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RAINFALL OBSERVATIONS IN CHINA, 1886-92,

By M. LE PROF. RAULIN.

WITH the year 1886 rainfall observations were commenced at many of the Chinese customhouses, and also by Missionaries at some towns on the Yang-Tse-Kiang river, in the centre of China, not far from the latitude of Shang-Hai, some of them nearly 700 miles inland. There were also five stations in Formosa and one in Hainan.

These observations have been published by Dr. Doberck, for the years 1886 to 1889, in the *Quarterly Journal of the Royal Meteorological Society*, and for the years 1890–92 in the *Observations and Results at the Hong Kong Observatory.*

We have thus information as to the rainfall of that part of Asia for from 5 to 7 years from 33 stations, which may be thus grouped :—

1. Southern coast of the Gulf of Pe-chi-li.
2. River Yang-Tse-Kiang.
3. Delta of the Yang-Tse-Kiang.
4. Coast from Wenchow to Swatow.
5. Canton and Hainan.
6. Formosa.

Mean annual rainfall.—This is small in the north, and increases greatly towards the south. From about 20 inches in the Gulf of Pe-chi-li, it becomes double that in the Delta of the Yang-Tse-Kiang, and going about 500 miles up the river we find 58 inches at Hankow. Continuing along the coast it is about 45 inches, but reaches 68 inches at Ningpo. At Canton it is 66 inches, in the north of the Island of Hainan 54 inches, in Formosa it ranges from 60 to 90 inches, but at Keelung, the N.E. point, it reaches 148 inches.

Seasonal distribution.—Notwithstanding the proximity of most of the stations to the sea, the régime is that of type I. which prevails over the greater part of Asia. The exceptions are Foochow, Middle Dog and Chapel Island, where the spring rains slightly exceed those of summer. The southern part of Formosa has also type I., but at Keelung, its northern extremity, we have the opposite, type IV., and at Tamsui, not far off, the intermediate type III.

Abstract of Rainfall in China, 1886–92.

Stations.	Long. E.	Lat. N.	Year.	Winter.	Spring.	Summr.	Autmn.	Year.
	° ′	° ′		in.	in.	in.	in.	in.
1. *South Coast of the Gulf of Pe-chi-li* :—								
Houki	120 39	38 4	6	0·09	1·71	10·91	3·21	15·92
Chefoo	121 32	37 34	6	1·93	2·20	17·02	4·45	25·60
Shangtung Promontory.	122 42	37 24	6	1·67	3·05	13·83	3·97	22·52
2. *Yang-Tse-Kiang R.* :—								
Ichang	111 19	30 12	7	3·26	12·47	21·43	7·92	45·08
Hankow	114 20	30 33	7	8·98	18 55	22·14	8·02	57·69
Kiukiang	116 7	29 43	7	7·97	19·26	20·05	8·13	55·41
Wuhu	118 22	31 22	7	5·64	11·87	15·21	7·48	40·20
Chinkiang	119 30	32 12	6	3·63	8·27	14·27	6·30	32·47
3. *Delta of the Yang-Tse-Kiang* :—								
Wusung	121 27	31 25	5	6·16	9·36	14·24	9·73	39·49
Shaweishan	122 15	31 25	6	7·35	8·16	14·73	10·53	40·77
North Saddle	122 40	30 52	5	7·19	7·31	10 21	7·26	31·97
Gutzlaff	122 11	30 49	4	5·95	7·80	12·53	5·78	32·06
Steep Island	122 36	30 12	6	5·90	9·81	11·46	11·05	38·22
Ningpo	121 44	29 58	6	11·55	15·10	24·43	17·18	68·26
4. *Coast from Wenchow to Swatow* :—								
Wenchow	120 35	28 0	6	7·67	18·56	30·24	10·97	67·44
Foochow	119 38	26 8	7	6·85	17·42	16·47	8·04	48·78
Middle Dog	120 2	25 58	7	6·83	16·71	15·31	7·69	46·54
Turnabout	119 59	25 26	5	6·23	15·39	17 85	7·48	46·95
Ockseu	119 28	24 59	6	4·41	11·23	14·88	3·88	34·40
Amoy	118 4	24 27	7	6·68	15·28	18·57	6·08	46·61
Chapel Island	118 13	24 10	6	5·86	13·91	12·05	5·61	37·43
Fisher Island	119 28	23 33	7	6·75	12·18	22·43	4·09	45·45
Lamocks	117 18	23 15	7	4·14	14 14	19·99	5·51	43 78
Swatow	116 43	23 20	7	5·88	18·41	27·18	7·49	58·96
Breaker Point	116 28	22 56	7	4·85	18·03	28·93	9·22	61·03
5. *Canton and Hainan* :—								
Canton	113 17	23 7	6	4·52	24 93	27·26	8·91	65·62
Pakhoi	109 6	21 29	7	6·10	13·41	33·67	9·73	62·91
Kiungchow (Hainan)	110 20	20 3	7	4·63	14·20	20 32	15·28	54·43
6. *Formosa* :—								
Keelung	121 45	25 8	7	46·48	33·98	24·65	43·25	148·36
Tamsui	121 25	25 10	7	16·93	21·86	19·10	22·07	79·96
Anping	120 13	22 59	6	2·33	14·95	41·67	5·53	64·48
Takow	120 16	22 36	6	0·86	12·50	39·52	8·73	61·61
South Cape	120 51	21 55	7	6·15	11·94	45·45	24·23	87·77

[It may be convenient to append the following values for the same district as given in Loomis's "*Contributions*" :—

Stations.	Long. E.	Lat. N.	Years.	Average Rain. in.
Pekin	116 29	39 57	33	24·56
,, Tsien Tsin	117 10	38 17	4	21·77
Shanghai	121 16	31 19	—	43·35
Zikawei	121 26	31 13	8	42 44
Kelung	121 46	25 20	2	120·08
Canton	113 16	23 15	—	77·64
Hong Kong	114 13	22 20	12	84·45
Macao	113 32	22 10	14	69·10
Hanoi Tonkin	105 48	21 2	1	70·91
Bangkok	100 30	11 45	10	58·55
Saigon	106 45	10 47	7	82·96

[Ed.

