SYMONS'S

METEOROLOGICAL MAGAZINE.

No. CCCCXXVIII.] SEPTEMBER, 1901. VOL. XXXVI.

Charles Meldrum.

KIRKMICHAEL, BANFFSHIRE, 1821.—EDINBURGH, 1901.

DR. CHARLES MELDRUM, C.M.G., F.R.S., whose researches on the meteorology of Mauritius and the Indian Ocean were of fundamental importance, died on August 28th, at Edinburgh, where he had resided since his retirement from active duties in 1896. After passing through the University of Aberdeen, he entered the Bombay Education Department in 1846, and was transferred two years later to the scene of his life's work in Mauritius. At first a Professor of Mathematics in the Royal College, he early turned his attention to meteorology, and in 1851 assisted in founding the Meteorological Society of Mauritius, of which he was Secretary for many years. The Society published many papers of importance, and was, so far as we are aware, the only meteorological society that has ever flourished outside Europe and North America. Dr. Meldrum was appointed Government Meteorological Observer in 1862, and since 1875 he had been Director of the Royal Alfred Observatory. For the last ten years of his life in Mauritius he was also a member of the Government Council of the colony.

Dr. Meldrum's name will always be associated with his work on the law of storms, especially the cyclones of the Indian Ocean, and with his early investigation of the relation of rainfall and other meteorological conditions to the sunspot cycle.

METEOROLOGY ON THE BRITISH ANTARCTIC EXPEDITION.

BY THE EDITOR.

HAVING had the privilege of accompanying the Antarctic exploring vessel "Discovery" as far as Madeira, on her voyage to the south, we are able to give an account of her equipment for meteorological work, perhaps the most important part of the scientific routine, if we except the magnetic observations.

During the voyage out observations will be made regularly every two hours, by the officer of the watch, and the various duplicate instruments capable of being tested on board ship will be carefully compared. Subsequently the observations on board will be kept

up, while even more complete arrangements will be made in connection with any land station that may be established.

We cannot give here a full description of the "Discovery." It must suffice to say that she is built of wood throughout, in the manner which the long experience of arctic whalers has shown to be the best for resisting polar ice, and she is undoubtedly the strongest ship of her size that has ever been built. The magnetic observatory, which stands amidships, under the bridge, is the scientific centre of the vessel, and the ship has been planned so that no iron or steel exists within 30 feet of the swinging table on which the magnetic instruments are placed. The zoological and botanical laboratories, one on each side of the magnetic observatory, are not allowed to contain so much as a bottle-brush of steel wire, or an iron tool of any kind. The engine-room is right aft, and the steam pipes to the winches forward are of copper. The bow of the ship is heavily plated with steel, so as not to be damaged by ice, but the length of the vessel is sufficient to keep this outside the magnetic zone.

For the ordinary routine observations a form of Stevenson screen is erected on the wall of the botanical laboratory on the port side, and when the ship is under way there will always be a current of air blowing through the gangway between it and the magnetic house. The screen contains a wet and dry bulb thermometer, a mercurial maximum, and a Sixe's maximum and minimum. The barometer, on the Kew pattern, is in the magnetic house, with its cistern about 12 feet above the water-line, and a barograph is kept at work in one of the companions. A thermograph and a hair hygrograph are placed on the outer walls of the magnetic house, and the three recording instruments are kept running to Greenwich time, a mark being made on the curve each day at local noon, so that a local time-scale may be afterwards applied. As the ship's time will be changed daily by amounts varying from a few minutes up to perhaps an hour or more, it would of course be impossible to adjust the recording instruments to follow it. The value of the hair hygrograph at sea is somewhat dubious. When the deck is being washed the indicator leaps up close to the saturation point, and falls gradually as the boards become dry; but the records on shore, or in the ice, should be of value. The temperature readings are checked by means of an Assmann's Aspiration Psychrometer, and sling thermometers are also provided for comparison. Rainfall observations are to be attempted by means of a marine rain gauge and evaporator on Dr. Black's pattern, the placing of which was a matter of some difficulty, on account of the way in which any part of the vessel may be sheltered when she is under sail. The method finally adopted was to place the raingauge on the top of the small deck house aft, on the weather side, shifting it whenever the ship changes her tack; the evaporator occupying a similar position on the lee side.

The surface temperature of the sea is taken each time the instru-

ments on board are read, a small canvas bucket being used from the bridge for the purpose of drawing a sample of water. Once daily, at noon, the colour of the sea-water is measured by means of Forel's colour-scale, or xanthometer, an instrument which attracted the special attention and admiration of the Queen when she accompanied the King to inspect the vessel at Cowes on the eve of departure.

The whole of the meteorological work on board is under the charge of the first officer, Lieutenant Charles Royds, R.N., who has had considerable experience in observing.

It is intended to make special observations in the Antarctic regions on the conditions of the upper atmosphere, and for this purpose a captive balloon is carried with a large supply of compressed hydrogen in long steel cylinders as used in military ballooning. For reaching great elevations, however, reliance is to be placed on kites, and for this purpose light aluminium meteorographs like those used at Blue Hill have been provided for attachment to the large box-kites of Hargrave's pattern. While at sea an experiment was made in flying a couple of small box-kites tandem-fashion from the ship, and they were found to rise readily and maintain their altitude steadily for nearly an hour when the ship was running before the wind and therefore in the least favourable condition for the experiment. No instruments were attached, and the only difficulty found was that when the kites descended it was impossible to haul in the line fast enough to keep them up, and the moment the slender structure of light sticks and cotton touched the water it went to pieces on account of the speed with which it was towed along by the ship. There is every reason, however, to believe that with the larger kites and a stronger wind this difficulty will not arise.

The kites and balloon are intended to be used mainly among the ice in the far south, and a large number of special instruments is being taken out for use on shore. These include spirit thermometers both for dry bulb and minimum readings, which are graduated as low as —90° F., special Stevenson screens, low-reading thermographs, sunshine recorders adapted for the peculiar conditions of a sun that never sets, earth-thermometers intended for use in borings made in the ice, etc. A Dines's pressure anemometer and an anemograph of similar pattern will be erected at the land-station on the Antarctic continent. A photographic spectrometer will, it is hoped, throw some light on the character of the *aurora australis*, and Professor Ramsay has supplied a crypton vacuum tube in order that the highly characteristic green line of that element may be compared directly with the similar line in the spectrum of the aurora.

