SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCLXXXVI.] NOVEMBER, 1889. [PRICE FOURPENCE, or 5s. per ann. post free.

THE FLOATING ISLAND IN LAKE DERWENTWATER.

By PROF. RAPHAEL MELDOLA, F.R.S.

As there still appears to be a certain amount of mystery attaching to this remarkable phenomenon, so well described by Mr. G. J. Symons in his interesting little work published last year,* I am induced to offer for the consideration of those interested in the subject some ideas which occurred to me on reading Mr. Symons's investigation, and which I have recently had the advantage of discussing with the author himself. It must be assumed that the majority of the readers of this Magazine are sufficiently acquainted with the results arrived at by Mr. Symons, to render a recapitulation of them unnecessary here.

The immediate cause of the rising of the mass of vegetable matter has been shown by the investigation to be the gases, consisting chiefly of marsh gas with a smaller proportion of nitrogen, entangled among the peat. The problem therefore resolves itself into ascertaining the source of these gases. If it could be shown with any probability that a subterranean source of the gases exists under the islands, the mystery would be at once solved, but there is unfortunately no evidence for such a belief, and it is generally admitted that it is unscientific to invoke unknown causes until all feasible explanations have failed. There is, moreover, much antecedent improbability against this view, since the emanation of marsh gas from fissures in strata as old as the Silurian is a phenomenon unknown, as far as I am aware, in this part of the world. I speak, of course, subject to correction by geologists on this point. It is true that some of the Canadian petroleum deposits occur in pre-Silurian strata, but when marsh gas can come to the surface from a petroleum deposit, it generally brings up hydrocarbon oils with it, and to my knowledge nothing of the kind has ever been observed on Derwentwater. The various theories which have been proposed to account for the phenomenon

* The Floating Island in Derwentwater, its History and Mystery, by G. J. Symons, F.R.S. Stanford.

have been so ably discussed by Mr. Symons that readers need only be referred to his work. Of these theories, the one which I hold to be the most natural, is that which attributes the flotation of the peat bed to the gases engendered by its own decomposition. This is substantially the view put forward in 1801 by "D. J. P." in the *Phil. Mag.*, vol. xi., and reiterated by Otley and Dalton in 1814-1830. The chief objections to this view, as I learn from Mr. Symons, are: 1st, that it does not explain why similar floating islands do not occur elsewhere where similar conditions, viz., a peat bed on a lake bottom, prevail; 2nd, that it fails to account for the long succession of recorded appearances of the island from 1773 down to the present time.

Respecting the first objection it must be observed that the essential (mechanical) conditions may, after all, be of very rare occurrence. What is required is a bed of peat resting on a sufficiently friable foundation to enable it to tear away from its basement when the specific gravity is sufficiently reduced by the entangled gas. This condition has been shown to exist in the Derwentwater deposit, but it cannot be assumed from this that similar conditions should be expected to prevail in other lakes. The peat bed which forms the floating island appears to be resting on a loose delta-deposit. It is not unlikely that the currents from the inflowing streams, the Lodore and the Cat Gill Beck, may keep this deposit in the necessary condition of looseness, and may prevent the peat bed from ever becoming firmly anchored to the bottom. For these reasons this first objection does not appear to me to possess much weight.

The second objection is the one which has really been instrumental in causing me to venture to touch upon the subject. It has seemed improbable to some writers that the peat should continue to evolve gas for so long a period. Thus Otley (as quoted by Mr. Symons) says that on the view that the gas is produced by the decomposition of the vegetable matter, "the process of forming gas must apparently reach a maximum and then gradually cease." Now we may fully admit this as an abstract proposition, but it seems to me quite impossible to define this maximum. There is no *à priori* reason why a deposit of peat should not go on evolving marsh gas and nitrogen for a century or for two centuries, especially when, as in the present case, the bed is added to from time to time by growth on its surface. The whole question turns upon the point as to how long a mass of vegetation decaying under water could go on evolving marsh gas, &c. Unfortunately we have very few data to furnish exact information on this point, but I have made certain calculations which I submit to the consideration of the readers of the Magazine for whatever they may be worth.

In the first place, with respect to the specific gravity of peat I can get but very scanty information, but the best authorities that I have been enabled to consult give it as about 1·2 for the denser kinds. We shall not be far wrong if we suppose that 10

cubic centimetres of peat freed from adhering water weigh 12 grammes. According to the average of numerous analyses, peat of this kind contains about 4·5 per cent. of hydrogen not in the form of water, 40 per cent of carbon, and about 1 to 1·5 per cent. of nitrogen. Supposing the whole of the hydrogen in peat to be evolved as marsh gas in the process of decay, one part by weight of hydrogen would yield four parts of this gas, so that 10 cubic centimetres of peat weighing 12 grammes and containing 0·54 gramme of hydrogen would yield 2·16 grammes of marsh gas. There is, however, no warrant for the belief that the whole of the hydrogen is converted into marsh gas, so that it will be safer to begin by assuming that only one half of the hydrogen—say 0·27 grammes—is evolved in this form. Then it will be found that this quantity of gas weighing 1·08 grammes at 0° C. and 760 mm. bar. occupies 1,500 cubic centimetres. At ordinary atmospheric temperature (15° C.) this volume becomes 1,582 cubic centimetres. The final result is that if we suppose only one half of the available hydrogen to be evolved as marsh gas, a given volume of peat would furnish over 150 times its volume of gas, so that if only one tenth of the whole quantity of hydrogen were evolved as marsh gas there would still be a volume of gas greater than that of the volume of peat decomposed. The density of marsh gas as compared with water is approximately ·0007, so that the decay of an extremely minute quantity of peat would give enough gas to float the bed.

