Symons's

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THE TRANSVAAL METEOROLOGICAL SERVICE.

We have been favoured with the following authoritative account of the new Meteorological Service of the Transvaal, the Director of which is Mr. R. T. A. Innes. It is extremely gratifying to find how energetically the work is being carried on, and we feel sure that meteorologists in all countries will read these notes with interest and pleasure :—

In November, 1902, the Transvaal Government decided to establish a Meteorolgical department. The Director of the new department entered on his duties in April, 1903. Orders were at once sent to England for meteorological instruments for the second and third order stations. These arrived in the second half of 1903, and have been distributed. A site was secured for the observatory three miles north-east of Johannesburg, on a range of hills—it was partly purchased, but more largely presented, by the Bezuidenhouts, a Dutch family. The grounds cover 10½ acres, and are about 5900 ft. above sea-level. The observatory is now built.

There are already 200 rainfall stations in operation, in addition to about thirty stations of the second and third order. The rainfall observers send postcards on the morning after each rainfall. These observers have all come forward voluntarily. Many are farmers or school teachers, in thinly populated districts. Some 25 of the observers send daily weather telegrams to headquarters. Daily telegrams are also exchanged with the meteorological services of the neighbouring colonies, viz. : with Cape Town, Durban, Bloemfontein, and Salisbury, the first named including returns from half-a-dozen stations. A weather report, based on these telegrams, is issued every day at noon. The report appears in the evening journals. A letter code for telegrams has been introduced, which permits the observer to send the rainfall in three figures, state of sky, wind force and direction, prevailing weather, wet and dry bulb and maximum and minimum thermometers, barometer to thousandths of an inch, with attached thermometer, in a total of 16 letters.

Continuously recording instruments for the observatory are now on the way to South Africa, and it is hoped that they will all be in working order by the 1st of July next, the date of the commencement of the Transvaal meteorological year.

THE VARYING DISTRIBUTION OF ATMOSPHERIC PRESSURE OVER THE SURFACE OF THE EARTH.

By L. Bonacina.

The precise distribution of atmospheric pressure that prevails at any instant of time over the Earth's surface must be regarded as the product of the following agents: (*a*) the distribution of the intensity of solar and terrestrial radiation over the surface of the globe; (*b*) the general circulation of the atmosphere; (*c*) the distribution of pressure that has previously prevailed; (*d*) the rotation of the Earth upon its axis.

When we consider these headings separately their meaning will be rendered clearer. With regard to (*a*) it is, of course, unnecessary to remark that all atmospheric changes have their ultimate origin in the sun's rays, which by exciting differences of temperature and of vapour tension, and consequently of pressure, set the air in motion, and thus engender the endless sequence of weather changes which it is the province of the meteorologist to investigate. Moreover, that the influence of terrestrial radiation is very considerable in modifying the distribution of atmospheric pressure is shown by the fact, that during the winter months over all the great continental land masses, which in virtue of the low specific heat of the rocks of which they are composed lose their heat very rapidly, pressure is relatively high,* and remains so, till upon the advent of spring the solar rays gain sufficient power to dislodge the cold dense masses of air.†

* Over central Asia the mean barometric height during the month of January is above 30·5 inches, and over central North America above 30·2 inches. During the southern winter in the month of July pressure over Australia increases to 30·1 inches, over South Africa to 30·2 inches, and over Paraguay and northern Argentina to 30·1 inches. As, however, the continental lands of the southern hemisphere lie much nearer the equator, and cover a much smaller area than those of the northern hemisphere, the lowering of temperature over them is nowhere sufficient to render pressure higher than over the sea, and, accordingly, the anticyclones of the South Atlantic, South Pacific, and South Indian oceans retain their positions, but become increased both in intensity and size, expanding so as to embrace the continental lands within their influence.

† It must, of course, be remembered that a reduction of temperature over a given area involves an increase of atmospheric pressure only because the air over it contracts, sinks, and thereby receives accessions to its mass from above, there being at the same time an outward underflow at the surface of the ground. Similarly, a rise of temperature over any given area implies a decrease of atmospheric pressure in consequence merely of the fact that the expanded air overflows at higher levels, and thereby loses a portion of its mass, there being, meanwhile, an influx of air at lower levels to supply the deficit. If these conditions were not realised the air would simply expand or contract at constant pressure.

When the temperature of a mass of gas kept at constant volume is raised its pressure increases, because the kinetic energy of its molecules, the number of their impacts per unit time against the sides of the containing vessel, is increased. When at sunrise the temperature of the air rises, the first effect is

With regard to heading (*b*) little more can be said than that the general circulation of the atmosphere is *ipso facto* responsible for the complex nature of that circulation, and that the cyclonic eddies, which are constantly disturbing the atmosphere, originate in the forward motion of the air as a whole. Of the mathematical laws upon which this complex circulation depends we are, of course, profoundly ignorant.*

Under heading (*c*) we have to discuss what is undoubtedly the cause of the variability in the character of the weather experienced during corresponding seasons of different years. Why does not precisely the same distribution of atmospheric pressure prevail all over the globe at corresponding dates every year when the Earth is in the same relative position with regard to the sun, and when, therefore, the atmosphere might be expected to circulate in the same manner, that is to say to produce similar eddies in the same places? Obviously the reason is that the distribution of pressure that prevails at any instant of time is, in some obscure manner, dependent upon the distribution which preceded it. and is in turn responsible for the type of distribution that will succeed it; in other words, we are forcibly driven to the conclusion that had the weather that prevailed, for example, ten years ago been of a different character, so likewise would the general character of the weather we are now experiencing be somewhat different. The knowledge of this dependence of one type of weather upon another is, of course, of little use to us in the work of forecasting weather changes, because we do not know *how* one type is related to another.

The difficulties which beset us when we endeavour to ascertain how, for example, the easterly type of weather that may have been conspicuous in England one month was related to the westerly type that may have prevailed the previous month, or how, again, a cyclone situated over the British Islands is related to an anticyclone that may be dominating the atmospheric conditions over Australia, are well nigh insurmountable. Moreover, when we discuss the minutiæ of synoptic charts we find that the various forms of distribution of atmospheric pressure, although capable of classification under a few well-marked types, are really infinite in number. Two synoptic charts, for example, constructed on two occasions, separated by a longer or shorter interval of time, might reveal a distribution of pressure so similar, that we should be tempted to base our predictions upon the second occasion upon our experience of the changes which followed after the first occasion. Yet there would be slight

an increase of atmospheric pressure, but afterwards as the rise of temperature continues and the air expands and overflows, pressure decreases in consequence of the greatly diminished density of the air, the fall of pressure from this cause being greater than is counterbalanced by the increase due to the higher temperature. [But see this Magazine, Vol. 36 (1901), p. 93. Ed. *S. M. M.*].

* When we reflect upon the infinite complexity of the motion of the water of a mountain torrent, for instance, need we wonder that the movements of the atmosphere are indeed inexplicable?

differences between the distribution of pressure on these two occasions, not indicated by the charts, that might suffice to be the precursors of quite a different set of atmospheric changes, and finally of the establishment of opposite types of weather. This is the chief source of the failures which discredit the science of weather prognostication. Moreover, as it is impossible to construct weather charts showing the simultaneous distribution of pressure over every small portion of the Earth's surface, we shall never be able, by the method of synoptic charts, to forecast atmospheric changes with the near approach to certainty with which we can predict the occurrence of many astronomical phenomena. We are now able to establish the following proposition: every locality would experience the same weather at corresponding times every year when its position with regard to the sun is the same, if it were not for the fact that one type of pressure distribution is *à posteriori* related to that which prevailed previously. In other words, it is this unknown relationship that causes, for instance, the character of two successive winters in England to be so dissimilar, and which prevents any two seasons, however similar, from being absolutely alike.

