of land, but beyond these limits no shells were to be found.

What I saw myself perfectly corroborated what I was told, the fields being still thickly covered. I never saw shells of the kind in the neighbourhood before, though I have known it well for many years, and my informant told me that though he had lived on the spot 13 years, he had never previously seen that kind of shell there.

I am told by residents that there can be little doubt that the shells fell from the clouds, and unless this theory be correct it is most difficult to account for their sudden appearance in such vast numbers in a locality where they had never before been seen. They are apparently *Helix Virgata* and *Bulimus Acutus*. I enclose a few of the shells.

I shall be happy to give any other information in my power.

I am, sir, yours truly,
ALFRED HAMILTON JENKIN.

Trewirgie, Redruth, 9th August, 1886.

SEVERE FROST IN PORTUGAL.

SIR,—The weather at the commencement of the year 1766 was of such extraordinary severeity in Spain and Portugal, and so remarkable a hailstorm occurred at Gibraltar, that I think you will be interested with the following extract from a work entitled "The Marquis of Bombal," by the Conde da Carnota, second edition, page 252 :—

> My Hay writes : "We have had the coldest winter ever known in Portugal. The frost set in at Christmas, and lasted about six weeks. And General Irwin, then Governor of Gibraltar, in a despatch to the British Government, dated February 1st, 1766, gives a most astounding account of the effects of the season. Indeed, were it from a less authentic source, some little exaggeration might be expected. Towards night, on the 30th of last month, there fell so much hail that it ran down our rock with such violence, that many persons and cattle, and some houses, were destroyed by it. The drains being suddenly choked up, and the ramparts confining it, the lower part of the town is almost buried in it—many people suffocated in their houses—others escaped with difficulty out of their upper windows. It has done much damage, particularly made two breaches in our line wall, and, I fear, ruined many shop-keepers. I have, however, put everybody in motion, and hope to clear the town in a short time."

Faithfully yours,
R. STRACHAN.

11, *Offord Road, N.*
July 24th, 1886.

PARTICULARS OF THE FLOOD OF MAY 14th TO 16th, 1886, AS OBSERVED ON THE RIVER SEVERN BETWEEN STOURPORT AND GLOUCESTER, AND COMPARED WITH THE WINTER FLOODS OF 1770 AND 1852.

THIS flood, which attained a greater height at Worcester than any since the year 1770 was occasioned by very heavy rainfalls on the 12th and 13th of May, 1886, which extended over the whole of the Severn water-shed, and supervened on rainfalls which during the two previous days had been sufficiently heavy to fully saturate the ground.

The rainfall recorded during those four days, at the Diglis Locks, near Worcester, belonging to the Severn Commissioners, was over four inches in depth, whilst in some of the upper portions of the Severn water-shed nearly twice that depth of rain fell in the same period.

The river was but little affected by the rainfall up to the evening of the 12th, the height of the water in it being then only a few inches above ordinary summer level.

During that night, however, the water rose nearly ten feet, and by the morning of the 14th it had risen twenty feet above summer level, and reached its highest point (thirty-four feet two inches) on the lower Sill Lock gauge at Diglis at 2 a.m. on the 15th, being then about twenty-five feet above low summer level as marked on that gauge—3ft. 11in. above the top of the Lock walls, and about 2ft. 3in. deep over the ground floors of the Lock-keepers' houses there.

This flood in no part of the river between Stourport and Gloucester reached the level of that of November, 1770, though it was within a few inches of doing so at Diglis.

The flood line of May, 1886, accorded more nearly with that of November, 1852. Commencing at Stourport-bridge, the flood of 1770 was the highest, having reached 70ft. 3in. above ordnance datum at that point. Then followed the flood of 1852, 3ft. below that of 1770 whilst the flood of 1886 was 2ft. lower than that of 1852, or 5ft. lower than that of 1770.

Passing down the river, the lines of the three floods gradually converged until at a point about $10\frac{1}{2}$ miles below Stourport-bridge and $2\frac{1}{2}$ miles above Worcester, the lines of the 1852 and 1886 floods intersected each other at a level only about 21 inches below the line of the 1770 flood, which at that point reached 54ft. 8in. above ordnance datum.

