

SYMONS'S METEOROLOGICAL

MONTHLY

METEOROLOGICAL
MAGAZINE.

VOLUME THE TWENTY-SEVENTH.

~~~~~  
1892.  
~~~~~

LONDON:
EDWARD STANFORD, COCKSPUR STREET, S.W.

—
1893.

Manley
Perkins

INDEX.

	PAGE		PAGE
Africa, Tropical, The Climate of	64	France, Meteorological Changes in	51
April and March, Exceptional Weather in	52	Frosts, The Recent	177
April 29th, 1892, The Mauritius Hurricane	65, 71	Frost Figures	179
Anemometer Comparisons	49	Frost of February, 1892, The Severe	17
Angot, Dr., Instructions	33	Frosts in 1892, Spring	86, 103
Artificial Production of Rain	129, 154	Heat in Aug., 1892, The Great	122
Atlantic, The Forecasting of Storms from the	98	Hurricane, The Mauritius, April 29th, 1892	65, 71
August, A Wet	121	Instructions, Dr. Angot's	33
August, 1892, Great Heat in	122	Irish Weather Maxims	144
August 18th, Welsh Earthquake	113	Jamaica, The Rainfall of	137
Auroras, The Heights of	121	July, A Cold	103
Barometer Indicators	161	July 2nd, Report on the Great Rainfall in East Clare	122
Barometer, Low, Jan. 13th, 1843	164	July 3rd, Thunderstorm and Cloud Burst near Driffield	82
Bench Marks, Ordnance	8	June 1st and May 31st, Thunderstorms of	72
British Association at Edinburgh, The	97, 116	June 28th, Great Rains on	81
Butterflies	144	Lightning Story, A	188
Clare, East, Report on the Great Rainfall on 2nd July, 1892	122	March and April, Exceptional Weather in	52
Climate, The, of the British Empire during 1891	105	Mauritius Hurricane, The, April 29th, 1892	65, 71
Climate, The, of Tropical Africa	64	May 31st and June 1st, Thunderstorms of	72
Climatological tables for the British Empire	12, 28, 44, 59, 76, 92, 108, 124, 140, 156, 172, 184	Mensbrugghe, Prof., on the Formation of Fog and Clouds	40
Cloud Bursts and Thunderstorms near Driffield, July 3rd	82	Meteorological Changes in France	51
Clouds & Fog, Prof. Mensbrugghe on the formation of	40	Meteorological Instruments, Spurious	91
Cold July, A	103	Meteorological Notes on the Months	15, 31, 47, 62, 79, 95, 111, 127, 143, 159, 175, 187
Colonial Observations, Early	162	Meteorological Observations, Forgotten	161
Conference, The Munich	27, 41	Meteorological Society, The Royal	9, 42, 89, 170, 182
Danger from Lightning	116	Modern Thermometry	167
Driffield, Thunderstorm and Cloud Burst near	82	Munich Conference, The	27, 41
Dry Spring, The	52, 85	New Zealand, The Rainfall of	145
Earthquake, Welsh, of Aug. 18th	113	Obituary: John W. Tripe, M.D.	33
Edinburgh, The British Association at	97, 116	Observations, Forgotten Meteorological	161
Errata in <i>Met. Mag.</i> in 1891	106	October 4th, Rain on	139
Exceptional Weather in March and April	52	October Rain and Floods	149
February, 1892, Severe Frost of	17	Ordnance Bench Marks	8
Firminus? Who was	6, 27, 36, 176	Prediction Fulfilled, A	27
Floods, The October Rain and	149	Rain and Floods, October	149
Fog and Clouds, Prof. V. Mensbrugghe on the Formation of	40	Rainfall and Temperature, Monthly	14, 30, 46, 61, 78, 94, 110, 126, 142, 158, 174, 186
Fogs, Town	1, 22, 42, 56		
Forgotten Meteorological Observations	161		

	PAGE		PAGE
Rainfall, Another St. Swithin's...	102	Observations on Dew and Frost, by the Hon. R. Russell, F.R. Met.Soc.	180
Rainfall of Jamaica, The	137	St. Swithin's Rainfall, Another...	102
Rainfall of New Zealand, The ...	145	Snow Crystals, Unusual.....	181
Rainfall, The Great, in East Clare, on the 2nd July, 1892.....	122	Sparkling Rain.....	171
Rain on October 4th	139	Spring Frosts in 1892	86, 103
Rains, Great, on June 28th	81	Spring, The Dry	52, 85
Rain, Sparkling	171	Spurious Meteorological Instru- ments	91
Rain, Artificial Production of.....	154	Storms, The Forecasting of from the Atlantic	98
Recent Frost, The	177	Supplementary Tables of Rain- fall... 13, 29, 45, 60, 77, 93, 109, 125, 141, 157, 173, 185	
REVIEW :—		Theophrastus on Wind and Weather.....	82, 101
The Natural History and Scien- tific Book Circular, No. 115.		Thermometry, Modern	167
Meteorology, Electricity, Magnetism and Galvanism...	11	Thunderstorms and Cloud Burst near Driffield, July 3rd	82
La radiation des Nuages supéri- eurs autour des minima baro- métriques, Par H. E. Hamberg	25	Thunderstorms of May 31st and June 1st.....	72
Annual Report of the Board of Regents of the Smithsonian Institution . . to July, 1889 : Washington Government Printing Office, 1890	26	Town Fogs.....	1, 22, 42, 56
Berliner Zweigverein der Deut- schen Meteorologischen Ge- sellschaft Neuntes Vereine- jahr, 1892 : Berlin, 1892.....	37	Tripe, John William, M.D.	33
Observatoire Royal de Mada- gascar. Observations faites à Tananarive Par le R. P. E. Colin. S. J. II. Volume, 1890	38	Tropical Africa, The Climate of...	64
Étude sur le Climat de Pau et du Sud-ouest Français, par le Dr. E. Duhourcau de Cau- terets	57	Unusual Snow Crystals	181
		Weather, Exceptional, in March and April	52
		Weather Maxims, Irish	144
		Welsh Earthquake of Aug. 18th.	113
		Wet August, A	121
		Wind and Weather, Theophrastus, on	82, 101

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCCXIII.]

FEBRUARY, 1892.

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

TOWN FOGS.

YEAR by year as winter comes round, hundreds of columns of the daily journals are filled with abuse of fogs, and anathemas of everything connected with them; full of such extravagant statements as "a mighty evil, every year increasing in intensity and slaying its tens of thousands before their time." "Cold kills, but cold with London smoke kills with double weight and leads to innumerable sudden deaths, as the Registrar-General's tables convincingly tell us."

Fortunately all this exaggerated declamation is as ephemeral as it is worthless, and the real literature of the subject is perhaps not so much overgrown and inflated with reproduction as is the case in many branches of knowledge.

In a paper read before the Meteorological Society, (*Quar. Jour.*, Vol. V, p. 157). the late Mr. George Dines set out very clearly the meteorological conditions which induce the formation of fog. Aitken in 1880 and subsequent years, clearly defined the physical conditions, counted and measured the particles, and proved that fog is one of the most active agents in removing the smaller solid impurities from the atmosphere. Dr. Russell in 1885 by washing foggy air analysed its constituents, and found that in foggy weather the amount of organic matter was double as much as existed in the air in merely dull weather, and that the amount of sulphates and chlorides increased under like conditions, but not to the same extent. The matter deposited on the glass roofs of plant houses at Chelsea, corresponded to a weight of 22lbs. to the acre, consisting chiefly of soot and dust rendered sticky by hydrocarbons; well described by Professor Thiselton Dyer as "like a brown paint, which would not wash off with water." At Manchester three days fog deposited per square mile of surface $1\frac{1}{2}$ cwt. of sulphuric acid, and even at Owen's College 1 cwt. of acid and 13 cwt. of blacks.

It has been shown that the extra amount of gas supplied by the Gas Light and Coke Company during one foggy day in 1889 cost £3,000; but there are of course other gas companies, there are electric light companies, and considerable quantities of oil are burnt, it is probable therefore that one day's fog costs London for light

alone £4,000. The cost for damage to furniture and decorations, to goods exposed for sale, to art treasures of all sorts, and for accidents and for doctor's bills is incalculable.

In a valuable and impartial paper presented to the International Congress of Hygiene and Demography last year, Dr. Russell examined at some length the records of temperature and death rate in London, during times of fog, and the following extracts give his conclusions on the subject.—“By far the greater number of fogs occur when there is a great fall of temperature; and clearly this is closely followed after a few days by a great increase in the death rate; but how much of this increase is to be attributed to the fog and how much to the fall in temperature may be difficult to determine; but we have evidence that when fogs occur without fall of temperature they do not appear to be followed by any remarkable increase of death rate. . . . That many people suffer much, both physically and mentally from the effects of fog, there can be no doubt; but, as far as I can interpret these returns of the Registrar-General, they do not confirm the popular impression that fog is a deadly scourge; at the same time, it is beyond doubt that an atmosphere charged with soot, dust, and empyreumatic products is an unwholesome atmosphere to breathe.”

This indictment is sufficiently severe though it practically gives a verdict of “not guilty” as regards the capital crime.

We have thus contributions to a knowledge of the Physics, Economics (and why should we not say) the Chemicals and Demographics of the subject. The Royal Horticultural Society has appointed a strong Committee to study its botanical aspects, and the question arises—Have Meteorological Observers done their share in the work? This we are afraid must be answered in the negative. As long ago as 1863 Dr. Gladstone, in a Friday evening lecture at the Royal Institution, after speaking of the utter confusion existing among observers on land as to what should be designated fog, suggested “that a pole, painted vermilion, should be set up at a hundred yards from the station, and that such an amount of mistiness as renders it invisible should alone be named fog.” In an article in the *Met. Mag.* in 1883 this was referred to, and a different plan was suggested, and illustrated, to meet the case of observers in towns, but we believe that the same utter confusion still prevails and that very few, if any, observers in towns have attempted to grapple with it.

That this confusion is real and so great that it cannot be neglected in any practical discussion of the subject, is clearly proved by a comparison of the observations at Camden Square, with the results given in a paper recently read before the Royal Meteorological Society by Mr. F. J. Brodie, “On the prevalence of Fog in London during the 20 years, 1871-90.” The paper states that “The sources from which the information has been derived are mainly the observations given in the *Daily Weather Reports*. These are taken in

the south-western parts of the Metropolis, either at Brixton or Westminster, but in preparing the tables I have included some few instances in which fog prevailed over a large portion of the London area, but in which it failed to affect the districts in question. Every endeavour has, in fact, been made to represent London as a whole; and as the same principle has been followed throughout the entire series of years the results are strictly comparable." This is not perfectly clear, but as the "observations given in the *Daily Weather Reports*" are for the hours 8 a.m. and 6 p.m., it implies that every day on which fog was recorded at either of those hours is counted, with the addition of "some few instances" when fog occurred in other districts.

At Camden Square the observations are taken at 9 a.m. and 9 p.m., and three degrees of fog are recognised, viz.: slight fog; fog; and dense fog; and all cases in which either of these occurred at the hour of observation are included. Westminster is roughly $\frac{1}{2}$ a mile, and Brixton 3 miles, S. of Charing Cross, while Camden Square is $2\frac{1}{2}$ miles N. Brixton is 77 feet above sea level and Camden Square 111 feet, so that there should not be much to choose between these two stations, for though Camden Square is higher ground, Brixton is further from the centre of London.

We may therefore fairly assume that for the morning observation the conditions are fairly comparable. In the evening observations there is a wide difference of time, and although 6 p.m. should apparently be less foggy than 9 p.m., Westminster is low ground, near the river, and more in town than the other localities. We should therefore expect a small difference in favour of Camden Square, but the discrepancy shown by the table on the following page is fairly staggering.

This table indicates that there are nearly three times as many fogs at Brixton and Westminster, as at Camden Square; a difference which appears to us incredible. We are not conscious of any indifference to fog, either in ourselves, or the other observers at Camden Square, and yet we cannot believe that so great a discrepancy can be accounted for by the difference of locality or of hour of observation.

As regards the relation of one year to another, the two records are in general agreement, and the Camden Square values show an even greater excess of the second ten years over the first, than do Mr. Brodie's figures.

That fog is not ignored at Camden Square is indicated in another way, by comparing the 9 a.m. and the 9 p.m. records, when we find that for the 20 years, for 421 fogs recorded at 9 a.m. only 139 were recorded at 9 p.m., which we believe to be in a great measure due to the 9 a.m. observations including many fogs too slight to be visible after dark.

Another indication that the Weather Report records convey an excessive idea of the foggiess of London is we think given by the Camden Square record of fog at 9 a.m. and 9 p.m. on the same day,

Comparison of Fog Records at Brixton and Westminster, and Camden Square.

YEARS.	BRIXTON & WESTMINSTER.		CAMDEN SQUARE.		Excess of Brixton and Westminster over Camden Square.
	No. of Days of Fog.	Per cent. of average.	No. of Days of Fog.	Per cent. of average.	
1871	42	69	18	74	24
1872	35	57	11	45	24
1873	75	122	19	78	56
1874	53	86	17	70	36
1875	49	80	12	49	37
1876	40	65	26	107	14
1877	46	75	24	98	22
1878	63	103	27	111	36
1879	69	112	25	102	44
1880	74	121	22	90	52
1881	59	96	19	78	40
1882	69	112	34	139	35
1883	61	100	23	94	38
1884	53	86	21	86	32
1885	69	112	26	107	43
1886	86	140	23	94	63
1887	83	135	50	205	33
1888	62	101	38	156	24
1889	75	122	24	98	51
1890	65	106	29	119	36
Mean	61.4	100	24.4	100	37.0
Mean 71-80	54.6	89.0	20.1	82.4	34.5
Mean 81-90	68.2	111.0	28.7	117.6	39.5

for a really bad fog even if it yields a little to the sun at mid-day rarely fails to return again in the evening, and yet out of the total number of 488 foggy days on only 72 was fog recorded both at 9 a.m. and 9 p.m.

All other comparisons of the two sets of results will of course vary to an equal extent in the total quantities, but the relative values may be none the less interesting, and we take next, monthly frequency.

AVERAGE NUMBER OF FOGGY DAYS AT BRIXTON AND WESTMINSTER AND AT CAMDEN SQUARE IN THE DIFFERENT MONTHS OF THE 20 YEARS 1871-90.

	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Brixton & Westminster } 8.9 6.6 5.6 2.2 1.1 0.9 0.7 1.4 5.9 9.2 8.8 10.2												
Camden Sq..... 4.7 2.9 1.7 0.5 0.1 0.2 0.1 0.2 1.0 3.6 3.3 6.1												

EXPRESSED AS PERCENTAGES OF THE TOTAL NUMBER.

Brixton & Westminster } 14 11 9 4 2 1 1 2 10 15 14 17												
Camden Sq..... 19 12 7 2 0 1 0 1 4 15 14 25												

These figures are in very close agreement except in January, October and December, Camden Square being much less foggy relatively in October and having an excess in the other two months. The figures for the summer months are however so small that they are not readily comparable, and probably the results will be more clearly shown by grouping them into seasons.

PERCENTAGE OF FOGGY DAYS IN THE FOUR SEASONS.

	Spring.	Summer.	Autumn.	Winter,	Year.
Brixton & Westminster 14.2 .. 4.8 ... 38.2 ... 42.9 ... 100					
Camden Square 9.4 ... 1.6 ... 32.8 ... 56.2 ... 100					

This shows a more marked excess of foginess in the winter at Camden Square than at Brixton and Westminster.

As regards increase of foginess in the different seasons, with the lapse of years, the figures, again expressed as percentages, of the total for the whole period are—

	1871-75.		1876-80.		1881-85.		1886-90.	
	BRIXTON	CAMDEN	BRIXTON	CAMDEN	BRIXTON	CAMDEN	BRIXTON	CAMDEN
Spring.....	23	13	21	20	27	37	29	30
Summer	30	25	17	25	22	25	32	25
Autumn	21	15	26	26	25	24	28	36
Winter	19	16	24	26	25	24	32	33
Mean	23	17	22	24	25	28	30	31

Again the Camden Square figures show the greater and more regular increase.

We consider the foregoing a very strong negative answer to our

question as to the contribution of Meteorological observers to the solution of the fog question. For until we know whether the number of foggy days in a year in London is 61 or 24 or whether there is three times as much fog at Brixton and Westminster, as at Camden Square, our knowledge of this branch of the subject is decidedly scanty.

WHO WAS FIRMINUS?

To the Editor of the Meteorological Magazine.

SIR,—You are quite right in stating on page 147 of your Magazine that Hippocrates is not the author of the scarce little book, “*Opusculū repertorii pronosticon*” (Venice, 1485, in small 4to), and that in the second edition issued in 1539 by Kerver, of Paris, the authorship is ascribed to “Firminus,” but I have strong doubts whether he was really the author.

Can you or any of the readers of your Magazine tell me anything about Firminus?

Certainly, men bearing this name have existed. There were several French saints and bishops in the sixth century, and later, named “Firmin,” but I have been unable to find out a learned man, “Firmin,” living in the 14th century, when the book must have been written, (an astronomical table in the earlier part being calculated for the year 1338). The real author therefore lived contemporaneously with, or a little later than, Albertus Magnus, whose authority is often quoted in the last chapter.

I am inclined to suppose that the editor of the second issue, Philippus Iollainus Blereius—he calls himself “*Turonensis*,” *i.e.*, from Tours—used for his edition and comments a MS. copy, in which a copyist had put erroneously the name Firminus as author, an error often committed in old MSS.

It is a curious fact that the commentator, Philippus Iollainus Blereius, does not say a single word in the praise of Firminus—he only calls him “*Astrologus*”—nor does he mention the first edition of 1485. In comparing the two editions, I have found some slight differences corroborating my opinion, that Blereius did not use, or perhaps even know of the *editio princeps*. This last supposition is supported by another fact.

A year later, in 1540, the same publisher, Jacobus Kerver, of Paris, issued a book of similar character under the following title, “*Alkindus De Temporum Mutationibus, sive de imbris, nunquam antea excussus. Nunc verò, per D. Io. Hieronymum à Scalingijs, emissus.*”

Well, the statement that this book of Alkindus was never printed before is not right, for it had been published more than 30 years previously, in 1507 at Venice by Peter Liechtenstein.

As to the scarceness of these books, I agree with you that the

"Opusculū" of 1485 is not *very* scarce. I have met with it in sale-catalogues twice within five years, only once with the second edition, and also once with both editions of Alkindus. However, in many large public libraries, all these early meteorological books are not to be found, and it would be difficult to get copies at any particular moment.

The "Opusculū" is of great interest for the history of meteorology, because it is the earliest printed collection of weather-prognostics, chiefly compiled from old Greek and Arabian astrologers. The first six chapters contain only astro-meteorological prognostics, the last one deals also with natural weather-signs. It seems to me a good testimony for the soundness of his views, that only in this part of the book is Albertus Magnus quoted.

The book is written in very barbarous Latin, and, although Blereius endeavoured to correct it, many obscure and unintelligible passages remain.

Hoping that this short notice may induce some one to make further inquiry as to the author of the "Opusculū," I remain, Sir,

Yours truly,

G. HELLMANN.

Berlin, January 12th, 1892.

[Dr. Hellmann is so great an authority upon the writings of early meteorologists that when he is puzzled there are few able to help him.

We do not quite understand, if Firminus had no existence, why in the two introductory "Addresses to the Reader" of the 1539 edition—we find Ioannes Darud commencing—

Hoc opus excelsum firminus texuit, alter
Qui verus cœli nuntius esse potest.

and further down Carolus Albosius Haedus says :—

Eccè sua tersus firminus nascitur arte :
Atq : fluens niveo lacte profudit opus.

Blereius may have made a mistake, but would Darud and Haedus thus write of a person of whom they had never heard ?

However, Dr. Hellmann has the 1539 edition and evidently attaches no importance to these addresses, and therefore the questions remain—Did Firminus write the book ? If so, who was he ? and when and where did he live ?

It is not the first time that doubt has been thrown upon the authorship of this work. Jérôme De La Lande in his *Bibliographie Astronomique* 1803, gives the 1485 edition as anonymous. The 1539 edition he ascribes to "Firmini, antiqui autoris," giving as his authority, *Duverdier*, Suppl. epit. bibl. Gesneri, but then he adds the following note :—"On ne trouve point de Firminus dans Fabricius, *Bibl. lat.*, mais seulement Julius Firmicus Maternus, qui avait fait huit livres de mathématiques. On ne trouve Jollainus, ni dans Gesner, ni dans les Bibliothèques de la Croix-du-Maine et Duverdier.

Therefore, according to him Jollainus and Firminus may be equally mythical. Moreover neither name is to be found either in the remarkable list of Astronomers in Sherburne's edition of *The Sphere of Manilius*, nor in Poggendorff's *Biographisch-Literarisches Handwörterbuch*, nor in any other list that we have been able to examine.

That however does not disprove the existence of Firminus, which is affirmed by the title page and by the head line of every page of the 1539 edition, is thrice mentioned in the preface, once in each of the two addresses dedicatory, (by the authors thereof), and several times in Jollainus's notes and comments.

However, we have the advantage of numbering among our readers M. Lancaster, the surviving editor of the *Bibliographie Générale de l'Astronomie*, in which work Vol. I., part 1., page 455, the 1539 edition is entered as—

1051. FIRMINUS [FIRMICUS.]

Repertorium de mutatione aeris, tam via astrologica quam metheorologica, pristino nitori restituta.

Fol., Parisiis, 1539 par P. Joallain [us].

C'est l'ouvrage précédent sous un autre titre.

We naturally look at the preceeding entry and here it is :—

1050. FIRMICUS MATERNUS, J.

(De nativitatibus) Matheseos institutionis libri VII.

Fol. Venetiis 1497 : 4 feuillets préliminaires et 115 feuillets numérotés, imprimés sur 2 colonnes en caractères romains ; fig. dans le texte.

Très rare ; un exemplaire à la Bibl. marciana de Venise.

We have referred to the copy of Firmicus in the British Museum, and can trace no resemblance whatever between the works above, numbered 1050 and 1051. Surely, the note that "This is the previous work [*i.e.*, 1050] under another title," must have been inserted by mistake.

We join in Dr. Hellmann's hope that someone will be able to clear the matter up.—ED.]

ORDNANCE BENCH MARKS.

To the Editor of the Meteorological Magazine.

SIR,—The extent of the evil pointed out by Mr. Gilbert is shown by the following extract from the "Report of the Progress of the Ordnance Survey to the 31st December, 1889," referring to the re-survey of Lancashire and Yorkshire after an interval of 40 years.

"The re-levelling rendered necessary by the re-survey on the 1-2500 scale has shown that of the bench marks on the principal lines of levelling in the two counties, published in the "Abstracts of the Principal Lines of Levelling in England and Wales," 47 per cent. have been destroyed, 11 per cent. have been disturbed more than

1-10th of a foot, and only 42 per cent. remain undisturbed, that is, differ less than 1-10th of a foot from the published levels. It has also brought to light some interesting facts respecting the subsidence of the ground in the mining districts. At one point on the line, between Warrington and Adlington, the ground has sunk as much as 6·523 feet, and the bench mark on Wigan Old Church Tower has sunk 5·825 feet. In the latter case the levellers observed a subsidence of one foot in twelve months. In the neighbourhood of Barnsley, Doncaster, and Rotherham the ground has sunk (over an area of about 100 square miles) in some cases as much as 5 feet. It is most desirable that the bench marks, of which the levels have been determined with great accuracy and at much cost, should be placed under the care of some local authority with a view to their preservation from ignorant or wilful destruction."

One cause for the rapid disappearance of the marks is the very temporary nature of the objects selected by the survey officers to put them on. The new survey was carried out here about seven years ago, and a large number of new bench marks were cut; a great proportion of these were put on wooden gate posts, a good many on bridge parapets, while houses and other permanent buildings seem to have been to a great extent avoided. Several of those on gate posts have gone already and the rest must follow their fate before many more years have past. A line of their levels came close past here, but they put no mark on the house or other buildings adjacent; the nearest was on the parapet of a small bridge which was washed out by a flood soon afterwards and had to be rebuilt; the next nearest is on a small gate post which cannot last much longer. On the new maps the altitudes are given, to the nearest foot, of a number of points on the surface of the roads; and when the bench marks are gone, these will probably serve for most purposes where extreme accuracy is not required.

Yours truly,

HENRY MELLISH.

Hodsock Priory, Worksop, Jan. 18th, 1892.

[It seems to us that the proper plan would be for the Ordnance authorities to erect dwarf pillars with the altitude marked upon them, and for it to be made a misdemeanour for any one to interfere with them except with the written consent of the Director of the Ordnance Survey.—ED.]

ROYAL METEOROLOGICAL SOCIETY.

The Annual General Meeting of this Society was held on Wednesday evening, January 27th, at the Institution of Civil Engineers, 25, Great George Street. S.W. Dr. W. Marcet, F.R.S., Vice-President, in the chair.

The Report of the Council for the past year showed the Society to be in a very satisfactory position. In May, the library and offices were removed to more commodious premises at 22, Great George

Street. Thirty-four new Fellows were elected during the year, the total number on the roll of the Society now being 552.

Owing to the absence of the President, Mr. Baldwin Latham, M Inst. C. E., through an attack of influenza, his address on "Evaporation and Condensation" was read by the Secretary.

The question of evaporation is of as great importance as is the study of the precipitation of water on the face of the earth seeing that the available water supplies of the country entirely depend upon the differences between these two sets of observations. The earth receives moisture by means of rain, dew, hoar frost, and by direct condensation. It loses its moisture very rapidly by evaporation. Although evaporation mainly depends upon the difference between the tensional force of vapour due to the temperature of the evaporating surface, and the tensional force of the vapour already in the atmosphere, yet it is largely influenced by the movement of the air, and by its dryness, or the difference between the dew point temperature and that of the air. Evaporation goes on at night as long as the water surface is warmer than the dew point. With sea water the evaporation is about $4\frac{1}{2}$ per cent. less than with rain water, while with water saturated with common salt the evaporation is 15 per cent. less than with rain water.

In his experiments, Mr. Latham used an evaporating gauge made of copper, 1 foot in diameter (and containing one foot in depth of water) which was floated by means of a hollow copper ring placed 6 inches distant from the body of the evaporator, and attached to it by four radial arms. It was floated in a tank 4 feet in diameter, containing 30 inches depth of water. This form of evaporator was found extremely convenient in carrying on all evaporation experiments. During the period of 13 years, from January, 1879, to December, 1891, this evaporator has never once been out of order or been interfered with in the slightest degree by frost.

Experiments were made, with some 5-inch evaporators, as to the effect of colour on the amount of evaporation, one being painted white, another black, and the results given by these gauges were compared with those by a copper gauge exposed under similar conditions. This comparison was the means of showing that the greatest errors in evaporating gauges arise from the water rising on the sides of the gauge by capillarity, and thus inordinately increasing the amount of evaporation. Consequently a small gauge having a relatively larger amount of side area than a larger gauge, gives a very much greater amount of evaporation.

The results from the floating evaporator, one foot in diameter, show that the average amount of water evaporated annually during 1879-91 was 19.95 inches. It was found however, that, as a rule, during the period from October to March, there were certain occasions when condensation was measured. The amount of these condensations in thirteen years averaged .31 inch per annum, so that the resultant total loss is 19.64 inches per annum. A 5-inch

evaporating gauge freely exposed to atmospheric influences, gave during the same period (1879-91), an average annual depth of evaporation equal to 38·19 inches or almost double. The average annual evaporation, during the three years, 1879-81, from the 5-inch copper gauge standing in water was 27·90 ins.; from one painted black, 22·97 ins., and from another painted white, 21·74 ins.; whilst a gauge of the same dimensions freely exposed in the atmosphere, lost, in the same period 36·96 ins., and the 1 foot floating evaporator, 19·40 ins. The 5-in. copper gauge gave a larger amount of evaporation than the gauge painted black.

Mr. Latham next described the percolation experiments which were carried out by Mr. C. Greaves, at Old Ford, by Messrs. Dickinson and Evans, at Hemel Hempstead, and by Sir J. B. Lawes and Dr. Gilbert, at Rothamsted. He then detailed the results of his own experiments, and also the gaugings of the underground waters in the drainage areas of the rivers Wandle and Graveney.

He further stated that in the course of his observations on the flow of underground water, he had observed that at certain particular seasons of the year it was possible to indicate the direction and volume of the flow of underground streams, even when they were at a considerable depth, owing to the formation of peculiar lines of fog.

Dr. C. Theodore Williams was elected President for the ensuing year.

REVIEW.

The Natural History and Scientific Book Circular, No. 115.—Meteorology, Electricity, Magnetism and Galvanism.—W. WESLEY & SON, Essex Street, Strand. 8vo. 40 pages.

DURING the existence of the *Meteorological Magazine*—i.e., during more than a quarter of a century, no English bookseller has to our recollection, published a catalogue which as regards Meteorology can compare with the above. Even from Mr. Quaritch, who occasionally brings out catalogues thousands of pages thick, we do not remember ever having had such a collection on Meteorology.

The majority of the works are modern, and both among the early and the late ones there are books which we have never before seen, and which may be regarded as rarities; such as Bartholinus E. De Naturæ Mirabilibus, 1674, with the second earliest engraving of snow crystals—reprinted from the 1660 edition—and an edition of Bloxham's Meteorology of Newport, dated 1858.

The misprints would be few in number were the work a bibliography, for a sale catalogue they are exceptionally rare—in fact we have noticed only on p. 70 Brown, for Broun, and some queer classification (for the works are classed under subjects) in the section on Ocean currents, Tides and Waves—in which it is rather amusing to see Hazen and Woodruff "On cold waves," Kapp "On alternate-current transformers" and the late Dr. Radcliffe's "Behind the Tides," though as regards the last-named work it is not easy to say in what other section it could have been placed.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1891.

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		
England, London	84·3	17	44·6	28	70·6	52·8	51·8	74	127·1	40·3	3·82	17	5·8
Malta.....	97·2	10	65·2	28	88·0	70·0	65·7	67	151·6	59·5	·00	0	0·5
Cape of Good Hope ...	76·4	7	36·6	16	64·4	48·6	...	...	...	...	7·35	10	5·2
Mauritius.....	75·0	16	58·0	2	72·9	62·9	59·4	76	128·2	47·3	2·06	24	5·0
Calcutta.....	94·2	2	76·2	30	88·0	78·7	78·5	86	158·3	74·9	8·28	14	7·7
Bombay.....	88·4	12	73·7	21	84·4	77·8	76·6	87	140·8	70·9	32·48	28	9·3
Ceylon, Colombo	86·7	10	72·3	24	84·7	76·7	72·2	79	144·0	68·0	4·59	17	5·1
Melbourne.....	61·3	8	33·9	31	55·7	43·5	44·7	84	114·4	29·5	7·02	14	6·4
Adelaide	67·6	4	37·4	31	58·7	44·1	43·5	75	124·2	26·8	2·83	19	5·7
Tasmania, Hobart.....	58·7	5, 9	34·0	27	53·2	39·6	43·1	87	114·0	26·3	2·61	19	6·1
Wellington	57·5	30	31·3	13	51·3	39·5	40·7	85	104·0	20·0	5·23	22	4·8
Auckland	63·0	5	40·5	25	56·4	47·0	42·8	72	117·0	27·0	5·23	16	6·1
Jamaica, Kingston.....	96·1	3	72·0	1	90·4	75·0	69·7	64	...	...	·49	...	...
Trinidad	92·0	27	68·0	9	87·5	71·1	72·5	80	155·0	65·0	11·88	24	...
Toronto	83·9	13	45·0	27	73·6	54·7	54·6	73	...	39·0	2·16	12	5·3
New Brunswick, Fredericton	83·5	14	46·5	23	75·2	53·9	58·2	76	...	...	5·15	15	5·5
Manitoba, Winnipeg ...	80·8	14	36·0	19	72·9	49·5	54·3	77	...	...	2·01	15	4·6
British Columbia, Esquimalt	88·6	23	43·9	7	71·0	51·3	55·3	85	...	...	·02	2	3·1

REMARKS.

MALTA.—Mean temp. 77°·7; mean hourly velocity of wind 7·3 miles. The Sea temp. rose from 80°·0 to 82°·2. J. SCOLES.

Mauritius.—Mean temp. of air 1°·1 below, mean dew point 0°·1 above, and rainfall ·23 in. below their respective averages. Mean hourly velocity of wind 10·2 miles, or 1·7 below average; extremes, 22·3 on 17th and 1·7 on 27th; prevailing direction S.E. by E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 1°·9, of dew point 3°·3, rainfall 5·27 in., humidity 4, and amount of cloud 0·1 above their respective averages. Prevailing wind N.; strong on 8 days. Heavy dews on 10 days. Hoar frost on 10th. Heavy downpour of R on 11th and 12th. T and L on the 5th, L on the 6th and 8th. Lunar halos on 4 days. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·2 below the average of 34 years. Rainfall ·21 in. above the average. Resultant direction of wind for the month N.N.W. C. TODD, F.R.S.

Wellington.—Generally showery and cold, with prevailing S. wind. Fine towards the end of the month. Generally moderate winds; foggy on 5 days; sleet and H on 31st. Mean temp. 2°·2 and rainfall ·66 in. below their averages. R. B. GORE.

Auckland.—Very heavy rain on the 4th, 2·46 in. being registered. Mean temp. slightly below the average; barometric pressure and rainfall slightly above. T. F. CHEESEMAN

SUPPLEMENTARY TABLE OF RAINFALL,
JANUARY, 1892.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	'82	XI.	Builth, Abergwessin Vic.	6'22
"	Birchington, Thor	'96	"	Rhayader, Nantgwillt..	5'28
"	Brighton Prestonville Rd	1'04	"	Corwen, Rhug	2'37
"	Hailsham	1'19	"	Carnarvon, Cocksidia ...	3'67
"	Ryde, Thornbrough	1'23	"	I. of Man, Douglas	3'46
"	Alton, Ashdell	'93	XII.	Stoneykirk, Ardwell Ho.	4'45
III.	Oxford, Magdalen Col...	'45	"	New Galloway, Glenlee	4'46
"	Banbury, Bloxham	'94	"	Melrose, Abbey Gate ...	1'74
"	Northampton, Sedgebrook	1'01	XIII.	N. Esk Res. [Penicuik]	2'00
"	Cambridge, Fulbourne..	'86	"	Edinburgh, Blacket Pl..	1'05
"	Wisbech, Bank House..	'97	XIV.	Glasgow, Queen's Park.	2'32
IV.	Southend	'31	XV.	Islay, Gruinart School..	5'66
"	Harlow, Sheering	'56	XVI.	Dollar	2'57
"	Rendlesham Hall	1'05	"	Balquhiddier, Stronvar..	7'37
"	Diss	1'04	"	Coupar Angus Station..	1'69
"	Swaffham	'91	"	Dunkeld, Inver Braan..	3'00
V.	Salisbury, Alderbury ...	1'10	"	Dalnaspidal H.R.S. ...	7'17
"	Bishop's Cannings	'87	XVII.	Keith H.R.S. ....	...
"	Blandford, Whatcombe .	1'92	"	Forres H.R.S.	2'40
"	Ashburton, Holne Vic. ...	2'91	XVIII.	Fearn, Lower Pitkerrie.	1'89
"	Okehampton, Oaklands.	3'77	"	Loch Shiel, Glenaladale	...
"	Hartland Abbey	2'71	"	N. Uist, Loch Maddy ...	7'28
"	Lynmouth, Glenthorne.	1'98	"	Invergarry	3'91
"	Probus, Lamellyn	2'47	"	Aviemore H.R.S. ....	...
"	Wincanton, Stowell Rec.	2'42	"	Loch Ness, Drumnadrochit	5'64
"	Clevedon, Charleville ...	...	XIX.	Lairg H.R.S.	3'10
VI.	Bristol, Clifton	1'49	"	Scourie	3'70
"	Ross, The Graig	1'90	"	Watten H.R.S.	2'64
"	Wem, Clive Vicarage ...	2'16	XX.	Dunmanway, Coolkelure	5'62
"	Cheadle, The Heath Ho.	2'63	"	Fermoy, Gas Works ...	2'60
"	Worcester, Diglis Lock	2'01	"	Killarney, Woodlawn ...	5'26
"	Coventry, Coundon	1'31	"	Tipperary, Henry Street	3'16
VII.	Ketton Hall [Stamford]	1'25	"	Limerick, Kilcornan ...	2'30
"	Grantham, Stainby	1'17	"	Ennis	3'02
"	Horncastle, Bucknall ...	'83	"	Miltown Malbay	2'52
"	Worksop, Hodsck Priory	1'23	XXI.	Gorey, Courtown House	'91
VIII.	Neston, Hinderton	2'49	"	Mullingar, Belvedere ...	1'65
"	Knutsford, Heathside...	3'89	"	Athlone, Twyford	1'50
"	Lancaster .....	...	"	Longford, Currygrane...	1'21
"	Broughton-in-Furness..	6'69	XXII.	Galway, Queen's Coll...	2'22
IX.	Ripon, Mickley	1'46	"	Crossmolina, Enniscoe..	5'80
"	Scarborough, West Bank	1'38	"	Collooney, Markree Obs.	3'07
"	East Layton [Darlington]	1'67	"	Ballinamore, Lawderdale	2'75
"	Middleton, Mickleton..	2'03	XXIII.	Lough Sheelin, Arley ..	1'64
X.	Haltwhistle, Unthank..	2'22	"	Warrenpoint	2'94
"	Bamburgh	1'41	"	Seaforde	3'18
"	Newton Reigney	2'25	"	Belfast, New Barnsley..	3'98
XI.	Llanfrechfa Grange	2'21	"	Bushmills, Dundarave...	3'22
"	Llandovery	3'05	"	Stewartstown	2'83
"	Castle Malgwyn	2'08	"	Buncrana	3'23

JANUARY, 1892.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which ·01 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Differ- ence from average 1880-9.	Greatest Fall in 24 hours		Max.		Min.					
				Dpth	Date			Deg.	Date	Deg.	Date	In shade.	On grass.
		inches.	inches.	in.				Deg.	Date	Deg.	Date		
I.	London (Camden Square) ...	·50	—	1·12	13	22	13	52·0	29	22·8	12	1	26
II.	Maidstone (Hunton Court)...	·51	—	1·04	12	23	8	...	...	...	...	...	...
III.	Strathfield Turgiss	·70	—	1·11	11	6	14	51·1	30	18·6	12	22	27
IV.	Hitchin	·84	—	·70	17	8	14	52·0	31	14·0	11	20	...
V.	Winslow (Addington)	·97	—	·84	16	10	15	53·0	31	12·0	12	20	27
VI.	Bury St. Edmunds (Westley)	1·16	—	·31	24	5	11	52·0	29	9·0	9	...	...
VII.	Norwich (Cossey)	1·04	—	·45	22	5	9	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring)	2·00	—	·34	82	16	13	51·0	30 ^a	22·0	10	16	...
IX.	Torquay, Babbacombe ...	1·43	—	1·39	53	16	13	53·8	30	23·8	9	12	17
X.	Bodmin (Fore Street)	3·86	—	·15	71	16	25	...	...	...	...	...	...
XI.	Stroud (Upfield)	1·14	—	1·06	27	18	20	53·0	30	23·0	11	21	...
XII.	Churchstretton (Woolstaston)	2·74	+	·58	53	18	20	50·5	29	19·0	9	19	26
XIII.	Tenbury (Orleton)	2·11	—	·03	63	16	17	54·5	29	11·0	12	19	23
XIV.	Leicester (Barkby)	1·03	—	·73	19	10	17	53·0	30	4·7	11	22	28
XV.	Boston	·92	—	·47	45	11	6	52·0	28	17·0	10 ^d	22	...
XVI.	Hesley Hall [Tickhill]	·94	—	·83	14	10	16	54·0	29	7·0	16	23	...
XVII.	Manchester (Plymouth Grove)	3·18	+	·72	55	27	17	52·0	29	17·0	8	16	22
XVIII.	Wetherby (Ribston Hall) ...	·76	—	1·13	18	11	9	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	4·90	—	·74	74	28	19	58·0	5	14·0	16	14	...
XX.	Hull (Pearson Park)	1·15	—	·62	25	27	18	52·0	29 ^b	20·0	16	21	25
XXI.	Newcastle (Town Moor)	1·47	—	·34	50	9	12	...	...	...	...	...	...
XXII.	Borrowdale (Seathwaite)	14·44	+	2·26	2·31	28	23	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	2·54	—	·75	55	16	17	...	...	...	...	...	...
XXIV.	Haverfordwest	3·03	—	1·39	62	17	23	49·8	29 ^b	12·0	10 ^e	12	17
XXV.	Aberystwith, Goggerddan ..	3·27	—	·26	75	29	17	49·0	27 ^c	8·0	9	15	...
XXVI.	Llandudno	2·73	+	·45	50	17	18	51·0	29 ^b	27·0	15 ^d	8	...
XXVII.	Cargen [Dumfries]	3·34	—	·43	1·06	17	20	54·8	29	19·0	16	19	...
XXVIII.	Jedburgh (Sunnyside)	1·39	—	·33	37	18	9	53·0	29	13·0	16	20	...
XXIX.	Old Cumnock	3·39	—	·60	62	28	25	...	...	...	...	...	...
XXX.	Lochgilthead (Kilmory)	5·82	—	·32	79	28	22	...	...	15·0	9	18	...
XXXI.	Oban (Craigvarren)	6·33	...	1·09	28	27	27	49·8	26	23·0	9	10	...
XXXII.	Mull (Quinish)	6·67	+	1·00	1·01	26	25	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices	2·00	—	·90	80	19	10	...	...	...	...	...	...
XXXIV.	Dundee (Eastern Necropolis)	1·60	—	·37	75	18	9	59·6	29	13·9	13	17	...
XXXV.	Braemar	2·50	—	·19	44	7	18	50·3	29	13·0	15	21	27
XXXVI.	Aberdeen (Cranford) ...	3·58	...	1·30	18	21	21	58·0	28	13·0	12	17	...
XXXVII.	Strome Ferry	8·14	+	2·15	1·85	28	25	...	...	...	...	...	...
XXXVIII.	Cawdor [Nairn]	3·41	+	1·24	98	7	23	...	...	...	...	...	...
XXXIX.	Dunrobin	3·23	+	·77	40	28	21	52·0	29	20·0	13	18	...
XL.	S. Ronaldsay (Roeberry)	4·85	+	1·90	83	28	28	49·0	29	25·0	6	13	...
XLI.	Darrynane Abbey	3·97	—	·60	15	29	...	...	...	...	...	...	...
XLII.	Waterford (Brook Lodge) ...	1·40	—	2·16	46	16	11	56·5	29	19·0	12	14	...
XLIII.	O'Briensbridge (Ross)	2·84	—	·57	7	23	23	52·0	30 ^a	24·0	11	19	...
XLIV.	Carlow (Browne's Hill)	1·58	—	1·32	43	16	12	...	...	...	...	...	...
XLV.	Dublin (Fitz William Square)	1·70	—	·16	62	16	20	54·0	29	22·2	10	15	25
XLVI.	Ballinasloe	1·70	—	1·38	27	31	18	48·0	29	15·0	10	24	...
XLVII.	Clifden (Kylemore)	6·45	...	1·27	21	30	...	...	...	...	...	...	...
XLVIII.	Waringtown	3·27	+	·62	1·40	8	21	55·0	29	16·0	15	23	24
XLIX.	Londonderry (Creggan Res.) ..	4·48	+	1·06	88	7	25	...	...	...	...	...	...
L.	Omagh (Edenfel)	2·40	—	·62	35	8	26	53·0	29	17·0	11	18	23

^a And 31. ^b And 30. ^c And 28. ^d And 16. ^e And 12.

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

METEOROLOGICAL NOTES ON JANUARY, 1892.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; 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.

STRATHFIELD TURGISS.—The month opened fine and clear with a high bar, but by the 7th pressure had decreased an inch, followed by fog and light rains and a very little S. The middle portion was fairly fine with slight R; and the month closed with rough but warm winds. Honey bee seen for the first time on 24th.

ADDINGTON.—The morning of the 6th was mild, the temp. at 9 a.m. being 40° when a loud peal of T occurred, followed immediately by a violent H storm, reducing the temperature to 35° in a few minutes. Intense frost on 12th, 14th and 16th; no other low readings during the month. A great rise of temp. occurred on the 29th, the max. of that, and the two following days, being above 50°. The first S of the winter fell on the 7th, and on the 9th a fall of 3 or 4 inches occurred.

BURY ST. EDMUNDS, WESTLEY.—A cold period prevailed from the 7th to the 17th; S falling on the 7th, 8th and 10th. Distant T on 11th.

LANGTON HERRING.—From the 1st to the 15th the weather was fine and cold, with slight S showers on the 7th and 8th. From the 16th to the end of the month it was mild, and on the last three days the temp. rose to 50° and 51°. On the whole the mean temp. at 9 a.m. was 2°·1 below the average of 20 years. A lunar rainbow was observed on the 6th. Fogs on the 17th, 18th and 22nd.

TORQUAY, BABBACOMBE.—A dry, fine, sunny, but rather cold month, with excess of N.W. wind and a rather low bar. R or S showers were frequent from 3rd to 11th, and on 14th; more than half of the month's R fell on 16th and 17th and showers were frequent on 22nd, 23rd, 27th and 28th. It was fine and sunny on the 1st, 4th, 15th, 24th and 25th; mostly dull and gloomy on the 16th, 17th, 18th, 20th and 22nd; cold from 2nd to 5th and 7th to 15th (especially on 10th) and on 20th, 21st and 26th; warm on 17th, 18th, 22nd to 24th and 27th to 31st. The max. in shade rose to, or above 50° on 6 days, but only rose to 31° on the 10th. Gales on 2 days; T and L on only 1 day; S on 6, H on 2, fog on 6, Solar Halos on 2.

BODMIN.—Up to the 22nd the coldest January for some years, with some S, H and sleet, but the remainder very mild. Fogs on 4 days.

STROUD, UPFIELD.—About an inch of S fell on 10th and again on 16th.

WOOLSTASTON.—A cold month. S fell on 11 days in the first three weeks; heavily on the 5th, 6th and 7th, mean temp. 35°·0.

TENBURY, ORLETON.—A cold month, the mean temp. being more than 2° below the average; much S and frost from the 6th to the 16th. Aurora Borealis on the 4th.

LEICESTER, BARKBY.—A variable month; very cloudy. On the afternoon of the 30th the upper clouds had a remarkably broad edge of prismatic colours most unusual and striking.

MANCHESTER, PLYMOUTH GROVE.—A fall of 4 or 5 inches of S occurred on the 7th, and some S and sleet fell on the 14th; dense fog and hard frost occurred on the 9th, and thick fogs on 12th, 15th and 25th. During the last fortnight the weather was mostly mild, damp and foggy. Mean temp. 35°·8.

HULL, PEARSON PARK.—S fell on the 5th, 8th, 9th, 10th and 14th; Fogs occurred on 9th, 16th, 20th, 21st, and dense on 23rd; H on 7th, 9th and 14th.

WALES.

HAVERFORDWEST.—Frost set in on the 7th increasing in intensity; S fell on the 8th and notably on the 9th, so as to measure on the level from 7 to 9 in., and higher up towards the hills the level depth was 13 in.; after this the frost became much more intense, and the temp. on the morning of the 10th fell to

12° in the screen 4 ft. from the ground, and again to the same point on the 12th; on the 15th the min. was 17°·5, after which the frost gradually broke up. The rest of the month was wet, chilly and stormy. The coldest January since 1881.

SCOTLAND.

CARGEN.—The first 20 days of the month were cold, the mean temp. of the period being only 32°·3. Mild weather prevailed during the last week, the mean temp. being 44°·1, about 1° below the mean temp. of April. Several days of thick fog were experienced about the middle of the month. I was seen on the evening of the 7th; S fell on 8 days.

JEDBURGH.—The weather was cold up to the middle of the month, but there was comparatively little S for January. Snowdrops in bloom on 25th. S on 5 days.

OLD CUMNOCK.—S on 6 days; frost on 8th and 9th. High winds from the 26th to the end of the month.

OBAN.—The month was memorable for severe weather of every type; blizzards and floods of R. In the hurricane of S from the 3rd to the 13th many roads were impassable and as much as 15 ft. drifts were met with, so that the mail carts were stopped and even on horseback the postmen in several cases had to return without reaching their destination. The cold was intense. This was followed by great floods of R to the close, but little injury was done.

MULL, QUINISH.—Heavy S storm and gale from N. on 6th, 7th and 8th.

S. RONALDSAY, ROEBERRY.—A very wet and rough month. The wettest January for 25 years, but exceeding January 1884 by only ·01 in.

IRELAND.

DARRYNANE ABBEY.—A heavy fall of S occurred from the 6th to the 9th both included, which lay on low ground until the 16th, an event which has not occurred since January 1881. Hard frost prevailed from the 9th to the 13th; during the rest of the month constant small R fell. Thick fogs occurred on the last 4 days. Heavy H showers on 14th.

WATERFORD, BROOK LODGE.—Slight S fell on the 7th, 8th and 9th and heavy S on the 10th. Thick fogs occurred on 18th, 19th and 20th; a gale from S.E. with H on 16th; bees out working on 29th. Mean temp. 38°·6.

O'BRIENSBIDGE, ROSS.—Severe frost prevailed from the 6th to the 16th, and S fell almost daily. The temp. was very low up to the 20th, but gradually rose after that date reaching a mean of 43° by the end of the month.

DUBLIN.—An inclement, cold, and cloudy month. A period of cold, which was ushered in by frequent snowstorms early in the month, lasted, with slight and temporary intermissions, until the 23rd, when the South Westerly type of weather became established, strong S.W. to W. winds, high but variable temp. and frequent showers and gales prevailing day after day to the end of the month. To this decided change is due the fact that the mean temp. of the month is only 2°·7 below the average, notwithstanding the cold of the first three weeks of the new year.

BALLINASLOE.—S on the 3rd and 8th. Gales on 15th, 16th and 31st. Thick fog all day on 18th, 19th and 20th.

WARINGSTOWN.—Very heavy S with high winds on the 6th, 7th and 8th, fully 1 ft. deep over all, and some heavy drifts.

EDENFEL.—The month commenced in raw dull weather which with a falling temp. was accompanied by more or less S from the 3rd onwards, culminating on the 8th in the heaviest fall since January, 1867, viz.: an average of 10 in., but reaching to several feet in drifts over the fields and roads. Curiously the lowest temp. of the month 17° was reached at 2.30 in the day of Monday the 11th, from which however it speedily rebounded to 28°. A dull slow thaw with an almost motionless ther. about 33° set in on the 13th and much of the snow remained till near the end of the month.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCCXIV.]

MARCH, 1892.

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

THE SEVERE FROST OF FEBRUARY, 1892.

There is usually considerable difficulty in dealing with an intense frost. It is generally very local, not extending more than perhaps 20 miles by 20 miles—say 400 square miles, and in such an area the probability is that there will not be more than one station provided with verified instruments mounted in a proper screen; very often there is no such station, and then the question arises, is it possible to utilize the miscellaneous records of which plenty are usually forthcoming, but as to which there is uncertainty: (1) if the thermometers ever were accurate; (2) if they have remained so, or have sunk 5° or 10° by spirit evaporating to the top of the tube, if they are of Rutherford's pattern; or, if the mercury has been shaken out of place, if they are of Six's; (3) if their situation is such as to give even approximately correct results.

In dealing with the recent severe frost we have had these difficulties to meet, and we have divided our summaries, giving first in the table on the following page the actual minimum for the four cold days at all the stations from which we have heard, and at which verified instruments are duly mounted in Stevenson screens. Unfortunately there is yet another source of confusion, in that apparently some observers either read their minimum thermometers at 9 p.m. instead of at 9 a.m., or else they reset them at the latter hour. However, this table contains some of the best observations obtainable, and the results agree in showing that there were two days of very low temperature, and that the locality on the two days differed.

On the morning of February 17th the greatest cold was near the centre of England, the reading in the Stevenson screen at Loughborough going slightly below zero ($-0^{\circ}5$ F.) On the morning of the 19th it was even colder, but in another part of the country viz.: in the N. of England and the S. of Scotland; readings below zero in Stevenson's stands were recorded as follows: Hurworth Grange, Darlington $-1^{\circ}0$ F.; Newton Reigny, Penrith $-2^{\circ}0$ F.; and Norton, Malton $-6^{\circ}2$ F. ($-21^{\circ}2$ C.)

Minima in Stevenson Screens of 20° and below.