ROYAL METEOROLOGICAL SOCIETY.

The Monthly Meeting of this Society was held on Wednesday evening, May 15th, at the Surveyors' Institution, Westminster, Mr. R. Inwards, F.R.A.S., President, in the chair.

Mr. G. J. Symons, F.R.S., and Mr. G. Chatterton, M.Inst C.E., read a paper on "The November Floods of 1894 in the Thames Valley," which they had prepared at the request of the Council of the Society. This consisted of a systematic description of the causes which led to the great floods of November last, and an analysis of the records obtained from the Thames Conservancy Board, from the engineers of several of the towns along the river, and also from rainfall observers throughout the Thames watershed. The information was given chiefly in the form of tables, one of the first being a chronological history of floods in the Thames Valley from the year A.D. 9 down to the present time. This was followed by a short description of the damage wrought in November, 1894, which was illustrated by a number of interesting lantern slides. Details were then given of the levels reached at various places in all the principal floods from 1750 to the present time. The authors exhibited a map showing the relative elevation of all the parts of the Thames Basin, and then gave details of the rainfall for each day from October 23rd to November 18th, 1894. The results obtained by the Thames Conservancy Board, showing the flood-levels at each lock, were exhibited on a longitudinal section from Lechlade to Teddington, and the hydraulic inclinations from lock to lock were shown in a tabular form. The volume of flood-water, as gauged by the Thames Conservancy at Teddington, rose rapidly from 4,000 million gallons per diem on November 12th, to 10,250 million gallons on the 16th, to 12,800 million gallons on the 17th, and to over 20,000 million gallons on the 18th, when the discharge reached its maximum. The last-named discharge is equivalent to 0·37 inch over the whole watershed of the Thames above Teddington Lock.

Mr. F. J. Brodie read a short paper "On the Barometrical

Changes preceding and accompanying the heavy Rainfall of November, 1894," from which it appeared that the latter half of October was characterised by unusually bad weather, especially in the more western and southern parts of the British Isles. The rains of November 11th to 14th, which actually caused the floods, were due to two secondary depressions which developed a certain amount of intensity as they passed over the southern part of England.

As the two papers dealt with two branches of one subject, the discussion on both was taken together.

Mr. Baldwin Latham thought that the paper proved that floods on the Thames were not larger than in old times, which showed that the statement so often heard that floods were increased by agricultural drainage was fallacious.

Mr. Peregrine Birch added his protest against the opinion that land drainage increased the floods, and suggested that the idea arose from the increase of buildings, the waters which now invaded dwellings being unnoticed in the times when they simply spread over meadows.

Mr. Chatterton said that he had been unable to ascertain the levels of the bed of the river, and spoke on the variations between the mean hydraulic gradient, and the actual level, of the floods. The water appears to be held up for a time in ditches, drains, &c., by slight obstructions till it reaches sufficient volume to carry away the obstructions and comes down with a run, causing a very rapid rise in the river.

Mr. R. F. Grantham did not agree with Mr. Latham and Mr. Birch that the floods were not increased by drainage, but the Thames had been greatly improved, and the water was passed down the river much more rapidly.

The Rev. J. Slatter thought that the Thames Conservancy might mitigate the floods by running the river down after heavy rain. At Whitchurch he had noticed that the rise of the river occurred 36 hours after the rain fell; the floods in recent years had not lasted one quarter of the time that they used to, owing to the improvements effected on the river.

The President, Mr. Scott, Mr. Burstall, Major Lamorock Flower, Captain Wilson Barker and Dr. Buchan also took part in the discussion.

Mr. Symons, in reply, said that the influence of drainage on floods is not ascertainable without precise information as to each individual flood, variations in the cause producing varying effects. He had pleaded for flood marks for 30 years, and could not understand the indifference of public bodies to their erection.

A paper by the Rev. F. W. Stow entitled "A Natural Thermometer" was also read, in which the author inferred the existence of a marked local difference of temperature from observations of the effects of the frosts of May 1894 on chestnut and ash trees near Bishopsdale, Yorkshire.

A *FIN DE SIÈCLE* PROJECT.

[WE do not regard the proposal dealt with in the following article —and which we believe has been rejected—quite so contemptuously as do our Belgian friends, but their criticism is so interesting and instructive that we translate it *in extenso* from *Ciel et Terre*—ED.]

The whole daily press has recently teemed with details respecting the magnificent project submitted by M. Paschal Grousset to the Director General of the Paris Exhibition of 1900, and destined, in the opinion of the author, to be the feature of the Exhibition.

M. Grousset requests authority to proceed with an experiment tending to clear up one of the most interesting subjects connected with terrestrial physics—that of the existence of a central fire. It is desired to ascertain whether beneath the crust of the earth there is a nucleus in a state of fusion, or any other source of heat accessible to man and forming a store of force, of light, and of motion. Or does a vast liquid ocean exist beneath our feet?

One may well be astonished, says M. Grousset, that man has never attempted to study a problem of such importance, and on the whole so easy, but in ordinary circumstances the costs of the attempt would be too great in proportion to the benefit immediately obtainable.

And this is how M. Grousset proposes to realise the magnificent project of which he is so fond, and to solve the important problem which has, for so many years, divided the physicists and geologists.

To dig horizontal galleries at successive depths of each 200 metres (say 650 feet), uniting them by a series of vertical shafts, and going downwards until an unbearably high temperature is reached, if the law of increase of temperature be confirmed.

We will not describe in detail the attractions which M. Grousset proposes to offer to visitors to his subterranean galleries—they are to pass in succession from representations of the Arctic regions with ice and snow, then to temperate, and finally to representations of the tropics. Electric lighting, perfect ventilation and safety, everything [!] has been arranged for.

