

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCLIII.]

FEBRUARY, 1887.

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

METEOROLOGICAL PAMPHLET EXCHANGE.

IN the course of my work on Meteorological Bibliography, I have formed an opinion which I desire to lay before working meteorologists.

It seems to me that many authors and establishments have stores of their own publications lying idle which would be very useful if distributed among those interested. As it is, they become older and older, their authors (if they think at all) think that all who desire to read them have long ago done so, and finally the entire remainder is destroyed as waste paper.

On the other hand, there are many persons who repeat investigations already conducted, and experiments already made, simply because they are unaware of what has been done. And there are many who while glad to obtain copies of meteorologists' publications, do not like to write and ask the authors for copies, and cannot afford to pay the prices sometimes put upon the few copies which come into the hands of dealers in second-hand books.

I am often asked by authors for a list of persons interested in the subject on which they have been writing, in order that they may send out a few copies as presents, but that is a very weak and imperfect way of achieving the object which I have in view, viz., the widest possible distribution and utilization of *all* printed copies of meteorological matter. This object is in no respect a commercial one. I am not thinking of books published for sale, but of privately-printed papers, extracts from Journals and Transactions, and such like.

I shall be glad to hear criticism of this idea, and if it be approved, to try to organize it. It is evident that it must be self-supporting, but perhaps the following rules would be sufficient:—

- I. Authors to send their papers carefully packed, but carriage unpaid.
- II. On receipt of any bundle, the cost of carriage (and sixpence for printing) to be divided by the number of pamphlets, and added to a charge of one penny each for expenses of despatching, and to whatever may be the book or parcel postage of each. This total (probably generally under 4d.) to be in fact the price of each.

- III. The title of each pamphlet, the total number of copies available, and the cost as settled by Rule II., to be printed in each number of the *Meteorological Magazine*, and copies to be forwarded to all applicants in priority of application, but *only* on receipt of the amount. No book-keeping or correspondence can be undertaken.
- IV. The undersigned reserves the right to abandon the scheme at any time should it prove too onerous.

G. J. SYMONS.

62, Camden Square, N. W.

EVAPORATION.*

It is so long since any good English paper has appeared upon the above subject, that one almost feels to be living life over again when reading it. We give a few references in support of this statement, and because they may be useful to those interested in the subject.

1870. "British Rainfall," 1869, contained descriptions of, and results obtained with, nearly thirty different patterns of evaporator. During this year very elaborate experiments with fifteen different patterns of instrument were made at Strathfield Turgiss, Hants. A brief description of the instruments and of their position was given in "British Rainfall," 1870.
1876. Paper on "Evaporation," read by Mr. Greaves, at the Inst. C.E., and important discussion thereupon.
1878. Prize awarded to Mr. S. H. Miller by the Utrecht Soc. of Arts and Sciences for his essay on "Evaporation," and the same published.
1883. Paper in "Wild's Repertorium," by E. Stelling, "On the determination of the absolute evaporation from a water surface."
1883. Paper in "Comptes Rendus," by M. Salles, on observations made at Arles (Bouches du Rhone.)

Hence it will be seen that it is eleven years since any important paper on the subject has been printed in England, and seventeen years since the commencement of the Strathfield Turgiss experiments.

It is impossible to give here a summary which should do justice to Mr. FitzGerald's able paper. His sections are as follows:—Investigation of the laws of evaporation—Influence of heat on evaporation—Effect of wind—Barometer—Formula for comparing evaporation—Influence of sun—Influence of depth. All these sections are developed with reference to special experiments and apparatus, which are fully described. The author then passes to what he calls

* "Evaporation," by Desmond FitzGerald, M. Am. Soc. C. E. 66 pp., 8vo. (Excerpt Trans. American Soc. C. E.)

Natural evaporation, viz., the amount evaporated from various tanks floating on the reservoirs of the Water Works of the City of Boston, the largest of these being 10 ft. in diameter and 10 ft. deep, with recording apparatus attached. This apparatus being useless in frost, the author made many experiments on the evaporation of ice and snow, and finally concludes that until more accurate values are obtained, those marked with an asterisk may be adopted.

Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
·90*	1·20*	1·80*	3·10	4·61	5·86	6·28	5·49	4·09	2·95	1·63	1·20*

This makes the total evaporation for the year 39·11 inches.

In conclusion the author devotes a few pages to a summary of the principal investigations of the subject on both sides of the Atlantic.

We regret that Mr. FitzGerald frequently speaks of the evaporation as being so much "per cent. of the rainfall." This ratio, as far as we are aware, proves nothing, for the variations in the amount of rain are so great as to vitiate such calculations, and besides that, though these values as to the evaporation from a water surface tell us approximately how much a reservoir loses, they tell us nothing of the loss between the fall of the rain and its collection in the reservoirs—that can be known only after long future work on the evaporation from trees and plants and soils—in fact, is too complicated ever to be accurately known.

ROYAL METEOROLOGICAL SOCIETY.

The Monthly Meeting of this Society was held on January 19th at the Institution of Civil Engineers, 25, Great George Street, Westminster; Mr. W. Ellis, F.R.A.S., President, in the Chair.

Mr. J. Willis Bund was elected a Fellow of the Society.