From the last-named point the flood line of 1886, as compared with the others, gradually rose, whilst that of 1852 sank, until at Saxons-lode-bridge, which is situate about $25\frac{1}{2}$ miles below Stourport-bridge and which carries the Midland Railway between Tewkesbury and Malvern over the Severn, the relative heights were as follows:—The line of the 1770 flood (45ft. 10in. above

ordnance datum) highest, followed by that of the 1886 flood 15 inches lower, and then by the 1852 flood 18 inches below the latter, or 2ft. 9in. below the flood of 1770.

After passing Saxons-lode-bridge a rapid change took place in the relative positions of the three flood lines, as at Tewkesbury, 4 miles below Saxons-lode-bridge, or 29½ miles below Stourport-bridge, the lines of the 1852 and 1886 floods again intersected each other at a level about 2ft. 8in. below the line of the 1770 flood, which at that point reached 43ft. 6in. above ordnance datum.

From that point the lines of the 1852 and 1886 floods, whilst continually falling below that of 1770, were almost identical until the Upper Parting was reached—about two miles above Gloucester, or 40 miles below Stourport-bridge, and where the Severn divides into two branches, encircling Alney Island, and at this point the three flood lines read as follows :—

The 1770 flood line (42 ft. 1 in. above ordnance datum) highest, with the 1852 and 1886 lines about 5 ft. lower.

From this point into the tideway about a mile below Gloucester, the line of the 1886 flood fell below that of the 1852 flood. Their relative positions being as follows at the entrance into the tide-way :— The 1770 flood, (41 ft. 10 in. above ordnance datum) highest, followed by the 1852 flood, 6 ft. 6 in. lower, and then by the 1886 flood about 13 in. lower than that of 1852, or 7 ft. 7 in. below the line of the 1770 flood.

The flood of 1886 rose higher at Diglis than the flood of 1852, and continued higher down to Saxons-lode-bridge, because a railway embankment in connection with that bridge had been constructed across Upton Ham, between those two periods.

The 1886 flood overtopped the river banks immediately above that bridge some 3 or 4 ft., and whilst, prior to the construction of the railway embankment, the over-bank flood water had a clear and unobstructed course across the Ham, and so into the lower reaches of the river, those over-bank flood waters have had since the construction of the railway embankment to strain themselves through a very inadequate water-way left through the railway embankment across the backland drainage channel, and the over-bank flood waters were in consequence very considerably backed up over a wide area of flooded lands extending up the stream for a distance of from 12 to 15 miles above the bridge.

From this circumstance it is evident that engineers having charge of important water-ways troubled with over-bank-full floods must secure not only adequate sectional water-way areas for the main stream, but also for the free discharge of over-bank flood waters along the backland drainage channels.

The flood of 1886 subsided quickly—the traffic on the river having been suspended by it for a period of only four days, as compared with a suspension of 14 days following the flood of 1852.

Accurate daily gauge records of the height of the water have been

kept at various points on this section of the river for nearly 40 years, and they present many interesting features with respect to its behaviour in a great variety of circumstances.

Within the last few years rain gauges have been established at the various locks between Stourport and Gloucester, the records of which are taken daily, and more recently the temperatures of the air and of the water in the river also have been taken each day at various points in the river between Avonmouth and New Town, in Wales, so that a large amount of valuable and useful information on many points relating to the river will in course of time be accumulated.

HENRY J. MARTEN, M.Inst.C.E.
Engineer to the Severn Commissioners.

ON THE CLIMATE OF THE BRITISH EMPIRE DURING 1885.

ALTHOUGH we have now published for several years in succession, in a similar form the Climatological Table for the British Empire, some of our readers have probably not seen the earlier ones, and those who have, will not be uninterested in having some of the more striking facts brought to their notice; we will, therefore, just glance over the summary, and add a few jottings noted in preparing it.

The table this year shows a considerable increase in the number of stations available, and is very fairly representative of Her Majesty's Dominions with the unfortunate exception of the Cape of Good Hope, the returns from which are not complete for the whole year; the returns from the Falkland Isles are also incomplete.

Adelaide maintains its pre-eminence for extreme heat, and Winnipeg has resumed its position for the other extreme—of cold. It is curious, though not at all significant meteorologically, that the greatest heat should have been registered on the last day of the year, and the greatest cold on the first day. That these extremes should be registered at the stations named would probably be expected by most students of Meteorology, but probably few would be prepared to find that Winnipeg, with the lowest min. temp. in shade, and a mean temperature 0°·5 below freezing point, has a max. in shade higher than that at Mauritius, and less than three degrees below that at Bombay. The max. at Malta (103°·9) also appears high, exceeding that of Colombo, Ceylon, which is fully 25° nearer the equator, by 8°, and that of Bombay by 11°; it is, however, remarkably in accord with the max. temperatures at Melbourne and Adelaide, its position being roughly 30° N. of the equator, while they are 30° S.