The oceanographical observations to be made during the voyage will include determinations of the density of the surface water twice daily by means of the Buchanan hydrometer, and also direct measurements of salinity by the titration of the sea water with a standard solution of silver nitrate. This department of the work

will be under the charge of Lieutenant E. H. Shackleton, R.N.R When deep-sea soundings are made samples of water will be collected from various depths for the measurement of their density and salinity. The temperature will be determined by the use of deep-sea thermometers of various familiar patterns, but most dependence will be placed upon the Pettersson-Nansen insulating water-bottle, from which very accurate temperature readings are to be looked for. Lieutenant M. Barne, R.N., will take charge of the deep-sea temperatures, and on the voyage out to Melbourne Mr. George Murray, F.R.S., of the Natural History Museum, who has had great experience in scientific work at sea, will take general charge of all the deep-sea work, physical as well as biological.

Researches more or less allied to those in meteorology will be carried out on land in the far south with the seismometer to investigate the crustal movements, and with very delicate pendulums to determine the force of gravity. The latter is of importance mainly in arriving at the figure of the Earth, but incidentally also in supplying a necessary correction for the barometer readings. Of the magnetic observations, which are under the charge of the navigating officer, Lieutenant A. Armitage, R.N.R., on board ship, and of Mr. Louis Bernacchi on shore, we have only space to say that they are perhaps the most carefully planned and completely thought out of all the branches of scientific work to be carried on on the expedition.

In addition to the officers and scientific staff the "Discovery" carries a highly-trained meteorological observer in the person of the cook's mate, who was for many years cook at Ben Nevis Observatory, where he took regular watches with the scientific observers.

Under the firm but sympathetic guidance of the commander, Captain R. F. Scott, R.N., with the enthusiasm of the officers and scientific staff, and the magnificent physique and thorough training of the crew we expect very solid results from the voyage of the "Discovery" to the Antarctic regions, which she will probably enter in the last week of the year.

ON THUNDERSTORMS.

By R. H. Curtis.

The thunderstorm is a phenomenon about which we have still a great deal to learn, whether we regard it from the point of view of the electrician, or take the wider range of the meteorologist, which embraces the atmospheric conditions that lead up to its genesis and development and also control the direction in which it is to travel, as well as the phenomena of wind, rain, or hail, by which the more strictly electrical phenomena are usually accompanied.

As a rule the text books on meteorology tell us very little about the origin of thunderstorms, and for the obvious reason that until we know more than we do at present respecting the conditions which exist in the upper strata of the atmosphere at the time of

their occurrence, we can do little more than speculate upon the subject. No doubt something is to be learned from a careful study of the cloud forms and movements which accompany the storms, and from the changes which can sometimes be observed to take place amongst the clouds themselves we can surmise something respecting the probable conditions of temperature which exist at their levels. But this does not carry us very far in our study, for at best such data possess a large element of uncertainty, and theories based upon them must necessarily be little more than guesses.

Our hope is great that in the near future the systematic use of kites for obtaining synchronous observations of the pressure, temperature, and humidity conditions at different heights in the free air will supply us with reliable data which will enlighten us as to the life-history of thunderstorms, and help us to solve many other meteorological problems whose solution awaits the collection of similar observations.

In the meantime, however, we are forced to confine ourselves mainly to a study of the conditions exhibited by simultaneous observations made at or very near the ground level, and although, as we have said, these leave a great hiatus which it is necessary to bridge over for a full understanding of the problem, yet they are frequently instructive and very interesting.

There can be no doubt that the distribution of temperature plays a very important—perhaps the most important—part in the production of a thunderstorm, and although the differences which exist through the atmosphere in a vertical direction are probably of most importance, yet those which co-exist at the ground level are by no means without a value of their own, and must not be overlooked.

The series of thunderstorms which were experienced over England towards the close of July this year, illustrates this statement very well.

The daily weather chart issued by the Meteorological Office shows that on the morning of the 24th, a shallow area of low pressure had become developed over England, the pressure to the northward and southward, and also over the continent to the eastward, being relatively high; to the westward of this shallow depression the incurving winds were northerly or north-westerly, and the temperature was relatively low, whilst on its eastern side warmer southerly and south-westerly winds were experienced.

Here then was a type of pressure distribution which is almost invariably associated, at anyrate in summer and in the British Isles, with the development of thunderstorms, and with heavy downpours of rain. Apparently one result of the meeting of two currents of air such as those referred to above, of different temperatures and probably of different degrees of humidity, is to force upwards large masses of the warmer air into regions where they become quickly chilled and where their moisture is rapidly condensed. The pressure gradients being slight the mingling of the air currents is generally

slow and probably somewhat irregular, which is perhaps one reason why the inversions of temperature which result from them appear very often to extend over comparatively limited areas, and why when heavy falls of rain occur at some places, other places close at hand get no rain at all.

The movements of the barometer during the three or four days following the 24th were slight. There was a gradual but intermittent increase of pressure, and the centre of the depression appeared to contract in size, whilst its general character remained unchanged; considerable differences in temperature were still observed, and thunderstorms of greater or less severity continued to occur over the south-east of England.

In many respects the thunderstorms of this period differed from those sometimes observed. They do not appear to have travelled along definite or prolonged tracks, as thunderstorms sometimes do; nor were they accompanied, in the instances which we have been able to examine, by those peculiar oscillations of the barometer so frequently observed, especially in storms of more than ordinary severity. In the remarkable storms of August 18th and 20th, 1898, these oscillations were of an unusually pronounced character, and the direction and rate of progress of the storms could be traced from the times at which similar phases of the accompanying oscillation occurred at different places along the paths they travelled.

The absence of any very marked barometrical movements in the thunderstorms of July seems to suggest that in some respects their accompanying conditions differed materially from those which existed in 1898, and precisely what that difference was is one of the points which we hope ere long to see made clear.