The following papers were read:—

(1.) "On the Identity of Cloud Forms all over the World; and on the general principles by which their indications must be read," by the Hon. R. Abercromby, F.R.Met.Soc. The author illustrated the identity of cloud forms by exhibiting 37 photographs of different kinds of clouds which he had taken in various longitudes, and in latitudes ranging from 72° N. to 55° S., including some actually on the Equator. Cumulus was shewn to be the commonest cloud in the Tropics; cumulo-stratus and cirro-stratus in the Temperature Zone; and stratus and fog in the Arctic Regions. The author considers that 90 per cent. of the skies all over the world might be described by Howard's well-known types of cloud:—cumulus, stratus, cirrus, cirro-stratus, cirro-cumulus, cumulo-stratus and nimbus. If by cirro-cumulus fleecy-looking clouds are denoted, although the forms are alike, the prognostic value of the same shape of cloud is not identical everywhere; for while woolly clouds indicate fine weather in England, they denote rain in Italy. The author shewed that the form alone of clouds is equivocal; and that

the indications of coming weather must be drawn not only from the form, but also from the surroundings of a cloud, just as the meaning of many words can be judged only by the context. This paper was rendered most interesting by the photographs being thrown on the Screen by his Lime-light Lantern, by Mr. B. C. Wainwright, F.R.Met.Soc.

(2.) "On the Cloud to which the name 'Roll-Cumulus' has been applied," by the Hon. R. Abercromby, F.R.Met.Soc. The author thinks that this cloud should be reported as "Stratus" or "Cumulo-stratus" according as the component masses partake more or less of the character of one or other of these clouds.

After the reading of these papers, the Annual General Meeting was held, when the Report of the Council was read by Dr. Tripe, which shewed the Society to be in a satisfactory condition. The number of Fellows was 524.

The President, Mr. W. Ellis, in his address, drew attention to the remarks made by Mr. Hawksley at the meeting of the Society on June 16th last, in which, after acknowledging the indebtedness of engineers to meteorologists for the information collected by them concerning floods and rainfall, without which as he said it would not be possible for engineers to carry on their work efficiently, he proceeded to urge on meteorologists the need of more investigation into the causes of the various phenomena connected with their science. The President suggested that this is just what meteorologists were always endeavouring to do, pointing out how great an amount of labour had already been thus expended, if not always wisely, at any rate with every desire to trace out connections and causes, any want of success being due rather to the difficulties of meteorological inquiry than to any other cause. Referring then to the connection of the physical sciences, and especially those of astronomy, terrestrial magnetism, and meteorology, he drew attention to various contrasts and relations existing between them, mentioning how in astronomy strict mathematical processes may be employed, whilst in meteorology tentative methods have to a great extent to be relied on—a state of development through which in earlier ages astronomy itself had also to pass, giving hope that in the confessedly difficult subject of meteorology we may in time pass from present systems to others more logical. There has already been progress; the preparation of a daily synoptic weather chart, made practicable by the aid of the electric telegraph, would have been impossible not very many years ago. Again, in astronomy the power of assimilating observations, as it were, is mostly in advance of the observational power, rendering ever greater instrumental means desirable. Not so in meteorology, for the purposes of which instruments can be constructed with accuracy beyond the power of adequately employing them, of which the difficulty of ascertaining the true temperature of the air is an illustration. This indeed troubles also the astronomer, the element of air temperature being one that

enters into the calculation of astronomical refraction, besides which he has in various other ways to reckon with temperature effects. After referring to some popular notions on weather changes as related to the sun and moon, as well as to more systematic endeavours made to discover relations, generally insignificant, between position and periods of the moon and different meteorological elements, the President remarked that the modern meteorologist had happily found a wider sphere of work, for troubling himself less about cycles and periods, he has seen the necessity of studying, by the aid of synoptic charts, the complex and broad phenomena of the atmosphere in all their varied relations. Passing on to consider some relations between meteorology and terrestrial magnetism, he mentioned some analogies existing between the meteorological element of temperature and the motion of the magnetic needle, as regards their diurnal and yearly variations; proceeding then to discuss to some extent the relation between solar spots, terrestrial magnetism and meteorology, pointing out that whilst in certain broad features their relation with magnetism was very striking, that with meteorology, as far as we are able to interpret the results obtained, is comparatively uncertain. Before concluding, the President, viewing the present outlook as regards meteorology, spoke of the new and higher meteorology that in spite of the difficulties of the subject is now springing up, and referring to the various international congresses as having promoted uniformity of action and division of labour, said that meteorology now, perhaps more than ever, stood in need of combined action among its workers, and alluding to the idea of federation of which of late so much has been heard, suggested that a permanent federation of the meteorologists of different countries might regulate meteorological action and inquiry throughout the world, and so promote the better elucidation of meteorological laws, whilst also accumulating materials for the future discussion not only of the meteorology of the earth as a whole, but also of any periodical or secular changes, however produced, that might be proceeding thereon.

THE CENTRE OF A BRITISH CYCLONE.

To the Editor of the Meteorological Magazine.

SIR,—May I ask any of your readers whether they can give me any information about the appearance of the sky in the centre of a cyclone?

It has been asserted that a blue patch is sometimes found there in this country, as in tropical cyclones. If any of your correspondents have any observations on this point, perhaps they will be good enough to send me the particulars as minutely as possible.

Yours faithfully,

RALPH ABERCROMBY.

21, Chapel Street, London, S. W., Jan. 22nd, 1887.

DAY AND NIGHT BREEZES.

To the Editor of the Meteorological Magazine.

SIR,—Dr. Burder seems to imply, though he does not state distinctly, that the tendency of the *diurnal* wind to veer, observed at Sunderland, exists over this country generally. If this is the case it would disprove the theory I suggested on pp. 121, 122 of vol. xxi. ; *Meteorological Magazine*, according to which, on the West Coast of England, the daily wind ought to back instead of veering. My letters in the *Magazine* have elicited no definite information on the subject, as regards Britain; but I have received two pamphlets by Mr. C. Chambers, F.R.S., “The Climate of the Bombay Presidency” and “The Normal Winds of Bombay,” which show the diurnal changes in that part of India, and which distinctly contradict my theory.