All these considerations tend to prove that the early explanation is the correct one, and that no great stretching of hypothesis is necessary to account for the facts. The circumstance that a moderately elevated temperature is most favourable to the appearance of the island is distinctly in accordance with the view here advocated, since the decomposition of vegetable matter under water is well known to proceed most rapidly in warm weather. The only point in which the present case differs from the ordinary evolution of marsh gas in stagnant ponds is that the mass of vegetable matter is sufficiently coherent to retain the gas bubbles, and to rise and sink as a whole. The periodicity of the phenomenon simply represents the intervals of time necessary for the bed to accumulate a sufficient charge of gas to raise it from its basement. When the mass rises, the gas, relieved from the pressure of water, gradually escapes, and the island sinks till the accumulated gas again diminishes the specific gravity of the whole to the critical point of flotation. The only observable effect upon the peat bed would be that in course of time it would become slightly richer in carbon and poorer in hydrogen; in fact, just the change in chemical composition which is known to take place in the transformation of peat into lignite.

THE AUTUMN CONGRESSES.

THE BRITISH ASSOCIATION AT MANCHESTER.

(*Continued from page* 136.)

THE DETERMINATION OF THE AMOUNT OF RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—There seem to be two or three errors (typographical ?) in the important paper of Prof. Cleveland Abbe in your October number. On page 133, the heading of the last column apparently should be—

$$6 \times \sqrt{\text{alt.}}$$

and the formula in the middle of page 134 should read $\sqrt{h_1}$ as well as $\sqrt{h_2}$, *i.e.*—

$$P = c_1 + \frac{1}{\sqrt{\frac{h_2}{h_1}} - 1}\left(c_1 - c_2\right)$$

There is a further misprint in the 12th line of page 135, for "deducted" read "deduced."—Yours truly,

T. W. BACKHOUSE.

[Mr. Backhouse is, we believe, perfectly right.—ED.]

ATMOSPHERIC ELECTRICITY.

A paper on "Atmospheric Electricity," by Prof. L. Weber was read, in which he gave results of experiments made by flying kites and by sending up balloons to which wires were attached leading to a galvanometer whose other terminal was put to earth. The results were given only for twelve bright summer days on which there were no clouds; the results on those days on which clouds prevailed having brought in various perturbations are reserved for discussion on a future occasion. The intensity of the currents was plotted, and it was found that the higher the kite went the more intense the current became. Up to 300 ft. the current was in a negative direction.

Prof. C. Michie Smith also read a paper entitled "Notes on Atmospheric Electricity, and the use of Sir W. Thomson's Portable Electrometer." In the course of his remarks he said that usually they had in Madras during September frequent magnificent displays of sheet lightning, and he had often made electrometer observations from the top of his house while these displays were in progress. In some cases an evident effect was produced on the electrification of the air, but in general it was found that the electrification was normal. This pointed to the conclusion that so-called sheet lightning might be divided into two classes. There was the reflection of distant lightning seen on the clouds or on the sky, but there was also, and it could be easily distinguished from the former, a series of discharges going on between two neighbouring masses of cloud.

These discharges often took the brush form. At other times, fine flashes might be seen lighting up the whole mass of the cloud, and at times a large series of discharges almost parallel and simultaneous pass between the two cloud banks. Such discharges taking place at a considerable distance did not sensibly affect the electrometer. On the other hand, when the sheet lightning was simply the reflection from distant flashes, the electrometer was usually strongly influenced. From his own experience of thirteen years of the portable electrometer, he found that the instrument must be very differently treated in damp tropical climates to what was necessary in this country. The observer must be content with much less complete insulation. In the first place, the pumice must be charged with a much larger quantity of acid—as much as it would absorb without showing a moist surface. This involved more frequent drying, and he found that about once a fortnight was long enough to leave it. The greatest difficulty, however, was in charging the instrument at all. It was almost hopeless to attempt it with the small electrophorus supplied with it, and even when an electrical machine of any kind was used the greatest care was required in drying the charging end. Recharging was necessary every three or four days. He mentioned these things as he found that the neglect of the precautions had caused many people to think that the use of the portable electrometer in India was impossible.

SUNSHINE AND RAINFALL AT BEN NEVIS.

The registrations of the sunshine recorder at Ben Nevis Observatory showed 970 hours of sunshine during the year, the smallest number of hours for any month being 8 for November, and the largest 250 in June, being nearly half the possible sunshine. The number of hours for the four years now observed beginning with 1885, were 680, 576, 898, and 970. The contrast of the sunshine of 1886 with that of 1888 is thus very striking. The amount of the rainfall for the year was 132·46in., the month of least rainfall, 3·76 in., being June, and the greatest, 20·60 in., being November. The number of days on which precipitation was nil, or less than the hundredth of an inch, was 118. The number of rainless days for the three last years have been 159, 128, and 118. From all the observations yet made, it is seen that a fall, equalling at least 1·00 a day, has occurred on an average of one day in nine. Atmospheric pressure was this year again above the annual average, the mean at sea-level being 29·889, or 0·055 higher. The lowest mean at the observatory, 25·035 in., occurred in March, and the highest, 25·590 in., in September; the difference being 0·555 in. At sea-level at Fort William, the extreme monthly means were 29·636 in. in November, and 30·132 in September; the difference being 0·496 in.

BLACK BULB *IN VACUO*.

Prof. McLeod, F.R.S., in a paper on the black-bulb thermometer *in vacuo*, concludes that the black bulbs should be as small as possible,

and very little of the stem blackened, and also that the case should be as thin as is consistent with strength.

DARK LIGHTNING FLASHES.