The cold wet summer which characterised the year 1903 in Britain was, so far, related to the mild open winter which preceded it, that any difference in the general character of the latter would have necessitated a difference in the general character of the former in accordance with the unknown laws which control the sequence of weather types. Since, however, one type of weather merges by insensible gradations into another, and since the various forms of distribution of atmospheric pressure are, when minute differences are taken into consideration, numerically infinite, so that at no two points of time have the atmospheric conditions over the globe ever been identical (though, of course, often very similar), it is manifestly impossible to predict the weather of a coming season. If, for example, we were to experience another winter very similar to that of the year 1903 we should not be justified in expecting the following summer to resemble that of the year 1903, inasmuch as small differences between any two seasons are adequate to produce quite disproportionate differences between the succeeding seasons.

Finally, under heading (*d*) we shall consider the potent influence exerted by the rotation of the Earth upon its axis in modifying the general circulation of the atmosphere, and therefore the distribution of barometric pressure.

The effect of the rotation of the Earth upon any current of air is to cause it to deviate to the right in the northern hemisphere, to the left in the southern, of the direction in which it would travel were it subjected to the influence of the disturbing force alone. If it were not for the axial rotation of the Earth, cyclonic disturbances, such as we know them, would not exist, for whatever may be the cause of the initial reduction of pressure, which renders the formation of cyclones possible, it is the rotation of the Earth, which by causing the wind to heap up masses of air to the right of its path (to the left south of the equator) greatly exaggerates the original atmospheric depression, and increases both the size and intensity of low-pressure systems.† Moreover, the great anticyclonic centres, situated more or less permanently over the oceans in about latitude 30° N. and S., owe their origin to the axial rotation of the Earth. In conclusion we would observe that the retardation of the rotation of the Earth upon its axis, caused by the oceanic tides raised by the moon, must be extremely slowly modifying the circulation of the atmosphere, and consequently the climatic conditions of the planet.

Correspondence.

To the Editor of Symons's Meteorological Magazine.

SOME WEATHER PROPHETS.

I QUITE agree with Mr. William Ellis, F.R.S., as to the inadvisability of publishing *crude and ill-considered theories* upon any subject, especially that of Meteorology, in which great *ignorance is shown of the conditions of the weather problem as well as of the proper method of treating it* among scientific men, especially those connected with the Royal Society, the Greenwich Observatory, and the Royal Meteorological Society.

Mr. Ellis is wrong if he thinks (as he appears to do) that he possesses complete knowledge on the subject. I should like to know who told him, and upon what authority he asseverates, that the moon does not attract the atmosphere. He gives no proof for this dogmatic assertion. He says rightly that the water of the ocean is attracted by the moon, but he excludes the ocean of air from that attraction, and it appears also the solid Earth, for he ridicules the idea that the moon can have any influence in the production of earthquakes and volcanic eruptions. The atmosphere, the hydrosphere, and the lithosphere are all composed of matter and are obedient to the great law of universal attraction, under which law every particle of matter attracts every other particle of matter directly as the mass and inversely as the square of the distance. This is the Newtonian law, but it appears Mr. Ellis has a law of his

† When once the essential condition for the formation of a cyclonic eddy, namely, a slight diminution of pressure, has been established, the atmospheric depression is further increased by (*a*) the rotation of the Earth, (*b*) the ascending motion of the air, (*c*) centrifugal force. Theoretically the air, in some portions of a cyclone, must be in a compressed state; the effect of this must be (1) to increase the steepness of the barometric gradients, (2) to render pressure in the portion where aërial compression exists higher than it otherwise would be, the increase of pressure due to compression serving to counteract the much greater reduction of pressure which, from other considerations, we should expect to observe in a cyclone.—(See P. Marc Dechevrens, "Les Variations passagères de la Température," pp. 29 and 30.)

own, denying the properties of matter to the atmosphere. This Elysian law is the outcome of his complete knowledge of the laws of Nature, and gives him the authority to teach other more benighted individuals that weather is not the result of the attraction of the atmosphere by the combined influences of the moon and sun, but that all weather changes are caused by the heat of the sun. This is altogether erroneous teaching, as the sun's heat is used up in the process of radiation and the work done in evaporation, by which, at enormous expense of solar heat, the particles of water are separated against the cohesive power binding them together. By my work and experience I have found that the amount of solar heat is constant, and that the variations of temperature on the Earth's surface are due to the varying amounts of sun's rays cut off by tidally produced clouds.

During the last twenty years I have correctly predicted the weather for both long and short periods. A man like Mr. Ellis, who professes to believe that I predicted the weather correctly for 153 successive days by mere guessing, is capable of believing anything.

Science admits no authority, no dogmatism, like that of Mr. Ellis and the sun's heat, but deals with facts based upon experiment and verification. The late Mr. Symons stated that we should gladly receive the solution of the great weather problem from any person. Now I claim to have solved the problem of not only weather changes but also the incidence of great tides and earthquakes. In fact, I have found and proved by experiment that the atmosphere, the hydrosphere, and the lithosphere are tidally affected by the moon and the sun. And in order to establish this fact, I am prepared to predict the weather correctly by the tidal action of those great luminaries for any day or days in the future, if Mr. Ellis will be good enough to form a committee to adjudicate upon the result.

HUGH CLEMENTS.

WITH much that Mr. Ellis says in his paper on "Some Weather Prophets," one may heartily agree. But there are two passages which seem to call for protest. He says (p. 46) that "by no known method, by reference to no celestial body whatever, can the character of the weather, for any length of time in advance, be foretold"; and he wonders apparently at the stupidity of those who "can persevere in a task at present so utterly hopeless as the endeavour," &c. Now, we have surely got beyond this. Is it not a fact that this forecasting of distant weather (one of the great aims, surely, of meteorology) is a problem regarded by many of our leading men with considerable hopefulness? Why this growing interest in the question of sunspots and weather, if there is not some reasonable hope of establishing definite relations between these, and, as a result, gaining light on future weather? Here, *e.g.*, are three names whose eminence none will dispute—Buchan, Eliot, Von Bezold. Dr. Buchan, we know, has recently offered evidence that the rainfall in Scotland is ruled by the sun-spot cycle (most rain with maxima). Sir John Eliot, as you tell us (p. 55), thinks "the next development of weather study will almost certainly be in the relation of meteorology to the phenomena of sun-spots and terrestrial magnetism." Again, at a recent triennial gathering of meteorologists in Germany, I find the president, Professor von Bezold, saying, very similarly, that "among the most important tasks of the near future is the explanation of the connection between the sun-spot frequency and terrestrial temperature." Can it be said, in view of such facts, that the forecasting of distant weather is a problem "utterly hopeless"?

