SYMONS'S

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CONTINUITY IN OBSERVATIONS.

IN the concluding part of our notice of the Belfast Meeting of the British Association we print this month long extracts from Professor Schuster's striking and original address to the sub-section of Astronomy and Cosmical Physics. These comprise the views of this eminent physicist as to the position of meteorology and his plan for its improvement. That meteorology is in an unsatisfactory state and that it requires improvement, we fully agree, and we are sure that the criticism and counsel of men of Professor Schuster's power will do much to help it. But we by no means agree that "drudgery is often its highest ambition," that "it would not be a great exaggeration to say that meteorology has advanced in spite of the observations and not because of them," or that disorganization can ever be better than organization.

Much advantage would inevitably accrue to meteorology by the exhaustive study of limited series of carefully planned observations, and we share the belief expressed by Dr. W. N. Shaw, in speaking on Professor Schuster's paper, that the establishment of Chairs of Meteorology in our Universities would promote this result, but we do not think it necessary to stop or even to discourage observations meanwhile. One might as well suggest that because it is possible by the diligent study of the baking of bread to improve the quality of the product, therefore the harvesting of wheat should be stopped for five years so that all the energy of all the farmers and their labourers could be concentrated on the problem of the improved loaf of the future.

We, no more than Professor Schuster, wish to become slaves to continuity. He allows that continuity is important, and we declare that it is essential; but we all agree that when observations are recognised as useless they should be stopped. Undoubtedly the routine of meteorological observations can be improved, undoubtedly much of the work done is of no direct utility; but in such a question as this the indirect utility of habits of methodical and conscientious work on the part of observers must also be taken into account. It must be remembered that if routine observations were stopped tomorrow, the energy of thousands of observers would not be concentrated on high problems of meteorology but dissipated on imperceptible trifles. It is not every observer who has the education or the habit of mind necessary for discussing his results. Many absurd ideas and immature speculations would have been spared to the world if observers had been sure of their work being considered and discussed by specialists adequately equipped for the task, and so had no excuse for themselves attempting with untrained minds to generalize from incomplete data. But those very observers can bring together accurate and comparable observations such as the highest genius would never have the patience to collect for himself.

It seems to us that the steady routine services of many people are not thrown away because only the work of a few is made use of to forward great discoveries; it is the way of Nature to seem lavish of unproductive labour. An oak grows from one acorn; but no forester would dream of restricting the number of acorns he allowed to sow themselves to the number of oaks he wished to spring up.

The question of meteorological work is complicated, and it must be treated as a whole and not in compartments. The highly trained specialist must discuss the best data he can get; it is the duty of the humbler servant of science to collect the material although its value may vary. In opposition to Professor Schuster's suggestion that observations should be stopped until we can decide what use is to be made of them, we assert the supreme importance of maintaining the continuity of records for ever. A gap in a long series of observations is an irreparable loss, for although it may possibly be patched up for some purposes, the weak place in the chain will always remain.

It is granted that carrying on special researches for a short period is sufficient to obtain many theoretical results which are much needed and of high value. This should be done without leaving the other undone; for it must be remembered that we have to deal with climatology as well as with meteorology, with the facts as well as with their causes. The climate even of the United Kingdom has not yet been satisfactorily described. If we allow that a fifty years' average is necessary to determine its normal condition, we can only guess at the normal condition of the greater part of the country, and when we endeavour to ascertain whether any long periodicity exists, or any secular change of climate is in progress, we are unable to come to any conclusion at all, except for a very few stations which cannot be accepted as representative. Discontinuity of observations is the chief stumbling block in the way; insufficient number of observing stations is another and a serious one. It may be that wet-bulb observations are of little use, but the observation of extremes of temperature is undoubtedly of high importance, and the measurement of rainfall is absolutely vital to the well-being of every country. From the purely scientific point of view continuity of observation is necessary, because the conditions of climate are too multitudinous ever to be reduced to dependence on a few simple factors; from the practical point of view it is even more necessary —because we must be able to compare our present condition with the past in order to gain some light on the future.

We sincerely hope that the attention of mathematicians and physicists will be directed to meteorology in this country more than has been the case in recent years; and we feel sure that when they do take up the subject seriously they will feel grateful for the long-continued records which it has been so difficult to maintain, and sorry for any gaps that may have been caused by their authoritative discouragement.

METEOROLOGY AT THE BRITISH ASSOCIATION.

BELFAST MEETING, 1902.

Address to Sub-section of Astronomy and Cosmical Physics. By PROFESSOR ARTHUR SCHUSTER, F.R.S.

A great advantage of the scientific treatment of periodical occurrences lies in the fact that we may determine *a priori* how many events it is necessary to take into account in order to prove an effect of given magnitude. Let us agree, for instance, that we are satisfied with a probability of a million to one as giving us reasonable security against a chance coincidence. Let there be a periodic effect of such a nature that the ratio of the occurrence at the time of maximum to that at the time of minimum shall on the average be as $1 + \lambda$ to $1 - \lambda$, then the number of observations necessary to establish such an effect is given by the equation $n = 200/\lambda^2$. If there are 2 per cent. more occurrences at the time of maximum than at the time of minimum $\lambda = {\cdot}01$, and n is equal to two million. If the effect is 5 per cent., the number of events required to establish it is 80,000.

To illustrate these results further, I take as a second example a suggested connection between the occurrence of thunderstorms and the relative position of sun and moon. Among the various statistical investigations which have been made on this point, that of Mr. MacDowall lends itself most easily to treatment by the theory of probability. One hundred and eighty-two thunderstorms observed at Greenwich during a period of fourteen years have been plotted by Mr. MacDowall as distributed through the different phases of the moon, and seem to show a striking connection. I have calculated the principal Fourier coefficient from the data supplied, and find that it indicates a lunar periodicity giving for the ratio of the number of thunderstorms near new moon to that near full moon the fraction 8·17 to 4·83.

This apparently indicates a very strong effect, but the inequality is only twice as great as that we should expect if thunderstorms were distributed quite at random over the month, and the probability of a true connection is only about 20 to 1. No decisive conclusions can be founded on this, the number of thunderstorms taken into account being far too small. We might dismiss as equally inconclusive most of the other researches published on the subject were it not for a remarkable agreement among them, that a larger number of storms occur near new moon than near full moon.