STATION.	OBSERVER.	FEBRUARY.			
		17th.	18th.	19th.	20th.
Manchester (Oldham Road) ...	Dr. Tatham	20·9	23·4	20·0	25·2
London (Camden Square)	G. J. Symons	19·4	23·6	21·1	28·4
Yarmouth	Met. Office	23	23	19	28
Oxford	"	17	17	19	25
Winchfield (Strathfield Turgiss)	Rev. C. H. Griffith	18·4	19·0	22·8	27·4
Doncaster (Wadworth Hall) ...	Rev. J. C. Ross	20	25	17	28·5
Ardrossan	Met. Office	29	25	16	19
Worksop (Hodsock Priory	H. Mellish	15·2	25·3	14·7	19·1
Durham (Ushaw Coll.)	Rev. J. Corbishley	16·0	19·0	14·0	21·0
Belper	J. Hunter	12·2	16·8	12·1	19·5
Shields	Met. Office	19	24	12	14
Cambridge	"	13	15	12	21
Winslow (Addington)	J. Mathison	11	18	11	25
Nottingham (Strelley)	T. L. K. Edge	12·1	16·2	10·1	20·3
" (Castle)	A. Brown	9·7	14·7	13·0	21·0
Southwell (Grant Ho.)	T. L. K. Edge	12·4	21·6	9·3	20·4
Cheltenham (Southam Villa) ...	R. Tyrer	14·0	9·0	22·8	29·0
Bedale (Aysgarth)	Rev. F. W. Stow	12·2	18·0	7·7	25·4
York	Met. Office	17	20	7	10
Driffield	J. Lovel	19·7	24·4	6·2	19·9
Keswick (The Beeches)	T. Paulin	16·3	17·0	6·0	18·5
Ketton [Stamford]	F. Coventry	0	9	0	19
Loughborough (Forest Road) ...	W. Berridge	-0·5	2·0	4·4	11·0
Darlington (Hurworth Grange).	J. E. Backhouse	8·0	17·0	-1·0	4·0
Penrith (Newton Reigny)	T. G. Benn	13·0	14·9	-2·0	4·8
Malton (Norton)	E. K. Spiegelhalter	13·0	25·0	-6·2	25·0

We next proceed to collect some miscellaneous notes from the vicinity of these two centres, in order to see how far they are corroborated, but it must be distinctly understood that as to the accuracy or otherwise of these supplementary readings, we cannot speak. Some we know to be good, though not complying with the conditions requisite for insertion in the previous table. For example, the Rev. G. H. Mullins, of Uppingham, is a very careful observer, but has not a Stevenson screen; Uppingham is on a hill 485 ft. above sea. The nearest stations to Uppingham are Ketton, 130 ft. above sea, and 8 miles E.N.E.; and Loughborough, 169 ft. above sea and 24 miles N.W. The figures are very remarkable.

	17th.	18th.	19th.	20th.	Mean.
Uppingham	11·4	19·1	16·3	27·7	—
Ketton	0·0	9·0	0·0	19·0	—
Loughborough	-0·5	2·0	4·4	11·0	—
Uppingham + Ketton	11·4	10·1	16·3	8·7	11·6
Uppingham + Loughborough.	11·9	17·1	11·9	16·7	14·4

We neither suggest nor believe that there is anything wrong with

the Uppingham record ; it could not go in the general table because Mr. Mullins says that the stand "is not a Stevenson, but a Glaisher, enclosed front and sides with louvres." From this description we doubt whether the records differ $0^{\circ} 2$ from what they would have been in a Stevenson. Wherefore then this excess of about $13^{\circ} 0$ above the other two stations ? Because Uppingham is on a hill, off which the heavy cold air would flow like so much water, and Ketton and Loughborough are nearly 350 ft. lower. This, however, is rather a digression.

Low Temperatures in and around Loughborough on Feb. 17th.

(S = Stevenson Screen).

Station.	Authority.	Distance from Loughborough.	Recorded Min.
Loughborough (Forest Road) ..	W. Berridge	0	-0.5 S
" (Southfield) ...	W. B. Paget	0 miles S.	4.0 S
" (NanPantanHill)	E. H. Warner	2 " S.	11.0 S
Quorndon	A. Hamshire	3 " S.S.E.	-7.0
Beau Manor Park Gardens.....	" "	3 " S.	-5.0
Swithland	" "	4 " S.	-6.0
Thurcaston	Rev. T. A. Preston..	6 " S.S.E.	6.4
Barkby	Rev. N. Pochin	8 " S.E.	-11.0
Rotherby Hall	J. Hames	8 " E.S.E.	0.0
Melton (Egerton Lodge).....	A. V. Pryor	12 " E.	-6.0
Nottingham	A. Brown.....	12 " N.E.	9.7 S
Melton	A. V. Pryor	13 " E.	-9.0
Strelley	T. L. K. Edge... ..	14 " N.	12.1 S
Willington	Rev. G. A. Smallwood	15 " N.W.	4.0
Grantham (Denton Ho.).....	W. E. Welby-Gregory	20 " E.N.E.	-4.0
Hoar Cross	F. W. Lycett	22 " W.	6.0
Uppingham	Rev. G. H. Mullins..	24 " S.E.	11.4
Ketton	F. Coventry.....	30 miles E.S.E.	0.0 S

Other Low Temperatures on Feb. 17th.

Essex.....	Harlow (Sheering).....	Rev. Canon Hill.....	10.0
Durham	Whorlton	Miss Dodgson.....	7.0
Northampton	Easton Maudit	Rev. H. A. Boys	7.5
Stafford	Tean	Rev. G. T. Ryves	6.0

Correspondence with the observer at Barkby as to the extremely low reading of -11° elicited the following facts:—The thermometer is a Rutherford minimum by Casella, and had a Kew certificate, which is mislaid, but in melting snow for one hour on March 10th stood at $32^{\circ} 1$; there was not a particle of spirit detached from the main column ; it was mounted on a screen nearly resembling a Glaisher stand, but was only 2 ft. 3 in. above ground. The station is close to a brook, and therefore at the bottom of a valley.

The Nottingham observations are not only influenced by the proximity of the town, but also by being made on the precipitous hill on which the castle stands, about 100 feet above the river. With the Uppingham ones we have already dealt ; therefore, from the foregoing, it is probable that a temperature below zero prevailed in the valleys of Rutland, of North Leicestershire and South Nottinghamshire.

Minima below 8° on February 19th.

S = Stevenson Screen.

County.	Station.	Observer.	Min.
York N.R. ...	Bedale, (Aysgarth)	Rev. F. W. Stow...	7·7 S
"	York	Met. Office.....	7·0 S
Northampton	Easton Maudit	Rev. H. A. Boys ...	7·0
Suffolk	Bury (Westley)	R. Burrell	7·0
Cambridge ...	Fulbourne Asylum	Dr. Crallan	7·0
York E.R. ...	Driffeld	J. Lovel	6·2 S
Cumberland...	Keswick (The Beeches)	T. Paulin	6·0 S
Northumber'd	Unthank	Rev. D. Brown.....	6·0
Lincoln.....	Bucknall	W. Carter	6·0
"	Hemingby	Rev. E. S. Bengough	5·2
Lancashire ...	Esthwaite	Maj. Alcock Beck...	5·1
Staffordshire	Teau	Rev. G. T. Ryves...	5·0
Leicester	Loughborough	W. Berridge	4·4 S
Derby	Willington	Rev G. A. Smallwood	4·0
Rutland	Ketton [Stamford]	F. Coventry	0·0 S
Durham	Darlington (Hurworth Grange)	J. E. Backhouse ...	-1·0 S
Cumberland...	Penrith (Newton Reigny)	T. G. Benn	-2·0
Durham	Sunderland (Haswell).....	C. Portsmouth	-3·0
York N.R. ...	Malton (On the Hill)	Messrs. Slater	-4·0
"	" (Norton)	E. K. Spiegelhalter	-6·2 S
"	" (The Brows)	Yorkshire Post	-9·0

Here, as in the previous case, there can be no question as to the minimum having been below zero over a large extent of the country.

The frost on this day was also very severe in the South of Scotland; the following are temperatures of 5° or less :—

Selkirk ...	The Hangingshaw	Miss Johnstone.....	5·0
Renfrew	Glasgow (Queen's Park).....	D. McLellan	5·0
Peebles.....	N. Esk Reservoir	W. Tod	4·0
Roxburgh ..	Melrose (Abbey Gate)	A. B. Dodds	-5·5
"	Jedburgh (Sunnyside)	G. Hilson	-15·0

There are other points of interest—*e.g.*, the rarity of such intense frost so late in the year. At Camden-square, London, a Glaisher stand has been in continuous use since 1858; the following are the only February minima below 20° in the 33 years :—

Year	1864	1865	1886	1888	1892
Date	10th	15th	10th	2nd	17th
Temp. ...	18·9	15·4	19·4	19·1	17·5

Similarly at Brighton the min. was reported by Mr. Phillips as 20°·5 on the 17th, and on searching the tables (compiled by the late Mr. Sawyer), of Brighton temperatures for 43 years, he finds only three cases of 19°, one of 18°, and one (Feb. 17th, 1855) of 16°.

The other point was the excessive amount of terrestrial radiation, where the grass minimum thermometers were kept clear of snow. At Newton Reigny, where Mr. Benn's min. in the Stevenson went down to -2°·0, that on the grass fell to -11°·2. That, difference of

9°·2 was, however, nothing compared with the 17°·9, 21°·5 and 22°·0, reported in the following letters:—

To the Editor of the Meteorological Magazine.

SIR,—The following readings may be of interest, both in regard to the unusual amount of terrestrial radiation, and the evident importance of discriminating between the results from sensitive and non-sensitive minimum thermometers, the difference between which is found to become chiefly apparent in severe frosts. Both our instruments were constructed by Mr. Hicks, were verified at Kew Observatory, and have recently been examined for change of zero.

Minima registered on surface of snow, which covered the ground to a depth of about 2·5 inches. (Snow firm, bulbs lying well upon it.)

Night.	"Cylinder Jacket."	Spherical Bulb.	In Stevenson Screen.
February 17-18	3·2	4·6	21·1
„ 18-19	-0·6	4·8	12·5

Similar differences between the two grass thers. (in fact up to 4°) were recorded in January.

The index in the tube of the spherical bulb thermometer runs freely, and is not left by the spirit, even if the bulb end be elevated considerably, and the instrument then placed in a low temperature. No condensed spirit exists in the upper part of the tube of the "cylinder jacket." Hence the observed differences may be accepted as *bona-fide* ones.—Yours very truly,

JOSEPH BAXENDELL.

The Observatory, Birkdale, Southport, Feb. 22nd, 1892.

To the Editor of the Meteorological Magazine.

SIR,—It may interest you to know that an exceedingly low temperature was registered in this neighbourhood on the night of Thursday, February 18th. My own observations are corroborated by those of a neighbour, Dr. Parker, of Bennington Lodge. I enclose the temp. values.

Yours truly,

C. WIGAN HARVEY.

Throcking Rectory, Buntingford, 23rd Feb., 1892.

Night of Thursday, February, 18th, 1892.

Throcking Rectory (484 ft.)	In shade..	16°·5	...	On grass...	-5°·0
Bennington Lodge (408 ft.)	„	20°·5	...	„	-1°·5

TOWN FOGS.

To the Editor of the Meteorological Magazine.

SIR,—The results of your enquiry into the prevalence of fog at Camden Square during the 20 years 1871-90, supply ample confirmation of the facts given in my paper of December last, in so far as they relate to the growth of fog in London within recent years. On another point, however, they reveal a state of things widely differing from that shown by the official record, the average annual number of days of fog at Camden Square being considerably less than half the number set down in the Daily Weather Report. This discrepancy is so enormous, that I have been induced to look a little more closely into the matter, with a view to discovering some possible solution of the difficulty.

A portion of the discrepancy may doubtless be attributed to differences in the hours of observation at the two stations. The morning observation at Brixton is taken an hour earlier than that at Camden Square; and in the spring and autumn seasons, when a foggy morning often gives place to a fine day, it is quite certain that this difference, slight though it may appear, is one of no little importance. The addition of a number of morning fogs to the Camden Square record would doubtless be counterbalanced to some extent by the lateness of the evening observation at your own station as compared with that made in the south-west of London. It is, however, quite certain that fogs are more common in the early morning than they are in the evening, so that the balance would be largely in favour of the official reports. Another point of some importance has quite escaped your notice. In the discussion which followed the reading of my paper, it was distinctly stated that the 2 p.m. observations given in the Daily Weather Report had been used, in addition to those for 8 a.m. and 6 p.m. The inclusion of afternoon fogs of course serves to increase the number given in my paper as compared with that recorded at Camden Square. In the year 1890 alone, there were six instances in which fog was prevalent at 2 p.m., and not at 8 a.m. or 6 p.m., a number which should without doubt, be added to your own record. Making every allowance, however, for the fact of the earlier morning observation, and including the fogs recorded at 2 p.m., it is quite evident that a large discrepancy between the two records has still to be accounted for.

In order to see whether Camden Square enjoys any immunities from the fogs which afflict other portions of the metropolis, I have examined the records made during the year 1890 at four other stations, viz., Old Street, the Gardens of the Royal Botanic Society, the Royal Observatory, Greenwich, and the Kew Observatory. Before giving the results of the comparison, it may, perhaps, be as well to say a few words as to the nature of the observations made at the four stations.

Old Street is, as you are doubtless aware, a climatological station in connection with the Royal Meteorological Society. Observations are made at 9 a.m. only, and although the form includes a column for "remarks," there is no space allotted to the weather prevailing at the hour the instruments are read. Experience shows that where an observer is not required to make an entry he is very apt to omit it altogether, and the Old Street record is certainly not overcrowded with information.

As regards the Botanic Society's returns, there are evidences of scrupulous care in the reading of the instrumental observations. The weather remarks are, however, entered with far less regard to scientific detail, the following being a fair specimen of a day's return—"dull, fresh morning, fine warm day, dull mild night." Excellent as this method of entry may be from a popular point of view, it certainly leaves much to be desired on the score of precision, and there can be no doubt that phenomena such as fog, which often prevail for only an hour or so at a time, may pass altogether without remark.

The observations I employed for Greenwich were those given on the last page of the Registrar-General's Weekly Return. They are, of course, made with great diligence, and supply an excellent record of the weather at that place. The observatory is, however, a long way from the more central parts of the metropolis, and as it stands 150 feet high, it is pretty clear that many ground fogs fail to reach it.

Kew Observatory from its low-lying situation, and its close proximity to the river, might naturally be thought to experience a maximum amount of fog. It is, however, quite outside the metropolis, so that while exposed to fog-producing influences of a natural order, it is well removed from the smoke and dust which operate so largely in the production of the "London particular." The Kew Observations, access to which has been kindly granted to me by the Meteorological Council, are made at five hours in the day, viz. : 10 a.m., noon, 2 p.m., 4 p.m. and 10 p.m. The earliest observation is therefore two hours later than that given in the Daily Weather Report, a difference in time which should make a very perceptible reduction in the number of fogs recorded.

The results of my enquiry as to the number of days on which fog occurred at each of the four urban or suburban stations during the year 1890, is :—

Old Street	27	|	Greenwich	39
Botanic Society's Gardens	25	|	Kew	68

Against which we have to set Camden Square with 29 and the Daily Weather Report with 65 days.

It will be seen, therefore, that at the two stations where the records are kept with palpable incompleteness the numbers agree very well with that at Camden Square. At Greenwich, where the record is good, but where the station is exposed to a minimum amount of fog, there were in 1890 39 days of fog, or 10 more than at Camden

Square. At Kew, where, taking all things into consideration, the results should be fairly comparable with those observed in the South-west of London, the number, was 68, or more than double that at Camden Square, and three more than those given in the Daily Weather Report.

The general conclusion of the whole matter seems to be that at Camden Square there is less fog than in some other parts of London. Whether the station is fairly representative of the metropolis as a whole, is of course another matter, and one which cannot be satisfactorily determined until we get the records from many other localities. For my own part, I very much question whether you would get a London jury to believe that, taking the whole year through, there are on an average only 24 days on which fog in one form or another is experienced in the metropolis.

It is very probable that among your London readers there are several who keep a systematic weather record, and as the material at my command has been all too scanty for an exhaustive discussion of the question, it is to be hoped that others will come forward and contribute to a more satisfactory solution of a difficulty you have vigorously, but very justly, described as "fairly staggering."

I am, Sir, yours faithfully,

FREDERICK J. BRODIE.

Wandsworth Common, 2nd March, 1892.

To the Editor of the Meteorological Magazine.

SIR,—I have read your article on "Town Fogs" in last month's *Meteorological Magazine* with great interest, but I must confess to being completely puzzled as to why Brixton and Westminster should be linked together in the table giving the number of foggy days. Surely the number of days on which fog occurred at those two places was not exactly the same. Any ordinary observer would suppose that fogs would be more frequent at Westminster than Brixton; how then is it possible to compare the number of foggy days at *two* places with those at *one* place?

Having resided on the north side of the Thames since 1865, I used to compare notes when there was a fog in town (to which I went nearly every day until 1883) with persons living on the south side; from these enquiries it seemed to me that the north side got much less fog than the south; as far as I could form an estimate probably a *third* less.

The reason of this I thought arose from the fact that winter fogs most often occur with a high barometer; a high barometer in the winter generally means wind somewhere between E. and N. or perhaps round to N.W.; such winds of course take the London smoke over towards the south side of the river. I am aware that with many fogs the wind may be nil, or almost nil, but it always seemed to me that it made it a difference in the density of the fog

from what point of the compass the wind *last* blew and also that a very gentle movement of the air is sufficient to clear a fog off from the windward side of London.—Yours truly,

J. W. SCOTT.

Elleray, Etchingham Park, Finchley, March 5th.

To the Editor of the Meteorological Magazine.

SIR,—In the article on “London Fogs” in your Magazine, I do not think you say anything about the prevailing wind. I have an idea, which I have not the means of verifying, that fogs prevail generally when the wind is E. or N.E. ; if so, this would account for Brixton and Westminster being more liable to them than Camden Town. I have for many years come from Richmond to the City and the fogs are usually more numerous, thicker, and worse between Clapham Junction and the Thames than on its northern side. I also think that I am much oftener delayed in my arrival at the office by fog, than one of my clerks who lives in the neighbourhood of Stamford Hill.—Yours very truly,

ARTHUR BREWIN.

6a, Austin Friars, London. E.C., 18th February, 1892.

[We regret a double mistake in the article in our last number. In the middle of page 5, October is printed twice in error for September.—ED.]

REVIEWS.

La radiation des Nuages supérieurs autour des minima barométriques. Par H. E. HAMBERG. [*Bihang till K. Svenska vet. akad. handlingar, Band 17., Afd I.*] 8vo., Stockholm, 1891.—21 pages, 1 plate.

OUR readers may not all know what is meant by the radiation of the clouds—the word radiation having, unfortunately, two very different meanings. This memoir deals with those cases in which the clouds are *apparently* arranged like the lines of longitude on a globe, starting from one point on the horizon widening out at the zenith and converging to a point on the horizon exactly opposite to that whence they originally diverged.

There is a popular notion that these clouds are in some way related to auroræ, because they are not infrequently observed to radiate from near magnetic north ; but there is no reference to the subject in this paper, and the whole drift of the argument is opposed to the idea. Though we see from Table 1 that M. Hamberg himself quotes the direction as N.W.—S.E. (true) nearly twice as often as the average. He gives 479 instances, and groups them under eight headings N.—S., N.N.E.—S.S.W., and so on ; therefore if they were equally prevalent there should have been 60 instances for each, but for N.W.—S.E., there are 113.

However, as we have said, this point is quiet away from the drift of the paper, which is to show that by noting their direction and the clouds on the horizon, it is possible, without having any communica-

tion with any other station, to ascertain the direction in which the lowest barometric pressure is then existing—in fact, to form a rough idea of the general character of the system of isobars which prevails at the time—a great aid to weather forecasting if it can be done with certainty.

This is a study within the easy reach of anyone in this country, who would take the slight trouble of always noting the azimuth of the point of divergence; it might be merely by the compass points, N., N.N.E., N.E. and so on; but it would be still better if they were read off from an azimuth compass, corrected for variation, and entered with the precise time. On the following days, when the Daily Weather Reports were received, the line should be ruled on the map at the proper angle, and the relation of it to the baric minimum be read off.

A collection of records of this kind would, we believe, be of both interest and utility, and we do not think that anyone would be more glad of such help than M. Hamberg himself.

Annual Report of the Board of Regents of the Smithsonian Institution, to July, 1889. Washington Government Printing Office, 1890. 8vo., xlvii.—815 pages.

SINCE the establishment of the U.S. Signal Office and the (later) regular issue of the *American Meteorological Journal*, the Smithsonian Institution has discontinued the issue of the excellent monographs upon meteorology, which used to appear in the "Contributions" and in the "Miscellaneous Collections."

The later issues of the Annual Reports have, however, contained some excellent papers, which we fear have hardly received the notice which they deserve, and would have obtained had they been issued separately, instead of in large volumes, in which they are nearly buried. For instance, many meteorologists are not aware that in the previous *Annual Report* for 1889 (*i.e.*, to July 1888), Prof. Cleveland Abbe gave a report upon "Recent Progress in Dynamic Meteorology," characterized by great thoroughness and as much clearness as is compatible with the rather abstruse nature of the subject—an altogether excellent paper of about 70 pages.

The present volume contains a very interesting report by Mr. G. E. Curtis, on the "Progress of Meteorology in 1889;" it is about the same length as Prof. Abbe's report in the previous volume, and is a very useful summary, although the multitude of subjects and papers which have to be noticed in it compels the occasional adoption of too great abbreviation. This is followed by a "Bibliography of Meteorology for 1889," by Mr. O. L. Fassig, of the Weather Bureau, which although far from perfect, contains about 500 entries. The meteorological articles in the volume close with a reprint of the capital lecture on "How Rain is Formed," delivered by Mr. H. F. Blanford, F.R.S., at the Hythe School of Musketry, Nov. 19th, 1888.

THE MUNICH CONFERENCE.

To the Editor of the Meteorological Magazine.

SIR,—On p. 180 in the paragraph “Rain,” there is some confusion as to the amount of rain that should fall on any day, for that day to be counted as a day of rain. Is this amount 0·005 in., or 0·1 mm. ? For 0·1 mm. only equals 0·004 in. Or does it mean that in England and countries where the unit of length is 1 in., the amount is 0·005 in., and that in countries where the metrical system is in force the amount is 0·1 mm. ?

These remarks apply also to the numbers ·05 in. and 1 mm.

Yours truly,

T. W. BACKHOUSE.

WHO WAS FIRMINUS?

To the Editor of the Meteorological Magazine.

SIR,—I enclose herewith a cutting from the *Bazaar* of February 26th, *re* Firminus.—Yours faithfully,

FRED. COVENTRY.

Duddington, Stamford, Feb. 27th, 1892.

OPUSCULA REPERTORII PRONOSTICON, 1415 (CELER ET AUDAX).—The title of the book runs, we think, as follows:—“*Firmini repertorium de Mutatione Æris*,” &c. The Paris edition (1539, folio) of this book was edited by Blereius, after the death of Firminus, who was an astrologer living at the end of the fifteenth century. Scarcely anything appears to be known about him.

[The information implied by the words “after the death of Firminus, who was an astrologer living at the end of the fifteenth century” is just what is wanted, but what is the evidence of these two facts—of his living at all, and of his dying before 1539. Ed.]

A PREDICTION FULFILLED.

[On the return for February, which bears the post marks of Leicester, March 1st, and London, March 2nd, our correspondent wrote as under; heading it with the words, “Please insert this.” We should have done so, had the weather been as mild as May; we do so with ice, more than two inches thick on our evaporating tank. We are always ready to insert such notes when they are clear, definite, and signed. Ed.]

SIR,—On this day, March 1st, with no hesitation or indecision, I forecast considerable cold weather for at least a fortnight.

E. N. POCHIN.

Barkby Vicarage, Leicester.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, AUGUST, 1891.

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		
England, London	75·8	14	43·2	30	68·2	52·7	53·6	79	126·2	39·3	4·75	22	7·1
Malta.....	97·8	7	67·8	23	88·5	71·1	67·5	69	150·6	59·5	·00	0	1·5
Cape of Good Hope ...	78·6	3	37·2	7	63·0	46·7	...	...	...	...	3·02	12	4·3
Mauritius.....	75·6	29	55·0	1	73·1	62·4	59·0	75	126·4	46·0	1·85	21	5·0
Calcutta.....	92·1	1	74·5	12	87·0	78·4	78·6	88	154·6	74·1	13·28	21	8·0
Bombay.....	86·9	30	74·0	5	84·7	77·6	75·6	84	139·0	71·4	6·94	29	9·0
Ceylon, Colombo	87·7	...	73·8	4	85·9	77·8	70·4	73	148·0	70·0	1·65	19	6·1
Melbourne.....	70·2	31	39·0	1	58·5	44·8	45·4	81	123·0	32·1	1·45	13	6·2
Adelaide	74·3	13	38·6	6	62·7	46·1	43·0	65	135·0	29·6	1·54	12	4·6
Tasmania, Hobart.....	65·7	15a	34·8	1	57·6	41·4	44·3	80	120·0	27·0	1·48	12	6·5
Wellington .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Auckland	64·0	31	40·0	6	58·4	48·1	44·8	73	120·0	29·0	2·41	20	6·6
Jamaica, Kingston.....	96·7	20	70·0	29	91·2	74·5	71·8	73	...	...	3·08	...	...
Trinidad	92·0	4	65·0	3	89·3	71·3	72·7	76	154·0	61·0	4·26	25	...
Toronto	89·6	7	46·1	29	75·0	57·1	58·5	78	...	46·1	4·83	13	5·4
New Brunswick, Fredericton.....	83·5	6	40·5	20	74·3	54·2	58·6	77	...	...	3·44	14	5·5
Manitoba, Winnipeg...	90·5	5	30·3	27	73·8	49·1	55·8	78	...	...	3·93	18	4·5
British Columbia, Esquimalt.....	78·8	30	46·0	31	68·3	51·3	56·1	91	...	...	1·47	7	3·8

" And 30.

REMARKS.

MALTA.—Mean temp. 78°·7; mean hourly velocity of wind 7·0 miles. The temp. of the sea fell from 82°·5 to 81°·0. L seen on 23rd. J. SCOLES.

Mauritius.—Mean temp. of air 1°·2 below, dew point equal to, and rainfall ·32 in. below, their respective averages. Mean hourly velocity of wind 10·7 miles, or 1·6 below average; extremes, 26·2 on 20th and 0·0 on 30th; prevailing direction S.E. by E. T and L on 10th. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 1°·0, of dew point 3°·1, and humidity 7, above their respective averages. Rainfall ·38 in., and amount of cloud ·1, below their respective averages. Prevailing winds N. and S.W.; strong on 8 days. Heavy dews on 13 days. Dense fog on 7 days. H on the 19th; L on 9th and 22nd. Lunar halo on the 18th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·4 above the average of 34 years. Rainfall ·82 in. below the average, making a total for the first 8 months of the year 8·05 in., or 1·33 in. below the previous lowest amount recorded for that period, and 7·08 in. below the average. The winter has been generally dry, especially over the southern districts of the Colony and to the N.W.; but the northern agricultural districts have fared much better. C. TODD, F.R.S.

Auckland.—A mild and cool month, with frequent slight showers, but little wind, and no heavy falls of rain. Mean temp. and rainfall both considerably below the average. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, FEBRUARY, 1892.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	1.18	XI.	Builth, Abergwessin Vic.	4.42
"	Birchington, Thor	2.31	"	Rhayader, Nantgwillt..	3.95
"	Brighton Prestonville Rd	1.28	"	Corwen, Rhug	2.29
"	Hailsham	2.04	"	Carnarvon, Cocksidia ..	1.69
"	Ryde, Thornbrough	1.16	"	I. of Man, Douglas	1.37
"	Alton, Ashdell	1.16	XII.	Stoneykirk, Ardwell Ho.	1.36
III.	Oxford, Magdalen Col...	.76	"	New Galloway, Glenlee	2.75
"	Banbury, Bloxham .....	.68	"	Melrose, Abbey Gate ..	2.34
"	Northampton, Sedgebrook	1.36	XIII.	N. Esk Res. [Penicuik]	3.50
"	Cambridge, Fulbourne..	2.72	"	Edinburgh, Blacket Pl..	2.00
"	Wisbech, Bank House..	2.03	XIV.	Glasgow, Queen's Park.	2.00
IV.	Southend	1.80	XV.	Islay, Gruinart School..	2.42
"	Harlow, Sheering	1.71	XVI.	Dollar	1.61
"	Rendlesham Hall	2.59	"	Balquhider, Stronvar..	2.88
"	Diss	2.35	"	Coupar Angus Station..	1.80
"	Swaffham	2.41	"	Dunkeld, Inver Braan..	1.56
V.	Salisbury, Alderbury ...	1.38	"	Dalnaspidal H.R.S.	2.65
"	Bishop's Cannings	1.75	XVII.	Keith H.R.S.	1.18
"	Blandford, Whatcombe .	1.39	"	Forres H.R.S.	2.27
"	Ashburton, Holne Vic....	5.10	XVIII.	Fearn, Lower Pitkerrie.	1.85
"	Okehampton, Oaklands.	4.19	"	Loch Shiel, Glenaladale	5.35
"	Hartland Abbey	2.47	"	N. Uist. Loch Maddy ...	2.55
"	Lynmouth, Glenthorne.	3.70	"	Invergarry	2.81
"	Probus, Lamellyn	4.88	"	Aviemore H.R.S.	1.53
"	Wincanton, Stowell Rec.	2.22	"	Loch Ness, Drumnadrochit	2.39
"	Clevedon, Charleville ...	...	XIX.	Lairg H.R.S. ....	...
VI.	Bristol, Clifton .....	...	"	Scourie	5.02
"	Ross, The Graig	2.17	"	Watten H.R.S.	2.00
"	Wem, Clive Vicarage ...	1.73	XX.	Dunmanway, Coolkelure	4.55
"	Cheadle, The Heath Ho.	1.59	"	Fermoy, Gas Works ...	4.30
"	Worcester, Diglis Lock	1.04	"	Killarney, Woodlawn ...	...
"	Coventry, Coundon .....	.90	"	Tipperary, Henry Street	4.54
VII.	Ketton Hall [Stamford]	2.44	"	Limerick, Kilcornan ...	2.71
"	Grantham, Stainby	1.56	"	Ennis	2.32
"	Horncastle, Bucknall ...	1.54	"	Miltown Malbay	2.97
"	Worksop, Hodsck Priory	1.95	XXI.	Gorey, Courtown House	3.39
VIII.	Neston, Hinderton	1.40	"	Mullingar, Belvedere ...	2.61
"	Knutsford, Heathside...	1.98	"	Athlone, Twyford	2.32
"	Lancaster	1.56	"	Longford, Currygrane...	1.74
"	Broughton-in-Furness..	2.20	XXII.	Galway, Queen's Coll...	1.92
IX.	Ripon, Mickley	2.92	"	Crossmolina, Enniscoe..	2.46
"	Scarborough, West Bank	2.13	"	Collooney, Markree Obs.	2.32
"	East Layton [Darlington]	2.30	"	Ballinamore, Lawderdale	2.43
"	Middleton, Mickleton..	4.15	XXIII.	Lough Sheelin, Arley ..	2.23
X.	Haltwhistle, Unthank..	2.38	"	Warrenpoint	1.89
"	Bamburgh	1.68	"	Seaforde	1.61
"	Newton Reigney	1.99	"	Belfast, New Barnsley..	1.63
XI.	Llanfrechfa Grange	2.57	"	Bushmills, Dundarave...	2.15
"	Llandovery	3.12	"	Stewartstown	2.01
"	Castle Malgwyn	2.05	"	Buncrana .....	...

FEBRUARY, 1892.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						Days on which -01 or more fell.	TEMPERATURE.				In shade.	
		Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours		Deg.	Date		Deg.	Date	In shade.			
				inches.	in.							Deg.		Date
I.	London (Camden Square) ...	1·62	—	·26	·43	15	17	53·0	7	17·5	17	8		
II.	Maidstone (Hunton Court)...	1·67	—	·13	·31	17	17	...	...	...	...	...
III.	Strathfield Turgiss	1·28	—	·72	·22	20	16	53·3	25	18·4	17	8		
IV.	Hitchin	1·47	—	·28	·29	16	17	51·0	7, 11	8·0	18	13		
V.	Winslow (Addington)	1·01	—	·15	·16	20	17	56·0	7	11·0	17	12		
VI.	Bury St. Edmunds (Westley)	2·61	+	1·05	·58	8	15	52·0	7	7·0	19	...		
VII.	Norwich (Cossey)	1·84	+	·25	·38	21	15	...	...	...	...	...
VIII.	Weymouth (Langton Herring)	1·25	—	1·35	·47	19	15	55·0	...	20·0	17	10		
IX.	Torquay, Babbacombe	2·27	—	·80	·57	18	17	53·8	8, 9	21·3	18	4		
X.	Bodmin (Fore Street)	4·71	—	·28	·97	18	22	...	...	...	...	...
XI.	Stroud (Upfield)	1·27	—	1·29	·45	20	17	52·0	7	20·0	16	13		
XII.	Churchstretton (Woolstaston)	1·66	—	·79	·30	22	20	53·0	7	11·5	17	12		
XIII.	Tenbury (Orleton)	1·53	—	·95	·31	20	17	55·0	7	13·5	19	11		
XIV.	Leicester (Barkby)	2·52	+	·71	·94	15	17	56·0	7	—11·0	16	17		
XV.	Boston	1·91	+	·23	·34	7	13	58·0	11	12·0	17	15		
XVI.	Hesley Hall [Tickhill]	1·95	+	·45	·65	14	17	54·0	7	17·0	19	11		
XVII.	Manchester (Plymouth Grove)	1·66	—	·39	·32	2	14	52·0	25	16·0	18	8		
XVIII.	Wetherby (Ribston Hall) ...	·96	—	·62	·41	21	5	...	...	...	...	...
XIX.	Skipton (Arneliffe)	4·61	—	·08	·83	19	16	51·0	12	9·0	19	9		
XX.	Hull (Pearson Park)	1·93	+	·13	·35	14	22	54·0	12	12·0	19	10		
XXI.	Newcastle (Town Moor)	2·81	+	1·41	·75	14	20	...	...	...	...	...
XXII.	Borrowdale (Seathwaite)	5·15	—	7·49	·93	7	17	...	...	...	...	...
XXIII.	Cardiff (Ely)	2·48	—	·71	·40	7	16	...	...	...	...	...
XXIV.	Haverfordwest	3·16	—	·96	·42	23	23	51·0	8	18·5	17	9		
XXV.	Aberystwith, Gogerddan	2·85	—	·41	·51	7	15	55·0	26	14·0	16	17		
XXVI.	Llandudno	1·53	—	·39	·26	7	13	53·0	26	22·6	19	6		
XXVII.	Cargen [Dumfries]	1·30	—	2·35	·26	20	10	53·6	12	6·8	19	13		
XXVIII.	Jedburgh (Sunnyside)	2·46	+	·95	...	...	12	53·0	9	—15·0	19	12
XXIX.	Old Cumnock	2·27	—	1·23	·36	2	17	...	...	...	...	...
XXX.	Lochgilphead (Kilmory)	3·05	—	2·14	·84	7	11	...	...	9·0	18	13
XXXI.	Oban (Craigvarren)	1·75	...	...	·52	7	15	48·9	23	18·2	20	8
XXXII.	Mull (Quinish) .....	...	...	...	...	...	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices	2·30	—	·45	·60	15	11	...	...	...	...	...
XXXIV.	Dundee (Eastern Necropolis)	2·10	—	·00	·60	21	9	54·9	12	16·3	19	12		
XXXV.	Braemar	2·38	—	·98	·77	21	20	49·2	9	—2·0	19	19		
XXXVI.	Aberdeen (Cranford)	1·92	...	...	·43	21	24	56·0	11	12·0	19	11
XXXVII.	Strome Ferry	2·72	—	3·01	·50	1	15	...	...	...	...	...
XXXVIII.	Cawdor [Nairn]	2·32	+	·09	·45	14	18	...	...	...	...	...
XXXIX.	Dunrobin	2·95	+	·86	·44	15	20	52·0	9	23·0	19	13		
XL.	S. Ronaldsay (Roeberry)	3·27	+	·63	·55	6	24	47·0	10	23·0	19	13		
XLI.	Darrynane Abbey	3·18	...	...	·53	20	21	...	...	...	...	...
XLII.	Waterford (Brook Lodge) ...	3·22	—	·86	·87	20	13	55·0	7	21·0	16	6		
XLIII.	O'Briensbridge (Ross)	2·53	...	...	·41	20	17	54·0	11	26·0	19	7
XLIV.	Carlow (Browne's Hill)	3·65	+	·57	1·10	19	20	...	...	...	...	...
XLV.	Dublin (Fitz William Square)	2·12	—	·23	·53	20	19	54·6	7	26·1	17	5		
XLVI.	Ballinasloe	2·17	—	·61	·49	7	15	48·0	7, 9	21·0	19	13		
XLVII.	Clifden (Kylemore) .....	...	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	1·91	—	·54	·39	1	17	58·0	6	16·0	19	13		
XLIX.	Londonderry (Creggan Res.) ..	2·32	—	·71	·44	2	21	...	...	...	...	...
L.	Omagh (Edenfel)	1·60	—	1·09	·37	2	21	50·0	7, 9	20·0	18	11		

a And 19. b And 17.

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

METEOROLOGICAL NOTES ON FEBRUARY, 1892.

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.—A dull cold month, especially about the 17th. Vegetation very backward. First wild primrose on 10th; brimstone butterfly flying on 13th; daisy in flower on 25th.

HITCHIN.—The min. temp. on 18th $8^{\circ}0$, is greatest cold recorded since February, 1855.

ADDINGTON.—From the 1st to the 11th moderately mild; severe frost from 16th to 20th, then much milder until the 25th, and colder again from thence until the end. R fell on a good many days, but never in large quantities.

BURY ST. EDMUNDS, WESTLEY.—The month was remarkable for the very cold period from 16th to 21st. S on 14th, 15th, 17th and 19th.

LANGTON HERRING.—The mean temp. at 9 a.m. was $0^{\circ}4$ below the average of 20 years. The 16th was a bitterly cold day; the min. temp. on the 17th was 20° , and the same temp. occurred on February 25th, 1888, but none lower has been observed in the last 20 years. Fogs on 6th and 16th.

TORQUAY, BABBACOMBE.—A rather dry, but showery month, with low bar, average temp.; more wet days and S.E. wind than usual, and large variations of temp. and pressure. Showery from 1st to 10th, and 14th to 27th. No R gauged in the 7 days, 7th to 13th or on the last 4 days. Dull on 11th, 14th and 27th; fine and sunny on 21st. Cold on 2nd and 3rd, from 16th to 20th and 27th to 29th (especially on 16th and 17th); warm from 5th to 13th and 21st to 26th. The max. in shade rose to, or above 50° on 12 days. The min. in shade ($21^{\circ}3$) on 17th was the lowest ever observed in February, and the relative humidity at 9 a.m. on 17th (46) was very low. W., E. and S.E. winds each occurred on 5 days; N.W., N. and variable on 4 days each; S.W. and S. on 1 day each. Gales blew from S.W. on 1st, E.N.E. on 16th, E. on 18th, E.S.E. on 19th and 20th. TS with heavy H on 20th, the H being 4in. in diameter; T on 21st; L on 23rd and 25th. Faint white aurora borealis on night of 3rd. H on 15th, 19th, 20th, 22nd and 25th; S on 1st, 2nd, 17th, 18th, 19th and 20th, covering the ground on 17th and 19th. Solar halos on 6 days. Fog on 3 days. Glazed frost on 17th and 18th.

BODMIN.—The weather was most remarkable, some days like spring or summer, some exceedingly cold, viz.: from 16th to 19th, and on the 27th and 28th. On the 18th a N.E. gale occurred, and a fall of nearly 9 inches of S with R, H, sleet, T and L. The last 4 days of the month were fine. Prevailing winds N.E. and E.

STROUD, UPFIELD.—A S.W. gale on 1st; S and H on 2nd. N.E. gale and about an inch of S between 4 p.m. and 4.30 p.m. on 15th; about 2 inches of S in the afternoon on 17th. On the 19th very fine small snow fell all the morning with an E. Gale, about $2\frac{1}{2}$ inches fell and there were great drifts. T heard between 3 and 4 p.m. on 25th.

WOOLSTASTON.—A very wintry month, the cold snap which commenced with a N.E. blizzard on the 15th and lasted till the 21st being exceptionally severe; S fell on 5 days; T and very vivid L on the evening of the 25th. Mean temp. of the month $36^{\circ}7$.

TENBURY, ORLETON.—A very cold month, although the mean temp. was only 1° below the average and higher than that of any other February since 1885, yet the mean of the maxima was but $44^{\circ}6$ against $50^{\circ}3$ last February. The grass minima on the 17th and 19th were the lowest recorded here in February being $8^{\circ}8$ and $7^{\circ}7$ respectively. Heavy T and L at 7.15 p.m. on 25th. Lunar halo on 4th; much fog at the end of the month.

LEICESTER, BARKBY.—A dull, cold, wet month. The minimum ther. registered 11° below zero on the 17th, and 1° below zero on the 19th. The S measured in several places where it was not drifted, averaged $10\frac{1}{2}$ inches dee

HESLEY HALL [TICKHILL].—On the 2nd at 11 a.m. L and T followed by great darkness for about ten minutes; snowing hard all the time.

MANCHESTER, PLYMOUTH GROVE.—S fell on the 1st, 16th, and 17th; S and sleet on the 2nd and 15th. It was damp and foggy with drizzling R on the 9th and 14th, very wintry from 15th to 19th; a complete thaw set in on 21st and a thick fog occurred on the morning of the 22nd. The last week was fine and springlike. Mean temp. $38^{\circ}8$.

HULL, PEARSON PARK.—Showers of H on 7 days; S on 7 days; Fog on 6 days.

WALES.

HAVERFORDWEST.—A severe month. Very wet and stormy on the 2nd and 3rd; the air mild up to the 8th, when the wind got up to the N.W., the air gradually became colder, and from the 14th to the 22nd very severe weather prevailed. A heavy snowstorm and fierce gale with very low temp. occurred on the 17th, the S as dry as salt and drifting furiously. After the 21st the cold abated and the remainder of the month was wet and raw.

SCOTLAND.

CARGEN.—The most marked feature of the month was the extreme cold which prevailed between the 17th and 22nd, the min. temp. on the 19th being the lowest recorded in February at this station during 33 years, and on only two occasions during that period has a lower reading occurred, viz., during the memorable winter of 1860-1, when on the 24th December $-4^{\circ}0$ was marked, and on the 14th December, 1878, when the ther. fell to $6^{\circ}0$. During this period of low temp. the barometric pressure was very low, ranging from 29.180 in. to 29.334 in. There were very light easterly winds on 15 days, in the latter part of the month. Temp. and R both considerably below the average. S on 1st, 17th, 20th and 21st.

JEDBURGH.—The weather of the month was very ungenial, but variable. The min. temp. on the 19th was the lowest for very many years. Spring flowers made very little progress. Fog prevailed much during the latter half of the month. S fell daily from 15th to 18th, the depth on the ground on the latter date being six inches.

OLD CUMNOCK.—H and R on the 4th. S on the 15th, 16th, 17th, 20th and 21st. Very hard frost on 18th and 19th.

S. RONALDSAY, ROEBERRY.—A very rough cold month. A snow storm lasting for a week prevailed from 15th to 21st.

IRELAND.

DARRYNANE ABBEY.—Moderately wet. A very strong N.E. gale and S showers on the 19th.

WATERFORD, BROOK LODGE.—Mean temp. $41^{\circ}7$. Very fine S commenced to fall about 11 a.m. on 18th, and continued all day and night until about 9 next morning. S fell also on 2nd and 15th. TL and H on 20th. Thick fog on the morning of 27th. Lunar halo on the 8th.

O'BRIENSBRIDGE, ROSS.—Very heavy S on 19th and 20th. Very deep drifts, and the roads and rails all blocked.

DUBLIN.—A wet, cold, stormy and cloudy month. R or S fell in measurable quantities on 19 out of 29 days, and on 10 days the wind reached the force of a gale. Mean temp. $41^{\circ}3$ or $1^{\circ}5$ below the average. S or sleet fell on 8 days, H on 5 days. Fog occurred 6 days, and high winds on 14 days.

EDENFEL.—The month commenced with raw, cold, unsettled weather, accompanied by strong westerly and north-westerly winds and S squalls. The second week was fine and mild, with but little R, but from the 14th cold easterly and N.E. winds set in, and continued without intermission to the end, culminating on the 21st in a S blizzard of great severity and violence, driving the S into drifts, many of which had not disappeared by the 6th of March. The last week was dry, cold, typical easterly weather, with sharp night frosts.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCCXV.]

APRIL, 1892.

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

John William Tripe, M.D.

1821—1892.

It is with great regret that we have to announce the death of Dr. Tripe, the Council Secretary of the Royal Meteorological Society.

Although Dr. Tripe wrote several valuable papers upon climatic and meteorological questions, his claim to the respect and regret of meteorologists is chiefly due to his constant and watchful care for the welfare of the Royal Meteorological Society, which he joined in its youth as the British Meteorological Society, in 1856. He was elected on the Council in 1858, became Vice-President in 1859, and it was during his presidency that the Society first obtained rooms of its own, with an assistant secretary in daily attendance. On resigning the Presidency in 1873, he was appointed Council Secretary, and the present position of the Royal Meteorological Society is largely due to the services which he rendered during the twenty subsequent years.

DR. ANGOT'S "INSTRUCTIONS."

WE are sure that both Governments and individuals are spending too much money and too much time on the purchase of meteorological instruments and on the making of observations, and too little, both of money and of time, in discussing the records already obtained.

Still it is obvious that many observations must yet be made, and that new observers must be trained to take the place of those who fall out of the ranks, and evidently the clearer and better the teaching, the better will be the records. For this reason we cordially welcome Dr. Angot's new "Instructions."*

We may as well say at once that the book is excellent as regards matter, arrangement, engraving and printing †, and will afford pleasure and profit to every one who reads it.

* *Instructions Météorologiques*, par A. ANGOT, Docteur ès Sciences, &c., 3^e édition, entièrement refondue. Paris, Gauthier-Villars, 1891, 8vo, vi. 124 pages.

† We have noticed only one misprint : on page 11, second paragraph, 4th line 1^{re} should be 1°.

Having thus done justice, and no more than justice, to the work as a whole, we shall not be misunderstood if we criticize some portions.

We are glad to see (but it should have had a separate heading) at the close of the description of the *Baromètre à large cuvette* that our French friends have at last adopted the Kew plan of an arbitrary scale.

Dr. Angot is the first person (as far as our memory serves) who has had the courage to say, what we quite believe, that better results will be obtained from a thermometer divided only to each degree, than from one divided to fifths of a degree.

On page 32 Dr. Angot makes the excellent suggestion that the French thermometer stand should have only one lateral wing, so that reflection from the inside should be impossible; but his engraver has put two.

On page 36, Dr. Angot describes a form of thermometer stand for tropical countries which strikes us as new. We should like to see some comparisons of temperatures in such a stand with simultaneous readings of a *thermomètre fronde*. We are also doubtful whether it would be durable; it is supported by four posts and is virtually two half drums—very much like the German metal window screen—but to be made of tarpaulin or pitched cardboard, the inner one 3 ft. and the outer one $4\frac{1}{2}$ ft. in radius, so that the observer can go inside to read the instruments.

We are by no means sure that as a rule the French manner of mounting thermometers in a light brass frame is not better than the costly English slabs—but we do not like the dry and wet bulb represented by fig. 16—the dry bulb looks as if its readings must be affected by the proximity of the wet bulb.

It is probably the engraver who is responsible for the funnel of the rain gauge, fig. 19; it is much too flat; there is no room for snow, heavy rain would splash out, and scarcely half a dozen hailstones would remain after the heaviest shower.

We notice that although French observers are requested to state the number of days when the fall exceeds 0.02 in., they are told to count as days with rain even those on which nothing is found in the rain gauge, if they have seen any drops on the pavement. Therefore in comparing French and English records of rainy days, the French records should probably be reduced by a tenth or the English ones proportionately increased.

The woodcuts of clouds seem to us among the best of that class of which we are aware.

An important point arises with respect to fig. 25, the Campbell-Stokes sunshine recorder which our neighbours put under a glass shade. We think that the two plans, the English of having no cover, and the French with the shade, should be tried side by side. The English plan allows the lens to become dirty, and covered with rime, and the cards to be saturated by every shower, the French plan

avoids the last of these evils, transfers the other two to the protecting shade, but introduces the extra difficulty of misty condensation on the inside of the shade. One plan or the other ought to be abandoned ; which of the two we do not know.

With respect to vanes, Dr. Angot makes an excellent suggestion, viz., that a vane can be made quite sensitive to light winds and yet steady during squalls, by making it rest not on an agate point or on friction rollers, but upon a hollow cylinder floating on a liquid—glycerine or a solution of chloride of calcium.

As the definition of fog seems not generally agreed upon in England, we translate Dr. Angot's Instruction.

"Account should be kept of all the days upon which there is fog ; if the observer has a free horizon he should notice not merely the presence of fog but its density. This may be measured by recording the greatest distance at which an object (such as a house or wall) can be seen clearly.

"Thus, for example, a fog of 300 yards would be one which obscured all objects at a greater distance. In order to form a scale of reference, it is well to select before-hand a series of objects at known distances and in various azimuths."

This is excellent advice, but we should like to know what Dr. Angot considers is the distance at which the obscuration of a house entitles the observer to record fog. And if English observers would express their opinions as to this, the fog question would perhaps be put upon a firmer basis than it has at present.

We have reached page 86 without finding a single sentence to which we object, but we do not agree with Dr. Angot in thinking that rainbows, coronæ, twilights and mirages ought to be omitted from a book of Instructions ; half a page or a page would have been usefully employed, if only in preventing confusion between halos and coronæ ; and as nothing in this world is perfect, we express the hope that a fourth edition may soon be necessary, and that we shall see a few lines not merely on these subjects, but also on the following :—How to set a vane truly N. ; Dust haze ; Glazed frost ; Silver thaw ; How to record a great Hailstorm ; *Grésil*, and how it differs from *Grêle* ; and we might even have some instructions as to the Kobar, which has recently been discussed by the Soc. Mét. de France.

We are slightly in doubt as to the expediency of instructing observers as to the best mode of interpolation ; much depends on the distances between the observers, and on their arithmetical powers, but on the whole we think that such work is done best at the central office.

In conclusion, we have to thank Dr. Angot for the very pleasant and instructive three hours which we have spent over his book. It is full of useful hints, and characterized throughout by that which it not too frequent, though both in England and in France it has nearly the same name, common sense.

WHO FIRMINUS WAS.

WE have always been of opinion that such a person as Firmin had existed, and are glad to be able to transpose the word "was" in the above heading on the high authority of M. Delisle, Administrateur Général of the Bibliothèque Nationale of Paris, who has most kindly furnished the following information :—

The treatise "de mutatione aeris" is by Firmin de Belleval, a French author of the middle of the XIVth. century. The name of Firmin was, in the middle ages, rarely found except in the North of France, and especially in the Diocese of Amiens. The author of the *Repertorium* was probably a native of Beauval, now a commune in the arrondissement of Doullens, in the department of La Somme.

There was a copy of the work in the library of King Charles V., which is thus described in the old catalogue :—

"Summa Leupoldi de Austria ; compilatio Firmini de Bellevalle de mutatione aeris, et alia plura, en papier." (DELISLE, *Le Cabinet des manuscrits* t. III, p. 146, Art. 679.)

The following are notes upon treatises by Firminus preserved in the Bibliothèque Nationale.

LATIN MS. No. 15104.—(This when in the library of the Abbey of St. Victor was numbered FFF No. 24.) In the last part of the volume, on folio 48 there is a treatise in XIVth century writing, without any title, but beginning

"Tres principes de milicia superiorum ex nobilissimo genere procreati a remotis partibus per diversos anfractus et limites tortuosos festinant ad consilium generale anno 1345, ultima die mensis certissimi Latinorum, videlicet inicio ejus in quo condita fuit tota creacio mundanorum, super altissimis negociis tractaturi

Explicit prognosticatio magistri Firmini de Bellavalle super consilio Saturni, Jovis et Martis, Anno Domini 1345.

This is followed in the same volume on folio 50, by another contemporary MS.