Again, we are favoured, once more, with that old, but not (I think) venerable, syllogism: Weather changes are exclusively an effect of heat; the moon gives no sensible heat; therefore the moon has nothing to do with weather changes. It is difficult to see how anyone can know all that. But what I wish rather to call attention to is, that hopeful interest in the moon as a factor in weather seems also to be growing. I might cite Dr. Russell, of Sydney Observatory, as having recently argued for lunar influence. And in the newspaper account of the German meeting (already quoted) I read that Prof. Möller, of Brunswick, lectured on the atmospheric flow and ebb movements as connected with the moon, &c., and Prof. Börnstein, of Berlin, demonstrated on a paper model how the air pressure varies with different lunar phases and positions of the sun.

There is, in truth, a growing body of evidence of lunar action; and unless we are to suppose many able minds strangely misled, we may reasonably demur to that summary dismissal of the subject which your critic recommends to us.

A. B. M.

I HAVE read the letters of Mr. Hugh Clements and of A.B.M. The principal impression produced is that they might to some extent have been couched in more courteous language. Otherwise there seems to be little to remark. I can only suggest some further study of what is set out in the article that appears in the April number of the Magazine. To have supported by evidence the statements contained therein would have occupied much more space than was likely to be at my disposal, besides this was scarcely necessary, since they refer to what is common knowledge in the scientific world, as depending on the proper discussion of observed facts.

A few words may, however, be added on some misconceptions. I have not said "that the moon does not attract the atmosphere." The discussion of barometric observations at St. Helena by Sabine, and at Singapore by Elliot, given in papers appearing respectively in Vols. 137 and 142 of the *Philosophical Transactions*, shows that the total lunar effect is less than the one-hundredth part of an inch: an amount altogether insignificant as compared with other disturbances to which the atmosphere is subject. It was not mentioned by me because so minute an effect could be of no conceivable use in the practical forecasting of weather. Neither did I ridicule the idea of the moon having "influence in the production of earthquakes and volcanic eruptions." I say they cannot be predicted so accurately as eclipses of the sun and moon, which Mr. Clements seems to claim. Further, I have in no way suggested that any of Mr. Clements' predictions were mere guessing. I simply wished to show that if the weather were set down, day by day, at random, how not unfrequently there might be such agreement as would lead some people (whom a few coincidences seem to convince) to suppose that the predictions were the result of scientific method. Again, like the late Mr. Symons, I would gladly see the solution of the great weather problem. But I am not aware that any solution has yet been arrived at by which weather can be predicted for long periods in advance.

A. B. M. asks in his letter whether the forecasting of the weather is not a problem to be entertained "with considerable hopefulness." Certainly, as a thing to be desired, but at present we are a very long way indeed from anything of the kind, and future weather remains yet an unsolved problem. This does not mean that we do not all honour the well known and revered names, cited by A. B. M, of those who have distinguished themselves in the endeavour to deduce from recorded observations some general laws in regard to relations that may or may not exist between sun-spots, magnetism, and other terrestrial phenomena. Their work and revelations on such matters are of the highest value, but not one of these scientists would presume to say that our present knowledge on the matters mentioned is of any practical value whatever in regard to any accurate forecasting of weather. Indeed, their object is really more the independent investigation of Nature's laws, without special regard to their use in forecasting. With respect to the question of heat received from the moon, A. B. M. gives a sentence which might be understood as a quotation from my article, but he does not give my words. I did not say "that weather changes are exclusively an effect of heat," neither did I say "that the moon has nothing to do with weather changes," but that I considered that lunar influence had not been definitely traced. And as regards the moon giving no sensible heat, if I am not mistaken the Earl of Rosse is one of those who have made and published observations thereon.

The outcome of the whole matter is, that whilst many minds are discussing many meteorological questions, nothing has yet been discovered that in any degree helps the forecasting of weather for long periods in advance. It is still only possible to do so for one or two days in advance, not from theoretical considerations, but simply from knowledge of the existing conditions of weather daily telegraphed from a great extent of country to the meteorological establishments of different nations. And there I leave the matter, desiring no prolonged discussion thereof. WILLIAM ELLIS.

Blackheath, May 7, 1904.

[Proofs of the two letters criticising Mr. Ellis were forwarded to him, and his reply is given above. Each writer is responsible for his own statements, which are printed in exact accordance with the proofs received from them. The correspondence confirms our feeling of gratitude to Mr. Ellis for expressing the outcome of his long experience and profound study of both meteorology and astronomy. The warning will not, we believe, fail to be of service to less experienced students. We will gladly welcome new light on any meteorological problem from any source, provided that the reasoning which conveys it is intelligible to us, and that the claimant to discoveries is willing to work out fully some portion of his chain of argument, and is not content merely to throw out fragmentary suggestions.—ED. *S.M.M.*].

THE REMARKABLE DARKNESS OF APRIL 15th.

YOU probably have had information already of the phenomenal darkness of last Friday, 12.25 p.m., but I should be glad to know if there is any explanation as I never saw anything quite like it, yet I see no notice of it in the press.

(1.) It came from S.W. quickly, and therefore was not smoke cloud.

(2.) It resembled, while passing over, a tunnel (of darkness) with light visible at either end, and lasted 10 minutes.

(3.) It was not accompanied by thunder or rain, but with puffs of wind from S.W.

It was too dark to go on with garden work, even in the open, for 10 minutes.

Do you think the darkness was from snow clouds?

STANLEY SINGLE.

Park View, Leopold Road, Wimbledon,
April 18th, 1904.

PARASELENE.

AT 10 p.m. on the 20th April a white lunar cross was visible here, like the inner cross shown in *Meteorological Magazine,* 1895, p. 123. The upper arm or pillar was about five lunar diameters in length, the side arms were three diameters, and the lower arm two diameters in length. At 10.30 only the upper arm was visible, much reduced in length and very slightly irridescent; shortly afterwards the moon disappeared behind a cloud. The time of moonset was 11.49 p.m.

Possibly, before I saw it the halo may have been more perfect.

J. P. MACLEAR.

Chiddingfold, Surrey.

ROYAL METEOROLOGICAL SOCIETY.

THE monthly meeting of this Society was held on Wednesday evening, April 20th, at the Institution of Civil Engineers, Great George Street, Westminster, Capt. D. Wilson-Barker, F.R.S.E., President, in the chair.

Mr. G. B. Clough, Mr. H. N. ffarrington, Mr. I. Goetz and Mr. A. E. Heyer were elected Fellows of the Society.

A paper by Mr. J. B. Cohen on "The Cause of Autumn Mists," was, in the absence of the author, read by Dr. W. N. Shaw. The author described some experiments which he had carried out on Coniston Lake in September, 1900. Two minimum thermometers were attached horizontally to the top and bottom of a stout board, which was floated on the water. The experiment was made about midnight, when a heavy mist hung over the water, and the thermometers were floated half-way across, and about half a mile from the head of, the lake. The depth of water was 22 feet, and the bottom temperature 57°·2. By this arrangement of thermometers, the temperature of the surface water and of the air in contact with it was taken simultaneously. It is clear that if any cooling of the surface water occurred, the cooler water would at once sink. The following are the results of two experiments:—

Experiment 1	Air 48°·2	Water 60°·8	Difference 12°·6
,, 2	,, 46·4	,, 60·8	,, 14·4

The point which appears to have escaped attention is that the phenomenon of autumn mist is accompanied by a difference of temperature of the air, which is warmer in the upper region of the atmosphere than at lower levels. The following temperatures were taken at different heights before sunrise on September 15th and 16th, 1900. The thermometers were suspended about 3 feet from the ground without any screen.