Mr. A. W. Clayden read a paper on dark flashes of lightning. The author exhibited a negative taken on June 6th last, which shows several reversed images of lightning-flashes. He described a series of experiments which he had carried on with the object of discovering whether the phenomenon could be imitated in the laboratory. The steps in the investigation were illustrated by a series of negatives showing photographs of electric sparks. The conclusions arrived at are, that photographic images of electric sparks can be reversed by the action of diffused light. Reversal is only produced when the exposure to diffused light is subsequent to (or possibly simultaneous with) exposure to the image of the spark. If the plate is first acted upon by diffused light, the sparks give a direct image unless the action has been considerable, in which case they seem to make no impression.

CONGRÈS INTERNATIONAL MÉTÉOROLOGIQUE.

In the notice of the programme of the above congress which we printed in July last we predicted that it could not be carried out, and our prediction was fulfilled. But nevertheless the Congress must be pronounced to have been a success, both for the eminence of many of the men who attended it, and because of the excellence of some of the papers. We have not a list of the members, but if we name in alphabetical order some of those who accepted the invitation of the French Meteorological Society, it will be seen that the gathering was an interesting and probably useful and important one :—

R. Billwiller...Switzerland
L. Cruls.....Rio de Janeiro
G. G. Davis ...Buenos Aires
M. Dechevrens Zi Ka Wei, Shanghai
F. Denza .....Turin
B. A. Gould ...Buenos Aires
S. Hepites ....Bucharest
H. H. Hildebrandsson..Upsala
A. Paulsen.....Copenhagen
A. L. Rotch ....Blue Hill, U.S.A.
G. J. Symons.....London
Y. Wada .....Tokio, Japan.

Of French meteorologists nearly all the leading men were there.

The inaugural meeting was held in the Trocadéro, M. le Prof. Mascart opening the proceedings by welcoming the members on behalf of the Minister of Public Instruction. Mr. Symons then proposed that M. Renou, director of the Observatory at Parc St. Maur and President de la Soc. Mét. de France, be elected president of the Congress. This was carried by acclamation, and M. Renou took the chair and delivered an address. Subsequently the vice-presidents and other officers were appointed and the meeting was closed. The subsequent sectional meetings were held in the rooms of the Physical Society, 44, rue de Rennes.

We do not intend to report upon the work done, because we know that one of the editors of the *American Meteorological Journal* took very careful notes and that an interesting abridgment will appear in that journal. There is no advantage in printing twice where once will suffice, and we therefore advise our readers to buy the November and December numbers of, if they are not already subscribers to, that publication.

And we have another suggestion to make, but as it involves the expenditure of half a sovereign, everybody may not be willing to adopt it. The papers sent in were both numerous and important, more so than was anticipated when the arrangements were originally made and the membership fee, entitling the member to a copy of all the reports, was fixed at 12 francs. It is doubtful whether the subscriptions already received will meet the cost of all this printing, and as no more copies of the reports will be printed than are subscribed for, those who desire to help a good work, and also to receive a valuable report should send a money order on Paris for 10s. to M. E. Renou, Prés. Soc. Mét. de France, 7, rue des Grands Augustins, Paris.

The ordinary meetings commenced on Friday, September 20th, and continued until the 25th. Four special visits were made—(1) to the Bureau Central, where Prof. Mascart not only explained all the ordinary working of his establishment now at last very commodiously housed, but also showed several charming experiments illustrative of the formation and action of whirlwinds, waterspouts, and dust storms; (2) to the remarkable collection of self-recording apparatus shown in the Exposition by MM. Richard Frères; (3) to the Meteorological Observatory at Parc St. Maur, where the Congressists were received by M. Renou, and subsequently shown the magnetic instruments by M. Mourreaux; (4) to the private part of the Eiffel Tower, at the extreme top of which MM. Richard Frères have established quite a meteorological observatory.

THE SANITARY INSTITUTE.

The meetings of this body show one curious feature—they are always best in Cathedral cities. It is not for us to spend much time in explaining or moralizing about the fact. It may be due to the desire of the clergy to render healthier and happier the homes of their poorer brethren; it may be due to the fact that generally the struggle for life—or shall we say for money—is less fierce than in other towns; we know not, we chronicle the fact, and pass on to the meteorology. The section for Meteorology, Chemistry, and Geology was fortunate in having for president one of the oldest medical officers of health, and a past president and the council secretary of the Royal Meteorological Society. Dr. Tripe's Address, entitled "Winds, with some remarks on their sanitary effects," dealt not only with the great general movements of the atmosphere, the trades, &c., but also with the exceptional ones, such as the Simoon,

the Helm, the Southerly Burster, the Föhn, the Sirocco, Khamsin, Harmattan, Solano, and others. Tornadoes, the relation between velocity and pressure, Beaufort's scale, Krakatoa, the Eiffel Tower, the distribution of seeds, waterspouts, showers of fish, fog, the distribution of small-pox, the sites of hospitals, and many other subjects, were dealt with in this able and comprehensive address, which of course will be printed *in extenso* in the Transactions of the Institute.

The only other strictly meteorological paper was by Surgeon-Major Black, who gave an interesting epitome of the results of observations of air and sea, made by him during several recent visits to the sea-side towns of Brighton, Folkestone, Hastings, Boulogne, and Havre. Dr. Black did not put forward his observations as other than those which any visitor could make, but his results are interesting, if not strictly comparable, and we do not remember having seen the question of sea-bathing in relation to the temperature of sea and of air so ably discussed before.

CONGRÈS INTERNATIONAL D'HYDROLOGIE ET DE CLIMATOLOGIE.