Winnipeg, in addition to the lowest min. in the shade, records the greatest range of temp., nearly twice that of London, which follows the Canadian stations in order of greatness, and more than six times that of Barbados, which enjoys a remarkably equable climate as

regards almost all the meteorological elements. Next in order for range of temp. come the Australian stations, Malta, Calcutta, New Zealand, Jamaica, Bombay, Mauritius, Ceylon, and Barbados, with, as before stated, the smallest range.

We confess we are at a loss to understand the extreme dryness of Adelaide or to see why the difference between the mean relative humidity there and at Melbourne should be 15, while the extreme range for the same element, between all the other stations, is only 11 ; but the high standing of the directors of the two observatories precludes the possibility of the records being unreliable.

As regards max. in sun and min. on grass, little can be said, the conditions being necessarily such as to render the observations not fairly comparable. The appearance of Toronto for the lowest min. on grass is due to the absence of records at the other Canadian stations.

The total amounts of rain do not vary so much as might be expected, the limits of variation being considerably within those of England alone, but if we admit considerations of the rainfall of the Lake District as a basis of comparison, we ought also to take the fall on a wet spot among the Himalayas, when we should find the average of nearly 200 inches per annum at The Stye sink into insignificance.

The number of wet days also does not vary greatly, exceeding 100 at every station but one, and not exceeding 200 at any. The smallest, 63, is at our new station, Malta, which also has the clearest skies, the mean amount of cloud being only 2·9.

SUMMARY.

Highest temperature in shade : 107°·4 at Adelaide, on Dec. 31st.
Lowest temperature in shade : —46°·0 at Winnipeg, on January 1st.
Greatest range in year : 135°·8 at Winnipeg.
Least range in year : 21°·0 at Barbados.
Greatest mean daily range : 22°·7 at Fredericton.
Least mean daily range : 9°·5 at Barbados.
Highest mean daily temperature : 81°·1 at Colombo, Ceylon.
Lowest mean daily temperature : 31°·5 at Winnipeg.
Driest station : Adelaide, mean humidity, 56.
Dampest station : Barbados, mean humidity, 82.
Highest temperature in sun : 164°·7, at Calcutta.
Lowest temperature on grass : —19°·0 at Toronto.
Greatest rainfall : 85·58 inches at Colombo, Ceylon.
Least rainfall : 15·48 inches at Malta.
Most cloudy station : Melbourne, average amount 6·4.
Least cloudy station : Malta average amount 2·9.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1885.

STATIONS. *Those in Italics are South of the Equator.*	ABSOLUTE.				AVERAGE.					ABSOLUTE.		TOTAL RAIN.		AVERAGE.
	Maximum		Minimum.		Max.	Min.	Mean.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date	Temp.	Date.										
England, London	90·4	July 26	22·3	December 11	57·1	42·0	49·6	41·6	78	129·3	15·4	26·64	165	6·2
Malta	103·9	August 8	40·6	December 14	73·0	59·5	66·3	56·0	74	150·7	33·8	15·48	63	2·9
Mauritius	86·7	February 1	57·4	July 25	79·2	69·3	74·3	64·9	75	142·9	46 2	44·61	200	5·6
Calcutta	105·3	April 15	50·2	December 27	86·9	71·0	79·0	69·8	77	164·7	37·4	66 72	128	4·6
Bombay	92·7	June 8	60·6	February 11	85·3	74·4	79·9	71·2	75	153·2	48·4	67·91	113	3 6
Ceylon, Colombo.	95·8	February 22	68·8	January 2	86·9	75·2	81·1	72·2	75	150·0	59·5	85·58	194	5·8
Melbourne	101·6	February 5	29·9	July 15	66·2	49·2	57·7	47·2	71	157·6	21·1	26 94	123	6·4
Adelaide	107·4	December 31	35·0	July 15	72·0	53·2	62·6	46·4	56	173·6	26·3	15·87	133	4·8
Wellington	76·0	February 14	33·0	July 22	60·8	48·3	54·6	...	...	147·0	29·5	36·82	159	...
Auckland	79·0	February 14	37·0	September 11	64·6	52·2	58·4	49·2	71	149·0	29·0	28·14	155	6·1
Jamaica, Kingston	95·2	November 6	58·2	December 29	86·9	71·6	79·3	71·2	78	...	...	23·55	...	4·3
Barbados	86·0	September 26	65·0	February 12	81·2	71·7	76·5	72·9	82	149·0	...	46·26	173	5·3
Toronto	88·6	July 17	—16·1	January 22	49·5	32·6	41·1	36·0	77	...	—19·0	32·90	160	...
Fredericton	88·7	July 25	—23·2	February 12	50·6	27·9	39·3	33·1	76	...	...	45·09	144	5·1
Winnipeg	89·8	July 29	—46·0	January 1	42·6	20·4	31·5	29·2	81	...	...	16·52	121	5·4
Victoria	83·0	July 7	22·0	January 11	...	...	...	...	...	...	...	28·14	122	