Lake Level		Sept. 15...47°·3	Sept. 16...46°·4
Slope of Coniston Old Man...	1750 ft.	,, 51·8	,, 49·6
Summit of Coniston Old Man	2600 ft.	,, 52·7	,, 50·9

Thus, there was a difference in the one case of 5°·4, and in the other of 4°·5, between the lake level and the summit. All the lower ground as far as the horizon lay immersed in a perfectly level sea of purple mist, through which the peaks of the higher hills projected, forming, as it seemed, little scattered islands which were quite clear and sharply defined. Moreover, there was scarcely any dew either on the grass or stones on the summit, whereas it lay very thick everywhere at the level of the lake.

The explanation which seems to follow from the above observations is, that after sunset in still weather the higher ground as it passes into shade begins to cool by radiation, and to cool the air in contact with it, which becomes denser and flows down to a lower level. The cold air on coming into contact with the warm moist air above the lake and surrounding ground, cools the latter below the dew-point and produces mist. The densest mist will naturally be found above damp ground or over water, which is precisely what occurs. Not only so, but if the sheet of water is long and narrow, with hills sloping down on both sides, as at Coniston, a thin column of mist will form where the stream of mist from both hillsides meets in the middle. This phenomenon is easily observed on Coniston lake by any one sitting in a boat an hour or two after sundown. At the same time a steady stream of mist may be seen flowing towards the lake from the adjacent meadows.

As the process continues, the whole basin of the valley fills with mist, which will go on rising until only the hill-tops remain visible, giving rise to the effect seen from the summit, and already described. After the sun has risen the mist clears, and the ground is found to be covered with a heavy dew. The dew is, however, not true dew in the sense that it is not produced by the deposition of moisture rising out of the ground and condensed by contact with a cold surface; but is formed by the deposition of drops of water suspended as mist in the air. That this is the case was easily shown by mooring a tin dish containing a freshly cut sod free from dew some distance from the shore of the lake whilst mist was forming. As the mist probably prevents radiation from the grass blades of the sod, the sod must rather gain than lose heat by contact with the water surrounding the dish, which is warmer than the air. Yet, before sunrise the following morning, the blades of grass in the dish were covered just as plentifully with dew as the grass of the surrounding meadows. If this occurs on the water, it is more than probable that a similar process takes place on the surrounding land.

An interesting discussion followed the reading of this paper, in which the President, Dr. W. N. Shaw, Dr. H. R. Mill, Mr. F. Campbell Bayard, Mr. R. G. K. Lempfert, Mr. W. Marriott, Mr. H. Southall, Mr. Baldwin Latham, Mr. J. E. Clark, and Mr. J. Hopkinson took part.

The second paper was by Mr. W. L. Dallas, on "The Variation of the Population of India compared with the Variation of Rainfall in the decennium 1891–1901." The author showed that during the 4 years 1891-5, the rainfall was generally normal or heavy over nearly the whole of India, and during the 6 years 1895–1901 the rainfall was greatly deficient. During the former or "wet" period the rainfall was deficient over Upper Burma and Madras, was normal over the remainder of Burma, Assam, Bengal, and the West coast of the Peninsula, and was excessive elsewhere; while during the latter or "dry" period the rainfall was again deficient over Upper Burma, normal or excessive over the remainder of Burma, Assam, Bengal, the United Provinces, the North-West Frontier Province, and the South of Madras, and was deficient elsewhere—most so over Rajputana and neighbouring areas.

The general Census of India taken on March 1st, 1901, showed the total population to be 293,475,477, which, excluding the territories not included in the Census of 1891, was an increase of only 1·3 per cent. The population has thus failed to increase according to the normal rate during the decade. Part of this failure was no doubt due to epidemics. The author, however, shows that there is an unmistakable relationship between the variations of the population and the variations of rainfall during the 6 dry years. The area within which the most serious decrease of population occurred coincides almost exactly with the area of greatest deficiency of rainfall.

The discussion of this paper was postponed until the next meeting of the Society.

REVIEWS.

Report of the Meteorological Council for the year ending 31*st of March,* 1903, *to the President and Council of the Royal Society. Presented to both Houses of Parliament by Command of His Majesty.* London: Eyre and Spottiswoode, 1904. Size $9\frac{1}{2} \times 6$. Pp. 180. Price 11d.

ONE instinctively looks forward to the publication of the annual report presented by the Meteorological Council to the body by which it is elected and to which it is responsible. Though a long time elapses before the King is able to command its presentation to both Houses of Parliament, by one of which the money for carrying on the work is voted, the taxpayer, who ultimately pays for it all, at length is privileged to purchase for less than a shilling this record of the transactions concluded rather more than a year before. The Report has a long way to travel, and must obtain the approval of many august bodies and personages before it reaches the public, yet though it speaks of events of last year in the future tense, it retains a certain amount of freshness, and presents several features of interest to meteorological observers. The interest would have been far greater if the Report could have appeared earlier.

Amongst the points referred to in the Report are the incorporation of the climatological stations reporting to the Registrar-General with the general climatological organization of the Meteorological Office, and the increased correspondence with the meteorological departments of the Colonies.

We learn that Mr. P. Y. Alexander, of Bath, had offered to lend a balloon for experiments at the National Physical Laboratory on the temperature of the free air up to 1000 feet on calm days, but unfortunately when it was tried the weather was only approximately calm, and the balloon becoming free proceeded to the north coast of France and was recovered in a somewhat damaged condition.

We regret to see that the efforts to arrange for wireless telegraphic reports of pressure from Atlantic steamers through Lloyd's signal stations were fruitless, but we gather that this was in no way the fault of the Council.

During the year reported on the staff of the Meteorological Office was strengthened by the appointment of Mr. R. G. K. Lempfert, of Emmanuel College, Cambridge, as special scientific assistant to the Secretary. But it has suffered a loss through the retirement of Mr. Frederic Gaster, who had been in charge of the Forecast and Storm Warning Branch since 1868. Everyone who has had the privilege of knowing Mr. Gaster will cordially concur in the praise which the Council bestows on him after his long service.

The completely successful forecasts made at 8.30 p.m. amounted to 53 per cent., the partially successful to 35 per cent., the partial failures to 10 per cent., and the complete failures only to 2 per cent. This result for 1902 was better than for any of the last ten years. Of the storm warnings only 6 per cent. failed to be justified by the subsequent weather.

A History of the Daubeny Laboratory, Magdalen College, Oxford . . . by R. T. GÜNTHER, M.A., F.Z.S. London: Henry Fronde, 1904. Size 9 x 5½. Pp. viii.+138. Price 5s. net.

IN 1848 Dr. C. G. B. Daubeny, Professor of Chemistry, Botany and Rural Economy in the University of Oxford, built a laboratory and class-room adjoining the Physic Garden at Oxford on ground belonging to Magdalen College. The double professor (he had resigned the chair of Chemistry in 1854) died in 1867, and left all his collections to Magdalen College, together with a sum of money to provide the salary of a curator. In 1869, Mr. Edward Chapman, now M.P. for the Hyde Division of Cheshire, was appointed Lecturer on Natural Science, a position which he held until 1894, and he has been succeeded by the author of this interesting little history.