"Incipit epistola super reformatione antiqui kalendarii directa domino pape Clementi VI per venerabiles et solemnes astrologos et magistros Johannem de Lineriis, Johannem de Muris, et Firminum de Bellavalle, Anno Domini 1345."

LATIN MS. No. 7378 A., Fol. 63.

Explicit pronosticacio magistri Johannis de Muris super conjunctione.

Incipit pronosticatio magistri Firmini de Bella valle super eodem.

"Tres principes" as in No. 15104.

LATIN MS. No. 7482, Fol. 34.—(This copy seems to have been made for Charles VIII, King of France).

“Incipit tractatus Firmini de mutacione aeris dictus Colliget astrologie, continens sex partes, aut capitula.

Quia in multis voluminibus sapientes antiqui de mutationibus aeris multa scripta fecerunt”

Finishes on fol. 155:

Explicit Colliget astrologie de mutatione aeris.

Explicit Firminus de pluviis et mutatione aeris.

It seems to us that the above amounts as nearly to demonstration as could be expected after the lapse of more than 600 years.

Let us sum up the fresh facts, first rectifying an error in Dr. Hellmann's letter on page 6 (near the middle), “for the year 1338” should have been “for the year 1312.”

As Dr. Hellmann originally stated, there were Firmins who wrote on Theology; to this M. Delisle adds that the name was rarely found except in the N. of France, and especially in the Diocese of Amiens. The Beauval which M. Delisle assumes to have been the residence of Firmin, is in Lat. $50^{\circ} 6' N.$, Lon. $2^{\circ} 20' E.$, about 4 miles S. of Doullens, and about 12 miles N. of Amiens, and on examining the *Carte d'état major* for the district, we find in the adjoining sheet, about 30 miles to the N.W., two localities named after a Firmin—we do not say after the meteorologist—but near the mouth of La Somme we have St. Firmin, a hamlet near Rue, and a little farther north we have the village of Nempont St. Firmin.

We therefore hold that M. Delisle has satisfactorily answered the question, “Who was Firminus?”

REVIEWS.

Berliner Zweigverein der Deutschen Meteorologischen Gesellschaft.
Neuntes Vereinsjahr, 1892. Berlin 1892, 8vo, 21 pages.

CHIEFLY we believe under the direction and care of Dr. Hellmann the German Meteorological Society has been making a series of comparisons of rain gauges in an experimental field, and also at about twenty stations in and around Berlin—with the usual result of having records ranging for 1890 from 23 inches to 28 inches—or about 25 per cent. We are sorry that no details are given either as to the sizes of the gauges, or their heights above ground and above sea. It is very little trouble to give this, and is always handy even if it has been given before. Dr. Hellmann has been observing three rain gauges on the roof of the Meteorological Office, and has found (as did Mr. Dines, and as Mr. Symons suggested as long since as *British Rainfall*, 1863, page 4) that near the centre of a large roof the fall is very similar to that at the level of the street. And as with the Rotherham experiments reported in *British Rainfall*, 1869, so at Berlin

Dr. Hellmann has satisfied himself that the predominating cause of differences in the amount of rain collected is wind.

In conclusion, he seems to think that the rain gauges should be protected from the influence of wind. We do not think so. What we require to know is what amount of rain falls upon the earth, not how much water can be collected from any given shower.



Observatoire Royal de Madagascar. Observations Météorologiques faites à Tananarive. Par le R. P. E. COLIN, S.J. II. Volume, 1890, Tananarive, Imprimerie de la Mission Catholique. 8vo.—278 pages.

ALTHOUGH we have not seen Vol I., we are very glad to welcome Vol. II. of the above work. It is evident that Father Colin spares no pains in the making, or care in the printing, of his observations.

There is a central observatory at Tananarivo, and there are altogether 16 subsidiary ones. The central one has been partly equipped by the Bureau Central of Paris, and has several standard barometers, Richard barograph and psychrometer, besides various thermometers, Robinson cup anemometer, &c. It has also an evaporator, designed by M. D'Abbadie, which, it seems to us, would give better results than the figures as printed by Father Colin. He tells us in the preface that he recognises the difficulties, and is trying to overcome them by making the instrument self-recording; but the readings if made as M. D'Abbadie suggested and *properly worked out*, would give all that is necessary and though not accurate values, would still give data of interest. We, therefore, describe the apparatus and the mode of publication.

The evaporator consists of a zinc cistern 40 in. by 40 in., and $2\frac{1}{2}$ inches deep [this is much too shallow], enclosed in a wooden box with bevelled edges, and mounted on a stone pillar, so that it is about 6 ft. above the ground. To one side is attached a thermometer to indicate the temperature of the water, and near it a divided glass tube, in which the height of the water can be read. To another side is a syphon to discharge part of the water [we presume into a vessel where its amount can be measured] in case of heavy rain rendering an overflow imminent, and on the third side there is a tap to empty the vessel when it is necessary to clean it.

There is a little complication in the mode of reading, which we either do not understand, or do not see the necessity for; but eventually values are obtained which, as Father Colin says, give the depth of the liquid evaporated, or of the rain. In the volume the black figures denote rain, the ordinary ones the amount evaporated.

The table for January, 1890, is not complete, so we take the next month—February, 1890—and reprint precisely the record for the first ten days, adding at the end the daily fall of the rain.

Fevrier, 1890.

Jours.	EVAPOROMETRE (<i>air libre</i>).						PLUVIOMETRE.	Total of Rain as per Evaporator
	7 h.	9 h.	13 h.	16 h	18 h.	Total.		
1	2·24	0	0·61	...	7·14	2·85	mm. 1·8	mm. 7·1
2	0·20	0·40	0·20	7·34	1·83	9·77	11·4	0·2
3	3·26	0	1·02	1·83	0·81	6·11	...	0·8
4	49·57	0·20	1·02	11·01	0·40	12·63	51·0	49·6
5	1·02	0·40	1·02	1·02	1·22	4·28	1·1	0·4
6	2·24	0	0·20	...	9·58	2·44	2·2	9·6
7	0·20	0·20	0·40	3·67	1·22	5·29	13·5	0·4
8	3·26	1·02	0·0	1·02	0·40	1·02	14·2	4·7
9	6·52	0	0·40	3·06	3·06	12·64	9·7	0·4
10	7·14	0	0·81	1·63	1·22	3·66	16·5	7·1
Total {	R 60·37	0·60	0·40	1·02	17·93	...	121·4	80·3
	E 15·28	1·62	5·28	29·56	8·95	60·69	...	...

There are several things in this table which seem to us to need alteration. In the first place it is delusive to print the records of such an instrument to two places of decimals of a millimetre—one place of decimals is as much as, or more than, is justified. Secondly, the entry at 4 p.m., on Feb. 4th, 11·01, [*i.e.*, 0·44 inch] as having been evaporated in the previous three hours, is surely a mistake; the only figure approaching it is 6·52 [*i.e.*, 0·26 in.] in the thirteen hours preceding 7 a.m. on the 9th. We are not believers in the use of the Piche evaporator, but as there is one at work at Tananarivo, we turned to see whether it, or the hygrometer, showed any trace of extra dryness on the 4th, and they do not. That entry is therefore wrong, but that may be a clerical error, and we merely note it and pass on to the real difficulty. This is the entering of the excess of one reading above the previous one as the amount of rain. It is not so; the reading gives the increased depth, but that is the depth of the rain less the evaporation during the time. This comes out clearly from the last two columns, where, in spite of a want of agreement in the daily values, which we cannot understand, the final result is that the rain recorded as falling into the evaporator, is only two-thirds of that collected by the rain gauge.

Reducing the 4 p.m. reading on the 4th to its probable value of 1·01 mm., we have for the total, for the ten days evaporation, about 2 inches; but the difference between the sum of the black figures and of the rain as recorded by the rain gauge has to be added, and then we get about 3·6 inches as the evaporation for the ten days, or about 130 inches per annum. We see that in few months is the evaporation so great as in February; therefore probably it would average about 90 inches. When we remember how shallow is the vessel, this amount is not improbable, but we hope that Father Colin

will put a rain gauge within a metre or two of his evaporator, and at the same height above the ground, and will determine his evaporation when there has been rain by the simple process :—

Previous Reading	...	...	...	4·7
Rain since	...	...	...	3·2
				<hr/>
Total	...	...	...	7·9
Present Reading	...	...	...	6·6
				<hr/>
Evaporation since previous Reading				1·3

His tank would be better if ten times as deep, and if lowered nearly to the ground level ; but even as it is, the records may be rendered very useful.

Some idea of the thoroughness of the work at Tananarivo may be gathered from the fact that most of the instruments are read five times daily, and all the values are printed *in extenso*, even to the Black and Bright bulb Solar Max. The observatory has both a burning and a photographic sunshine recorder, a set of earth thermometers, &c.

We hope and expect to get very valuable work from future volumes, and that is the reason that we have devoted so much time to the present one, and why we seem perhaps hard upon a comparative beginner, whom we wish to help and not to repress. We are delighted to see prospects of useful information from Madagascar—a country of which we know so little ; but we wish the volumes to be not merely masses of figures, but figures upon which everybody can rely. At present Father Colin is but starting and he will, we hope, forgive us for trying to put him on the right track. The best observer is not he who enters 10,000 more figures than his brother, but the man of whom one is certain that 99 figures out of 100 are absolutely correct. It was, of course, tantalising that out of the eleven stations with rain gauges, quoted on p. 273, only one had a perfect record for every month, and could, therefore, properly have its total printed ; but when the author has had a little more experience, he will regret having printed totals for five stations, of which one had a record of only ten months, one of nine, and three of only eight months ; totals, moreover, which do not agree with the sums of the monthly values as printed.

PROFESSOR VANDER MENSBRUGGHE ON THE FORMATION OF FOG AND OF CLOUDS.

(Translated from *Ciel et Terre*, March 16th, 1892.)

IN the last number of *Ciel et Terre*, I see an interesting article by Dr. W. J. Russell on "Town Fogs and their effects," in which the author deals with the researches of Aitken on the condensation of vapour in the atmosphere. As I have recently been at work upon the same subject I hope that you will reprint two paragraphs from my note, (Bull. de l'Acad. Roy. de Belgique 3^e série, t. xix No. 2, 1890) "On the condensation of aqueous vapour in capillary spaces."

"Let us quote one of the most important facts in the economy of nature, the formation of fogs and of clouds. We know the excellent researches upon this subject by M. Aitken; this physicist has proved by varied and conclusive experiments that aqueous vapour condenses in the air only in the presence of solid particles around which the invisible vapour becomes a liquid : but if the researches of M. Aitken have fully established the mode and the conditions of the formation of fogs and of clouds, they throw little light on the cause of the phenomena. If I have rightly grasped the theory of the English savant, he attributes the condensation of the vapour to the nature of the surface of the particles, which he calls free, but in no way indicates the form of this surface. Now I think that it is precisely to form—irregular, indented, offering minute capillary spaces,—that the condensation so well shown by his experiments is due. In what substance would it be possible to find more minute capillary spaces, than in the myriads of motes of dust, germs, &c., floating everywhere and at all times in the lower strata of the atmosphere.

"If this is really so, the fact of the condensation of vapour around these corpuscles follows naturally from the very simple principle enunciated by Sir W. Thomson, and forms I think the most beautiful and the most important of all the applications in the vast laboratory of nature.

"The theory which I put forward two years ago in the above paper seems to me to offer a ready explanation for the 'high fog' of which Dr. Russell said that the cause was unknown. It must be admitted that the temperature of the air over great towns—especially northern ones—is probably lower than in the streets, hence condensation will begin sooner at a height, than at the level of the streets."

THE MUNICH CONFERENCE.

To the Editor of the Meteorological Magazine.

SIR,—Through your obligingly publishing my query (on p. 27) respecting the minimum daily rainfall to be recorded as satisfying the proposals of the Munich Conference on this point, I have received an unimpeachably authoritative letter containing the statement that the Conference recommended 0·1 mm., and 1 mm., as the sole measurements to be set out in the résumés; so that the presumed equivalence of the quantities 0·005 in and 0·1 millimetre (also 0·05 inch and 1 mm.), given p. 180 of last vol., is not at all warranted. In fact, though we may continue to record 0·005 inch as the minimum standard for British Rainfall, 0·004 inch should be recorded to satisfy the recommendations of the Conference.

Yours truly,

T. W. BACKHOUSE.

Sunderland, March 19th, 1892.

TOWN FOGS.

To the Editor of the Meteorological Magazine.

SIR,—The subject of "Fog" has been engaging much attention of late, and it seems as if the physical features of the phenomenon somewhat imported vagueness into the discussion. Nothing is so abhorrent to the scientific temper as want of precision; but surely it is possible to rescue the records of our observations from something of the vagueness that has hitherto characterized them. I have for years attempted to record the density of fogs—in this way. When I enter "fog" in my note-book, I generally put in small figures like the algebraic powers of quantities, the notation of the distance in yards at which objects are just visible, *e.g.*, In my record of December last I find: 15th, *fog*⁴⁰⁰; 21st, *fog*⁸⁰⁰; 22nd, *fog*⁶⁰; 23rd, *fog*⁸⁰; 24th, *fog*⁶⁰; 25th, *fog*¹⁰⁰. The density of the fog is of course in the inverse ratio. In the suburbs of a town it would be easy to be very exact, as it would not be difficult to lay down once and for all the distances of neighbouring buildings.

Next as to the origin of fogs. In the instance above, the cause was not far to seek. The mean temperature of the air from 21st to 25th December was below 24°F. That of the River Thames, which was very full but not in flood, was probably over 40°. The valley was a trough of vapour. On the hills at a height of, say 250 feet above it, there was sky without cloud and a blaze of sunshine from sunrise to sunset.

The river is doubtless the cause in the first instance of the London fogs—in most cases. We want the M.T. of the air and the M.T. of the river, and if these were placed before us, there could be, I think, no hesitation. Not that such is always or altogether the explanation. The last dense fog that I experienced in London, was so dense that near the Marble Arch when you could see the colour of the horse's head that was meeting you, you could not tell what vehicle it was drawing. However, at the bottom of Park Lane there was no fog, only a very gloomy condition of atmosphere. It certainly seemed that on that occasion it was independent of the river.

I remain, your obedient servant,

JOHN SLATTER.

Whitchurch Rectory, Oxon, 18th March, 1892.

ROYAL METEOROLOGICAL SOCIETY.

At the meeting of this Society on Wednesday evening, the 16th March, Dr. C. Theodore Williams, the President, delivered an address on the "Value of Meteorological Instruments in the selection of Health Resorts." He drew attention to thermometers, maximum and minimum as the foundation on which medical climatology rests, and instanced effects of extreme cold or of heat on the human organism. The direct rays of the sun are of the greatest importance, and in health resorts should be utilized to the full; in fact only climates where during the winter months even a

delicate person can lie or sit for several hours a day basking in the sunshine, are to be recommended for most complaints, and the various forms of sunshine recorders are used to aid the medical adviser in choice of such health stations. After referring to the value of rain-gauges, hygrometers, and barometers, Dr. Williams stated that many health resorts owe their reputation almost solely to their shelter from cold winds; for instance, the advantages in climate which Hyères and Mentone enjoy over Marseilles is chiefly due to their being more sheltered from the *mistral*, or north-west wind, the scourge of the lower valley of the Rhone from Valence to Avignon. He went on to describe the climate of the Riviera, illustrating it by lantern slides from recent photographs, including views of Hyères, Costebelle, Cannes, Nice, Mentone, San Remo, &c., and he showed the three principal causes of the warm winter of this region to be: (1) the Southern latitude; (2) the protection from cold winds by mountain ranges; and (3) the equalizing and warming influence of the Mediterranean Sea, which being practically tideless is always equally potent, not varying with hour and season. Dr. Williams mentioned the weak points of the South of France climate with its blustering *mistral*, its occasional cold *bise*, its moist *scirocco* wind, but summed up the Riviera winter climate as being, as a whole, clear, bright and dry, with fog and mist practically unknown, with a winter temperature of 8° to 10° higher than England though subject to considerable nocturnal radiation, with about half the number of rainy days, and four or five times the number of bright ones, which we can boast of; with cold winds and cold weather, without which it would lose its health-giving effect.

After the delivery of this address the meeting was adjourned, in order to allow the Fellows and their friends an opportunity to inspect the Exhibition of Instruments relating to Climatology, which had been arranged in the rooms of the Institution of Civil Engineers, 25, Great George Street. The Meteorological office showed a set of instruments necessary for the equipment of a climatological station, viz., Stevenson thermometer screen, fitted with dry bulb, wet bulb, maximum and minimum thermometers; and also a rain-gauge. Thermometers were also shown for ascertaining the temperature on the ground, under the ground, and at a distance, as well as for recording temperature continuously. Various forms of sunshine recorders were exhibited, as well as a number of actinometers and solar radiation instruments for ascertaining the heating effect of the solar rays. The exhibition included a large and interesting collection of hygrometers, also several rain-gauges and other instruments. Among the curiosities was a piece of plate glass which was "starred" during a thunderstorm on August 21st, 1879; this was not broken, but it has a number of wavy hair-like lines. The exhibition contained a large number of beautiful photographs of clouds, lightning, and snow scenes, as well as of the damage done by the destructive tornado at Lawrence, Mass., U.S.A.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, SEPTEMBER, 1891.

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		
England, London	80·4	13	43·3	24	68·5	51·4	51·7	77	116·9	39·4	1·03	15	4·6
Malta.....	96·6	8	63·9	27	84·4	70·4	65·3	71	148·6	57·0	·65	4	2·6
Cape of Good Hope ...	81·1	3	38·9	14	62·9	48·0	...	...	...	...	3·20	10	4·8
Mauritius.....	78·4	30	63·2	2	75·5	66·0	61·1	74	131·6	53·3	2·50	18	5·6
Calcutta.....	91·1	15	74·0	21	86·9	77·6	78·0	88	156·2	73·1	9·25	19	6·7
Bombay.....	87·0	28	73·2	29	84·7	76·3	75·3	85	141·0	70·9	22·53	25	7·7
Ceylon, Colombo	87·9	27	72·8	6	85·9	77·3	71·5	75	146·0	70·0	4·42	21	5·5
Melbourne.....	77·1	30	35·9	26	63·2	45·7	45·8	73	127·6	29·4	1·14	14	5·4
Adelaide	80·6	3	42·4	15	67·4	49·8	45·0	60	144·2	32·2	·76	17	5·0
Tasmania, Hobart.....	79·5	30	35·2	7, 11	60·8	41·8	43·7	73	127·0	26·7	·40	14	5·6
Wellington .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Auckland	90	20	43·5	4, 5	62·1	49·5	46·9	72	132·0	33·0	1·96	13	5·4
Jamaica, Kingston.....	91·7	25	70·5	7	89·4	74·4	72·4	75	...	...	1·54	...	...
Trinidad	92·0	1, 8a	68·0	6, 20	89·1	71·5	73·2	79	159·0	63·0	7·44	18	...
Toronto	87·5	25	41·9	30	...	...	56·5	80	...	37·0	1·71	8	3·6
New Brunswick, Fredericton	82·7	25	37·5	16	...	...	53·7	78	...	...	3·56	11	4·5
Manitoba, Winnipeg ...	84·8	19	31·1	8	...	...	50·5	78	...	...	2·02	18	5·1
British Columbia, Esquimalt	68·6	1	41·5	27	...	...	52·9	95	...	...	4·27	16	6·5

a And 20.

REMARKS.

MALTA.—Mean temp. 75°·8 ; mean hourly velocity of wind 7·3 miles. Sea temp fell from 81°·0 to 76°·0. TSS on 19th and 20th ; L on 4 days. J. SCOLES.

Mauritius.—Mean temp. of air 0°·3 above, dew point 0·3 above, and R 1·03 in. above their respective averages. Mean hourly velocity of wind 12·1 miles, or 0·1 mile above average ; extremes, 27·0 on 4th and 2·0 on 29th ; prevailing direction E.S.E. $\frac{1}{2}$ S. C. MELDRUM, F.R.S.

CEYLON.—L only was seen on the 26th, 27th, 28th, 29th and 30th.

J. C. H. CLARKE, Lt.-Col., R.E.

Melbourne.—Mean temp. of air 1°·2, of dew point 2°·1, and humidity 2, above their respective averages ; R 1·11 in., and cloud 0·7, below their averages. Prevailing winds S. and N., strong on 10 days. Heavy dew on 13 days. Dense fog on the morning of the 19th ; L on 1st ; T and L on the 2nd. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 1°·5 above and R. 1·03 in. below the average of 34 years. The R for the first 9 months of the year is little more than half the average, and 1·68 in. below the previous lowest record. C. TODD, F.R.S.

Tasmania, Hobart.—Mean temp. of air 0°·6 above, dew point 0°·8 below, and humidity 4 below the averages of 7 years. Prevailing winds N.W. and S. R very slight. J. SHORTT, CAPT. R.N.

Auckland.—An unusually fine and dry month, the mean temp being 1° above the average, and the R 1·5 in. below the average. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
MARCH, 1892.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	1·54	XI.	Builth, Abergwessin Vic.	1·86
„	Birchington, Thor	1·85	„	Rhayader, Nantgwillt..	1·59
„	Brighton Prestonville Rd	1·00	„	Corwen, Rhug	1·56
„	Hailsham	1·45	„	Carnarvon, Cocksidia ...	1·60
„	Ryde, Thornbrough	1·03	„	I. of Man, Douglas	·98
„	Alton, Ashdell	1·22	XII.	Stoneykirk, Ardwell Ho.	·53
III.	Oxford, Magdalen Col...	·37	„	New Galloway, Glenlee	1·29
„	Banbury, Bloxham	·71	„	Melrose, Abbey Gate ...	1·72
„	Northampton, Sedgebrook	·74	XIII.	N. Esk Res. [Penicuick]	2·15
„	Cambridge, Fulbourne..	1·43	„	Edinburgh, Blacket Pl.	1·37
„	Wisbech, Bank House..	·75	XIV.	Glasgow, Queen's Park.	·58
IV.	Southend	1·49	XV.	Islay, Gruinart School..	1·33
„	Harlow, Sheering ...	1·27	XVI.	Dollar	·88
„	Rendlesham Hall	1·75	„	Balquhider, Stronvar..	2·27
„	Diss	2·18	„	Coupar Angus Station..	·59
„	Swaffham	·79	„	Dunkeld, Inver Braan..	1·00
V.	Salisbury, Alderbury ...	·80	„	Dalnaspidal H.R.S. ...	1·33
„	Bishop's Cannings	·68	XVII.	Keith H.R.S.	·23
„	Blandford, Whatcombe .	·79	„	Forres H.R.S.	1·29
„	Ashburton, Holne Vic. ...	2·24	XVIII.	Fearn, Lower Pitkerrie.	1·02
„	Okehampton, Oaklands.	1·35	„	Loch Shiel, Glenaladale	2·40
„	Hartland Abbey	1·24	„	N. Uist. Loch Maddy ...	1·98
„	Lynmouth, Glenthorne.	1·02	„	Invergarry	1·74
„	Probus, Lamellyn	1·16	„	Aviemore H.R.S.	1·54
„	Wincanton, Stowell Rec.	·74	„	Loch Ness, Drumnadrochit	2·03
„	Clevedon, Charleville ...	...	XIX.	Lairg H.R.S. ....	...
VI.	Bristol, Clifton .....	...	„	Scourie	2·53
„	Ross, The Graig	·89	„	Watten H.R.S.	·83
„	Wem, Clive Vicarage ...	·85	XX.	Dunmanway, Coolkelure	2·98
„	Cheadle, The Heath Ho.	·90	„	Fermoy, Gas Works ...	1·01
„	Worcester, Diglis Lock	·70	„	Killarney, Woodlawn ...	2·03
„	Coventry, Coundon	·94	„	Tipperary, Henry Street	·97
VII.	Ketton Hall [Stamford]	1·19	„	Limerick, Kilcornan ...	·68
„	Grantham, Stainby	1·25	„	Ennis	·56
„	Horncastle, Bucknall ...	1·18	„	Miltown Malbay	·74
„	Worksop, Hodsck Priory	·97	XXI.	Gorey, Courtown House	1·17
VIII.	Neston, Hinderton	1·18	„	Mullingar, Belvedere ...	·69
„	Knutsford, Heathside ...	1·14	„	Athlone, Twyford	·71
„	Lancaster	·57	„	Longford, Currygrane ...	·96
„	Broughton-in-Furness..	2·04	XXII.	Galway, Queen's Coll...	·90
IX.	Ripon, Mickley	1·02	„	Crossmolina, Enniscoe..	1·94
„	Scarborough, West Bank	1·14	„	Collooney, Markree Obs.	·80
„	East Layton [Darlington]	·89	„	Ballinamore, Lawderdale	1·13
„	Middleton, Mickleton..	·50	XXIII.	Lough Sheelin, Arley ..	·84
X.	Haltwhistle, Unthank..	1·25	„	Warrenpoint	·47
„	Bamburgh	1·05	„	Seaforde	·71
„	Newton Reigny	·82	„	Belfast, New Barnsley..	·86
XI.	Llanfrechfa Grange	1·10	„	Bushmills, Dundarave...	·98
„	Llandovery	1·35	„	Stewartstown	1·01
„	Castle Malgwyn	·92	„	Buncrana	·87

MARCH, 1892.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which ·01 or more fell.	TEMPERATURE.				No. of Night below 32°	
		Total Fall.	Difference from average. 1880-9.	Greatest Fall in 24 hours		Max.		Min.					
				Dpth	Date				Deg.	Date	Deg.			Date
		inches.	inches.	in.								In shade.	On grass.
I.	London (Camden Square) ...	1.04	— .57	.20	15	9	59.8	18	22.3	9	19	25	
II.	Maidstone (Hunton Court)...	1.94	+ .44	.55	15	10	...	...	...	...	...	...
	Strathfield Turgiss	1.04	— .55	.34	15	11	57.1	31	20.1	9	21	28	
III.	Hitchin	1.03	— .31	.34	15	12	58.0	18 ^b	22.0	7, 9	24	...	
	Winslow (Addington) .....	.55	— 1.17	.18	27	8	60.0	18 ^c	19.0	9, 14	23	26	
IV.	Bury St. Edmunds (Westley)	1.35	— .20	.32	21	10	54.0	17	12.0	10 ^e	...	...
	Norwich (Cossey) .....	.96	— .46	.24	15	9	58.0	18	15.0	10	10	15	
V.	Weymouth (Langton Herring)	.77	— 1.13	.39	15	7	57.0	31	24.0	9	18	...	
	Torquay, Babbacombe	1.15	— 1.80	.59	15	7	53.3	27	25.7	10	14	21	
	Bodmin (Fore Street)	1.25	— 2.53	.53	15	7	...	...	...	...	...	...
VI.	Stroud (Upfield) .....	.95	— 1.24	.44	15	11	61.0	18	24.0	8, 12	24	...	
	Church Stretton (Woolstaston)	.95	— 1.18	.24	8, 15	11	60.0	18	21.0	10	23	26	
	Tenbury (Orleton) .....	.82	— 1.26	.30	15	10	63.0	31	20.0	13	21	26	
VII.	Leicester (Barkby)	1.00	— .71	.32	15	14	62.0	18	14.0	9	25	29	
	Boston .....	.85	— .69	.22	15	7	66.0	31	21.0	10	21	...	
	Hesley Hall [Tickhill] .....	.73	— 1.17	.29	15	9	65.0	31	19.0	14	25	...	
VIII.	Manchester (Plymouth Grove)	.93	— 1.29	.48	15	5	64.0	18	15.0	11	24	26	
IX.	Wetherby (Ribston Hall) ...	1.19	— .87	.48	10	7	...	...	...	...	...	...
	Skipton (Arncliffe)	1.00	— 4.10	.26	8	10	...	...	...	...	...	...
	Hull (Pearson Park)	1.26	— .79	.21	9 ^a	17	64.0	31	19.0	12	23	28	
X.	Newcastle (Town Moor)	1.73	— .90	.50	26	14	...	...	...	...	...	...
	Borrowdale (Seathwaite)	3.29	— 7.21	1.60	17	9	...	...	...	...	...	...
XI.	Cardiff (Ely) .....	.96	— 2.02	.54	15	7	...	...	...	...	...	...
	Haverfordwest	1.42	— 1.82	.43	16	12	56.4	19	19.0	13	24	29	
	Aberystwith, Gogerddan .....	.91	— 2.07	.35	14	6	63.0	18	16.0	12	26	...	
	Llandudno	1.13	— .95	.24	15	11	...	...	...	...	...	...
XII.	Cargen [Dumfries]	1.03	— 2.27	.30	9, 26	7	61.4	18	17.6	28	21	...	
	Jedburgh (Sunnyside) .....	...	...	...	...	...	...	...	...	...	...	...
XIV.	Old Cumnock	1.31	— 1.82	.40	26	9	...	...	...	...	...	...
XV.	Lochgilphed (Kilmory)	1.12	— 3.34	.59	9	6	...	...	18.0	11	24	...	
	Oban (Craigvarren) .....	.66	...	.31	16	7	59.2	19	22.2	29	14	...	
	Mull (Quinish)	1.58	— 2.26	.76	16	11	...	...	...	...	...	...
XVI.	Loch Leven Sluices .....	.60	— 2.37	.20	13 ^f	4	...	...	...	...	...	...
	Dundee (Eastern Necropolis)	.90	— 1.50	.45	10	6	59.0	31	20.1	10	22	...	
XVII.	Braemar .....	.37	— 2.27	.13	16	9	51.3	18	3.3	16	23	28	
	Aberdeen (Cranford)	1.06	...	.31	12	15	66.0	31	16.0	15	23	...	
XVIII.	Strome Ferry	2.40	— 2.23	.60	16	16	...	...	...	...	...	...
	Cawdor [Nairn]	1.64	— .40	.40	14	13	...	...	...	...	...	...
XIX.	Dunrobin	1.03	— 1.22	.38	11	7	55.0	31	22.0	27	20	...	
	S. Ronaldsay (Roeberry)	1.37	— 1.17	.30	16	18	49.0	17 ^d	20.0	26	17	...	
XX.	Darrynane Abbey	2.75	...	.93	14	10	...	...	...	...	...	...
	Waterford (Brook Lodge) ...	1.12	— 1.78	.44	15	9	62.0	31	23.0	13	18	...	
	O'Briensbridge (Ross) .....	.53	...	.22	15	6	56.0	31	23.0	11	25	...	
XXI.	Carlow (Browne's Hill)	1.04	— 1.33	.45	15	9	...	...	...	...	...	...
	Dublin (Fitz William Square)	.99	— 1.02	.40	14	9	59.2	17	23.8	11	16	25	
XXII.	Ballinasloe .....	.68	— 1.95	.24	10	8	...	...	...	...	...	...
	Clifden (Kylemore)	2.52	...	.62	14	9	...	...	...	...	...	...
XXIII.	Waringstown .....	.90	— 1.45	.26	9	10	65.0	31	16.0	11	25	26	
	Londonderry (Creggan Res.) ..	1.43	— 1.30	.48	26	14	...	...	...	...	...	...
	Omagh (Edenfel) .....	.76	— 1.75	.20	9	13	58.0	18	18.0	10	20	23	

^a And 11, 15. ^b And 31. ^c And 19, 31. ^d And 18, 21, 25, 30, 31. ^e And 11. ^f And 27.

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

METEOROLOGICAL NOTES ON MARCH, 1892.

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.—March was cold throughout, only three nights being without frost upon the ground, while on the 5th, 9th and 13th, the cold was intense for the time of year. All agricultural development was consequently retarded. S on 9th and 10th.

ADDINGTON.—By far the smallest rainfall recorded in March at this station during 22 years. Frost in shade every night from 2nd to 15th, at which date ice was two inches thick on the lake. Min. in shade on 9th and 10th, 19° and 21°, and on 13th and 14th, 21° and 19°. From the 16th to the 21st the max. temp. was rather higher, but it fell off again until the last day, when it rose to 60°. The last three days were almost cloudless and the nights very cold. Dense fog in the morning on 26th.

BURY ST. EDMUNDS, WESTLEY.—Cold and winterly, with snow on the ground most of the month; very cold on 10th and 11th. Very little wind for March. Vegetation very backward. S on six days.

LANGTON HERRING.—With the exception of March, 1879, when only .42 in. of R fell, this was the driest March for 18 years, making the deficit for the three months of this year 2.82 in. or 41 per cent. The mean temp. at 9 a.m. 36°.4 is as much as 5°.2 below the average of 20 years, and only in 1886 was there a colder March during that period; while in only seven months in 20 years has the mean min. been lower. Fogs on 16th and 26th. Solar halos on 8th, 12th, 13th and 20th; fine lunar halo on 7th.

TORQUAY, BABBACOMBE.—A fine, very dry and cold month, with great excess of N.E. wind and a rather high bar. No R was measured in the 11 days, February 26th to March 7th, and only .01 in. on the 26th, in the last 15 days; S showers were frequent from 2nd to 10th, and on the 14th; R fell on the 15th and 16th. It was dull on 2nd, 3rd, 4th, 7th, 25th and 26th; fine and sunny on 11th, 12th, 18th, 19th, 23rd, 29th, 30th and 31st; cold from 1st to 14th (especially on 3rd, 4th and 8th,) and on 25th, 26th, 28th and 29th; warm on 16th, 17th, 18th, 21st, 27th and 31st. Max. shade temp. rose to or above 50° on 6 days, but only to 31°.5 on 3rd and 32°.0 on 4th. Frost in air on 13 consecutive nights (2nd to 14th). It was the coldest March (mean of 9 a.m., 9 p.m., max. and min. temp. 38°.7) registered except in 1883 when it was 38°.4. The number of days of N.E. wind (10) was more, and of wet days (7) was less than in any of the preceding 15 Marches. The total R of the 3 months from January 1st (4.85 in.) was the least registered in the first quarter of any year. N.E. winds on 13 days, E. on 8, N.W. and S.W. and variable 3 days each, W. on 1 day. Gales on 3rd and 15th; soft H on 9th, 10th and 14th; S on nine days, covering the ground from 9th to 15th, max. depth 2 inches on 10th. Solar halos on 8th, 12th, 13th, 20th, 21st, 27th and 31st; Lunar halos on 7th, 12th, 13th and 14th. (*Erratum*).—In February the min. occurred on the 17th, not on the 18th.

BODMIN.—The coldest March known, and the driest during the 29 years recorded. Cold and dry with frost at night, to the 7th, and from the 10th to the 13th. S H and R on the 14th, 15th, 16th and 17th, and then dry and bright sunny days and frost nearly every night, to the end of the month. Gales of wind on 9th, 15th, 16th and 22nd. Splendid weather for tilling.

STROUD, UPFIELD.—East winds on 8 days, N.E. on 10. Very cold from 1st to 5th. S showers on the 9th and 27th, heavy S on the 10th.

WOOLSTASTON.—The first fortnight was intensely cold and S fell on several days, heavily on 8th; a thaw set in on the 16th, but the latter part of the month was again very cold and S fell heavily on the 27th. Mean temp. 36°.4.

TENBURY, ORLETON.—A very dry, cold month, being the driest March but one, and the coldest but two since 1860. On 10 days during the first 15 the ther. never reached 40°. Severe frost most of the month, and S on the 2nd.

8th, 9th, 11th, 13th 14th and 27th. Fog on 20th, 24th and 25th. Lunar halo on 7th.

LEICESTER, BARKBY.—A very cold month; mean temp. $36^{\circ}0$. A very late spring.

MANCHESTER, PLYMOUTH GROVE.—The driest March for 25 years' excepting March, 1875, and the coldest for 25 years except March, 1882, when the mean temp. was 36° . Slight S fell on 1st, 2nd, 3rd and 27th, a heavier fall on 9th and a fall of 7 to 8 inches on the 10th. Dense fog occurred on 12th but cleared away about noon, and thick fog on the mornings of the 30th and 31st. A complete thaw set in on the 15th. It was very fine on 18th, 19th and 20th; fair with cold wind from 21st to 26th. Mean temp. $37^{\circ}3$.

WALES.

HAVERFORDWEST.—A very severe March. S with violent wind prevailed from the 9th to the 12th, which was difficult to measure, as it was so dry, that the wind blew it away. The temp. was uniformly low, the mean day reading of the 12 days, from the 2nd to the 14th, not being higher than 36° , and the night readings as low as 25° . Damp weather with thaw occurred about the 17th and 19th, followed to the end by brilliant days and cold frosty nights. Some S fell on the 28th, and the ther. in shade fell to $22^{\circ}3$ on the morning of the 29th.

SCOTLAND.

CARGEN.—The mean temp. of the month $36^{\circ}6$ (4° below the average), is the lowest recorded in March during 33 years, with the exception of 1883, when the mean was $35^{\circ}5$, and 1888, when it was $36^{\circ}4$. The first 16 days were very cold, the mean for the period being only $33^{\circ}4$. An interval of comparatively mild weather occurred from 17th to 20th, when the mean temp. was $47^{\circ}4$, but the latter part of the month was again very cold. Easterly winds prevailed for 23 days; S fell on 5 days. The R for the first quarter of the year has been 5.85 inches below the average.

OBAN.—A very fine and dry month, with much sunshine, but occasional cold winds and S showers.

S. RONALDSAY, ROEBERRY.—Upon the whole a fine month, but cold.

IRELAND.

DARRYNANE ABBEY.—The first half of the month was very cold with strong N.E. wind; from 15th to 20th it was foggy, and the last 11 days were very fine, with sharp frost at night from 27th to 30th. Vegetation very backward. S and H showers on the 8th, 9th and 10th. S on 13th.

WATERFORD, BROOK LODGE.—Prevailing winds, N.E. to S.E.; mean temp. $38^{\circ}5$; the driest March since 1878; S on the 8th; fog on 24th.

O'BRIENSBRIDGE, ROSS.—The driest March on record; many bright days, but temp. very low.

DUBLIN.—A remarkably cold, dry month, with scanty R, and a great prevalence of searching polar winds. The week ending Saturday the 12th was the coldest experienced in Dublin during the winter of 1891-2, and had it not been for a temporary rise of the ther. to $55^{\circ}7$ on the 31st, the month would have proved the coldest March on record within the past 30 years. The mean temp. $39^{\circ}1$, was $2^{\circ}2$ below that of February, and $4^{\circ}0$ below the average. The atmosphere was thick with dry smoke fog on the 4th, 6th, 7th, 12th, 20th, 21st, 24th, 29th, 30th and 31st. High winds were noted on 4 days, reaching the force of a gale on the 18th. S or sleet occurred on 7 days; H fell on 9 days. The temp. exceeded $50^{\circ}0$ in the screen on only 6 days, compared with 9 days in March, 1891, and 19 days in March, 1890, while it fell to or below 32° in the screen on as many as 16 days, compared with 10 days in March, 1891, and only 4 days, in March, 1890.

EDENFEL.—The weather was dry and cold to the 8th, when it gave place to excessive frost, with considerable S. The third week was milder with some R, thence to the 28th was very cold, with occasional slight S and sharp night frosts. The month ended in brilliant and milder weather. S on 9 days; H on 21st. The R for the three months to March 31st (chiefly made up of melted S) 4.76 in., is little more than half the average, and the smallest for the same period for at least 28 years. The springs are already failing.

SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

CCCXVI.]

MAY, 1892.

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

ANEMOMETER COMPARISONS.

THE usual monthly meeting of the Royal Meteorological Society was held on Wednesday evening, April 20th, at the Institution of Civil Engineers, 25, Great George Street, Westminster. Dr. C. Theodore Williams, President, in the chair.

The President, and other Officers and Fellows of the Society spoke of the great loss which it (and other associations with which he was connected) had sustained by the death of Dr. Tripe, Council Secretary of the Society for 20 years; and a resolution of sympathy with the family was passed by the meeting.

Señor R. Aguilar y Santillan, Sir Andrew Clark, Bart, F.R.S., Mr. F. W. Cross, Assoc.M.Inst.C.E., Mr. H. Hancock, M.A., Mr. W. B. Heberden, Dr. Hermann Weber and Mr. E. R. Williams were elected Fellows of the Society.

The following papers were read :—

“Anemometer Comparisons,” by Mr. W. H. Dines, B.A., F.R.Met.Soc. This was a report on a series of experiments carried out at the request of the Council of the Society, with the object of obtaining a direct comparison of the various anemometers in common use, that an opinion might be formed as to which type is most suitable for general purposes, the cost of the experiments being defrayed out of a vote made by Parliament to the Meteorological Council for such purposes.

The anemometers compared were :—1. Kew Pattern, Robinson ; 2. Self-adjusting Helicoid ; 3. Air Meter ; 4. Circular Pressure Plate (of one square foot area) ; and 5. A special modification of Tube Anemometer. The Helicoid Anemometer is the invention of the author, who also so modified the orifice of the Tube Anemometer as to obviate the inaccuracy shown by previous experiments to be due to any inclination of the air currents. Very ingenious apparatus, fully described in the paper, was designed to make all five instruments record continuously, on one sheet of paper driven by clock-work the rate of travel, of which could be varied at pleasure from 1 inch to 3 inches per minute.

The instruments were at first mounted 9 ft. above the highest part of the roof of a house, but the eddies from the chimney stacks

and gables produced discrepancies, amounting in some instances to 30 per cent. The height was therefore increased to 18 ft. The author's conclusions are :—

“The Robinson Cups are very simple, strong, and independent of the direction of the wind ; it also appears from this investigation that the factor of the Kew Pattern type is practically constant. It is an objection that the large sizes offer great resistance to the wind, and therefore require a very strong and rigid support. During light winds the registration must depend on the order in which the instrument is kept, but I think that a Kew pattern instrument must be in a very bad and dirty condition indeed before its registration is much altered during a gale. It hardly seems necessary to add how very desirable it is that instruments of certain definite sizes and proportions only, should be made and used.”

“The Helicoid Anemometer is quite independent of friction for all excepting light winds, and different sizes read alike, but it is not so simple in construction as the cup form, and its readings are liable to be altered by comparatively slight damage to the blades.”

“The Air Meter consists of a single screw blade formed of thin aluminium and made as nearly as possible into the exact shape of a portion of a Helicoid. A similar instrument with a larger blade and with the dial protected from the weather would probably form a useful and correct Anemometer. It would be light and offer a very trifling resistance to the wind.”

“The oscillations of the pressure plate must have been considerably damped by the action of the floating weight, but as it was, they were sufficiently violent. It is perhaps a question as to how far it is desirable to allow these oscillations. The extreme pressures which occur are of very short duration, and they can only be recorded by an instrument which acts quickly. It seems probable that the remarkably high values sometimes given by the Osler Pressure Plate may be due to the inertia of the moving parts.”

“The Tube Anemometer appears to me to possess numerous advantages. The head is simple in construction and so strong that it is practically indestructible by the most violent hurricane. The recording apparatus can be placed at any reasonable distance from the head, and the connecting pipes may go round several sharp corners without harm. The power is conveyed from the head without loss by friction, and hence the instrument may be made sensitive to very low velocities without impairing its ability to resist the most severe gale. The quickness with which the recording apparatus follows the variations of the wind depends on the length and diameter of the connecting pipes, and may be altered at pleasure by a valve placed in one of them. It has been previously shown that the mean recorded seems to be independent of the size of the pipes.”

“With regard to one most important point in connection with this investigation, namely, the determination of the factor of the Kew Pattern Robinson Anemometer, these comparisons prove conclu-

sively that it must lie between 2.00 and 2.20. Reasons have been given which at least partly explain the difference of 13 per cent. between the two classes of instruments ; and if these reasons be the right ones, the record of the velocity instruments should be accepted as more likely to be correct, at any rate for the high velocities."

"I think that if 2.10 be taken as the factor, we may be certain of being within 5 per cent. of the truth, and that there is a very great probability that this value is within $2\frac{1}{2}$ per cent. of the right one."

The "Hurricane over the West Indies, August 18th—27th, 1891." by Mr. F. Watts. The author has collected a number of observations on this violent hurricane, which on August 18th, swept from the Atlantic into the Carribbean Sea, and moved in a north-north-westerly direction over San Domingo, and thence northward and eastward. At Martinique the barometer, which at 5.30 p.m. stood at 29.80 in. fell to 28.38 in. at 8.15 p.m. during the passing of the centre of the cyclone.*

METEOROLOGICAL CHANGES IN FRANCE.

MONS. FLAMMARION, the French astronomer, has recently been directing attention to the climatic changes in France. According to the United States Consul at Bordeaux, he states that, from actual figures obtained within the past six years, the temperature of Europe has been falling. France has been suffering for a long time from an excess of cold weather, the thermometrical readings at Paris having been one degree Centigrade below the normal height. Other readings show even less favourable results. The fall is more noticeable in the spring than during other periods of the year. Similar phenomena are recorded in Great Britain, Belgium, Spain, Italy, Austria, and Germany, while the really cold countries, such as Denmark, Norway, Sweden, and Russia, have enjoyed, during the last four years, a temperature slightly above the average. In the days of Philippe Auguste, in the 13th century, the wines of Etampes and Beauvais were the favourite beverages at court. Henry IV., a pronounced *bon vivant*, frequently expressed his fondness for the product of the Suresnes grape. At the present day, there is not a vineyard of importance north of Paris ; and as for the *petit vin* now made at Suresnes, it has become only the drink of the poorer classes. In the middle of the 16th century, Maçon was celebrated for its muscat wines, whereas the muscatel grape, at this moment, can scarcely be made to thrive there. Ancient chronicles mention the cultivation of the vine in Northern Brittany, where now even apples are not plentiful. Again, it is to be remarked that trees which once flourished in the north of France, are at present found only in the extreme south, and a considerable number have disappeared altogether. Languedoc no longer grows the lemon ; there is not an

* See also *Met. Mag.*, vol. xxvi. (1891) p. 167.

orange left in Roussillon. The Lombardy poplar, so familiar and picturesque an object in old French line engravings, is now nowhere to be found on French soil. These are facts which, says Consul Knowles, putting statistics out of the question, serve to illustrate the changes wrought by temperature in the great fruit-producing country of France.—*Journal of Society of Arts*, April 22nd, 1892.

SPRING DROUGHT.

To the Editor of the Meteorological Magazine.

SIR,—The deficiency of rainfall at this place and at Muswell Hill during the first four months of this year seems worthy of notice.

For those of your readers who are not acquainted with the locality, I may mention that the two stations are distant two miles "as the crow flies," Muswell Hill being E.S.E. of Finchley; their elevation above the Thames is about 300 feet, the difference between them being probably not more than 15 feet. At Muswell Hill a record has been kept for a complete 20 years, 1872—1891; here, for the 6 years 1886—1891, too short a time to establish an average, but the difference during that period in the amount of rain between the two stations is very small, Muswell Hill exceeding this place by an average of 0·23 in. per annum.

RAINFALL AT MUSWELL HILL.							ETCHINGHAM PARK, FINCHLEY.		
Month. 1892.	Amount of rain. in.		Less than 20 years average by in.		Percentage below average.	No. of days on which rain fell.	Amount. in.		Days.
January	0·67	.....	1·59	.....	70	..... 10	0·73	.....	15
February ...	1·47	.....	0·40	.....	21	..... 19	1·62	.....	18
March	1·19	.....	0·66	.....	35	..... 10	1·28	.....	12
April	1·02	.....	0·88	.....	46	..... 11	1·05	.....	12
	4·35		3·53	=45	per cent. deficiency.	50	4·68		57

In no other year since the gauge was started has so small a quantity of R as 4·35 inches fallen from January 1st to April 30th. In 1874 the amount was 4·72 inches, and in 1891 4·97 in.

Yours faithfully,

J. W. SCOTT.

Elleray, Etchingam Park, Finchley, Middlesex, May 4th, 1892.

EXCEPTIONAL WEATHER IN MARCH AND APRIL.

To the Editor of the Meteorological Magazine.

SIR,—We have had very dry weather the last four days, and Saturday was the driest day during my ten years' observations here. At 3.15 p.m., the difference between the dry and wet bulbs was 20°·2, and the relative humidity 27. On 4th July, 1886 (details of which I sent you at the time), at 3.5 p.m., the difference between dry and wet was 22°·3 (85°·6—63°·3), but as the temperature was 16° higher, the relative humidity was 28. Moreover, the morning and evening

on Saturday were much drier than on 4th July, 1886; even at 9 p.m. there was a difference of $10^{\circ}\cdot 9$, with temp. $50^{\circ}\cdot 8$ I send the readings from 2 p.m. to 6 p.m., as they may be of interest. Yesterday (Sunday) the difference reached at 3 p.m. was $18^{\circ}\cdot 6$ ($67^{\circ}\cdot 7-49^{\circ}\cdot 1$) and relative humidity 29. To-day it is very much damper, and I hope we may have some rain.—Yours very truly,

R. H. BARNES.

*Heatherlands, Parkstone, Dorset,
April 4th, 1892.*

1892. 2nd April.	Dry Bulb.	Wet Bulb.	Dew Point.	Relative Humidity.	WIND.	CLOUD.
2. 0 p.m.	68·7	50·5	36·3	31	E.N.E. 3 to 5	1. Cirrus & Cirro Stratus.
2.30 „	69·4	50·8	36·4	30	N.E. by E. 3 to 5	1. Cirrus & Cirro Stratus.
3. 0 „	69·7	49·9	34·6	27		
3.15 „	69·5	49·3	33·6	27		
3.30 „	69·0	49·1	33·6	27	E.N.E. 3 to 5	1. Cirrus & Cirro Cumulus.
4. 0 „	68·7	48·7	33·0	27		
4.30 „	68·0	48·9	33·8	29	E.N.E. 3 to 5	0. Scattered wisps of Cirrus.
5. 0 „	66·7	47·3	31·7	27		
5.30 „	64·5	46·7	32·1	29	E.N.E. 2 to 3	4. Cirrus & Cirro Stratus.
6. 0 „	61·9	46·1	32·5	33		

To the Editor of the Meteorological Magazine.

SIR,—I notice a letter in the *Times* from Mr. Sowerby respecting dryness at Regent's Park. Here it was even more remarkable. For several days the difference between wet and dry bulb has been 15° to 17° , but on Wednesday, the 6th, at 1 p.m. the readings were :—

Dry $72^{\circ}\cdot 0$
Wet $53^{\circ}\cdot 5$

Diff..... $18^{\circ}\cdot 5$ giving a relative humidity of 31.

My instruments are in good order.

I enclose readings of max., min., and range for the week ending April 7th, and comparison with most similar previous years :—

	1892.	Max.	Min.	Range.	Cloud, 9 a.m.	Rain.
April 1		65·7	27·2	38·5	0	·00
„ 2		68·6	31·6	37·0	5	·00
„ 3		69·0	30·3	38·7	0	·00
„ 4		71·3	36·2	35·1	2	·00
„ 5		69·1	42·3	26·8	4	·00
„ 6		72·2	37·7	34·5	0	·00
„ 7		67·0	40·6	26·4	0	·00
Average 7 days ..		69·0	35·1	33·9	1·6	·00
1859.						
April 2 to 8		65·6	44·5	20·6		
1865.						
April 5 to 11		66·4	44·4	20·0		

The absolute height of maximum was exceeded on April 6th, 1859, which was 79° at Greenwich and $76^{\circ}5$ at Ross, but the mean max. for the week was much higher in 1892, and the range much greater also.

I ventured, some months since, to anticipate a warm April, on the ground that we have had an unusually long succession of cold ones. In 1859 there was a cold period from the 12th to 24th, the temperature on the 18th being 34 degrees colder than on the 6th. In 1865 the warmth continued to the close of the month. March was remarkable here for the number of frosts: 23 at 4 ft. and 29 on grass (the same as in 1883), no other year since 1859 having as many. The intensity was slightly greater in 1883. It was also remarkable for absence of cloud, the average at 9 a.m. being 4.5 only.—Truly yours,

H. SOUTHALL.

The Graig, Ross, Herefordshire, April 8th, 1892.

To the Editor of the Meteorological Magazine.

SIR,—The dryness was rather remarkable here to-day for the time of year; thermometers on Glaisher's screen:—

	Dry Bulb.	Wet Bulb.	Relative Humidity.
10 a.m.	53.0	41.0	40
12 noon	60.5	45.4	34
1 p.m.	61.5	45.5	33
2 „	61.2	45.0	33
3 „	60.7	44.8	33

Sky quite cloudless; light airs from N. and N.W.

Yours truly,

G. T. RYVES.

*Team Vicarage, Stoke-on-Trent,
March 31st, 1892.*

To the Editor of the Meteorological Magazine.