Correspondence.

A HOT DAY IN NORTH-WEST LANCASHIRE.

To the Editor of Symons's Meteorological Magazine.

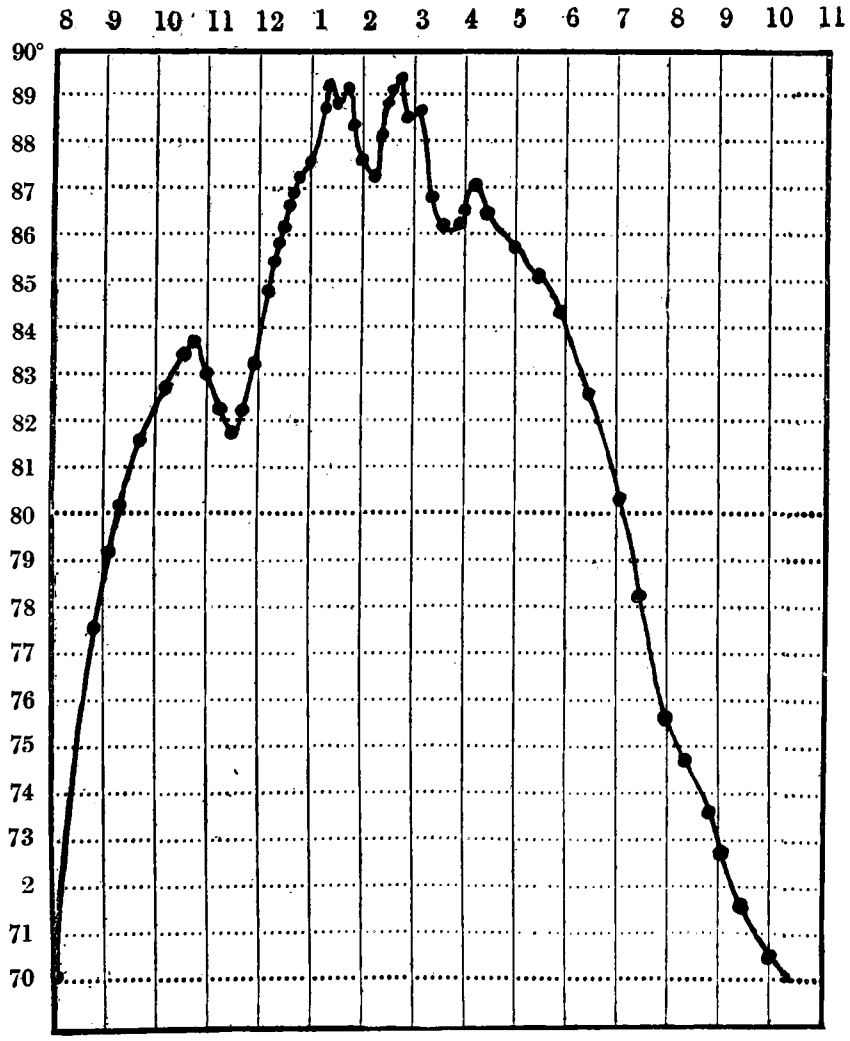
THE enclosed observations of temperature recorded here on July 20th may be of interest to readers of your journal. The readings are from thermometers verified at Kew and placed in a Stevenson screen 93 feet above sea level and 7 miles from the sea.

At 8.0 a.m. on Saturday, July 20th, the air was calm, the barometer steady, and the temperature, 70°·2, was rising rapidly; the sun was shining from a cloudless sky, after a clear night, during which the minimum had been 53°·5. With these conditions there appeared every probability that a sea breeze would shortly spring up, which would generally have the effect of preventing the temperature rising higher than about 75° Instead of this, however, a fairly strong S.E. wind commenced at 8.15, which, with the brilliant sun, made the temperature rise rapidly, 77°·6 being reached at

8.48 a.m. It rose steadily to 83°·7 at 10.50, when, owing to the large amount of smoke brought over by the S.E. wind from the manufacturing districts of S.E. Lancashire (there were no clouds), the sun was so dimmed that the temperature fell to 81°·8 at 11.30, at which time the sun scarcely shone sufficiently to produce a shadow.

After this the wind veered to a little west of south, so that it then blew from a point west of the smoke-producing district, and yet it was not sufficiently westerly to be from the sea. The smoke haze soon cleared off, and the temperature rose rapidly, reaching 89°·2 at 1.25 p.m. It then fell a little, apparently owing to the strength of the wind, but rose to 89°·4 at 2.45 p m.

The wind was of considerable strength from the S. all the afternoon, and the sky remarkably free from cloud, which accounts for



the particularly high readings of 87°·1 at 4.15, and 83°·6 at 6.0 p.m. The temperature was above 80° from 9.25 a.m. to 7.0 p.m.

I may mention that the summer maximum readings here are often kept comparatively low owing to sea breezes; whilst, on the other hand, when the conditions of pressure are such as to produce a south-easterly wind sufficient to overcome the tendency to sea breeze formation, the maxima are kept down owing to the sun being partially obscured by smoke from the East Lancashire and West Yorkshire manufacturing districts.

During the fortnight preceding July 20th, I registered maxima of over 70° on 10 days, and of over 80° on 3 days, whilst on the night of the 18th to 19th the minimum was as high as 66°.

The maximum of 89°·4 on the 20th and the minimum of 66°·2 during the night between the 20th and 21st are the highest respectively during the 16 years I have kept a register, and both readings are doubtless *most exceptional.*

I have seldom recorded maxima above 83° here, 85°·5 being the previous highest on June 18th, 1893.

SYDNEY WILSON.

Bruna Hill, Garstang, 26th July, 1901.

THE YORKSHIRE THUNDERSTORM OF AUGUST 10TH.

To the Editor of Symons's Meteorological Magazine.

WOULD you allow me, through your pages, to ask any of your North Country readers who are willing to send me their rainfall for Saturday, August 10th, the day of the great thunderstorm over East Yorkshire? Notes on the storm would also be acceptable, especially as to when the first rain fell in the afternoon.