Meteorological records were started by Dr. Daubeny in 1861, but they were made by himself wherever he happened to be, at home or abroad, so that so far as Oxford is concerned the record is a broken one, and the fact that the observations lapsed at his death is of little importance. In 1868 they were resumed in a more systematic way, and in 1869 they came under the charge of Mr. Chapman, and have since been maintained in a state of efficiency. The shade thermometers, however, are not exposed in a standard screen, but placed against a north wall, and since 1873 observations have been made at 10 a.m. instead of the standard hour of 9 a.m. This makes it impossible to compare the results with other stations. There are two rain gauges, one at the standard height of 1 foot above ground and 190 feet above sea-level, the other on a roof 20 feet higher. There are also two river gauges in the Cherwell, and the temperature of the water in the river is recorded each morning. The observations on river temperature proved most useful when a Committee of the British Association was engaged on an investigation on the temperature of exposed water surfaces about twelve years ago. The monthly means for each year since 1882 are published in this volume, and we reprint the summary table comparing the data for two nearly equal periods. It will be noticed that the difference between the water and air temperature remains practically the same, but that the mean rainfall of the second period is more than 2 inches less, and the mean temperature of both water and air one degree higher than in the first period. In the table the figure I. refers to the means for the ten years 1882–91, the figure II. to the means for the twelve years 1892–1903.

Mean Temperature of River Cherwell at Oxford.

MONTH.	Mean Air Temperature for Day.		Mean River Temperature, 10 a.m.		Excess of River over Air Temperature.		Average Rainfall in inches.	
	I.	II.	I.	II.	I.	II.	I.	II.
January	37·6°	38·4°	37·8°	38·4°	0·2°	0·0°	1·87	1·49
February	38·6	39·2	39·5	39·3	0·9	0·1	1·66	1·48
March	40·6	42·5	41·9	43·2	1·3	0·7	1·48	1·27
April	45·9	48·5	48·3	50·7	2·4	2·2	1·80	1·37
May	53·1	53·8	55·4	56·9	2·3	3·1	2·05	1·35
June	59·6	60·5	61·6	63 2	2·0	2·7	2·17	1·95
July	62·3	64·2	64·6	65·7	2·3	1·5	2·58	2·33
August	61·3	62·6	63·1	63·8	1·8	1·2	2·00	2·48
September	57·2	57·5	58·8	59·7	1·6	2·2	2·16	1·78
October	48·9	49·7	50·0	50·9	1·1	1·2	2·73	2·83
November	43·1	44·3	43·4	44 3	0·3	0·0	2·47	2·11
December	37·4	39·7	38·4	39·7	1·0	0·2	1·97	1·98
YEAR	48·9	50·0	50·3	51·3	1·4	1·3	24·94	22·42

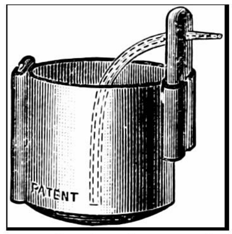
Geographen-Kalender. In Verbinding mit DR. WILHELM BLANKENBERG, PROFESSOR PAUL LANGHANS, PROFESSOR PAUL LEHMANN und HUGO WICHMANN, herausgegehen von DR. HERMANN HAACK. Zweiter Jahrgang: 1904-1905. Gotha, Justus Perthes. Size 6½ x 4. Pp. 360. Portrait and Map. Price 4s.

THIS publication, now in its second year, claims to be a geographical "Who's Who?" and, as Geography is taken in its widest sense, it includes Meteorology. The previous issue gave a directory of about 5000 persons interested in the geographical sciences in all parts of the world, including the authors of all papers on meteorology who could be traced; the current issue gives a list of about 3000 institutions and societies and 2000 periodicals of similar aims. Although mainly in German, all the statistical tables are printed also in English and with the units familiar in English-speaking countries. There is no other work covering the same ground, and it should prove useful to meteorologists. The little book is very neatly got up and contains an engraved portrait of Sir Clements Markham.

THE DITTMAR RECORDING PEN.

AT the request of Mr. William Dittmar we have recently made a trial of a new form of pen for use with recording instruments, which he has patented. The particular pen was specially adapted for use on the Redier Barograph, but in principle it differs in no way from the ordinary form, as shown in the accompanying sketch. The pen may be used for any sort of recording instrument, and is particularly useful where absence of friction is a desideratum, as it works without any pressure on the paper.

The pen consists of a tiny cup to hold the ink, and an excessively fine capillary tube dipping nearly to the bottom, and drawn out to a point projecting at right angles from the side of the cup. When the cup is filled with ink the capillary tube may be filled by slight suction by means of an ordinary fountain-pen filler, and once filled it holds the ink, allowing it neither to run back into the cup nor to form a drop at the point. The maker claims the following among other advantages:—The pen records, in any direction, a line of equal breadth; a record can be taken at any desired speed; the ink only flows when the pen moves across the paper; the pen requires no attention when once started. We have found that the claim is fully justified, the line drawn being particularly fine, clear, and of uniform blackness. Observers who have been troubled by the unsightly dripping from some of the unsatisfactory types of recording pen will appreciate Mr. Dittmar's invention.



METEOROLOGICAL NEWS AND NOTES.

THE ROTHESAY METEOROLOGICAL RECORDS are amongst the oldest in the United Kingdom, and it is with regret that we read in the *Buteman* of April 23rd of their "threatened abandonment." We cannot believe that the historic interest in meteorology has so completely departed from Scotland as to permit such a suggestion to be carried out. Mr. Kay has performed a splendid service by keeping the record for 28 years, and deserves the greatest credit for his scientific zeal aud public spirit. Now, when he finds it necessary to retire, we trust that some of his townsmen, or the Corporation itself, will see to the continuity of this record of 104 years.

BRITISH RAINFALL 1903, is now so far advanced that additional returns should be forwarded to the Editor within a week if they are to be utilized in the discussions. Amongst the returns received, there is one giving only the total of 43·60 in., but no other information; neither place nor name of observer, nor a word of handwriting, the envelope having a printed address. To complete the puzzle, the Post Office, which has done much to hamper the collection of rainfall statistics, succeeded in impressing a post-mark of which no single letter was legible! Did any of our readers record such a rainfall?