SIR,—So much snow fell here last night, that it may be of some interest (being the middle of April) to record the details. There were snow showers between 2 and 3 p.m. (15th), afterwards it was fair with sun; this morning at 5 a.m. the branches of the trees were thick with snow, and the beds of hyacinths in beautiful bloom entirely covered, and beds of tulips partially in bloom disappeared entirely in the white covering. The melted snow from the gauge at 9 a.m. was 0.85 in. The night before last the thermometer was at 24° , unpleasing spring weather for Easter-tide.—Yours very truly,
BESSIE METCALFE.

Harbledown, Canterbury, April 16th, 1892.

To the Editor of the Meteorological Magazine.

SIR,—We had extreme dryness here on April 3rd; at 1.30 p.m. the dry bulb read 69° , wet bulb 51° , so that the relative humidity was only 31. Heavy snow here on 15th and 16th. Snow began falling

about 9 p.m. on 15th and continued to 9 a.m. on 16th. Depth on Stevenson screen, $3\frac{1}{2}$ inches ; average depth on ground, 4 in. giving

Depth.	Water.	Ratio.
4·00 in.	·60 in.	$6\frac{1}{2}$ to 1
Max. on 16th	45°·0	Min. 32°·6

Considerable damage to telegraph and telephone systems, the number of poles "down" unprecedentedly large. Fall of temperature from 70°·3 on 6th, to 29°·5 on 15th, or 40°·8 in 9 days.—Yours, &c.,
F. H. PHILLIPS.

1, Prestonville Road, Brighton, April 18th, 1892.

To the Editor of the Meteorological Magazine.

SIR,—The following readings of the maximum thermometer at the beginning of April may be of interest to some of the readers of your Magazine, or for comparison with other readings :—

March 31st.....	66°·5	April 3rd	69°·0
April 1st.....	75°·1	„ 4th	67°·4
„ 2nd	70°·0		

The air on March 31st was very dry, as shown by the wet and dry bulb thermometers ; at 11 a.m., the dry and wet stood at 57°·2 and 40°·2 respectively, giving a relative humidity of 28. Snow was lying unmelted in the shadows.—Yours truly,

WALTER E. STEWART.

Elcott House, Hurworth-on-Tees, Darlington,
May 4th, 1892.

To the Editor of the Meteorological Magazine.

SIR,—The following figures will give you an idea of the severity of the weather this Easter. My thermometer is 4 feet from the ground, and in a case ; on Good Friday night I put another one on the grass and it fell to 10°.

	Max.	Min.		Max.	Min.
April 14th	44·0	21·0	April 17th	46·0	19·5
„ 15th	46·0	19·5	„ 18th	47·0	21·5
„ 16th	48·0	20·0	„ 19th	49·7	21·8

—Yours truly,

ROBERT A. CLARKE.

Norwood Cottage, Casterton, Kirkby Lonsdale,
April 20th, 1892.

THE WEATHER IN MID-SUSSEX on Saturday morning, April 16th, would have been much more in harmony with Christmas than Easter. About 4 inches of snow had fallen, and was driven by a strong N.W. wind with great fury. Every twig was coated with snow, and evergreens were weighed down to the ground. It has been followed by sharp frosts. Gooseberries are in full bloom but well in leaf, and do not seem to have suffered. Pear blooms out on E. aspect wall under fish nets are destroyed, and I fear that the plums will share the same fate.—R. I. [Near Hawkhurst the snow was a foot deep.]

FROST AND SNOW IN THE ISLE OF WIGHT.—The weather here lately has been very wintry. The tops of the hills behind Ventnor are covered with snow—a very unusual thing for this part of the country at this time of the year. We have sharp frosts every night. On Friday night, 15th, it fell to 26°, which blackened all the early potatoes, and must do severe injury to the blossom of the early fruit trees. The tops of the asparagus are killed, and altogether it will make a very backward spring still later. Summer visitors are here, but having a very cold reception. The cuckoo and the nightingale were heard last week, and yesterday (the 17th) I saw the first swallow, so we ought soon to have better weather.

C. ORCHARD.

THE WEATHER IN HAMPSHIRE.—This has undergone a complete change during the last eight days, as it has in other localities. The first eleven days in the month produced a temperature of 70° in the shade, and over; on the 10th, 76° was registered, the nights being really warm for the time of year, on the night of the 6th the lowest reading being 48°, and vegetation moved rapidly. During the night of the 12th the temperature fell to freezing point, and since then we have had nightly frosts of great severity. This morning (April 18th) at 6.30, we had a temp. of 22°. I fear the early promise of a full fruit crop will not be realized, as I note that the unopened buds of pear trees are blackened. The early blossom of plums and cherries on walls is in an equal plight. Rain is needed for newly-sown seeds and plants just put out, scarcely any having fallen for a month.—E. M.

Journal of Horticulture.

TOWN FOGS.

To the Editor of the Meteorological Magazine.

SIR,—I am glad to see (p. 42) Mr. Slatter's letter on the mode of recording fogs; but it occurs to me that there are other points which ought to be noted if exact records are to be kept. Some fogs are denser near the ground than at a little altitude, while in other instances the reverse is the case; also they are sometimes denser in one direction than in another. My plan has been to record the fog on a scale depending on the distance of the *furthest* terrestrial object I could see at any altitude or in any direction; but I perceive now that this is not consistent, and that if we want to know the amount of fog at the exact point of observation, we should observe an object at the same altitude, recording what we deem would be the distance visible if there was a uniform fog equal to that existing at the point of observation—sometimes fogs are very far from uniform. It is also a matter of meteorological interest what the density is in different altitudes and azimuths.

T. W. BACKHOUSE.

Sunderland, April 28th, 1892.

REVIEW.

Étude sur le Climat de Pau et du Sud-ouest Français, par le DR. E. DUHOURCAU de Cauterets. [Mémoire lu au Congrès de l'Association Pyrénéenne (Bordeaux, Mai, 1891).] Toulouse, Privat 1891, 8vo. 26 pages.

THIS pamphlet may be described in brief as drawing attention to all the good points in the climate of Pau, and attacking those persons who have called attention to any points which tell against it. We do not regard this as either a judicial or judicious way to treat the subject, and we shall certainly not take any part in the controversy. We are much indebted to Dr. Duhourcau for sending a copy, for papers by him are always worth reading (some of the quotations in the present are quite amusing, *e.g.*, a *calori-soustractionomètre* suggested by M. Piche), and though last, by no means least, because the pamphlet contains a table so useful that we have converted into English measures and reprinted all the values except those for the hygrometer, for which the returns are too rarely given to afford satisfactory data for comparison.

Three Years Meteorology at Paris and in the S. and S.W. of France.

STATION.		MEAN DAILY MAX.				MEAN DAILY MIN.				TOTAL DAYS WITH FROST.	MEAN CLOUD AT NOON.			
		Winter.	Spring.	Summer.	Autumn.	Winter.	Spring.	Summer.	Autumn.		Winter.	Spring.	Summer.	Autumn.
Paris	1888	38°·8	56°·3	71°·2	59°·2	30°·0	39°·9	52°·9	42°·4	67	7	8	7	6
„	1889	41°·9	57°·7	76°·1	58°·6	30°·0	41°·2	54°·5	42°·6	66	7	7	6	6
„	1890	42°·6	60°·3	72°·0	58°·5	32°·5	40°·6	52°·2	42°·4	63	7	6	7	6
Arcachon ..	1888	49°·6	67°·8	77°·9	68°·5	36°·1	46°·9	57°·2	48°·7	?	...	...	...	...
„	1889	48°·9	60°·1	77°·4	66°·2	38°·7	44°·2	58°·6	49°·6	27	...	...	...	...
„	1890	49°·3	62°·1	77°·2	64°·9	36°·9	44°·4	57°·7	47°·1	33	...	...	...	...
Bayonne	1888	48°·6	59°·5	76°·3	66°·7	34°·2	43°·2	56°·5	49°·1	36	8	6	5	5
„	1889	50°·7	59°·5	75°·9	66°·9	36°·3	43°·3	57°·4	47°·1	27	7	6	5	7
„	1890	53°·2	60°·1	75°·4	64°·2	35°·4	44°·1	58°·1	50°·5	43	6	6	6	5
Biarritz	1888	48°·9	59°·5	74°·3	67°·1	37°·8	43°·9	58°·1	51°·6	20	7	6	5	6
„	1889	51°·8	58°·6	74°·5	66°·7	39°·7	47°·5	60°·8	51°·8	21	7	6	5	5
„	1890	53°·2	60°·8	73°·4	64°·6	39°·0	47°·7	60°·8	51°·3	20	6	6	6	5
Pau	1888	44°·6	62°·8	77°·7	66°·0	34°·2	40°·6	52°·2	42°·3	63	6	5	5	4
„	1889	50°·5	65°·7	76°·6	64°·8	33°·3	44°·6	55°·9	43°·7	49	6	7	6	5
„	1890	51°·8	65°·7	77°·7	65°·1	32°·2	40°·3	53°·8	43°·2	61	6	7	6	5
Bagnères de	1888	44°·2	59°·2	71°·2	61°·9	33°·1	36°·7	51°·6	45°·5	56	7	6	7	6
Bigorre ...	1889	47°·5	55°·4	71°·4	63°·0	33°·3	39°·0	54°·3	45°·1	55	6	8	7	5
„	1890	47°·8	57°·7	72°·7	61°·3	32°·4	40°·3	52°·9	43°·5	52	6	5	6	5
Nice	1888	49°·8	60°·8	75°·9	65°·8	36°·3	45°·7	59°·2	50°·5	16	...	...	...	...
„	1889	52°·2	60°·1	78°·8	65°·8	37°·6	45°·0	58°·8	50°·2	14	...	...	...	...
„	1890	51°·3	62°·8	76°·3	63°·9	38°·7	45°·3	60°·1	47°·7	9	6	6	4	6

Three Years Meteorology at Paris and in the S. and S.W. of France.

STATION.		RAIN.										
		DEPTH.					DAYS.					
		Winter.	Spring.	Summer.	Autumn.	Total.	Winter.	Spring.	Summer.	Autumn.	Total.	
		in.	in.	in.	in.	in.						
Paris	1888	4·13	3·32	8·23	4·22	19·90	15	48	46	30	139	
„	1889	3·90	6·34	5·12	5·32	20·68	30	46	33	41	150	
„	1890	3·54	4·37	8·11	4·26	20·28	24	33	43	52	152	
Arcachon	1888	5·98	5·71	8·15	10·16	30·00	50	?	48	36	?	
„	1889	10·72	10·75	4·16	14·40	40·03	54	55	51	57	217	
„	1890	6·69	7·90	5·73	12·00	32·32	31	49	33	?	?	
Bayonne ..	1888	10·15	8·88	12·05	12·81	43·89	21	34	33	34	122	
„	1889	20·16	14·04	11·73	18·05	63·98	39	46	35	41	161	
„	1890	11·25	14·13	7·13	15·30	47·81	30	48	24	30	132	
Biarritz ...	1888	11·02	10·73	13·23	14·45	49·43	40	38	40	35	153	
„	1889	17·32	13·86	12·28	18·13	61·59	51	46	43	41	181	
„	1890	10·30	13·46	6·61	15·47	45·84	30	48	24	30	132	
Pau	1888	7·21	14·60	13·78	8·66	44·25	32	43	45	30	150	
„	1889	16·93	19·69	14·11	13·35	64·08	44	68	39	32	183	
„	1890	7·93	16·83	11·89	10·59	47·24	26	51	35	31	143	
Bagnèresde	1888	5·31	7·57	13·43	8·63	34·94	19	?	60	49	?	
Bigorre	1889	19·63	16·70	5·33	10·98	52·64	30	50	52	42	174	
„	1890	7·50	14·54	10·93	18·94	51·91	30	50	40	45	165	
Nice	1888	2·01	8·19	3·11	16·06	29·37	8	27	16	24	75	
„	1889	7·24	9·02	4·96	15·20	36·42	19	31	15	26	91	
„	1890	6·62	19·33	2·17	6·02	34·14	9	31	5	18	63	

N.B.—For Paris in 1888 and Pau in 1890 there is a mistake or misprint in the rainfall. We have given above the sum of the seasons, but the totals as printed give for the year 1888 at Paris 23·43, and for 1890 at Pau 43·31 inches.

Sequence of Stations according to Dr. Duhourcau's Table.

Mean Min. in Winter.	Days with Frost.	Total Rain.	Days with Rain.
Paris..... 30°·8	Paris..... 65	in. 52·29	Pau ... 159
Bagnères. 32·6	Pau 58	Bayonne. 51·90	Biarritz. 155
Pau 33·2	Bagnères 54	Pau 51·86	Paris 147
Bayonne. 35·3	Bayonne. 35	Bagnères. 46·50	Bayonne 138
Arcachon 37·2	Biarritz.. 20	Arcachon 34·12	Nice ... 76
Nice ... 37·5	Nice 13	Nice 33·31	
Biarritz.. 38·8		Paris..... 20·29	

The winter min. is therefore 5°·6 lower at Pau than at Biarritz, and the frosts at Pau are to those at Biarritz as 58 to 20. We had no idea that it was so cold.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCTOBER, 1891.

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		
England, London	65·9	9	29·7	31	58·3	45·0	46·3	84	104·0	24·4	4·80	20	5·6
Malta.....	88·4	6	57·5	24	77·5	65·4	62·8	81	144·0	51·2	1·85	10	3·8
Cape of Good Hope ...	87·6	20	44·5	23	70·3	53·1	...	...	...	...	·28	3	2·6
Mauritius.....	82·0	31	64·0	21	78·1	67·4	63·9	77	134·0	53·8	1·34	14	5·9
Calcutta.....	90·2	6	67·7	28	87·3	73·1	72·7	79	148·7	60·5	·10	1	2·0
Bombay.....	91·9	26	73·2	30	88·8	76·4	73·3	74	140·0	61·7	1·04	3	2·2
Ceylon, Colombo	86·7	8	72·5	8	84·1	74·3	72·3	81	149·5	67·3	35·28	29	9·4
Melbourne.....	84·2	24	38·0	14	65·4	48·7	47·1	71	136·0	30·2	3·04	14	6·3
Adelaide	93·5	25	37·6	15	70·9	52·8	46·1	56	158·0	30·0	2·52	15	5·6
Tasmania, Hobart.....	84·0	24	34·0	14	62·2	44·7	46·5	75	140·0	25·2	2·77	18	7·0
Wellington .....	...	...	...	...	...	...	...	...	...	...	...	..	...
Auckland	69·0	28	48·0	27	64·1	51·9	48·8	72	138·0	41·0	2·64	11	4·9
Jamaica, Kingston.....	91·7	24	70·3	29	87·1	74·0	71·5	78	...	...	9·10	...	...
Trinidad	92·0	2	66·5	3	89·0	71·1	73·3	82	...	66·0	5·77	...	...
Toronto	80·7	3	21·6	28	56·1	39·1	41·6	74	...	15·0	1·71	11	5·2
New Brunswick, Fredericton	79·7	3	17·3	29	52·0	34·6	39·0	79	...	...	4·70	11	5·8
Manitoba, Winnipeg ...	68·0	29	19·2	15	51·4	30·6	34·8	80	...	...	1·19	14	5·8
British Columbia, Esquimalt	69·6	7	38·5	1	57·3	45·1	49·8	97	...	...	2·04	20	6·6

REMARKS.

MALTA.—Mean temp. 69°·8; mean hourly velocity of wind 9·2 miles. The temp. of the sea fell from 76°·3 to 71°·0. Thunderstorms occurred on 5 days; lightning was seen on 8 other days. J. SCOLES.

Mauritius.—Mean temp. of air 0°·6 above, dew point 2°·2 above, and rainfall ·49 in. below, their respective averages. Mean hourly velocity of wind 9·5 miles, or 2·0 below average; extremes, 22·2 on 12th and 0·0 on 18th, 19th and 29th; prevailing direction E. by S. C. MELDRUM, F.R.S.

CEYLON.—Thunderstorms occurred on 16 days, and lightning was seen on 5 other days. F. J. DAY, Maj., R.E.

Melbourne.—Mean temp. of air same as the average of 33 years; mean temp. of dew point 0°·8, humidity 2, amount of cloud 0·3, and rainfall ·26 in., above their respective averages. Prevailing winds S. and N., strong on 11 days. Heavy dew on 6 days; hail on 17th; lightning on 28th; thunderstorm on 29th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·1 below the average of 34 years; rainfall ·69 in. above the average. C. TODD, F.R.S.

Auckland.—An unusually fine and dry month, the rainfall being rather more than ·75 in. below, the average; mean temp. slightly above, the average. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, APRIL, 1892.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	1·19	XI.	Builth, Abergwessin Vic.	2·09
"	Birchington, Thor	1·30	"	Rhayader, Nantgwillt..	1·50
"	Brighton, Prestonville Rd	1·31	"	Corwen, Rhug	·88
"	Hailsham	1·46	"	Carnarvon, Cocksidia ...	1·45
"	Ryde, Thornbrough	1·00	"	I. of Man, Douglas	1·73
"	Alton, Ashdell	·88	XII.	Stoneykirk, Ardwell Ho.	1·23
III.	Oxford, Magdalen Col...	·72	"	New Galloway, Glenlee	1·28
"	Banbury, Bloxham	·75	"	Melrose, Abbey Gate...	1·65
"	Northampton, Sedgebrook	·79	XIII.	N. Esk Res. [Penicuick]	·90
"	Cambridge, Fulbourne..	2·34	"	Edinburgh, Blacket Pl..	1·11
"	Wisbech, Bank House..	1·87	XIV.	Glasgow, Queen's Park.	·67
IV.	Southend	1·19	XV.	Islay, Gruinart School..	1·23
"	Harlow, Sheering ...	1·06	XVI.	Dollar.....	1·03
"	Rendlesham Hall	2·27	"	Balquhiddy, Stronvar..	1·75
"	Diss	1·64	"	Coupar Angus Station..	·55
"	Swaffham	·84	"	Dunkeld, Inver Braan..	...
V.	Salisbury, Alderbury ...	·62	"	Dalnaspidal H.R.S. ...	2·15
"	Bishop's Cannings	·71	XVII.	Keith H.R.S.	·75
"	Blandford, Whatcombe.	1·04	"	Forres H.R.S.	·91
"	Ashburton, Holne Vic. ...	1·52	XVIII.	Fearn, Lower Pitkerrie.	1·27
"	Okehampton, Oaklands.	1·49	"	Loch Shiel, Glenaladale	3·48
"	Hartland Abbey	2·40	"	N. Uist, Loch Maddy ...	1·69
"	Lynmouth, Glenthorne.	1·82	"	Invergarry	1·84
"	Probus, Lamellyn	1·43	"	Aviemore H.R.S.	·83
"	Wincanton, Stowell Rec.	1·18	"	Loch Ness, Drumnadrochit	1·58
"	Clevedon, Charleville ...	...	XIX.	Lairg H.R.S. ....	...
VI.	Bristol, Clifton .....	...	"	Scourie	1·97
"	Ross, The Graig	·92	"	Watten H.R.S.	1·48
"	Wem, Clive Vicarage ...	1·29	XX.	Dunmanway, Coolkelure	2·53
"	Cheadle, The Heath Ho.	1·00	"	Fermoy, Gas Works ...	1·36
"	Worcester, Diglis Lock	·55	"	Killarney, Woodlawn ...	1·61
"	Coventry, Coundon	·79	"	Tipperary, Henry Street	1·24
VII.	Ketton Hall [Stamford]	·85	"	Limerick, Kilcornan ...	1·08
"	Grantham, Stainby	1·53	"	Ennis	·83
"	Horncastle, Bucknall ...	1·62	"	Miltown Malbay.....	1·47
"	Workshop, Hodsck Priory	·72	XXI.	Gorey, Courtown House	1·16
VIII.	Neston, Hinderton	1·49	"	Mullingar, Belvedere...	1·31
"	Knutsford, Heathside...	1·20	"	Athlone, Twyford	1·06
"	Lancaster ...	2·04	"	Longford, Currygrane...	1·06
"	Broughton-in-Furness..	2·40	XXII.	Galway, Queen's Coll...	1·66
IX.	Ripon, Mickley	1·72	"	Crossmolina, Enniscoe..	2·65
"	Scarborough, West Bank	1·26	"	Collooney, Markree Obs.	1·52
"	East Layton [Darlington]	·97	"	Ballinamore, Lawderdale	1·26
"	Middleton, Mickleton..	·88	XXIII.	Lough Sheelin, Arley ..	1·13
X.	Haltwhistle, Unthank..	1·41	"	Warrenpoint	·92
"	Bamburgh	·92	"	Seaforde	·99
"	Newton Reigny	1·08	"	Belfast, New Barnsley..	1·44
XI.	Llanfrechfa Grange	1·12	"	Bushmills, Dundarave...	1·84
"	Llandovery	1·58	"	Stewartstown	·75
"	Castle Malgwyn	1·07	"	Buncrana	1·63
			"	Lough Swilly, Carrablagh	1·22

APRIL, 1892.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which "0.1 or more fell.	TEMPERATURE.				No. of Night below 32°	
		Total Fall.	Differ- ence from average 1880-9.	Greatest Fall in 24 hours		Max.		Min.		In shade.	On grass.		
				Dpth	Date			Deg.	Date			Deg.	Date.
		inches.	inches.	in.				Deg.	Date	Deg.	Date.		
I.	London (Camden Square) ...	.99	— .75	.27	27	9		73.0	4	28.2	17	7	20
II.	Maidstone (Hunton Court)...	1.82	+ .17	1.10	15	11		...	...	...	...	...	...
III.	Strathfield Turgiss .....	.83	— .77	.15	20	10		70.6	4	23.3	17	15	25
III.	Hitchin .....	.91	— .88	.42	28	11		70.0	5	25.0	13	17	...
IV.	Winslow (Addington) .....	.57	— 1.35	.14	27	8		71.0	6	23.0	30	15	22
IV.	Bury St. Edmunds (Westley)	1.62	— .04	.39	27	7		67.0	4	22.0	14	...	...
V.	Norwich (Cossey)	1.89	+ .18	.82	16	13		64.0	2, 4	21.0	15	18	...
V.	Weymouth (Langton Herring)	1.13	— .75	.51	20	10		66.0	9	28.0	15	7	...
VI.	Torquay, Babbacombe .....	.85	— 1.39	.48	28	8		66.9	4	26.4	15	3	12
VI.	Bodmin (Fore Street)	2.14	— .93	.75	15	14		...	...	...	...	...	...
VI.	Stroud (Upfield) .....	.89	— 1.26	.29	13	13		68.0	10	26.0	14	6	...
VII.	Churchstretton (Woolstaston)	.89	— 1.45	.24	12	8		67.0	3	24.5	13	9	18
VII.	Tenbury (Orleton) .....	.99	— 1.09	.37	13	10		71.2	6	22.5	15	15	19
VII.	Leicester (Barkby) .....	.85	— 1.25	.30	27	8		74.0	5	19.0	13	20	24
VIII.	Boston	1.41	— .30	.38	27	9		76.0	5, 6	22.0	14	11	...
VIII.	Hesley Hall [Tickhill]	1.09	— .62	.37	14	8		71.0	2	20.0	19	18	...
VIII.	Manchester (Plymouth Grove)	1.22	— .49	.33	27	12		71.0	3	24.0	13	11	16
IX.	Wetherby (Ribston Hall) ...	.95	— .90	.45	28	5		...	...	...	...	...	...
IX.	Skipton (Arncliffe)	2.84	— .59	.92	27	14		74.0	2	17.0	15	...	...
X.	Hull (Pearson Park)	2.08	+ .16	.48	27	14		69.0	4	24.0	19	14	18
X.	Newcastle (Town Moor)	1.15	— .68	.43	27	15		...	...	...	...	...	...
X.	Borrowdale (Seathwaite)	3.91	— 3.23	1.02	27	14		...	...	...	...	...	...
XI.	Cardiff (Ely)	1.74	— .67	.53	20	9		...	...	...	...	...	...
XI.	Haverfordwest	2.16	— .47	.48	25	16		68.8	11	24.0	16	8	18
XI.	Aberystwith, Gogerddan	1.85	— .71	.51	20	10		74.0	2	17.0	15	14	...
XII.	Llandudno	1.06	— .75	.34	24	14		...	...	...	...	...	...
XII.	Cargen [Dumfries] .....	.76	— 1.47	.39	26	7		67.4	3	21.8	15	c	13
XII.	Jedburgh (Sunnyside) .....	.92	— .78	.39	27	7		71.0	2	21.0	19	14	...
XIV.	Old Cumnock	1.06	— 1.07	.37	26	10		...	...	...	...	...	...
XV.	Lochgilthead (Kilmory)	1.94	— .87	.32	26	15		...	...	20.0	16	12	...
XV.	Oban (Craigvarren)	1.83	...	.38	26	15		65.2	8, 12	26.2	14	5	...
XV.	Mull (Quinish)	1.99	— .99	.55	19	15		...	...	...	...	...	...
XVI.	Loch Leven Sluices .....	.90	— 1.32	.40	28	4		...	...	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	.70	— 1.35	.30	27	10		69.5	2	23.5	15	10	...
XVII.	Braemar .....	.81	— 1.61	.30	27	12		66.7	4	11.0	16	17	22
XVII.	Aberdeen (Cranford)	1.12	...	.45	27	15		71.0	1	18.0	15	10	...
XVIII.	Strome Ferry	1.72	— 1.20	.30	20	15		...	...	...	...	...	...
XVIII.	Cawdor [Nairn]	1.17	— .35	.36	27	12		...	...	...	...	...	...
XIX.	Dunrobin	2.17	+ .44	.49	27	13		57.0	5	25.0	15	9	...
XIX.	S. Ronaldsay (Roeberry)	2.63	+ 1.02	.68	27	19		62.0	2	28.0	12	d	11
XX.	Darrynane Abbey	2.22	...	.53	4	17		...	...	...	...	...	...
XX.	Waterford (Brook Lodge) ...	.98	— 1.49	.31	28	13		64.5	2, 10	25.0	19	...	...
XX.	O'Briensbridge (Ross)	1.12	...	.31	24	13		65.0	11	29.0	19	9	...
XXI.	Carlow (Browne's Hill)	1.24	— 1.04	.30	28	12		...	...	...	...	...	...
XXI.	Dublin (Fitz William Square)	1.11	— 1.01	.41	24	13		63.8	20	27.3	15	5	14
XXII.	Ballinasloe	1.08	— 1.26	.33	24	13		63.0	3, 7	26.0	14	e	9
XXII.	Clifden (Kylemore)	3.23	...	.71	24	14		...	...	...	...	...	...
XXIII.	Waringstown .....	.98	— 1.44	.15	20a	15		72.0	3	21.0	15	f	11
XXIII.	Londonderry (Creggan Res.)	1.17	— 1.07	.19	26	15		...	...	...	...	...	...
XXIII.	Omagh (Edenfel) .....	.84	— 1.39	.21	26	15		65.0	3	21.0	15	9	11

a And 26. b And 15, 17. c And 16. d And 13. e And 16, 19. f And 19.

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

METEOROLOGICAL NOTES ON APRIL, 1892.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; 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.

STRATHFIELD TURGISS.—The first fortnight was very dry, cold at night, and very hot in the middle of the day; on the 4th and 5th the max. was the highest recorded at this station in April. The middle and close of the month were similar in character, but very cold at night. Swallows seen for the first time on 6th; cuckoo heard on the 17th; nightingale on the 22nd; spotted fly-catcher seen on 25th.

HITCHIN.—The max. on 5th is the highest temp. ever recorded here so early in the year.

ADDINGTON.—The least April rainfall registered here; only once before has less than one inch fallen (i.e., .59 in 1881). During the first week the day temp. was high, but the nights were cold throughout, and often very sharp, minima of 25° or under, occurring on 6 nights. On the 13th a good deal of S fell; on 25th aurora was seen between 9 and 10 p.m. First swallow seen on 21st; cuckoo heard on 25th (both late dates.)

BURY ST. EDMUNDS, WESTLEY.—The early part of the month was very mild; the middle and last three days very cold. Migratory birds rather later than usual; 19 days of northerly wind; vegetation backward. S on 12th, 15th, 16th and 27th; T on 15th.

LANGTON HERRING.—Another dry month, making for the four months of this year only 5.15 in. of R on 45 days, the deficit being a little over 50 per cent., or 5.17 in. Less R has fallen in the last four months than in the corresponding period of any year since 1875, when observations commenced. The changes of temp. were abnormally great. The heat of the days from 6th to 11th, and the coldness of the nights from 15th to 20th being unprecedented in 20 years. The mean temp. of the month was very slightly in excess of the average. The weather was very fine from 1st to 12th; fog on 4th and 5th; solar halo on 8th and 24th; T on 18th.

TORQUAY, BABBACOMBE.—A warm, very dry, fine, sunny, month, with great excess of N.E. wind, large daily range and variability of temp., and a high bar. No rain was gauged in the 17 days from March 27th to April 12th; only .01 in. (on March 26th) fell in the 27th days, March 17th to April 12th, and only .24 in. (on 6 days) in the 41 days, March 17th to April 26th. Showery from April 13th to 21st (with H and S from 14th to 18th), and 25th to 29th, fine and sunny from 1st to 3rd, 6th to 12th and on 23rd, 24th and 30th; warm from 1st to 12th and 21st to 26th, especially on 6th, when the mean of 9 a.m. and 9 p.m. max. and min. temp. was 54°·9; cold from 13th to 19th and on 29th and 30th, especially on 15th, when the mean temp. was 36°·6. The max. shade temp. rose to or above 60° on 9 days. The air was very dry on 1st (humidity at 9 a.m. 43) and 11th (humidity at 3.10 p.m. 41.) The average max. in shade (56°·3) was higher than in any of the preceding 15 Aprils. The total R, 5.70 in. and wet days 45 of the first four months of this year, are the least registered in any year. No gales blew; S fell on 14th, 16th, 17th and 18th, but did not cover the ground; H on 13th, 16th and 18th; aurora borealis on 23rd and 25th; solar halos on 10 days, with parhelia on 2 days; fog on 4th and 5th.

BODMIN.—Very dry and pleasant weather to the 13th, some days very hot, especially the 6th and 10th. S on 13th, a heavy fall on the 15th and 16th, and a little on the 17th, then showery and rather cold to the 28th.

STROUD, UPFIELD.—S fell all day on the 13th, and in showers on the 14th 15th and 16th. S on the hills on 14th and 18th. First swallow seen on the 15th; N.E. winds on 8 days; N.W. on 13 days.

WOOLSTASTON.—A cold and very backward month with much frost. S fell heavily on the 12th and the two following days. The rainfall was very slight. Mean temp. 45°·7.

TENBURY, ORLETON.—A month with great and sudden extremes of temp.

The daily max. were unusually high from the 1st to the 11th, 4 days being above 70°, and the lowest 63°. From the 12th to the 18th the highest max. was 49°·8. and the lowest 37°·2. Altogether there were 15 days with a max. over 60°, against 4 last year; 3 in 1890, and 3 in 1889. S fell on the 12th, 13th, 14th, 16th and 18th. Aurora borealis was seen on the 25th; cuckoo heard on the 24th; cherries and damsons in full blossom about the 27th.

LEICESTER, BARKBY.—A very cold and dry month, with continuous, late and damaging frosts, which destroyed almost all fruit blossom. The first week was warm during the day. First swallow seen on the 7th; first cuckoo heard on the 28th. Four inches of S on the 12th, 13th and 14th.

MANCHESTER, PLYMOUTH GROVE.—Summer weather on the 3rd, 4th and 10th; S showers on the 14th, 15th, 17th and 18th; thick fog on the mornings of the 11th and 14th; fine weather on the 7th, 8th and 9th, and from 21st to 26th; squally and bitterly cold on the 28th. Mean temp. 45°·3.

HULL, PEARSON PARK.—TS with showers of H and R on the 25th; T on 18th; S on 12th, 14th, 15th and 18th.

WALES.

HAVERFORDWEST.—The first four days of the month were of the same wintry character as March, when a sudden change to great and almost unprecedented heat, for so early in the year, took place; it was warm even up to a late hour in the evening, especially on the 10th, when, at 8 p.m., the ther. registered 64° in screen. After this a sudden change back to cold occurred, with severe frost and frequent showers of S, especially on the 16th, when a blinding S storm took place, covering the ground to a depth of three inches, and cold weather with S showers continued to the end of the month. Vegetation very backward.

SCOTLAND.

CARGEN.—The temp. of the month was very variable; the mean, for the first eleven days was 48°·4 (2°·6 above the average for the whole month) notwithstanding, five nights were very cold. For the following eight days—12th to 19th—the mean temp. was only 36°·2; the mean temp. of the month was 1°·7 below the average. The duration of sunshine (206 hours) was much above the average. The R for the first 4 months of the year is 7·27 in. below the average. A very marked solar halo was observed in the afternoon of the 19th, and a brilliant display of the aurora on the night of the 24th. S fell on 13th and 15th, and sleet on 26th.

JEDBURGH, SUNNYSIDE.—The weather was bitterly cold during the greater part of the month—the night temp. being very low, but there was a good deal of sunshine during the day. Vegetation made little progress. About an inch and a half of S fell on 12th and 13th.

OLD CUMNOCK.—T and H on the 15th; slight S on the 13th and 16th. Grand display of aurora borealis at 10 p.m. on the 25th.

OBAN.—The first quarter of the month was warm and sunny, the remainder was exceptionally cold and disturbed.

CAWDOR [NAIRN].—S showers on 12th, 13th, 15th, 17th and 26th.

S. RONALDSAY, ROEBERRY.—The first part of the month was fine, the middle and latter part wet, stormy and cold.

IRELAND.

DARRYNANE ABBEY.—The first ten days were mild and spring-like, the next ten very cold, and the remainder changeable; T on the 7th; S showers on 15th and 16th.

WATERFORD, BROOK LODGE.—The driest April since 1870. A cold, backward month; prevailing winds easterly; H on the 13th and 15th; T on the 15th; fog on the 20th; sea fog on the 21st; S on the Comeragh Mountains on 29th. First swallow seen on the 23rd; cuckoo heard on the 27th.

O'BRIENSBIDGE, ROSS.—Temp. rather low for the season, but a very full allowance of sunshine. Many brilliant days up to the 20th, and again at the close of the month; but N. & N.E. winds, with slight frosts at night, kept vegetation backward.

DUBLIN.—A cold, rather dry and March-like month. The mean temp., R, and rainy days were all below the average. On six days the temp. rose above 60° in the shade, but on five nights it fell below 32°. Mean temp. 46°·2 or 1°·5 below the average. Solar halos on the 7th and 30th; lunar halo on the 7th; fogs on 10 days; high winds on 3 days; S or sleet on 5 days; H on 8 days. The temp. exceeded 50° in the screen on 24 days, compared with 18 days in April, 1891.

EDENFEL.—During the first 12 days there occurred a spell of genuine summer weather, with southerly winds and clear skies and a higher mean temp. than has been before recorded here for the same period; but on the 13th these conditions were suddenly reversed, and a week of bitter polar and easterly winds followed, accompanied by occasional light drifting S and severe night frosts; the min. in shade on 15th (21°) being the lowest recorded here in April. From the 20th to the end of the month the weather somewhat improved, with fresh, cool airs, and alternate light S, H and R. The drought remained practically unbroken to the close; the total rainfall for the month reaching about one-third of the average, and for the four months to May 1st about one-half.

THE CLIMATE OF TROPICAL AFRICA.

At the Cardiff meeting of the British Association attention was drawn to the importance of knowledge of the climate of Tropical Africa, and a committee, consisting of the undersigned, was appointed to collect information upon the subject and to render it generally accessible.

Our work consists of two branches—(1) the collecting and epitomizing such records as have been made; (2) endeavouring to secure the establishment of a network of stations throughout that vast region; not merely the British portion, but right across the continent, because, happily, scientific men of different nations rarely fail to be good friends and to co-operate in work which is for the benefit of all.

The task is a large one, and the fund at our disposal (£75) extremely small, but we hope to render a good account of our stewardship.

We commence our work by making a request, and an offer.

We request information of all trustworthy and regular meteorological observations made in Tropical Africa, and the loan of any unpublished *data* of that nature. (We are ourselves tabulating all those known to us, but doubtless there are some of which we have not heard).

We shall be happy to supply instructions for observing and blank forms for the entry of observations to all residents in that portion of Africa who will undertake to observe regularly and to return to us their forms duly filled up.

We do not dwell upon the importance of the subject either with respect to agriculture or to the engineering works which will have to be carried out in that country, because it appears to us to be so obvious that it would be waste of space to dwell upon it.

All communications should be sent to the Secretary at 62, Camden Square, N.W.

E. G. RAVENSTEIN, *Chairman*.

BALDWIN LATHAM.

G. J. SYMONS, *Secretary*.

S Y M O N S ' S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCXVII.]

JUNE, 1892.

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

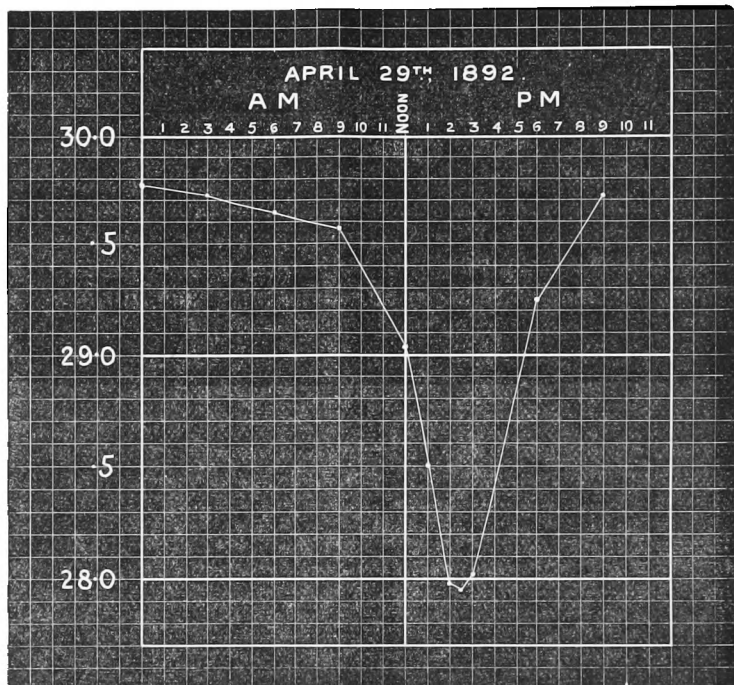
THE MAURITIUS HURRICANE, APRIL 29TH, 1892.

WE are very much indebted to our correspondent, Dr. Meldrum, F.R.S., for, amid the great misfortune which has fallen upon Mauritius, thinking of the *Meteorological Magazine*, and sending us a copy of the special edition of the *Merchants' and Planters' Gazette*, containing two articles—one on the catastrophe of April 29th, and the other intimately related thereto. We notice that Dr. Meldrum calls the phenomenon a “hurricane,” and, in deference to his judgment, we accept the term. M. Moureaux, who read a paper on the subject at the *Soc. Mét. de France*, on June 7th, called it a cyclone; while the description sent to the *Standard* by an eye-witness (which we reprint below) seems rather that of what in this country we should call a whirlwind, and our American friends would call a tornado. Dr. Meldrum will, doubtless, settle the point later on, but it seems to depend upon the limit of diameter at which a whirlwind or tornado ceases to be called such, and becomes entitled to the term cyclone. We think that Dr. Meldrum has nearly, if not perfectly, grasped the situation in the paragraph on p. 69, which we have marked with a black line.

As a general description of the storm, we have seen none equal to that given in the *Standard*, and which we reprint at the end of Dr. Meldrum's paper; but we think that there is evidence that the damage extended over a greater breadth than the writer to the *Standard* implies, and evidence in the same direction is afforded by the diagram which we have prepared from Dr. Meldrum's observations, which shows that the pressure remained at or below 28 in. nearly an hour. It must be remembered that the Royal Alfred Observatory escaped the worst of the storm; and we shall not be surprised to hear that, while damage was general over a considerable area, it was much greater in the path indicated by the writer to the *Standard*.

Considering the enormous damage caused, we trust that the relief fund started by the Lord Mayor will be warmly supported. English men, as a rule, have not yet awakened to the importance of their

colonies. Some of our people have ample funds : we are sure that they could not find many better modes of disposing of part, than by helping a colony which has suffered so severely.



THE HURRICANE AT MAURITIUS.

Royal Alfred Observatory, Mauritius, April 30th, 1892.

The hurricane which raged for a few hours yesterday, the 29th of April, has, in many respects, been unprecedented in Mauritius.

Never till now has the island been visited by a hurricane on any day between the 12th of April and the 1st of December. Hitherto the hurricane season of Mauritius has been supposed to begin on the latter, and to end on the former, day, and till yesterday there has been no exception to the rule.

Nor was there any sign of danger till yesterday, when the barometer began to fall rapidly and the wind to increase to a heavy gale. The suddenness, rapidity and extent of the changes which took place in a few hours are unparalleled in the annals of the colony.

The following table will, for the present, suffice to convey some idea of the changes which took place in the barometric pressure and the direction and velocity of the wind from 9 a.m. on the 24th to 9 p.m. on the 29th :—

Day and Hour.	Barometer.		Wind.	
	Corrected and Reduced to Sea Level.	Fall or Rise per hour, corrected for variations.	Mean Direction.	Velocity in miles per hour.
	in.			
April 24— 9 a.m.....	30·059	.....	E.S.E. $\frac{1}{2}$ S.	8
„ 27— 9 „	29·903	.....	E. by S.	15
„ 28— 9 „	·905	— ·003	N.E. by E.	12
„ „— 4 p.m.....	·816	— ·006	N.E. by E.	14
„ „— 9 „	·850	— ·018	N.E.	12
„ 29— 6 a.m.....	·660	— ·029	N.E. by E.	22
„ „— 8 „	·630	— ·063	N.E. $\frac{1}{2}$ E.	35
„ „— 9 „	·576	— ·094	N.E. by E.	35
„ „— 10 „	·480	— ·131	E.N.E. $\frac{1}{2}$ N.	40
„ „— 11 „	·338	— ·251	N.E. by E.	52
„ „— Noon	29·066	— ·532	N.E. $\frac{1}{2}$ E.	68
„ „— 1 p.m....	28·517	— ·513	N.E. $\frac{1}{2}$ E.	96
„ „— 2 „	27·990	+ ·048	North	56
„ „— 3 „	28·034	+ ·483	W.N.W.	68
„ „— 4 „	·520	+ ·529	W.S.W.	112
„ „— 5 „	29·059	+ ·151	S.W.	82
„ „— 9 „	·719		S. Ward.....	26

In the above table the fall or rise in the barometric pressure is corrected for the daily variation, and from 9 a.m. on the 24th to 9 a.m. on the 29th the mean hourly velocities of the wind are given; whereas from 10 a.m. to 5 p.m. on the 29th the rates of the velocity per hour are given as obtained from observations taken during intervals of from two to five minutes.

It will be seen that at 2 p.m. on the 29th the barometer was at 27·990 in.; that from noon to 2 p.m. it fell* 1·045 in.; that from 3 to 5 p.m. it rose* 1·012 in.; and that from 5 to 9 p.m. it rose ·660 in. The absolutely lowest pressure was 27·961 in. at 2.30 p.m., which is the lowest on record in Mauritius.

From 9 a.m. on the 28th to 1 p.m. on the 29th the mean direction of the wind did not vary much, but it occasionally showed a tendency to veer towards north, being at times from N.E. by N. to N.N.E. Between 1 and 2 p.m. it, on the whole, veered to north, and between 2 and 8 p.m. to W.N.W., oscillating considerably, and soon after settling down at W.S.W.

After 11 a.m. the velocity of the wind increased much, being at 1 p.m. at the rate of 96·5 miles an hour, and at 1.20 at the rate of 104 miles. But from 1.25 to 2.30 p.m. there was a lull; the velocity decreasing to the rate of 43 miles an hour at 2.33 p.m. It then began to increase again, and at 3.47 p.m. was at the rate of 121·2 miles an hour; but it soon began to abate, being at the rate of 72 miles at 5.20 p.m., 60 miles at 6 p.m., 47 miles at 7 p.m., and

* Correcting for diurnal range.

26 miles at 9 p.m. By this time the weather was fine, the sky partially clear, and here and there stars shining brightly.

Seeing that from 9 a.m. on the 24th to 9 a.m. on the 27th the barometer had fallen from 30·059 to 29·903 in., and that the wind, though light, had veered from E.S.E. $\frac{1}{2}$ S. to E. by S., a note was sent to the newspapers on the latter day, stating that there was heavy weather to the northward, and that it had existed since the 24th; which, as usual in such circumstances, meant that there were indications of a cyclone away to the northward, and that it was travelling from north-eastward to south-westward.

But the wind having by 9 a.m. on the 28th reached N.E. by E., and the barometer being higher than on the 27th at the same hour, there was no apprehension; and in the afternoon of the 28th, the wind being still moderate from north-eastward, and the barometer falling at the rate of only ·003 in. per hour, it was announced that there was no fear.

As already stated, it was only on the 29th that the conditions became unfavourable, and at 9.40 a.m. a telegram was despatched announcing that the barometer was falling at an accelerating rate.

Other telegrams, despatched at 11 a.m., announced that the velocity of the wind was at the rate of 52 miles an hour in the squalls, and that probably it would not exceed 56 miles an hour.

Soon afterwards the telegraph wires were broken, and all communications ceased.

The barometer continuing to fall at an accelerating rate, and the mean direction of the wind being nearly constant, it was inferred that the centre of the depression would, contrary to long experience (the wind being from N.E.), pass over the island, and that the wind would then come from nearly the opposite direction.

The centre, however, did not pass over the Observatory, but over a point about 8 miles to the westward of it, and apparently from that point it travelled across the island on an east-south-easterly course.

As a rule, when the wind is from north-eastward, there is scarcely any danger of a hurricane in Mauritius. All our great hurricanes have commenced, not with a north-easterly, but with a south-easterly wind; and this is why, when the wind was from N.E. by E., at 11 a.m. yesterday, and the barometer at 29·338, it was considered probable that the velocity of the wind would not exceed 56 miles an hour. On the 12th of February last the barometer fell to 29·325, and the greatest velocity of the wind was 47·5 miles per hour from N.E., the barometer soon afterwards rising and the wind decreasing.

There are, apparently, only two ways of accounting in a measure for the passage of the centre of a hurricane over the island yesterday from west-north-westward to east-south-eastward. Firstly, the cyclone which had been travelling to the northward and north-westward of the island on a south-westerly course, from the 24th to

the 27th, recurved to the southward and south-eastward; or, secondly, a small secondary cyclone, which was generated in the S.E. quadrant of the larger cyclone, travelled to the east-south-eastward, and bore down on Mauritius. The latter is, perhaps, the more probable hypothesis; for the small but violent hurricane of yesterday, with respect to its extent, duration, &c., exhibited the characteristics of a local atmospheric disturbance.

On the night of the 27th and morning of the 28th there was a great deal of lightning and thunder, and also frequent lightning during the night of the 28th. But the hurricanes of Mauritius are seldom, if ever, immediately preceded by lightning and thunder.

It may be stated, also, that from the 25th to the 29th there were five or six groups of sun-spots, indicating a considerable increase of solar activity; and that from the 25th to the 28th there were large magnetic disturbances, the portion of the sun's disc on which there was a very large group of spots on the 12th of February being again on or near the sun's central meridian.

C. MELDRUM.

HURRICANES AND GALES IN APRIL.

Fifteen years ago I prepared a list of all the hurricanes and gales which, as far as could be ascertained, had been experienced in Mauritius from 1759 to 1877.

From that list, which is given in Kyshe's Almanack for 1878, it will be seen that the dates of all the known hurricanes and gales experienced in April, with the lowest barometric pressures, and the directions and maximum force of the wind, are as follows:—

Years.	Days of Month.	Lowest Barometer.	WIND.		Remarks.
			Direction.	Pres. in lbs. on sq. ft.	
1773	9th	inches. ?	?	?	Hurricane.
1814	19th	29·343	N.N.E.	?	Strong Gale.
1824	11th	29·138	S.E. by E. to N.E.	?	Hurricane.
1830	4th	29·485	?	?	Strong Gale.
1833	10th	29·547	S.	?	Do.
1834	30th	29·822	S.E. to E. & N.	?	Do.
1840	10th	28·965	S.E. to E. & N.W.	?	Hurricane.
1855	30th	29·921	E.S.E. to N.E.	17	No damage.
1856	3rd to 6th ..	29·631	S.E. to S. & S.W.	24	—
1866	13th to 19th...	29 825	S.E. to E.	13	—
1867	9th to 14th...	29 762	S.E. to S.	13	—
1870	4th to 8th ..	29·801	S.E. to N.E.	16	—

In all, there were, from 1759 to 1877, three hurricanes and nine gales in April.

The hurricanes occurred respectively on the 9th of April, 1773, the 11th of April, 1824, and the 10th of April, 1840.

The lowest barometric pressure in 1773 is not known, but in the two other hurricanes it was respectively 29·138 and 28·965 in.

From 1853 to 1867 the pressure of the wind was registered by an anemometer, and during that period the greatest pressure in April was 24 lbs. per square foot, on the 4th of April, 1856.

Since 1870 there has been no gale in April, the greatest velocity of the wind in that month having been only 31 miles an hour, on the 4th of April, 1877.

There have been gales in Mauritius even in May and June, but no hurricane. On the 7th of May, 1868, the barometer fell to 29·710 in., with the wind from S.E. to E., and the maximum pressure was 16 lbs. to the square foot. On the 21st of June, 1860, there was a pressure of 18 lbs., with the wind from S. But as far as is known there has never been a hurricane in Mauritius between the 12th of April and the 1st of December, till the 29th of April, 1892.

As to the other months of the year, the lowest readings of the barometer and the directions and force of the wind, in the severest of our hurricanes, were as follows :—

Years.	Month & Days.	Lowest Barometer.	WIND.	
			Direction.	Press. in lbs. on sq. ft.
		inches.		
1818	March 1 ...	28·000	S.S.E. to N.E. and N.W. ...	?
1819	Jan. 25 ...	28·782	S.S.E. to S.W. and W.	?
1824	Feb. 23 ...	28·161	S.E. to E.N.E. and N.W. ...	?
1828	March 6 ...	28·517	S.E. to E. and N.	?
1836	March 5 ...	28·114	S.E. to E. and N.W.	?
1848	March 8 ...	28 790	S.E. to E. and N.E.	?
1861	Feb. 16 ...	29·041	S.E. to E., N., and N.W....	45
1868	March 12 ...	28·813	S.E. to E., N., and W.	50
1874	March 27 ...	28 665	S.E. to E., N., and N.W. ...	36
1879	March 21 ...	29·032	S.E. to E., N., and N.W. ...	40

In all these, and other hurricanes, the wind began to increase from the south-eastward ; whereas in the hurricane of the 29th ultimo it began to increase from the north-eastward. The lowest barometric pressure was 28·000 in. on the 1st of March, 1818. But on the 29th of April last the barometer fell to 27·961 in. at sea-level, and the maximum pressure of the wind for five minutes was 73 lbs., corresponding to a velocity at the rate of 121 miles an hour.

There are only two instances on record of a cyclone having approached the island from the north-westward.

One of these cyclones occurred on January, 1863, and the other in January, 1868. In the former, the barometer fell to 29·231, and in the latter to 29·512 in., and very little damage was done.

In my last communication I gave the rates of the velocity of the wind per hour, as observed for intervals of from two to five minutes. Since that time the mean hourly velocities, as deduced from the anemogram, have been determined. From 10.30 to 11.30 a.m. (on

the 29th of April) the mean velocity for one hour was 50·6 miles. It then increased to 89 miles from 0.30 to 1.30 p.m. ; decreased to 65 miles from 1.30 to 2.30 p.m. ; increased to 103·3 miles from 3.30 to 4.30 p.m. ; and then decreased to 50 miles from 6.30 to 7.30 p.m.

A velocity of 103 miles represents a pressure of 53 lbs. on a square foot.

It has been reported that on the day of the hurricane, balls of fire (electricity) were seen in different parts of the island.

7th of May.

C. MELDRUM.

THE HURRICANE IN MAURITIUS.