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JAN., 1886.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Maximum. Date.	Minimum. Temp.	Minimum. Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	TotalRain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	51·3	2	20·8	8	41·4	31·6	33·9	91	67·6	8·3	1·02	23	6·6
Malta	65·1	8*a*	41·1	11	59·7	48·8	46·2	81	116·9	37·2	5·24	16	4·8
Cape of Good Hope	101·0	27	50·2	9	85·2	59·9	58·6	66	...	...	·23	3	2·0
Mauritius	87·5	31	69·6	19	84·9	73·6	69·3	74	142·6	62·4	2·13	16	5·2
Calcutta	83·0	24	50·6	2	76·6	56·1	56·1	73	136·7	39·4	1·28	3	1·8
Bombay	86·2	5	62·0	30	81·3	67·8	62·5	67	139·8	50·1	·00	0	3·3
Ceylon, Colombo	90·2	7	69·0	3	86·6	73·0	70·7	73	153·0	60·0	2·43	10	5·5
Melbourne	100·0	5	48·3	12	78·3	57·9	56·2	68	147·4	41·0	4·54	10	4·9
Adelaide	112·4	4	50·8	31	86·9	65·0	51·9	43	174·5	43·9	·77	9	4·5
Wellington	79·0	25	45·0	2	70·2	54·7	54·3	75	145·0	44·0	4·92	9	4·0
Auckland	82·0	22	57·0	5	75·3	61·4	57·8	67	149·0	44·0	2·16	5	6·0
Jamaica, Kingston	87·6	8	62·2	26	84·3	67·0	66·7	78	...	...	3·48	...	3·9
Barbados	82·0	27	69·0	13*b*	80·0	71·0	70·9	60	144·0	...	1·13	10	6·0
Toronto	47·3	4	—13·8	12	25·9	11·4	19·2	85	..	—18·0	5·52	20	7·5
New Brunswick, Fredericton	42·9	6	—24·0	13	24·2	6·2	17·5	86	...	...	5·20	15	6·6
Manitoba, Winnipeg	24·2	13	—44·6	9	—5·3	—24·5	—10·0	98	..	...	·38	7	5·0
British Columbia, Victoria	51·0	13	17·0	21	38·7	30·9	..	...	..		3·84	13	..

(*a*) And 27. (*b*) And 14, 29. (*c*) And 5, 28.

REMARKS, JANUARY, 1886.

MALTA.—Mean temp. 53°·3 ; mean hourly velocity of wind 13·8 miles, unusually high ; velocity 34 miles per hour from noon to 3 p.m. on 1st. TS on 11th, H on 11th, 13th and 21st. J. SCOLES.

Mauritius.—Rainfall 3·47 in. below, and mean temp. of air 0°·4 above average ; mean hourly velocity of wind 10·8 miles ; extremes 23·6 miles on 15th, and 0·0 mile on 1st ; prevailing direction E.S.E. L on 8th, 9th, 22nd and 25th, T on 23rd and 26th, T and L on 11th and 24th. C. MELDRUM, F.R.S.

COLOMBO.—T on 19th. L on 8 days. TSS on 2 days. F. C. H. CLARKE, Lt.-Col.R.A.

Melbourne.—Mean temp. of air 1°·9, of dew point 3°·6, mean humidity 4, mean pressure ·049 in., and rainfall 2·86 in. above their respective averages ; mean amount of cloud 0·2 below average. Prevailing winds S.E. and S., strong on 5 days. T and L on 16th, 19th and 29th, T on 20th, L on 25th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure ·039 in. and mean temp. 1°·4 above average ; rainfall slightly below average. W. E. COOKE.