At Bombay the principal diurnal winds are, of course, the sea-breeze by day and the land-breeze by night; but there is also a veering of the wind, whereas according to my theory it ought to back, except in the summer, when the sun is north of the latitude of Bombay. These phenomena are well marked, except from June to August—the rainy season. Mr. Chambers prefers to look at the question as not one of veering or backing, but as an oscillation of the wind in a north and south direction; and he shows that in every month of the year the north component of the wind has *two* daily maxima and minima. In the average of the whole year the principal minimum is about 10.30 a.m., and the maximum about 6.15 p.m.; the secondary minimum and maximum being about 1.30 a.m., and 5.15 p.m. respectively. In a portion of the year the secondary minimum is the principal one.

At Deesa, where, though about 240 miles from the open sea, the sea-breezes are felt, the diurnal change in the monsoon (or summer) months is, however, a backing instead of a veering. During the rest of the year the circulation is in the same direction as at Bombay. Inland at Belgaum and Poonah there are no sea-breezes, the chief daily variation of the wind being of the reverse character—viz., blowing towards the interior of the country in the night, and the opposite way in the day, the reason for which is not assigned; but the wind veers at those places also, so that the north and south winds must reach their maxima at opposite times to those at which they are reached at Bombay, and at similar times as at Sunderland.

Here, I cannot say whether the double oscillation of the north component takes place, inasmuch as I have not made observations in the night, which would be required to show it; but the oscillation I have observed here takes place at just about the reverse times to what the principal one does at Bombay, the wind blowing from the north at the same time as it there blows from the south, and *vice versa*.

I cannot see the force of Dr. Burder's first suggestion on p. 161

(vol. xxi.) ; but his second one (p. 162) that the veering may be caused directly by the rotation of the earth, seems a more likely explanation ; the earth's rotation causing anything in the northern hemisphere to deviate towards the right ; but this would not explain the *whole* of the mode of the diurnal variation at Bombay, because, whereas it turns to the right during the greater part of the day, there is a portion of the night in which, owing to the double oscillation, the turning is towards the left. Mr. Chambers does not explain the north and south oscillations in the pamphlets, but Mr. F. Chambers believes that they, together with a portion of the variation of the east components of the wind and the diurnal variation of the barometric pressure, are three phenomena with one cause, applying to widely distant places.

T. W. BACKHOUSE.

Sunderland, February 4th, 1887.

THE WEATHER AND THE "CYCLISTS."

To the Editor of the Meteorological Magazine.

SIR,—I think that your readers will not set a very high value on Mr. Ryves' criticisms, for a critic who directs his most caustic remarks against acts similar to those which he commits himself, cannot be regarded as a very formidable opponent. For instance, why does he object to my references to the weather of March and May, 1886, when he has made the same references himself? I should not have thought of alluding to the spring months at all if his letter (in your November number) had not suggested it to me. Mr. Ryves, in using the words of Mr. Harding, goes back to "January 4th" in order to prove that up to "August 2nd" the summer of 1886 was not warm. He thought it expedient to give a quotation containing some allusions which he considered "irrelevant" to the subject under discussion.

In his first letter, to which I have referred, he says, "The max. shade temp. at Greenwich during the summer of 1886" was "only 87°, whereas in recent years it has frequently exceeded 90°, and on one occasion reached 97°." If it is true that "the shaded thermometers at Greenwich are sometimes several degrees in excess of the true reading," then, probably, 97° was never really reached there at all, and 90° was not "frequently exceeded in recent years." Mr. Ryves approves of these high maxima to fortify his own statements, but objects to them when they are used by me. Is this fair?

The summer of 1886, if limited to June, July and August, differed from that of 1869 in one important respect—it was considerably warmer, the mean temp. having been 0°·7 above that of 17 years before.

Although October cannot "properly be included amongst the summer months," we certainly had an extension of summer into the October of last year. On the 4th and 5th of that month, the Greenwich shade maxima were 79°·2 and 77°·0, and the mean daily values

66°·7 and 64°·9 respectively, which are higher temperatures than those of any other *two consecutive* October days during at least 72 years past, and including Luke Howard's observations during 80 years past.—Yours truly,

GEORGE D. BRUMHAM.

Barnsbury, Feb. 3rd, 1887.

REMARKABLE DISPLACEMENT OF EARTH.

To the Editor of the Meteorological Magazine.

SIR,—A rather unusual occurrence took place a few days ago in a grass field near my house. The facts are these. On a dry hill side a piece of turf (with soil adhering to a depth of 5 inches), was lifted bodily out of its position and placed in exactly its original shape at a distance of 8 feet. It is triangular in shape, and its sides are respectively 3 ft., 3 ft. 2 in., and 2 ft. 11 in. There is a large crack in the soil where it has been torn out about a yard long. This occurred during hard frost, when the ground was frozen. There is ample proof that no artificial means were employed, for a thick hoar frost prevailed on the morning of its occurrence, and foot marks would have been readily detected. Can any one suggest a cause?

Yours truly,

THOS. G. BENN.

Newton Reigny Observatory, Penrith, Jan. 25th.

P.S.—The hill is not steep, and the displaced soil was not thrown downwards, but cross-wise.

R E V I E W S .

Jahrbücher der k. k. Central-Anstalt für Meteorologie und Erdmagnetismus.
Vol. XXII., n.s. Vienna, 1886.