The French mail steamer *Australien*, which arrived at Marseilles on Tuesday, brings detailed despatches from Port Louis regarding the terrible hurricane which devastated the island of Mauritius on the 29th of April. The total number of lives lost amounted to 1,200, while the list of persons injured exceeded 4,000. A correspondent who witnessed the hurricane sends to the *Standard* a description of his experiences. Owing to the stoppage of traffic on the railway by the storm, he was prevented from returning home from St. Louis, where he had been to attend to his business. He took shelter in the railway manager's room at the station :—

"It was here, from the upper verandah of the railway station, that I saw the formation of the destructive whirlwind that descended on the best parts of Port Louis. That town is, on the land side, surrounded by hills, the last of which is called the Signal Mountain, because from it the arrival of all ships, &c., is announced. My attention was arrested by what I saw going on about the top of the Signal Mountain. The whole sky was one mass of dark gray atmosphere without an apparent cloud ; but the air above the mountain was far denser and far darker than any cloud, and the upper part of this black matter was going for a little while in one direction, and the lower part in the opposite direction ; and then the whole seemed to coalesce and rush down the side of the mountain with the roar of cannon. This was the time, I doubt not, when our Astronomer Royal says that the wind was moving at the rate of 121 miles an hour. It seemed to me as if there was a zone, or belt, of the atmosphere to which this phenomenon, which I have just described, was confined, and that zone, or belt, continued for about half an hour to rush down the side of the Signal Mountain, and went onwards to the Champ Delort and Champ de Mars in its destructive course. I could not help exclaiming to myself audibly, 'God help those who are subjected to that wind !' Yes ! I saw it moving quickly down the hill, and going in the direction of that part of the town which was injured seriously, and carrying everything before it. We shall see what happened during the short time that the tornado, or typhoon, or blizzard, lasted.

"Soon shouts were heard of 'Come to the end of the verandah and see the hulls of ships on the land.' It was with difficulty that one was

able to stand up against the wind and walk even that short distance. But there in the dark light of that terrible day were to be seen what seemed the mere hulls of ships far up on the land—aye, upon land which is some twenty feet higher than the sea in the harbour. To be sure, subsequently, I found in the open space opposite the Quay, called the 'Chien de Plomb,' thirteen huge lighters, each forty-five to fifty feet in length, scattered all over the open space, and the thirteenth lay between the houses in Church Street, so high had the cyclone wave risen. But amidst the pelting storm one could only remain a minute or two, and soon I came back to the manager's private room for shelter, and then descended to the lower story, to hear what men were now going to do. The first news I heard was that the Church of the Immaculate Conception and the Convent de Bon Secours were down, and the fate of the orphan children in the latter sent a shudder through the crowd. To the other horrors was now added that of fire, for we plainly saw the sky illuminated just behind the barracks in a straight line further inland than the railway station. As soon as a house fell, it often happened fire broke out in the ruins, and no fewer than sixteen complete large houses blazed up and were consumed that afternoon and the following night in the midst of the roaring tempest."—*The Standard*.

THUNDERSTORMS OF MAY 31ST AND JUNE 1ST.

MAY 31ST.

GLOUCESTER.—At Blakeney rain fell in torrents, flooding the houses and streets, and the downpour was accompanied by vivid lightning and heavy thunder. This was followed by a tornado, which swept over the district, carrying before it timber, fruit trees, chimneys, lead and iron roofing, and a variety of movable property, including several beehives. Great consternation prevailed.

HEREFORD.—At Leominster, a double chimney attached to a house and shop at Providence Works was struck by lightning and burst open from the top to the bottom, both fires being extinguished. Mr. Wall and his two men who were at work at the forge had a narrow escape. At Messrs. Wilmot and Co.'s Brewery, opposite, three men who were in the engine-house were also struck by the lightning and dazed for a few minutes, but fortunately not seriously injured.

FALL OF A THUNDERBOLT AT HEREFORD.—What is thought to be a thunderbolt fell on Tuesday afternoon in the yard attached to the house of Mr. Griffiths in Bath-street. As the family were sitting down to dinner, the yard was suddenly brilliantly illuminated with a flash of bluish light, and immediately afterwards a deafening sound was heard. Around the spot where the "bolt" fell were found a large number of fragments of what seemed to have been the exterior of a ball, into the composition of which metallic substances entered, but its exact nature has not been ascertained. For some minutes after the explosion a strong sulphuric smell was perceptible.—*Hereford Times*.

Of course we could not accept this statement. We applied to Mr. Griffiths for a specimen. He most kindly sent us several, and they prove to be *scales of iron rust, probably from the gutter of the house*—one more proof of "*The non-existence of thunderbolts.*"

YORKSHIRE.—FARMHOUSE STRUCK IN HOLDERNESS.—During the very severe storms which prevailed on Tuesday afternoon, the farmhouse of Mr. William Care was struck by lightning and considerably damaged. The lightning entered the chimney, destroying the top of it, and entered the building by the roof. Several tiles were demolished. Passing through the bedroom, it entered a lower room in which Mr. and Mrs. Care and a child were sitting. The window of the room was smashed, and a large fissure made in one of the walls. Fortunately none of the inmates were injured, though a little child, who was in bed upstairs, was covered with the *debris* from the roof.

DURHAM.—During the afternoon George Walton, who was walking in a field at Shildon, near Bishop Auckland, was killed by lightning.

DARLINGTON.—About 3 p.m. Hermitage Hill, at Bank Top, was struck by the lightning, which entered the attic and melted a gas pipe, the gas from the fracture getting alight. The lightning also ran along the bell wires, and, descending the chimney, put out the kitchen fire. Fortunately the damage in the attic was discovered in time, and the fire, which had extended to some woodwork and paper, was got out before the brigade arrived.

NORTHUMBERLAND.—The thunderstorm at North Sunderland was very severe, beginning suddenly about 1 p.m., and continuing till about 6. A valuable mare was killed while being led home by Alexander Johnston, who was riding on another horse, which, with its rider, fortunately escaped unhurt. In a neighbouring field a sheep belonging to Messrs. Mole Bros. was killed. A house in the village occupied by Mrs. Ramsay, and another at Seahouses occupied by Mr. John Dawson, sen., fisherman, were struck and damaged. The storm exceeded in severity almost any in the remembrance of the older inhabitants of the village. Whittingham also was visited by the thunderstorm. It was of unexampled fury, accompanied by a tornado of wind, rain, and hail, which wrecked gardens, flooded houses, and did, it is feared, great damage to the newly-sown turnips in the fields. The hailstones measured 2 inches in circumference, and did terrible damage to vegetation. The roads are washed away in many places, the ordinary spouts, drains, and sewers being of no use whatever in carrying off the deluge of water. Six stacks on the farm of Lyham West Field, belonging to Mr. Thomas Turnbull, were also struck by lightning. A man standing at a distance saw a flash among the stacks, and immediately after smoke issuing from them. The Wooler fire engine was soon on the spot, but before any service could be rendered, five stacks had been destroyed.

CUMBERLAND.—About 5 p.m. a severe thunderstorm broke over the town of Penrith and the district. The lightning was very

brilliant, and followed, at the height of the storm, with heavy peals of thunder and a downpour of rain. One of the finest oaks in the neighbourhood, situated at the entrance to the green lane leading from Myers' Beck in the direction of Stainton, measuring 14 feet in circumference at the base, and proportionately high, was struck by the lightning, which cut it open in the centre down its whole length, and tearing a large piece from the heart of the tree (as much as four strong men could lift), threw it some distance on to the adjoining wall. Fragments of the riven wood were also scattered all around, some pieces being found as far away as forty yards.

DENBIGH.—About four p.m. a farmer's wife, named Susan Jones, was killed by lightning at Rhewl, Ruthin, Vale of Clwyd. The house was struck at the gable end, the chimney and roof being partly demolished. Deceased, while in the act of putting coal on the fire, was struck by the lightning, and found insensible with the coal bucket in her hand. She died in a short time.

BERWICK.—At night a severe thunderstorm visited Berwick and neighbourhood. The thunder was loud, and was accompanied by several flashes of vivid lightning. Much rain also fell. The weather recently has been very sultry. A valuable three-crop Border Leicester ewe and one of her twin lambs, belonging to Lord Polwarth's noted flock, were killed in one of the northern fields of the farm of Clinthill, on the Mertoun estate.

JUNE 1st.

GLOUCESTER.—The Bristol University College was on Wednesday struck by lightning, which completely demolished a large stone ornamental figure rising above the south wing of the building. A section, weighing two hundredweight, was dashed through the roof of the electrician's department, smashing the valuable apparatus. The other sections of the block fell outside the building, and one was carried into the grounds of the Blind Asylum.

STAFFORD.—During the thunderstorm, the lightning struck the house occupied by Captain Harrison, at Aldershaw, about two miles from Lichfield. About half-past two o'clock it was discovered that the rafters had taken fire, and a messenger was dispatched to Lichfield to summon the brigade, the servants in the meantime doing their utmost to prevent the fire from spreading. With as little delay as possible the brigade proceeded to the house, and after working for about half-an-hour, succeeded in putting out the flames. The damage done was fortunately very slight. At Walsall, on Wednesday afternoon, the lightning struck the steeple of the Board School, doing very considerable damage. The children were not permitted to attend school during the afternoon. A thunderstorm of exceptional violence passed over Darlaston. The lightning struck the gable-end of a house in Pinfold Alley and did a great deal of damage. Fortunately the inmates escaped injury. At West Bromwich, a stoker was struck by lightning and severely injured.

LINCOLN.—A MILL TOP BLOWN OFF.—A heavy storm raged at Lincoln on Wednesday morning. Vivid flashes of lightning and loud peals of thunder were accompanied by a heavy downpour of rain and a strong fitful wind. About half-past eight, a miller (W. Blanshard) was working at the mill at the top of Burton-road, when his attention was attracted by the sails taking a wrong turn, the wind having changed from east to west very suddenly. He ran up the steps to see to the matter when the top of the mill, with the four sails and crosses, was lifted off the building and blown to the ground. The miller had a miraculous escape. Singularly enough, no damage was done to the stabling and other out-buildings which surround the mill, for the *débris*, of which there was seven or eight tons, fell upon vacant land. It will cost £300 to repair.

EPWORTH.—On Wednesday morning a sharp storm of lightning and thunder, accompanied by rain and hail, passed over Epworth, lasting about half-an-hour. The storm was at its height about eight o'clock, when there was a vivid flash of lightning, immediately followed by a crashing peal of thunder. At that moment the house of Mr. C. Newton, plumber, near the old Wesleyan chapel, was struck by the lightning, causing damage to one end of the building. The lightning seems to have entered the chimney above the roof, throwing down the chimney pot and stripping off a large number of the tiles. It next passed into the attic and forced out the glass in a small window. Continuing its course, it passed to a bedroom immediately below the attic, stripping the paper and plaster off the walls and ceiling of one corner of the room, flinging the plaster all over the floor and bed, breaking glass in picture frames, scattering various articles about the room, which it filled with smoke and a smell of sulphur, and breaking eight panes in the window in its passage out, loosening the frame.

GAINSBOROUGH.—The signal box on the Great Northern Railway at Lea was struck, the instruments were damaged, and the lightning protectors fused. The discharge melted wires and set fire to wood in no fewer than five places.

RETFORD.—Portions of the wooden sheds, which are in course of erection in connection with the forthcoming Nott Agricultural Society's Show, were struck, and four of the workmen injured. At Rockley a servant was struck by lightning.

DERBY.—St. Werburgh's church, which is shortly to be rebuilt, was struck, and one of the pinnacles of the tower displaced.

CHESTER.—A heavy thunderstorm, accompanied by vivid flashes of lightning and a phenomenal downpour of hail, occurred. About two o'clock while the storm was at its height, Mr. Partington, resident engineer for the Salford Sewage Works, was walking along the banks of the Ship Canal, when he was struck by lightning and instantly killed. A companion with him was struck down, but beyond a shock was little the worse.

YORK.—Near Whitby a lad was killed by lightning as he was crossing the railway just outside a village.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, NOVEMBER, 1891.

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		
England, London	57·2	1	29·0	28	48·7	38·4	40·4	88	83·4	22·9	1·98	18	7·2
Malta.....	74·8	14	49·3	2	70·2	58·2	57·1	86	130·0	45·5	1·36	7	4·8
Cape of Good Hope ...	94·9	10	52·7	28	74·0	57·0	...	...	...	...	·24	2	5·6
Mauritius.....	83·0	30	66·2	13	80·5	70·0	65·1	73	136·2	55·2	1·47	11	5·4
Calcutta.....	86·8	2, 3	60·1	20	82·9	65·2	64·8	75	146·5	53·3	·51	1	2·2
Bombay.....	92·0	10	69·0	25	88·3	73·6	66·8	64	140·0	54·0	·00	0	1·1
Ceylon, Colombo ...	88·7	26	71·8	...	85·2	73·9	71·5	79	149·0	62·0	18·37	14	5·2
Melbourne.....	97·1	26	44·3	3	68·7	51·2	50·5	72	150·0	37·0	1·98	13	5·7
Adelaide.....	99·2	25	44·9	23	78·0	55·4	47·8	50	158·8	36·8	·84	7	4·3
Tasmania, Hobart.....	88·5	15	38·7	16	64·1	46·3	45·1	65	138·0	29·8	1·97	11	7·9
Wellington	75·0	28	39·8	13	63·9	50·2	51·2	81	135·0	29·0	2·50	19	4·4
Auckland	76·0	28 ^a	45·0	12	68·2	54·3	52·6	74	142·0	38·0	1·45	9	4·9
Jamaica, Kingston.....	89·9	9	66·9	29	84·1	69·3	70·0	77	...	...	3·95	...	...
Trinidad	91·5	8	68·0	29	88·3	71·5	72·3	80	...	63·5	6·66	17	...
Toronto	58·3	9	7·5	29	43·0	30·3	31·9	76	...	—0·5	3·55	19	7·8
New Brunswick, Fredericton	59·7	17	0·0	30	42·6	25·1	30·6	76	...	...	2·43	14	5·1
Manitoba, Winnipeg ...	57·6	6	—33·4	27	25·1	5·2	16·2	91	...	...	1·19	11	6·0
British Columbia, Esquimalt.....	57·6	2	31·3	14	49·4	41·9	45·0	95	...	...	7·22	24	8·3

^a And 29.

REMARKS.

MALTA.—Mean temp. 62°·6; mean hourly velocity of wind 7·6 miles. The sea temp. fell from 71°·0 to 67°·3. Thunderstorms on 3rd and 10th; lightning on 1st, 6th, 7th, and 8th. J. SCOLES.

Mauritius.—Mean temp. of air 0°·4 above, of dew point 0°·9 above, and rainfall ·48 in. below, their respective averages. Mean hourly velocity of wind 10·8 miles, or 0·1 below average; extremes, 34·0 on 12th and 1·7 on 25th; prevailing direction S.E. by E. to E. by N. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 4 days, and lightning was seen on 3 other days. J. C. H. CLARKE, Lt.-Col. R.E.

Melbourne.—Mean temp. of air 0°·5, amount of cloud 0·3, and rainfall ·63 in., below their respective averages; mean temp. of dew point 1°·9, and humidity 5, above their averages. Prevailing winds S. and S.W., strong on 5 days. Hot wind on 26th. Thunder on 1st, 10th, and 19th; lightning on 3rd, 23rd, and 26th; hail on 1st. Heavy dew on 8 days. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 0°·1 below, and rainfall ·18 in. below the average of 34 years. C. TODD, F.R.S.

Wellington.—Showery and rather damp during the early part of the month, although the rainfall was below the average. Prevailing winds N.W., strong or stormy on nine days. Cold weather about the middle of the month; fine and warm towards the end. H on 11th, and snow on the mountains. R. B. GORE.

Auckland.—An unusually fine and dry month. Mean temp. a degree above the average; rainfall barely one-half the average. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
MAY, 1892.

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

Div.	STATION.	Total Rain. in.	Div.	STATION.	Total Rain. in.
II.	Dorking, Abinger Hall.	1·37	XI.	Rhayader, Nantgwillt..	2·37
„	Birchington, Thor	·25	„	Corwen, Rhug	3·83
„	Brighton Prestonville Rd	1·47	„	Carnarvon, Cocksidia ...	3·18
„	Hailsham	·68	„	I. of Man, Douglas	3·89
„	Ryde, Thornbrough	1·05	XII.	Stoneykirk, Ardwell Ho.	4·82
„	Alton, Ashdell	·70	„	New Galloway, Glenlee	5·93
III.	Oxford, Magdalen Col...	1·19	„	Melrose, Abbey Gate...	3·39
„	Banbury, Bloxham	1·26	XIII.	N. Esk Res. [Penicuick]	3·25
„	Northampton, Sedgebrook	1·83	„	Edinburgh, Blacket Pl..	3·00
„	Cambridge, Fulbourne..	1·78	XIV.	Glasgow, Queen's Park.	4·09
„	Wisbech, Bank House..	1·56	XV.	Islay, Gruinart School..	5·60
IV.	Southend	·50	XVI.	Dollar	2·65
„	Harlow, Sheering	1·54	„	Balquhiddier, Stronvar..	5·69
„	Rendlesham Hall	·91	„	Coupar Angus Station..	2·92
„	Diss	1·90	„	Dunkeld, Inver Braan..	...
„	Swaffham	1·42	„	Dalnaspidal H.R.S. ...	5·38
V.	Salisbury, Alderbury...	1·00	XVII.	Keith H.R.S.	2·92
„	Bishop's Cannings	1·09	„	Forres H.R.S.	2·13
„	Blandford, Whatcombe.	1·01	XVIII.	Fearn, Lower Pitkerrie.	2·36
„	Ashburton, Holne Vic...	1·88	„	Loch Shiel, Glenaladale	8·45
„	Okehampton, Oaklands.	1·83	„	N. Uist. Loch Maddy ...	8·73
„	Hartland Abbey	1·51	„	Invergarry	4·70
„	Lynmouth, Glenthorne.	1·29	„	Aviemore H.R.S.	1·71
„	Probus, Lamellyn	1·37	„	Loch Ness, Drumnadrochit	2·65
„	Wincanton, Stowell Rec.	·53	XIX.	Lairg H.R.S. ....	...
„	Clevedon, Charleville ...	...	„	Scourie	3·02
VI.	Bristol, Clifton .....	...	„	Watten H.R.S.	2·12
„	Ross, The Graig	1·67	XX.	Dunmanway, Coolkelure	3·72
„	Wem, Clive Vicarage ...	2·99	„	Fermoy, Gas Works ...	2·71
„	Cheadle, The Heath Ho.	2·94	„	Killarney, Woodlawn ...	3·65
„	Worcester, Diglis Lock	1·93	„	Tipperary, Henry Street	2·85
„	Coventry, Coundon	1·70	„	Limerick, Kilcornan ...	3·36
VII.	Ketton Hall [Stamford]	1·75	„	Ennis	3·94
„	Grantham, Stainby	1·89	„	Miltown Malbay	4·13
„	Horncastle, Bucknall ...	2·10	XXI.	Gorey, Courtown House	2·51
„	Worksop, Hodsck Priory	2·58	„	Mullingar, Belvedere...	5·25
VIII.	Neston, Hinderton	2·53	„	Athlone, Twyford	5·18
„	Knutsford, Heathside...	2·92	„	Longford, Currygrane...	4·41
„	Lancaster	5·74	XXII.	Galway, Queen's Coll...	4·06
„	Broughton-in-Furness..	6·59	„	Crossmolina, Enniscoe..	5·30
IX.	Ripon, Mickley	2·80	„	Collooney, Markree Obs.	4·71
„	Scarborough, West Bank	3·21	„	Ballinamore, Lawderdale	5·49
„	East Layton [Darlington]	2·58	XXIII.	Lough Sheelin, Arley ..	5·78
„	Middleton, Mickleton..	4·96	„	Warrenpoint	4·59
X.	Haltwhistle, Unthank..	3·99	„	Seaforde	4·08
„	Bamburgh	2·57	„	Belfast, New Barnsley..	4·94
„	Newton Reigny	3·36	„	Bushmills, Dundarave...	4·02
XI.	Llanfrechfa Grange	2·22	„	Stewartstown	5·98
„	Llandovery	2·03	„	Buncrana	4·31
„	Castle Malgwyn	2·49	„	Lough Swilly, Carrablagh	6·09
„	Builth, Abergwessin Vic.	3·48			

MAY, 1892.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.						Days on which ·01 or more fell.	TEMPERATURE.				No. of Night below 32°		
		Total Fall.	Differ- ence from average 1880-9.	Greatest Fall in 24 hours		Max	Min.		In shade.	On grass.					
				Dpth	Date		Deg.				Date	Deg.			Date
inches.	inches.	in.			Deg.	Date	Deg.	Date							
I.	London (Camden Square) ...	1·51	—	·39	·74	25	11	82·2	28	28·4	7	1	8		
II.	Maidstone (Hunton Court)...	·43	—	·95	·17	25	6	...	...	...	...	...	...
III.	Strathfield Turgiss	1·13	—	·74	·38	25	13	80·1	31	25·1	8	4	7		
III.	Hitchin	1·66	—	·29	·54	25	11	80·0	31	28·0	6	2	...		
IV.	Winslow (Addington)	1·55	—	·55	·36	26	13	82·0	31	25·0	7	3	5		
IV.	Bury St. Edmunds (Westley)	1·84	+	·09	·83	25	13	74·0	28 _a	23·0	7	...	...
V.	Norwich (Cossey)	1·60	—	·07	·42	2	13	...	...	...	...	...	...
V.	Weymouth (Langton Herring)	·60	—	1·01	·18	26	9	71·0	11	34·0	1	0	...		
V.	Torquay, Babbacombe ...	·57	—	1·55	·28	27	10	69·0	13	33·0	1	0	5		
VI.	Bodmin (Fore Street)	2·04	—	·49	·51	27	17	...	...	...	...	...	...
VI.	Stroud (Upfield)	1·07	—	·97	·60	27	14	78·0	31	33·0	6	0	...		
VI.	Churchstretton (Woolstaston)	3·42	+	·55	1·68	27	13	73·5	31	30·5	6	1	7		
VII.	Tenbury (Orleton)	1·90	—	·65	·49	3	14	78·5	28	25·7	2	4	7		
VII.	Leicester (Barkby)	2·21	+	·24	·48	27	15	82·0	28 _b	25·0	5	3	11		
VII.	Boston	1·25	—	·47	·42	2	14	87·0	31	33·0	7	0	...		
VIII.	Hesley Hall [Tickhill]	2·43	+	·39	·58	3	15	77·0	31	28·0	1	3	...		
IX.	Manchester (Plymouth Grove)	3·33	+	·98	·80	27	20	80·0	31	31·0	6	2	6		
IX.	Wetherby (Ribston Hall) ...	2·93	+	·98	1·01	28	11	...	...	...	...	...	...
IX.	Skipton (Arncliffe)	6·72	+	3·00	·86	19	20	73·0	13	28·0	1, 2 _d	·5	...		
X.	Hull (Pearson Park) ...	3·59	+	1·71	·62	31	18	79·0	31	32·0	2, 7	2	5		
X.	Newcastle (Town Moor)	2·85	+	1·10	·62	26	19	...	...	...	...	...	...
XI.	Borrowdale (Seathwaite)	12·13	+	3·52	1·76	18	20	...	...	...	...	...	...
XI.	Cardiff (Ely)	1·50	—	1·35	·64	27	11	...	...	...	...	...	...
XI.	Haverfordwest	2·27	—	·09	·51	27	17	71·9	12	27·5	1	3	8		
XII.	Aberystwith, Gogerddan	2·16	—	...	·65	13	11	75·0	29	25·0	6	7	...		
XII.	Llandudno	2·46	+	·53	·53	26	18	72·0	28	34·8	5	0	...		
XII.	Cargen [Dumfries]	4·62	+	2·10	·69	22	20	69·6	12	27·8	6	2	...		
XIV.	Jedburgh (Sunnyside)	2·82	+	·92	·51	31	20	70·0	31	28·0	2	2	...		
XIV.	Old Cumnock	3·50	+	1·06	·60	22	17	...	...	...	...	...	...
XV.	Lochgilthead (Kilmory)	7·26	+	3·91	1·25	28	20	...	...	29·0	5	3	...
XV.	Oban (Craigvarren)	5·05	—	...	·68	13	16	64·6	10	32·0	6	1	...		
XV.	Mull (Quinish)	6·15	+	3·20	·84	23	20	...	...	...	...	...	...
XVI.	Loch Leven Sluices	3·60	+	1·04	·70	23	15	...	...	...	...	...	...
XVI.	Dundee (Eastern Necropolis)	2·70	+	1·04	·45	22	17	72·9	31	32·1	2	0	...		
XVII.	Braemar	2·16	—	·25	·39	25	18	64·3	31	27·0	2	7	20		
XVII.	Aberdeen (Cranford) ...	2·44	—	...	·38	22	21	67·0	21	29·0	6	2	...		
XVIII.	Strome Ferry	5·11	+	1·76	·65	13	21	...	...	...	...	...	...
XVIII.	Cawdor [Nairn]	2·40	+	·65	·35	20	21	...	...	...	...	...	...
XIX.	Dunrobin	3·35	+	1·25	·49	28	17	65·0	30	35·0	22	0	...		
XIX.	S. Ronaldsay (Roeberry)	3·68	+	1·96	·95	18	19	62·0	31	36·0	18	0	...		
XX.	Darrynane Abbey	2·78	—	...	·55	22	19	...	...	...	...	...	...
XX.	Waterford (Brook Lodge) ...	3·47	+	1·24	1·23	28	16	65·0	11	33·0	9	0	...		
XXI.	O'Briensbridge (Ross)	3·71	—	...	·59	12	19	72·0	c	32·0	5	1	...		
XXI.	Carlow (Browne's Hill)	4·30	+	1·96	1·24	28	19	...	...	...	...	...	...
XXI.	Dublin (Fitz William Square)	4·18	+	2·25	2·06	28	19	69·5	25	37·9	5	0	4		
XXII.	Ballinasloe	5·26	+	2·57	·69	28	20	67·0	11	35·0	5	0	...		
XXII.	Clifden (Kylemore)	6·41	—	...	·86	12	18	...	...	...	...	...	...
XXIII.	Waringstown	3·89	+	1·45	·56	28	20	74·0	10	31·0	10	2	...		
XXIII.	Londonderry (Creggan Res.) ..	4·64	+	2·12	·86	31	21	...	...	...	...	...	...
XXIII.	Omagh (Edenfel) .....	...	—	...	...	...	...	...	...	...	...	...	...

a And 31. b And 31. c Various. d And 7.

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

METEOROLOGICAL NOTES ON MAY, 1892.

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.

SIRATHFIELD TURGISS.—A changeable month; the early part dry, but very cold, especially about the 8th; the latter portion warm and showery; the end of the month very hot, with a TS on 31st.

HITCHIN.—The hottest May ever known.

ADDINGTON.—The early part of the month was cold, sharp frosts occurring on the 1st and 7th, and the latter doing much damage to the fruit crops. Distant T on 25th and 26th, with heavy showers of short duration; on 31st heavy TS after intense heat, the max. in shade rising to 82°, the highest temperature recorded here in May. The range of temp. during the month (57°) was exceptionally great.

BURY ST. EDMUNDS, WESTLEY.—Sharp frost on the 7th, but otherwise very little frost during the month. The last week was very hot, with a heavy TS on morning of the 26th and another on 27th.

LANGTON HERRING.—The fifth very dry month in succession, the deficit for the five months being 4·57 in., or more than 44 per cent., and making the driest five consecutive months since observations were commenced. From April 28th to May 23rd—25 days—only ·02 in. of R fell. In the last 8 days ·58 in. fell, which was most beneficial to the hay and other crops. The mean 9 a.m. temp. was 1° above the average of 20 years. Solar halos were seen on 22nd, 24th and 31st; T heard on 25th, 28th and 30th; fogs occurred on 15th and 29th.

TORQUAY, BABBACOMBE.—A warm, dry, generally fine month, with large daily range of temp., and very cold nights from 1st to 9th. Only ·07 in. of R fell on 3 days from April 29th to May 22nd. It was fine and sunny on the 1st, from 6th to 12th, and on the 19th; showery from 13th to 18th, and 23rd to 31st. Cold from 1st to 9th and on 15th. Warm from 10th to 14th (especially on 11th, 12th and 13th), and on 19th, 20th 21st, 23rd, 25th and 28th to 31st. The min. air temp. (33°·0 on 1st), and the total R (·57 in.) were lower than in any of the preceding 15 Mays. The total R (6·27 in.) and wet days (55) of the first 5 months of the year were the least registered in any corresponding period. Variable winds blew on 14 days; a W.S.W. gale blew on the 28th; slight TSS on the 27th and 31st; aurora borealis 10.30 to 11 p.m. on 18th; solar halos on 10 days; lunar halo on 12th; fog on 5 days.

BODMIN.—Dry to the 26th, and then splendid showers to the end of the month—fine for the country, which required R after the hot weather at the beginning of the month. Very sultry, with T, during the last three days.

STROUD, UPFIELD.—Heavy TSS on 27th and 31st; T and L on 24th and 30th; gale from S. on 28th.

WOOLSTASTON.—The early part of the month was very cold and dry: the latter part was warmer, with a fair amount of R. A very heavy fall (1·68 in.) occurred in the night of the 26th–27th, and a very severe storm of T and L on the 31st; mean temp. of month 52°·9.

TENBURY, ORLETON.—The first six days were cold, with rather sharp frosts, but the remainder of the month was fine and warm, the mean for the whole month being 1°·8 above the average. With the exception of a heavy fall of R on the 3rd, the first 25 days were very dry, but from the 26th to the end of the month there were rather heavy falls of R, with much T, on the 25th, 27th and 29th, and frequent L. Apple trees in full bloom by the 14th.

LEICESTER, BARKBY.—Warm days but cold nights during the first fortnight and some strong winds. T on the 24th and 31st. Great change and increase of temp. during the last fortnight. Hardly any plum blossom; all destroyed by severe frost on the 6th. Mean temp. of the month 54°·5.

ARNCLIFFE.—R fell chiefly in the last half of the month. Heavy TS on the 31st.

HULL, PEARSON PARK.—TSS occurred on the 19th, 25th, 28th and 31st. H on the 19th.

WALES.

HAVERFORDWEST.—One of the driest Mays in 43 years. Actual frost, and white frost, continued up to the 10th, the days being fine and bright. The grass lands looked very bare, due to the long prevalence of N. and E. winds, and the severe frosts which prevailed in March and April. Whitethorn in blossom on the 22nd. The air was particularly dry during the early part of the month, a difference of 10° or 12° being frequently observed between the wet and dry bulb thermometers.

SCOTLAND.

CARGEN.—The first 12 days were warm, with very cold nights, the daily range on several occasions being 30° to 36° . No rain fell during this period, which, in connection with the small R of April, was severely felt, everything suffering from want of moisture. From the 12th to the end of the month each day was wet, and vegetation made rapid progress. The ash tree is unusually backward in showing its leaves. T on 19th, 25th, and 30th.

JEDBURGH, SUNNYSIDE.—The first part of the month was cold and ungenial, the winds being mostly from the N.E., and vegetation was almost stationary; but R began on the 12th, and the face of the country changed rapidly, grass and cereals making great progress. T and L on 31st.

OBAN.—The early part of the month was warm and very fine, but from the 11th to the close it was unusually showery, which was, however, very beneficial to agricultural interests. The close of the month was, as usual, cold, and S fell on the higher hills.

MULL, QUINISH.—The wettest May on record for 25 years.

S. RONALDSAY, ROEBERRY.—The first part of the month was dry; the latter very wet. Heavy H showers on the 21st.

IRELAND.

DARRYNANE ABBEY.—A warm, fine month. Vegetation very rapid.

WATERFORD, BROOK LODGE.—Mean temp. $51^{\circ}\cdot 8$. A very backward spring.

O'BRIENSBRIDGE, ROSS.—Beautiful summer weather up to the 12th, after which useful R and rapid vegetation; rather an excess of R, accompanied by T and L and high winds from S.E. and S.W., in the last 8 days.

DUBLIN.—A generally favourable, though changeable month. At first dry, cold, and bright; afterwards warm but unsettled, with frequent showers or even heavy rains, and strong S.W. winds. After the 12th R fell almost daily. On the 28th an extraordinary downpour occurred, lasting 6 hours, within which time 1.90 in. of R fell, the fall for the 24 hours being 2.06 in., or nearly half the total for the month. Mean temp. ($53^{\circ}\cdot 6$) $1^{\circ}\cdot 6$ above the average. Solar halos were seen on the 17th, 24th, and 27th. High winds were noted on as many as 10 days, attaining the force of a gale on the 16th, when H fell.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCCXVIII.]

JULY, 1892.

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

GREAT RAINS ON JUNE 28TH.

NOTHING in rainfall work has been so difficult as to induce observers to believe in the possibility of five four, or even three inches of rain falling at their own station in the course of a few hours. Hardly a volume of *British Rainfall* has appeared without proofs of the occurrence of such falls, and on the other hand hardly a volume has been free from the record of some observer who, paying no heed to the warning, had allowed his gauge to run over. However, repetition if persisted in long enough prevails at last, and after urging the point for a quarter of a century, there are signs that it is beginning to be believed.

During June 28th and the early hours of the 29th, thunderstorms occurred generally over England, with the usual result of isolated heavy rains, houses flooded and drains burst, but with the unique result of not having, as far as we have at present heard, over-filled a single rain gauge. This is as it should be, and it is the best evidence possible that observers have begun to believe in heavy falls and have procured better patterns of rain gauge.

The falls on the 28th which exceeded two inches were :—

			in.
Kent	Riverhead Vic., Sevenoaks.....	Rev. J. M. B. Murdoch ..	2·38
„	Ash, Sevenoaks	C. J. G. Hulkes, Esq. ..	2·73
Suffolk	Rendlesham Hall, Woodbridge	Rt. Hon. Lord Rendlesham	3·08
Shropshire..	Burwarton	Rev. A. James	2·67
Stafford ...	Rodbaston, Penkridge	H. Ward, Esq.	4·04
„	Dunster, „	„ „	2·60
„	Hoar Cross, Burton	F. Lycett, Esq.	3·00
„	The Heath House, Cheadle... ..	J. C. Philips, Esq.....	2·15
„	Tean Vic., „	Rev. G. T. Ryves	2·02
Lincoln.....	Bucknall, Horncastle	W. Carter, Esq.....	2·27
„	Branston, Lincoln	A. S. Leslie Melville, Esq.	3·75
„	Hemingby, Horncastle.....	Rev. E. S. Bengough ..	2·54
Nottingham	Market Place, Mansfield	P. J. Shacklock, Esq.	2·85
Derby	Holmeside, Hazlewood, Derby...	C. H. B. Hambly, Esq. ...	3·33
„	Northfield, Belper.....	J. Hunter, Esq., C.E.	3·53
Lancashire	Hope Street, Liverpool.....	G. Jevons, Esq.....	2·46
York, W.R.	Tylecote, Ranmoor, Sheffield...	J. Dixon, Esq.	2·27
Cardigan ...	Gogerddan, Aberystwith	Sir Pryce Pryce, Bt.	2·12

THEOPHRASTUS ON WIND AND WEATHER.

PROBABLY few of our readers are aware that the Greek Philosopher Theophrastus, the pupil, disciple and successor of Aristotle, wrote two books of which nearly perfect copies have come down to the present date. One was *De Ventis* (On the winds), and the other *De signis pluviarum*, &c., (On the signs of rain). Theophrastus lived at Eresium in Lesbos, between B.C. 371 and B.C. 287, or more than two thousand years ago. His works have been translated from the original Greek into Latin, and one edition was published at Leipzig in 1818. It seems to us most desirable that these comparatively short works—about 25 pages of this magazine—should be translated into English so as to be generally accessible.

Is it too much to hope that some reader of these pages may volunteer to prepare the translation? If so, we will arrange for its being printed and published.

 THUNDERSTORM AND CLOUD BURST NEAR DRIFFIELD,
JULY 3RD.

AT Driffield, upon the stroke of 6 o'clock on Sunday night, appearances in the sky presaged a storm; the clouds gathered, thunder was heard in the distance, a few drops of rain fell. The sky grew darker and darker, and at 6.30 the distant rumble of thunder began to be accompanied by vivid flashes of lightning; the electric fluid continued to play over the town, lighting up the churches and chapels with its flare—principally of forked lightning—and causing intense alarm amongst the worshippers at the Parish Church, some of whom, thinking that the building might be struck, hurried out. The sky, we think, never looked so dark, except at the approach of midnight. The storm at last broke with great fury; lightning and thunder in quick succession, being accompanied by torrential rains, which rapidly filled up gulleys and drains, flowed in rapid streams along the streets, and formed into pools at every crossing where the water had not an easy flow. Such a storm has not been witnessed by the oldest inhabitant; and people who are usually alarmed by an ordinary thunderstorm, were at their wits' end on Sunday night.

Mr. Wood, of Kendale, states that he and Mr. Highmoor were at the house of the former, when, at about 8.15, their attention was called to a rush of water coming down from the direction of Mrs. Kirby's, Elmswell Wold, at a terrific rate, and with a sound like the roaring of the sea. They went at once down to the bottom of the Kendale Bushes, and seeing the alarming state of affairs rushed down to Driffield to give notice to the inhabitants at North End, who were somewhat loth to believe them, but they soon began to realise that something was wrong, and at once made efforts to save themselves. Mr. Wood says that the water came down in a sheet about 100 yards wide and 3 feet high, carrying with it hedges, hay,

and anything that came in its mad career. He estimates the damage done to his own property at about £200, there being 20 acres of fine wheat entirely destroyed, besides a quantity of barley and turnips.

Mr. Chas. Cooper, the keeper of the waterworks, states that his attention was called by Mr. Kirby to a rumbling resembling an earthquake, and very soon he observed the water streaming along over the hills into the valleys. He was one of the first to give the alarm to the inhabitants of North End, but was laughed at for his pains, and it was only on the appearance of Mr. Highmoor and Mr. Wood, and the rushing of the water, that they made efforts to make their escape. One man had got so far into the water that it was only on another man, named Friday Hodgson, wading in to him that he was rescued.

Two cottages at North End, which are known as the Parish Houses, served as a sluice for the stream, and it rushed from front to back and out into the stream beyond with great force. A little further down, there is an ancient house, which has been termed (facetiously) "Hawarden Castle," and is tenanted by an aged couple named Wauldby, who were roused out of their sleep by the crowd. Their little castle was surrounded by a deep flood. In this and other houses this morning are deposits of mud several inches in depth. The bridge at the North-end withstood the storm pretty well, but that in Bridge-street was damaged, the masonry on the south side being overturned into the stream, and the ironwork along with it. The next road-bridge, that in Exchange-street, came in for most damage; the brickwork parapet on the north side was washed away, the footpath destroyed, and a hole made in the roadway, extending half across the street, which has been temporarily blocked, except for foot passengers.

The roadway at North End was impassable for a distance of more than a hundred yards. In the neighbourhood of Brook Street, the inhabitants of Brook Cottages, close by the west bank of the beck, are said to have shouted for help from the windows, fearing that the flood would drown them, and here, as at North End, men carried on their backs women and children out of the houses. The flooding extended as far as the River Head, where the beck empties itself into the Driffeld Canal. The Blue Bell Inn, the premises of which are adjacent to the bridge at the canal basin was inundated. The locks of the canal were opened to permit the gathering volume of water to pass away, and the sluice board also near the filtration area was lifted to relieve the rapidly rising canal.

Great damage has been done at the brewery of Mr. Holtby, in Eastgate, the storeroom of which became flooded to a depth of 4 feet, and a large number of newly-filled barrels of ale were set afloat. A whole brewing of beer was thus destroyed.

The Albion Mills—also owned by Mr. Holtby—and one portion of which is worked by water, were flooded, and the volume of water which gathered in the mill dam caused an overflow into Manor

House garden, and a wall, three bricks thick, was knocked down to liberate the water, and to save the mill building from destruction.

The newly-laid-out grounds of Mr. Harrison Holt, at Highfield (north of the town) are situated on both sides of the beck, and here, amongst other improvements carried out by the owner, is that of the widening of the stream; and fortunately this arrangement counteracted the force of the current. Last night the report was abroad that the huge blocks of masonry, some weighing two tons apiece, which have been formed into an artificial waterfall, had been washed down the stream; but this on examination at daylight proved to be a bit of that fiction which is generally due to an excited state of the mind on such exceptional occasions. We are glad to say that the waterfall is intact, and that the damage done on Mr. Holt's estate is comparatively trifling in view of the tremendous volume of water which had to pass through his grounds. The fish-pond has suffered a good deal, and this morning the large area of water has the appearance of a mass of mud, with which is intermingled branches of quickwood, shrubs, and grass. A wooden fence which stretched across the stream facing the North-end bridge was washed down, and hurled against the arch of the bridge.

The flood is supposed to have been caused by the bursting of a water-spout somewhere about Sledmere, and to have taken two courses, one by Weaverthorpe, Foxholes, Wold Newton, North Burton, and Grindale, and the other passing down by way of Cowlam, Cottam, and Driffield, where in its course it swept over hedges to the height of over five feet and at a width of some hundred yards. What is known as "Mossy Brow," in Low Peter Lane, at Kendale, was more like a lake than a field, and in some places on the route the water was up to the nave of the wheels of the trap. In Mrs. Kirby's field at the bottom of Elmswell Wold the flood came across some turnip fields, and washing a quantity of them up, deposited them far away from their original bed.

Mr. Robson, of the Wold, describes the water as rushing down Cowlam Bottom like a cataract, at the rate of twenty to thirty miles an hour, coursing over hedges fully five feet high.

At Langtoft, about five miles north of Driffield, great destruction was wrought, about 40 out of its 140 houses being damaged, some very seriously. The rain began about 7 p.m., when most of the villagers were at church or chapel, and the actual site of the descent of the waterspout has been found on a place called Round Hill--the spot on which a spout burst about four years since. The force of the water is traceable on a seeds-field, from which many tons of chalk and stone have been swept into the valley beneath, and immense holes have been made into the chalk. From this point the rain seems to have swept over the village in a northerly and westerly direction, the combined torrents meeting at the bottom of the hill near Mr. Stork's house, rose to a height of nearly 9 feet, and then rushed on, carrying all before them. Doors were burst open,

furniture was swept out of the ground floor rooms, many of which had four and some five feet of muddy water in them. In one house the water reached the bedroom floor, and eventually the whole front of the house was carried away. In another case a woman and child could be rescued only by breaking a hole through the roof. A threshing machine, weighing five tons, is said to have been carried 40 feet.

At Lowthorpe the streams have risen to an extent never before known, but no damage has been done.

THE DRY SPRING.

To the Editor of the Meteorological Magazine.

SIR,—As Mr. Scott has sent you the rainfall at Muswell Hill and Etchingham Park for the first four months of the year, I send you mine for comparison. We are about one and half miles from Muswell Hill, and our elevation above sea level is 300 feet.

It will be noticed that my total rainfall varies from the Muswell Hill record by only '01 in.

Yours faithfully,

B. C. WAINWRIGHT. F.R.Met.Soc.

Rainfall at East Finchley.

Month. 1892.	Amount of rain. inches.	No. of days on which rain fell.
January.....	.74	13
February	1.35	18
March.....	1.21	8
April	1.04	9
	<hr/> 4.34	<hr/> 48

Elmhurst, East Finchley, 21st May, 1892.

To the Editor of the Meteorological Magazine.

SIR,—You will doubtless have several communications from your numerous correspondents as to the drought which seems to be now prevailing all over England, but perhaps a note of its extent and effects here may be of interest.

The rainfall this year has been as follows :—

	inches.
January	1.55
February	1.81
March	0.86
April	0.88
May	1.02

Total fall 6.12

This is little more than half the average fall, and 2.41 inches less

than even in the corresponding dry period of 1891. Were it not that at the end of last year we had had an excess of nearly five inches over the average, which all fell in the second half of the year, such a drought as we are now experiencing would be even more severely felt than it is. But even so, its effect on all young plants is very marked. Combined with the severe cold at Easter and subsequent parching winds and frosty nights the drought has (to use a local expression) played the bear with hardly annual seedlings, while evergreens have a truly miserable appearance. The destruction too among sweet herbs and the cabbage tribe has been very great. Truly the life of a gardener under such conditions of climate as we have lately experienced is not a happy one.

Yours faithfully,

M. LUEWELLYN EVANS.

Cheltenham, May, 19th, 1892.

To the Editor of the Meteorological Magazine.

SIR,—The record of our rainfall for the current year, January to May inclusive, has been so remarkable, that I send you a copy of my usual report to the local papers.—Yours faithfully,

R. LITTLEBOY.

Newport Pagnell, Bucks.

Rainfall, May, 1892, 0·97 in.

Average of ten years 2·19 in.

The five months, January to May inclusive, show a remarkable deficiency of rainfall.

The amount for the five months has been 4·65 inches only.

The average for ten years being 8·12 inches.

During the month of May the highest record was 0·23 on the 3rd.

At Newport Pagnell we have escaped the thunder storms which have been prevalent throughout the country.

R. LITTLEBOY.

Newport Pagnell, June, 3rd, 1892.

SPRING FROSTS IN 1892.

To the Editor of the Meteorological Magazine.

SIR,—Our minimum thermometer here fell last night to 28°. Many of our potato tops are cut and turned black, and all the upper leaves and bines of the kidney beans and scarlet runners are killed so that they will have to put out again from nearly the bottom. I do not remember so severe a frost within a week of the longest day. I think that the coldest part of the night was about midnight, when it was clear with north wind.

JOHN GULSON.

The Spring, Stoke, near Coventry, 15th, June, 189

To the Editor of the Meteorological Magazine.

SIR,—The variation in temperature during the past eight days has been so remarkable that I send you my readings. The max. on the 9th was higher than that of any day during the last two years. On the 12th there was a great fall, and the min. on stand was the lowest recorded in June since June 9th, 1881. On the 14th the min. was somewhat higher, but on the 15th both that on the stand and on the grass were the lowest registered in June during the past fifteen years, and considerable damage has been done in exposed gardens to all tender plants.

		Max.		Min.		Mean.		Grass.
June	8.....	75·7	.....	45·5	.....	60·6	.....	41·0
	„ 9.....	79·8	.....	44·8	.....	62·3	.....	43·5
	„ 10.....	79·0	.....	51·4	.....	65·2	.....	47·0
	„ 11.....	67·0	.....	52·0	.....	59·5	.....	47·5
	„ 12.....	59·8	.....	46·8	.....	53·3	.....	41·0
	„ 13.....	58·0	.....	32·6	.....	45·3	.....	27·5
	„ 14.....	57·5	.....	41·2	.....	49·3	.....	33·0
	„ 15.....	64·2	.....	31·4	.....	47·8	.....	27·0

Faithfully yours,
RICHARD TYRER.

Cheltenham, June 15th, 1892.

To the Editor of the Meteorological Magazine.

SIR,—Surely there must be some reason for this great wave of cold which is passing over us. I do not remember seeing so much lamage done by frost so late in June, with vegetation in such an advanced state; thermometer in shade 32°, and on grass 28°.

Some things are injured past recovery, such as dahlias, which are a foot high, cut to the ground; vegetable marrows, French beans, and potatoes blackened; begonias, heliotrope, marigolds, and of hardier things, a fine specimen of *Magnolia Cordata*, 30 feet high, black from top to bottom; nettles, docks, digitalis, all hanging their heads. You will imagine what a sorry sight it is. No doubt the great heat of last week would tend to make things rather more susceptible to cold. I hope that everybody has not suffered so much. I dare say you will hear enough about it.

I am, Sir, yours truly,
JOHN MATHISON.

Addington, June 15th, 1892.

To the Editor of the Meteorological Magazine.

SIR,—Thinking that the number of frosts during this first half of 1892 has been quite unusually great, I enclose tables showing the number and, to some extent also, the severity of the frosts.

My instruments are *not* standard ones, and my screen is *not* a “Stevenson;” but the thermometers are carefully watched, and

there is no condensed spirit at the top of the tube. I do not, except in rare cases, attempt to read nearer than to half a degree.

My grass thermometer is placed every night by a stick near the middle of my lawn, which has a dry subsoil, a fair number of trees round about, and is well above the little valley at the end of my garden.

Here, then, in the first 134 days of the year 1892, there were but 27 minima above 32° on the grass—*i.e.*, there were 107 ground frosts; and in the Nene Valley, three miles to the north, no doubt upwards of 110!

The autumn and the spring were in very marked contrast. The 73 days, beginning October 5th and ending December 16th, yielded 10.51 in. of rain, while the frosts were few and slight. The 149 days, beginning with December 17th and ending May 13th, yielded only 5.66 of rain, and gave in shelter as many as 86 frosts, and on the grass, 120!!

Low as my reckoning of the rain is (1.13 per month), it is higher than that of my neighbours at Castle Ashby and Earl's Barton, and this because I have estimated the snowfall more highly than they.

I write this letter hoping to elicit from some of your correspondents the greatest number of ground frosts which has been noted in the first half of any previous year.

Cold as the first half of 1891 was, it gave not more than 104 ground frosts, with same instrument in the same place.—Yours truly,

H. A. BOYS.

Easton Mauduit Vicarage, Northampton. May 27th, 1892.

Table showing Minimum Temperatures on the Grass at Easton Mauduit Vicarage, near Northampton, during the 149 days from Dec. 17th, 1891, to May 13th, 1892, inclusive.

Number of Minima between			Dec. 17—31.	Jan.	Feb.	March.	April.	May 1—13.	Total.
49.9 and 45	...	...	1	...	...	...	1	...	2
44.9 „ 40	...	...	...	2	1	1	1	2	7
39.5 „ 35	...	...	...	1	4	2	3	3	13
34.9 „ 32.1	...	...	1	2	1	1	2	...	7
32 „ 30	...	...	2	4	6	3	4	3	22
29.9 „ 25	...	...	2	7	10	6	7	2	34
24.9 „ 20	...	...	...	6	2	6	5	3	22
19.9 „ 15	...	...	4	4	3	12	7	...	30
14.9 „ 10	...	...	4	2	...	...	...	...	6
9.9 „ 5	...	...	1	3	...	...	...	...	4
4.9 „ 2	...	...	...	...	...	...	...	...	...
1.9 „ -1	...	...	...	...	2	...	...	...	2
			15	31	29	31	30	13	149

Table showing Minimum Temperatures under Shelter at Easton Mauduit Vicarage, near Northampton, during the 149 days from Dec. 17th, 1891, to May 13th, 1892, inclusive.

Number of Minima between		Dec. 17—31.	Jan.	Feb.	March.	April.	May 1—13.	Total.
49° 9 and 45°	...	1	...	...	...	2	...	3
44° 9 „ 40	...	...	3	4	2	2	3	14
39° 9 „ 35	...	1	4	6	2	7	6	26
34° 9 „ 32° 1	...	2	3	9	2	3	1	20
32 „ 30	...	1	4	2	2	1	1	11
29° 9 „ 25	...	2	7	4	13	14	2	42
24° 9 „ 20	...	1	5	1	10	1	...	18
19° 9 „ 15	...	4	1	1	...	...	...	6
14° 9 „ 10	...	3	3	...	...	...	...	6
9° 9 „ 5	...	...	1	2	...	...	...	3
		15	31	29	31	30	13	149

ROYAL METEOROLOGICAL SOCIETY.

The usual monthly meeting of this Society was held on Wednesday evening, May 18th, at the Institution of Civil Engineers, 25, Great George Street, S.W.; Dr. C. Theodore Williams, M.A., President, in the Chair.

Mr. B. E. C. Chambers, Mr. R. Law, F.C.S., Dr. W. A. Sturge and Dr. E. Symes Thompson, were elected Fellows of the Society. Five Honorary Members also were elected, viz.:—Mons. A. D'Abbadie, Dr. W. H. von Bezold, Dr. R. Billwiller, Mons. N. Ekholm, and Prof. P. Tacchini.

The following papers were read:—

“Raindrops,” by Mr. E. J. Lowe, F.R.S., F.R.Met.Soc. The author has made over three hundred sketches of raindrops, and has gathered some interesting facts respecting their variation in size, form, and distribution. Sheets of slate in a book form, which could be instantly closed were employed; these were ruled in inch squares, and after exposure the drops were copied on sheets of paper ruled like the slates. The size of the drop, as spread on the slate, ranges from an almost invisible point to a diameter of two inches. Besides the ordinary raindrops, the author exhibited diagrams, showing the drops produced by a mist floating along the ground, and also the manner in which snowflakes, on melting, wet the slates.