I have put together in the following table the results of all investigations that are known to me; following the example of Koeppen, I have placed in parallel columns the number of thunderstorms which have occurred during the fortnight including new moon and the first quarter, and the fortnight including the other two phases.

Place of Observations and Author.	Time of Observations.	Percentage of Thunderstorms during the fortnight including	
		New moon and first quarter.	Full moon and last quarter.
Karlsruhe (Eisenlohr)	1801-31	50·8	49·2
Gotha (Luedicke)	1867-75	72·5	27·5
Vigevano (Schiaparelli)	1827-64	46	54
Germany (Köppen)	1879-83	56	44
Glatz, Silesia (Richter)	1877-84	62	38
United States (Hazen)	1884	56·5	43·5
Prag (Grüss)	1840-59	51	49
,, ,,	1860-79	52·5	47·5
Göttingen (Meyer)	1857-80	54	46
Kremsmunster (Wagner)	1862-87	53·8	46·2
Aix la Chapelle (Polis)	1833-92	54·4	45·6
Sweden (Ekholm)	1880-95	53·8	46·2
Batavia (v.d. Stock)	1887-95	51·9	48·1
Greenwich (MacDowall)	1888-91	54	46
Average	—	54·9	45·1

It will be seen that out of fourteen comparisons, thirteen show higher numbers in the first column, there being also, except in two cases, a general agreement as regards the magnitude of the effect. Two of the stations given in the table, Göttingen and Gotha, are perhaps geographically too near together to be treated as independent stations, and we may, therefore, say that there are thirteen cases of agreement, against which there is only one published investigation (Schiaparelli) in which the maximum effect is near the full moon.

The probability that out of thirteen cases in which there are two alternatives, selected at random, twelve should agree and one disagree is one in twelve hundred. If the details of the investigations summarised in the above table are examined, considerable differences are found, the maximum taking place sometimes before new moon and sometimes a week later. There is, however, evidently sufficient *prima facie* evidence to render an exhaustive investigation desirable. The most remarkable of all coincidences between thunderstorms and the position of the moon remains to be quoted. A. Richter has arranged the thunderstorms observed at Glatz, in Silesia, according to lunar hours, and finds that in each of seven successive years the maximum takes place within the four hours beginning with upper culmination. If this coincidence is a freak of chance, the probability of its recurrence is only one in three hundred thousand. The seven years which were subjected to calculation ended in 1884. What has happened since? Eighteen years have now elapsed, and a further discussion with increased material would have definitely settled the question, but nothing has been done, or, at any rate, published. To me it seems quite unintelligible how a matter of this kind can be left in this unsatisfactory state. Meteorological observations have been allowed to accumulate for years, one might be tempted to say for centuries, yet when a question of extraordinary interest arises we are obliged to remain satisfied with partial discussion of insufficient data.

The cases I have so far discussed were confined to periodical recurrences of single detached and independent events, the condition, under which the mathematical results hold true, being that every event is entirely independent of every other one. But many phenomena, which it is desirable to examine for periodic regularities, are not of this nature. The barometric pressure, for instance, varies from day to day in such a manner that the deviations from the mean on successive days are not independent. If the barometer on any particular day stands half an inch above its average it is much more likely that on the following day it should deviate from the mean by the same amount in the same direction than that it should stand half an inch below its mean value. This renders it necessary to modify the method of reduction, but the theory of probability is still capable of supplying a safe and certain test of the reality of any supposed periodic influence. I can only briefly indicate the mathematical theorem on which the test is founded. The calculation of Fourier's coefficients depends on the calculation of a certain time integral. This time integral will for truly homogeneous periodicities oscillate about a mean value, which increases proportionately to the interval, while for variations showing no preference for any given period, the increase is only proportional to the square root of the time.

Investigations of periodicities are much facilitated by a certain preliminary treatment of the observations suggested by an optical analogy. The curve, which marks the changes of such variables as the barometric pressure, presents characteristics similar to those marking the curve of disturbance along a ray of white light. . . . . .

I believe meteorologists would find it useful to draw similar curves connecting intensity and period for all variations which vary round a mean value such as barometric, thermometric or magnetic variations. These curves will, I believe, in all cases add much to our knowledge ; but they are absolutely essential if systematic searches are to be made for homogeneous periods. The absence of any knowledge of the intensity of periodic variation renders it, *e.g.*, impossible to judge of the reality of the lunar effect which Ekholm and Arrhenius believe to have traced in the variations of electric potential on the surface of the Earth. The problem of separating any homogeneous variation, such as might be due to lunar or sunspot effects, is identical with the problem of separating the bright lines of the chromosphere from the continuous overlapping spectrum of the sun. This separation is accomplished by applying spectroscopes of great resolving powers. In the Fourier analysis, resolving power corresponds to the interval of time which is taken into account, hence to discover periodicities of small amplitude we must extend the time interval of the observations.

I believe that the curve which connects the intensity with the period will play an important *rôle* in meteorology. It is a curve which ought to have a name, and for want of a better one I have suggested that of periodograph. To take once more barometric variations as an example, it is easy to see that, just as in the case of white light, the periodograph would be zero for very short, and probably also for very long, periods. There must be some period for which intensity of variation is a maximum. Where is that maximum? And does it vary according to locality? The answer to these questions might give us valuable information on the difference of climate. Once the periodograph has been obtained, the question of testing the reality of any special periodicity is an extremely simple one. If h be the height of the periodograph, the probability that, during the time interval chosen, the square of the Fourier coefficient should exceed kh is e^{-k}. If we wish this quantity to be less than a million, k must be about 11; so that in order to be reasonably certain that any periodicity indicates the existence of a truly homogeneous variation, the square of the Fourier coefficient found should not be less than 11 times the corresponding ordinate of a periodograph. . . . . .

If such a danger exists in Astronomy, what shall we say about Meteorology? That science is bred on routine, and drudgery is often its highest ambition. The heavens may fall in, but the wet bulb must be read. Observations are essential, but though you may never be able to observe enough, I think you can observe too much. I do not forget the advances which Meteorology has made in recent years, but if you look at these advances, I think you will find that most of them do not depend on the accumulation of a vast quantity of material. The progress in some cases has come through theory, as in the applications of Thermodynamics, or through special experiments as by kite and balloon observations, and when it has come through the ordinary channels of observation only a comparatively short period of time has been utilised. It would not be a great exaggeration to say that Meteorology has advanced in spite of the observations and not because of them.