THE Austrian Meteorological Office has just published its yearly volume of observations for 1885. It corresponds generally in contents and arrangement to its predecessors, and contains :—(1) Observations made three times daily at 16 stations in the Austrian Empire, and 2 foreign stations, Alexandria and Beyrout.—(2) Monthly and yearly summaries at 363 stations of the I.–III. orders. Some of the stations are nearer each other than may be absolutely necessary, there being no less than 10 in Vienna alone.—(3) Temperature means in the Alpine district for each month and year for the period 1851–85 for the principal stations used in Dr. Hann's work, *Temperatur der oesterreichischen Alpenländer*. These observations are additions to the usual tables, and are followed by means for each of the seven lustra. Dr. Hann expresses the hope that others will follow this plan, so as to render comparison easier for similar periods in Europe. There are also tables of the monthly and yearly means

of 380 stations for the 30 years 1851-80, being a reprint of all the observations used in the above work, in a form convenient for reference.—(4) Hourly observations taken at the central office at Vienna, with the addition of the results of hourly observations at Eger, Klagenfurt, Kremsmünster and Hochobir. Much credit is due to Dr. Hann and his staff for the way in which these year books are worked up, and we note that in the hourly observations both the *hourly* and daily means are calculated. There seems, however, a reluctance on the part of all central offices to deal in a general way with the results of wind observations, whether by reduction to two components, as in the Orkney and Bermuda discussions published some years ago by our Meteorological office, or otherwise. We are not sure whether the reason lies in the difficulty of the problem or in the amount of the labour entailed. Probably both.

Part 5 contains the magnetic observations made at the Central Institute.

J. S. HARDING.

The Mountain Meteorological Stations of Europe. By A. LAWRENCE ROTCH, S.B., F.R.Met.Soc., &c. 8vo., 42 pp., 15 plates. [Reprinted from *American Meteorological Journal*]. Ann Arbor, 1886.

Mr. ROTCH, the founder, proprietor and director of the Blue Hill Observatory, Readville, Massachussets, adopted the very wise course of coming to the old world and visiting the majority of the high level stations so as to apply the experience so gained to the equipment of his own. He published in successive numbers of the *American Meteorological Journal*, descriptions of the observatories which he visited, and notes respecting a few others, and the work before us is a reprint of those articles illustrated by fourteen plates, most of them excellent heliotype reproductions of photographs of the various observatories. Full details as to site, equipment and publications are given respecting the following establishments:—

Country.	Station	Latitude.	Longitude.	Altitude feet.
Germany ...	The Brocken ...	51° 48' N	10° 37' E	3744
„ ...	Schneekoppe ...	50 44 N	15 44 E	5246
„ ...	Wendelstein ...	47 42 N	12 1 E	5669
Austria	Hoch Obir	46 30 N	14 27 E	7047
Switzerland..	Säntis	47 23 N	9 28 E	8215
„	Righi	47 3 N	8 30 E	5873
France	Puy de Dome ...	45 47 N	0 37 E	4800
„	Pic du Midi ...	42 56 N	2 12 W	9439
Scotland	Ben Nevis	56 48 N	5 8 W	4400

The work is in all respects well done, very interesting and useful.

Handbuch der ausübenden Witterungskunde, von DR. W. J. VAN BEBBER. 1 Theile, Geschichte der Wetterprognose. Stuttgart, Ferdinand Enke, 1885. 8vo., viii.—392 pp.

If we turn to the last pages of this book first, we shall probably give to the English reader a clear idea of its importance. The last 24 pages are entirely occupied by no fewer than 394 notes and references to other works upon weather and weather prognostics, ranging from Hippocrates, Cicero, Ovid and Pliny, through the times of W. Cock, J. Goad, Toaldo, Schübler and so down to modern times, with references to almost every one who has dealt with the subject of weather forecasting, from Mathieu (de la Drôme) and Wiggins, to the International Congresses. The only weakness seems to be in English authors; we do not see Brumham, or Clouston, Inwards, Swainson or Whistlecraft—no, nor either Old Moore or Zadkiel, yet these last are at least as worthy of note as Mathieu (de la Drôme). By-the-bye we hear that he, like Zadkiel, made a fortune by his almanac—truly Carlyle was a sage.

The work is divided into sections, the first being devoted to an analysis of writings, indicating a belief in the influence of supernatural powers in modifying Meteorological phenomena. In this, various quotations are made from both the Old and the New Testament, and reference is made to the existing prayers, litanies, &c., for change of weather. The author then traces similar ideas in Greek and Latin authors, and approaches thereto among the Chaldees, Egyptians, Brahmins and others. Ten pages are then devoted to beliefs in demoniacal influence on the weather, and startling details are given as to witch burning, and the assumed influence of witches in producing storms and shipwrecks.

The second section is much longer and is devoted to Astro-Meteorology in all its forms, but the lunar influence is excepted and forms a section by itself. The Astro-Meteorological section deals very fully with the subject, starting with the Chaldæans and coming down through Greeks and Romans, past Paracelsus and Melancthon down to Schneider. As regards the Egyptians and the early Greeks, such as Hesiod (B.C. 850), we are inclined to think that Dr. van Bebbber would agree with us that, except as regards the moon, theirs was scarcely what is understood by Astro-Meteorology, but was rather a species of calendar, indicating dates of the year by the visibility of certain constellations, and then saying that at those dates such and such weather was probable. True Astro-Meteorology should rather be called Planeto-Meteorology.

The influence of the moon on atmospheric pressure is very fully treated, nearly 100 authors and papers being quoted and referred to, and abstracts given of the results obtained at many stations during the present century. Small effects seem established, but we agree with the author that in our latitude the changes are too small to have any influence on the weather.

The subsection II. *b* (Influence of the Moon on Weather Changes) opens with a great mistake, for which, however, we can hardly hold Dr. van Bebbber responsible. He (evidently impressed by the reputation of the elder Herschel) reproduces *in extenso* the weather table which was falsely attributed to Herschel. Dr. van Bebbber gives his authority Dr. Jahn's *Handbuch der Witterungskunde*, and it is not for us to complain that he was not aware of the repudiation of it in the *Met. Mag.*, Vol. IV., p. 136. We may as well give the history abridged from the full account in Smyth's *Speculum Hartwellianum*, and supplemented by one or two facts which have come to our own knowledge.