I had a rather unique opportunity of watching the initial stages of its development, an account of which can be seen in *The Friend*, for August 23rd, and am desirous of tracing its development.

J. EDMUND CLARK.

112, Wool Exchange, London, E.C., Aug. 28th, 1901.

REVIEWS.

Report of the Director of the Observatory to the Marine Committee, and Meteorological Results deduced from the Observations taken at the Liverpool Observatory, Bidston, Birkenhead, in the year 1900. Published by order of the Mersey Dock and Harbour Board. Liverpool, 1901. Size $9\frac{1}{2} \times 6\frac{1}{2}$. Pp. 42.

THIS report gives the daily readings for the year, and adopts the excellent plan of printing a summary of monthly values in British and Metric units so as to admit of ready comparison with Continental observations.

Sur les Observations Pluviométriques faites dans la Zone Equatoriale de 10 *degrés nord à* 10 *degrés sud.* Par M. V. RAULIN. (Extrait des Comptes rendus de l'Association Française pour l'avancement des Sciences, 1900). Paris. Size 9 × 6. Pp. 24.

THE author publishes the average monthly rainfall for between 400 and 500 stations lying within 10° of the equator north or south, mentioning in each case the number of years from which the average is calculated. The results are of course very unequal in value, but we must remember that in the equatorial zone the range of all climatic conditions, both diurnal and annual, is at a minimum; so that figures that would be absolutely useless for Europe may yet give valuable information as to the tropics.

Koninklijk Nederlandsch Meteorologisch Instituut, DR. H. EKAMA. *Onweders, Optische Verschijnselen Enz. in Nederland. Naar Vrijwillige Waarnemingen in* 1900. Deel xxi. Amsterdam: H. G. Bom, 1901. Size 9 × 6½. Pp. 128. *Plates.*

AN account of the atmospheric disturbances in Holland during 1900, with very full data from a large number of voluntary observers of various optical atmospheric phenomena, such as lightning, St. Elmo's fire, auroras, rainbows, halos, etc. A short appendix details some observations of the curious marine noises named in Dutch "*Mistpoeffers,*" a word which other languages prefer to adopt rather than translate, but the nature and origin of the phenomenon remain mysterious.

Results of Meteorological Observations made at the Radcliffe Observatory, Oxford, in the Eight Years 1892-99. *Edited by* ARTHUR A. RAMBAUT, M.A., D.Sc., F.R.S. Vol. XLVIII. Oxford: James Parker & Co., 1901. Size 10 × 6½. Pp. 246. *Plates.*

THIS volume contains the full daily values of all the meteorological elements recorded at an Observatory of the first order, together with the daily reading of experimental instruments, such as max. and min. thermometers placed on the tower, daily details of wind and ozone, and monthly summaries and notes. The readings of the platinum electric-resistance earth-thermometers are also given. Monthly values are printed for two rain gauges on the ground, and of other gauges at 22 feet and 112 feet respectively.

The letterpress consists of an introduction of 24 pages, and is mainly devoted to a discussion of the observations made at various depths by means of the electrical-resistance thermometers.

ERRATA.

P. 115, line 21 and line 23, *for* Zuryeff *read* Yuryeff.
,, ,, 25, ,, vod ,, von.
,, ,, 27, ,, Föhandlingar *read* Förhandlingar.
P. 116, ,, 3, ,, Antartic ,, Antarctic.

METEOROLOGICAL OBSERVATIONS AT CAMDEN SQUARE FOR 40 YEARS, 1858–97.

TEMPERATURE.—EXTREMES IN SHADE.

Months.	HIGHEST.				LOWEST.				MAXIMUM.					MINIMUM.				
	9 A.M.		9 P.M.		9 A.M.		9 P.M.											
	Reading.	Mean of all.	Reading.	Mean of all.	Reading.	Mean of all.	Reading.	Mean of all.	Absolute Highest.	Lowest Highest.	Highest Lowest.	Absolute Lowest.	Mean of all Highest.	Absolute Highest.	Lowest Highest.	Highest Lowest.	Absolute Lowest.	Mean of all Lowest.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January	53·9	50·2	54·6	50·3	7·2	25·0	12·8	27·4	56·4	45·2	40·4	16·9	53·1	52·3	36·5	32·2	6·7	21·8
February	54·0	49·6	54·0	49·6	15·2	28·4	17·2	29·4	62·5	46·2	44·1	24·2	55·2	51·2	34·1	31·4	7·3	24·1
March	57·9	52·2	57·2	51·4	20·4	31·3	24·7	31·7	70·1	54·0	48·7	31·4	61·9	51·3	38·4	29·4	15·6	25·3
April	68·0	58·9	63·2	56·3	33·5	38·8	31·5	36·8	81·4	61·7	54·9	40·0	70·7	54·8	43·2	34·5	24·5	29·8
May	78·2	67·0	72·4	62·6	38·7	45·5	35·5	41·8	87·6	68·0	59·0	42·5	78·1	60·3	48·8	42·7	28·4	33·8
June	80·8	72·0	76·1	67·9	48·4	52·3	44·3	49·5	92·6	71·9	69·1	53·5	83·1	63·8	55·0	46·9	35·6	41·8
July	80·3	73·6	79·7	69·7	45·4	55·8	49·4	53·5	94·6	72·7	70·9	55·5	85·2	66·3	56·7	48·9	40·3	45·4
August	84·3	71·6	76·3	68·1	45·2	54·8	47·0	52·0	93·6	70·3	68·5	58·5	84·0	65·8	57·4	50·1	38·2	44·3
September	77·0	66·5	71·8	64·1	43·1	49·0	39·5	46·9	91·0	69·5	64·4	50·1	77·1	64·2	54·0	44·2	33·0	39·1
October	67·5	60·5	64·5	59·2	29·6	36·9	30·9	37·9	80·9	60·4	53·1	37·2	68·1	60·5	47·3	39·6	23·8	31·4
November	61·2	54·8	59·7	54·3	23·8	31·2	22·0	32·3	63·9	50·3	45·2	28·6	58·4	54·7	40·7	34·6	20·1	27·2
December	56·0	51·6	56·5	51·7	12·1	26·4	17·3	27·5	58·9	43·7	40·8	24·3	54·5	52·8	36·6	31·5	6·7	22·9
Mean	68·3	60·7	65·5	58·8	30·2	39·6	31·0	38·9	77·8	59·5	54·9	38·6	69·1	58·2	45·7	38·8	23·4	32·2
Highest	84·3	73·6	79·7	69·7	48·4	55·8	49·4	53·5	94·6	72·7	70·9	58·5	85·2	66·3	57·4	50·1	40·3	45·4
Lowest	53·9	49·6	54·0	49·6	7·2	25·0	12·8	27·4	56·4	43·7	40·4	16·9	53·1	51·2	34·1	29·4	6·7	21·8

METEOROLOGICAL NEWS AND NOTES.