It is said that there were 68 Congresses held in Paris this year; there were certainly too many, and it may have been to that, to cold, wet weather, or to lateness in the year, that the woeful contrast between the Biarritz and the Paris Congress was due. Instead of the hundreds assembled at Biarritz, the total list of members (including Parisians, and in some cases the wives and daughter) up to Oct. 3rd was only 79, and at the sectional meetings an audience of half-a-dozen was unusually large. To some extent quality atoned for numbers, as the following list will show:—Antoine d'Abbadie, Bonkowski-Bey (*Constantinople*), Bouloumié (*Vittel*), Donaciano Moralès (*Mexico*), Duhourcau (*Cauterets*), Durand Fardel, Faralli (*Florence*), Fines (*Perpignan*), Gandy (*Bagneres de Bigorre*), Labat, Lemoine, Leudet, Marcailhou d'Aymèric (*Ax*), Meunier (*Eaux Bonnes*), Poskin (*Brussels*), de Ranse, Renou, Rotch (*Blue Hill*), Schlemmer, Sénac Lagrange (*Cauterets*), de Valcourt (*Cannes*), Wada (*Japan*), Winternitz (*Vienna*).

It could, of course, not be otherwise than profitable to have the advantage of meeting men of such standing, but we are by no means sure that they would all feel gratified at contemplating the papers and discussions, good though some of them were.

The excursion to the Vosges was abandoned, the weather being unfavourable and late autumn having set in.

It was understood that the Italian delegates invited the Congress to assemble in Rome in 1892.

FINE METEOR DOUBLY OBSERVED.

To the Editor of the Meteorological Magazine.

SIR,—There was a magnificent meteor seen here on Monday, November the 4th, towards eight o'clock. I did not see it myself, but from the descriptions it must have been a fine sight. Many were startled by the sudden light shining on the ground, and looking up had just time to see the cause disappearing. My son was fortunate enough to see all its course for a long way across the sky.

Yours truly,

J. MATHISON.

Addington, Winslow.

To the Editor of the Meteorological Magazine.

SIR,—Did you see a very fine meteor at 7.55 p.m. on November 4th, in the N.W. at an altitude of 45°? The sky was completely overcast, so that no stars were visible; the light of the moon could be seen, but not its outline, and the meteor shone through the clouds like a small moon, and was followed by a very brilliant train or attendant meteor. Had the sky been clear, I think that it would have been magnificent.—Yours faithfully,

E. WHITE WALLIS.

49, *Clifton Hill, St. John's Wood, N.W., 5th November*, 1889.

A COLD PERIOD.*

To the Editor of the Meteorological Magazine.

SIR,—The fall in temperature which has taken place in parts of Europe suggests the question, has a similar fall taken place in the Southern Hemisphere? And as a contribution to the answer I send a diagram *(see frontispiece)* showing the mean temperature at Sydney, 1856 to 1888 inclusive, and the maximum and minimum for the same period. It will be seen that as far as Sydney is concerned the past four years have a mean 0°·3 above the average, and 1885 was the hottest year since 1867. Had the question been asked here in 1872, the answer would have been that the temperature had fallen steadily for the previous four years; if in 1878, that there had been a steady increase in temperature for the previous six years.†

Yours very truly,

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

Sydney Observatory, 26th August, 1887.

---

* See *Met. Mag.*, vol. xxiv., pp. 17 & 72.

† From 1856 to 1865 inclusive the exposure of the minimum was different from what it has been since, and the readings have been corrected to accord with those taken for the past twenty-three years, during which period thermometers have been exposed in the same shed.

REVIEWS.

Lehrbuch der Meteorologie für Studierende und zum gebrauch in der Praxis. Von DR. W. J. VAN BEBBER. 8vo., viii.–392 pages, 120 woodcuts, and 5 plates. Stuttgart : F. Enke, 1890.

WE protest against the custom of dating books wrongly, but as the bad example was, we believe, set by English publishers, it would be unfair to hold Herr Enke responsible, though he has dated an 1889 book 1890, and the evil will cure itself as the dates will soon become so unreliable as to pass without notice.

Taken altogether this is a very good book, and we cannot quote any English one similar to it. Of course, it is unequal ; meteorology is becoming too large a subject for anyone to be equally competent in all its branches. The author of the *Handbuch der Ausübenden Witterungskunde* is naturally strong upon synchronous observations and their application to weather forecasting, and his love of facts has led him to give a host of useful tables, many of them original, and the others judiciously selected. He is, however, too kind ; when he knows that people are doing wrong, he says nothing about it, shows that he knows it, but says nothing. For instance, on p. 125 he recognizes that the factor for Robinson's cups is considerably less than 3·0, and that therefore all published wind velocities are too great; but he does not express any opinion upon the wisdom of continuing to publish figures which all well-informed persons know to be wrong. So also on pages 152 to 154 he shows that he is well aware that the force of wind increases with height above the ground, and yet he says nothing as to the absurdity of meteorological directors allowing architectural considerations to determine at what height their anemometers should be. As it is, there are hardly two anemometers in Europe fairly comparable. It is strange to observe how terribly weak Dr. van Bebber is respecting instruments. His (Fig. 2), a Rutherford max. and min., such as was used in this country last century, would (as regards the max.) now and for thirty years past, have found its only proper place on a rubbish heap. We have not seen so bad an instrument at any station in France or England for at least 20 years. It is very curious to find such old-fashioned and defective apparatus engraved in the same book with some of Richard's best instruments, and in which other portions are of the highest character, and embody the results of the very latest researches, such as the chapters on "Cyclonic and Anti-Cyclonic Weather," and on "Weather Types." There is on the last page a funny illustration of the well-known tendency to make a second error if you try to correct one. On p. 234, the author (who does not often quote except from German sources) mentions twice Professor Osborne Reynolds as "Reynold" ; he has noticed this trivial error in the *Berichtigungen*, but says there that it should be "Reynholds."

We notice that of the numerical tables some begin the year with December, some with January. We hope that this merely arises from some being copied from older works. Surely Dr. van Bebber

does not intend to oppose the decision of the various congresses; if so, it will be for the official meteorologists who attended at Vienna, Rome, &c., to deal with the matter. We represent only the outside public, but on their behalf feel bound to protest against two sorts of year being used in one book.