The table (which, as far as we know, appeared in English first in 1803, in Vol. LX., p. 24 of the *European Magazine*) was not original but pirated from the *Curiosiora et Selectiora Variarum Scientiarum Miscellanea* of Martin Szent-Jvany. It was, however, impudently and falsely stated to be by Dr. Herschel. Dr. (afterwards Sir William) Herschel repudiated all connection with it on every possible occasion, and his son did the same: and yet here we are, nearly a century later, still trying to correct the libel and the lie.

Subsequent subsections deal with lunar influence on rainfall, the amount of cloud, frequency of thunderstorms, direction of wind, and temperature. By the bye, there is no reference to Mr. Glaisher's two papers in the *Quarterly Journal Royal Met. Soc.*—"The influence of the Moon on the amount and frequency of Rainfall as dependent on her age" and "The Influence of the Moon on the Direction of the Wind." Then come sections on the influence of comets, meteorites and sunspots, and section VII. on weather rules (the only weak section in the book) closes the first part.

The second part commences with a section on the "Origin and Developement of the Newer Meteorology," *i.e.* all the results flowing from our knowledge of storm areas, barometric gradients, &c., and then passes on to summarise the actions of the various governments with respect to weather telegraphy, and gives a history of the proceedings and of the work of most of the various congresses and conferences.

The book is useful and interesting in the highest degree, the only thing to be regretted is that it is not in English.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1886.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
°		°		°	°	°	0-100	°	°	inches		0-10	
England, London	87·5	4	44·4	28	74·4	54·4	53·5	73	133·4	43·7	2·37	11	5·6
Malta	94·4	26	63·2	14	85·8	68·8	64·3	66	146·9	58·3	·00	0	0·7
<i>Cape of Good Hope</i> ...	73·0	30	35·0	7, 21	63·8	44·4	44·9	86	...	...	2·43	9	3·8
<i>Mauritius</i>	76·2	8	58·2	15	73·7	63·2	59·0	74	124·2	49·4	2·22	20	5·2
Calcutta	92·5	11	74·7	8	88·4	78·7	78·5	87	161·5	74·1	15·35	29	8·2
Bombay	87·6	5	74·6	23	84·0	77·3	76·2	86	144·8	72·9	35·79	29	8·6
Ceylon, Colombo	87·2	5	72·8	23	84·9	76·8	73·0	76	146·0	66·0	7·87	15	6·2
<i>Melbourne</i>	65·1	19	28·1	8	56·8	39·5	41·3	80	116·0	20·8	·84	11	5·9
<i>Adelaide</i>	69·0	3	36·6	16	59·9	45·8	42·6	69	121·5	27·5	2·72	21	5·5
<i>Wellington</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Auckland</i>	60·0	19	37·0	8	56·1	43·8	42·9	78	119·0	28·0	2·26	12	5·5
Jamaica, Kingston	94·7	10	69·5	31	91·1	73·1	72·5	76	...	...	2·10	13	6·8
Barbados	84·0	1, 2a	68·0	15	82·0	72·0	72·4	81	144·0	...	10·63	24	7·0
Toronto	89·5	6	47·5	1	76·6	55·9	55·8	68	...	40·0	2·45	10	5·1
New Brunswick, Fredericton	89·3	6	44·5	25	75·8	55·0	56·5	67	...	...	1·56	14	5·7
Manitoba, Winnipeg ...	94·8	10	46·0	17b	84·4	55·0	57·7	66	...	...	1·34	13	5·2
British Columbia, Victoria	85·0	18	43·0	3	70·5	50·4	...	...	...	...	·80	5	...

a And 8. b And 21.

REMARKS, JULY, 1886.

MALTA.—Mean temp. 76°·4; mean hourly velocity of wind 7·3 miles. J. SCOLES.

Mauritius.—Rainfall 31 in., and mean temp. 0°·9 below the average; mean hourly velocity of wind 12·2 miles; extremes 28·8 miles on 21st, and 1·7 miles on 15th prevailing direction E.S.E.

C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air and mean humidity, average; rainfall 1·88 in., and temp. of dewpoint and mean amount of cloud, slightly below average; pressure 101 in. above average. Prevailing winds N. and N.E., strong on 4 days; heavy dew on 11 days, hoar frost on 10, ice on 3, fog on 6 days.

R. L. J. ELLERY, F.R.S.

Adelaide.—Mean pressure slightly above average, the highest reading recorded here (30·731 in.) occurring on 14th; mean temp. (52°·8) 1°·2 above average; rainfall slightly above average, but over the northern areas splendid rains fell, principally during the latter half of the month.

C. TODD.

Auckland.—An unusually fine month with little wind. Showery from 1st to 5th, and 12th to 20th, remainder of month fine and settled, with clear and often frosty nights. Pressure above the average, mean temp. below it, rainfall not half the average.

T. F. CHEESEMAN.

BARBADOS.—Mean temp. (76°) 1° below the average; rainfall greatly above the average, nearly equal to the fall of the previous six months. On the 15th 1·20 in. fell in about half an hour; only once in 25 years has a larger rainfall been registered (11·47 in. in 1877.) Prevailing wind N.E.; mean hourly velocity 10·4 miles; extremes 17·1 miles and 4 miles. Twelve days were cloudy and overcast. T and L on 4 days.

R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL,
JANUARY, 1887.