“Results of a Comparison of Richards' Anémo-Cinémographe with the Standard Beckley Anemograph at the Kew Observatory,” by Mr. G. M. Whipple, B.Sc., F.R.Met.Soc. This instrument is a windmill vane anemometer, and is formed by six small wings or vanes of aluminium, four inches in diameter, inclined at 45°, rivetted on very

light steel arms, the diameter of which is so calculated that the vane should make exactly one turn for each metre of wind. Its running is always verified before leaving the factory, by means of a whirling frame, fitted up in an experimental room where the air is absolutely calm, and, if necessary, a table of corrections is supplied. The recording part of the apparatus differs entirely from any other anemometer, and is called the *Anémo-Cinémographe*, and in principle is as follows:—The pen, recording on a moving paper, is wound upwards at a constant rate by means of a conical pendulum acting as a train of wheel links, whilst a second train, driven by the fan, is always tending to force it down to the lower edge of the paper, its position, therefore, is governed by the relative difference in the velocity of the two trains of wheel-work, being at zero when the air is calm, but at other times it records the rate of the fan in metres per second. The author has made a comparison of this instrument with the Standard Anemometer at the Kew Observatory, and finds that it gives exceedingly good results.

“Levels of the River Vaal at Kimberley, South Africa, with remarks on the Rainfall of the Watershed,” by Mr. W. B. Tripp, M.Inst.C.E., F.R.Met.Soc. Measurements of the height of the River Vaal have for several years past been made at the Kimberley Waterworks, under the direction of Mr. R. H. Twigg, M.Inst.C.E., F.R.Met.Soc. These gaugings having been placed at the disposal of the Society, Mr. Tripp has compared them with the rainfall of the watershed. There is a marked period of floods and fluctuations at a comparatively high level from about the end of October to the latter part of April, and a period of quiescence, during which the river steadily falls with very slight fluctuations from the middle of April to the end of October. The highest flood, 52·5 feet, occurred in 1880, the next highest being 50·3 feet on January 24th, 1891.

The last meeting of this Society for the session was held on June 15th. Dr. C. Theodore Williams, President, in the chair.

Mr. T. W. Backhouse, F.R.A.S., Lieut. H. M. Lambert, R.N.R., and Mr. W. Topley, F.R.S., were elected Fellows of the Society.

The following papers were read:—

“English Climatology, 1881—1890,” by Mr. F. C. Bayard, F.R.Met.Soc. This is a discussion of the results of the Climatological observations, made at the Society's stations, and printed in the *Meteorological Record* for the ten years 1881—1890. The instruments at these stations have all been verified, and are mostly exposed under similar conditions, the thermometers being mounted in a Stevenson screen, with their bulbs 4 feet above the ground. The stations are regularly inspected and the instruments tested by the Assistant-Secretary. The stations now number about 80, but there were only 52 which had complete results for the ten years in question. The

author has discussed the results from these stations, and given the monthly and yearly means of temperature, humidity, cloud and rainfall. His general conclusions are:—(1.) With respect to mean temperature the sea-coast stations are warm in winter and cool in summer, whilst the inland stations are cold in winter and hot in summer. (2.) At all stations the maximum temperature occurs in July or August, and at nearly all the minimum in December or January. (3.) Relative humidity is lowest at the sea-coast stations and highest at the inland ones. (4.) The south-western district seems the most cloudy in winter, spring and autumn, and the southern district the least cloudy in the summer months, and the sea-coast stations are, as a rule, less cloudy than the inland ones. (5.) Rainfall is smallest in April, and, as a rule, greatest in November, and it increases from east to west.

“The Mean Temperature of the Air on each day of the year at the Royal Observatory, Greenwich, on the average of the fifty years, 1841 to 1890,” by Mr. W. Ellis, F.R.A.S. The values given in this paper are derived from eye-observations from 1841 to 1848, and from the photographic records from 1849 to 1890. The mean annual temperature is $49^{\circ}5$. The lowest mean daily temperature, $37^{\circ}2$, occurs on January 12th, and the highest mean daily temperature, $63^{\circ}8$, on July 15th. The average temperature of the year is reached in spring, on May 2nd, and in autumn on October 18th. The interval during which the temperature is above the average is 169 days, the interval during which it is below it being 196 days.

SPURIOUS METEOROLOGICAL INSTRUMENTS.

WHATEVER may be the practice of other journals, we hope that we shall never let the *Meteorological Magazine* take to the profitable but disreputable practice of paid puffing. Many persons may consider it beyond our province if we put a line in these pages which can be construed into an advertisement, but it has been brought to our notice that instruments much resembling *in appearance* Richard's Barographs and Thermographs are being sold in this country, which instruments were not made by MM. Richard.

Original inventors and manufacturers have obviously the best means for, and the greatest interest in, turning out high-class work. We express no opinion as to the action of those who imitate, or those who sell imitations; but we probably sufficiently intimate it by having applied to MM. Richard for the copy of their trade mark, which is upon all genuine instruments. *Verb. sap.*



CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, DECEMBER, 1891.

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.	Cloud.
	Temp.	Date.	Temp.	Date.									
°		°		°	°	°	0-100	°	°	inches			
England, London	57·2	5	16·8	22	46·3	35·3	37·7	88	71·1	12·6	3·24	18	6·8
Malta.....	69·1	1	40·3	21	62·6	53·8	49·9	78	116·8	33·3	3·40	11	5·6
Cape of Good Hope ...	85·3	24	51·7	6	75·0	57·4	...	...	...	...	·78	2	4·1
Mauritius.....	85·7	26	68·2	30	82·7	72·0	68·2	76	137·7	59·4	3·68	16	5·9
Calcutta.....	80·9	18	50·7	31	78·1	56·6	55·4	69	138·5	41·7	·00	0	1·2
Bombay.....	89·4	14	67·0	16b	86·8	70·5	63·0	61	132·0	53·0	·00	0	0·7
Ceylon, Colombo	88·7	28	66·8	23	85·6	73·8	71·7	80	153·0	61·0	7·66	22	6·4
Melbourne.....	101·2	22	44·9	26	72·8	51·9	51·0	67	153·6	34·7	2·06	8	5·8
Adelaide	99·2	4	48·8	6	80·1	56·8	47·2	47	165·0	38·2	1·84	7	3·2
Tasmania, Hobart.....	84·0	22	45·2	2	68·7	51·2	49·4	69	142·0	35·0	4·04	18	7·9
Wellington	75·0	13a	46·0	2c	71·4	54·6	55·6	77	140·0	35·0	·94	5	3·3
Auckland	80·0	10	55·0	2	74·7	59·3	59·2	76	143·0	51·0	·94	4	4·0
Jamaica, Kingston.....	89·3	14	63·9	24	87·1	69·4	66·3	71	...	...	·23	...	...
Trinidad	89·5	1	66·0	25d	85·5	70·3	70·2	81	152·0	54·0	4·09	13	...
Toronto	49·1	4	3·4	17	40·0	27·0	27·1	75	...	...	2·88	14	6·0
New Brunswick, Fredericton	49·8	23	0·5	17	36·4	19·2	23·2	78	...	...	7·20	11	6·1
Manitoba, Winnipeg ...	40·0	8	30·3	26	20·1	1·5	14·7	96	...	...	·75	13	5·9
British Columbia, Esquimalt	58·0	16	28·4	24	44·6	35·4	39·8	97	...	...	12·58	25	7·4

a And 15, 16. b And 17, 31. c And 28. d And 26, 27.

REMARKS.

MALTA.—Mean temp. 57°·4. Mean hourly velocity of wind 12·4 miles. The sea temp. fell from 67°·3 to 61°·5. L on 1st; H on 19th. J. SCOLES.

Mauritius.—Mean temp. of air 0°·3 below, of dew point 0°·3 above, and rainfall 1·53 in. below, their respective averages. Mean hourly velocity of wind 8·6 miles, or 2·5 miles below the average; extremes, 17·7 miles on 1st and 1·7 on 13th; prevailing direction E.S.E. to E. by N. L on 9th, 29th and 31st; T on 14th and 27th; T and L on 13th, 26th and 28th. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 7th, 9th and 10th.

J. C. H. CLARKE, Lt.-Col. R.E.

Melbourne.—Mean temp. of air 1°·2, and rainfall ·38 in., below their respective averages; mean temp. of dew point 0°·3, humidity 2, and amount of cloud 0·2, above their averages. Prevailing winds S.W. and S., strong on 9 days. Heavy dew on 6 days. L on 5th and 9th; T and L on 12th and 13th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 2°·8 below, and rainfall 1·03 in. above, the average of 34 years. C. TODD, F.R.S.

Wellington.—Very fine bright weather in the early part of the month, with light winds from S. and S.E. Slight showers occurred in the latter part, and the wind was generally strong from N.W. Mean temp. 2°·2 above, and rainfall 3·00 in. below, the average. R. B. GORE.

Auckland.—An unusually dry and warm month, the rainfall being only one-third of the average, and the mean temp. 3°·0 in excess. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL, JUNE, 1892.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	2.56	XI.	Rhayader, Nantgwillt..	2.45
„	Birchington, Thor ..	2.75	„	Corwen, Rhug	2.42
„	Brighton Prestonville Rd	2.07	„	Carnarvon, Cocksidia ..	2.27
„	Hailsham	2.70	„	I. of Man, Douglas	2.88
„	Ryde, Thornbrough	1.80	XII.	Stoneykirk, Ardwell Ho.	3.11
„	Alton, Ashdell	1.60	„	New Galloway, Glenlee	4.26
III.	Oxford, Magdalen Col...	1.66	„	Melrose, Abbey Gate ...	3.98
„	Banbury, Bloxham	1.98	XIII.	N. Esk Res. [Penicuik]	3.25
„	Northampton, Sedgebrook	1.79	„	Edinburgh, Blacket Pl.	3.14
„	Cambridge, Fulbourne..	4.41	XIV.	Glasgow, Queen's Park.	3.66
„	Wisbech, Bank House..	2.04	XV.	Islay, Gruinart School..	4.56
IV.	Southend	3.31	XVI.	Dollar	4.04
„	Harlow, Sheering	2.95	„	Balquhidder, Stronvar..	5.05
„	Rendlesham Hall	5.32	„	Coupar Angus Station..	2.46
„	Diss	3.18	„	Dunkeld, Inver Braan..	3.74
„	Swaffham	2.59	„	Dalnaspidal H.R.S.	4.80
V.	Salisbury, Alderbury ...	1.05	XVII.	Keith H.R.S.	2.51
„	Bishop's Cannings	1.72	„	Forres H.R.S.	1.18
„	Blandford, Whatcombe ..	1.50	XVIII.	Fearn, Lower Pitkerrie.	1.71
„	Ashburton, Holne Vic. ...	2.78	„	Loch Shiel, Glenaladale	...
„	Okehampton, Oaklands.	2.08	„	N. Uist, Loch Maddy ...	3.98
„	Hartland Abbey	2.27	„	Invergarry	3.10
„	Lynmouth, Glenthorne.	2.26	„	Aviemore H.R.S.	1.73
„	Probus, Lamellyn	1.96	„	Loch Ness, Drumnadrochit	2.46
„	Wincanton, Stowell Rec.	1.79	XIX.	Lairg H.R.S. ....	...
„	Clevedon, Charleville ...	...	„	Scourie .....	...
VI.	Bristol, Clifton .....	...	„	Watten H.R.S.	2.35
„	Ross, The Graig	1.91	XX.	Dunmanway, Coolkelure	...
„	Wem, Clive Vicarage ...	2.30	„	Fermoy, Gas Works ...	1.90
„	Cheadle, The Heath Ho.	4.49	„	Killarney, Woodlawn ...	2.55
„	Worcester, Diglis Lock	1.70	„	Tipperary, Henry Street	2.53
„	Coventry, Coundon	3.60	„	Limerick, Kilcornan ...	.86
VII.	Ketton Hall [Stamford]	2.25	„	Ennis	2.21
„	Grantham, Stainby	1.58	„	Miltown Malbay	2.37
„	Horncastle, Bucknall ...	3.26	XXI.	Gorey, Courtown House	2.80
„	Worksop, Hodsck Priory	3.26	„	Mullingar, Belvedere ...	2.92
VIII.	Neston, Hinderton	3.33	„	Athlone, Twyford	1.99
„	Knutsford, Heathside ...	3.81	„	Longford, Currygrane...	2.85
„	Lancaster .....	...	XXII.	Galway, Queen's Coll... 1.46	
„	Broughton-in-Furness..	3.32	„	Crossmolina, Enniscoe..	2.02
IX.	Ripon, Mickley	4.08	„	Collooney, Markree Obs.	3.79
„	Scarborough, West Bank	4.18	„	Ballinamore, Lawderdale	3.12
„	East Layton [Darlington]	3.78	XXIII.	Lough Sheelin, Arley ..	2.32
„	Middleton, Mickleton...	3.59	„	Warrenpoint	2.79
X.	Haltwhistle, Unthank..	3.96	„	Seaforde	3.86
„	Bamburgh	3.56	„	Belfast, New Barnsley..	...
„	Newton Reiguy	3.65	„	Bushmills, Dundarave...	3.58
XI.	Llanfrechfa Grange	2.19	„	Stewartstown	4.56
„	Llandovery	1.87	„	Buncrana	3.47
„	Castle Malgwyn	1.95	„	Lough Swilly, Carrablagh	4.47
„	Builth, Abergwessin Vic.	2.57			

JUNE, 1892.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which -01 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average. 1880-9.	Greatest Fall in 24 hours		Max.		Min.		In shade.	On grass.		
				Dpth	Date			Deg.	Date			Deg.	Date
I.	London (Camden Square) ...	2.46	+ .45	.72	28	13	82.7	10	38.6	15	0	1	
II.	Maidstone (Hunton Court)...	2.73	+ 1.11	.74	28	14	...	...	...	...	...	...
III.	Strathfield Turgiss	1.91	+ .11	.52	4	17	80.2	10	33.4	15	0	2	
IV.	Hitchin	2.81	+ .95	.89	28	15	80.0	10a	32.0	14	1	...	
V.	Winslow (Addington)	1.75	— .11	.33	23	12	83.0	10	32.0	15	1	2	
VI.	Bury St. Edmunds (Westley)	3.65	+ 1.86	1.07	28	15	75.0	10	...	...	...	...
VII.	Norwich (Cossey)	3.50	+ 1.95	1.23	28	12	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring)	.81	— 1.42	.34	4	11	76.0	28	39.0	15	0	...	
IX.	Torquay, Babbacombe	1.72	— .15	.49	4	12	72.4	10	41.6	18	0	0	
X.	Bodmin (Fore Street)	2.46	— .29	1.07	1	13	...	...	...	...	...	...
XI.	Stroud (Upfield)	2.76	+ .37	.68	22	12	81.0	9	40.0	14	0	...	
XII.	Church Stretton (Woolstaston)	2.04	— .51	.79	28	13	76.5	9	37.0	13	0	0	
XIII.	Tenbury (Orleton)	3.02	+ .41	1.17	28	14	81.5	10	33.0	15	0	1	
XIV.	Leicester (Barkby)	2.96	+ .61	1.38	28	19	88.0	10	29.0	14	2	5	
XV.	Boston	2.80	+ .91	.75	28	12	92.0	9	39.0	18	0	0	
XVI.	Hesley Hall (Tickhill)	2.78	+ .86	1.15	28	16	82.0	9	35.0	15	0	0	
XVII.	Manchester (Plymouth Grove)	3.51	+ .86	.90	28	19	86.0	9	36.0	17	0	2	
XVIII.	Wetherby (Ribston Hall) ..	4.36	+ 2.47	1.55	29	15	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	4.83	+ 1.47	.80	5	21	87.0	10	34.0	18	0	...	
XX.	Hull (Pearson Park)	3.74	+ 1.99	1.00	28	21	80.0	9	38.0	15	0	...	
XXI.	Newcastle (Town Moor)	2.83	+ 1.19	.61	19	16	...	...	...	...	...	...
XXII.	Borrowdale (Seathwaite)	8.01	+ 1.43	1.82	26	15	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	2.00	— .43	.61	28	13	...	...	...	...	...	...
XXIV.	Haverfordwest	2.22	— .34	.52	5	13	78.0	10	36.1	15	0	2	
XXV.	Aberystwith, Gogerddan	3.96	...	2.12	28	11	85.0	9	30.0	14	2	...	
XXVI.	Llandudno	2.59	+ .82	1.25	28	16	...	...	...	...	...	...
XXVII.	Cargen [Dumfries]	3.88	+ 1.93	.63	4	19	79.8	9	35.4	12	0	...	
XXVIII.	Jedburgh (Sunnyside)	3.92	+ 2.18	.76	10	21	80.0	9	37.0	14	0	...	
XXIX.	Old Cumnock	3.01	+ 1.15	.71	10	17	...	...	...	...	...	...
XXX.	Lochgilphhead (Kilmory)	4.69	+ 1.59	.96	25	17	...	...	33.0	13	0	...
XXXI.	Oban (Craigvarren)	3.99	...	.97	26	16	72.6	8	38.8	14	0	0
XXXII.	Mull (Quinish)	3.25	— .04	.81	2, 25	14	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices	3.50	+ 1.75	.70	26	13	...	...	...	...	...	...
XXXIV.	Dundee (Eastern Necropolis)	2.70	+ 1.20	.45	10f	18	79.8	7	35.9	13	0	...	
XXXV.	Braemar	1.87	— .12	.34	2	21	76.5	7	34.2	21	0	8	
XXXVI.	Aberdeen (Cranford)	2.46	...	.59	19	16	70.0	8	36.0	16	0	...
XXXVII.	Strome Ferry	1.72	— 1.34	.37	25	13	...	...	...	...	...	...
XXXVIII.	Cawdor [Nairn]	2.28	+ .88	.60	17	16	...	...	...	...	...	...
XXXIX.	Dunrobin	1.59	— .43	.41	2	10	75.0	7	36.0	14	0	...	
XL.	S. Ronaldsay (Roeberry)	2.73	+ .97	.70	3	15	67.0	8	40.0	4c	0	...	
XLI.	Darrynane Abbey	2.71	...	.86	22	14	...	...	...	...	...	...
XLII.	Waterford (Brook Lodge) ...	2.01	— .06	.96	1	10	72.0	10	37.5	15	0	...	
XLIII.	O'Briensbridge (Ross)	1.68	...	.33	1, 4	14	78.0	1, 8b	42.0	14d	0	...
XLIV.	Carlow (Browne's Hill)	2.42	+ .58	.67	1	15	...	...	...	...	...	...
XLV.	Dublin (Fitz William Square)	1.67	+ .01	.61	1	17	76.8	26	40.0	14	0	0	
XLVI.	Ballinasloe	1.90	— .40	.50	4	15	74.0	7	39.0	13e	0	...	
XLVII.	Clifden (Kylemore)	3.67	...	1.06	4	17	...	...	...	...	...	...
XLVIII.	Waringstown	3.30	+ 1.23	.98	10	17	84.0	9	38.0	13	0	0	
XLIX.	Londonderry (Creggan Res.) ..	3.54	+ 1.12	1.16	10	20	...	...	...	...	...	...
L.	Omagh (Edenfel)	3.33	+ .86	.81	10	19	76.0	9	41.0	13	0	...	

a And 27.

b And 9.

c And 12, 15, 16, & 24.

d And 15.

e And 14.

f And 19th

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

METEOROLOGICAL NOTES ON JUNE, 1892.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; 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.

STRATHFIELD TURGISS.—A pleasant month with an average rainfall. Great heat on the 10th and a nip of frost on the 15th. Hay scarce from the dryness of the season. Honeysuckle in flower on 1st; elder on 15th; privet on 20th.

HITCHIN.—The frost on the 14th was the first ever recorded here in June.

ADDINGTON.—A great range of temp. occurred during the month, the shade max. of 83° on the 10th, being followed by a min. of 32° on the 15th. This frost, occurring so soon after the heat of the 10th, did much damage to many crops, potatoes in some cases being cut down to the ground. The nights were often very cold between the 13th and 20th; the average min. on grass for the six nights being 32°·5; unusually low for the month of June. T, H and R on the 1st; distant T with much L on the night of the 28th.

BURY ST. EDMUNDS, WESTLEY.—On the 15th the exposed ther. fell to 30°, and potatoes were blackened on low grounds. The hot spell of 27th and 28th, ended with a magnificent TS with heavy R, the L high in the clouds. Vegetation 10 days earlier than last year; T on 18th and 20th.

LANGTON HERRING.—The sixth month in succession with less than the average rainfall, the total for the 6 months being only 6·56 in., or 6·00 in. below the average. The want of R is seriously felt, the hay crop being very light, and the root crops almost a failure. The mean temp. at 9 a.m. was 12·7 below the average of 20 years; some nights were very cold, frost on the ground occurring on 15th; dense fogs on 25th, 26th and 27th; T on 28th; solar halos on 22nd and 24th.

TORQUAY, BABBACOMBE.—A rather dry, fine, but showery month, with temperature slightly below the average, and a large daily range of temp. It was the six successive month of deficient R. It was generally showery from 1st to 5th and 11th to 26th. No R fell in the 6 days 6th to 11th, or in the last 5. Fine and sunny on 3rd, 7th to 10th and 24th; warm on 1st, 6th to 11th and 26th and 27th; cold on 3rd and 4th, from 13th to 20th, and on 23rd, 25th and 30th; the max. shade temp. rose to or above 70°·0 on only 3 days. The max. in sun (130·4) was lower than in any of the preceeding 15 Junes. Total R (7·99 in.) of the first 6 months of this year, was the least registered in that period. S.W. winds blew on 11 days; variable on 8; N.W. on 5; southerly gales on 2nd and 4th; distant T on 28th; solar halos on 1st, 22nd and 24th; fog on 6 days.

BODMIN.—Some days were exceedingly hot, especially the 7th and 9th. All crops looking well, but grass rather light. Slight frost on the 14th. Gale with T, L and heavy R on 1st.

STROUD, UPFIELD.—TS from noon to 1 p.m. on the 1st, with 19 in. of R. On the 14th potatoes and French beans touched by frost in low-lying damp places. T on 23rd; T and L on 28th.

WOOLSTASTON.—The early part of the month was very hot, but on the 12th it became extremely cold; the last week was again warm and genial. Mean temp. 56°·5.

TENBURY, ORLETON.—A fairly warm month, but with a very cold spell from the 12th to the 20th. Mean temp. of the month about three-fourths of a degree above the average. Very heavy storm of R on the 28th; the fall for the 24 hours (1·17 in.) being the greatest recorded since Dec. 28th, 1888. The total R for the first 6 months of this year is only 10·36 in. Much damage was done to potatoes, &c., by frost on the 13th, although no frost was recorded here. T on 1st, 19th and 28th.

LEICESTER, BARKBY.—The middle of the month was comparatively cold, whole fields of potatoes being browned by frost on the 14th, and all tender things much hurt. T on the 10th; T and H on the 18th; T on the 28th, with 1·38 in. of R, within 10 hours.

HESLEY HALL, [TICKHILL].—Heavy TS on 28th.

MANCHESTER, PLYMOUTH GROVE.—From the 6th to the 10th (both inclusive) summer weather prevailed. The rest of the month was changeable and very cold. T and L on the 1st, 23rd and 28th.

WALES.

HAVERFORDWEST.—A splendidly fine month, some days very hot, and a large amount of sunlight. A cold spell occurred from 14th to 16th; at, or just before sunrise on 14th and 15th, the grass ther. registered 32°. Although the weather was very fine, the temp. was never high after this cold spell. The hay crop which promised well during the early part of the month received a check, and will not realize early expectations; turnips suffered also from the cold and drought, but corn crops look remarkable well. The R of the first six months of the year (14·40 in.) is very small, only three drier Springs having occurred in the last 43 years. The driest was 1853—the year of the great drought—when only 11·34 in. fell.

SCOTLAND.

CARGEN.—The mean temp. of the month (54°·3) is 2°·1 below the average. A short period of warm weather, which lasted for only three days occurred from the 6th to the 9th, the temp. then fell 44°·4 in 48 hours. Excluding the three warm days, the mean temp. of the remaining 27, is 53°·1, or 1° lower than has been recorded in June during 33 years. The R for the first six months of the year is 14·93 in., or 4·02 in. below the average of the period; T on the 2nd and T and L on the 10th, 17th, 19th and 23rd.

JEDBURGH, SUNNYSIDE.—The temp. was high during the first 9 days, but after that R fell more or less every day, except on 14th, 27th, 29th and 30th. The wind was generally N.E. Vegetation advanced rapidly during the first 10 days, and crops generally have a fine healthy appearance.

OBAN.—Following a wet May, this month was disturbed with heavy rain storms and broken weather. The temp. was below the normal. All crops are well advanced in growth, but more sunshine is needed to yield a favourable harvest.

MULL, QUINISH.—A showery unsettled month; very cold from 12th to 17th inclusive, but on the whole very favourable to growth of crops, which in this district promise unusually well.

S. RONALDSAY, ROEBERRY.—A cold, wet month. Mean temp. 50°·5.

IRELAND.

DARRYNANE ABBEY.—A warm, and on the whole fine month.

O'BRIENSBRIDGE, ROSS.—A fine summer month, with moderate R and average temp.

DUBLIN.—A changeable but on the whole favourable month. The weather was showery and cool at first, then a period of beautiful bright, warm weather occurred, which was broken up by a TS on the 10th; a remarkable chill then passed over the country, and the weather was very showery after the 15th. Mean temp (56°·7), 1°·1 below the average. High winds on 8 days; T on 10th and 23rd; H on the 2nd and 22nd.

OMAGH, EDENFEL.—The month commenced in broken showery weather, but on the 7th three hot days followed, terminating suddenly on the 10th in a TS and heavy R, thence to the 20th a cool (almost cold) period followed with irregular frosts at some neighbouring places. The end of the month was humid, but generally favourable, with occasional short heavy showers of H and R. On the 30th 48 in. of H and R fell between 1 and 2 p.m.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCCXIX.]

AUGUST, 1892.

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

THE BRITISH ASSOCIATION AT EDINBURGH.

Twenty-one years have passed since the last meeting of the British Association in the beautiful capital of Scotland, and we naturally turn back to the *Meteorological Magazine* for August, 1871, to refresh our memory. It is in some respects a sad one. Of the 42 Meteorologists then present, at least 16 are dead. We know not what has become of 6, 17 were absent, and of the whole 42 only 3 (Mr. T. W. Backhouse, Dr. Buchan, and Mr. Symons) were present. But though we have to regret the large number of absentees, there were of meteorologists and rainfall observers quite a fair proportion. We have doubtless overlooked some, and have possibly excluded some whose eminence in other branches of science makes one doubtful whether to include them or not. At any rate the following list needs addition rather than subtraction:—

Aitken, J.	Clayden, A. W.	Gregson, W.	Snellen, Dr. M.
Amery, F. S.	Copeland, Dr. R.	Hughes, G. P.	Stanley, W. F.
Bevan, Rev. J. O.	Crewdson, Rev. G.	Mill, Dr. H. R.	Steward, Rev. W. C.
Binnie, A. R.	Crowley, F.	Mossman, R. C.	Swindells, R.
Black, Dr. W. G.	Dickson, H. N.	Peek, C.	Symons, G. J.
Brett, Dr. A. T.	Dreyer, Dr. J. L. E.	Rawson, Sir R.	Walker, A. O.
Buchan, Dr. A.	Dunn, Rev. J.	Rotch, A. L.	Watts, W.
Buchanan, J. Y.	Edmonds, F. B.	Roth, H. L.	Williams, J. A. B.
Clark, J. E.	Fassig, O. L.	Scott, Prof. A. W.	Wilson, Col. Sir C.

The number of papers upon Meteorological subjects was much larger than usual, but they were so distributed over time and in several sections, that it is only upon trying to notice them all that their importance becomes realized. The Monday in Section A, which by tradition belongs to Meteorologists, was, by the Organizing Committee, appropriated to another subject, and papers on, or allied to, Meteorology were read in every section, except F and H. It is therefore in vain to try to give our account in systematic order, but we hope to notice all except interim reports.

THE FORECASTING OF STORMS FROM THE ATLANTIC.

His Serene Highness the Prince of Monaco opened the day's proceedings in Section E. with a paper on North Atlantic Currents, and on Atlantic Meteorology generally. Dealing with the first part of his subject, he fully explained the nature and the results of the experiments in which of late years he has been engaged with the view of ascertaining the direction and velocity of the currents in the North Atlantic. He afterwards went on to speak of observations he had made on Atlantic meteorology generally, and pointed out that the western shores of Europe, especially those of Great Britain and Ireland, were exposed to continual devastations by storms which came from the westward. The only source from which warning could be obtained was the continent of North America, and the warnings thence received were of the greatest value. But the width of the North Atlantic was so great that American storms lost themselves, and others were generated of which Europeans could at present receive no warning. The North Atlantic was fairly rich in islands, and in nearly every group there was at least one island of remarkable altitude, where the meteorological conditions were likely to be quite distinct from those existing at the sea-level. The results already achieved at the high-level observatory on Ben Nevis justified the confident expectation that equally, and perhaps more, valuable results would be obtained by the establishment of a pair of high and low level observatories in one of the Atlantic groups of islands, preferably the Azores. All these groups of islands either were already, or would be shortly, connected by cable with Europe, and he strongly advocated that they should now commence to establish meteorological observing stations in carefully selected sea-level positions having cable connection with Europe, and at least one high-level observatory at the top of one of the many remarkable peaks. Further, as it might be advantageous to have these observations collected and discussed at an observatory where much attention was given to oceanographical work, His Serene Highness offered to undertake at Monaco the collection and discussion of the observations received daily, and the distribution of the results. (Applause.)

The President of the Association (Sir Archibald Geikie), in moving a vote of thanks to His Serene Highness, said that the Prince had suggested a new method of investigation, by which he had very clearly pointed out that we might quite well hope to have timely warning of the storms which came from the west with such devastating force on the British Isles and on the western shores of Europe. If such a system of observation as he had sketched out were adopted, there seemed every probability that they could receive in time due warning of those storms. (Applause.)

Dr. Buchan, Scottish Meteorological Society, subsequently opened a discussion on the subject of the paper. He said that he entirely concurred in the suggestions of His Serene Highness with regard to the establishment of oceanic meteorological stations in the Atlantic. Observations had shown that when the temperature of the surface water of the Atlantic in late autumn was much above the average, the result was a higher air temperature and more active evaporation from the surface of the sea, and that in many cases had been followed by the storms of the subsequent winter and spring taking a more southerly course than usual through Europe, thereby bringing the British Isles on the north side of the centres of the cyclones, and exposing them to a hard winter and spring, with prevailing northerly and easterly winds and snow

storms. If they had a first-class meteorological observatory at the Bermudas in connection by cable with this country, a very important element would be furnished to those in the London Meteorological Office whose duty it was to forecast the weather. Dr. Buchan strongly advocated the establishment of a high-level observatory at the Azores, mainly because by combination of the records of such an observatory with that at Ben Nevis the meteorological bureaux of Europe would be furnished with a set of observations that would enable them to improve the weather forecasts.

Among others taking part in the discussion were Mr. J. Y. Buchanan, and Mr. A. L. Rotch, Boston, the latter of whom said that such stations as the Prince proposed would be of the greatest service in making up weather forecasts, and more especially those applicable to European countries.

The vote of thanks to His Serene Highness was heartily accorded.

PHYSICAL GEOGRAPHY OF THE FIRTH OF FORTH.

Dr. H. R. Mill, Edinburgh, contributed a paper on the physical geography of the Firth of Forth. In the course of it he said that the most recent information obtained by observations at fixed stations by the Fishery Board for Scotland mainly concerned the rate of increase of transparency in the water from the river seaward, and the effects of tidal action on temperatures and salinity. In summer, estuary water was warmer, in winter colder, than that of the sea, so that, disregarding solar influence, the temperature of the water at a station near the mouth of an estuary was either at a maximum or a minimum at high water and low water, the maximum occurring with low water in summer, with high water in winter. In summer, when low water occurred in the afternoon, the afternoon temperature at the Abertay lightship was over 1 deg. C. higher than in the morning; and when high water occurred in the afternoon the temperature was nearly 1 deg. C. lower than in the morning, no matter how strong the solar heat might be. (Applause.)

THE NEED FOR TEACHING IN METEOROLOGY.

Mr. H. M. Dickson, Edinburgh, read a paper on "The Need for Teaching in Meteorology." He pointed out that, apart from special applications to arts and manufactures, a want is felt of a subject which shall at the same time afford opportunities of illustrating scientific methods and give examples of practical value in accounting for many natural phenomena of common observation. The ordinary phenomena of meteorology, as embodied in the weather folk-lore current everywhere, are already familiar to sailors, fishermen, and farmers, the classes it is most important to reach; and by properly classifying and arranging the facts already known to them, several laws may be made to suggest themselves. In this way the meteorological elements, which in this restricted sense underlie a great part of biology, geology, and geography, form an introduction to the fundamental notions of these sciences, as well as to those of physics involved in their discussion. There is as yet no instruction in meteorology available in this country, but in view of the rapid development of technical instruction it is urgent that this should be remedied. The best method of properly introducing the subject seems to be that the facts of the case be set before the Technical Education Committees of the County Councils, backed by the approval of the various bodies whose function it is to regulate and extend scientific instruction. In this way a demand for teaching in meteorology would be created, and the supply should come from some of the

main fixed centres of technical education, which should not only supply systematic instruction, but should be in a position to deal with questions referring to the relations of meteorology to agriculture, fisheries, &c., and to discuss the data collected by the teachers sent out bearing on local observations and prognostics.

ROBINSON'S CUPS AS A WINDMILL.

Professor Blyth, Glasgow and West of Scotland Technical College, described experiments he made several years ago to obtain the best form of windmill to charge storage cells. A solution of the problem presented itself to him in the Robinson cup anemometer, and he proceeded to construct a windmill of the anemometer type. The machine he made was at present working, charging thirteen accumulators, and running a dynamo, which at its maximum speed required four horse-power. He believed that electric windmills might be used for lighthouses.

Sir Douglas Galton said that the windmill might be very useful for the tenants of moderate-sized farms for performing much of the ordinary work. After a few comments by Sir Frederick Bramwell and Mr. Wyllie, the discussion was closed, and Professor Blyth was thanked for his communication.

UNDERGROUND TEMPERATURES.

Mr. G. J. Symons read the report of the Committee on Underground Temperature. It dealt with observations taken at a boring made at a deep well in Wheeling, West Virginia. The well had been sunk by the Wheeling Development Company to a depth of 4,500 feet. Observations had been taken last summer at depths of every 125 feet to the bottom, and they had been carefully checked. The general result was this. Taking the surface temperature at 51° , at a little more than 1,000 feet from the surface the temperature was $68^{\circ}\cdot7$, at 3,000 feet the temperature was 87° , at 4,000 feet it was 102° , and at the bottom of the well $110^{\circ}\cdot2$. The increase of temperature became faster and faster towards the bottom. From 1,590 feet to 1,835 feet the rate of increase was 1° in 92 feet; from 1,835 feet to 2,486 feet the increase was 1° in $84\frac{1}{2}$ feet; the next group 2486 feet to 3232 feet gave 1° in 81 feet, then 3232 to 3875 feet 1° for 62 feet, and, finally, at the lowest depth 3875 feet to 4462 feet 1° for 58 feet. The mean of all these increases was 1° F. in 72 feet.

OCEAN TEMPERATURE.

Dr. Buchan gave a preliminary account of ocean circulation based on the "Challenger's" observations. He explained that he had been engaged upon the work for a long time, and the inquiry had so far advanced that the more prominent results could now be stated. The "Challenger" observations had been supplemented by those of Mohn, Agassiz, J. Y. Buchanan, Belknap, and Captain Wharton, the hydrographer. Dr. Buchan emphasized the importance of the accurate study of the surface winds of the globe, as bearing on the subject of ocean temperature. He referred particularly to the directions of the winds of the Atlantic, the result of the observations going to show that from the ocean currents thereby generated, the temperature on the west side of the Atlantic, at depths from 100 to 500 fathoms was nearly 10° degrees warmer than at the same depth on the east side. At 500 fathoms the temperatures on both sides of the Atlantic were nearly equal, but at lower depths they were

reversed, the warmer water now being on the east side, and the colder on the west side. The west side at these depths was more under the influence of the Arctic currents along the American coast, and the east side was more under the influence of the under-currents from the Mediterranean and the equatorial regions of the Atlantic. This high temperature was carried northward even beyond the Wyvil Thompson ridge, which lay between Shetland and Iceland. Indeed, at depths of 700 fathoms the temperature immediately to the south of this ridge was five or six degrees warmer than over the Pacific, Indian, and South Atlantic oceans at the same depth. The temperature of the Mediterranean at 200 fathoms was about 56° . From this point down to the bottom, which extended in some places to 1,500 fathoms, there was no change. Similarly, in the Gulf of Mexico a temperature of $29^{\circ}5$ was reached at 700 fathoms, and below that there was no change. On the other hand, in the North Atlantic, north of the Wyvil Thomson ridge, at all depths below 700 fathoms there was a uniform temperature of about $29\frac{1}{2}^{\circ}$, which was 2° or 3° higher than the freezing point of water of the sea there. The bearing of the under-current of the Mediterranean of warm salt water on the currents of the Atlantic seemed to him to fully explain why history gave no instance of an iceberg appearing off the West of Europe, this warm southerly under-current extending beyond the North Cape of Norway.

PHOTOGRAPHY APPLIED TO METEOROLOGY.

Mr. A. W. Clayden gave in the report of the Committee on Meteorological Photography, which showed that there had been considerable additions to the number of observers, and contained suggestions as to methods of cloud photography. The paper was illustrated by a remarkably fine series of photographs of cloud formations, of lightning, hoar frost, &c., thrown upon a screen, the room being darkened for the purpose.

THEOPHRASTUS ON WIND AND WEATHER.

WE are very glad to state that we shall be able to carry out the proposed publication of an English translation of the above. We were placed in a little difficulty by the receipt of no fewer than four offers to undertake gratuitously the work of translation, but we had no hesitation in accepting the first, that of one of the contributors to *British Rainfall* 1860-61, Mr. James G. Wood, then of Chepstow. Mr. Wood is entering upon the work with a thoroughness which will ensure a scholarly, as well as a meteorologically, interesting translation. Considering the fact of the three other offers having been made, we think that our readers may be willing to support us in producing similar translations of some of the other rare and hitherto untranslated works. There ought to be no difficulty as to either of the three requisites: (1) Works to be translated; (2) Translators; (3) Subscribers to purchase the translations. The mere printing, paper, and stitching will cost very little, and therefore the price can be low if any reasonable number of copies are subscribed for; but all depends

upon the number. If there are 200, probably 2s. each would suffice ; if 50, the copies would have to be 5s. each. We do not desire to make a profit on the work, but merely to avoid loss, and yet enable our readers to have books which will be interesting and valuable.

The first thing is for those who desire to secure copies, to send a postcard to that effect ; prices and details can be settled afterwards.

It may not be inappropriate to mention that 35s. is now being asked for a copy of the Merle's M.S., which we issued to the subscribers at 10s. 6d.

ANOTHER ST. SWITHIN'S RAINFALL.

ALTHOUGH the old proverb respecting St. Swithin has been shown to be incorrect, a new form of it would, we think, stand a good chance of fulfilment, viz. : one that somewhere in the British Isles there would be within a week of St. Swithin's Day a fall of from two to five inches of rain. We have not worked up the facts, our suggestion may be without foundation, and the long series of volumes of *British Rainfall*, would enable anyone with leisure to verify or destroy it. Here, however, is one case, and, by-the-bye, we must direct to the letter the attention of any reader still sceptical as to the necessity for having a rain gauge capable of holding 6 inches. The Rev. C. O. Miles wrote as follows :—

*Vicarage, Almondsbury, Bristol,
July 25th.*

SIR,—In case the record of the rainfall on July 16th does not reach you, I send the fall at Mr. A. Gibbs, at Tyntesfield, Somerset, near Bristol. Surely it is almost unequalled. Mr. Gibbs measured 3·75 in. in 2 hours ; 4·25 in. in 21 hours. My brother, R. F. Miles, at Abbots Leigh, near Bristol, measured 3·25 in. in 24 hours. The fall here was only 1·65 in.

Yours truly

C. O. MILES.

On receipt of the above, we applied to the observers in the vicinity for copy of their records, and the returns are very accordant. They show that the fall over North Somersetshire on the 16th was generally between an inch and an-inch-and-a-quarter, but that it exceeded one-and-a-half inches at the following stations :—

Station.	Observer.	Distance and bearing from Tyntesfield.	Total Rain. in.
Almondsbury	Rev. C. O. Miles.....	10 miles N.E.	1·65
Chew Magna	A. J. Alexander, Esq.	7 „ S.E.	1·84
Ensleigh, Lansdowne, Bath	C. H. Weston, Esq...	15 „ E.S.E.....	2·01
Barrow Gurney Res.	A. J. Alexander, Esq.	2 „ S.E.	2·48
Long Aston, Bristol	T. Dyke, Esq.	3 „ E.	2·72
Abbot's Leigh, „	R. F. Miles, Esq. ...	3 „ N.E.	3·25
Chelvey	A. J. Alexander, Esq.	3 „ S.W.	3·52
Tyntesfield, Flax Bourton..	A. Gibbs, Esq.....	{ 5½ „ W.S.W. of Bristol. }	4·25

A COLD JULY.

To the Editor of the Meteorological Magazine.

SIR,—I do not know whether the following facts are sufficiently extraordinary to interest you :—

July, 1892.—On no day after the 4th did the mean temperature here ($\frac{9 \text{ a.m.} + 9 \text{ p.m.} + \text{max.} + \text{min.}}{4}$) reach 60°. From the 12th to the 21st inclusive, it never reached 55°; and on the 13th it was 50°·6; on the 19th 50°·2. At no time between the 13th and 19th inclusive, did the temperature of the air reach 60°.

On no whole day in the month was the sky clear, twenty-two days were overcast. Only two observations (9 p.m. on 3rd, and 9 a.m. on 22nd) were cloudless.

The rainfall was 0·6 in. below the average.

I find that the mean of 12th–21st is very little above that of the coldest days quoted under the same dates from 1814–1873 in Glaisher's paper—(*Quar. Jour. Met. Soc.*, for October, 1876.)

Is there any record of such length of cold in July?

Yours truly,

G. H. MULLINS.

West Deyne, Uppingham, Aug. 1st, 1892.

SPRING [?] FROSTS IN 1892.

To the Editor of the Meteorological Magazine.

[P.S. to letter of May 27th, published in July.]

SIR,—I made up my table of frosts for the first half of 1892 too soon; for June added one to the list of frosts in the shade, and no fewer than *five* to those on the grass!

These were as follows :—31° on 18th and 30th; 30° on 13th; 27° on 14th; and 24° on 15th on grass, and 30° under shelter, with effects on flowers and vegetables truly disastrous.

Thus the first six months of 1892, being 182 days, gave 76 frosts under shelter, and 112 frosts on grass.

In corroboration of the letter from Newport Pagnell, which appeared in your last number, I may add that no violent storms have visited this locality, the maximum rainfalls having been for a long time remarkably small: being for January ·31 in. (snow); for February ·39 in. (snow); for March ·26 in.; for April ·21 in.; for May ·33 in. Our heaviest fall was one of ·76 in. in about 15 hours on June 22nd and 23rd; and July yielded ·50 in. on the 5th.

Our total rainfall during the seven months that ended on July 16th, was only 9·10 in.; the first six months of 1892, Jan. to June, yielded only 7·59 in.; the wettest month of the six being June, with 1·98 in.

And now July is making a name for itself with unusually low maxima. I have recorded on 13th, 55°·5; on 14th, 56°·5; on 17th, 58°·5. Gardens and cornfields are alike at a standstill.

Yours truly,

H. A. BOYS.

Easton Mauduit Vicarage, Northampton, July 19th, 1892.

To the Editor of the Meteorological Magazine.

SIR,—With reference to the correspondence on the above subject in the *Meteorological Magazine* of July, I send you the readings of the shade and grass thermometers at Ketton Hall, near Stamford, June 8th-17th, for comparison with those of Mr. Tyrer. The instruments are verified, and those in the shade are in a Stevenson's Screen :—

1892.		AIR			GRASS	
		Max.	Min.	Mean.	Min.	
June	8	75	41	58	37	
"	9	81	44	62.5	41	
"	10	82	48	65	44	
"	11	64	52	58	54	
"	12	57	46	51.5	48	
"	13	60	40	50	34	
"	14	57	37	47	32	
"	15	62	30	46	28	
"	16	62	42	52	38	
"	17	60	34	47	31	

In reply to Mr. Boys ; on reference to my notes 1884-1891, I find that the greatest number of ground frosts recorded in any of the first halves of these years is 105, in the half-year January-June, 1887. The number recorded in the half-year January-June, 1892, is 116, of which three occurred in June. The following table shows the number of shade and ground frosts, 1884-1892 :—

JANUARY-JUNE.				YEAR.	
	Shade.	Grass.		Shade.	Grass.
1884	35	70		60	125
1885	56	69		83	110
1886	71	84		101	133
1887	74	105		116	173
1888	78	100		110	153
1889	56	93		110	195
1890	47	89		91	147
1891	65	100		91	159
1892	82	116			

In the first 134 days of the year, 1892, there were 113 ground frosts, or only 21 minima above 32° on the grass.

The 73 days, beginning October 5th, and ending December 16th, yielded 9.91 inches of rain (no rain on December 16th), and gave 16 frosts in the shade, and 43 on the grass. The 149 days, beginning December 17th and ending May 13th, yielded 7.25 inches of rain, and gave 89 frosts in the shade, and 127 on the grass.

The rainfall of the first six months of 1892, shows a deficiency of 1.07 in. or just 10 per cent. ; February and June being the only months with more than the average.

Yours faithfully,

FRED. COVENTRY.

The Holmes, Ketton, Stamford, July 27th, 1892.

THE CLIMATE OF THE BRITISH EMPIRE DURING 1891.

WE are unfortunately obliged to omit from our annual summary of the climate of the British Empire for last year, both the West Indian stations—Jamaica and Trinidad—the returns for one month having failed to reach us. We endeavoured to complete the table by reference to the library of the Royal Meteorological Society, but the sets of publications there show precisely the same hiatus.

Examination of the eleven months received, indicates that this omission does not affect the Summary of extremes, though the West Indies generally secured a prominent place when returns were received from Barbados, owing to the extremely small range of temperature in that Island.

Making our usual brief commentary on the tables, we find Melbourne for the first time beating both Adelaide and Calcutta by $0^{\circ}3$, and recording the highest shade temp., and at the same time preventing a tie between the Australian and East Indian rivals, one of which almost invariably heads the list. In connection with high temp. we would refer our readers to Mr. Todd's note on the record at Alice Springs in Dec. (p. 108), showing an absolute shade max. of 117° , and an average max. for the month of above 100° .

Adelaide, though exceeded by $0^{\circ}3$ in its shade max., recorded the extreme max. in sun, the lowest relative humidity, and also the smallest rainfall.

As long as Winnipeg remains in the tables it seems impossible for any other station to score the lowest temperature, either absolute or average, or the greatest total range, or mean daily range. For even Fredericton, which compares most nearly with it, has a mean temp. $7^{\circ}5$ higher, and $2^{\circ}5$ less daily range.

Ceylon as usual recorded the highest mean temp., slightly exceeding Bombay, and more considerably the other East Indian Stations. It also had far the highest min. temp., and a total range of less than 25° between the max. of the hottest day, and the min. of the coldest night.

The extremes of rainfall perhaps show more variation both of amount, and of the stations at which they occur, than any other element, and it may be of interest to give the details for the last ten years :—

	GREATEST RAINFALL.			LEAST RAINFALL.		
1882	79.63 in.	at Colombo, Ceylon.		15.74 in.	at Adelaide.	
1883	103.61	„ „ „		23.70	„ Melbourne.	
1884	82.14	„ „ „		17.97	„ Malta.	
1885	85.58	„ „ „		15.48	„ „	
1886	99.74	„ Bombay.		14.42	„ Adelaide.	
1887	94.95	„ „		17.23	„ Malta.	
1888	101.06	„ Colombo, Ceylon.		13.75	„ „	
1889*	73.79	„ Trinidad.		14.95	„ Winnipeg.	
1890	82.90	„ „		19.96	„ Jamaica.	
1891	119.03	„ Colombo, Ceylon.		14.01	„ Adelaide.	

* Returns from Colombo, Ceylon, were not included in the table for 1889. It is worthy of note that Colombo is the the only station at which the fall has exceeded 100 inches.

In the table for the year under review, there are returns for sixteen stations, and the summary contains sixteen entries—*i.e.*, the two opposite extremes of eight elements. It will be seen that Winnipeg monopolises four of these—the lowest shade temp., the greatest range, the greatest mean daily range, and the lowest mean temp.; Colombo, Ceylon monopolises three—the least range of temp., the highest mean temp., and the greatest rainfall; Adelaide also monopolises three—the least mean humidity, the highest temp. in sun, and the least rainfall; thus leaving only six extremes to be distributed among the remaining thirteen stations. Malta has appeared in the summary every year since the returns were first received in 1884, with either the smallest rainfall or the least amount of cloud, or frequently with both, but this year it is beaten on both points.

SUMMARY.

<i>Highest Temp. in shade</i>	103°·0 at Melbourne on January 4th
<i>Lowest</i> " "	— 34°·5 at Winnipeg on February 1st
<i>Greatest Range in year</i>	128°·1 at Winnipeg
<i>Least</i> " "	24°·3 at Colombo, Ceylon
<i>Greatest Mean Daily Range</i> ..	22°·9 at Winnipeg
<i>Least</i> " " " ..	9°·8 at Mauritius
<i>Highest Mean Temp.</i>	80°·7 at Colombo, Ceylon
<i>Lowest</i> " " ..	34°·2 at Winnipeg
<i>Driest Station</i>	Adelaide, mean humidity 57
<i>Dampest Station</i>	Esquimalt mean humidity 90
<i>Highest Temperature in Sun</i> ...	165°·0 at Adelaide
<i>Lowest Temperature on Grass</i>	— 8°·2 Toronto*
<i>Greatest Rainfall</i>	119·03 in. at Colombo, Ceylon
<i>Least</i> "	14·01 in. at Adelaide
<i>Most Cloudy Station</i>	Hobart, Tasmania, average amount 6·7
<i>Least Cloudy Station</i>	Bombay, average amount 3·6

* The min. on grass not being recorded at the other Canadian stations.

ERRATA IN "METEOROLOGICAL MAGAZINE," 1891.

REGULAR TABLE.

London (Camden Square).....	November.....	should be	1·98 in.	not	2·08 in.
Maidstone (Hunton Court) ...	August	"	2·93	"	3·03 "
Strathfield Turgiss	January.....	"	1·83	"	1·73 "
Hitchin	July	"	2·23	"	2·52 "
"	August	"	3·40	"	3·42 "
Norwich (Cossey) ..	March	"	1·55	"	1·45 "
" (")	November.....	"	1·70	"	1·78 "
Hull (The Park)	September.....	"	1·29	"	1·19 "
Aberdeen (Cranford).....	"	"	5·64	"	5·46 "
Dromore Castle	June	"	2·91	"	2·53 "
O'Briensbridge (Ross)	"	"	1·17	"	1·20 "

SUPPLEMENTARY TABLE.

Ashburton (Holne Vicarage). ..	October ..	should be	15·24 in.	not	5·24 in.
Lancaster (Edenbreck).....	November.....	"	4·45	"	4·25 "
Ripon (Mickley).....	February	"	·08	"	·03 "
Carnarvon (Cocksidia)	June	"	2·89	"	2·92 "

CLIMATOLOGICAL TABLE FOR JUNE.

England (London) Rainfall should be ·86 in. not 8·02 in.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE FOR 1891.