THE LATEST NUMBER of the *Quarterly Journal* of the Royal Meteorological Society states that—"The Council of the Royal Society has lately reconstructed the Meteorological Council, as follows:—General Sir R. Strachey (Chairman), Prof. G. H. Darwin, Dr. A. Buchan, and Mr. W. N. Shaw, together with the Hydrographer of the Admiralty, are appointed Directors. The Earl of Rosse, Mr. J. Y. Buchanan, Mr. W. H. Dines, Mr. R. H. Scott and Prof. A. Schuster are appointed other members of the Association; the first two to serve for five years, the last three for three years. No honorarium is to be paid to these additional members."

SUN-SPOT PERIODICITY in relation to weather having recently received renewed attention, much interest attaches to a paper by Dr. W. J. S. Lockyer, read at a meeting of the Royal Society in May, on "Solar Activity, 1833–1900." The author adduces evidence from which he has drawn the following conclusions:—

1. There is an *alternate* increase and decrease in the length of a sunspot period reckoning from minimum to minimum.
2. The epoch of maximum varies *regularly* with respect to the preceding minimum. The amplitude of this variation about the mean position is about $\pm 0{\cdot}8$ years. The cycle of this variation is about thirty-five years.
3. The total spotted area included between any two consecutive minima varies regularly. The cycle of this variation is about thirty-five years.
4. There is no indication of the fifty-five-year period as suggested by Dr. Wolf.
5. The climate variations indicated by Professor Brückner are generally in accordance with the thirty-five-year period.
6. The frequency of auroræ and magnetic storms since 1833 show indications of a secular period of thirty-five years.

PROFESSOR E. MASCART, head of the Central Meteorological Office in Paris, is the subject of a biographical sketch, illustrated by a portrait, in the July number of *Terrestrial Magnetism*.

BOOKS RECEIVED.

Cornwall County Council. Sanitary Committee. Annual Report, Vital Statistics and Meteorological Summary for 1900. Truro, 1901. Size $9\frac{1}{2} \times 6\frac{1}{2}$. Pp. 20.

Meteorological Notes, 1900. (From observations taken at Bradestone House, Brundall, Norfolk). By Arthur W. Preston, F.R.Met.Soc. Reprinted from the Transactions of the Norfolk and Norwich Naturalists' Society, Vol. 7. Size $8\frac{1}{2} \times 5\frac{1}{2}$. Pp. 8.

The International Congresses of Aeronautics and of Meteorology. By A. Lawrence Rotch. Extract from Report of the Commissioner-General of the United States to the International Universal Exposition, Paris, 1900. Vol. 6. Size 9×6. Pp. 8.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1901.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Date.	Absolute. Minimum. Temp	Date.	Average. Max.	Min.	Dew Point.	Humidity.	Absolute. Max. in Sun.	Min. on Grass.	Total Rain. Depth.	Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		
London, Camden Square	55·2	4, 5	23·2	29	46·9	34·0	34·7	82	96·7	19·0	2·14	16	7·6
Malta	71·5	26	45·2	25	64·4	51·1	49·7	80	129·5	39·9	·81	6	3·4
Cape Town	85·8	20	42·8	25	75·5	57·3	55·3	69	...	...	·33	7	2·4
Mauritius	88·5	16	70·1	12*a*	85·2	73·2	72·4	82	153·1	62·2	9·68	18	6·6
Calcutta	101·7	31	59·3	3	93·2	68·0	60·5	54	154·0	54·6	·00	0	1·6
Bombay	96·4	12	67·8	2	86·4	74·0	70·1	73	144·4	60·8	·00	0	1·6
Colombo, Ceylon	92·8	11	71·0	10	90·5	74·4	75·1	83	152·5	68·0	5·12	13	4·2
Melbourne	102·2	2	45·5	20	75·5	54·5	51·5	66	154·0	39·4	3·14	11	4·9
Adelaide	98·7	8	47·4	31	79·4	57·4	50·5	55	156·2	39·1	·70	6	3·5
Sydney	88·9	10	55·4	31	75·7	62·7	60·2	76	145·0	45·0	3·72	13	4·7
Wellington	73·5	16	45·0	22	64·9	51·6	47·4	68	124·0	38·0	2·05	11	4·2
Auckland	74·0	6	53·5	22	68·1	57·2	50·6	65	146·0	49·0	5·11	16	6·4
Jamaica, Halfway Tree	90·0	10	65·0	18	85·4	68·2	65·1	71	...	...	·74	3	1·9
Trinidad	93·0	3	61·0	21*b*	88·5	65·7	71·6	83	163·0	54·0	2·30	13	...
Grenada	88·4	26	70·2	1	82·8	72·5	68·7	72	154·2	...	2·17	18	2·5
Toronto	45·6	25	0·0	6	36·9	23·1	25·2	79	60·2	—3·5	2·74	15	7·0
Fredericton, New Brunswick	47·8	22	—9·3	8	37·6	16·1	18·0	67	...	...	4·55	10	5·9
Winnipeg, Manitoba	38·0	12	—22·7	4	28·9	2·3	...	...	...	...	·26	3	4·7
Victoria, British Columbia	57·5	1	32·8	24	49·6	39·3		...	...	...	·93	13	7·3

a—and 13. *b*—and 22, 24.

REMARKS.