What can we do to mend matters? If we wish to prepare the way for the gradual substitution of a better system, we should have some one responsible for the continuation of the present one. For this purpose it should be recognised that the head of the Meteorological Office is something more than a Secretary to a Board of Directors; also that he is appointed to conduct Meteorological research and not to sign weather forecasts. The endowment of Meteorology should mean a good deal more than the endowment of the Telegraph Office which transmits the observations. Terrestrial Magnetism and Atmospheric Electricity are looked after at present by institutions already over-worked in other directions and should be handed over to an enlarged Department of Meteorology. Seismology in this country now depends on the private enterprise and enthusiasm of a single man, and as long as Prof. Milne is willing to continue his work, we cannot do better than leave it with him, but some permanent provision will ultimately have to be made.

An improved organisation such as I have sketched out would do good, but could only very slowly overcome the accumulated inertia of ages. I should prefer a more radical treatment. Organisation is good, but sometimes disorganisation is better.

Most earnestly do I believe that the subjects of meteorology and terrestrial magnetism, and possibly also of atmospheric electricity, could be most quickly advanced at the present moment if all observations were stopped for five years, and all the energy of all observers and computors concentrated on the discussion of the results obtained and the preparation of an improved scheme of observation for the future. When we have made up our minds what to do with the observations, when we have actually done it, when we know where our present instruments require refining or supplementing, and especially when we have found out whether we have not spent much time and trouble on unnecessary detail, then the time will have arrived for us to draw up an economical, sufficient and efficient scheme of observations. At present we are disinclined to discontinue observations, though recognised as useless, for fear of causing a break. We make ourselves slaves to so-called "continuity," which is important, but may be, and I believe is being, too dearly purchased.

There are no doubt some, though probably not very many, observations which it is necessary to carry on continuously over long periods of time. But at present we are groping in the dark, and go on observing everything, and always in the hope that some time the observations may prove useful. Our whole point of view in this respect wants altering. We should fix on our problem first and then provide the observations which are necessary for the solution of the problem. Let us restrict, in the first instance, the secular observations to the smallest number, and concentrate our attention, for short periods of time, on some special question. Let us have, for instance, two or three years of thunderstorm observations, all countries joining in concentrating their energies to the elucidation of all the various features of their phenomena. When that is accomplished, it will probably be found that thunderstorms may be left to shift for themselves for a while, and attention might be directed to some other matter. The whole question of lunar influence on meteorological phenomena might be settled in a comparatively short space of time if the civilised countries of the world could agree to record all observations during a few years according to lunar instead of solar co-ordinates. Other problems will readily suggest themselves to you, and several might possibly be dealt with simultaneously.

The great reform I have in view is this:—Before you observe, make sure that your observations will be useful and will help to answer a definite question. . . . . .

Radiation in Meteorology. By W. N. SHAW, Sc.D., F.R.S.

It may be said, without any serious misrepresentation, that experimental measurements of radiation are at present devoted to astronomical purposes, in respect of which the atmosphere is an undesirable disturbing element to be eliminated if possible. The intruments have been directed towards the unclouded sun or the moon with the object of determining a "constant" of solar or lunar radiation, and, to avoid the disturbing effect of the atmosphere, observations have been taken at very considerable heights. The solar constant depends upon the temperature of the sun, and radiation experiments are our only means of estimating that temperature. We may, indeed, regard a "radiometer," using that name to indicate any instrument used for measuring radiation (although "actinometer" may be the more correct appellation from the literary point of view) as a thermometer which, under certain assumptions, has the invaluable characteristic that its readings depend on action at a distance. In a sense a radiometer will determine the temperature of anything that it can see, and on that account it is very desirable that radiometric methods should be applied to the atmosphere for meteorological purposes. It is of course a little unfortunate that a radiometer can usually see the whole thickness of the more or less transparent atmosphere, and that meteorology offers no object so well defined from the point of view of radiation as the sun or the moon ; but very valuable information of at least a qualitative kind might be obtained by differential measurements of the effect upon a radiometer when the sky is not clear, or intermittently clear, and much light may thus be thrown upon such subjects as the temperature of clouds and the physical processes associated with various states of the weather.

An effective radiometer might be regarded as a sixth sense for the meteorologist, giving the same kind of information with regard to the temperature of clouds and other masses of air, as the eye gives for luminosity. There are, of course, many difficulties to be overcome before the readings of such an instrument can be fully interpreted, but even the eye itself is not free from objections as an instrument for observing meteorological changes, it nevertheless gives us information which is altogether indispensable, and a good radiometer might be no worse, and perhaps no better, than the eye.

The instrumental observations of the meteorologist, on the other hand, have developed into a certain routine, and it is in the hope that those observers who have the opportunity and inclination to prosecute the study in a more experimental manner may be encouraged to take up the subject of the measurement of radiation, that I have ventured to make this communication.

In this paper I do not purpose dealing with special apparatus of comparatively recent design, such as that of Violle, Crova, Ångstrom or Chevolson, for the accurate measurement of radiation.

Some of the meteorological instruments already in general use depend upon radiation for their readings, viz., the grass minimum and the black bulb thermometers, and the sunshine recorder. I shall leave out of account the grass minimum, because it is purposely placed in a situation in which convection, or the absence of it, affects the readings very seriously. It records the cumulative effect of direct radiation, together with the cooling produced by previous exposure.

The black bulb thermometer is used only as a maximum instrument, and although its indications may be useful for statistical purposes, they are of very little importance to students of atmospheric physics. On the other hand, a comparison of the simultaneous readings of a thermometer sensitive to and exposed to radiation and of a thermometer in the screen might give very valuable results for different conditions of weather. Such observations taken at night might distinguish between warm and cold clouds. The thick haze which sometimes precedes a thunderstorm is relatively opaque and might probably be recognised as producing considerable rise of temperature in objects in consequence of its own radiation.