In wie weit ist das heutige Klima Konstant. Von Prof. DR. E. BRÜCKNER. 8vo., 16 pages. Berlin; D. Reimer, 1889.

THIS is a short paper, read before the German Geographical Society, on the very important subject of the variability of the earth's climate It seems to us that the author rather changes the subject as he goes on. He seems to start with the idea of a change running during many centuries, quoting, *e.g.*, the prehistoric warm vegetation of the present Polar regions, and then drifts down to a discussion of a dry period occurring in some countries in 1856–60, in others 1861–65, and in others 1866–70. He tells us, however, that the large mass of data which he has collected will shortly be printed *in extenso*, and we therefore refrain from doing more than calling attention to the present paper and to the forthcoming book. We ought to mention that the author has not confined his researches to rainfall, but has studied the records of glaciers, of temperature, of the levels of lakes, of the freezing of rivers and of harbours, as well as those of the vintages, some of which go back hundreds of years. Dr. Brückner has set himself a Herculean task, and it will be to everybody's advantage if he can accomplish it.

Ergebnisse der Meteorologischen Beobachtungen im Systeme der Deutschen Seewarte, 1876–1885. Large 4to., 42 pages; Hamburg, 1889.

Dr. Neumayer here gives us abstracts for the two lustra (1876–80 and 1881–85) as well as for the decade 1876–85 of the observations at nine coast stations in Northern Germany. The observations seem good, accurately reduced and printed, but we do not understand why the years begin with December. Surely that is not following the rules of the Vienna Congress. Why, even in this paper Dr. Neumayer says, "Nach den Beschlüssen des Wiener Kongresses beginnt das Beobachtungs-Jahr mit dem 1 Januar."* and yet he, a member of the Vienna Congress, breaks its rules all through this book. Doubtless there is some explanation of this apparent contradiction, and we shall be happy to publish it if any one will tell us what it is.

The mean sea level pressures agree very closely, all being between 29·922 in. and 29·953 in. The mean temperatures range from 44°·3 at Memel to 47°·4 at Borkum; the absolute max. was 93°·6 at Neufahrwasser, and the absolute minimum was —13°·5 at the same station, giving it therefore a range of 107°·1. The mean amount of cloud is generally between 6 and 7 on the usual scale of 0-10. The mean rainfall is least (18·47 in.) at Warnem-Wustrow and greatest (25·85 in.) at Keitum. Large daily falls are rare, but there is one case of 3·37 in. in 24 hours on June 17th, 1879, at Hamburg.

---

* According to the decision of the Vienna Congress, the observing year begins with the 1st of January.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1889.

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.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0–10
England, London	63·9	19	32·4	16	54·4	39·5	39·9	81	104·4	25·1	2·06	20	6·9
Malta	79·4	24	45·7	1	66·3	52·8	50·8	77	131·3	40·5	·42	2	3·8
Cape of Good Hope.	78·0	26	49·1	17	68·8	55·7	...	...	...	...	5·12	10	6·4
Mauritius	82·5	4, 7	69·4	15, 30	80·3	72·1	68·0	78	133·3	60·7	4·65	23	5·8
Calcutta	101·6	25	66·6	3	96·4	76·7	73·0	60	159·2	59·2	1·31	4	2·1
Bombay	91·4	15	72·0	10	88·1	77·3	74·0	75	146·8	63·0	·00	0	1·9
Ceylon, Colombo	93·0	3	74·3	29	89·5	76·6	73·5	78	151·0	72·0	15·18	23	5·6
Melbourne	87·9	2	37·2	28	69·7	52·1	51·1	72	136·2	29·5	3·60	7	6·1
Adelaide	82·5	30	49·6	7, 28	70·6	55·4	53·4	71	136·7	39·3	5·65	15	6·3
Wellington	70·0	4	40·0	14	63·4	49·0	47·7	73	123·0	31·0	1·32	7	3·6
Auckland	74·0	8	46·0	24	67·7	53·3	52·5	75	138·0	40·0	1·04	13	5·8
Jamaica, Kingston	92·9	28	69·6	23	89·0	72·9	71·4	71	...	...	·91	...	...
Trinidad	95·0	29	65·0	15	91·0	70·4	76·1	81	160·0	58·0	1·05	...	...
Toronto	67·3	24	25·5	1	51·7	34·9	34·1	68	...	19·8	1·59	11	5·8
New Brunswick, Fredericton	69·0	26	19·9	7	53·4	33·0	33·9	63	...	...	2·78	10	6·5
Manitoba, Winnipeg	79·2	25	13·0	3	54·9	28·7	30·3	65	...	...	·99	9	4·1
British Columbia, Victoria	66·0	7, 8	32·0	19	60·3	40·7	...	...	...	...	1·83	8	...

Remarks, April, 1889.

Malta.—Mean temp. 58°·4; mean hourly velocity of wind 13·2 miles. The Sea temp. rose from 59°·8 to 62°·2. TS on 6th. J. Scoles.

Mauritius.—Mean temp. of air 0°·6, of dew point 0°·1, and R 0·67 in. below their respective averages. Mean hourly velocity of wind 12·0 miles, or 1·0 above average; extremes 25·8 on 14th and 2·0 on 29th. Prevailing winds E.S.E. and E.

C. Meldrum, F.R.S.

Colombo.—Thunderstorms occurred on 17 days, and L was seen on 10 other days.

J. C. H. Clarke, Lt.-Col. R.A.

Melbourne.—Mean temp. of air, 1°·8 of dew point 1°·7, mean amount of cloud 0·2, and R 1·37 in. above average; humidity same as average. Prevailing winds W. and N.; strong on 6 days. Heavy squalls from W. on 7th and 8th. Heavy dew on 14 days. L on the 2nd. R. L. J. Ellery, F.R.S.