Wellington.—From 1st to 12th, fine, and at times very warm ; showery from 13th to 18th, then fine again until night of 25th, which with the 26th was wet ; fine on 28th, but heavy R on night of 29th ; remainder of the month showery. Prevailing winds N.W. and S.E. generally moderate. Rainfall 1·42 in., and pressure ·216 in. above average ; mean temp. 0°·1 below average. R. B. GORE.

Auckland.—The early and middle parts of the month were fine, warm and rainless, heavy R (1·20 in.) fell on 27th, and on 29th. Mean temp. and pressure above average, rainfall below it. T. F. CHEESEMAN.

JAMAICA.—Moderate shocks of earthquake were felt throughout the Island at about 9.30 p.m. on 1st. MAXWELL HALL.

BARBADOS.—Mean temp. (75°) 1°·5, and rainfall 256 per cent. above average ; pressure pretty steady ; wind N.E. on 30 days, and S.E. on 1 day, mean hourly velocity 9°·8 miles, about the average ; three days were more or less cloudy.

R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, JULY, 1886.

[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	...	XI.	Castle Malgwyn	2·87
,,	Margate, Birchington...	1·87	,,	Rhayader, Nantgwillt..	5·89
,,	Littlehampton	2.55	,,	Carno, Tybrith	3·87
,,	Hailsham	2·68	,,	Corwen, Rhug	3·28
,,	I. of W., St. Lawrence.	...	,,	Port Madoc	6·33
,,	Alton, Ashdell.....	2·26	,,	I. of Man, Douglas	4·93
III.	Winslow, Addington ...	3·90	XII.	Stoneykirk, ArdwellHo.	2·93
,,	Oxford, Magdalen Col...	3·39	,,	Melrose, Abbey Gate..	3·18
,,	Northampton	3·39	XIII.	N. Esk Res. [Penicuick]	3·20
,,	Cambridge, Beech Ho...	3·17	XIV.	Ballantrae, Glendrishaig	3·16
,,	Wisbech, Bank House..	5·24	,,	Glasgow, Queen's Park.	1·79
IV.	Southend	2·76	XV.	Islay, Gruinart School..	4·23
,,	Harlow, Sheering	2·09	XVI.	St. Andrews, PilmourCot	3·64
,,	Rendlesham Hall	2·75	,,	Balquhidder, Stronvar..	4·77
,,	Diss	3·47	,,	Dunkeld, Inver Braan..	4·42
,,	Swaffham	5·16	,,	Dalnaspidal H.R.S. ...	4·36
V.	Salisbury, Alderbury...	2·10	XVII.	Keith H.R.S.	2·65
,,	Warminster	2·42	,,	Forres H.R.S.	2·17
,,	Calne, Compton Bassett	3·12	XVIII.	Strome Ferry H.R.S....	4·94
,,	Ashburton, Holne Vic..	4·59	,,	Tain, Springfield.....	2·04
,,	Holsworthy, Clawton...	2·43	,,	Loch Shiel, Glenaladale	...
,,	Hatherleigh, Winsford.	3·21	,,	S. Uist. Ardkenneth ...	2·70
,,	Lynmouth, Glenthorne.	2·67	,,	Invergarry	4·22
,,	Probus, Lamellyn	4·42	XIX.	Lairg H.R.S.	...
,,	Wincanton, StowellRec.	2·79	,,	Forsinard H.R.S.	2·75
,,	Taunton, Lydeard Ho...	2·68	,,	Watten H.R.S.	2·30
,,	Wells, Westbury.....	2·64	XX.	Dunmanway, Coolkelure	7·41
VI.	Bristol, Clifton	3·69	,,	Fermoy, Gas Works ...	3·69
,,	Ross	3·27	,,	Tralee, Castlemorris ...	4·91
,,	Wem, Sansaw Hall.....	...	,,	Tipperary, Henry Street	4·73
,,	Cheadle, The Heath Ho.	3·73	,,	Newcastle West	3·51
,,	Worcester, Diglis Lock	2·93	,,	Miltown Malbay.....	4·60
,,	Coventry, Coundon	3.04	XXI.	Gorey, Courtown House	3·99
VII.	Melton, Coston	2·66	,,	Navan, Balrath	...
,,	Ketton Hall [Stamford]	3·69	,,	Mullingar, Belvedere...	3·23
,,	Horncastle, Bucknall ...	2·40	,,	Athlone, Twyford	4·37
,,	Mansfield, St. John's St.	3·05	XXII.	Galway, Queen's Coll...	5·12
VIII.	Macclesfield, The Park.	5·28	,,	Clifden, Kylemore	10·40
,,	Walton-on-the-Hill.....	4·42	,,	Crossmolina, Enniscoe..	4·52
,,	Lancaster, South Road.	5·56	,,	Collooney, Markree Obs.	3·33
,,	Broughton-in-Furness..	6·79	,,	Carrick-on-Shannon ...	3 41
IX.	Wakefield, Stanley Vic.	5·43	XXIII.	Rockcorry.....	3·76
,,	Ripon, Mickley	5·47	,,	Warrenpoint	3·45
,,	Scarborough.....	3·81	,,	Newtownards	3·50
,,	EastLayton[Darlington]	4·69	,,	Belfast, New Barnsley..	4·02
,,	Middleton, Mickleton..	4·36	,,	Cushendun	2·34
X.	Haltwhistle, Unthank..	5·68	,,	Bushmills	2·21
,,	Shap, Copy Hill	7·59	,,	Stewartstown	3·63
XI.	Llanfrechfa Grange	3·66	,,	Buncrana	3·29
,,	Llandovery	5·74			