It is doubtful whether the black bulb in vacuo would be a serviceable instrument for these purposes on account of the opacity as regards heat of the glass envelope. Mr. Omond found it unserviceable for this purpose at the Ben Nevis Observatory, but an unenclosed black bulb might be arranged to show some indication. Many years ago Mr. Glaisher compared a thermometer in a screen with one exposed at the focus of a parabolic mirror directed to the sky and obtained differences of 1°·5 C. for a cloudy sky and 4°·6 C. for a clear sky. It is also, I believe, well known that in the mountain districts of India radiation may cause very serious disturbance of the temperature readings. So that it is still possible that a thermometer might be found sufficiently sensitive for the purpose I have indicated, and a reading each night under various specified conditions of weather might enable us to explain on the basis of meteorological fact the difference, for example, between sultry and brisk warm weather.

The sunshine recorder shows, of course, a record whenever the sun's radiation exceeds a certain limit, but there are still some unexplained phenomena associated with solar records which accentuate the desirability of exploring the atmosphere with a radiometer. In this matter I wish to refer to some records shown to me recently by Mr. A. Cresswell, of the Midland Institute Observatory, Birmingham. Mr. Cresswell has the solar records of the Campbell-Stokes and the Jordan sunshine recorders placed side by side. Some of these records show traces of actinic effect when no charring effect is produced—that does not seem surprising—but there were also cases in which there was a scar on the Campbell-Stokes card without any record on the photographic paper. I hope Mr. Cresswell will give the details. They appear to show that there is no immediate proportionality between the transparency of the atmosphere for thermal and actinic rays, and this selective absorption certainly requires investigation. The Birmingham atmosphere may, perhaps, not be regarded as normal, but at least one other observer has informed me that he has noticed corresponding effects. I mention these matters because they show that we have not yet reached the meteorological explanation, or even a complete classification, of the facts which our instruments record. The meteorologist who is satisfied with his mean values and desires to go beyond the limits of routine, if he is willing to venture into the region of experiment, need not go far to find subjects of interest and importance.

Correspondence.

THE MOON AND THUNDERSTORMS.

To the Editor of Symons's Meteorological Magazine.

I HAVE just seen in your August number (p. 108) a letter by the Rev. S. J. Johnson, in which he gives the results of his observations of the relation of thunderstorms to the phases of the moon during thirty years, from which he concludes, in opposition to other observers, that there was a slight excess of thunderstorms about full moon and a slight defect about new moon.

I agree with him that the question is far from being settled, and that it deserves fuller consideration, but it seems to me that his conclusion is based on too small a number of cases, for the 97 thunderstorms with which he deals only amount to an average of a trifle over three each year. On the other hand the results I found, which are in accordance with those of Mr. MacDowall, and the other observers cited by him, according to Professor Hann, are deduced from observations of 455 thunderstorms at Madrid, during the twenty years 1882–1901, an average of nearly 23 per year.

It is to be regretted that Mr. Johnson has been able to make use only of data which are, in my opinion, insufficient; for in all such statistical problems the laws governing phenomena can only be deduced by the systematic study of a considerable assemblage of observed facts. V. VENTOSA.

Observatorio Astronomico, Madrid, 23rd Oct., 1902.

THE TEN MONTHS' RAINFALL OF 1902.

Aggregate Rainfall for January—October, 1902.

Stations.	Diff. from Aver.	Per cent. of Aver.	Stations.	Diff. from Aver.	Per cent. of Aver	Station.	Diff. from Aver.	Per cent. of Aver.
	in.			in.			in.	
London	–1·10	94	Arncliffe	-16·99	65	Aberdeen	–1·82	93
Tenterden	–4·96	77	Hull	–2·49	88	Cawdor	–2·81	89
Hartley Wintney	–2·89	86	Newcastle	–3·25	85	Strathconan	–7·18	83
Hitchin	·00	100	Seathwaite	-35·38	66	Glencarron	–6·94	91
Winslow	–4·16	79	Cardiff	–4·94	84	Dunrobin	–3·44	86
Westley	–1·73	92	Haverfordwest	–3·80	89	Darrynane	–9·64	75
Brundall	–1·19	94	Gogerddan	–6·87	80	Waterford	– ·95	97
Blandford	...	...	Llandudno	–3·55	85	Broadford	–4·88	82
Polapit Tamar	–4·08	86	Dumfries	–7·95	77	Carlow	– ·37	99
Stroud	–1·67	92	Lilliesleaf	–2·99	88	Dublin	+2·09	109
Woolstaston	+2·25	110	Colmonell	–4·37	87	Mullingar	–5·06	83
Worcester	+2·13	112	Glasgow	–4·74	83	Ballinasloe	–6·93	76
Boston	+2·37	114	Islay	–2·41	93	Clifden	-19·10	70
Hesley Hall	– ·15	99	Mull	–3·19	93	Crossmolina	–6·19	85
Derby	+1·09	106	Loch Leven	–7·77	73	Seaforde	+3·28	111
Manchester	...	...	Dundee	–4·68	79	Londonderry	–3·22	87
Wetherby	–1·85	91	Braemar	–4·34	84	Omagh	– ·49	98

The past month has proved exceptionally dry. Normally no part of the British Islands receives less than 2·50 in. of rain during October, but for October, 1902, the whole of the centre of Ireland, the east of Scotland, and a great triangular area of England spreading from Bath to the Wash on the north-east and to Dungeness on the south-east, have received less than two inches. The result has been to intensify the dearth of rain, diminishing the area of the district within which a normal amount has been received to the Midland counties and the Welsh border. The deficiency is most marked in some of the districts which have normally the heaviest fall—thus, for the ten months less than eight-tenths of the normal rainfall appear to have fallen in the south west of Ireland, the English Lake District and the neighbouring parts of Yorkshire and Northumberland, the centre of the Southern Uplands of Scotland, Midlothian, Fife and Forfar. Certain isolated parts of the south of England, illustrated in the above table by Tenterden and Winslow, shared in this excessive dryness.

BOOKS RECEIVED.

Annales de l'Observatoire National d'Athènes. Tome III. Publiées par Démétrius Eginitis. Athènes, 1901. Size 12 x 9. Pp. 376.

Borough of Eastbourne. Annual Report of the Meteorological Observations for the year 1901. Published by authority. Alderman N. Strange, R. Sheward, and C. H. Taylor. Size 9 x 6. Pp. 19.

Cornwall County Council. Sanitary Committee. Annual report, vital statistics and meteorological summary for 1901. Truro, 1902. Size 11 x 8½. Pp. 20.

METEOROLOGICAL NEWS AND NOTES.