Adelaide.—Mean temp. 1°·4 below the average. The principal features of the month were the two heavy general rainfalls and floods on the 1st and 15th, which caused a great deal of damage, and resulted in loss of life by drowning. The total R for the past four months is the greatest for the same period since the foundation of the Colony. C. Todd, F.R.S.

Wellington.—Generally fine weather, and a small R; showers in the middle and at the end of the month. Prevailing wind N.W., strong on 9 days. Slight earthquake on the 8th. Mean temp. 0°·8 below the average. R less than half the aver age.

R. B. Gore.

Auckland.—A fine and dry but cool month. Bar. pressure considerably above the average of 22 years. Mean temp. about 1° below the average. R not one-third of the average. T. F. Cheeseman.

Trinidad.—R ·85 in. below the average of 25 years. H. C. Hart.

SUPPLEMENTARY TABLE OF RAINFALL, OCTOBER, 1889.

[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 Hall.	5·88	XI.	Castle Malgwyn	5·85
,,	Margate, Birchington...	5·05	,,	Rhayader, Nantgwillt..	7·28
,,	Littlehampton	6·26	,,	Carno, Tybrith	6·21
,,	Hailsham	8·21	,,	Corwen, Rhug	5·62
,,	Ryde, Thornbrough	7·69	,,	Port Madoc	4·93
,,	Alton, Ashdell.....	5·09	,,	I. of Man, Douglas	3·77
III.	Oxford, Magdalen Col...	2·36	XII.	Stoneykirk, Ardwell Ho.	4·29
,,	Banbury, Bloxham	3·00	,,	New Galloway, Glenlee	5·71
,,	Northampton	3·07	,,	Melrose, Abbey Gate...	4·79
,,	Cambridge, Beech Ho...	...	XIII.	N. Esk Res. [Penicuick]	4·45
,,	Wisbech, Bank House..	3·76	XIV.	Ballantrae, Glendrishaig	4·66
IV.	Southend	3·79	,,	Glasgow, Queen's Park.	2·69
,,	Harlow, Sheering	3·59	XV.	Islay, Gruinart School..	4·63
,,	Rendlesham Hall	5·17	XVI.	Dollar.....	3·83
,,	Diss	3·30	,,	St. Andrews, Pilmour Cot	2·87
,,	Swaffham	2·76	,,	Balquhidder, Stronvar..	6·11
V.	Salisbury, Alderbury...	3·74	,,	Dunkeld, Inver Braan..	4·49
,,	Warminster	3·67	,,	Dalnaspidal H.R.S. ...	5·53
,,	Bishop's Cannings	2·45	XVII.	Keith H.R.S.	2·51
,,	Ashburton, Holne Vic....	7·35	,,	Forres H.R.S.	2·39
,,	Hatherleigh, Winsford.	3·61	XVIII.	Strome Ferry H.R.S....	3·81
,,	Lynmouth, Glenthorne.	6·82	,,	Fearn, Lower Pitkerrie.	2·93
,,	Probus, Lamellyn	7·22	,,	Loch Shiel, Glenaladale	5·56
,,	Launceston, S. Petherwin	5·28	,,	N. Uist. Loch Maddy ...	3·82
,,	Wincanton, Stowell Rec.	4·66	,,	Invergarry	2·91
,,	Taunton, Lydeard Ho...	4·82	,,	Loch Ness, Drumnadrochit	2·31
,,	Wells, Westbury.....	3·92	XIX.	Lairg H.R.S.	1·00
VI.	Bristol, Clifton	2·26	,,	Forsinard H.R.S.	...
,,	Ross	3·77	,,	Watten H.R.S.	3·07
,,	Wem, Clive Vicarage ...	3·54	XX.	Dunmanway, Coolkelure	6·10
,,	Cheadle, The Heath Ho.	3·08	,,	Fermoy, Gas Works ...	4·02
,,	Worcester, Diglis Lock	2·70	,,	Tipperary, Henry Street	4·06
,,	Coventry, Coundon	2·61	,,	Limerick, Kilcornan ...	2·91
VII.	Ketton Hall [Stamford]	3·24	,,	Miltown Malbay.....	3·80
,,	Grantham, Stainby	2·59	XXI.	Gorey, Courtown House	6·33
,,	Horncastle, Bucknall ...	4·30	,,	Navan, Balrath	4·41
,,	Mansfield, St. John's St.	3·94	,,	Mullingar, Belvedere ...	5·29
VIII.	Neston, Hinderton	2·91	,,	Athlone, Twyford	4·59
,,	Knutsford, Heathside ...	2·90	,,	Longford, Currygrane...	4·55
,,	Lancaster, South Road.	4·99	XXII.	Galway, Queen's Coll...	4·00
,,	Broughton-in-Furness ..	7·18	,,	Clifden, Kylemore	7·02
IX.	Wakefield Prison	3·53	,,	Crossmolina, Enniscoe..	7·23
,,	Ripon, Mickley	4·14	,,	Collooney, Markree Obs.	6·15
,,	Scarborough, West Bank	5·13	,,	Ballinamore, Lawderdale	4·63
,,	East Layton [Darlington]	5·30	XXIII.	Warrenpoint	3·92
,,	Middleton, Mickleton..	4·89	,,	Seaforde	3·88
X.	Haltwhistle, Unthank..	3·80	,,	Belfast, New Barnsley .	4·02
,,	Shap, Copy Hill	7·05	,,	Bushmills, Dundarave...	3·78
XI.	Llanfrechfa Grange	3·08	,,	Stewartstown	3·08
,,	Llandovery	5·31	,,	Buncrana	5·81

OCTOBER, 1889.