RAINFALL AND TEMPERATURE, APRIL, 1904.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables in *British Rainfall* to which each station belongs.]	RAINFALL. Total Fall.	Diff. from average, 1890-9.	Greatest in 24 hours. Depth	Greatest 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°. Shade	Grass
		inches	inches.	in.								
I.	London (Camden Square) ...	1·01	— ·51	·37	22	10	67·9	14	36·2	11	0	7
II.	Tenterden	1·22	— ·55	·37	12	10	66·0	14	33·0	22, 26	0	7
,,	Hartley Wintney	1·36	— ·28	·40	15	14	67·0	19	33·0	26	0	6
III.	Hitchin	·81	— ·71	·24	22	10	64·0	14, 18	35·0	17	0	...
,,	Winslow (Addington)	1·05	— ·51	·28	15, 22	12	65·0	14	33·0	11	0	10
IV.	Bury St. Edmunds (Westley)	·87	— ·66	·28	12	9	64·5	18	31·5	22	...	...
,,	Brundall	·86	— ·65	·37	22	11	68·6	15	32·8	22	0	4
V.	Alderbury	1·08	— ·69	·17	2	13	58·0	16*a*	32·0	1, 6	2	...
,,	Winterborne Steepleton ...	1·35	...	·35	15	12	64·0	20	32·0	11	1	6
,,	Torquay (Cary Green)	1·09	...	·37	13	12	63·3	24	37·6	17	0	6
,,	Polapit Tamar [Launceston]	1·99	— ·17	·54	13	18	61·3	19	31·0	26	2	2
,,	Bath	1·80	...	·32	22	14	63·2	18	33·8	17	0	...
VI.	Stroud (Upfield)	1·23	— ·61	·21	15	15	63·0	18, 30	37·0	10	0	...
,,	Church Stretton (Woolstaston)	1·64	— ·24	·35	22	16	63·5	24	...	...	...	...
,,	Bromsgrove (Stoke Reformatory)	1·24	— ·11	·26	14	10	61·0	18	..	...	...	...
VII.	Boston	·74	— ·64	·25	22	10	65·0	14	34·0	22	...	...
,,	Bawtry (Hesley Hall)	1·07	— ·27	·27	15	13	...	...	...	...	...	...
,,	Derby (Midland Railway)...	1·67	+ ·12	·49	14	16	65·0	19, 20	34·0	15	0	...
VIII.	Bolton (The Park)	2·57	+ ·38	·31	2	21	59·5	19	35·6	10	0	1
IX.	Wetherby (Ribston Hall) ...	1·78	+ ·04	·39	14	16	...	...	...	...	...	...
,,	Arncliffe Vicarage	7·68	+ 4·32	1·31	28	21	...	...	...	...	...	...
,,	Hull (Pearson Park)	1·15	— ·44	·40	15	14	63·0	29, 30	34·0	12*b*	0	7
X.	Newcastle (Town Moor) ...	1·59	— ·07	·37	22	14	...	...	...	...	...	...
,,	Borrowdale (Seathwaite) ...	14·40	+ 8·06	2·60	2	21	63·5	19	33·6	1	0	...
XI.	Cardiff (Ely)	2·28	+ ·10	·35	2, 29	17	...	...	...	...	...	..
,,	Haverfordwest (High St.)..	2·12	— ·30	·41	13	14	63·7	19	33·7	11	0	3
,,	Aberystwith (Gogerddan)..	3·08	+ ·51	·72	29	13	70·0	19	34·0	19	0	...
,,	Llandudno	1·49	— ·29	·18	2	17	62·0	12	38·8	9	0	...
XII.	Cargen [Dumfries]	4·38	+ 2·05	·86	3	19	64·0	19	34·0	12	0	...
XIII.	Edinburgh (Royal Observy.)	1·69	...	·30	9	17	62·5	19	32·6	10	0	5
XIV.	Colmonell	2·71	+ ·54	·48	28	20	64·0	29	31·0	26	1	...
XV.	Tighnabruaich	6·67	...	·77	2	27	54·0	23	31·0	20	3	3
,,	Mull (Quinish)	6·17	+ 3·38	·89	5	27	...	...	...	...	...	...
XVI.	Loch Leven Sluices	4·23	+ 2·24	·60	3	16	...	...	...	...	...	...
,,	Dundee (Eastern Necropolis)	1·70	+ ·16	·30	5, 13	18	63·6	18	33·6	9, 19	0	...
XVII.	Braemar	2·78	+ ·69	·70	2	18	56·3	19	23·3	1	5	23
,,	Aberdeen (Cranford)	1·83	— ·01	·51	13	16	61·0	29	30·0	3, 4	4	...
,,	Cawdor (Budgate)	2·77	+ 1·20	·58	6	19	...	...	...	...	...	...
XVIII.	Glencarron Lodge	13·29	+ 8·63	1·30	27	27	...	...	...	...	..	...
,,	Bendamph.	12·15	+ 7·75	1·50	2	25	...	...	...	...	...	...
XIX.	Dunrobin Castle	5·25	+ 3·48	·80	27	19	60·0	19	30·0	4	1	...
,,	Castletown	4·17	...	·76	5	25	63·0	19	31·0	8, 9	5	...
XX.	Killarney	3·23	— ·53	·58	3	22	64·0	30	37·0	1	0	...
,,	Waterford (Brook Lodge)...	1·15	— 1·47	·21	17	14	61·5	19, 29	29·0	11	1	...
,,	Broadford (Hurdlestown) ...	2·09	+ ·01	·28	17	23	60·0	29	34·0	16*c*	0	...
XXI.	Carlow (Browne's Hill)	1·54	— ·75	·37	2	12	...	...	...	...	...	...
,,	Dublin (FitzWilliam Square)	1·12	— ·85	·19	2	19	62·0	27	35·7	21	0	1
XXII.	Ballinasloe	2·08	— ·21	·29	2	23	67·0	19	29·0	19	3	...
,,	Clifden (Kylemore House)..	7·39	+ 2·12	1·00	13	25	...	...	...	...	...	...
XXIII.	Seaforde	2·49	+ ·06	·25	2	23	60·0	18	32·0	18	1	3
,,	Londonderry (Creggan Res.)	3·22	+ ·76	·30	9	26	...	...	...	...	...	...
,,	Omagh (Edenfel)	3·07	+ ·71	·60	5	24	60·0	19	32·0	9*c*	3	7

+ Shows that the fall was above the average; — that it was below it. *a* and 18, 19, 20. *b* and 16, 20, 21. *c* and 17, 20.

SUPPLEMENTARY RAINFALL, APRIL, 1904.