M. Paschal Grousset is perhaps a profound politician and a great statesman (he was a member of the Paris Commune), but he is unquestionably an indifferent *savant*, and his knowledge of the physical condition of the earth's crust is that of the last century.

Some years ago a Spanish or Mexican engineer (we forget which) tried to awake popular interest in an even wilder scheme, namely, to dig a hole right through the centre of the globe!

One of our most distinguished bibliophiles, very learned in many things, who was equally haunted by the question of a central fire, imagined another mode of solving the problem, by selecting a very lofty and isolated volcano and at its base excavating a horizontal gallery abutting on the central region of the mountain.

M. Grousset would be satisfied with going down 1,500 metres

(nearly a mile), but to do that there is no need to sink at Paris horizontal galleries connected by vertical shafts—of which the cost is put at 15 million francs (say £600,000).

The Belgian mine of Viviers-Réunis (Gilly) has a depth of about 1,100 metres ($\frac{3}{4}$mile) and many others are between 800 and 1,000 metres.

At the well of Sperenberg, 40 kilomètres (24 miles) South of Berlin, the greatest depth is 1,390 metres (0·8 mile) and at Schledebach, also in Germany, the depth of 1,910 metres (1·2 miles) has been reached. Lastly, at Wheeling, in Western Virginia, a bore hole goes down to 1,500 metres.

When the Mont Cenis tunnel was being pierced, part of it was 1,654 metres (1 mile) below the summit, the summit of the St. Gothard is 1,706 metres (1·1 miles) above the rails, and those in the Simplon will be 2,135 metres (1·3 miles) below the summit.

M. Grousset does not appear to have any idea of the temperatures already ascertained at the great depths which we have above quoted.

In the Belgian coal mine of Poirier, although only 940 metres (0·6 mile) deep, the temperature in badly ventilated portions is 28° or 29° C. (82° to 84° F.), and in *culs-de-sac* it reaches 32° or 33° C. (90° to 91° F.).

At Sperenberg 49° C. (120° F.) and at Schledebach 57·5° C. (135·5° F.) has been observed.

At Wheeling, where the observations were made as a scientific investigation lasting over a whole year, the bottom temperature was 43°·5 C. (110°·3 F.), although at the surface it was only 10°·5 C. (51° F.) The increase of temperature became more rapid the deeper the boring was carried; for the whole depth it averaged 1° C. in 40 metres (1° F. for 72 feet), but near the bottom it was 1° C. for 30 metres (1° F. for 54 feet).

During the construction of the St. Gothard tunnel 30°·8 C. (87°·4 F.) was recorded. In the Simplon tunnel it has been computed that a temperature of 47°·5 C. (117°·5 F.) will be reached, and that for 10 kilometres (6 miles) it will be at least 40° C. (104° F.). The constructors will reduce this excessive temperature by powerful ventilation and by the production of water spray under high pressure and infinitessimally fine.

The foregoing statements show that the temperature at the depth of 1,500 metres (4,875 feet) is already known. The realisation of M. Grousset's project would therefore teach us nothing.

Finally (and this is an important detail), has M. Grousset estimated the cost of cartage and dumping of the millions of cube metres of earth which will have to be raised from the various shafts and galleries? No such item appears in the estimates.

So far *Ciel et Terre*. We do not say that its criticism is not well founded, but this proposal like most, may be regarded from two points of view.

When the Eiffel Tower was proposed, much ridicule was heaped upon the suggestion, and yet to this hour instruments on its topmost platform are automatically recording facts in the *Bureau Météorologique* which, like those already obtained, will doubtless be worked up by French *savants* and published by M. Mascart—sufficient proof of their utility.

So with M. Grousset's project. It is perfectly true that deeper borings and mines have been sunk, but almost always with a commercial object, and nothing approaching to a physical or magnetical observatory has ever been established at a great depth. Why should less be learned at 1,500 metres below the ground than at 300 metres (1,000 feet) above it? Earth Tremors, the transit of earthquake shocks, the flexure of the Earth's crust, variations in the force of gravity, in fact a multitude of problems occur to us which a deep-seated observatory free from the vibration of machinery, of blasting and of mining work could pursue.

Lastly, we are certain that to the general public the law of increase of temperature with depth is unknown, and we can see no harm, but rather the contrary, in the general diffusion of knowledge upon the subject.

EARTH TEMPERATURE AND WATER PIPES.

[We wish to ascertain the truth, and care relatively nothing as to whether suggestions made by ourselves are accepted or rejected. We see no advantage in printing letters which accept the suggestions which we offered; but, on the other hand, we wish to put our readers in possession of all that we have received, or seen, in criticism of our position, and these are the only two. The Rev. J. Slatter's letter really confirms our theory. The well water would not be "ice-cold water"—not like the Thames water which we see had, after storage, a temperature of 32°·9.—ED.].

WATER PIPES.

To the Editor of the Meteorological Magazine.

SIR,—There is one cause of injury to the water-pipes by frost which has escaped you—but which by my own cursory observations I am convinced has had as much to do with it as any you have enumerated—I mean careless laying of the pipes; so that continuity of the soil which was filled in was not preserved. My own pump draws from the well by about 35 feet of pipe laid horizontally, not more than 15 inches below the surface, and with a northern exposure; yet I suffered no inconvenience from frost. I attribute my immunity to the pipe being laid in ashes, which substance is not a good conductor, and being homogeneous and fitting close shut out the cold air completely.

Yours faithfully,

JOHN SLATTER.

Whitchurch, Oxon, 23rd May, 1895.

HATFIELD WATER WORKS.

SIR,—Regarding your remarks in the *Meteorological Magazine* (pp. 58 and 59) as to the temperature of the water of this well, viz. 51°, ameliorating the condition of mains from being frozen, this may be so, under certain conditions, to a greater or less degree. But the depth of the mains is a most essential factor in preserving them from frost, even when the water is pumped at the temperature as above. That this is so is proven by the circumstances of the water mains of St. Albans and Watford, both in this district, which were frozen to such a degree during the late frost as to almost deprive for several weeks these towns of water, and that the Engineers of these respective water works inform me that the water from their wells, as pumped, is of a temperature of from 50° to 51°. In both towns the water is pumped into covered reservoirs. Hatfield mains would have been frozen this last winter just as so many other mains were, but that they were laid to the depth described in my letter on p. 58.