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	Greatest Fall in 24 hours. Date	Days on which ·01 or more fell.	TEMPERATURE Max. Deg	Max. Date	Min. Deg.	Min. Date	No. of Nights below 32° In shade.	No. of Nights below 32° On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	3·75	+ 1·05	·73	19	22	60·6	16	35·5	13	0	1
II.		Maidstone (Hunton Court)...	5·09	+ 2·63	·75	10	21	...	...	...	...	...	...
,,		Strathfield Turgiss	3·16	+ ·42	·44	20	23	60·3	2	30·1	14	5	10
III.		Hitchin	3·41	+ 1·23	·69	19	23	57·0	7 *b*	35·0	13	0	...
,,		Winslow (Addington)	3·10	+ ·48	·41	11	21	60·0	10 *c*	30·0	14	2	5
IV.		Bury St. Edmunds (Westley)	4·35	+ 2·32	·64	22	22	...	...	...	...	...	...
,,		Norwich (Cossey)	3·02	+ ·69	·50	16	17	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	4·33	...	·52	18 *a*	22	59·0	2 *d*	39·0	13	0	...
,,		Barnstaple	5·59	+ ·14	·90	4	24	60·0	1 *e*	...	...	...	...
,,		Bodmin (Fore Street)	7·52	+ 1·30	1·56	18	26	...	...	...	...	...	...
VI.		Stroud (Upfield)	2·45	— ·56	·52	19	23	68·0	21	32·0	12 *g*	2	...
,,		ChurchStretton(Woolstaston)	4·01	— ·59	·66	27	29	58·0	5	37·0	26	0	3
,,		Tenbury (Orleton)	3·21	— ·03	·61	27	25	61·2	17	30·0	14 *f*	6	10
VII.		Leicester (Barkby)	2·99	+ ·64	·41	27	27	60·0	2	29·0	13	4	9
,,		Boston	3·10	+ 1·07	·95	16	24	60·0	21	31·0	14	1	...
,,		Hesley Hall [Tickhill].....	2·99	...	·42	11 *i*	25	59·0	14	30·0	11	4	...
VIII.		Manchester(PlymouthGrove)	3·11	— 1·25	·53	7	21	58·0	21	34·0	10	0	3
IX.		Wetherby (Ribston Hall) ..	3·82	+ ·46	·56	12	19	...	...	...	...	...	...
,,		Skipton (Arncliffe)	8·59	+ 1·33	1·72	22	22	59·0	1	37·0	5	0	...
,,		Hull (People's Park)	3·97	+ 1·17	·78	16	24	...	...	...	...	...	...
X.		North Shields	4·40	+ 1·89	·80	12	24	58·0	6	36·0	11	0	0
,,		Borrowdale (Seathwaite).....	13·77	— 2·78	2·43	6	21	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	4·21	— 1·02	·62	19	23	...	...	...	...	...	...
,,		Haverfordwest	4·75	— 1·70	·98	18	24	59·9	5	28·5	13	4	7
,,		Plinlimmon (Cwmsymlog) ...	7·94	...	1·22	4	21	..	...	...	...	...	...
,,		Llandudno.....	3·36	— 1·23	·57	6	20	59·2	7	37·5	25	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	5·51	— ·20	·98	6	21	58·6	5	30·0	26	1	...
,,		Jedburgh (Sunnyside).....	4·74	+ 2·07	·67	12	26	55·0	11	33·0	14	0	...
XIV.		Old Cumnock	3·91	— 1·25	·97	6	20	58·0	16	23·0	25	10	...
XV.		Lochgilphead (Kilmory).....	5·56	— 2·76	·95	6	16	...	...	...	...	...	...
,,		Oban (Craigvarren)	5·24	...	·90	10	18	57·0	16	33·2	28	0	1
,,		Mull (Quinish).....	5·26	...	·77	31	14	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·50	— ·81	·50	5	18	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	2·70	— ·47	·50	4	21	60·3	5	32·2	29	0	...
XVII.		Braemar	3·58	— ·90	·61	19	22	55·0	2	24·3	14	7	16
,,		Aberdeen (Cranford)	3·71	...	·58	17	25	60·0	11	30·0	28	4	...
XVIII		Lochbroom	4·01	...	1·25	7	15	...	...	...	...	...	...
,,		Culloden	2·36	+ ·07	...	...	...	55·0	6, 30	27·0	25	6	21
XIX.		Dunrobin	3·12	...	·81	7	12	56·5	1	32·0	28	1	...
,,		S. Ronaldsay (Roeberry).....	3·38	— ·30	·49	9	20	53·0	5	40·0	25 *h*	...	...
XX.	IRELAND.	Cork (Blackrock)	3·68	— 1·06	·86	18	20	62·0	16	30·0	28	2	..
,,		Dromore Castle	4 94	...	·84	6	21	67·0	1	30·0	23	...	...
,,		Waterford (Brook Lodge) ...	5·05	...	2·06	18	24	61·0	2	30·0	14	2	..
,,		O'Briensbridge (Ross)	2·96	...	·53	18	20	57·0	1, 2	32·0	25 *h*	4	...
XXI.		Carlow (Browne's Hill)	5·77	+ 1·66	1·25	18	28	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	4·85	+ 1·43	·94	19	22	57·4	7	35·2	14	0	4
XXII.		Ballinasloe	4·43	·00	1·12	18	23	54·0	15	28·0	28	8	...
XXIII		Waringstown	3·52	— ·09	·64	4	25	60·0	2, 10	29·0	23	7	14
,,		Londonderry (Creggan Res.).	4·46	...	·87	6	23	...	...	...	...	...	...
,,		Omagh (Edenfel)	4·42	+ ·10	·75	3	20	55·0	1, 2 *f*	31·0	24	2	7

a And 19. *b* And 8, 17. *c* And 15, 17. *d* And 7, 11, 15, 16. *e* And 16, 29. *f* And 15. *g* And 13. *h* And 26, 27, 28. *i* And 27.