STATIONS.	ABSOLUTE.				AVERAGE.						ABSOLUTE.		TOTAL RAIN.		AVER- AGE.
	Maximum.		Minimum.		Max.	Min.	Mean.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.		
	Temp.	Date.	Temp.	Date.											
<i>Those in Italics are South of the Equator.</i>															
England, London ...	84·3	July 17	16·8	December 22	56·6	42·0	49·3	42·7	81	127·1	12·5	in. 28·15	178	0-10 6·2	
Malta	99·6	June 7	37·7	February 20	72·2	58·6	65·4	55·3	76	155·7	32·5	17·21	81	3·9	
<i>Cape of Good Hope.</i>	96·1	June 25	36·6	July 16	70·3	53·7	62·0	...	...	...	...	30·30	88	...
<i>Mauritius</i>	86·0	February 4	55·0	August 1	78·4	68·6	73·5	64·2	77	140·3	46·0	44·63	224	5·7	
Calcutta ...	102·7	April 14	46·2	February 7	86·4	70·4	78·4	69·9	77	158·5	37·5	46·93	88	4·3	
Bombay	93·2	June 7	58·5	February 9	86·3	74·7	80·5	70·6	73	141·6	43·4	77·18	100	3·6	
Ceylon, Colombo ...	91·1	February 10	66·8	December 23	86·2	75·4	80·7	71·3	77	153·0	58·0	119·03	215	5·7	
<i>Melbourne</i>	103·0	January 4	33·9	July 31	66·5	49·2	57·9	48·5	73	158·8	27·5	26·73	126	5·8	
<i>Adelaide</i>	102·7	February 8	36·2	June 23	72·1	52·4	62·2	46·5	57	165·0	25·9	14·01	113	4·1	
<i>Tasmania, Hobart..</i>	97·5	March 7	33·2	June 9	62·7	46·1	54·4	46·8	75	144·0	25·2	23·50	171	6·7	
<i>Wellington</i>	81·0	March 11	31·3	July 13	61·8	47·9	54·8	49·8	84	140·0	20·0	35·15	166	4·0	
<i>Auckland</i>	80·0	Feb. 1, Dec. 10	39·0	June 15	65·6	52·9	59·3	50·3	73	143·0	27·0	36·04	156	5·4	
Toronto	91·9	June 16	— 2·0	February 4	54·0	37·6	45·8	39·0	75	...	—8·2	31·54	173	5·9	
New Brunswick, { Fredericton.	86·0	June 16	—15·8	January 17	51·9	31·5	41·7	36·2	74	...	...	48·02	180	5·8
Manitoba Winnipeg	93·6	May 7	—34·5	February 1	45·7	22·8	34·2	...	83	...	...	19·54	159	5·2
British Columbia, { Esquimalt	88·6	July 23	20·0	March 3	55·3	42·4	48·8	45·8	90	...	...	43·63	199	6·5

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JANUARY, 1892.

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			
England, London	52·0	29	22·8	12	41·5	30·9	33·5	89	78·9	15·8	·50	13	6·4
Malta.....	68·4	12	44·0	30	62·1	50·5	48·7	83	116·4	38·2	3·23	10	4·3
Cape of Good Hope	89·6	19	54·8	7a	78·2	60·8	...	...	...	...	·86	3	3·4
Mauritius.....	85·7	12	71·0	9	83·5	74·7	71·5	76	137·9	64·5	6·96	22	6·4
Calcutta.....	85·5	14	49·5	21	79·8	54·8	54·8	69	137·8	41·0	·00	0	0·7
Bombay.....	89·2	5	63·0	23	83·5	69·3	65·0	68	130·7	49·1	·00	0	0·8
Ceylon, Colombo	90·1	29	69·8	...	84·8	72·7	70·6	80	155·0	62·0	7·39	19	7·2
Melbourne.....	99·5	22	47·2	9	76·3	55·5	54·2	63	150·1	38·0	·86	7	5·3
Adelaide	110·8	20	50·5	16	81·2	59·2	50·1	50	173·8	39·4	1·62	5	4·1
Tasmania, Hobart.....	...	...	...	...	...	...	...	...	...	...	...	...	...
Wellington	77·5	15	48·0	24a	69·5	53·8	53·5	77	138·0	41·0	7·08	16	4·4
Auckland	80·0	29	51·5	23	74·6	58·8	59·5	78	142·0	46·0	3·41	9	4·6
Jamaica, Kingston.....	90·2	11	64·1	22	86·1	68·4	65·5	71	...	...	·15	4	4·7
Trinidad	96·0	24	65·0	30	87·9	68·8	69·7	77	155·0	58·0	1·93	12	...
Toronto	46·1	1	—10·2	20	27·6	11·3	18·4	83	...	...	1·55	20	7·0
New Brunswick, Frederickton	49·8	14	—12·7	17	27·3	8·3	19·4	88	...	...	8·34	20	7·0
Manitoba, Winnipeg ...	36·8	23	—44·4	18	3·7	—17·2	2·0	99	...	...	·41	7	3·0
British Columbia, Esquimalt	55·0	25	28·9	5	44·0	34·5	38·3	94	...	...	4·95	18	7·0

a And 25.

REMARKS.

MALTA.—Mean temp. 55°·3. Mean hourly velocity of wind 11·2 miles. The temp. of the sea fell from 61°·5 to 58°·6. TSS on 25th and 26th. J. SCOLES.

Mauritius.—Mean temp. of air 0°·3 above, dew point 1°·7 above, and rainfall ·12 in. above their respective averages. Mean hourly velocity of wind 10·5 miles, or 0·6 mile below average; extremes, 23·1 on 12th and 1·7 on 8th; prevailing direction S.E. by E. to E. by N. T and L on 2nd, 16th, 18th and 19th; L on 3rd and T on 20th. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 0°·9 below, of dew point 0°·9 below; humidity 1 below, amount of cloud 0·2 above and rainfall ·99 in. below their respective averages. Prevailing winds S. and S.W., strong on 6 days. Heavy dust storm on the 2nd. Heavy dew on 4th and 30th. L and T on 19th. R. L. J. ELLERY, F.R.S.

Adelaide.—Rainfall ·79 in. above the average. The mean temp. (70°·2) was 4°·4 below, and the average max. 6°·0 below the average of 35 years; only twice have the corresponding means been below these figures. There was only one hot spell during the month, viz. : from 17th to 21st, when the max. were 84°·3, 96°·2, 103°·5, 110°·8 and 96°·8; the rest of the month was cool with one or two warm days.

At Alice Springs in the centre of Australia the max. in shade in December reached 90° on 30 days and 100° on 26 days, the highest being 117°. C. TODD, F.R.S.

Wellington.—Showery in the early part of the month; prevailing wind S.; fine during the middle, and showery again during the latter part, with intervals of fine weather. Prevailing winds S., S.E. and N.W., strong on ten days. T and vivid L on night of 4th. 3·40 in of rain fell on 5th, making the total for the month rather more than twice the average. Mean temp. 1°·0 below the average. R. B. GORE.

Auckland.—A heavy fall of R occurred on the 25th and 26th, 2·63 in, being registered. The rest of the month was fine and dry, with light variable winds. Barometrical pressure and mean temp. slightly above the average. R $\frac{3}{4}$ in. above the average. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
JULY, 1892.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	2.11	XI.	Rhayader, Nantgwillt..	3.03
"	Birchington, Thor	2.38	"	Corwen, Rhug	2.49
"	Brighton Prestonville Rd	1.95	"	Carnarvon, Cocksidia ...	3.04
"	Hailsham	1.82	"	I. of Man, Douglas	3.00
"	Ryde, Thornbrough	3.09	XII.	Stoneykirk, Ardwell Ho.	2.72
"	Alton, Ashdell	2.54	"	New Galloway, Glenlee	3.89
III.	Oxford, Magdalen Col...	2.81	"	Melrose, Abbey Gate ...	2.06
"	Banbury, Bloxham	1.66	XIII.	N. Esk Res. [Penicuik]	1.40
"	Northampton, Sedgebrook	1.88	"	Edinburgh, Blacket Pl..	1.17
"	Cambridge, Fulbourne..	3.22?	XIV.	Glasgow, Queen's Park.	1.72
"	Wisbech, Bank House..	2.68	XV.	Islay, Gruinart School..	4.07
IV.	Southend	1.64	XVI.	Dollar	2.07
"	Harlow, Sheering	1.96	"	Balquhiddel, Stronvar..	4.43
"	Rendlesham Hall	1.84	"	Coupar Angus Station..	1.51
"	Diss	2.75	"	Dunkeld, Inver Braan..	1.59
"	Swaffham	4.11	"	Dalnaspidal H.R.S. ...	3.98
V.	Salisbury, Alderbury ...	1.95	XVII.	Keith H.R.S.	3.55
"	Bishop's Cannings	2.30	"	Forres H.R.S.	3.00
"	Blandford, Whatcombe ..	2.72	XVIII.	Fearn, Lower Pitkerrie.	1.96
"	Ashburton, Holne Vic. ...	2.31	"	Loch Shiel, Glenaladale	5.45
"	Okehampton, Oaklands.	2.26	"	N. Uist. Loch Maddy ...	2.64
"	Hartland Abbey	1.76	"	Invergarry	3.70
"	Lynmouth, Glenthorne.	2.17	"	Aviemore H.R.S.	2.73
"	Probus, Lamellyn	3.19	"	Loch Ness, Drumnadrochit	2.40
"	Wincanton, Stowell Rec.	2.23	XIX.	Lairg H.R.S. ....	...
"	Weston-super-Mare	2.67	"	Scourie	4.07
VI.	Bristol, Clifton .....	...	"	Watten H.R.S.	2.46
"	Ross, The Graig	3.10	XX.	Dunmanway, Coolkelure	5.59
"	Wern, Clive Vicarage ...	2.82	"	Fermoy, Gas Works ...	...
"	Cheadle, The Heath Ho.	3.07	"	Killarney, Woodlawn ...	3.19
"	Worcester, Diglis Lock	.97	"	Tipperary, Henry Street	2.62
"	Coventry, Coundon	2.42	"	Limerick, Kilcornan ...	2.69
VII.	Ketton Hall [Stamford]	2.30	"	Ennis	3.47
"	Grantham, Stainby	2.41	"	Miltown Malbay	2.43
"	Horncastle, Bucknall ...	2.23	XXI.	Gorey, Courtown House	3.90
"	Worksop, Hodsck Priory	2.14	"	Mullingar, Belvedere ...	3.79
VIII.	Neston, Hinderton	2.09	"	Athlone, Twyford	4.36
"	Knutsford, Heathside ...	3.54	"	Longford, Currygrane ...	3.11
"	Lancaster .....	...	XXII.	Galway, Queen's Coll. ...	3.34
"	Broughton-in-Furness ..	3.25	"	Crossmolina, Enniscoe..	3.67
IX.	Ripon, Mickley	1.63	"	Collooney, Markree Obs.	2.66
"	Scarborough, West Bank	1.25	"	Ballinamore, Lawderdale	3.05
"	East Layton [Darlington]	1.21	XXIII.	Lough Sheelin, Arley ..	...
"	Middleton, Mickleton..	1.58	"	Warrenpoint	2.88
X.	Haltwhistle, Unthank..	1.87	"	Seaford	2.29
"	Bamburgh	1.82	"	Belfast, Springfield	3.16
"	Newton Reigny	1.90	"	Bushmills, Dundarave ...	2.92
XI.	Llanfrechfa Grange	3.31	"	Stewartstown	3.46
"	Llandovery	2.68	"	Buncrana	3.04
"	Castle Malgwyn	1.60	"	Lough Swilly, Carrablagh	3.92
"	Builth, Abergwessin Vic.	3.24			

JULY, 1892.

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 1880-9.	Greatest Fall in 24 hours		Days on which 01 or more fell.	Max.		Min.				
				Dpth	Date		Deg.	Date	Deg.	Date.			
											inches.	inches.	in.
I.	London (Camden Square) ...	1·62	— 1·06	·68	19	9	81·7	3	46·3	19	0	0	
II.	Maidstone (Hunton Court)...	1·52	— ·66	·47	19	10	...	...	...	...	...	...
III.	Strathfield Turgiss	2·77	+ ·38	·71	5	12	80·1	3	40·9	1	0	0	
IV.	Hitchin	2·74	+ ·02	·81	19	10	80·0	3	47·0	14	0	...	
V.	Winslow (Addington)	2·16	— 1·13	·57	19	12	85·0	3	41·0	21	0	0	
VI.	Bury St. Edmunds (Westley) ..	2·74	+ ·17	1·00	19	11	74·0	4	...	...	0	...
VII.	Norwich (Cossey)	3·14	...	·86	19	12	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring) ..	2·84	+ ·69	1·22	16	11	74·0	29	46·0	19	0	...	
IX.	Torquay, Babbacombe	1·40	— 1·52	·40	11	13	79·1	31	46·4	10	0	0	
X.	Bodmin (Fore Street)	1·27	— 3·34	·37	5	13	...	...	...	...	...	...
XI.	Stroud (Upfield)	2·86	— ·71	1·01	12	11	81·0	3	47·0	21	0	...	
XII.	Churchstretton (Woolstaston) ..	1·89	— 1·08	·56	16	14	77·5	3	44·5	19	0	0	
XIII.	Tenbury (Orleton)	2·83	— ·03	1·22	16	13	83·0	3	41·6	22	0	0	
XIV.	Leicester (Barkby)	2·75	— ·24	1·06	16	12	85·0	3	39·0	18 ^a	0	0	
XV.	Boston	2·03	— ·76	·50	19	9	88·0	3	45·0	19 ^b	0	0	
XVI.	Hesley Hall [Tickhill]	1·78	— ·89	·54	15	12	81·0	3	39·0	25	0	0	
XVII.	Manchester (Plymouth Grove) ..	3·52	— ·27	1·27	15	12	83·0	3	42·0	17	0	0	
XVIII.	Wetherby (Ribston Hall) ...	1·28	— 1·90	·45	4, 21	8	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	2·72	— 2·92	·84	20	11	76·0	4	...	...	...	...
X.	Hull (Pearson Park)	1·67	— ·92	·60	19	10	79·0	3	41·0	25	0	0	
XI.	Newcastle (Town Moor)	1·52	— 2·00	·48	19	12	...	...	...	...	...	...
XII.	Borrowdale (Seathwaite)	8·39	— 2·60	2·72	6	13	...	...	...	...	...	...
XIII.	Cardiff (Ely)	3·64	— ·42	1·16	12	13	...	...	...	...	...	...
XIV.	Haverfordwest	2·74	— 1·47	1·17	17	14	74·0	29	42·2	21	0	0	
XV.	Aberystwith, Gogerddan	3·23	...	·86	19	11	78·0	28	35·0	20	0	...	
XVI.	Llandudno	2·46	— ·54	·65	19	13	...	...	...	...	...	...
XVII.	Cargen [Dumfries]	2·49	— 1·44	·44	9	11	73·0	25	43·0	11	0	...	
XVIII.	Jedburgh (Sunnyside)	2·38	— 1·06	·59	9	11	74·0	30	39·0	7 ^c	0	...	
XIX.	Old Cumnock	3·12	— ·40	·85	3	13	...	...	...	...	...	...
X.	Lochgilphead (Kilmory)	4·56	+ ·26	1·80	2	13	...	...	40·0	9 ^d	0	...
XI.	Oban (Craigvarren)	4·99	...	1·19	3	13	71·0	26	43·4	17	0	0	
XII.	Mull (Quinish)	4·37	+ ·32	1·06	2	15	...	...	...	...	...	...
XIII.	Loch Leven Sluices	1·20	— 2·42	·40	4	5	...	...	...	...	...	...
XIV.	Dundee (Eastern Necropolis) ..	1·70	— 1·76	·55	18	9	71·0	21	42·2	21	0	...	
XV.	Braemar	2·16	— 1·05	·76	3	11	74·0	29	38·0	21	0	0	
XVI.	Aberdeen (Cranford)	2·27	...	·60	19	14	74·0	31	37·0	20	0	...	
XVII.	Strome Ferry	3·56	— ·73	1·04	18	13	...	...	...	...	...	...
XVIII.	Cawdor [Nairn]	2·95	— ·35	1·10	3	19	...	...	...	...	...	...
XIX.	Dunrobin	2·81	— ·04	·97	18	11	66·8	23	44·0	21	0	...	
X.	S. Ronaldsay (Roeberry)	2·75	+ ·39	·75	18	14	63·0	30	46·0	5 ^e	0	...	
XI.	Darrynane Abbey	6·55	...	1·95	11	19	...	...	...	...	...	...
XII.	Waterford (Brook Lodge) ...	3·30	— ·23	·58	2	12	74·0	31	43·0	24 ^f	0	...	
XIII.	O'Briensbridge (Ross)	2·71	...	1·23	2	13	74·0	31	47·0	9	0	...	
XIV.	Carlow (Browne's Hill)	3·90	+ ·38	·87	11	15	...	...	...	...	...	...
XV.	Dublin (Fitz William Square) ..	1·95	— ·73	·61	15	12	70·8	6	46·6	21	0	0	
XVI.	Ballinasloe	5·08	+ 1·53	1·45	2	15	70·0	24	41·0	10	0	...	
XVII.	Clifden (Kylemore)	6·15	...	1·15	2	16	...	...	...	...	...	...
XVIII.	Waringstown	3·38	— ·14	1·28	3	10	75·0	24	46·0	29	0	0	
XIX.	Londonderry (Creggan Res.) ..	3·31	— ·81	1·39	2	13	...	...	...	...	...	...
X.	Omagh (Edenfel)	2·60	— 1·12	·65	2	12	70·0	29	39·0	28	0	0	

^a And 24. ^b And 21, 22. ^c And 21. ^d And 19, 23. ^e And 13, 14, 15, 16. ^f And 29.

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

METEOROLOGICAL NOTES ON JULY, 1892.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; 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.

STRATHFIELD TURGISS.—During the first three weeks of July there was ample R for the growing crops, but too much for the unsaved hay. The end of the month was very dry, but with winds somewhat cold.

ADDINGTON.—The first four days were nice and warm, but the remainder of the month was much cooler; very fine from 20th until the end. The hay crop is the lightest for many years.

BURY ST. EDMUNDS, WESTLEY.—A cold month, with N. winds on 15 days. On 13th the max. temp. was only 54°; no L or T.

LANGTON HERRING.—The first month of the year with R above the average of the ten years (1880-89.) The fall for the seven months has been only 9.40 in. on 76 days, the deficit being still 5.30 in. or 36 per cent. From the 19th to the end of the month, with the exception of the 29th, the weather was very fine and bright; constant N.E. wind from the 22nd to 30th inclusive. The mean temp. at 9 a.m. (60°·8), is 2°·1 below the average of 20 years. T on 11th, 12th, 13th and 30th.

TORQUAY, BABBACOMBE.—A generally dry, fine, but variable month, with temp. slightly below, and bar. slightly above, the average; a large excess of N.E. wind, and less sun heat than usual. It was the 7th consecutive month with deficient R. The total R of the first 7 months of this year is less than half the average of 15 years (1877-91), and the least registered in any consecutive 7 months since observations began in August 1876. It was showery from 3rd to 19th, and on 30th and 31st, but no R was measured in the 9 days from 20th to 28th, and only .01 in. (on 29th) in the last 12 days; the max. on the 31st, 79°·1, was the highest since June 27th, 1889; Max. temp. at or above 70° on 6 days; variable winds on 12 days; N.E. on 8; S.W. on 6; gales on 2 days; Solar halos on 6; Lunar halo on 1; fog on 2 days.

BODMIN.—Very dry and hot; fresh winds on the 7th, 8th and 9th.

STROUD, UPFIELD.—T and L in afternoon of the 17th; E. winds on 10 days.

WOOLSTASTON.—After a few days of warm weather at the beginning of the month, it became very cold with constant showers till the 19th; the latter part was fine and dry. Mean temp. 56°·0

TENBURY, ORLETON.—A very cold month, in fact the coldest July, with the exception of 1888, in the last 31 years; the mean temp. for the month being more than 4° below the average. The first four days were very fine and warm, but from then till the end of the month the temp. at 9 a.m. only exceeded 60° on six mornings. Great R on the evening of the 16th; gale on the 19th.

LEICESTER, BARKBY.—The first half of the month was wet, the latter half dry, with high bar.; persistent N.E. winds, and much cloud; T on 5th.

MANCHESTER, PLYMOUTH GROVE.—The first two days and the 11th and 12th were bright and sunny, and fine summer weather prevailed from the 20th to the 25th, and on 27th and 28th. The rest of the month was cold and unsettled. Mean temp. 58°. A severe TS occurred on the 3rd, the lightning being very vivid and frightfully near—a woman was killed during the storm.

WALES.

HAVERFORDWEST.—Another fine month, with small R; the heat was never excessive, the temp. rising to or above 70° on only seven days. Haymaking was carried on under difficulties during the first half of the month, but from the 19th to the 31st, was superb haymaking weather. The morning of the 16th opened damp and close, thunder clouds gathering and culminating in a great storm of T L and R at 2 p.m., lasting till midnight; the L was very vivid

and the T very loud and near. On the 18th and 19th it blew with the force of a gale from the N.N.E., especially from 6 p.m. to midnight of 18th, after which the weather was fine and bright to the end of the month. [In the remarks on June the driest spring was 1859, not 1853.]

SCOTLAND.

CARGEN.—The mean temp. of the month ($56^{\circ}6$) is $2^{\circ}5$ below the average. The first three weeks were unusually cold for July, the mean temp. of the period having been only $54^{\circ}8$; the last ten days were warmer, but very slightly above the average. The remarkable cyclonic disturbance, which traversed Britain on the 19th, was felt here severely, the centre of the storm apparently being over this district between noon and 2 p.m. The R for the 7 months of the year ($17\cdot42$ in.) is $4\cdot66$ in. below the average; Sunshine 44 hours less than the average; vegetation retarded, and harvest will be unusually late; H showers on the 8th; gale on 19th; E winds on 17 days.

JEDBURGH, SUNNYSIDE.—Great want of sunshine and much N.E. wind; dry weather during the latter half of the month; the hay crop is good and well got in; cereals have made great progress, and the crops look well; turnips are good and promise well.

OBAN.—After the first week, which was wet, the month remained very dry throughout, and gave an excellent first hay crop; but other crops were backward, and the temperature was below the average to the end.

ABERDEEN.—A cold cheerless month; wind for the greater part from N. or N.E.; fruit backward for want of sun; and flowers damaged by cold winds.

IRELAND.

DARRYNANE ABBEY.—The first half of the month was very wet; the second half, dry and hot. The total R fall is the heaviest for July in the 13 years 1870-79 and 1890-92; the next heaviest was $6\cdot42$ in. in July, 1871; $1\cdot46$ in. fell between 4 a.m. and 9.40 a.m. on 9th (most of it after 7.30 a.m.), causing a very high flood.

WATERFORD BROOK LODGE.—Mean. temp. $57^{\circ}7$. The latter half of the month was most favourable for haymaking; thick fog in the evening of the 1st; T and L on 5th and 11th; gale from N.W. on the 18th. Blight has commenced to show on the potatoes.

O'BRIENSBRIDGE, ROSS.—A fine haymaking season from the 15th to the end of the month; no excessive heat but good average temp. and much brilliant sunshine. Gales from S.W. in the first ten days.

DUBLIN.—A changeable, squally, showery, but by no means wet month, of very low mean temp. and deficient rainfall, a great preponderance of N.E. and N.W. winds. Mean temp. $57^{\circ}8$, $2^{\circ}8$ below the average; the shade temp. exceeding 70° on only two days. In only two years since 1864 was July colder than in the present year. High winds were noted on 10 days and attained the force of a fresh or moderate gale on 6th, 9th, and the 19th. Distant T on the 3rd; fog on the 30th. The rainfall for the 7 months, ending July 31st, amounted to $13\cdot72$ in. on 109 days, compared with $10\cdot94$ in. on 92 days in 1891, and a 25 years average of $14\cdot73$ in. on 113 days.

BALLINASLOE.—The latter part of the month very fine and warm, and much hay was saved.

WARINGSTOWN.—Hay secured in unusually good condition, and a good crop. All other crops promising.

OMAGH, EDENFEL.—Up to the 9th the weather was cool, wet and unsettled, but from thence to the end (with the exception of a short break on the 18th) it continued dry and fine, with settled easterly and northerly airs and mostly cloudy skies and temperatures under the average. An excellent hay harvest has been secured in superb condition.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCCXX.]

SEPTEMBER, 1892.

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

THE WELSH EARTHQUAKE OF AUGUST 18TH.

WE have been favoured by several of our correspondents with notices of the above, but we see in *Nature* that C. Davison, Esq., M.A., of 38, Charlotte Road, Birmingham, who is the secretary of the British Association Committee on Earth Tremors, is preparing a report upon it, and we shall, therefore, place in his hands all the information we have received and collected, and we invite all who can to render him all possible assistance.

This, however, need not prevent our giving a few details.

Area.—The shock was felt over the South-East of Ireland, the whole of Wales, in Cornwall as far as Penzance, in Herefordshire and in Worcestershire.

Time.—As is usual the records are very unsatisfactory; they range between 0.15 a.m. and 0.35 a.m. The most numerous records are 0.30 a.m., but 0.25 a.m. was often given. As regards the 0.30 a.m. its frequency arises from the habitual lack of precision, and 0.30 a.m. implies some time between 0.20 and 0.40 a.m. There is, we think, little doubt that the time recorded by Mr. E. P. Phillips, of Haverfordwest, is correct, or within one minute. He did not merely trust his own watch, but checked it by the clock at the telegraph office, and reported 0.24 a.m. The following are fairly consistent :—

	A.M.		A.M.
Carmarthen, Whitland	0.23	Carmarthen, Carmarthen	0.25
Pembroke, Haverfordwest	0.23	Cardigan, Cardigan	0.25
" "	0.24	Dublin, Greystones	0.25
" "	0.25	Pembroke, Broad Haven.....	0.26
" Milford	0.25	" Tenby	0.27
Hereford, Hereford	0.25	Wexford, Inch	0.28
Devon, Ilfracombe	0.25	Flint, Rhyl.....	0.30
Glamorgan, Cardiff	0.25		

There was a less violent shock about 1.39 a.m. on the same day—i.e., 1½ hours afterwards.

Structural damage.—This was quite insignificant; one chimney was thrown down at Haverfordwest Workhouse, some plaster was

cracked at Pembroke Dock, and some windows were broken near Llanstephan.

This being the case, our readers may think that to collect information about it is "much ado about nothing." We do not think so. Much information respecting the effects of earthquakes and the areas over which they are most prevalent has been collected during the last half century, but we are as far as ever from knowing when to expect them. And though anybody can understand that if sea water penetrates into crevasses in red hot rocks a very considerable explosion will result, no one has yet explained why that explosion occurs so rarely. So that there is great room for discovery in this matter.

It has often struck us as strange that scarcely anyone seems to study the records of the numerous self-recording tide gauges, except with the view to the improvement of the constants. Surely a study of their irregularities would amply repay the labour. There are dozens of these costly and beautiful instruments at work, and yet (except *re* Krakatoa) we never heard of a meteorologist or seismologist devoting himself to the study of their records.

The relation between thunderstorms, tidal disturbances and barometric oscillations has not been worked out; and whether or not these are further connected with such slight earthquakes as that of August 18th can neither be affirmed nor denied. As contributions towards it we draw attention to the remarks on page 127 from our Babbacombe observer, and we print the following notes. If anyone is inclined to investigate the subject we will lend all the aid in our power, and can give references to some very queer "coincidences," if nothing else, during the last 30 or 40 years. Even as regards August 18th there are several useful letters in the *Standard*, and even as far from the centre of disturbance as London some curious irregularities in the barometric curve.

NOTES AS TO THE EARTHQUAKE IN DEVON, CORNWALL, AND SOUTH WALES, AUGUST 18TH, 1892, 12.30 A.M.

Friday, August 12th.—Fine aurora, 7–9 p.m., reported from Gloucester. Telegraph instruments much disturbed by earth currents. Aurora also seen at Highgate.

Monday, August 15th (9 p.m.).—Bright meteor seen at the Lizard by one of my party.

Wednesday, August 17th.—At Fowey. Morning brilliantly cloudless, wind S.W. Sun oppressively hot, so much so that it was impossible to remain any length of time exposed, even on the water. At 3 p.m. the "Noah's Ark" formed across the sky from S.W. to N.E., the form very perfect, the bands of cloud unusually wide and dense, but sharp. This continued till 4 p.m., and then dispersed.

Travelling later to Plymouth, all distant views appeared to me remarkably sharp and clear. Fine night, rather cold; wind S.

I was afterwards informed by the captain of the "Dartmouth

Castle" (plying on the Dart between Dartmouth and Totnes), that on his arrival at Totnes on this (Wednesday) afternoon, about 1 p.m., when it should have been high water, the tide was almost out, and it came in afterwards late.

Thursday, August 18th—Earthquake at 12.30 a.m. I felt nothing of this at Plymouth, and if felt there at all, must have been slight. The first I heard of it was at Princetown on the following morning.

10–11 a.m. A severe thunderstorm, with heavy rain, passed over Plymouth from the sea, travelling N.

On this (Thursday) afternoon the Dart was again disturbed. I was subsequently informed by a member of the committee of the Totnes Regatta (which took place this day) that high water being due about 2 p.m., the tide ceased to flow, and began to ebb before 1 p.m., so much so that it was feared the regatta would be stopped. About 2 p.m. he was on Totnes Bridge, and saw a wave about a foot high coming up the river and sweeping along and over the banks. After this passed, the tide continued to flow, and high water was reached about 3 p.m., or about an hour late.

This phenomenon was not observed on the Thursday by the captain of the "Dartmouth Castle," for he was lower down the river at the time; but he was informed by a man fishing up one of the creeks that he had heard the rush of the water on the rocks a mile away.

I have long held the belief that earthquakes are of three classes, or, rather, due to three distinct causes:—

- (a) Those which are due to volcanic disturbance, and are connected with the eruptive action of volcanoes, whether actually accompanied by an eruption or not.
- (b) Those which are due to the contraction, crushing or slipping of the rocks forming the earth's crust, resulting, it may be, in faults of greater or less magnitude, but not arising from volcanic disturbance.
- (c) Those which are due to a disturbance of the electrical and magnetic equilibrium of the earth producing an irregular tension on various portions of the crust. The cause of such disturbances may be very complex; it may be due entirely to agencies within the sphere of the earth and its atmosphere, or to meteoric causes. In this relation I have frequently observed that earthquakes occur at a time when meteors are frequent. For instance, during the great series of the Charleston earthquakes some autumns ago I nightly observed numerous meteors of unusual brilliancy, and at the same time there were constant thunderstorms over England and France.

I am induced to think that the phenomena I have mentioned point to the earthquake of August 18th being one of the third class.

JAMES WOOD, M.A., F.G.S,

August 30th, 1892.

THE BRITISH ASSOCIATION AT EDINBURGH.

(Continued from page 101).

THE EFFECTS OF RAINFALL IN THE ISLAND OF FORMOSA.

Mr. John Thomson said that the island afforded a striking example of the work of rain in altering the surface of the land, building up plains seawards, and ultimately fitting them for tillage, and for the support of an increasing population. After giving some particulars as to the geographical position and configuration of the island of Formosa, ocean currents, temperature and prevailing winds, Mr. Thomson said that on the eastern side of the island the rain descended in torrential streams and cataracts through chasms and gorges to the ocean. The eastern side presented a rocky front to the sea. The denudation of the mountains by erosion and its effects could hardly be traced on that side of the island, as the detritus was deposited in the deep sea adjoining the cliffs. On the west of the central chain, where the gradient was more gentle, they found an extensive plain, part of which had been built up within the historic era by the detritus washed down from the mountains, and the major part in a similar manner during the carboniferous period. Evidence of how the change had been accomplished existed in the table-lands and spurs of the central range, about fifteen miles inland from Taiwau, in the manner in which these lower "no man's lands" (so named by the Chinese), were cut up and demolished by the drainage of the lofty chain, chasms cut out by torrents during the rainy season, vast funnel-shaped pits where the land had fallen in undermined by water, broad river beds cut deep into the table-lands, their banks strewn with rounded and polished boulders of gigantic proportions that had been driven from inaccessible heights and rounded on their downward course to the plain. The greater part of the plain was "an alluvium," a rich loam derived partly from the shales of the central mountains, partly from the sandstones south, and partly from the limestone hills which reached here and there above the level of the lowland. Thus they saw within the narrow compass of the island of Formosa, rainfall and its results, year by year adding to the habitable plain, and creating extensive shoals between the island and mainland.

DANGER FROM LIGHTNING.

Mr. W. H. Preece read a paper on the "Destruction of Lightning Protectors by recent Municipal Legislation." He said that in this country the immunity of private houses from being struck by lightning was very marked, and was considered to be due to the fact that the lead on the roofs and the iron stack-pipes which drained the roofs, connected as they were, formed an admirable lightning protector. Householders were now, however, required to cut off the direct communication of these pipes with the drains, and to leave an air-space between the end of the pipe and the grating of the drain. The result was that the electrical conduction of the pipe was broken, the stack-pipe ceasing to be a lightning protector, the houses were left exposed to the dangers of atmospheric electricity. The remedy was very simple. The pipe need not be entirely cut away. Three-fourths of its circular section might be removed for the distance required, and one-fourth might be left to maintain the old electrical connection; or, if the separation had been effected, then the

stack-pipe should be connected with the drain by a wire or rod, so as to restore the path of the charge to earth. Householders were also, by the same legislation, now compelled to put up pipes to ventilate their soil pipes, erecting above the roof a metal tube forming a permanent object exposed to the atmospheric charge, and terminating frequently in an earthenware pipe which was entirely disconnected from earth. Hence it was liable to be struck by lightning as it offered no means of escape. That should be connected with the earth through the stack-pipes.

Professor Reynolds asked if the whole blame rested with the authorities, or whether the sanitary engineers only recommended the detaching the pipes from the drains?

Mr. Preece said that he did not know where the blame rested. In reply to another question, Mr. Preece said that they might take it from him that if some means were not taken to protect the stack-pipes from atmospheric electricity, injury was sure to occur, which could only be prevented by completing the electrical connection.

REPORT OF THE EARTH TREMOR COMMITTEE.

This was read by Mr. C. Davison, Secretary to the Committee.

During the past year the attention of the Committee has been directed to ascertaining what instruments have been devised in all countries suitable for the work with which your Committee is charged. They believe that the list is now nearly complete, and in their next report they propose to fully describe and illustrate these devices, as they are sure that such a collection of descriptions would be extremely useful.

This list will certainly contain the following instruments, and probably others of a simpler and less expensive character :—

1. The *Nadirane*. Erected by M. Wolf in the Observatory of Paris.
2. The *Pendulum with double-suspension mirror*. Employed by Messrs. G. H. and H. Darwin, at Cambridge, in their attempt to determine the lunar disturbance of gravity.
3. The *Tromometer*. Used by P. Bertelli at Florence, and by other observers in Italy and Switzerland.
4. The *Tremor Recorder* of Professor Milne. Used by him in Japan.

Mr. Horace Darwin has recently invented another form of pendulum, smaller and less delicate than the one referred to above. This instrument has been made by the Cambridge Scientific Instrument Company, and Mr. Darwin has generously offered to place it temporarily at the disposal of the Committee. Experiments will be made with it shortly, an account of which the Committee hope to give in their next report.

The Committee request that they be re-appointed, with the addition of Prof. C. G. Knott, Mr. Horace Darwin and Prof. J. H. Poynting.

SPIDERS AS WEATHER PROPHETS.

The title of the paper to be read by the Rev. H. C. M'Cook, of Philadelphia, was announced as "On the Social Habits of Spiders," but we have changed it to one which seems more appropriate.

The author said that the opinion was widely disseminated that spiders had the power to foretell weather changes. The notion had indeed been enter-

tained as far back as the time of Pliny. The opinion in England was expressed by the Rev. J. G. Wood in his charming book, "Homes without Hands," where he stated that spiders never troubled themselves to make webs when a storm was brewing. Again, many farmers in America believed that when spider webs appeared on the grass the weather would be fine. Mr. M'Cook also referred to the romantic incident related of Disjonval, an Adjutant-General in the Dutch service, who was imprisoned by the Stadtholder of Holland, and during his eight years of imprisonment studied the habits of spiders so accurately that he was able to tell ten or twelve days in advance the approach of clear or stormy weather. When the French troops entered Holland in 1794, their approach was arrested by the thawing of the canals. When they were about to leave the country Disjonval sent their General word that there would be a hard frost. The General advanced, and the prediction was realised. The country was occupied, and Disjonval was freed. Independent of a number of inconsistencies, the author was of opinion that the little incident was but a fairy tale, and considered that any person could have predicted that a frost would have followed. He proceeded to give the evidence derived from his own observations on the subject. His method was to make observations in various parts of the country, and secondly to colonise various species of the ordinary weaver spiders found on the shrubbery and vines on his own manse yard. He quoted these observations extending over a period of five or six years, the result of which showed that spiders have not the power to prognosticate the weather. They were found in the early morning spinning their webs when the day following was rainy and stormy. The observations were made in couples and triplets, so that there could not arise the doubt that they were predicting for the following day, for his observations showed that the day following was also bad. Further, the spiders remained on the webs during heavy storms, many of them taking no notice of the rain. He gave one observation he had made in England at Manchester during the meeting of the British Association. There were the usual excursions on Saturday, and the day preceding was rainy, and the weather on the Saturday was alternately sunshine and stormy. While walking through the policies of Tatton Hall he observed that the spiders had everywhere woven innumerable webs. In conclusion, he ventured the opinion that the popular tradition that the weather could be predicted by the actions of the spiders was without any basis in fact. His observations did not apply to all spiders, but specially to the ordinary weavers.

REPORT OF THE COMMITTEE ON SOLAR RADIATION.

This was read by Sir George Stokes, who described the various forms of actinometer in use for measuring the intensity of solar radiation. He classified these into two forms—namely, statical, in which the constant temperature of a thermometer exposed to the sun was recorded; and dynamical actinometers, whose thermometer was exposed intermittently and read at regular intervals. Some results obtained by a new dynamical actinometer of the late Professor Balfour Stewart were then discussed.

YORK WEATHER, 1841 to 1890.

This paper, by Mr. J. E. Clark, has been printed, and we hope ere long to notice it among our Reviews.

REPORT OF COMMITTEE ON SEISMOLOGICAL PHENOMENA OF JAPAN.

In the absence of Professor Milne, this was read by Dr. C. G. Knott. The most interesting feature was a description of the severe earthquake which occurred recently, some results of which were shown by means of engravings from photographs. Among the results may be mentioned the depression of a valley by about 19 ft. and for a distance of 30 miles, thus forming a great geological fault; also the destruction of mills, bridges, and towns, and the curving of a railway line running along an embankment and bridge in the path of the earthquake. Incidentally Dr. Knott mentioned that, in many cases of earthquake, oil was overturned, and by catching fire did more damage than the earthquake itself. In the recent earthquake, however, the damage by fire was comparatively slight.

THE IMPURITIES OF TOWN AIR.

Dr. G. H. Bailey, of Manchester, said that during the past twelve months the Air Analysis Committee of Manchester, in conjunction with the Royal Horticultural Society, had been engaged on the analysis of the air of large towns. Much information as to the carbonic acid in the air having been collected by previous observers it had been thought desirable to devote especial attention to sulphurous acid and organic matter. Since the object was not merely to collect data, but to lay the foundations of what may be termed chemical meteorology, the atmospheric conditions prevailing at the time of the observation had been noted. From the results of several hundreds of analyses carefully conducted in London, Manchester, and Liverpool, the following conclusions had been drawn:—(1) That in clear breezy weather the amount of sulphurous acid is less than 1 milligramme per 100 cubic feet of air; (2) that in anticyclonic periods it rises very considerably, and in times of fog, maxima of 34 and 50 milligrammes have been recorded for the worst districts of Manchester and London respectively; (3) that wherever an open space or a less densely populated area occurs, there is a very marked diminution of the amount of impurities in the air; (4) that an increase in the amount of sulphurous acid is accompanied by at least as large an increase in the amount of organic impurities in the air; and (5) that smoke, promoting as it does the formation of fog, and preventing free diffusion into the upper stratum of the air, must be regarded as the principal cause of the impure state of the atmosphere in large towns.

THE BEN NEVIS OBSERVATIONS.

Lord M'Laren submitted the report of the committee appointed for the purpose of co-operating with the Scottish Meteorological Council. It stated that during the past year the hourly observations by night and by day had been made without interruption by Mr. Omond and the assistants, and that at the low level observatory at Fort William in connection with the Meteorological Council, the continuous registration and other observations had been also successfully carried out. The maximum temperature for the year at the top was 64°·9 in June. The minimum temperature was 5°·6 in March. This gave the unusually large range of 59°·3 of temperature for the year at the top

of the Ben, being nearly 10° larger than the previous year. The mean temperature for the year 1891 at Fort William was 47° , being a fifth of a degree lower than the mean of previous years. The mean temperature at the top of the mountain was $31^{\circ}3$, or three-tenths of a degree above the average of the year. This excess of annual temperature held good at insular situations from Barra Head to Islay. The sunshine recorder at Fort William showed 1,220 hours, but that on the Ben showed only 908 hours out of a possible 4,470 hours; in 1890 the number was even smaller, only 591 hours. The rainfall for the year was 178.02 inches; in 1890 it was 198.24 inches. At Fort William it was 78.81 inches, nearly 100 inches less than on the top of the mountain. On 106 days the rainfall was *nil* or less than 100th of an inch, there being only one fair day in August, but the unusually large number of 19 fair days were reported in April, and 18 in June.

On the suggestion of Mr. J. Y. Buchanan, a systematic series of observations had been instituted, having for their object a careful record of the height above sea level of the lower surface of clouds that from time to time covered the face of the mountain facing Fort William. The importance of these observations would be recognised when it was remembered that during a large portion of the year the Observatory was enveloped with a completely saturated atmosphere.

Steps had been taken to make the observation of dust particles in the atmosphere part of the regular work of the Observatory. The observations already taken showed that dry thick fog contained a great amount of dust, but thin wet mist very little. It was when a thin dry mist enveloped the mountain that the lowest values were observed, and the all-important observation had been made, after consulting the daily weather maps of Europe, at the time when the winds differed in direction 90° degrees or more from the winds then prevailing near the sea level. In other words, the drizzling and practically dustless winds blew out from a shallow cyclone, overspreading that part of Europe at the time.

The scholarship placed at the disposal of the directors of the Observatory by the Commissioners of the 1851 Exhibition was to be devoted to observations on the hygrometry of the atmosphere at the two observatories.

During the past year Mr. Omond had been engaged in an inquiry into the relations of the Ben Nevis high and low level observatories to the cyclones and anti-cyclones, or the weather changes of the British Isles; Dr. Buchan was investigating the observations at the two observatories during February and September, 1891, in their relation to changes of weather; and Mr. Mossman had been discussing the observations made by Mr. Wragge in 1882.

The President moved a vote of thanks to the committee conducting the work at Ben Nevis.

MISCELLANEOUS COMMUNICATIONS.

Mr. J. Y. Buchanan, Edinburgh, communicated to the section the results of a number of observations he had made with the view of determining the density, temperature, and motion of the waters of the gulf of Guinea. Colonel Tanner, of the Ordnance Survey Department, read a paper on the subjects of photography as a means of surveying, in which he expressed himself of opinion that photography might be employed with advantage in the surveying of highly mountainous tracts.

THE HEIGHTS OF AURORAS.

To the Editor of the Meteorological Magazine.

SIR,—It is to be regretted that no even moderately systematic attempt to calculate the heights of auroras has been made in this country for a long time past. An effort is being made by Dr. Veeder in the United States, and I would suggest that observations should be made on the lines proposed in my letter, which appeared in your vol. vi., pp. 223, 224, to which might be added :—

“Observers should state with what degree of accuracy they know the time, and if they are doubtful as to the exact time, they should extend their observations sufficiently to be sure they *include* the precise hour and half-hour.”

Probably Dr. Veeder would undertake the discussion of European observations—failing anyone here to do so. Any I may make I purpose submitting to him, and I should have pleasure in forwarding others that may be made and sent to me here.

T. W. BACKHOUSE.

Sunderland, August 26th, 1892.

A WET AUGUST.

To the Editor of the Meteorological Magazine.

SIR,—Among those who never visit Ireland, and who neglect to read the *Meteorological Magazine*, there is a general belief that it rains incessantly in this much maligned island.

During the first six months of this year the rainfall here was only 10·90 inches, but this amount has been exceeded by the fall of 11·37 in. during the past two months—viz. : 3·57 in. in July, and 7·80 in. (a “record”) on 24 days of August.

	in.		in.
August 1.....	·02	Forward.....	5·30
„ 2.....	—	August 18.....	·01
„ 3.....	—	„ 19.....	—
„ 4.....	—	„ 20.....	·01
„ 5.....	·05	„ 21.....	·03
„ 6.....	·19	„ 22.....	·46
„ 7...	1·09	„ 23.....	·96
„ 8.....	—	„ 24.....	·22
„ 9.....	—	„ 25.....	·01
„ 10.....	·04	„ 26.....	·09
„ 11.....	·05	„ 27.....	—
„ 12.....	·87	„ 28.....	·08
„ 13.....	·17	„ 29.....	·19
„ 14.....	1·42	„ 30.....	·39
„ 15.....	·41	„ 31.....	·05
„ 16.....	·38		
„ 17.....	·61		
	5·30		7·80

3·86 in 6 days.

Yours faithfully,
F. FRASER.

Hazelfort, Shinrone, Tipperary.

THE GREAT HEAT IN AUGUST, 1892.

ABRIDGED AND TRANSLATED FROM "CIEL ET TERRE."

OUR readers know our strong objection to duplicate work, and, therefore, will not be surprised that, instead of ourselves investigating the distribution of the exceptional heat in the middle of August, we at once accept the summary given by M. Lancaster in *Ciel et Terre*, and refer those of our readers, who are not regular readers of that excellent journal to it for full details, giving here only the salient features.

Had it not been for telegraphs and newspapers, English people would have thought that the heading must be wrong, for in this country the heat has not been at all exceptional.

As a general classification M. Lancaster seems to put the districts as follows :—

Exceptionally hot.	Average.	Below average.
France, Central.	Algeria	British Isles.
„ West ...	Italy.....	Holland.
„ North ...	Spain	Germany, East.
Belgium.....	France, South-East ...	Norway.
Germany, South		

Referring our readers to M. Lancaster's article for the details for 35 stations for each day from August 15th to 19th, we quote only records of 100° F. or upwards !

North Africa...	Tunis	102°·2 on 19th
Spain	Madrid	104°·9 on 15th
Italy	Florence	100°·4 on 18th
Austria	Buda Pesth ...	100°·4 on 18th
France	Biarritz	107°·6 on 16th, and 104°·0 on 17th
„	Bordeaux	107°·4 on 16th, and 104°·4 on 17th

When we mention that even at Biskra, which is so far inland in Africa that it may be fairly described as in the desert of Sahara, the maximum was only 96°·8, the exceptional character of the above entries will be fully realized.

REPORT ON THE GREAT RAINFALL IN EAST CLARE
ON THE 2ND OF JULY, 1892.

AN unparalleled fall of rain took place in East Clare on the 2nd July, 1892. The rain fell at various times during the day and night, but the largest part fell between 1 p.m. and 3.30 p.m. The amount of rain recorded for the 24 hours, ending at 9 a.m. on the 3rd, was as follows :—

Kilkishen Glebe (Canon Lloyd)	1·17 inches
Hurdlestown (Capt. Bentley)	2·12 „
Ross (John Digan, Esq.)	1·23 „

It will be seen that the great bulk of the rain fell in the mountain

district round Hurdlestown ; 2·12 inches being the largest fall in 24 hours on record there, during 7 years observations.

Floods.—This fall of rain caused (in the barony of Lower Tulla) the greatest floods remembered. The water ran down the mountain sides in torrents, and caused very considerable damage to the roads and bridges, some of which may be mentioned.

The Ballymacdonnell River.—This river, which drains the north slope of the Kilbane Mountains, is at all times liable to very sudden and severe floods. When in its normal condition, it contains but little water, and may be forded at any point ; but when much rain falls on the mountains, it becomes a raging torrent nearly 40 yards wide. The high road from Broadford to Scariff crosses it by a bridge of two arches, which was designed by, and built in 1845, under the superintendence of, Mr. John Hill, M. Inst., E.C. During the ten years previous to that date, seven or eight bridges had been built in the same place, and had been all carried away by floods. The flood on the evening of the 2nd of July was the largest seen in the river since the last bridge was carried away in 1845. It did the present structure no damage, but completely filled up the north arch with sand and large stones. Much injury was done to the low lands on the banks of the river, some small fields of potatoes being carried clean away.

The Crean Stream.—This is a very small stream, and during the summer months it is very often quite dry, but after the rain on the 2nd of July it contained a very severe flood. The flood in it was so great that it moved a large stone in the bed of the stream some distance. I measured this stone, and found its weight to be nearly 7 tons.

The Cloughera River.—This river was also much flooded. Half of one arch of Cloughera-bridge was carried away, and considerable damage was done to the structure.

The Hurdlestown Stream.—This is a small stream often quite dry in summer, but it contained the largest flood on record on the 2nd of July. The flood moved many large rocks in the bed of the stream, some being smashed in pieces by the force with which they struck against each other.

The Roads.—The roads in this district nearly all sustained much damage, in many cases the broken stones on the surface being washed away and the "crust" was broken through in many instances.

No person living here remembers a greater fall of rain, or more severe floods.

H. A. BENTLEY, CAPTN.

Hurdlestown, Broadford, Co. Clare, 30th Aug., 1892.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEBRUARY, 1892.

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		
England, London	53·0	7	17·5	17	44·7	33·9	35·9	89	86·1	12·2	1·62	17	6·9
Malta.....	68·2	19	45·0	5	61·6	51·8	50·5	86	123·4	39·0	1·18	10	5·7
Cape of Good Hope ...	89·9	10	48·1	14	78·5	57·9	...	...	...	...	·16	1	2·5
Mauritius.....	85·4	23a	71·1	20	83·2	75·2	72·2	81	138·7	66·2	13·86	21	7·6
Calcutta.....	90·7	27	52·2	17	84·7	61·6	59·0	65	143·7	44·4	·04	1	1·8
Bombay.....	88·2	2	66·0	15	84·8	71·6	65·7	66	135·2	51·0	·00	0	0·6
Ceylon, Colombo ...	91·8	2	71·3	...	87·1	73·6	71·1	77	151·5	65·0	5·32	12	4·7
Melbourne.....	96·5	22	47·1	27	77·1	56·5	54·6	67	147·0	39·9	·60	4	4·7
Adelaide	107·6	18	51·5	26	85·8	61·3	51·7	47	164·4	42·6	·23	5	3·4
Tasmania, Hobart.....	...	...	...	...	...	...	...	...	...	...	...	...	...
Wellington	76·0	5c	47·0	1	70·6	55·1	54·9	79	130·0	40·0	4·20	9	4·5
Auckland	80·5	1	55·0	8	73·3	60·0	60·5	81	143·0	50·0	2·64	13	5·2
Jamaica, Kingston.....	87·7	15	63·0	2	84·8	66·6	64·2	70	...	...	·34	4	4·3
Trinidad	92·0	13	65·0	16	88·2	69·2	68·6	72	156·0	56·0	2·19	7	...
Toronto	39·1	22	— 6·2	13	31·0	17·5	22·8	85	...	—11·0	2·27	15	7·0
New Brunswick, Fredericton	42·9	26	— 7·7	28	29·5	10·5	14·5	70	...	...	2·45	12	7·0
Manitoba, Winnipeg ...	34·6	22	—39·9	18	11·6	—11·9	...	...	...	...	·60	9	5·0
British Columbia, Esquimalt.....	59·9	28	29·0	6	47·5	35·4	40·0	95	...	...	·80	19	7·0
a And 24. b And 10, 18. c And 23.													

REMARKS.

MALTA.—Mean temp. 55°·9. Mean hourly velocity of wind 12 miles. The sea temp. rose from 58°·6 to 61°·0. L seen on 23rd. R for the winter 34 per cent. below average. J. SCOLES, S.J.

Mauritius.—Mean temp. of air 0°·6, of dew point 2°·1, and total R 7·34 in. above, their respective averages. Mean hourly velocity of wind 13·0 miles, or 1·7 above average; extremes, 47·5 miles on 12th and 1·9 miles on the 16th; prevailing direction E. to E. by N. T and L on 16th and 27th, and L on 25th and 26th. Two cyclones passed N., N.W., and W. of the island, one from the 11th to the 14th, and one from the 24th to the 28th, C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—TSS occurred on the 11th, 13th, 15th, 25th, 27th, and 28th. L only was seen on the 16th, 19th, and 22nd. J. C. H. CLARKE, Lt.-Col. R.E.

Melbourne.—Mean temp. of air 0°·4, of dew point 1°·3, and humidity 1, above; mean amount of cloud 0·6 and total R 1·28 in. below, their respective averages. Prevailing winds S. and S.W., strong on 4 days. Heavy dew on 12 days. L on 3 days. Dense fog on the morning of the 19th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean barometer ·057 in. above, and mean temp. 0°·1 and total R ·44 in. below, the 35 years average. The shade max., 107°·6, is the highest recorded in February since 1879. The month was very dry all over the colony, particularly in S. and S.E. C. TODD, F.R.S.

Wellington.—Generally fine weather, with showers at intervals; heavy R in early part, 2·43 in. falling on the 6th. Prevailing N.W. wind, strong on 7 days. Earthquakes on 14th, 11.20 p.m., smart; on 28th very slight at night. R. B. GORE.