JULY, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max Deg	Date	Min. D g	Date	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	2·37	— ·10	·66	25	11	87·5	4	44·4	28	0	0
II.		Maidstone (Hunton Court)...	2·14	+ ·10	·40	13*a*	13	...	...	...	...	...	...
,,		Strathfield Turgiss	2·00	— ·30	·43	25	13	85·2	6	44·3	1	0	0
III.		Hitchin	1·69	— 1·01	·64	25	13	80·0	4, 21	46·0	27	0	...
,,		Banbury	3·07	+ ·09	·86	25	14	85·0	4	45·0	9,16	0	...
IV.		Bury St. Edmunds (Culford)	3·55	+ ·58	1·21	25	15	90·0	6	40·0	8	0	...
,,		Norwich (Cossey)	...	...	...	...	...	...	...	...	...	..	...
V.		Weymouth(LangtonHerring)	2·53	...	·50	12	12	77·0	4, 5	46·0	28	0	...
,,		Barnstaple.....	2·66	— ·89	·52	11	12	79·0	19*b*	53·5	15	0	...
,,		Bodmin	3·71	+ ·27	·53	21	18	80·0	3	49·0	10	0	0
VI.		Stroud (Upfield)	3·29	+ ·45	·65	25	14	87·0	4	46·0	27	0	...
,,		ChurchStretton(Woolstaston)	2·71	— ·32	·65	13	19	80·0	3	44·0	28	0	0
,,		Tenbury (Orleton)	2·71	— ·20	·75	19	19	86·7	3	36·2	28	0	0
VII.		Leicester	3·74	...	·70	7	17	85·0	3	46·2	9,16	0	0
,,		Boston	3·06	+ ·53	·92	25	13	95·0	3,4	43·0	1	0	...
,,		Grimsby (Killingholme).....	...	...	...	...	...	...	...	...	...	...	...
,,		Hesley Hall [Tickhill].....	2·57	...	·64	23	16	82·0	2*c*	43·0	10	0	...
VIII.		Manchester (Ardwick).....	...	...	...	...	...	...	...	...	...	...	...
IX.		Wetherby (Ribston Hall) ...	3·50	+ ·89	1·67	25	9	...	...	...	...	...	...
,,		Skipton (Arncliffe)	5·03	+ ·08	·92	11	16	83·0	2	36·0	9	0	...
X.		North Shields	4·32	+ 1·77	1·24	26	14	83·5	2, 4	39·5	28	0	0
,,		Borrowdale (Seathwaite).....	10·69	+ 1·92	2·04	13	18	79·5	3	45·5	28	0	...
XI.	WALES.	Cardiff (Ely).....	4·31	+ ·49	·82	11	17	...	...	...	...	...	...
,,		Haverfordwest	5·21	+ 1·28	·93	16	17	81·0	3	43·0	9	0	...
,,		Plinlimmon (Cwmsymlog) ...	6·64	...	1·10	11	22	...	...	...	...	...	...
,,		Llandudno.....	2·48	— ·23	·42	29	15	78·0	3	47·8	10	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	3·38	+ ·25	·65	13	15	78·8	1	39·8	14	0	...
,,		Jedburgh (Sunnyside).....	3·68	+ ·75	1·17	23	14	81·0	2, 3	40·0	10*d*	0	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	..	...	...
XV.		Lochgilphead (Kilmory).....	4·28	— ·26	1·10	13	18	...	...	35·0	8	0	...
,,		Oban (Craigvarren)	4·60	...	·91	13	22	78·5	1	41·9	9	0	...
,,		Mull (Quinish).....	4·27	...	·84	12	23	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·10	+ ·05	·90	26	10	...	...	...	...	...	...
,,		Arbroath	3·69	+ 1·05	·84	24	13	82·0	2	41·0	9	0	...
XVII.		Braemar	2·26	— ·60	·49	13 *e*	21	77·0	1	36·8	9	0	1
,,		Aberdeen	2·28	...	·46	13	18	81·0	2	40·0	9	0	...
XVIII		Lochbroom	3·33	...	·48	24	23	...	...	...	...	...	...
,,		Culloden	2·23	— ·55	...	...	...	79·0	1	36·0	9	0	1
XIX.		Dunrobin	2·35	...	·86	13	13	70·8	4	40·0	9	0	...
,,		Kirkwall (Swanbister)..... ..	3·12	...	·70	14	18	71·0	1	38·0	29*h*	0	...
XX.	IRELAND.	Cork (Blackrock)	5·14	+ 2·30	1·35	20	17	85·0	3	43·0	31	0	...
,,		Dromore Castle	7·66	...	1·50	16	17	70·0	2	51·0	31	0	...
,,		Waterford (Brook Lodge) ...	4·28	...	1·00	20	17	84·0	3	45·0	10*f*	0	0
,,		Killaloe	3·02	...	·86	25	20	80·0	1	47·0	10*g*	0	...
XXI.		Carlow (Browne's Hill)	3·00	+ ·44	·65	17	19	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	1·72	— ·70	·34	17	18	78·7	3	48·6	9	0	0
XXII.		Ballinasloe	3·06	+ ·18	·81	17	22	76·0	1	42·0	14	0	...
XXIII		Waringstown	3·46	— ·12	·56	28	19	85·0	1, 3	44·0	9	0	0
,,		Londonderry (Creggan Res.).	3·35	...	·47	13	23	...	...	...	...	...	...
,,		Omagh (Edenfel)	2·71	— ·54	·58	13	22	79·0	1	40·0	27	0	...