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

METEOROLOGICAL NOTES ON OCTOBER, 1889.

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.—During the month the weather was changeable, with frequent R storms. On the whole the temp. was high and the atmosphere damp and muggy, with only a few days of fine weather with strong and drying winds.

ADDINGTON.—The month was characterised by frequent R, very little frost, and at times a very low barometer, particularly on the 7th, 9th, 19th, 20th, and 21st. Thunder on 3rd and 20th; heavy gale on 26th and 27th.

BURY ST. EDMUND'S, WESTLEY.—The total R for the month has been exceeded only four times in October since 1857. During a severe TS on the 3rd the church tower was struck by L and much injured.

LANGTON HERRING.—This was the wettest month since September, 1883, and the mean temp. was 0°·9 below the average. L on the 11th.

WOOLSTASTON.—A pleasant autumn month, though there were only two days without rain. There was a severe gale on the 7th. Mean temp. 47°1.

ORLETON.—A cold, cloudy, damp, and rainy month, with a mean temp. about 2°·2 below the average of 28 years, although the first 9 days were a little warmer than the average. The nights then became cold and frosty till the 15th, after which there was generally a cold, cloudy sky, with R every day, but not in large falls. Fogs occurred frequently. A solar halo was seen on the 14th and fine rainbows on the 17th, 19th, and 22nd. A storm passed over on the 8th, with some L and T, and distant T was heard on the 10th; on the 17th a strong gale blew. The bar. was generally low and unsteady during the latter half of the month.

LEICESTER, BARKBY.—An unusual number of days on which R fell, but no great bulk of R. T on the 3rd, 10th, and 20th; very few frosts. Swallow seen on 25th. Mean temp. 46°·2.

MANCHESTER, PLYMOUTH GROVE.—During the month there were only about ten days of fine autumn weather, the remainder being wet, damp, and gloomy. Dense fog on the 11th and 17th. Mean temp. 47°·5.

HULL.—With the exception of the 8th to 10th, 13th and 14th, 18th and 19th, and 29th to 31st, the weather during the month was wet, with frequent mists or fogs.

WALES.

HAVERFORDWEST.—There were a great many beautiful days for although R was recorded on so many, much of it fell at night. Temp. about the mean. Very stormy on the 7th. A fine frosty period occurred from 10th to 14th, followed by a week of very wet weather. Another frosty period occurred from the 23rd to 26th, and the month ended with damp and mildness.

SCOTLAND.

CARGEN.—A very wet and unsettled month. Mean temp. 46°·4, or 1°·7 below the average. Easterly winds prevailed for 19 days. Sunshine 20 hours less than the average. The beautiful appearance in the sky at sunrise showing bands of prismatic colours, as described in December, 1884, was seen on one or two mornings. T and L on 8th.

JEDBURGH.—A month of almost daily R. Trees shed their leaves with unusual rapidity.

MULL QUINISH.—A very fine month, excepting from 4th to 10th and the last three days.

LOCHBROOM.—A wonderful mixture of good, bad, and indifferent weather,

but there were many fine days and frosty nights. A very heavy storm with heavy R occurred on the 7th, followed by high floods, and the month closed with another great gale.

INVERNESS, CULLODEN.—The month was generally fine, little R falling after the 9th.

IRELAND.

CORK.—Fully two-thirds of the month was cool, cloudy and dark. A strong gale with heavy R blew on 17th and 18th, and there was much sheet L at night on the 21st. Temp. nearly two degrees below the average.

WATERFORD.—R ·88 in. above the average. Mean temp. 47°·5. Swallows seen on the 15th, and starlings on the 20th. S.W. gale on 30th.

O'BRIANSBRIDGE, ROSS.—R nearly every day until 20th; then one week of fine bright weather, with slight frosts. A heavy gale blew from S.W. on the night of the 6th, uprooting large trees.

DUBLIN.—A cold, rainy, squally month, W. and S.W. winds prevailing at first, while E. and N.E. winds held from 18th to 29th. A gale of exceptional violence blew on the night of the 6th, the wind rising S.S.E. and subsequently veering to W. and W.N.W. There was another less destructive gale on the night of the 31st.

EDENFEL, OMAGH.—With the exception of the first two days and the fourth week—which were ideal autumn weather, clear dry and crisp—the month was persistently wet and unsettled, culminating on the nights of the 6th and 31st in gales of considerable violence; the former expended its greatest force to the south, and the latter to the north, of this station.

CLOUD PICTURES.

Many of our readers are aware that for years past Prof. Hildebrandsson, of Upsala, has devoted great attention to the study, the classification, and the photographic representation of clouds. Some years since he brought out a limited edition of a photographic atlas of clouds, which is still in great request. He is now about to issue a series of twelve chromolithographs reproducing oil paintings, of the principal forms of cloud, by Swedish and by German artists, and which paintings have been repeatedly retouched by the artists in consultation with Professors Hildebrandsson, Neumayer, and Köppen, and with Mr. Weilbach, of Copenhagen.

The chromolithographs will each be 12 inches by 9 inches (without reckoning the margin of the mounts); there will be twelve of them, and they will be accompanied by short explanations in French, German, and English.

As a grant in aid of the cost has been obtained, sets will be supplied by the publisher, G. W. Seitz, of Hamburg, at twelve shillings each set, or if 25 sets be ordered, at ten shillings per set.

We hope that for the credit of their country, for their personal pleasure, and for their instruction, several of our readers will treat themselves to a copy. They can either apply direct to the publisher, or, if they prefer it, we will do so, and may thereby save the 2s. per copy—though as there will be carriage to pay, the 2s. may dwindle to 1s., or become invisible.