Another circumstance that deprives the temperature index of almost any significance in the case of these works is, that the supply of water is so great in relation to its consumption, that pumping for 15 hours suffices for the week's constant service of 168 hours. The former number of hours is but 9 per cent. of the latter. Consequently the water in the open reservoir, which has a week's supply capacity, was nearly all the winter as cold as ice, as long as the frost continued.

Yours sincerely,
H. M. MILLER.

Hatfield, Herts, May 31st, 1895.

PHOTOGRAPHING METEORS.

IN *Ciel et Terre*, for April 16th, details are given of attempts made in the United States in 1893 to photograph members of several shooting star groups, and they were sufficiently successful to induce us to bring the suggestion before our readers, so that those interested in photography may try a new object. At Yale Observatory the camera was put upon an equatorial mounting and directed towards the radiant point, the total exposure was four hours, and three traces were found on the plate—one very good. On the same evening an ordinary camera, fixed at a window at Ansonia, caught the same meteor, and from the two traces the details of the meteor's path have been computed. The notice concludes with the following remarks:—

"Experience shows that with perseverance records of the path of meteors can be obtained. The exactitude of the results obtained is incomparably greater than can be obtained by any other method."

REVIEWS.

Les Aurores Polaires, par ALFRED ANGOT, Météorologiste titulaire au Bureau central météorologique de France. F. Alcan, Paris, 1895. 8vo., vii.–318 pages, 18 engravings or plates.

M. ANGOT calls attention to the long interval (more than a century) between the appearance of de Mairan's *Traité physique et historique de l'aurore boréale* (1733), and the next important work, Bravais' contributions, published in the Voyages of the "Commission Scientifique du Nord," and to the fact that during the subsequent half century no special work upon the subject has appeared in French. We do not quite understand this, and had perhaps better quote verbatim, first from M. Angot's preface, "Depuis cette époque [1840? the publication of Bravais's work] aucun travail d'ensemble n'a paru sur cette question dans notre pays."

Either M. Angot's memory failed him, or else this is a severe hit at Prof. Lemström's *L'Aurore boréale*, published in Paris in 1886, and the Avant-propos of which finishes with these words, "Nous sommes heureux de pouvoir réproduire à la fin de cet ouvrage neuf dessins d'aurores boréales, qui ont éte gravés d'apres les documents fournis par M. Angot, météorologiste titulaire au Bureau central météorologique de France."

As regards the plates, those in Prof. Lemström's book are certainly better than those in M. Angot's.

However, we forsake comparisons and confine our attention to the work before us, which certainly has several merits. The subject is treated systematically, thoroughly, judiciously, and clearly; these are strong words, but we believe that each is absolutely true. It is not often that we can forgive an author who issues a book without an index, but M. Angot's arrangement of chapters and sections is so extremely good that the table of contents answers almost every purpose which an index would. For example, Chapter III., "The Physical Characteristics of Auroræ," has the following sections:—Colour, Intensity of the Light, Nature of the Light, Noise, Odour; or again, Chapter V., "Periodicity of Auroræ': Daily Period, Annual Period, Secular Period, Relation to Sun-spot Periodicity. Classification like this renders it easy to ascertain with great rapidity not merely M. Angot's opinion on any point, but what the most recent and competent investigators have said; because, as we have already mentioned, M. Angot seems to us to have written not merely a well-arranged book, but one which is very fair and judicial in the way it discusses statements, and which is very easy and pleasant to read.

As regards the sound of Auroræ, M. Angot evidently feels that the evidence is very weak, but he leaves the suggestion open for further investigation, but the evidence for Auroræ producing a smell either like ozone or of any other kind, he considers too unsatisfactory to be accepted.

One feature has struck us on looking through this book, and we

mention it without for a moment asserting that there is anything in it. In recent photographs of lightning strokes, they have not infrequently appeared as gauzy ribbons. Some of the "curtain" patterns of aurora are by no means dissimilar in appearance.

We ought to give a short extract typical of the general style of the book, but it is all interesting, and therefore selection is difficult. The Section, "On the relations between the Clouds and Auroræ," is very good, but we have room for the conclusion only, viz. :—

"To sum up, there exist indisputable relations between clouds of the cirrus type and auroræ; the two phenomena present the same laws of periodicity, they are successive and sometimes co-existent, and their analogy is often such that many observers do not hesitate to affirm that the production of aurora is dependent upon the presence of cirri. We shall see later on that these views have very important bearings upon the theory of the aurora."

We can conclude by strongly recommending the book to the attention of our readers.

Dorset Annual Rainfall, 1848-92, by HENRY STORKS EATON, M.A. Past President of the Roy. Meteor. Soc. 8vo, Dorchester, 1895 (Excerpt Proc. Dorset Nat. Hist. and Antiq. Field Club), 30 pp., 2 coloured plates.

Mr. Storks Eaton has long been known as one of the best amateur meteorologists in the country. More than 30 years ago (in 1861) he contributed to the British (now the Royal) Meteorological Society a paper "On the fall of rain in Devonshire" which was far in advance of anything of the class, which had up to that time been done either for any part of England or of the world. In intervening years he has dealt with temperature, pressure, and other subjects, and now in the short paper under notice he gives an epitome of the rainfall of his native county which is almost as perfect as we can imagine, and as the observations permit. He has collected records from 75 stations in the county, and from 37 in the adjoining counties of Hants, Devon, Somerset and Wilts, the aggregate number of years dealt with being 670 in Dorset and 376 in the adjoining counties. The totals are printed *in extenso* so that they are available for anyone, but Mr. Eaton has worked out the true mean for each station with great care, computing them by differentiation from four stations and then adopting the mean of the four values. Mr. Eaton has, we believe, visited the majority of the existing stations so as to become conversant with the position and details of each, and gives in his paper a large map showing by shading the altitude above sea level of the whole county, while facing it is another on the same scale (4 miles to 1 inch, about $\frac{1}{253440}$) showing the rainfall by small figures over the sites of the observations, and also by blue shading, which naturally takes much the same configuration as the shading repre-