a And 25 *b* And 20. *c* And 3, 4. *d* And 27. *e* And 24. *f* And 28. *g* And 14. *h* And 30.
+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON JULY, 1886.

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

ENGLAND.

STRATHFIELD TURGISS.—The R which fell in the middle of the month was most acceptable to the crops and did an incalculable amount of good throughout the country, large areas of wheat being saved by it. Privet in flower on 1st, harebell on 2nd, mallow on 7th, convolvulus on 8th.

BANBURY.—Mean temp. 63°·5; T and L with heavy R on 25th.

CULFORD.—The temperature during the month was very variable, reaching 90° on the 6th, while two days later it fell to 40°. Crops generally were improved by the R, but the want of sunshine delayed the harvest.

LANGTON HERRING.—Rainfall ·24in. above the average of 11 years; no R fell from June 14th to July 11th. Mean temp. (63°·6) 0°·4 above the average of 14 years. Fog on 18th, 19th, and 25th; solar halo on 29th. On the 21st the sea, which is one mile distant, roared very loudly.

BODMIN.—The early part of the month was hot and dry, and the R which followed was very welcome. Mean temp. (64°·5) 2° above the average.

WOOLSTASTON.—A warm growing month, wheat crops at the close looking exceptionally well, but barley generally very indifferent. Mean temp. 59°·6.

ORLETON.—The first seven days were very bright and hot with the sky frequently cloudless. No R fell till the 11th, when the wind changed to S.W. and the remainder of the month was very showery with R almost every day, and much rough wind, greatly hindering the late hay harvest; the early hay crop was not an average, but was carried in fine condition without R. Distant T was heard on the 25th. Pressure was very unsteady after the 11th, but the fluctuations were not great. Mean temp. 0°·6 above the average of 25 years.

BOSTON.—During a TS on the 25th the L damaged Swineshead Church and several buildings in the neighbourhoood.

ARNCLIFFE.—On the 21st, ·50 in. of R fell in about 15 minutes during a TS.

NORTH SHIELDS.—Great heat prevailed from the 1st to the 7th; the weather from the 21st to the 31st was very unsettled and wet, and from the 25th unusually cold. TSS on 21st and 31st.