THE SCOTTISH ANTARCTIC EXPEDITION sailed from the Clyde on November 2nd, on board the *Scotia*, which is practically a new ship, specially built and equipped for scientific work. The *Scotia* is a singularly graceful vessel, and while as strong as any Arctic whaler she can steam faster, and proceed faster under sail, than any of the four ships now employed on scientific work in Antarctic waters. She is under the command of an able and experienced whaler, Captain Thomas Robertson, acting under the instructions of Mr. W. S. Bruce, who is alone responsible for the promotion and execution of the expedition. The funds were provided by private subscription, one or two wealthy donors giving the greater part. No society or committee can claim any credit in the matter. Special attention will be devoted to meteorology, including kite-work. Mr. Bruce is himself a trained meteorological observer, and so is his assistant, Mr. Wilton; but this department has been placed in the eminently capable hands of Mr. R. C. Mossman, whose original work in many departments of meteorology is familiar to our readers. The equipment of recording instruments is very complete.

KITE EXPERIMENTS AT SEA were made from the German Antarctic ship *Gauss*, on her voyage to Cape Town, last year, but from the recently published report they do not seem to have been successful. Great difficulty was found in raising the kite when the ship was under sail on account of the eddy of air from the sails, and the experiments were ultimately postponed so as to leave sufficient material for observations in the Antarctic. The greatest height reached was on October 18th, 1901, in about 18° 7′ S., when the kite was raised to about 1,200 feet, the temperature at that height being found to be 7° F. lower than at sea-level.

SUNSETS OF REMARKABLE BEAUTY have been reported from many parts of the country, and there seems no reason to doubt that they are the result of the presence of very fine particles of dust, resulting from the volcanic eruptions in the West Indies.

THE CYCLONE is a poem by Mr. Townsend Allen, quoted from a newspaper by the *Monthly Weather Review*, and since the Editor of that official publication justifies the quotation because "the poetry is good; the meteorology seems to be correct," we need make no apology in offering the two first stanzas to our readers—

"With my heart on fire
With the sun's desire,
I arise from my tropic home,
And curl and swirl
With a passionate whirl
To the breast of the temperate zone;
Then my arms I fling
Round the winds and sing,
As I fast and faster turn
In my sullen shroud
Of darkening cloud
Through which the lightnings burn.

"Around and around
With terrible sound
A living wheel of air
I circling glide
O'er the ocean's tide
And scatter the ships that are there,
Then close to the shore
I press on and roar
While towns and cities fall,
As my garments swing
In the fatal ring
I destroy them one and all.

OCTOBER, 1902.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1890-9.	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date	Min. Deg.	Min. Date	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square)	1·46	— 1·13	·28	9	17	66·2	10	32·7	19	0	2
II.		Tenterden	1·90	— 1·09	·35	15	18	64·0	10	33·0	30	0	4
,,		Hartley Wintney	1·72	— 1·17	·33	10	14	68·0	10	31·0	31	2	5
III.		Hitchin	1·73	— ·84	·38	17	19	63·0	10	30·0	18	1	...
,,		Winslow (Addington)	1·60	— 1·09	·56	9	16	63·0	10	28·0	19	2	6
IV.		Bury St. Edmunds (Westley)	1·61	— 1·05	·31	17	18	64·5	10	33·0	19	0	...
,,		Norwich (Brundall)	1·34	— 1·28	·21	5	23	65·3	10	35·6	31	0	2
V.		Winterborne Steepleton	2·92	...	·50	10	17	63·3	10	33·0	8	0	8
,,		Torquay	3·51	...	1·38	9	17	62·8	26	41·6	31	0	0
,,		Polapit Tamar [Launceston]	3·32	— 1·22	·60	9	22	61·2	23	29·0	8	1	2
VI.		Stroud (Upfield)	1·72	— 1·06	·66	9	12	61·0	10	37·0	17	0	...
,,		Church Stretton (Woolstaston)	3·27	— ·23	1·25	9	20	59·0	13	37·0	3,4,5	0	1
,,		Worcester (Diglis Lock)	2·82	+ ·17	1·02	8	18	...	...	...	...	...	...
VII.		Boston	2·15	— ·12	·55	13	16	60·0	12	30·0	31	...	...
,,		Hesley Hall [Tickhill]	2·50	— ·07	·55	13	20	57·0	25	31·0	4	1	...
,,		Derby (Midland Railway)	2·42	— ·12	·40	13	23	65·0	4	35·0	12	0	...
VIII.		Manchester (Plymouth Grove)	...	...	...	...	...	...	...	...	...	...	...
IX.		Wetherby (Ribston Hall)	3·29	+ ·49	1·01	9	22	...	...	...	...	...	...
,,		Skipton (Arncliffe)	5·50	— 1·14	·78	15	25	...	...	...	...	...	...
,,		Hull (Pearson Park)	3·19	+ ·15	·84	13	22	60·0	13	31·0	19	1	10
X.		Newcastle (Town Moor)	2·51	— ·21	·95	10	21	...	...	...	...	...	...
,,		Borrowdale (Seathwaite)	10·61	— 2·81	1·50	15	19	58·5	13	30·3	8	1	...
XI.	WALES.	Cardiff (Ely)	3·57	— ·86	·67	9	20	...	...	...	...	...	...
,,		Haverfordwest	4·13	— ·95	·90	13	16	61·2	1	35·5	19	0	6
,,		Aberystwith (Gogerddan)	5·29	— ·17	2·00	13	18	63·0	10	27·0	11	5	...
,,		Llandudno	2·91	— 1·09	·90	9	18	61·2	13	40·0	19	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	3·80	— ·63	·61	14	14	59·0	14*a*	29·0	19	2	...
XIII.		Edinburgh (Royal Observatory)	1·06	...	·30	14	13	60·7	29	36·9	19	0	5
XIV.		Colmonell	2·21	— 2·13	·62	25	17	66·0	3	29·0	3	3	...
XV.		Tighnabruaich	4·24	...	·71	25	16	54·0	1	32·0	10	1	...
,,		Mull (Quinish)	4·79	— ·78	·86	14	18	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·90	— 1·67	·37	16	17	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	1·40	— 1·36	·25	14	20	58·9	31	29·9	19	3	...
XVII.		Braemar	3·18	— ·70	·93	16	19	56·0	28	21·8	11	9	15
,,		Aberdeen (Cranford)	1·59	— 1·77	·30	14	22	60·0	14	25·0	18	7	...
,,		Cawdor (Budgate)	1·94	— 1·00	·48	24	13	...	...	...	...	...	...
XVIII.		Strathconan [Beauly]	3·72	— 1·93	·74	17	11	...	...	...	...	...	...
,,		Glencarron Lodge	10·34	+ 1·05	2·66	15	21	58·0	2	31·8	4	1	...
XIX.		Dunrobin	1·64	— 1·64	·75	19	13	59·0	29	32·0	19	1	...
,,		S. Ronaldshay (Roeberry)	2·33	— 1·85	·28	23	22	59·0	2	36·0	30	0	...
XX.	IRELAND.	Darrynane Abbey	2·97	— 2·24	·58	25	17	...	...	...	...	...	...
,,		Waterford (Brook Lodge)	2·53	+ 1·37	·45	9	16	60·0	1	37·0	21	0	...
,,		Broadford (Hurdlestown)	1·87	— 1·23	·40	25	21	62·0	31	34·0	10	0	...
XXI.		Carlow (Browne's Hill)	2·59	— ·81	·40	10	20	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	3·06	+ ·03	·81	4	23	61·5	12	40·3	17	0	0
XXII.		Ballinasloe	1·59	— 1·81	·35	19	17	60·0	11*b*	34·0	11	0	...
,,		Clifden (Kylemore)	3·65	— 4·29	·54	20	15	...	...	...	...	...	...
XXIII.		Seaforde	2·00	— 1·59	·50	17	18	59·0	29	32·0	3	1	3
,,		Londonderry (Creggan Res.)	2·81	— 1·27	·76	15	17	...	...	...	...	...	...
,,		Omagh (Edenfel)	2·66	— 1·25	·52	15	18	58·0	24	31·0	10	1	4