[For the Counties, Latitudes, and Longitudes of most of these Stations,
see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	2·77	XI.	Castle Malgwyn	4·41
„	Margate, Birchington ..	1·32	„	Rhayader, Nantgwillt..	4·95
„	Littlehampton	2·15	„	Carno, Tybrith ..	3·47
„	Hailsham	2·97	„	Corwen, Rhug	3·16
„	Ryde, Thornbrough	3·27	„	Port Madoc	4·62
„	Alton, Ashdell	2·60	„	I. of Man, Douglas	3·75
III.	Banbury, Bloxham .....	...	XII.	Stoneykirk, Ardwell Ho.	1·89
„	Oxford, Magdalen Col...	2·16	„	New Galloway, Glenlee	6·26
„	Northampton	2·51	„	Melrose, Abbey Gate...	1·86
„	Cambridge, Beech Ho...	1·55	XIII.	N. Esk Res. [Penicuik]	1·40
„	Wisbech, Bank House..	1·94	XIV.	Ballantrae, Glendrishaig	4·84
IV.	Southend .....	...	„	Glasgow, Queen's Park.	2·05
„	Harlow, Sheering	1·25	XV.	Islay, Gruinart School..	3·66
„	Rendlesham Hall	2·36	XVI.	St. Andrews, Pilmour Cot	1·97
„	Diss	1·84	„	Balquhiddier, Stronvar..	9·53
„	Swaffham	1·79	„	Dunkeld, Inver Braan..	3·54
V.	Salisbury, Alderbury...	3·58	„	Dalnaspidal H.R.S.	7·10
„	Warminster	3·00	XVII.	Keith H.R.S.	1·24
„	Calne, Compton Bassett	2·30	„	Forres H.R.S.	1·15
„	Ashburton, Holne Vic..	6·69	XVIII.	Strome Ferry H.R.S....	7·31
„	Holsworthy, Clawton...	2·79	„	Tain, Springfield	2·13
„	Hatherleigh, Winsford.	3·47	„	Loch Shiel, Glenaladale	13·63
„	Lynmouth, Glenthorne.	4·29	„	S. Uist. Ardkenneth ...	7·54
„	Probus, Lamellyn	3·39	„	Invergarry	10·14
„	Wincanton, Stowell Rec.	2·84	XIX.	Lairg H.R.S.	1·75
„	Taunton, Lydeard Ho ...	2·50	„	Forsinard H.R.S.	4·46
„	Wells, Westbury	2·78	„	Watten H.R.S.	2·05
VI.	Bristol, Clifton	2·27	XX.	Dunmanway, Coolkelure	8·85
„	Ross	2·73	„	Fermoy, Gas Works ...	5·14
„	Wem, Clive Vicarage ...	...	„	Tralee, Castlemorris ...	5·42
„	Cheadle, The Heath Ho.	2·92	„	Tipperary, Henry Street	4·34
„	Worcester, Diglis Lock	2·46	„	Newcastle West .....	...
„	Coventry, Coundon	3·51	„	Milton Malbay	4·21
VII.	Melton, Coston	1·96	XXI.	Gorey, Courtown House	3·71
„	Ketton Hall [Stamford]	2·35	„	Navan, Balrath	2·57
„	Horncastle, Bucknall ...	1·90	„	Mullingar, Belvedere ...	2·80
„	Mansfield, St. John's St.	2·25	„	Athlone, Twyford	3·00
VIII.	Macclesfield, The Park.	2·24	XXII.	Galway, Queen's Coll...	2·40
„	Walton-on-the-Hill	2·32	„	Clifden, Kylemore .....	...
„	Lancaster, South Road.	...	„	Crossmolina, Enniscoe..	5·11
„	Broughton-in-Furness ..	3·98	„	Collooney, Markree Obs.	3·43
IX.	Wakefield, Stanley Vic.	1·89	„	Carrick-on-Shannon ...	...
„	Ripon, Mickley	2·08	XXIII.	Rockcorry .....	...
„	Scarborough	2·49	„	Warrenpoint	2·78
„	East Layton [Darlington]	2·63	„	Newtownards .....	...
„	Middleton, Mickleton ..	1·74	„	Belfast, New Barnsley .	3·03
X.	Haltwhistle, Unthank..	1·89	„	Cushendun	2·99
„	Shap, Copy Hill	7·39	„	Bushmills	2·18
XI.	Llanfrechfa Grange	3·49	„	Stewartstown	1·83
„	Llandovery	4·19	„	Buncrana	2·55