senting altitude. It is with this map alone that we should have preferred an alteration, or to speak correctly an addition. We do not understand why the author did not put on isohyetal lines for 30, 35 and 40 inches of rainfall. We have drawn them on our own copy and think that they tend greatly to emphasise the facts observed. The mean rainfall varies from rather below 30 inches near Weymouth, and Swanage, and in the extreme N.W., to nearly 50 inches on the hills in the centre; where, for the information of water engineers, we may mention that there is a ridge nearly 20 miles by 4 miles—say of 80 square miles with a mean rainfall of more than 40 inches. If we took it at 44 inches this would give a daily supply of 40,000,000 gallons a day, sufficient for say two million persons.

The paper brings out many facts of interest and importance; we will quote two only. There has lately been a discussion as to whether in a long register the driest three consecutive years will have a rainfall less than the mean by $\frac{1}{6}$th or by $\frac{1}{5}$th—we prefer to express it thus: whether the mean ratio for the driest three consecutive years should be taken as 83·3 or 80·0—Mr. Eaton's table gives 78·7. The other discussion has been as to there being any justification for the statement that years ending with 4 are generally dry. The only such years in Mr. Eaton's table, and the ratios for these, are

Year.	Ratio.	
1854	62	
1864.....	71	Average, 79.
1874.....	95	
1884.....	89	

Therefore they were all dry, and on the average there was a deficiency of 21 per cent.

Mr. Eaton and the Dorset Nat. Hist. Club have to be thanked for, and congratulated upon, an excellent piece of work.

CORRIGENDUM.

To the Editor of the Meteorological Magazine.

Met. Mag., vol. xxx., p. 61, Foot note, *, line 11,

For "The wind was easterly,"

Read "The wind was westerly."

With every apology for the slip of the pen,

F. C.

[We thought so, and therefore put the ?.—ED.].

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOVEMBER, 1894.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
England, London	63·9		31·3	22	52·0	41·5	42·7	87	98·1	26·1	2·85	14	6·3
Malta.....	78·6	1	52·5	25	70·6	58·5	51·3	80	130·5	46·8	4·60	16	6·6
Cape of Good Hope ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius.....	83·9	9	63·5	24	81·9	68·7	63·8	71	135·8	53·3	1·31	10	5 3
Calcutta.....	85·6	1	59·2	25	79·7	64·4	65·0	80	146·8	52·0	3·04	4	2·1
Bombay.....	89·0	22	68·1	30	86·2	71·4	66·9	67	138·3	59·7	·00	0	1·2
Ceylon, Colombo	91·0	29	71·3	24	85·7	74·1	72·1	81	153·0	65·0	14·63	20	6·5
Melbourne.....	105·7	27	41·5	14	73·5	52·1	49·5	67	152·1	38·0	·79	7	5·1
Adelaide	107·0	26	45·3	1	81·5	55·2	47·5	47	161·0	37·3	·23	3	3·2
Sydney	97·5	26	55·3	19	79·2	62·8	57·3	62	155·0	43·9	·68	7	3·6
Wellington	70·0	1	42·0	26	63·8	51·3	48·5	76	142·0	29·0	4·14	14	4·5
Auckland	73·0	3	48·0	14	67·2	54·0	53·7	80	140·0	46·0	5·66	17	5·3
Jamaica, Kingston.....	90·3	19	68·7	5	88·2	71·1	70·4	81	...	...	2·07	6	4·6
Grenada.....	84·8	10	70·0	27*a*	82·8	73·3	71·1	74	157·0	...	9·23	26	4·0
Trinidad	92·0	6	63·0	20*b*	86·4	70·7	71·1	81	167·0	63·0	7·28	20	...
Toronto	54·8	3	10·0	29	40·7	27·6	28·1	73	...	5·7	·61	23	7·3
New Brunswick, Fredericton ..... }	56·9	3	1·5	30	37·4	21·2	24·2	74	...	...	1 66	14	5·5
Manitoba, Winnipeg ...	43·8	1	—25·0	28	27·0	9·3	...	...	...	...	1·87	17	7·1
British Columbia, Esquimalt..... }	56·6	8	29·7	16	48·5	40·7	43 3	94	...	...	6·88	25	8·2

a—and 29. *b*—and 22.

Erratum.—In August table on p. 32, London—Absolute min. should be 44°·3, not 63°·1.

REMARKS.

MALTA.—Adopted mean temp. (62°·8), 1°·3 above the average. Mean hourly velocity of wind 7·3 miles. Thunderstorms on 5 days, and lightning on 8 other days. Hail on 15th. Dew point temp. ranged between 64°·4 on the 1st and 46°·7 on the 3rd. At noon on the 30th, during a dead calm, several waterspouts were seen over the sea three or four miles N.E. and N.W. of this station. J. F. DOBSON.

Mauritius.—Mean temp. of air equal to, dew point 0°·3 below, and rainfall ·59 in. below, their respective averages. Mean hourly velocity of wind 11·2 miles, or 0·3 mile above average; extremes, 23·5 on 2nd and 12th and 1·7 on 5th; prevailing direction, E. by S. to E. by N. Thunder and lightning on 28th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 11 days and lightning was seen on two other days. D. G. MANTELL.

Melbourne.—The max. temp. in shade (105°·7 on 27th) is the highest recorded in November during 40 years. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 1°·5 above the average of 37 years. On four consecutive days (23rd to 26th) the max. shade temp exceeded 100°, a very unusual occurrence in November. Rainfall ·79 in. below average. C. TODD, F.R.S.