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

a—and 23. *b*—and 24.

SUPPLEMENTARY TABLE OF RAINFALL, OCTOBER, 1902.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	1·73	XI.	Castle Malgwyn	4·02
II.	Dorking, Abinger Hall .	2·44	,,	Builth, Abergwesyn Vic.	...
,,	Sheppey, Leysdown	1·71	,,	Rhayader, Nantgwillt ...	4·87
,,	Hailsham	2·62	,,	Lake Vyrnwy	5·20
,,	Crowborough..............	3·12	,,	Ruthin, Plâs Drâw	3·84
,,	Ryde, Beldornie Tower..	2·13	,,	Criccieth, Talarvor	4·36
,,	Emsworth, Redlands ...	2·25	,,	I. of Anglesey, Lligwy..	3·50
,,	Alton, Ashdell	2·26	,,	Douglas, Woodville......	4·20
,,	Newbury, Welford Park	2·20	XII.	Stoneykirk, Ardwell Ho.	1·93
III.	Oxford, Magdalen Coll..	1·66	,,	Dalry, Old Garroch	3·82
,,	Banbury, Bloxham	2·26	,,	Moniaive, Maxwelton Ho.	2·96
,,	Pitsford, Sedgebrook ...	2·18	,,	Lilliesleaf, Riddell	2·12
,,	Huntingdon, Brampton.	1·81	XIII.	N. Esk Res. [Penicuick]	2·50
,,	Wisbech, Bank House...	1·80	XIV.	Glasgow, Queen's Park..	2·36
IV.	Southend	1·72	XV.	Inveraray, Newtown ...	5·69
,,	Colchester, Lexden	1·49	,,	Ballachulish, Ardsheal...	7·69
,,	Saffron Waldon, Newport	1·29	,,	Islay, Eallabus...........	2·18
,,	Rendlesham Hall	1·81	XVI.	Dollar......................	2·63
,,	Swaffham	1·86	,,	Balquhidder, Stronvar...	5·41
V.	Salisbury, Alderbury ...	1·85	,,	Coupar Angus Station...	1·18
,,	Bishop's Cannings	1·78	,,	Blair Atholl	1·48
,,	Blandford, Whatcombe .	...	,,	Montrose, Sunnyside ...	1·61
,,	Ashburton, Druid House	4·00	XVII.	Keith H.R.S..............	3·12
,,	Okehampton, Oaklands.	3·61	XVIII.	Fearn, Lower Pitkerrie..	1·28
,,	Hartland Abbey	3·63	,,	S. Uist, Askernish	3·98
,,	Lynmouth, Rock House	4·17	,,	Invergarry.................	6·82
,,	Probus, Lamellyn	2·91	,,	Aviemore, Alvie Manse.	2·98
,,	Wellington, The Avenue	1·98	,,	Loch Ness, Drumnadrochit	2·49
,,	North Cadbury Rectory	2·28	XIX.	Invershin	1·12
VI.	Clifton, Pembroke Road	2·56	,,	Bettyhill	3·91
,,	Ross, The Graig	3·36	,,	Watten H.R.S............	1·85
,,	Shifnal, Hatton Grange	2·78	XX.	Dunmanway, Coolkelure	...
,,	Wem, Clive Vicarage ...	2·89	,,	Cork, Wellesley Terrace	1·30
,,	Cheadle, The Heath Ho.	3·09	,,	Killarney, District Asyl.	2·46
,,	Coventry, Priory Row ..	2·55	,,	Caher, Duneske	...
VII.	Market Overton	2·49	,,	Ballingarry, Hazelfort...	1·76
,,	Grantham, Stainby	2·14	,,	Miltown Malbay	2·37
,,	Horncastle, Bucknall ...	1·99	XXI.	Gorey, Courtown House	2·64
,,	Worksop, Hodsck Priory	2·16	,,	Moynalty, Westland ...	2·43
VIII.	Neston, Hinderton	3·28	,,	Athlone, Twyford	1·82
,,	Southport, Hesketh Park	3·01	,,	Mullingar, Belvedere ...	2·52
,,	Chatburn, Middlewood.	5·30	XXII.	Woodlawn	1·67
,,	Duddon Val., Seathwaite Vic.	6·48	,,	Westport, Murrisk Abbey	3·25
IX.	Baldersby	2·39	,,	Crossmolina, Enniscoe ..	4·02
,,	Scalby, Silverdale	2·88	,,	Collooney, Markree Obs.	3·12
,,	Ingleby Greenhow Vic..	3·08	XXIII.	Enniskillen, Model Sch.	...
,,	Middleton, Mickleton ...	2·57	,,	Warrenpoint..............	2·21
X.	Beltingham	3·37	,,	Banbridge, Milltown ...	1·32
,,	Bamburgh	1·26	,,	Belfast, Springfield	...
,,	Keswick, The Bank	5·30	,,	Bushmills, Dundarave..	1·93
XI.	Llanfrechfa Grange	4·29	,,	Stewartstown	1·65
,,	Treherbert, Tyn-y-waun	7·85	,,	Killybegs	4·65
,,	Llandovery	4·08	,,	Horn Head	3·47

METEOROLOGICAL NOTES ON OCTOBER, 1902.