WALES.

HAVERFORDWEST.—The finest and warmest weather of this summer occurred during the first seven days of July, after which the weather was most precarious and uncertain, there being few fine days and the air being often chilly. The temperature on the whole was rather above the average owing to the excess of the first seven days. Late haymaking was seriously interfered with by R, and the harvest is likely to be a late one, though corn and green crops were looking well at the close. On ten days the temp. rose to or above 70°; mean temp 60°·3.

LLANDUDNO.—The first part of the month was bright and warm and without a single shower to the 9th inclusive; afterwards the weather was variable and unsettled and the wind was at times rather cold, especially in the evenings. Heavy T showers fell on the 21st, but without audible T, and the 26th was continuously wet; it was also very wet on the morning of the 29th. Though R fell on 15 days the total fall was about 8 per cent. below the average. The mean temp (59°·6) was 1·4 below the average; the range for the month (30°·9) was but slightly above the average, and the daily range (12°·1) was 2°·3 below it. There were only three days without sunshine and the aggregate amount (189 hours) was large.

SCOTLAND.

CARGEN.—Mean temp. (57°·7) 1°·9 below the average. The mean temp. of every month this year has been below average, viz., January 3°·9, February 5°·3, March 2°·9, April 1°·3, May 3°·2, June 1°·8, July 1°·9. T and L on 21st.

JEDBURGH.—The rainfall was considerably above the average of 20 years and there was unusual chilliness in the air. The want of R during the last half of June and the early part of July had a great effect on cereal crops, but the R later did much good and root crops looked well at the close. The harvest will be three weeks or a month later than usual even in the earlier districts. T on 3rd ; T and L on 24th.

OBAN.—An increased rainfall, well distributed over the month, brought forward the hay crop, which is plentiful, and white crops also are of fair quality and quantity. The temperature rose considerably during the month.

BRAEMAR.—A month of changeable weather.

ABERDEEN.—The most noticeable incident during the month was a grand auroral display on the night of the 27th, forming a corona at the zenith ; it is seldom that so vivid an aurora is seen in July ; in several places in Aberdeenshire the phenomenon was observed, and also in the outer Hebrides. The rainfall was slightly below the average. T and L occurred about midnight of 21st.

LOCHBROOM.—A month of cold and R, with sleet and S on the heights, and very little heat or sunshine, the temp. like that of spring and the R incessant. No grass was cut at the close and very little corn was in ear, indeed it promises to be a sad and late summer. The fishing is a failure.

IRELAND.

BLACKROCK,—Fine summer weather prevailed to the 10th almost without R, thence it was very changeable to the close with R on every day except six. Mean temp. (61°·2) 1°·5 below average. T on 20th.

WATERFORD.—A cold, wet month with rainfall 1·34 in. above the average.

KILLALOE.—Fair average weather and temperature.

DUBLIN.—Although it opened with brilliant, hot, summerlike weather, the month proved changeable, showery, and squally, with preponderating N.W. to S.W. winds. The contrast, as regards temperature, between the beginning and the close was very striking, the mean of the first seven days being 66°·1, while that of the last week was only 56°·2, a falling off of nearly ten degrees The rainfall, though distributed over as many as 18 days, was by no means heavy, and there was a complete absence of TSS. Prevailing winds N.W. and S.W., strong on 10 days ; solar halo on 29th ; fog on 2nd. Mean humidity 75 ; mean amount of cloud 6·6.

RAINFALL OF JULY 26TH, 1886.

To the Editor of the Meteorological Magazine.

SIR,—You will probably wish to know some particulars of the remarkable rainfall of the 26th ult. I am informed it commenced about midnight on the 25th ; it probably ceased about the following midnight, having been incessant, so far as I am aware, the whole day. The rainfall up to 8 a.m. on the 25th was 0·63 in. ; from that time up to 10.30 p.m., 1·46 in. fell, and the total set down to the 26th was 1·59, making a total of 2·22 in., the whole of which probably fell within 24 hours. I do not know that I ever measured so much in the time, but as it is divided between two rainfall days, it does not appear so heavy. With this great fall, the total rainfall from the 13th to the 31st of July was 4·84 in., following a remarkable dry period of 41 days, in which only 0·34 in. rain fell ; perhaps a drier period than I have before recorded of equal length.

T. W. BACKHOUSE.

West Hendon House, Sunderland.
6th August, 1886.