Sydney.—Mean temp. 4°·4 above, humidity 8 below, and rainfall 2·49 in. below, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—On the whole a wet month, with short intervals of fine weather. Prevailing N.W. winds, generally strong. Lightning on 13th. Mean temp. 1°·0 above, and rainfall 0·3 in. below, their respective averages. R. B. GORE.

Auckland.—Showery and variable during the month. Particularly heavy fall of rain on 17th, 3·15 in. falling in less than 12 hours. Barometric pressure and mean temp. close to the average of 27 years, rainfall 2·5 in. over the average. T. F. CHEESEMAN.

JAMAICA, KINGSTON.—Mean hourly velocity of wind 3·1 miles. In Kingston the weather was fine, with rainfall a little below the average. R. JOHNSTONE.

TRINIDAD.—Rainfall ·42 in. above the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, MAY, 1895.

[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.			
II.	Dorking, Abinger Hall.	·56	XI.	Lake Vyrnwy	...
,,	Birchington, Thor	·70	,,	Corwen, Rhug	2·52
,,	Hailsham	·12	,,	Carnarvon, Cocksidia ...	·32
,,	Ryde, Thornbrough	·27	,,	I. of Man, Douglas	·26
,,	Emsworth, Redlands ...	·25	XII.	Stoneykirk, Ardwell Ho.	·41
,,	Alton, Ashdell.....	2·27	,,	New Galloway, Glenlee	·58
III.	Oxford, Magdalen Col...	·18	,,	Melrose, Abbey Gate ..	1·05
,,	Banbury, Bloxham	·49	XIII.	N. Esk Res. [Penicuick]	·90
,,	Northampton, Sedgebrook	·51	,,	Edinburgh, Blacket Pl..	1·42
,,	Alconbury	·47	XIV.	Glasgow, Queen's Park.	·20
,,	Wisbech, Bank House..	·89	XV.	Inverary, Newtown	1·17
IV.	Southend	·16	,,	Islay, Gruinart School..	·07
,,	Harlow, Sheering	1·09	XVI.	Dollar.....	·54
,,	Colchester, Lexden.....	·31	,,	Balquhidder, Stronvar..	1·00
,.	Rendlesham Hall	·35	,,	Ballinluig	·44
,,	Diss	·59	,,	Dalnaspidal H.R.S. ...	1·36
,,	Swaffham	1·11	XVII.	Keith H.R.S.	·79
V.	Salisbury, Alderbury...	·22	,,	Forres H.R.S.	1·10
,,	Bishop's Cannings	1·08	XVIII.	Fearn, Lower Pitkerrie.	·52
,,	Blandford, Whatcombe.	·24	,,	Loch Shiel, Glenaladale	2·60
,,	Ashburton, Holne Vic....	1·59	,,	N. Uist. Loch Maddy ...	1·77
,,	Okehampton, Oaklands.	·60	,,	Invergarry	1·03
,,	Hartland Abbey	·61	,,	Aviemore H.R.S.	1·49
,,	Lynmouth, Glenthorne.	·53	,,	Loch Ness, Drumnadrochit	1·67
,,	Probus, Lamellyn	·92	XIX.	Invershin	·56
,,	Wellington, Sunnyside..	·65	,,	Scourie	1·24
,,	Wincanton, Stowell Rec.	·41	,,	Watten H.R.S.	·43
VI.	Clifton, Pembroke Road	1·01	XX.	Dunmanway, Coolkelure	1·60
,,	Ross. The Graig	·43	,,	Fermoy, Gas Works ...	·70
,,	Wem, Clive Vicarage ...	1·01	,,	Killarney, Woodlawn ...	·94
,,	Cheadle, The Heath Ho.	·58	,,	Caher, Duneske	1·02
,,	Worcester, Diglis Lock	...	,,	Ballingarry, Hazelfort...	·99
,,	Coventry, Coundon	·77	,,	Limerick, Kilcornan ...	·86
VII.	Ketton Hall [Stamford]	·64	,,	Ennis..... .	1·03
,,	Grantham, Stainby	·60	,,	Miltown Malbay.....	1·17
,,	Horncastle, Bucknall ...	·89	XXI.	Gorey, Courtown House	·15
,,	Worksop, Hodsck Priory	1·89	,,	Athlone, Twyford	·41
VIII.	Neston, Hinderton	·39	,,	Mullingar, Belvedere...	·15
,,	Preston, Haighton	...	,,	Longford, Currygrane...	·51
,,	Broughton-in-Furness..	·71	XXII.	Woodlawn.....	·96
IX.	Ripon, Mickley	·53	,,	Crossmolina, Enniscoe..	2·17
,,	Melmerby, Baldersby ...	·70	,,	Collooney, Markree Obs.	1·30
,,	Scarborough, South Cliff	...	,,	Ballinamore, Lawderdale	·90
,,	Middleton, Mickleton..	·89	XXIII.	Lough Sheelin, Arley ..	·41
X.	Haltwhistle, Unthank..	·47	,,	Warrenpoint	·19
,,	Bamburgh.....	·55	,,	Seaforde	·21
,,	Keswick, The Beeches...	...	,,	Belfast, Springfield	·31
XI.	Llanfrechfa Grange	·34	,,	Bushmills, Dundarave...	·93
,,	Llandovery	·63	,,	Stewartstown	·69
,,	Castle Malgwyn	·26	,,	Buncrana	1·23
,,	Builth, Abergwessin Vic.	·91	,,	Lough Swilly, Carrablagh	1·10
,,	Rhayader, Nantgwillt..	·97			