MALTA.—Mean temp. of air 56°·8, or 0°·9 above the average. Mean hourly velocity of wind 11·3 miles or 0·5 above average. Mean temp. of sea 61°·9. TSS on 5th and 11th; H on 5th. J. F. DOBSON.

Mauritius.—Mean temp. of air 1°·1, of dew point 1°·8, and R 1·34 in. above their respective averages. Mean hourly velocity of wind 7·6 miles, or 2·3 miles below average; extremes, 23·1 on 5th and 00 on 2nd; prevailing direction E. by N. to S.E., with occasional light airs from N.W. L and T on 6 days; T on 3 days. T. F. CLAXTON.

COLOMBO, CEYLON.—Mean temp. of air 0°·3 below, of dew point 2°·2 above, and R ·37 in. above, their respective averages. Mean hourly velocity of wind 6·1 miles; prevailing direction N.W. to N.E. TSS occurred on 7 days. W. C. S. INGLES.

Adelaide.—Mean temp. of air 2°·0 below average; R ·36 in. below 44 years' average. C. TODD, F.R.S.

Sydney.—Mean temp. of air 0°·1 below, humidity 0°·3 above, and R 1·46 in. below, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—Mean temp. of air 3°·9 below, and R 1·49 in. below, their respective averages. Generally fine, with wet intervals; prevailing S. and N.W. wind, and generally moderate. Earthquake on 15th at 11.15 p.m., short and sharp. R. B. GORE.

Auckland.—Mean temp. 2° below, R largely in excess, being more than twice the average. A cloudy and rainy month. T. F. CHEESEMAN.

TRINIDAD.—R ·43 in. above the 30 years' average. J. H. HART.

TORONTO.—TSS on 10th and 25th. R. F. STUPART.

SUPPLEMENTARY TABLE OF RAINFALL, AUGUST, 1901.

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
I.	Uxbridge, Harefield Pk..	1·86	XI.	Castle Malgwyn	4·15
II.	Dorking, Abinger Hall .	1·76	,,	Builth, Abergwesyn Vic.	6·14
,,	Sheppey, Leysdown	1·43	,,	Rhayader, Nantgwillt ...	3·62
,,	Hailsham	1·59	,,	Lake Vyrnwy	3·78
,,	Crowborough.....	1·78	,,	Corwen, Rhug	...
,,	Ryde, Thornbrough	...	,,	Criccieth, Talarvor	4·95
,,	Emsworth, Redlands ...	1·63	,,	I. of Anglesey, Lligwy..	3·80
,,	Alton, Ashdell	1·77	,,	Douglas, Woodville.....	4·12
,,	Newbury, Welford Park	2·17	XII.	Stoneykirk, Ardwell Ho.	3·57
III.	Oxford, Magdalen Coll..	1·94	,,	New Galloway, Glenlee	5·18
,,	Banbury, Bloxham	1·94	,,	Moniaive, Maxwelton Ho.	5·22
,,	Pitsford, Sedgebrook ...	1·56	,,	Lilliesleaf, Riddell	4·74
,,	Huntingdon, Brampton.	1·48	XIII.	N. Esk Res. [Penicuick]	6·15
,,	Wisbech, Bank House...	1·84	XIV.	Glasgow, Queen's Park..	3·59
IV.	Southend	1·38	XV.	Inveraray, Newtown ...	5·75
,,	Colchester, Lexden	·91	,,	Ballachulish, Ardsheal...	6·18
,,	Saffron Waldon, Newport	2·02	,,	Islay, Eallabus.....	5·83
,,	Rendlesham Hall	1·07	XVI.	Dollar.....	5·30
,,	Swaffham	1·51	,,	Balquhidder, Stronvar...	5·14
V.	Salisbury, Alderbury ...	2·11	,,	Coupar Angus Station...	3·73
,,	Bishop's Cannings	2·21	,,	Blair Atholl	3·35
,,	Blandford, Whatcombe .	2·51	XVII.	Keith H.R.S.....	3·49
,,	Ashburton, Druid House	2·11	,,	Forres H.R.S.	2·60
,,	Okehampton, Oaklands.	1·97	XVIII.	Fearn, Lower Pitkerrie..	2·53
,,	Hartland Abbey	3·50	,,	S. Uist, Askernish	1·39
,,	Lynton, Glenthorne ...	...	,,	Invergarry.....	1·40
,,	Probus, Lamellyn	1·44	,,	Aviemore, Alvie Manse.	3·05
,,	Wellington, The Avenue	1·35	,,	Loch Ness, Drumnadrochit	2·37
,,	North Cadbury Rectory	2·82	XIX.	Invershin	2·81
,,	Clifton, Pembroke Road	2·80	,,	Durness	...
VI.	Ross, The Graig	1·45	,,	Watten H.R.S.....	3·61
,,	Wem, Clive Vicarage ...	1·98	XX.	Dunmanway, Coolkelure	4·45
,,	Wolverhampton, Tettenhall	...	,,	Cork, Wellesley Terrace	2·47
,,	Cheadle, The Heath Ho.	2·32	,,	Killarney, District Asyl.	3·17
,,	Coventry, Priory Row ..	1·88	,,	Caher, Duneske	...
VII.	Market Overton	1·27	,,	Ballingarry, Hazelfort...	3·05
,,	Grantham, Stainby	1·46	,,	Limerick, Kilcornan ...	2·73
,,	Horncastle, Bucknall ...	...	,,	Miltown Malbay	6·03
,,	Worksop, Hodsck Priory	1·59	XXI.	Gorey, Courtown House	3·35
VIII.	Neston, Hinderton	3·40	,,	Moynalty, Westland ...	4·24
,,	Southport, Hesketh Park	2·80	,,	Athlone, Twyford	2·62
,,	Chatburn, Middlewood.	3·10	,,	Mullingar, Belvedere ...	2·71
,,	Duddon Val., Seathwaite Vic.	8·99	XXII.	Woodlawn	3 62
IX.	Baldersby	1·54	,,	Crossmolina, Enniscoe ..	3·21
,,	Scalby, Silverdale	...	,,	Collooney, Markree Obs.	4·29
,,	Ingleby Greenhow Vic..	...	XXIII.	Enniskillen, Model Sch.	4·81
,,	Middleton, Mickleton ...	2·43	,,	Warrenpoint.....	3·54
X.	Haltwhistle, Unthank H.	...	,,	Miltown, Banbridge.....	4·28
,,	Bamburgh	2·27	,,	Belfast, Springfield	3·83
,,	Keswick, The Bank.....	4·69	,,	Bushmills, Dundarave..	5·07
XI.	Llanfrechfa Grange	3·22	,,	Stewartstown	3·41
,,	Treherbert, Tyn-y-waun	7·44	,,	Killybegs	6·11
,,	Llandovery	3·80	,,	Horn Head	4·50

AUGUST, 1901.