Div.	STATION.	Rain. inches	Div.	STATION.	Rain. inches
II.	Dorking, Abinger Hall	1·36	XI.	New Radnor, Ednol	2·13
,,	Sheppey, Leysdown	·90	,,	Rhayader, Nantgwillt	4·18
,,	Hailsham	1·08	,,	Lake Vyrnwy	4·22
,,	Crowborough	1·43	,,	Ruthin, Plâs Drâw	1·14
,,	Ryde, Beldornie Tower	1·03	,,	Criccieth, Talarvor	2·52
,,	Emsworth, Redlands	1·31	,,	Anglesey, Lligwy	2·19
,,	Alton, Ashdell	1·70	,,	Douglas, Woodville	2·20
,,	Newbury, Welford Park	1·35	XII.	Stoneykirk, Ardwell House	1·69
III.	Harrow Weald	·95	,,	Dalry, Old Garroch	6·02
,,	Oxford, Magdalen College	·77	,,	Langholm, Drove Road	5·74
,,	Banbury, Bloxham	·89	,,	Moniaive, Maxwelton House	4·81
,,	Pitsford, Sedgebrook	·88	,,	Lilliesleaf, Riddell	2·36
,,	Huntingdon, Brampton	·71	XIII.	N. Esk Reservoir [Penicuick]	4·30
,,	Wisbech, Bank House	·52	XIV.	Maybole, Knockdon Farm	3·54
IV.	Southend	·58	,,	Glasgow, Queen's Park	4·39
,,	Colchester, Lexden	·92	XV.	Inveraray, Newtown	9·69
,,	Saffron Waldon, Newport	·83	,,	Ballachulish, Ardsheal	11·66
,,	Rendlesham Hall	·99	,,	Campbeltown, Redknowe	3·62
,,	Swaffham	1·12	,,	Islay, Eallabus	5·29
,,	Blakeney	·58	XVI.	Dollar	5·02
V.	Bishop's Cannings	1·52	,,	Balquhidder, Stronvar	9·79
,,	Ashburton, Druid House	2·21	,,	Coupar Angus Station	2·27
,,	Okehampton, Oaklands	2·62	,,	Blair Atholl	4·01
,,	Hartland Abbey	1·75	,,	Montrose, Sunnyside	1·32
,,	Lynmouth, Rock House	1·70	XVII.	Alford, Lynturk Manse	1·97
,,	Probus, Lamellyn	1·32	,,	Keith, H.R.S.	2·09
,,	Wellington, The Avenue	1·21	XVIII.	Fearn, Lower Pitkerrie	2·33
,,	North Cadbury Rectory	1·45	,,	S. Uist, Askernish	5·58
VI.	Clifton, Pembroke Road	2·29	,,	Invergarry	11·44
,,	Moreton-in-Marsh, Longboro'	1·21	,,	Aviemore, Alvie Manse	2·96
,,	Ross, The Graig	1·25	,,	Loch Ness, Drumnadrochit	4·15
,,	Shifnal, Hatton Grange	1·35	XIX.	Invershin	4·44
,,	Wem Rectory	·87	,,	Altnaharra	6·67
,,	Cheadle, The Heath House	1·92	,,	Bettyhill	5·03
,,	Coventry, Kingswood	1·15	,,	Watten, H.R.S.	3·19
VII.	Market Overton	1·28	XX.	Cork, Wellesley Terrace	1·28
,,	Market Rasen	·99	,,	Darrynane Abbey	3·23
,,	Worksop, Hodsock Priory	1·18	,,	Glenam [Clonmel]	2·16
VIII.	Neston, Hinderton	·73	,,	Ballingarry, Hazelfort	1·95
,,	Southport, Hesketh Park	1·69	,,	Miltown Malbay	3·79
,,	Chatburn, Middlewood	4·21	XXI.	Gorey, Courtown House	1·22
,,	Duddon Valley, Seathwaite Vic.	6·02	,,	Moynalty, Westland	1·88
IX.	Langsett Moor, Up. Midhope	3·68	,,	Athlone, Twyford	2·17
,,	Baldersby	1·56	,,	Mullingar, Belvedere	2·19
,,	Scalby, Silverdale	1·27	XXII.	Woodlawn	2·10
,,	Ingleby Greenhow Vicarage	1·78	,,	Westport, Murrisk Abbey	4·24
,,	Middleton, Mickleton	2·02	,,	Crossmolina, Enniscoe	5·33
X.	Beltingham	2·88	,,	Collooney, Markree Obsy	3·49
,,	Bamburgh	·78	XXIII.	Enniskillen, Portora	2·95
,,	Keswick, The Bank	5·13	,,	Warrenpoint	2·19
,,	Melmerby Rectory	2·63	,,	Banbridge, Milltown	1·70
XI.	Llanfrechfa Grange	2·01	,,	Belfast, Springfield	3·20
,,	Treherbert, Tyn-y-waun	6·63	,,	Bushmills, Dundarave	2·77
,,	Llandovery, Tonn	2·45	,,	Stewartstown	2·65
,,	Castle Malgwyn	2·56	,,	Killybegs	3·41
,,	Llandefaelog-fach	2·02	,,	Horn Head	3·36

METEOROLOGICAL NOTES ON APRIL, 1904.

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

ENGLAND AND WALES.

LONDON, CAMDEN SQUARE.—A month of beautiful weather, mild and sunny, with cool breezes but almost entire absence of harsh E. wind. The R was slight and the greater part fell during the night. No frost was registered in the screen, and the mean min. temp. was 43°·4, or 3°·7 above the average, and the highest in April during 47 years. The duration of sunshine was 141·3* hours and of R only 18·9 hours. Mean temp. 48°·1, or 2°·4 above the average.

TENTERDEN.—A beautiful spring month, generally dry, but very windy for the first 10 days. Duration of sunshine 177† hours.

HARTLEY WINTNEY.—Showery, with westerly winds for the first fortnight; then drier and harsher. Vegetation backward.

PITSFORD, SEDGEBROOK.—The first week was rather wet and squally, the remainder fine and warm. R ·96 in. below the average. Mean temp. 48°·5.

BRUNDALL.—A magnificent April, warmer than any since 1894. On no day did the temp. fail to reach 50°, an occurrence which has not happened since observations commenced in 1883.

TORQUAY.—R 1·28 in. below the average. Duration of sunshine 180·2* hours, or equal to the average. Mean temp. 50°·2, or 2°·0 above the average. Mean amount of ozone 5·8.

WELLINGTON.—On the 15th set in one of the finest periods experienced for a considerable time, only ·08 in. of R falling on 16 days. Abundant sunshine.

NORTH CADBURY RECTORY.—Seasonable, with small range of temp. R less than in any April in 8 years, and less than in any month since Sept., 1902.

CLIFTON.—The first fortnight was showery and cool, with rather strong westerly winds. Fine weather from 16th to 20th and from 23rd to 27th.

ROSS.—An almost typical April, with much less R than usual. The mean min. (41°·8) was the highest since 1865, but the max. (57°·4) was scarcely above the average. On no night was frost recorded in the screen, and as a consequence vegetation, though somewhat backward, progressed rapidly.

BOLTON.—Typical April weather, showers and sunshine being sandwiched together throughout. The shade min. (35°·6) was the highest on record, and the daily range (10°·7) the least in 18 years. Mean temp. 45°·5, or 1°·2 above the average. Duration of sunshine 102·7* hours, or 8 hours below the average.

SOUTHPORT.—Exceptionally stormy, W.S.W. winds greatly preponderating. Mean temp. 1°·3 above the average. Duration of sunshine 7* hours below the average, and R ·03 in. below the average. Mean daily movement of the wind 135 miles above the average.

UPPER MIDHOPE.—Stormy from 1st to 10th, with sleet, S, H and R. Fine from 16th to 30th. R ·82 in. above the average of 9 years.

HULL.—On the whole genial spring weather prevailed. After the 7th it was generally mild, with a fair amount of bright sunshine.

LLANFRECHFA GRANGE.—Cold winds and warm sun in the latter part; favourable for garden and field work.

HAVERFORDWEST.—Strong westerly winds and gales throughout. No extremes of temp., which was uniformly below the average, especially the max; this exercised a salutary influence in checking blossom of fruit trees and vegetation generally. Duration of sunshine 147·6* hours.

DOUGLAS.—The gale of March 31st continued without intermission until April 11th. Temp. about normal, with low maxima. The light R and constant wind were favourable to agriculture.

* Campbell-Stokes. † Jordan.

SCOTLAND.

MAXWELTON HOUSE.—The first half was wet and cold, the second fine and warm with much sunshine. Mean temp. 46°·0, or 1°·0 above the average. R 2·04 in. above the average.

LILLIESLEAF, RIDDELL.—Very windy throughout, and cold up to the last few days. Vegetation was backward, but seeds well got in.

BALLACHULISH.—R 7·25 in. above the average and the greatest recorded here.

MULL, QUINISH.—The wettest April since the gauge was started in 1874.

LYNTURK MANSE.—Frequent strong winds throughout. Notwithstanding a large number of rainy days, there was a good sowing time.

DRUMNADROCHIT.—The greatest R in April for 19 years, and 2·38 in. above the average. The rainy days were also the greatest on record.

BETTYHILL.—Heavy R, generally accompanied by strong winds.

CASTLETOWN.—The first half was cold, windy and wet, with S on 9th. From 15th to 21st was very mild and dry, and from 21st to the end wet, stormy and cold.