MAY, 1895.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date.	No. of Night below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·34	— 1·56	·12	17	5	86·2	30	35·7	2	0	1
II.		Maidstone (Hunton Court)...	·17	— 1·21	·10	17	3	...	...	...	...	..	...
,,		Strathfield Turgiss	·60	— 1·27	·28	23	8	85·1	30	31·5	3	2	4
III.		Hitchin	·70	— 1·25	·25	17*d*	6	82·0	30	35·0	4	0	...
,,		Winslow (Addington)	·50	— 1·60	·18	17	6	84 0	30	33·0	2, 17	0	3
IV.		Bury St. Edmunds (Westley)	·88	— ·87	·39	17	9	76·0	30	34·0	17	0	...
,,		Norwich (Brundall)	1·09	...	·35	17	9	80·0	30	36·2	17	0	5
V.		Weymouth(LangtonHerring)	·31	— 1·30	·20	31	3	71·0	30	38·0	5	0	...
,,		Torquay (Cary Green)	·66	...	·38	31	3	73·7	14	39·0	7	0	0
,,		Polapit Tamar [Launceston]..	·33	— 1·50	·19	31	5	77·0	30	31·0	2	1	4
VI.		Stroud (Upfield)	·48	— 1·56	·21	24	6	81·0	30	37·0	1	0	...
,,		ChurchStretton(Woolstaston)	·78	— 2·09	·49	1	8	78 0	30	34·0	17	0	2
,,		Tenbury (Orleton)	·61	— 1·94	·32	1	9	82·1	30	32·5	2	0	5
VII.		Leicester (Barkby)	·63	— 1·34	·25	1	4	86 5	30	29·0	1	2	11
,,		Boston	1·87	+ ·15	·76	31	8	88 0	29*c*	31·0	2	1	...
,,		Hesley Hall [Tickhill].....	1·15	— ·89	·60	24	8	84·0	30	35·0	2	0	...
VIII.		Manchester(PlymouthGrove)	·59	— 1·76	·32	1	8	85·0	30	34·0	1	0	...
IX.		Wetherby (Ribston Hall) ..	·04	— 1·91	·04	11	1	...	...	...	...	...	...
,,		Skipton (Arncliffe)	·86	— 2·86	·38	25	8	...	...	...	...	...	...
,,		Hull (PearsonPark)	·64	— 1·24	·27	1	8	...	...	...	..	...	...
X.		Newcastle (Town Moor)	·68	— 1·07	18	19	11	...	...	...	...	...	..
,,		Borrowdale (Seathwaite).....	·58	— 8·03	·25	24	9	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	·48	— 2·37	·39	31	2	..	...	...	...	...	...
,,		Haverfordwest	·09	— 2·27	·05	31	5	77·6	30	34·4	3	0	6
,,		Aberystwith (Gogerddan) ...	·43	...	·15	24	3	85·0	30	...	...	...	...
,,		Llandudno.....	·42	— 1·51	·17	24	6	81·5	30	41·4	3	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	·06	— 2·46	·06	25	1	76·4	30	34·0	20	0	...
,,		Jedburgh (Sunnyside).....	1·22	— ·68	·52	24	11	75·0	29*c*	35·0	2	0	...
XIV.		Colmonell	·42	...	·22	24	2	80·0	30	33·0	19	0	...
XV.		Lochgilphead (Kilmory).....	·27	— 3·08	·16	25	5	...	...	31·0	19	2	...
,,		Mull (Quinish).....	·84	— 2·11	·41	14	10	...	...	...	...	...	...
XVI.		Loch Leven Sluices	·70	— 1·86	·20	31	6	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	·55	— 1·11	·15	31	9	77·8	28	35·4	2	0	...
XVII.		Braemar	·55	— 1·86	·15	24	12	69·9	30	30·2	3	2	19
,,		Aberdeen (Cranford)	·69	...	·25	19	11	71·0	28*b*	33·0	16	0	...
XVIII		Strathconan [Beauly]	2·28	— ·81	·65	25	6	...	...	...	...	...	...
,,		Glencarron Lodge.....	3·45	...	·72	23	15	75·5	31	33·0	18	0	...
,,		Cawdor [Nairn]	1·74	— ·01	·37	22	14	...	...	...	...	...	...
XIX.		Dunrobin	1·10	— 1·00	·30	19	10	68·0	29	37·0	2	0	...
,,		S. Ronaldsay (Roeberry).....	·70	— 1·02	·33	12	6	66 0	27	36·0	16	...	...
XX.	IRELAND.	Darrynane Abbey.....	1·93	...	·56	31	13	...	...	...	...	...	...
,,		Waterford (Brook Lodge) ...	·61	— 1·62	·27	31	4	71·0	30	32·0	2, 3	2	...
,,		O'Briensbridge (Ross)	·85	...	·36	22	7	..	...	...	...	...	...
XXI.		Carlow (Browne's Hill)	·54	— 1·80	·17	12*a*	5	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	·18	— 1·75	·07	31	3	71·9	30	36·1	21	0	1
XXII.		Ballinasloe	1·30	— 1·39	·85	31	8	79·0	30	30·0	3, 6	5	...
,,		Clifden (Kylemore)	·83	...	·17	11*b*	11	...	...	...	...	..	...
XXIII		Waringstown	·21	— 2·23	·16	12	3	81·0	30	33·0	1	0	4
,,		Londonderry (Creggan Res.).	·99	— 1·53	·29	24	10	...	...	...	...	...	...
,,		Omagh (Edenfel).....	·74	— 1·73	·28	24	9	77·0	30	34·0	1	0	1

a And 31. *b* And 29. *c* And 30. *d* And 23.

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

METEOROLOGICAL NOTES ON MAY, 1895.

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.—A very dry May, fine and bright, with plenty of sunshine, and warm until the 15th when a sudden fall of temp. occurred. Great heat on the 30th, followed by a TS at night. First swarm of bees on the 3rd; Swift first seen on 6th; horse chestnut in flower on 7th, Ox eye daisy on 17th, Laburnum on 19th. TSS on 23rd and 30th.

ADDINGTON.—A very fine month. R the least in May during the last quarter of a century, with the exception of 1871 when ·47 in. fell on 5 days. Max temp. the highest registered in May since 1871. A sharp TS on the night of the 30th with very vivid L but not much R.

BURY ST. EDMUNDS, WESTLEY.—A dry sunny month; temp. above the average until the 14th, then five days of cold north winds which injured the trees and hedges on the north side like exposure to fire; very hot from the 26th to the end of the month. R much wanted. T on the 12th, and distant T on the 23rd. H on 16th and 17th.