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.

LONDON, CAMDEN SQUARE.—Variable weather with frequent drizzle, but little heavy R. Mild on the whole, though often damp, with frequent fog during the last week. Mean temp. 50°·4, or 0°·6 above the average.

ABINGER HALL.—Very mild and genial throughout. Flowers, including roses, still adorn our gardens. The foliage is beautiful on account of calm weather and absence of frost.

TENTERDEN.—R and sunshine both deficient. Ground dry at the close, but grass was abundant. Duration of sunshine 73 hours. T and H on 14th.

CROWBOROUGH.—October maintained its reputation as a rainy month. Sun on 19 days. Mean max. temp. 54°·6, mean min. 43°·2.

WINSLOW, ADDINGTON.—Very unsettled weather. Generally dull, but favourable for outdoor work. T on 14th.

PITSFORD, SEDGEBROOK.—Mild, cloudy and open. R ·90 in. below the average of 10 years. Mean temp. 48°·6.

BURY ST. EDMUNDS, WESTLEY.—Mild, with tender flowers in full bloom at the end. TS on 14th.

NORWICH, BRUNDALL.—Although R was recorded on 23 days, on 17 of these the fall was under ·10 in. There was practically no frost, and garden flowers kept in full bloom. T and L on 14th.

TORQUAY, CARY GREEN.—R ·44 in. below the average. Mean temp. 53°·8, or 2°·0 above the average. Duration of sunshine 93·5 hours, or 22·8 hours below the average. Mean amount of ozone 5·0, max. 9·0 on 9th, with E. wind, 10th with S.S.E. wind, and 11th with N.W. wind, and min. 1·0 on 6th, with N.E. wind.

LYNMOUTH, ROCK HOUSE.—Mild, but with no long period of bright sunshine. On 14th H fell between 8 and 9 a.m.

WELLINGTON, THE AVENUE.—R more than an inch deficient. The month opened with strong, dry and cold N.E. winds, but after the 8th the temp. was fairly high.

NORTH CADBURY RECTORY.—Very equable temp.; the early part cool and the latter warm. Frosts were unusually few. R was small and frequent, hardly up to the average. Excessively damp, and cloud considerably in excess.

CLIFTON, PEMBROKE ROAD.—Weather changeable, but a dry mild type predominated. R 1·16 in. below the average.

ROSS, THE GRAIG.—The R, which almost all fell in the first 19 days, was ·40 in. above the average. Mean temp. 50°·0, or 1°·4 above the average of 30 years. The first twenty days were usually cold and wet, the remainder very fine and warm. There was no frost in the screen, and tender plants, such as dahlias, were uninjured at the close. Autumn tints very beautiful.

COVENTRY, PRIORY ROW.—Very fine, though a fairly heavy R, and perhaps less sun, than usual. Foliage little changed at the end. No severe frosts.

CHATBURN, MIDDLEWOOD.—R ·75 in. above the average of 13 years.

HULL, PEARSON PARK.—Very cloudy and dismal on several occasions. R fell principally during daytime. Fog on 15 days, generally slight. N.E. winds in the earlier part, afterwards S. or S.W. Duration of sunshine 31 hours.

WALES AND THE ISLANDS.

HAVERFORDWEST, HIGH STREET.—There were 11 days without R, and 14 more when the R fell at night, so October may be said to have had its proverbial 20 fine days. Uniform mildness characterized the month. Prevailing winds N.E., W., and N.W. Hours of bright sunshine 80.

DOUGLAS, WOODVILLE.—Northerly winds, more or less strong and cold, prevailed for the first week, and were followed by strong S.W. winds, with milder weather, frequent gales, and almost daily R. The last week, though the temp. was nearly 3° above the mean, was almost sunless. No frost.

SCOTLAND.

LILLIESLEAF, RIDDELL.—Continual light and short showers, with little wind, kept the corn very wet, and it was impossible to get it properly in. A severe storm, with some R, on 15th, lasted from about 10 a.m. to 5 p.m., the wind velocity varying from 30 to 49 miles an hour. A good deal of damage was done, principally to ash trees.

TIGHNABRUAICH.—The prevailing winds were N.E., and so long as they blew steadily there was no R. However they gave way during the latter part, favouring us with an average fall.

COUPAR ANGUS.—Mean temp. 45°·7, or about 1°·0 above the average, and R 1·48 in. below the average. As in the preceding months the atmosphere was continuously moisture laden. Harvest not yet finished.

BETTYHILL.—R fell pretty frequently, but was generally very slight. There were two or three very stormy days, notably the 24th.

WATTEN, H.R.S.—The first half was cloudy and comparatively dry, with frosts at night; the second half wet and dull, with storms of wind and moderate R.

S. RONALDSHAY, ROEBERRY.—A very fair month, with no severe gales. Mean temp. 46°·7, or 0°·5 above the average of 12 years.

IRELAND.

CORK, WELLESLEY TERRACE.—Mean temp. 1°·7 below the average. A cyclonic storm from S.W. on the morning of 15th did great damage to shipping and old houses.

DARRYNANE ABBEY.—The first ten days were very fine, but with cold E. and N.E. wind. The remainder was mild, with days usually dry and R at night. The last few days were foggy and close.

MILTOWN MALBAY.—Very fine and mild with no high wind except a heavy N.W. gale on 15th. The first fortnight was very dry, and dried up all pastures and springs, so that a dearth of feed for cattle and of water ensued. The latter half was dripping, with two heavy falls, but no water reached the springs, though herbage became green again.