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.	Date	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches.	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	1·79	— ·31	·48	14	9	85·3	9	45·2	28	0	0
II.		Tenterden	2·09	— ·35	·78	27	9	80·0	18	45·0	28	0	0
,,		Hartley Wintney	2·56	+ ·21	·86	25	10	84·0	18	44·0	5*d*	0	0
III.		Hitchin	1·61	— ·52	·45	25	11	83·0	10	45·0	21*e*	0	...
,,		Winslow (Addington)	1·92	— ·21	·53	26	12	84·0	10	42·0	22*f*	0	0
IV.		Bury St. Edmunds (Westley)	1·41	— ·99	·53	25	9	84·5	10	43·0	28	0	...
,,		Norwich (Brundall)	·87	...	·23	25	9	83·5	9	45·0	22*f*	0	0
V.		Winterbourne Steepleton ...	2·74	...	2·10	14	10	78·1	19	43·2	24	0	0
,,		Torquay (Cary Green)	·89	...	·50	14	10	77·6	19	47·4	28	0	0
,,		Polapit Tamar [Launceston]..	2·14	— 1·20	·57	13	14	79·7	23	43·0	3	0	0
VI.		Stroud (Upfield)	1·87	— ·67	·48	14	15	78·0	1*a*	46·0	27	0	...
,,		Church Stretton (Woolstaston)	1·81	— 1·03	·51	26	14	77·5	25	45·0	2, 28	0	0
,,		Worcester (Diglis Lock)	2·31	+ ·16	·56	27	13	...	...	...	...	...	...
VII.		Boston	1·55	— ·40	·70	25	8	...	...	...	...	...	...
,,		Hesley Hall [Tickhill].....	1·55	— ·66	·40	10	9	89·0	10	41·0	21	0	...
,,		Derby (Midland Railway).....	1·51	— ·61	·32	12	13	85·0	10*b*	45·0	28	0	...
VIII.		Manchester (Plymouth Grove)	1·56	— 1·85	·35	26	13	82·0	22	42·0	31	0	0
IX.		Wetherby (Ribston Hall) ...	1·79	— ·48	·50	14	12	...	...	...	...	...	...
,,		Skipton (Arncliffe)	7·00	+ 1·51	1·81	13	20	...	...	...	...	...	...
,,		Hull (Pearson Park).....	5·75	+ 3·13	3·18	10	13	81·0	18	42·0	28	0	0
X.		Newcastle (Town Moor)	2·25	— ·66	·55	26	12	...	...	...	...	...	...
,,		Borrowdale (Seathwaite).....	11·78	+ ·38	1·71	10	21	78·5	22	45·2	31	0	...
XI.	WALES.	Cardiff (Ely).....	4·90	+ ·73	1·43	13	15	...	...	...	...	...	...
,,		Haverfordwest	5·17	+ 1·51	1·73	13	15	78·7	18	45·4	3	0	0
,,		Aberystwith (Gogerddan) ...	5·85	+ 1·90	1·25	30	15	80·0	19*c*	42·0	15*g*	0	0
,,		Llandudno.....	3·84	+ 1·04	1·41	9	16	76·5	25	50·0	11	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	4·73	+ ·59	1·08	10	12	75·0	1	42·0	31	0	...
XIII.		Edinburgh (Royal Observatory)	3·59	...	1·59	10	12	76·5	1	44·6	28	0	0
XIV.		Colmonell	6·31	+ 2·32	1·19	17	17	78·0	22	35·0	31	0	...
XV.		Tighnabruaich	4·79	...	·58	17	18	66·0	1	40·0	31	0	...
,,		Mull (Quinish).....	6·04	+ ·92	1·16	25	22	...	...	...	...	...	...
XVI.		Loch Leven Sluices	4·25	+ ·59	1·56	11	12	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	3·70	+ ·89	1·15	10	13	77·5	9	45·0	17*c*	0	...
XVII.		Braemar	3·56	— ·11	1·34	10	18	73·8	21	37·0	17	0	1
,,		Aberdeen (Cranford)	3·21	— ·09	1·24	10	20	79·0	1	40·0	20	0	...
,,		Cawdor (Budgate)	2·66	— ·49	·83	10	17	...	...	...	...	...	...
XVIII		Strathconan [Beauly]	4·32	— ·08	·75	26	13	...	...	...	...	...	...
,,		Glencarron Lodge.....	...	...	...	...	...	...	...	...	...	...	...
XIX.		Dunrobin	...	...	...	...	...	...	...	...	...	...	...
,,		S. Ronaldshay (Roeberry) ...	3·71	+ ·69	·54	12	23	67·0	19	43·0	27	0	...
XX.	IRELAND.	Darrynane Abbey.....	2·03	— 2·46	·62	16	20	...	...	...	...	...	...
,,		Waterford (Brook Lodge) ...	4·22	+ ·29	1·41	9	16	77·0	23	39·5	11	0	...
,,		Broadford (Hurdlestown) ...	3·66	+ ·08	·63	5	21	...	...	...	...	...	...
XXI.		Carlow (Browne's Hill)	3·34	— ·09	1·10	9	18	...	...	...	...	...	..
,,		Dublin (Fitz William Square)	2·95	— ·01	·89	10	13	76·9	8	44·2	28	0	0
XXII.		Ballinasloe	2·72	— 1·21	·56	16	17	79·0	22	42·0	20	0	...
,,		Clifden (Kylemore)	8·57	+ ·67	1·32	11	20	...	...	...	...	...	...
XXIII		Seaforde.....	3·16	— ·14	·75	9	18	75·0	22	42·0	23*e*	0	...
,,		Londonderry (Creggan Res.).	6·22	+ 1·80	1·35	25	21	...	...	...	...	...	...
,,		Omagh (Edenfel)	4·78	+ ·54	·83	14	20	76·0	22	33·0	31	0	1

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

a—and 9, 18, 25. *b*—and 25. *c*—and 21. *d*—and 24, 28. *e*—and 31. *f*—and 28. *g*—and 20, 22.