IRELAND.

CORK.—R 1·60 in. less than the average. Mean temp. 3°·5 below the average.

DARRYNANE ABBEY.—Changeable, with strong northerly wind. R 13 per cent. below the average. Vegetation very backward.

WATERFORD.—R less than half the average. A very late spring.

MILTOWN MALBAY.—The stormiest and coldest April remembered. Only four days without R.

DUBLIN.—Favourable though changeable. The first few days were stormy and cold, but after the 9th only ·29 in. of R fell. Mean temp. 49°·1 and duration of sunshine 175·5 hours, both above the average. R was frequent, but moderate in amount.

OMAGH, EDENFEL.—Harsh and unsettled, except for a short spell in the middle. The weather was such as might be expected from the frequent fluctuating pressure. Although robust vegetation did not suffer much, delicate garden seeds made little progress.

THE FOUR MONTHS' RAINFALL OF 1904.

Aggregate Rainfall for January—April, 1904.

Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.	Stations.	Total Rain.	Per cent. of Aver.
	in.			in.			in.	
London	7·64	124	Arncliffe	25·13	128	Braemar	9·22	94
Tenterden	9·34	131	Hull	6·61	100	Aberdeen	11·16	122
Hartley Wintney	9·35	138	Newcastle	7·33	107	Cawdor	7·30	92
Hitchin	7·18	117	Seathwaite	52·94	121	Glencarron	31·35	107
Winslow	8·41	135	Cardiff	16·59	148	Dunrobin	11·74	127
Westley	6·95	109	Haverfordwest	16·22	124	Killarney	21·04	125
Brundall	7·47	118	Gogerddan	14·58	114	Waterford	16·12	139
Alderbury	11·46	143	Llandudno	9·28	113	Broadford	13·39	139
Ashburton	24·19	146	Dumfries	14·77	108	Carlow	11·59	115
Polapit Tamar	17·91	173	Lilliesleaf	10·63	124	Dublin	9·06	115
Stroud	10 97	143	Colmonell	13·91	102	Mullingar	14·25	137
Woolstaston	10·42	128	Glasgow	12·28	117	Ballinasloe	14·16	134
Boston	6·09	115	Inveraray	26·43	113	Clifden	31·12	128
Hesley Hall	7·31	131	Islay	18·26	131	Crossmolina	23·14	140
Derby	8·09	134	Mull	22·72	129	Seaforde	12·29	111
Bolton	12·40	119	Loch Leven	11·99	113	Londonderry	13·34	116
Wetherby	9 52	147	Dundee	9·55	117	Omagh	16·10	146

NOTE.—In the above Table the first column gives the total rainfall of the four months, not, as in former years, the difference from the average.

Climatological Table for the British Empire, November, 1903.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.										
	Temp.	Date.	Temp.	Date.	Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	57·2	1	29·9	20	50·2	39·7	41·3	88	82·3	23·3	1·86	12	6·3
Malta	75·3	18	48·5	14	66·9	55·4	54·9	86	119·1	43·4	3·38	14	4·6
Lagos, W. Africa	91·0	22	70·0	10	87·4	75·1	75·2	75	146·0	68·0	4·11	7	4·9
Cape Town	86·0	9	46·1	16	70·2	53·3	51·1	68	...	...	·25	4	4·6
Durban, Natal	87·6	19	52·4	4	78·6	63·2	...	...	140·1	...	8·99	19	6·7
Mauritius	88·4	27*a*	60·1	23	82·7	65·1	61·5	66	152·3	54·5	·96	8	4·9
Calcutta	84·4	3	57·9	30	81·3	64·8	63·2	71	145·0	52·1	·02	1	3·2
Bombay	90·5	11	68·3	27	86·3	72·3	69·0	72	137·5	58·2	·00	0	1·5
Madras	89·8	1	66·0	25	82·9	72·2	71·2	85	141·3	60·5	17·76	13	6·3
Kodaikanal	69·8	23	45·7	21	62·8	50·1	47·0	76	132·8	34·3	5·85	12	5·7
Colombo, Ceylon	90·7	13	70·5	27	88·5	74·6	72·4	78	155·0	65·5	·94	12	4·9
Hongkong	85·3	18	46·7	28	73·8	62·1	53·6	62	133·3	...	1·09	3	4·0
Melbourne	93·9	25	41·9	13	72·2	53·6	51·3	68	156·1	34·0	4·28	10	6·2
Adelaide	96·2	25	46·3	13	80·2	58·5	49·8	49	149·7	40·4	2·57	12	4·6
Coolgardie	99·0	24	46·0	15*b*	82·7	55·6	47·6	47	162·6	43·1	·15	4	3·0
Sydney	95·1	26	51·4	21	71·6	58·9	37·0	68	132·3	44·2	1·96	13	6·2
Wellington	79·5	30	38·2	21	67·3	51·3	51·4	76	136·0	30·0	5·41	12	6·4
Auckland	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica, Negril Point.	89·2	7	61·0	30	85·4	71·1	70·3	77	...	...	2·46	9	...
Trinidad	91·0	Var	67·0	21	77·2	73·0	71·0	72	177·0	64·0	2·59	5	...
Grenada	88·6	28	72·2	1	85·5	74·9	72·6	77	152·0	...	2·55	13	2·5
Toronto	70·2	3	6·1	26	42·2	27·8	27·2	76	86·0	2·4	1·26	14	6·1
Fredericton	60·7	4	3·1	27	39·9	22·9	22·2	67	...	...	4·86	13	5·8
Winnipeg	71·3	2	—28·7	25	29·1	8·4	...	...	...	...	1·50	5	4·8
Victoria, B.C.	59·0	1	31·2	17	47·9	41·1	...	...	...	...	6·00	...	8·8
Dawson	40·5	4	—42·4	16	2·7	—10·3	...	...	...	...	·45	4	3·8

a and 30. *b* and 16.

MALTA.—Mean temp. of air 2°·6 below, dew point 0°·5 above, and R ·24 in. below, and mean hourly velocity of wind 0·8 miles above averages. Mean temp. of sea 67°·2.

Natal.—R 3·99 in. above 30 years' average.

Mauritius.—Mean temp. of air 1°·5, dew point 2°·4, and R ·90 in. below, averages. Mean hourly velocity of wind 10·4 miles, or 0·1 mile below average; extremes 23·5 on 15th, and 2·0 on 28th; mean direction E. by S.

MADRAS.—Bright sunshine 122·6 hours, or 35·6 per cent. of the possible amount.

KODAIKANAL.—Mean temp. of air 55°·0. Mean velocity of wind 237 miles per day. Bright sunshine 143·6 hours.

COLOMBO, CEYLON.—Mean temp. of air 81°·0 or 1°·2 above, of dew point 0°·1, and R 12·06 in., below averages. Mean hourly velocity of wind 8·2 miles, prevailing dir. S.W.

HONGKONG.—Mean temp. of air 67°·2, or 2°·0 below average. Bright sunshine 209·2 hours. Mean hourly velocity of wind 9·6 miles; prevailing direction N.E.

Adelaide.—Mean temp. of air 2°1, and R 1·59 in., above averages.

Sydney.—Mean temp. of air 1°·6, humidity 1·0, and R 1·19 in., below averages.

Wellington.—Mean temp. of air 5°·1, and R 2·45 in., above averages.

TRINIDAD.—R 4·69 in. below the 40 years' average.