DUBLIN, FITZWILLIAM SQUARE.—Cloudy skies, deficient sunshine, frequent R and high mean temp. Mean temp. 51°·7 or 2°·3 above the average. High winds on 14 days, reaching the force of a gale only on 15th. Foggy on 8th and 11th. Duration of sunshine 84 hours.

COLLOONEY, MARKREE OBSERVATORY.—The first part was fine but at times gloomy, and with cold nights. From 11th it was showery with high wind, H on 16th. Duration of sunshine 66 hours.

OMAGH, EDENFEL.—Fine with practically no R until 12th, and less humidity than in September, so that a good though late harvest was fairly well saved. There was little or no frost, and the R fell mostly at night. The mean temp. 48°·6, is nearly 3°·0 above the average, and as a result the fall of the leaf was delayed beyond precedent.

REMARKABLE SQUALL AT MAURITIUS.

Mr. Claxton sends us the following note as to a squall felt at Mauritius on May 21st, 1902. The wind suddenly chopped from N.W. to S.W. at 9.50 p.m., and increased in velocity from 14 to 25 miles per hour, the temperature fell from 77°·2 to 68°·9, in eight minutes, while the barometer rose from 29·727 in. to 29·751 in. in 25 minutes. The preceding weather indicated that a storm was passing from S.W. to S.E. of Mauritius. Similar squalls often occur near the centres of extra-tropical gales, and from subsequent weather it would seem that the whole weather-system of the Southern Ocean has this year advanced farther north than usual.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1902.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	72·3	31	31·4	14	59·6	41·7	40·9	68	121·9	26·4	2·60	22	6·3
Malta	76·9	4	48·9	11	70·4	56·9	52·9	74	139·0	43·6	·52	2	3·9
Cape Town	91·7	14	40·4	29	71·9	53·3	54·0	72	...	...	4·28	11	4·2
Durban, Natal	83·5	2	52·0	17	77·4	59·3	...	...	132·3	...	1·21	10	2·4
Mauritius	83·4	4	59·9	31	80·2	66·4	64·4	76	146·2	51·8	1·88	12	5·7
Calcutta	97·2	7	68·4	3	92·2	76·6	75·8	77	152·8	67·2	9·19	9	4·5
Bombay	94·0	13	79·6	1	92·5	82·3	76·6	72	140·7	75·0	·00	0	2·7
Madras	108·0	8	77·7	3	100·5	82·2	74·0	66	150·2	75·7	·17	1	3·2
Kodaikanal	75·2	7	52·7	17	70·4	55·5	53·0	74	144·5	45·9	3·95	14	5·7
Colombo, Ceylon	90·5	12	72·8	21	88·3	78·6	76·0	83	148·8	70·0	11·89	24	7·3
Hongkong	89·1	7	70·6	11	83·9	76·0	74·3	84	141·7	...	26·73	24	8·1
Melbourne	71·7	5	37·1	20	62·2	47·9	47·7	78	128·0	29·1	1·05	7	6·1
Adelaide	83·9	5	43·9	1*b*	70·5	51·9	46·6	62	136·9	35·0	1·07	11	5·3
Coolgardie	80·9	19	42·0	27	69·7	49·0	48·6	60	148·0	34·6	2·20	6	5·2
Sydney	75·3	7	45·2	21	64·8	51·5	47·5	77	118·8	36·0	1·21	14	3·8
Wellington	64·0	31	33·0	24	57·2	45·9	39·9	64	110·0	28·0	5·19	21	6·5
Auckland	67·0	10	45·0	27	60·2	49·7	45·4	70	127·0	43·0	6·30	25	6·0
Jamaica, Negril Point	...	...	...	...	86·5	72·7	72·3	74	...	...	4·57	10	...
Trinidad	94·0	8*a*	65·0	1	91·7	66·7	71·9	69	167·0	58·0	2·14	7	...
Grenada	90·8	18	73·0	2*c*	84·3	75·4	71·0	75	154·0	...	3·00	16	4·0
Toronto	80·0	19	29·0	11	63·3	43·5	44·3	69	97·5	19·7	1·89	13	5·8
Fredericton, N.B.	81·7	23	25·9	19	60·3	37·7	32·9	48	...	...	4·84	13	5·9
Winnipeg	86·0	19	24·5	9	65·9	44·2	...	...	...	...	3·87	13	7·2
Victoria, B.C.	77·0	26	42·4	19	60·6	48·0	...	...	...	...	·97	10	6·8

a—and 12, 14. *b*—and 22. *c*—and 25.

Remarks.

Malta.—Mean temp. of air 62°·3, or 1°·8, below, and mean hourly velocity of wind 10·1 or 0·1 above, average. Mean temp. of sea 66°·8. TS on 25th. J. F. Dobson.

Mauritius.—Mean temp. of air 0°·5 above, dew point 0°·4, and rainfall 2·19 in. below, their respective averages. Mean hourly velocity of wind 8·8 miles, or 1·4 below average; prevailing direction S.S.E. to E. (See also p. 167). T. F. Claxton.

Madras.—Mean temp. of air below normal during first week, and then rose rapidly. Sunshine 202·5 hours, or 51·5 per cent. of possible amount. A. Moffat.

Kodaikanal.—Mean temp. of air 61°·1; sunshine 185·7 hours; mean daily velocity of wind 218 miles. Many afternoon TSS. C. Michie Smith.

Colombo, Ceylon.—Mean temp. of air 82°·7 or 0°·2 above, of dew point 76°·0 or 0°·6 above, and R 0·3 in. above, their respective averages. Mean hourly velocity of wind 9·5 miles, prevailing direction S.W. H. O. Barnard.

Hongkong.—Mean temp. of air 79°·4, or 2°·8 above average. Sunshine 121·0, or 31 hours below average. R 14·19 in. above 39 years average. Mean hourly velocity of wind 12·0 miles, prevailing direction S.E. F. G. Figg.

Adelaide.—Mean temp. 61°·2, the highest on record for May in 46 years. R 1·73 in. below the average. Extreme drought over all inland parts of State. C. Todd, F.R.S.

Coolgardie.—R excessive. W. Ernest Cooke.

Auckland.—Excessively stormy. Mean temp. of air 3° below average. R 2·07 in. above average of 30 years. T. F. Cheeseman.

Trinidad.—R 1·25 in. below average of 40 years. J. H. Hart.