METEOROLOGICAL NOTES ON AUGUST, 1901.

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.

TENTERDEN.—Rainfall and mean temperature above that of last year; wells lower, pastures nearly as much burnt up and scarcely at all benefited by the rains. TSS on 15th. Duration of sunshine 242 hours. On 10th the min. in shade was 64°·0.

HARTLEY WINTNEY.—With the exception of showers from the 10th to the 15th the dry weather continued. A short but terrific TS occurred at 1 a.m. on the 26th, the L being synchronous with the T, and damaging five trees and killing two horses. The storm was of only 35 minutes duration, with ·86 in. of R. L in south on 10th. Fog each morning from 20th to 25th. Ozone on ten days, with a mean of 2·8. Swifts last seen on 7th.

WINSLOW, ADDINGTON.—A fine month and more rain is needed, the ground being still dry within a few inches of the surface. Max. temp. generally high till the 25th; then cool, damp and dull weather till the end.

BURY ST. EDMUNDS, WESTLEY.—A hot, dry month. Temp. above 70° on eighteen days. Ponds nearly dry and deep wells rapidly decreasing.

NORWICH, BRUNDALL.—An exceedingly fine month. Mean temp. and rainfall nearly the same as in August, 1899. T and L on 26th and 27th. The R of the first eight months of the year shows a deficiency of 4·45 in.

WINTERBOURNE STEEPLETON.—The month was generally fine, and the R slight, except for the exceptionally heavy fall on the 14th.

TORQUAY, CARY GREEN.—R 1·83 in. below the average; mean temp. 0°·7 above the average. Duration of bright sunshine 26·8 hours above the average. One sunless day. Mean ozone 4·6, max. 6·5 on 17th, with wind from S.E.

POLAPIT TAMAR [LAUNCESTON].—A rather calm dry month. L and T on 9th, T on 11th.

HULL, PEARSON PARK.—Severe TS with H, heavy R and lumps of ice on 10th. TS on 26th.

SEATHWAITE.—TSS on 10th and 26th. Four days on which the R exceeded an inch.

WALES.

HAVERFORDWEST.—August was on the whole a fine warm month, with a good deal of bright sunshine, more than average R, and generally high temp. Gales occurred on two days, but there was an entire absence of TSS.

ABERYSTWITH, GOGERDDAN.—A month of heavy R. Rapid barometric changes and variable winds throughout. Occasionally cold for the time of year.

LLANDUDNO.—T, L, H and heavy R at 6 a.m. on 10th.

SCOTLAND.

CARGEN [DUMFRIES].—Notwithstanding the somewhat heavy rainfall during the first half of the month, the harvest was completed very early. Nearly all the crop was secured by the end of the month. T on 11th, 12th and 13th.

CLACHANTON, COLMONELL.—Mean temp. 0°·1 below the average of 25 years. Strong winds on many days.

TIGHNABRUAICH, CRAIGANDARAICH.—Rainfall and temp. about the average, and taken as a whole it was a good harvest month.

ABERDEEN, CRANFORD.—Heavy TS on the 10th.

S. RONALDSHAY, ROEBERRY.—A very good month upon the whole till the 25th, when there were four days of very severe weather. Mean temp. 54°, or 0°·6 below the average of 11 years.

IRELAND.

DARRYNANE ABBEY.—A variable month with a good deal of fog and drizzle. Very fine and hot from 17th to 24th, with heavy dews at night.

BROADFORD, HURDLESTOWN.—On the whole a fairly fine August. Number of rainy days just the average.

DUBLIN, FITZWILLIAM SQUARE.—R fell heavily at times, but there were intervening spells of fine weather, notably from the 16th to the 25th. A sudden fall of temp. from 75°·8 to 49°·3 in a few hours occurred on the 25th, and a series of cold nights followed. Mean temp. 60°·5 or 0°·8 above the average. High winds on 12 days attaining the force of a gale on 26th and 30th.

OMAGH, EDENFEL.—To judge only by the heavy aggregate rainfall and the large number of rainy days, August might be supposed to have been anything but an agreeable summer month, but as a matter of fact it was very favourable. Most of the rain fell at night and the harvest (the earliest and best for some years) was not interrupted, and at the end three-fourths of the cereals were cut in excellent order. Potatoes and green crops abundant.

IRIDESCENT CLOUDS.

To the Editor of Symons's Meteorological Magazine.

I NOTICED at this place four days ago a phenomenon of iridescence in clouds which is new to me, and of which I should be interested in knowing the probable explanation, especially if it chanced to throw any light on the question of ice-formation in the higher strata of clouds.

The sky at the time was strewn with brilliantly white clouds of somewhat peculiar shape, coming under none of the ordinary classes of cloud with which I am acquainted. "Cirro-stratus" would, I think, most nearly describe them; but they were rounder, more "blobby," than this term naturally suggests. In fact, they suggested to me very vividly bits of massed eider-down—the edges, for the most part, being extremely soft and rounded and not fretted, though in some cases they were slightly so. These clouds were evidently pretty high, and also thin, as the sun was full behind one of them and yet too bright to look at. On the sun-ward edges of two clouds close by this one, I detected beautiful bands of iridescent colours. To my eyes (curiously, as it seemed to me), instead of the full scale of primary colours there were only two, and these two repeated, viz. (starting from near the sun), pink, green, and then pink and green again. The bands followed the contour, but did not come close up to the edge of the cloud.

I should be very glad to know if similar instances of cloud-colouring have been often observed before; and, if so, with what conditions they are usually associated.

ISABEL FRY.

Cromarty, N.B., August 3rd, 1901.