JANUARY, 1887.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						TEMPERATURE.						No. of Nights below 32°
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Days on which ≥ 0.1 or more fell.	Max.		Min.		In shade.	On grass.		
				Dpth	Date.		Deg.	Date.	Deg.	Date.				
inches	inches.	in.												
I.	London (Camden Square) ...	1.26	— 1.09	.34	3	13	52.2	19	14.5	2	19	23		
II.	Maidstone (Hunton Court)...	1.28	— 1.29	.46	3	9	...	...	...	...	...	...
III.	Strathfield Turgiss	2.39	— .16	.98	3	15	...	...	...	...	...	...
III.	Hitchin	2.00	— .22	.77	3	14	50.0	28 ^c	15.0	1	19	...		
IV.	Winslow (Addington)	2.44	— .11	1.14	3	15	52.0	29	6.0	1	22	27		
IV.	Bury St. Edmunds (Culford)	1.76	— .08	.34	5	14	51.0	31	15.0	1	23	...		
V.	Norwich (Cossey)	1.43	— .27	.50	8	7	53.0	29	36.0	24	11	20		
V.	Weymouth (Langton Herring)	3.17	...	.92	3	15	50.0	19 ^d	23.0	1	13	...	
V.	Barnstaple	3.96	— .30	.64	6	17	55.0	26	25.0	1, 2	...	...
V.	Bodmin	3.70	— 2.81	.74	10	16	51.0	19	27.0	2, 13	14	17		
VI.	Stroud (Upfield)	3.03	+ .04	.49	2	18	52.0	28	20.0	1	18	...		
VI.	Church Stretton (Woolstaston)	1.98	— 1.45	.50	19	14	53.0	29	22.0	17	18	24		
VI.	Tenbury (Orleton)	2.97	— .02	.52	10	17	55.0	28	15.6	7	22	23		
VII.	Leicester	2.67	...	.99	7	17	54.2	28	14.0	17	17	29	
VII.	Boston	1.22	— .50	.28	11	7	54.0	28	16.0	1	23	...		
VII.	Hesley Hall [Tickhill]	2.30	...	.60	7	15	53.0	29	14.0	13	20	...	
VIII.	Manchester (Ardwick)	1.72	— 1.52	.35	5	16	49.0	20	23.0	17	17	...		
IX.	Wetherby (Ribston Hall) ...	1.56	— .66	.48	8	10	...	...	...	...	...	...
IX.	Skipton (Arncliffe)	5.86	— 1.07	.80	17	20	...	...	...	...	...	...
IX.	Hull (Beverley Road)	1.57	— .22	.26	5	16	49.0	28 ^c	21.0	2, 7	16	21		
X.	North Shields	1.63	— .21	.25	5	15	54.0	30	21.5	17	19	20		
X.	Borrowdale (Seathwaite)	12.11	— 6.64	1.76	31	23	53.5	27	18.5	8	17	...		
XI.	Cardiff (Ely)	3.28	— 1.43	.76	7	23	...	...	...	...	...	...
XI.	Haverfordwest	5.97	— .30	.90	8	23	52.0	19	22.0	12	16	24		
XI.	Plinlimmon (Cwmsymlog) ...	3.88	...	.92	19	15	...	...	...	...	...	...
XI.	Llandudno	2.75	— .21	.69	31	16	...	...	27.4	16	9	...	
XII.	Cargen [Dumfries]	3.63	— 2.48	.64	3	15	49.8	27	19.4	6, 10	15	...		
XII.	Jedburgh (Sunnyside)	1.68	— .40	.49	6	11	53.0	29 ^k	19.0	6, 8	19	...		
XIV.	Old Cumnock	3.54	— 1.10	.82	3	18	51.0	25	16.0	10	16	...		
XV.	Lochgilhead (Kilmory)	5.49	— 2.38	1.28	10	20	...	...	...	...	...	...
XV.	Oban (Craigvarren)	6.96	...	1.65	18	22	53.0	3	21.0	9	10	...		
XV.	Mull (Quinish)	6.76	...	.69	17	24	...	...	...	...	...	...
XVI.	Loch Leven Sluices	1.70	— 2.12	.30	11 ^a	11	...	...	...	...	...	...
XVI.	Arbroath	2.63	+ .18	.46	10	11	50.0	28 ^e	25.0	15	15	...		
XVII.	Braemar	1.91	— .87	.75	11	16	46.0	19	14.0	15	17	23		
XVII.	Aberdeen	2.92	...	.53	17	18	54.0	29	24.0	14 ^h	13	...	
XVIII.	Lochbroom	6.30	...	.93	18 ^b	26	...	...	...	...	...	...
XVIII.	Culloden .....	.94	— .83	...	...	...	53.0	26 ^f	23.0	6	11	20	
XIX.	Dunrobin	2.72	...	.65	6	13	55.0	26 ^e	27.0	10 ^j	18	...	
XIX.	Kirkwall (Swanbister) .....	...	...	...	...	...	...	...	...	...	...	...
XX.	Cork (Blackrock)	4.57	— 1.45	.93	10	21	53.0	25 ^g	27.0	9, 11	12	...		
XX.	Dromore Castle	7.63	...	.73	25	24	54.0	25	29.0	7	...	...
XX.	Waterford (Brook Lodge) ...	4.57	...	1.42	10	16	52.0	26	22.0	10	11	...		
XX.	O'Briens Bridge (Ross)	3.63	...	.69	31	21	53.0	30	27.0	8	11	...	
XXI.	Carlow (Browne's Hill)	3.23	— .39	.77	9	17	...	...	...	...	...	...
XXI.	Dublin (Fitz William Square)	1.82	— .44	.44	10	16	57.4	26	23.1	10	8	19		
XXII.	Ballinasloe	2.96	— 1.40	.44	31	23	51.0	26	24.0	10	17	...		
XXIII.	Waringstown	3.57	+ .16	1.42	10	16	56.0	27	12.0	9	20	20		
XXIII.	Londonderry (Creggan Res.) ..	2.22	...	.37	18	22	...	...	...	...	...	...
XXIII.	Omagh (Edenfel)	2.74	— 1.03	.94	10	19	53.0	26	11.0	9	17	22		

a And 19. *b* And 21. *c* And 29, 31. *d* And 31. *e* And 29. *f* And 27. *g* And 27, 29. *h* And 15. *i* And 17. *j* And 11. *k* And 30.

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

METEOROLOGICAL NOTES ON JANUARY, 1887.

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

ENGLAND.

STRATHFIELD TURGISS.—The new year opened with very severe weather, repeated (but fortunately without S), on 17th and 18th. At the end of the month the weather was mild and springlike. The melting of the snow caused rather severe floods, and the land at the close was very wet. Much S on 2nd and 3rd.

ADDINGTON.—Intense frost after the lifting of the fog on the morning of the 1st. The min. only 6° at 9 a.m., the dry bulb 7°, and at 10 a.m. only 10°.

CULFORD.—The weather up to the 18th, was very cold and frosty, gradually improving towards the close. Mean temp. 33°. S on 3rd and 17th. Fog on 6th, 9th and 24th.

LANGTON HERRING.—The weather was very unsettled, especially from 1st to 19th. R slightly in excess of the average of 12 years. Mean temp. at 9 a.m. (37°·0) 2°·5 below the average of 15 years. During the night of 17th, the temp. rose to 45°. There were great fluctuations of pressure, which from 4th to 9th was unusually low. Dense fogs on 27th, 28th and 29th.