NORWICH, BRUNDALL.—Fine and warm to 14th; on the 16th a great fall in temp., the max being 72°·0 on the 14th, 58°·4 on 15th, and 44°·2 on 16th, on which day storms of H and sleet were frequent. The latter part of the month was again warm. In many parts of the county the results of the storm of the 16th were apparent to the end of the month, the north sides of the trees being covered with brown shrivelled leaves as in November, while on the south side the bright green May foliage was intact. L and T at night on 30th.

LANGTON HERRING.—There was an absolute drought of 29 days from 2nd to 29th inclusive. A fine warm month; mean temp. at 9 a.m. 56°·0, or 2°·1 above the average of 23 years. Fogs on the 13th, 14th, 24th, and 27th. TS on 30th. Hawthorn in blossom on 18th.

TORQUAY, CARY GREEN.—Rainfall 1·63 in. below the average. Mean temp. 54°·5, or 2°·7 above the average. Mean humidity 73. Duration of sunshine 298 hours 35 minutes, being 79 hours above the average; no sunless days.

POLAPIT TAMAR.—The driest May for 14 years. In addition to the drought the mouth was remarkable for the exceptional amount of sunny bright hot weather, and for the number of days on which there was very little wind. The average shade max. is 63°·9. There have been only three other months since January 1881 with less R.

STROUD, UPFIELD.—S and sleet fell on the hills on the 17th. T was heard on 22nd with H showers, and TSS occurred on 24th and 30th.

WOOLSTASTON.—An extremely dry month; the first and last parts were very hot, the middle part as cold, S falling lightly on the 17th. T with most vivid L for many hours on the 30th. Mean temp. 55°·1.

TENBURY, ORLETON.—The driest May for 47 years, and with the exception of May 1893 the warmest for 35 years, despite a week's cold weather from the 16th to the 22nd inclusive. The ther. reached 70° on 15 days and the maximum of 82°·1 on the 30th is the highest recorded in May since 1864. T on 23rd, 24th, 25th, and 30th. L on 25th and 30th.

LEICESTER, BARKBY.—A month of drought and changeable temp. First swift on 1st., first nightingale on 12th. L and T on the 9th without R, also on 30th with some R. Slight S on 20th.

MANCHESTER, PLYMOUTH GROVE.—The driest May experienced since observations commenced 29 years ago. The 30th was the hottest day in May for 29 years according to my record with the one exception of May 20th 1868, when the max temp in shade was 87°. A slight fall of S occurred in the early morning of the 17th, T and L on 24th, and T on the 30th. Mean temp. 55°·8.

WETHERBY, RIBSTON.—Hot sunshine daily; R much wanted.

WALES.

HAVERFORDWEST.—Excepting 1859—the year of great drought, when May was rainless—this is the least R in any May recorded. Great heat prevailed from the 7th to the 11th, succeeded by a sudden fall of temp. At night on the 15th it blew a gale stripping the fruit trees of their splendid bloom, and cold days and colder nights prevailed up to the 26th, when a warm period again set in. A great amount of bright sunshine and grass lands suffering much for the want of R. Wind generally N or N.E.

GOGGERDAN.—Very dry throughout the month, with bright sunshine. T and R in the neighbourhood.

SCOTLAND.

CARGEN.—Another record in 1895 has to be noted, after the coldest month ever experienced (February), we have had in May the driest month since observations commenced 36 years ago, R falling on only one day during a short T8. On no previous occasion has the R in any month been below ·10 in. Unless we have far more than the average for the next two months the water supply as far as it is dependent on springs and wells, is likely to become a serious consideration. The mean temp. for the month 53°·3 is 2°·6 above the average for May. In only three years since 1859 has a higher mean temp. been recorded, viz, 53°·7 in 1875, 54°·3 in 1889, 54°·5 in 1893. An unusually warm period prevailed during the last 11 days of the month, the mean temp. from 21st to 31st being 56°·5. The nights were generally very clear and cloudless, and radiation reduced the mean temp. below what might have been expected from the number of very warm days. Another feature was the high mean bar. 30·05 in., this pressure having been only twice exceeded in May since 1859. Vegetation unusually backward, and pastures and corn crops suffering for want of R.

JEDBURGH.—The early part of the month was, as usual, cold and ungenial, with low temp. and N.E. and E. winds. The last fortnight was mild, and vegetation progressed rapidly. All crops look well. T and L on 24th and 29th.

COLMONELL.—Rainfall 2·23 in. below the average of 19 years.

ROEBERRY.—Very dry, with a very cold week during the middle of the month. Mean temp. 49°·5.

IRELAND.

DARRYNANE ABBEY.—A fine and dry month and on the whole warm, but with a few cold days in the middle and at the end.

WATERFORD, BROOK LODGE. T and H showers on the 1st. Mean temp. 51°·9. Prevailing winds easterly.

O'BRIENSBRIDGE, ROSS.—A fine month with abundant sunshine, and the smallest R in May since 1861, when only ·51 in. fell. Cool in the evening from 15th to 21st. Great heat on 29th and 30th. Whitethorn bloom very scarce.

DUBLIN.—A beautiful month—bright and dry, without any severe night frosts. The amount of cloud was very low, only 3·7. Mean temp. 54°·3, 2°·3 above the average. Solar halos on the 3rd and 4th. Lunar halos on the 2nd, 3rd, and 9th, and an aurora on the 2nd. High winds on 3 days, attaining the force of a gale on 31st. T on 1st and 24th. H and sleet on the 1st. Slightly foggy on the 3rd and 4th.

WARINGSTOWN.—The driest May recorded.

EDENFEL.—Another month of deficient rainfall, making the total since 1st January, 9·65 in., the lowest for the like period in the 31 years during which the record here extends. Temp. above the average except during the third week, but as it did not then reach freezing point, the prospects of fruit are excellent, and the foliage is most luxuriant, but the drought is seriously affecting ordinary crops.