BODMIN.—The latter part of the month was singularly bright and fine. Mean temp. 38° 5.

STROUD.—The temp. fell to 32° daily from 1st to 17th. S fell on 8 days, though never to any great depth, but more fell on the hills, where it drifted. A little fog on 13th and 14th.

WOOLSTASTON.—Severe frost prevailed till 18th, after which the weather became more open. S fell on 4th and 7th, and heavily on 8th. Mean temp. 35°·8.

ORLETON.—Great fog and rime, with severe frost occurred on 1st and 2nd, followed by a slight thaw. Then frequent falls of S ensued, succeeded by slight thaws, and severe frosts rendering the roads very icy and dangerous. The ground was covered with S and ice till the 19th. The mean temp. of the first 18 days was only 29°·3. The remainder of the month was above the average temp. but dry, with many days fine and pleasant, and a few frosty mornings. The S was nearly all gone by 21st, but in many places the roads were very icy till 23rd. Mean temp, 3°·3 below the average of 26 years. Range of pressure great. S on 7 days; about 4 inches deep on 5th and 8th. Fog frequent.

LEICESTER.—The early part of the month was intensely cold and dreary; the latter part very much milder.

MANCHESTER.—A seasonable month; rather cold throughout with occasional B, sleet, and a little S.

HULL.—Dull and cold. During the two months December, 1886, and January, 1887, the max. temp. in shade only once reached 50°, viz.: on December 5th.

WALES.

HAVERFORDWEST.—Another stormy, wet, and cold month. During the first 16 days the frost was at times very sharp, although the temperature during the daytime neutralized the effects of the low night temperature to a considerable extent. The latter 15 days were damp, very wet at times, and the air was raw and cold. There was no skating. The Precelly Range was three times covered with S. On the 4th it was very stormy; about midnight a squall of unusual violence occurred, so sudden and powerful, that some thought it the shock of an earthquake. S on 5th and 8th.

LLANDUDNO.—Mean temp. (41°·3) within a fraction of the average; the range, diurnal and monthly, also near the average. The weather on the whole was fine, especially from 19th to 30th. From the 1st to the 17th the temp. was

considerably below the average, thence to the close considerably above it. An uninterrupted cyclone prevailed from 20th to 30th., followed by a sudden fall of pressure on 31st, accompanied by high wind and heavy R. There was a sprinkling of S on the ground on the morning of the 6th and occasional S showers occurred during the day, but it melted almost as it fell; the S storms of North Wales seldom reach this peninsula. H on 3rd; fog on 14th.

SCOTLAND.

CARGEN.—Cold weather prevailed during the first half of the month, while the last ten days were remarkably mild. Mean temp ($36^{\circ}\cdot8$) $1^{\circ}\cdot3$ below the average. There was great want of sunshine, only 40 hours being recorded. High winds prevailed during the last ten days. S on 5th and 17th.

OBAN.—A stormy month, cold, and signalled by a heavy and continuous rainfall. On the 18th the R was unusually heavy for a short period of time and caused a large amount of damage to roads and bridges, one of the latter being swept away in Glen Etive. T on 24th; S on 5th, 9th, and 17th; aurora on 16th, followed by very severe weather.

ABERDEEN.—The first half of the month was cold, with frequent falls of S; later, however, milder weather set in, and prevailed to the close. Rainfall about half an inch above the average. Aurora on 14th and 23rd.

LOCHBROOM.—This month was very much like the last, a mixture of all kinds of weather; from fine, warm, summerlike weather to the rigour of Siberia, and from calms to strong gales. Seldom has a month been seen of such variety, yet on the whole it was fine and open. S on 3rd, 6th, and 17th; sleet on 3rd and 10th; H on 6th; gales on 17th, 18th, and 28th to 30th; T and L on 31st.

CULLODEN.—Very changeable with heavy storms of wind and much frost.

IRELAND.

BLACKROCK.—Excepting three bright days the weather was dull, humid and depressing. Pressure very variable. Prevailing wind W. Mean temp. $41^{\circ}\cdot5$. S on two days.

DUBLIN.—Cold, changeable and inclement until the 19th, the weather afterwards was singularly mild and fine. The wind blew freshly from W. or S., scarcely any rain fell for a period of ten days, and the mean temp. of the week ending 29th was as much as 9° above the average, which raised the mean temp. of the month to the average. During the last two days the fine weather broke up, and there was a S.W. gale on 31st. Solar halo on 10th; fog on 7th, 10th, 14th and 18th. High winds on 13 days; S gale on 11th; H on 3rd and 7th. S or sleet on 4th, 6th, 7th, 9th and 16th. Mean humidity 86; mean amount of cloud $6\cdot3$; prevailing winds S.W. and W.

EDENFEL.—The weather of the first fortnight was of the same severe character as that of December, but from the 18th to the end there followed a mild, comparatively dry and occasionally summer-like period, during which much of the time lost to agricultural operations through wet, was made up.

HEAT OF JANUARY 8TH AND 9TH, 1887, IN SOUTH AUSTRALIA.

According to the *South Australian Register* of January 10th very exceptional heat prevailed in Adelaide and over much of South Australia on January 8th and 9th. At the Adelaide Observatory the values were:—

	9 a.m.	9 p.m.	max.	min.
January 8th.....	98°	$93^{\circ}\cdot3$	$110^{\circ}\cdot1$	—
„ 9th.....	$97^{\circ}\cdot6$	$94^{\circ}\cdot2$	$111^{\circ}\cdot2$	$84^{\circ}\cdot0$

At various other stations max. temperatures in shade are reported of from 106° to $114^{\circ}\cdot8$.