Auckland.—Showery at the commencement and middle of the month, otherwise fine and dry, with light, variable winds. R and mean temp. both slightly below the average of 25 years; barometric pressure a little above. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
 AUGUST, 1892.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	3·38	XI.	Rhayader, Nantgwillt..	3·64
„	Birchington, Thor	4·42	„	Corwen, Rhug	4·18
„	Brighton Prestonville Rd	2·86	„	Carnarvon, Cocksidia ...	5·92
„	Hailsham	3·70	„	I. of Man, Douglas	6·54
„	Ryde, Thornbrough	2·69	XII.	Stoneykirk, Ardwell Ho.	7·01
„	Alton, Ashdell	4·57	„	New Galloway, Glenlee	8·07
III.	Oxford, Magdalen Col...	2·91	„	Melrose, Abbey Gate ...	4·11
„	Banbury, Bloxham	2·58	XIII.	N. Esk Res. [Penicuik]	4·90
„	Northampton, Sedgebrook	2·04	„	Edinburgh, Blacket Pl..	4·80
„	Cambridge, Fulbourne..	...	XIV.	Glasgow, Queen's Park.	6·13
„	Wisbech, Bank House..	2·17	XV.	Islay, Gruinart School..	4·21
IV.	Southend	2·64	XVI.	Dollar	7·40
„	Harlow, Sheering	3·48	„	Balquhider, Stronvar..	10·80
„	Rendlesham Hall	4·75	„	Coupar Angus Station..	3·99
„	Diss	2·86	„	Dunkeld, Inver Braan..	4·88
„	Swaffham	2·33	„	Dalnaspidal H.R.S. ...	7·60
V.	Salisbury, Alderbury...	3·68	XVII.	Keith H.R.S.	3·97
„	Bishop's Cannings	4·37	„	Forres H.R.S.	2·50
„	Blandford, Whatcombe.	3·98	XVIII.	Fearn, Lower Pitkerrie.	2·62
„	Ashburton, Holne Vic. ...	5·49	„	Loch Shiel, Glenaladale	9·61
„	Okehampton, Oaklands.	4·19	„	N. Uist. Loch Maddy ...	3·64
„	Hartland Abbey	4·70	„	Invergarry	7·11
„	Lynmouth, Glenthorne.	4·95	„	Aviemore H.R.S.	4·35
„	Probus, Lamellyn	4·63	„	Loch Ness, Drumnadrochit	3·90
„	Wincanton, Stowell Rec.	4·52	XIX.	Lairg H.R.S. ....	...
„	Weston-super-Mare	3·96	„	Scourie	5·82
VI.	Bristol, Clifton .....	...	„	Watten H.R.S.	2·08
„	Ross, The Graig	2·67	XX.	Dunmanway, Coolkelure	9·96
„	Wem, Clive Vicarage ...	1·97	„	Fermoy, Gas Works ...	7·26
„	Cheadle, The Heath Ho.	2·87	„	Killarney, Woodlawn ...	10·24
„	Worcester, Diglis Lock	2·66	„	Tipperary, Henry Street	6·45
„	Coventry, Coundon	2·65	„	Limerick, Kilcornan ...	5·01
VII.	Ketton Hall [Stamford]	1·52	„	Ennis	6·52
„	Grantham, Stainby	1·83	„	Miltown Malbay	7·56
„	Horncastle, Bucknall ...	1·26	XXI.	Gorey, Courtown House	4·65
„	Worksop, Hodsck Priory	1·79	„	Mullingar, Belvedere ...	7·56
VIII.	Neston, Hinderton	3·74	„	Athlone, Twyford	7·06
„	Knutsford, Heathside...	3·52	„	Longford, Currygrane...	7·61
„	Lancaster .....	...	XXII.	Galway, Queen's Coll..	7·34
„	Broughton-in-Furness..	10·41	„	Crossmolina, Enniscoe..	6·46
IX.	Ripon, Mickley	3·87	„	Collooney, Markree Obs.	6·06
„	Scarborough, West Bank	2·31	„	Ballinamore, Lawderdale	...
„	East Layton [Darlington]	4·01	XXIII.	Lough Sheelin, Arley ..	7·69
„	Middleton, Mickleton..	4·39	„	Warrenpoint	7·48
X.	Haltwhistle, Unthank..	4·89	„	Seaforde	6·06
„	Bamburgh	3·50	„	Belfast, Springfield	5·81
„	Newton Reigny	6·63	„	Bushmills, Dundarave...	3·78
XI.	Llanfrechfa Grange	4·18	„	Stewartstown	6·55
„	Llandovery	4·32	„	Buncrana	4·61
„	Castle Malgwyn	3·06	„	Lough Swilly, Carrablagh	4·36
„	Builth, Abergwessin Vic.	5·22			

AUGUST, 1892.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which -01 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Differ- ence from average 1880-9.	Greatest Fall in 24 hours		Max.		Min.		In shade.	On grass.		
				Dpth	Date			Deg.	Date			Deg.	Date.
		inches.	inches.	in.				Deg.	Date	Deg.	Date.		
I.	London (Camden Square) ...	3.06	+ 1.18	1.71	27	17		82.1	17	43.1	11	0	0
II.	Maidstone (Hunton Court)...	3.11	+ 1.42	.66	19	16		...	...	...	...
III.	Strathfield Turgiss	3.82	+ 2.11	1.85	27	18		79.3	17	37.2	5	0	0
IV.	Hitchin	2.51	+ .69	.99	27	13		79.0	17b	44.0	10	0	...
V.	Winslow (Addington)	2.39	+ .42	.82	27	12		81.0	17	37.0	11	0	0
VI.	Bury St. Edmunds (Westley) ...	2.77	+ .57	.74	27	14		76.0	17	46.0	11	0	...
VII.	Norwich (Cossey)	2.34	...	.90	27	14		81.0	18	...	...
VIII.	Weymouth (Langton Herring) ...	2.67	+ .74	1.33	27	12		73.0	17	45.0	10	0	...
IX.	Torquay, Babbacombe ...	3.53	+ 1.55	1.75	27	15		76.2	17	43.6	11	0	0
X.	Bodmin (Fore Street)	4.76	+ 1.91	1.79	27	22		...	...	...	...
XI.	Stroud (Upfield)	3.07	+ .98	.91	27	19		70.0	1	45.0	10	0	...
XII.	Church Stretton (Woolstaston) ...	2.40	— .36	.61	23	20		74.0	22	42.5	10	0	0
XIII.	Tenbury (Orleton)	3.55	+ 1.43	.83	27	18		76.5	17	36.6	11	0	0
XIV.	Leicester (Barkby)	1.41	— 1.03	.43	27	12		82.0	23	35.0	4	0	0
XV.	Boston	1.93	— .19	.40	24	10		88.0	23	42.0	11	0	0
XVI.	Hesley Hall [Tickhill]	2.12	— .04	.96	29	13		81.0	23	42.0	11	0	0
XVII.	Manchester (Plymouth Grove) ...	4.94	+ 1.85	1.03	23	18		80.0	23	41.0	9	0	0
XVIII.	Wetherby (Ribston Hall) ..	2.84	+ .50	.78	29	9		...	...	...	...
XIX.	Skipton (Arnccliffe)	7.89	+ 3.56	1.87	31	14		78.0	23	42.0	20	0	0
XX.	Hull (Pearson Park)	2.85	+ .21	1.16	29	13		81.0	23	44.0	11	0	0
XXI.	Newcastle (Town Moor)	3.60	+ .89	.70	7	16		...	...	...	...
XXII.	Borrowdale (Seathwaite)	15.57	+ 7.12	2.70	26	23		...	...	...	...
XXIII.	Cardiff (Ely)	4.78	+ 1.17	1.61	27	14		...	...	...	...
XXIV.	Haverfordwest	3.15	— .03	.96	29	21		72.6	24	40.1	11	0	0
XXV.	Aberystwith, Gogerddan	3.13	...	.74	29	16		79.0	22	36.0	9	0	...
XXVI.	Llandudno	3.04	+ .68	.81	29	18		...	...	...	...
XXVII.	Cargen [Dumfries]	7.33	+ 4.34	1.98	29	17		75.8	23	35.4	10	0	...
XXVIII.	Jedburgh (Sunnyside)	3.75	+ 1.51	.47	29	16		73.0	23	35.0	10	0	...
XXIX.	Old Cumnock	6.08	+ 2.66	1.04	29	25		...	...	...	...
XXX.	Lochgilhead (Kilmory)	5.21	+ .65	.62	29	26		...	...	28.0	28	3	...
XXXI.	Oban (Craigvarren)	4.42	...	.69	14	22		68.0	1, 21	40.0	9	0	0
XXXII.	Mull (Quinish)	5.12	+ .97	.74	24	23		...	...	...	...
XXXIII.	Loch Leven Sluices	5.20	+ 2.26	1.00	30a	13		...	...	...	...
XXXIV.	Dundee (Eastern Necropolis) ...	5.95	+ 3.38	1.75	29	21		73.3	22	38.1	29	0	...
XXXV.	Braemar	3.76	+ .43	.87	29	24		71.0	23	32.0	10	1	3
XXXVI.	Aberdeen (Cranford)	3.86	...	.90	30	18		70.0	10	34.0	9	0	...
XXXVII.	Strome Ferry	6.25	+ 1.58	.71	26	25		...	...	...	...
XXXVIII.	Cawdor [Nairn]	3.20	+ .95	1.24	30	23		...	...	...	...
XXXIX.	Dunrobin	2.73	+ .33	.71	18	16		69.0	21	42.0	10	0	...
XL.	S. Ronaldsay (Roeberry)	3.68	+ 1.12	.81	14	20		66.0	22	42.0	2	0	...
XLI.	Darrynane Abbey	8.21	...	.90	12	26		...	...	...	...
XLII.	Waterford (Brook Lodge) ...	4.74	+ 1.32	1.00	28	21		71.5	1	41.0	10	0	...
XLIII.	O'Briensbridge (Ross)	6.08	...	1.17	7	20		73.0	1c	47.0	10	0	...
XLIV.	Carlow (Browne's Hill)	4.25	+ 1.28	.99	16	20		...	...	...	...
XLV.	Dublin (Fitz William Square) ...	3.56	+ 1.04	1.31	16	22		70.0	11d	43.0	10	0	0
XLVI.	Ballinasloe	6.50	+ 3.32	1.41	7	20		67.0	11c	44.0	9	0	...
XLVII.	Clifden (Kylemore)	9.05	...	1.34	12	23		...	...	...	...
XLVIII.	Waringstown	5.68	+ 2.57	1.12	7	20		76.0	23	45.0	28	0	0
XLIX.	Londonderry (Creggan Res.) ...	4.41	+ .29	.77	7	26		...	...	...	...
L.	Omagh (Edenfel)	4.83	+ 1.34	.80	7b	23		69.0	17c	33.0	6	0	0

a And 31. b And 23. c And 21. d And 13.

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

METEOROLOGICAL NOTES ON AUGUST, 1892.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; 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.

STRATHFIELD TURGISS.—On the whole a fair, warm month, but stormy towards the close. A heavy TS “circled” this station on the 24th, but did not develop here. TS on 18th; heavy gale on the 30th; very heavy R on the 27th.

ADDINGTON.—A fine month; very little R until after the 26th, when there was a downpour. The nights of the 5th and 11th very cold; min. on grass, 35° and 34°. Wind very rough on 29th and 30th. On the 18th and 23rd distant T and much L at night. The total R since 1st January, 10·95 in., is the least yet recorded during any corresponding period.

BURY ST. EDMUNDS, WESTLEY.—First half of the month seasonable; latter half much R, with high temp. TSS on 18th and 24th; T on 25th.

LANGTON HERRING.—Mean temp. very near the average. T and L on 18th and 23rd. Very high wind on 1st and 30th. Fog on 17th. The R for the eight months of this year (12·07 in.) is 4·57 in. below the average.

TORQUAY, BABBACOMBE.—A warm, variable month, with R fall above, Bar. and wet days exactly, and solar radiation below, the mean. No R was gauged in the first 7 days; only ·01 in. (on July 29th) in 19 days (July 20th to August 7th), and only 10·22 in. on 90 days in the long drought of 239 days, from January 12th to August 26th. On 27th 1·75 in. fell, the greatest in any day since November 12th, 1888. Shade max. rose to or above 70° on 14 days. Mean solar radiation, 51°·8, the lowest observed in August. A remarkable series of small Bar. waves (·01 to ·03 in.), 1 to 3 per hour, occurred from 8 p.m. 17th to 8 p.m. 18th, tidal waves or “bores” were felt in rivers Tamar, Yealm, and Exe, in the first 10 hours of—and TSS in English Channel throughout—this time, and earthquake in Devon, &c.—felt 2 miles N. of here—at 0.30 a.m. 18th. Gales on 3 days; T on 18th and 23rd; L on 18th, 22nd, and 23rd, and solar halos on 6 days; fog on 5 days. Parhelia on 10th; aurora borealis on 12th. Good harvest, mostly secured by 26th; heavy R following, did great good to burnt up pastures and roots.

BODMIN.—A large number of rainy days; chiefly very hot and sunny, except from the 27th, then colder and very wet, especially on that day, when 1·79 in. fell. The shock of an earthquake was felt here on the 18th at 0.30 a.m. A splendid month for the harvest, which is nearly completed in this district; crops generally good.

STROUD, UPFIELD.—On the 23rd, T and L from 7 to 8 p.m., very severe in the N. and S., but not heavy here. S.W. gale on 29th and 30th. Earthquake shock felt at 0.30 a.m. on 18th.

WOOLSTASTON.—A fine month till the last week, which was cold and showery. A severe storm of T and L on the 23rd. A shock of earthquake was very distinctly felt here at 0.30 a.m. (exactly) on the 18th. Mean temp. of month, 58°·9.

TENBURY, ORLETON.—Fairly warm, but no really hot days, though the max. reached 70° on 15 occasions. Great TS on 23rd; after the storm had passed over, 21 flashes of L were counted in a minute, and during the height of the storm their frequency was greater. T and L on 30th. Also aurora on 12th.

LEICESTER, BARKBY.—A variable month; deficiency of water; little or no fruit about here; corn harvest began on 12th. L on the 26th and 29th.

MANCHESTER, PLYMOUTH GROVE.—The first 12 days were on the whole bright and sunny. Summer weather prevailed from the 19th to 24th. The last week was cold and unsettled. A severe TS on the 23rd. Mean temp. 59°·5.

HULL, PEARSON PARK.—T was heard on the 24th; L seen on the 13th; aurora borealis on the 12th; TS on the 29th.

WALES.

HAVERFORDWEST.—Although some rain fell on 21 days, the month was remarkable for its warm character and amount of bright sunshine. The rain fell principally at night or during the early morning, and everything went well until the 29th, when a sudden change of weather with rapid fall of the barometer took place. The month ended stormy and wet; nearly half the R fall of the month occurring during the last three days. If it continues the crops will suffer serious damage. On the 29th and 30th a heavy gale blew from S.S.W. to N.W.; temperature reached 70° on only three days.

SCOTLAND.

CARGEN.—With the exception of three or four warm days between the 21st and 25th, the temp. of the month has been low and ungenial. For the whole month the temp. is 1°·2 below the average. The R fall has been excessive; on the 7th 1·58 in. was registered, and on the 30th 1·98 in., but the R fall for the past eight months (24·75 in.) is still 1·29 in. below the average for the period. The very heavy falls of R have done much damage to the corn crops, and will render harvesting operations very difficult. TSS were experienced on the 12th and 30th.

JEDBURGH, SUNNYSIDE.—The weather has been generally very wet. The temp. on the whole has been high, especially during the third week, which advanced all sorts of crops greatly. The hay has been well got in and is a good crop; the cereals are fully an average crop; the turnips are good; potatoes very good. Corn-cutting will not be general for a fortnight. Health of county good.

OBAN, CRAIGVARREN.—Temp. below the average. Crops backward, but the yield of hay good.

ABERDEEN.—A cold and cheerless month, little sunshine. Winds N. and N.E.

IRELAND.

DARRYNANE ABBEY.—Very wet and cold for the season. Harvest very backward and potatoes much diseased.

WATERFORD, BROOK LODGE.—R fall nearly an inch above the average. Very broken weather all the month. T on the 13th, 23rd and 29th. Gale from S.W. on 14th. Earthquake shock about 0·5 a.m. on 18th.

O'BRIENSBRIDGE, ROSS.—Weather generally unfavourable to harvesting; injury to crops by floods in mountain districts and low-lying lands. T frequent during the month, especially on the 30th. Gales from S. and S.W., some lasting over 48 hours. Mean temp. 60°·0.

DUBLIN.—August was characterised by heavy rains, but much less unfavourable than it had proved in each of the three preceding years. The rains were never continuous, and fine, bright intervals were often enjoyed. The mean temp. was 60°·0, or 0°·3 above the average. High winds were noted on 12 days, and attained the force of a gale on the 1st and 14th; TS on the 18th; T heard on the 13th; L was seen on 22nd and 23rd; solar halos were seen on the 10th, 17th and 19th; fog on 22nd. Shock of earthquake felt in Dublin, Kildare, Wicklow and Wexford in the early morning of the 18th.

EDENFEL.—Although the rainfall was above the average and rather persistent, much of it fell at night, and with fresh, often bright, days the month was neither unpleasant nor unfavourable.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCXXI.]

OCTOBER, 1892.

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

THE ARTIFICIAL PRODUCTION OF RAIN.

THE literature upon the above subject is becoming considerable, and some of it is not characterized by judicial calmness. We desire to place both sides fairly before our readers, and as we regard the following paper by Prof. Cleveland Abbe as the best summary of one side of the question, we have for the first time broken our rule of not reprinting papers printed in English.

The copy was sent to us as it had been sent to the American journal *Agricultural Science*, and looking at its title we feel sure that the proprietors will not object to our laying before readers on this side of the Atlantic what they have spread among our cousins on the other side. Possibly some of our readers may think that if articles of this quality appear in *Agricultural Science* it may be to their interest to see it regularly.

— — —

ON THE PRODUCTION OF RAIN.

BY CLEVELAND ABBE.

THE great interest that has recently been excited throughout the world in the question as to whether or not the progress of science gives us as yet any hope that man may cause rain to fall in times of drought, or to cease falling in times of flood, renders it proper that a brief sketch should be given of some, at least, of the many methods that have been suggested as a means of accomplishing this end. Although none of these methods have any practical value, still it is important to briefly summarize the results of experience if only as a means of saving present and future generations from an unnecessary waste of money. It is, on the other hand, equally important, after divesting ourselves of erroneous views, to seek for such light on the subject as our limited knowledge affords, and to mark out such further lines of investigation as may elucidate this difficult but important problem.

Although the production of rain is undoubtedly a purely material, physical process and should be studied by the methods of modern

science, yet it is impossible not to recognize that there has always been a certain supernatural aspect to the question and that probably the majority of mankind, at the present moment, take that view of it. In fact the importance of rain to human existence has, from time immemorial, led mankind to seek some method by which to secure it when needed. Divinations and incantations, prayers and sacrifices, the fetish of Africa and the gapogari of India illustrate respectively what may be called the superstitious and the theological theories on the subject of man's influence upon the weather. The recent progress of meteorological science has led us, on the one hand, to properly evaluate supernatural methods and, on the other hand, to query as to whether there really is any material physical principle that we can call to our aid in order to make it rain or cease raining. The following paragraphs may therefore illustrate such methods as have been suggested or tried :

1. Before the use of cannon the church bells were rung vigorously in order to dissipate dangerous storms. Parent states that in 1703 the inhabitants of Iliers by ringing the bells forced a hailstorm to break in two and thus saved their fields. It would appear that originally this practice was suggested by the idea that the ringing of the bell called the people to prayer and that, in fact, the bell represented the voice and prayers of the church, but eventually the theory was advanced by Le Maout (at Le Briec in 1854) that the sound, namely, the concussion in the air, produced by the bell, in some way caused the clouds to drop rain.

2. It is well known that it has long been the practice among sailors to discharge cannon at a water-spout, hoping that it can thus be broken up before reaching the ship. Mr. R. de C. Ward (*Am. Met. Jour.*, March, 1892) states that in the memoirs of Benvenuto Cellini there is mention of the fact that an impending rainstorm was averted in the year 1539, at Rome, by firing off artillery in the direction of the clouds which had already begun to drop their moisture. Arago says that as early as 1769 it was the practice to fire guns to break up a storm, but he shows by weather records that such firing has no such effect. The Swiss peasants discharge firearms into the clouds to draw off the rain before lightning and hail can form. The idea was that quiet air produced large hail, but that when disturbed by noise it could only produce small hail and rain—just as a crystallizing solution gives large crystals the more quiet it is. Patricius Heinrich in a prize essay published by the Bavarian Academy, in 1785, showed that cannonading does not prevent hail, and, in fact, has no appreciable influence on the clouds. Kaemtz (in 1831) quoted the case of 36,000 soldiers who fired a salute in order to break up an approaching thunderstorm during their evolutions—but failed. Denize and Parrot maintained that the vapor and smoke of gunpowder exerts a chemical influence unfavorable to the formation of thunderstorms and thus prevents them.

3. In opposition to the preceding the idea has been frequently

defended, during the past century, that the violent concussion produced by the explosion of gunpowder caused the minute particles in the clouds to jostle together and fall as rain. The earliest one to advance this idea, as far as I can find, was J. C. Lewis of Washington, in 1825, but its most prominent advocate since 1870 has been Mr. Edward Powers. On this principle, in 1854, Le Maout, from the rainfalls in western France, predicted that an important battle must be in progress in the Crimea, which, in fact, he subsequently identified as the cannonading at the battle of Inkerman an hour before his predictions. The ideas advocated in this country by Mr. Powers and in England by Mr. R. B. Belcher in 1874 received a qualified adherence from Prof. J. K. Laughton, Prof. Elias Loomis and Prof. J. D. Everett, although these distinctly disclaim their approval of the arguments used by Powers and Belcher. Mr. H. C. Russell, of Sydney, Australia, has strongly combatted both the arguments and the ideas. At present this concussion theory certainly has not the support of any prominent physicist.

4. The hypothesis that electrification keeps the particles of a cloud apart, and that its sudden removal by the discharge of lightning directly causes hail, and heavy rains or cloud-bursts, was promulgated soon after Franklin's experiments with his electric kite. Montbelliard, of Dijon, in 1776, held that hail would be impossible if the electricity were drawn early and quietly from the clouds, hence followed attempts to quietly discharge electrified clouds by means of lightning rods or wires carried up by kites, or even by captive balloons, in the hope that the formation of destructive hail or rain would be prevented. P. Heinrich in his prize essay above referred to, Wrede and Weiss in 1800, and many since then, have shown by statistics that fields of grain thus protected by lightning rods suffer from the hail, rain and wind quite as much as the neighbouring fields without protection. The rods do not appreciably diminish the number and intensity of destructive discharges of lightning, but when they receive the discharges they save the buildings and the harvested crops from destruction by fire; the rods have no influence on the rain and hail. According to Volta large hailstones are formed from smaller ones that are alternately attracted and repelled between two parallel layers of clouds; the surfaces of the hailstones are cooled by the electrical evaporation of the added water; Volta expressly demonstrates that the electric condition of these clouds cannot be affected by lightning rods.

5. It has been thought that, by setting fire to heaps of brush-wood, a destructive storm, with its lightning and hail, can be averted; but Volta, the advocate of this method of depriving the cloud of its electricity, after a first few years of success on the Roman Campagna, found that his experience was the same as that of his neighbours and that no effect was produced. P. Heinrich, in his prize essay, also shows the uselessness of such fires. Piccard compared the data for twenty-five years as to fires and rainy days in

Switzerland, but found it demonstrable that there was no connection between them. Professor John Trowbridge, in 1872, showed how a slight possible connection might exist that is worthy of further study.

6. The electrical condition of a moist atmosphere seems likely to have some relation to the formation of raindrops, but our knowledge on this subject is very meagre. Most students agree with Kaemtz, who, in 1831, said that we know not which is cause and which is effect, but that most probably the lightning is the result of the formation of cloud and rain. Professor John Trowbridge in his experiments, above referred to, showed that flames from fires tend, like lightning-rods, to reduce the positive electrification ordinarily observed, to a neutral or even to a negative condition. Ordinary observations of atmospheric electricity show that cold, polar winds bring an increase of positive electric tension. In general a positive condition exists in the air in or around a snowstorm, but rapid changes, even from positive to negative, frequently accompany hail and rain. It is more probable that these electric changes are the result rather than that they are the cause of the precipitation or of the winds or temperature. In 1880 Mr. Ruggles advanced the idea that "by altering the electrical condition of the upper air and the electrical force that controls the atmosphere" he could govern the formation and movements of rain-clouds and thunderstorms, but no adequate means to accomplish such alteration has been devised.

7. A number of interesting laboratory experiments by Rayleigh and others (see Guthrie on "Soap Bubbles") have shown that by electrifying a fine jet of water we may prevent it from breaking up into separate drops. These results are apparently produced by changes of the surface tension of the drops; the electrified drops coalesce when they strike each other, whereas drops of pure water unelectrified rebound and remain separate. Hence follows the idea that by thus electrifying a cloud we may cause the suspended small drops to unite into a steady downpour of rain; but no means has yet been found to accomplish this end. Possibly this idea is equivalent to that present in the minds of those who advocate making it rain (see J. R. Buchanan, 1891) by drawing the electricity from the clouds.

8. Having given up the idea that rain and hail are due to the sudden removal of an intense electrification, such as precedes the discharge of lightning, some theorists reverted to the idea that it is the noise of the thunder attending the lightning that produces a concussion within the cloud and that this is nature's method of jostling the cloud particles together into larger drops of rain. This is an advance on the idea that noises made by mankind, such as bell-ringing or cannonading, can cause rain; but it is equally contradicted by ordinary observation, which shows that there is no necessary connection between thunder and rain. On this whole question of the effect of concussion, namely the rapid vibrations of sound, it may be remarked that Champion and Pellet, in 1873, succeeded in inducing

the explosion of dry iodide of nitrogen by the high-pitched notes of the violin and the Chinese tom-toms and by the explosion of a very little nitro-glycerine, but not by the noise made by the explosion of ordinary gunpowder. It has not yet been shown, however, whether the result was caused by the sympathetic vibration of the molecules of these chemicals responding to the high-pitched note, or whether it was due to the small masses of the chemicals rubbing against each other and the anvil on which they rested, both being set into sympathetic vibrations with the string of the violin. The latter is more probable, but neither case would afford ground for supposing that cloud-particles, which are relatively far apart, could be brought to coalesce by this process. The experimental firing of a pistol or a gun into a cloud of fog or steam produces no appreciable agglomerations of the globules of water.

9. The advocates of the theory that great battles are followed by rain, not content with maintaining the influence of great noise in producing rain, have also gone to the extreme of maintaining that the heat of the conflict and the moisture from the breath and the perspiration of many men has an appreciable influence in producing the subsequent rain. In general, however, it does not appear that rain is any more likely to follow a battle, great or small, than it is to occur without a battle.

10. About a hundred years ago Hutton advocated the idea that rain is naturally formed by mixing warm, moist air with colder moist air; this idea has long since been dispelled as it has been shown that by mixture alone we can produce only a haze or fog, but not a rain; nevertheless it has been lately proposed to produce rain artificially by this method of mixture. Mr. G. H. Bell proposed to erect a tall tower, which might also serve for other purposes, and through which warm air is to be sent up into the upper regions and mixed with the cold, moist air above, producing a local rain in the immediate neighbourhood whenever desired. This inventor also proposed, when need be, to reverse the motion of the fan, thereby bringing the clouds down to the earth and preventing rain. A similar idea is advocated by Mr. James M. Pitkin, of Kansas City, who would have a large sheet of canvas held up by balloons, so that a horizontal wind striking against it will be deflected upwards precisely as when blowing against a mountain side. Mr. Pitkin also proposes to support large canvas tubes by means of balloons, the cold air to be drawn down a long tube and driven up through a short tube until it can be delivered at the proper elevation in the atmosphere.

These ideas of Pitkin and Bell must utterly fail of their object because of the mechanical impossibilities as well as because of the erroneous principle on which it was proposed to make rain.

11. The idea that an extensive fire may, under certain circumstances, determine the formation of cloud and rain was maintained by Espy as a necessary consequence of his theory of the cooling by expansion of rising air. In fact, numerous examples are at hand to

show that when the air is very moist a large fire may initiate a rising current of air and a cloud that shall grow into a local rainstorm ; the fire is simply the initiative and determines where the cloud will start ; it can hardly be said to cause the rain, nor does it decide, in any case, where the rain will fall ; it simply performs the same office that the pulling of a trigger does for the discharge of a gun and the fall of a distant bird ; or that an act of the will does for our physiological muscular machinery.

Prof. Espy's ideas have been widely supported, and the fact that rain cannot be started by an artificial fire when the air is very dry is really a further confirmation of the views expressed by him. Prof. J. K. Laughton, in England, and Mr. H. C. Russell, of Sydney, New South Wales, have shown how rarely the bush fires of Australia are followed by rain owing to the dryness of the climate ; in general, when the winds are blowing up over a mountain range, plenty of rain falls, and usually without lightning, so that we have no reason to invoke the aid of electricity, noise, smoke or fire. The power contained in the sunshine that is received on a single acre of ground, when the sun is near the zenith, is greater than that exerted by a steam engine of 4,000 horse-power ; when this power is exerted to heat the air and cause it to rise it is fully equal to the work of lifting 60 tons of moist air 1,000 ft. high per minute.

12. The experiments of many physicists have shown that certain solids have the power of attracting around themselves a condensed atmosphere of one or more gases, especially is this true of carbon, so that the fine particles that constitute smoke and soot may be conceived of as surrounded by dense atmospheres of aqueous vapour. These nuclei being good radiators of heat are supposed to become especially cooled and to condense the vapour upon themselves, so that they may become the nuclei of cloud particles. Thus these dust particles, whether they result from forest fires or the spray of the ocean, the pollen of plants, the dust of the highway, or the consumption of shooting stars, may be an essential feature in the formation of rain or snow. Therefore any process that increases the quantity of dust in the air contributes to the formation of rain, and in fact visible drops of vapour are not easily formed, even by cooling the air below its dew-point, unless dust nuclei be present ; this is made the basis of Aitken's method for determining the number of particles of dust in the air. Prof. Blake, of Kansas University, proposes to make rain by distributing fine dust in the atmosphere, but human agency cannot economically increase the percentage of dust already in the cloud region.

13. The idea has been promulgated that possibly there exists some gas or vapour or other substance that, like smoke, can be injected into the air and that will initiate the condensation of the aqueous vapour. This is the method claimed by Mr. Frank Melbourne, but the chemicals used by him are kept a secret, and other parties having adopted the same idea appear to be using

chemicals different from Melbourne's. The general method of procedure seems to be that the operator, within a building, makes the gas in secret, and it is seen escaping from a chimney, while an assistant circulates among the spectators outside and takes their bets as to the success of the operation. There is no principle known to chemists that would justify us in expecting this method to succeed in producing rain, and actual experience shows that the failures have been quite as numerous as the successes, just as would be the case if the chemicals had nothing to do with the rain.

14. The explosion of balloons, filled with a mixture of oxygen and hydrogen, produces a small quantity of aqueous vapour which is at first hot and expanded, but in a few moments becomes cool and condensed. Dysenforth advances the theory that these few particles of nascent water serve as natural nuclei, attracting to themselves the aqueous vapour already in the atmosphere resulting in the formation of mist, cloud and rain. No successful experiment of this kind has ever yet demonstrated the truth of this ingenious theory. Evidently the great heat produced by the chemical combination of oxygen and hydrogen must, in some way, be got rid of before the surrounding aqueous vapour can condense into drops.

15. Man may not hope to assist nature in the formation or prevention of rain until he better understands the details of nature's own methods. The ideas most widely accepted, at present, as to the natural process of the formation of rain, go only so far as to say that the moisture present in the atmosphere is extracted from the air by three different steps, namely, *first*, the saturation with aqueous vapour that is produced by cooling the air; *second*, the condensation of the vapour into small visible particles of cloud and fog; *third*, the agglomeration of these droplets of water into drops large enough to be precipitated as falling rain, hail or snow.

I. The ordinary natural methods of accomplishing the cooling required in the first of these steps are: (a) the mixing of cold and warm air, by which, however, only a very slight amount of precipitation can be formed; (b) the radiation of heat to the colder earth and air and space by which at first thin layers of fog or stratus clouds are formed which then slowly thicken with time; (c) the rise and expansion of large masses of air; the mechanical work done by the expansion simultaneously of the whole mass may cool it to any extent whatever. This last is the important process on which all our rain depends.

II. The second step, namely, condensation, is a molecular process that has been likened to the crystallization of solid salts from liquid solutions, although there is too little known about either process to warrant the belief that they are really similar. Aitken and others maintain that the condensation of vapour, like the crystallization of salts, demands some nucleus as a starting-point, and that every minute droplet of fog or cloud must have a particle of atmospheric dust as its initiative.

III. The third step in the above process of rain formation is the agglomeration of fog or cloud-particles into larger drops. About this there is very little known from actual observation, and the hypotheses are quite various. The hypothesis that among these particles some are larger than others, and, by their more rapid descent, overtake the smaller ones and thus grow larger as they descend, seems at first quite natural, and is sufficient to explain the fact that the quantity of rainfall is an exceedingly small percentage of the water that is visible as a cloud and, of course, a still smaller percentage of the water that is present as vapour in the air. On the other hand, microscopic observations of the sizes of the particles of fogs do not show a variation in the diameters sufficient to allow of one particle falling much faster than its neighbour; therefore, as the air always has a motion sufficient to carry these minute particles along with it, it would seem that if they are to come in contact and form larger particles, it must be through a process of jostling together rather than through a process of falling by gravity.

But the contact of two particles, whether by gravitational fall or by the jostling of wind-currents, will not necessarily cause their union; it is essential that the surface tensions of the two particles be properly adjusted to each other, and this latter point seems to demand further study. It is true that by proper electrification we are able, in the laboratory, to alter the surface tensions and to cause small fog particles to coalesce, but it is not so evident that this is the ordinary process of nature. We are also able in a laboratory to alter surface tensions by surrounding the particles with a different gaseous or vaporious atmosphere, or even by changing the temperature of the particles; but neither of these processes is likely to be the process that takes place in the clouds. Rayleigh's experiments on jets of soapy water make it plausible that a slight impurity in the rain water, such as ammonia or nitric acid, may make it possible for certain cloud-particles to agglomerate, while the neighbouring droplets of pure water would not do so. Again, a thin film of foreign substance, such as oil on the water, lowers the surface tension and allows two such oily drops to combine into one, when the film is broken at any point, by pressing the drops close together. But none of these laboratory experiments seem applicable to the formation of the natural cloud and rain.

16. As to these various hypotheses that have been suggested concerning the method by which the agglomeration of droplets into large drops is actually affected by nature in her regular process of making rain, I must remark that it is not yet clear to me that anyone has demonstrated that small drops actually do agglomerate into larger ones to any considerable extent. I think it quite possible that the union of small cloud-particles into larger ones is only effective in driving fogs or clouds whose upper surfaces cool by radiation but is, after all, not an important feature in the natural production of generous rains and summer thunder showers. It is a reasonable

"working hypothesis" that the particles which were originally too small to fall from the clouds with any rapidity actually remain there entangled in the currents of air that characterize clouds, and that they are subsequently evaporated, while, on the other hand, only those fall as rain which, originally, had a size vastly larger than the average size of the smaller particles that constitute the major portion of a cloud. There may be some reason why the condensation of the superabundant molecules of a saturated vapour should form not merely cloud-particles whose diameter is ordinarily less than one one-hundredth of an inch, but also, here and there, large drops which fall to the ground as rain with very much the same size as when originally formed a few moments before in the clouds. The sudden pour of heavy rain from a limited region within a thunder cloud cannot be due to a general slow progressive agglomeration of droplets into drops.

On this point I submit the following modification of ideas suggested by reading von Bezold's fourth paper on the "Thermodynamics of the Atmosphere," Berlin, 1892; it suggests a new point of view, and one that demands further experimental elucidation.

(*To be continued.*)

THE RAINFALL OF JAMAICA.

Few things are more striking than the rapidity with which a network of stations for the measurement of the fall of rain has spread over the globe. It has been accepted as so essential that the development has hardly excited any comment, and few, if any, persons have realized the magnitude of the movement—except the opticians, some of whom must have found it very profitable.

This development can be illustrated from nearly all parts of the world, but the present notice of it has been suggested by Mr. Maxwell Hall's excellent book,* though we must go behind it to the monthly *Weather Reports* issued under his supervision (and upon which the present beautiful maps are based), to realise fully the progress that has been made. We give merely two facts. In 1877 by far the best paper upon the rainfall of Jamaica which had appeared, was sent to the Meteorological Society. It embraced the seven years 1870-76, and contained perfect records for the seven years from only 3 stations, and fragmentary records from 22 others, the largest number perfect in any one year being 17. In 1892 the number of stations is 149, or nearly ten times what it was 15 years previously.

* Special Publications of the Institute of Jamaica: No. 1. The Rainfall of Jamaica; thirteen maps, showing the average rainfall in each month and during the year, with explanatory text, by Maxwell Hall, M.A., F.R.A.S., Barrister-at-Law, Jamaica Government Meteorologist, &c. London: Stanford, 1891. Fcap. folio, 8 pp., and 13 coloured plates.

The present work is based upon observations at no fewer than 153 stations, all of which had been established long before 1889. The numerical values have been given in the Government publication; the present work is essentially an atlas of rainfall maps, one for each month and one for the year, giving the relative rainfall all over the island.

But we must, *en passant*, mention that there is one respect in which we think that Mr. Maxwell Hall's work could be improved. His report, No. 33 of October 18th, 1883, and his yearly summaries are equally excellent, but he has never given a table like Table II., p. 16, of the *Quar. Jour. Met. Soc.*, vol. iv. He has the yearly total from one or more stations for every year from 1858 onwards, and if he would give us the entire series grouped in his own divisions, it would be easy to determine many questions as to the fluctuation of the yearly fall, and as to the true averages, which at present it would be impossible for any non-resident to work up correctly.

As a rough type of what we suggest, we give as much of the first 15 years of the table as our page will take in, but doubtless have made some errors in it, especially in grouping the stations:

Total Rainfall at Stations in Jamaica.

Years.	Hampstead.	Albion.	Bradfield.	Salter's Hill.	Drax Hall.	Georgia.	Green Park.	Brace.	Denbigh.	Chapelton.	Windsor.	Black River.
1858	47·33	...	...	...	...	...	...	...	...	...	...	...
9	45·02	...	...	...	...	...	...	...	...	...	...	...
1860	63·39	...	...	...	...	...	...	...	...	...	...	...
1	64·83	...	...	...	...	...	...	...	...	...	...	...
2	73·35	...	...	...	...	...	...	...	71·65	...	...	...
3	...	...	...	...	...	...	...	...	56·88	...	...	...
4	...	...	...	...	...	...	...	...	53·53	...	...	...
5	...	...	...	...	...	...	...	...	44·81	...	...	...
6	...	74·17	70·89	...	...	...	...	...	36·57	...	51·86	...
7	...	63·47	66·82	...	...	...	...	...	62·83	...	65·44	...
8	...	70·13	77·16	...	...	...	...	...	55·79	...	73·80	...
9	...	63·81	74·91	78·86	...	...	...	...	26·75	...	61·15	...
1870	...	84·60	103·74	114·34	96·56	85·48	79·78	75·10	78·16	61·78	92·36	71·11
1	...	64·91	74·16	70·46	64·29	44·03	35·54	33·26	37·95	43·67	70·78	48·17
2	...	61·06	61·50	62·53	51·34	33·93	31·51	30·44	40·69	48·35	69·04	55·75

Reverting, however, to the maps, they are tinted in blue of five shades, representing—

	I.	II.	III.	IV.	V.
Monthly maps...	1 to 3,	3 to 5,	6 to 9,	10 to 14,	over 15 inches.
Yearly map	30 ,, 35,	40 ,, 50,	55 ,, 70,	75 ,, 95,	,, 100 ,,

Jamaica, we may add, is about 140 miles long from W. to E., and on the average about 25 miles broad—rather more than half the area of Yorkshire.

The total yearly rainfall varies in Jamaica much as it does in Yorkshire ; the wettest part of Jamaica has about 100 inches and the driest about 30 inches—while for Yorkshire we suppose that the corresponding values would be about 80 inches and 25 respectively. Subject to correction for the altitude of the stations, the fall seems to us tolerably uniform, except in the N.E. of Jamaica, where it is much heavier than in other parts—just as, to continue our parallel, the fall in the N.W. of Yorkshire far exceeds that in other parts of the county.

As regards the beautiful monthly maps, we cannot do justice to them, as all our readers have not them to refer to. Perhaps the best commentary is to reprint the concluding paragraph of Mr. Maxwell Hall's introduction :—

“The utility of these maps is sufficiently obvious ; if the agriculturist wants constant and heavy rains, he will find them as a rule in the parishes of Portland and St. Mary ; if he wants heavy summer rains, he will find them in the west central parts of the island ; if he wants a moderate rainfall all the year round, he will find it in the area between Chapelton and Linstead, Albion and Cave valley. Not that he will, perhaps, secure such rainfall in any one year, but that, taking one year with another for a series of years, he may count upon the rainfall laid down in these maps.”

RAIN ON OCTOBER 4TH.

It was stated recently by a correspondent of the *Morning Post* that the fall of rain (2·65 inches) on the 4th instant at Cross-in-Hand, Sussex, was such that “the oldest inhabitants of this district cannot remember anything like this rainfall.” We think that the memory of these good persons must be failing rapidly, for as recently as July 31st, 1888, over an area of quite 100 square miles, and within about ten miles of Cross-in-hand, if indeed it did not reach there, the fall was between three inches and three inches and a half. (*British Rainfall*, 1888, p. [102].)

However, the fall was undoubtedly an important one, affecting chiefly the South-east of England. Arranged according to largeness of totals, the following are the values already reported :—

Sussex	Cross-in-Hand	2·65 in.
„	Winchelsea	2·50 „
„	Bryckden, Waldon	2·19 „
„	Lower Cusley Wood, Wadhurst	2·17 „
Kent	Benenden	1·97 „
„	Leysdown, Isle of Sheppey	1·93 „
Norfolk	Yarmouth	1·86 „
Kent	Tenterden	1·66 „

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MARCH, 1892.

STATIONS. (Those in <i>italics</i> 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			
England, London	59·8	18	22·3	9	44·9	31·0	32·3	83	96·7	20·3	1·04	9	5·6
Malta.....	70·8	14	44·9	20	63·9	51·8	49·6	81	129·4	38·0	·81	5	4·4
Cape of Good Hope ...	90·1	4	52·2	22	76·0	58·5	...	...	...	...	1·75	7	4·5
Mauritius	84·7	8	69·6	31	82·6	73·6	71·8	83	137·5	64·0	9·57	24	6·7
Calcutta	100·8	21	53·8	1	93·9	68·4	64·6	61	155·1	43·0	·00	0	1·2
Bombay	91·8	26	66·0	5	85·4	74·1	70·8	74	135·8	49·7	·00	0	7·0
Ceylon, Colombo ...	91·0	29	69·8	8	85·1	75·7	71·4	64	159·0	65·0	1·52	5	4·5
Melbourne.....	104·0	8	43·2	31	76·3	56·3	55·8	72	153·2	33·8	1·56	6	5·2
Adelaide	104·5	7	47·3	29	81·8	60·5	52·7	53	163·2	39·2	·76	3	4·4
Tasmania, Hobart.....	...	...	...	...	...	...	...	...	...	...	...	...	...
Wellington	75·0	2a	44·0	27	68·6	54·0	53·5	77	128·0	38·0	6·36	11	4·3
Auckland	79·0	17	51·0	23	73·9	60·9	61·2	80	136·0	47·0	1·53	7	5·0
Jamaica, Kingston.....	88·3	20	64·0	1	85·8	69·8	68·4	73	...	...	·19	3	...
Trinidad	91·0	7b	66·0	25	88·7	69·0	69·2	74	158·0	56·0	1·85	14	...
Toronto	43·6	29	5·3	14	34·2	21·7	21·6	73	...	2·0	·77	16	5·1
New Brunswick, Fredericton	48·0	10	— 3·3	15	33·5	16·6	19·0	68	...	...	3·15	12	4·9
Manitoba, Winnipeg }	46·9	30	— 23·5	15	26·6	6·1	...	...	...	...	1·60	8	4·9
British Columbia, Esquimalt	61·9	15	31·5	2	51·6	40·3	44·1	94	...	...	3·05	19	7·2

a And 9, 15.

b And 8, 28, 29.

REMARKS.

MALTA.—Mean temp. 56°·5. Mean hourly velocity of wind 10·9 miles. The sea temp. fell from 61°·0 to 59°·8. L on 30th. J. SCOLES.

Mauritius.—Mean temp. of air 0°·2, dew point 1°·9, and rainfall 1·28 in. above their respective averages. Mean hourly velocity of wind 7·4 miles, or 2·5 miles below the average; extremes, 20·3 on 25th and 0·0 on 2nd; prevailing direction E.S.E. T and L on 7 days, T on 2 days, and L on 1 day.

C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 1°·9, of dew point 3°·7, and humidity 4, above; mean amount of cloud ·4 and total rain ·48 in. below, their respective averages. Prevailing winds S. and S.E., strong on 5 days. Heavy dew on 11 days. Fog on the 31st. L on the 14th. Dust storm on the evening of the 25th.

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

Adelaide.—Mean pressure ·073 in. below the average of 35 years, the absolute max. (30·253 in.) being the lowest max. on record for March. Mean temp. 0°·8 above the average, the max being over 90°·0 on 5 days, and on 2 days over 100°. The absolute max. (104°·5) is the highest in March since 1872. Rainfall ·30 in. below the average. The month was very dry over the whole colony, particularly the inland regions.

C. TODD, F.R.S.

Wellington.—Fine in the early part, with moderate northerly winds, except on 11th and 12th, when it was strong. Heavy rains fell in the middle of the month, especially on 18th and 20th, when 2·14 in. and 2·10 in. were recorded. The last few days were fine, with N. wind. Mean temp. 0°·7 below the average. Rainfall 3·54 in. above the average.

R. B. GORE.

Auckland.—An unusually fine and dry month, the only rain experienced being in the period from the 17th to the 23rd. Mean temp. 2° above, and rainfall nearly an inch below, the average.

T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
SEPTEMBER, 1892.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	2·87	XI.	Rhayader, Nantgwillt..	4·88
„	Birchington, Thor	1·75	„	Corwen, Rhug	3·79
„	Brighton Prestonville Rd	2·69	„	Carnarvon, Cooksidia ...	5·86
„	Hailsham	2·86	„	I. of Man, Douglas	4·05
„	Ryde, Thornbrough	3·16	XII.	Stoneykirk, Ardwell Ho.	3·15
„	Alton, Ashdell.....	3·31	„	New Galloway, Glenlee	5·39
III.	Oxford, Magdalen Col...	2·19	„	Melrose, Abbey Gate ..	1·56
„	Banbury, Bloxham	2·97	XIII.	N. Esk Res. [Penicuik]	2·80
„	Northampton, Sedgebrook	2·67	„	Edinburgh, Blacket Pl..	1·20
„	Cambridge, Fulbourn..	...	XIV.	Glasgow, Queen's Park.	4·12
„	Wisbech, Bank House..	3·39	XV.	Islay, Gruinart School..	6·57
IV.	Southend	1·21	XVI.	Dollar.....	3·06
„	Harlow, Sheering ...	2·22	„	Balquhider, Stronvar..	10·01
„	Rendlesham Hall	1·89	„	Coupar Angus Station..	1·95
„	Diss	3·33	„	Dunkeld, Inver Braan..	2·29
„	Swaffham	2·17	„	Dalnaspidal H.R.S. ...	8·37
V.	Salisbury, Alderbury...	2·36	XVII.	Keith H.R.S.	2·37
„	Bishop's Cannings	2·75	„	Forres H.R.S.	2·10
„	Blandford, Whatcombe.	2·78	XVIII.	Fearn, Lower Pitkerrie.	2·79
„	Ashburton, Holne Vic...	4·14	„	Loch Shiel, Glenaladale	16·69
„	Okehampton, Oaklands.	4·59	„	N. Uist. Loch Maddy ...	5·58
„	Hartland Abbey	4·14	„	Invergarry	10·28
„	Lynmouth, Glenthorne.	4·14	„	Aviemore H.R.S.	3·79
„	Probus, Lamellyn	2·52	„	Loch Ness, Drumnadrochit	4·08
„	Wincanton, Stowell Rec.	2·70	XIX.	Lairg H.R.S. ....	...
„	Weston-super-Mare	3·19	„	Scourie	5·84
VI.	Clifton, Pembroke Road	3·40	„	Watten H.R.S.	2·16
„	Ross, The Graig	2·36	XX.	Dunmanway, Coolkelure	6·57
„	Wem, Clive Vicarage ...	2·38	„	Fermoy, Gas Works ...	3·55
„	Cheadle, The Heath Ho.	3·35	„	Killarney, Woodlawn ...	5·24
„	Worcester, Diglis Lock	2·27	„	Tipperary, Henry Street	3·69
„	Coventry, Coundon	2·12	„	Limerick, Kilcornan ...	4·09
VII.	Ketton Hall [Stamford]	2·39	„	Eunis	5·49
„	Grantham, Stainby	2·21	„	Miltown Malbay.....	6·60
„	Horncastle, Bucknall ...	1·90	XXI.	Gorey, Courtown House	3·47
„	Worksop, Hodsck Priory	1·74	„	Mullingar, Belvedere...	3·74
VIII.	Neston, Hinderton	2·95	„	Athlone, Twyford	4·48
„	Knutsford, Heathside...	2·81	„	Longford, Currygrane...	4·56
„	Lancaster .....	...	XXII.	Galway, Queen's Coll...	5·72
„	Broughton-in-Furness..	8·40	„	Crossmolina, Enniscoe..	6·03
IX.	Ripon, Mickley	1·29	„	Collooney, Markree Obs.	4·93
„	Scarborough, West Bank	1·21	„	Ballinamore, Lawderdale	4·83
„	East Layton [Darlington]	2·76	XXIII.	Lough Sheelin, Arley ..	4·59
„	Middleton, Mickleton..	5·39	„	Warrenpoint	4·04
X.	Haltwhistle, Unthank..	5·20	„	Seaforde	2·94
„	Bamburgh	1·70	„	Belfast, Springfield	2·91
„	Newton Reigny	5·33	„	Bushmills, Dundarave...	3·49
XI.	Llanfrechfa Grange	2·76	„	Stewartstown	3·52
„	Llandovery	5·08	„	Buncrana	3·80
„	Castle Malgwyn	2·48	„	Lough Swilly, Carrablagh	4·76
„	Builth, Abergwessin Vic.	5·24			

SEPTEMBER, 1892.

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.	Differ- ence from average 1880-9.	Greatest Fall in 24 hours		Days on which '01 or more fell.	Max.		Min.				
				Dpth	Date		Deg.	Date	Deg.	Date.	In shade.	On grass.	
		inches.	inches.	in.									
I.	London (Camden Square) ...	2.12	—	.39	.94	29	13	73.6	19	36.4	18	0	2
II.	Maidstone (Hunton Court)...	2.01	—	.58	.57	21	13	...	...	...	...	...	...
III.	Strathfield Turgiss	2.76	+	.31	.89	29	21	78.2	21	30.4	18	...	...
III.	Hitchin	2.83	+	.33	1.13	21	12	70.0	13	37.0	17	0	...
IV.	Winslow (Addington)	2.95	+	.28	.75	29	13	72.0	13	33.0	18	0	1
IV.	Bury St. Edmunds (Westley) ...	3.86	+	1.16	1.84	21	11	68.0	13	41.0	8	0	...
V.	Norwich (Cossey)	2.20	—	.46	.91	29	14	...	...	...	...	...	...
V.	Weymouth (Langton Herring) ...	2.61	+	.19	1.04	29	11	68.0	10	44.0	8, 18	0	...
"	Torquay, Babbacombe	2.12	—	.51	.73	29	13	70.5	10	36.5	18	0	1
"	Bodmin (Fore Street)	3.21	—	1.26	.78	29	21	...	...	...	...	...	...
VI.	Stroud (Upfield)	2.66	—	.25	1.59	29	15	70.0	10	40.0	17e	0	...
"	Church Stretton (Woolstaston) ...	2.96	+	.46	1.10	20	24	65.0	1	39.0	18	0	...
"	Tenbury (Orleton)	2.35	—	.26	.64	20	17	69.0	10	31.0	18	1	3
VII.	Leicester (Barkby)	2.03	—	.61	.59	20	17	72.0	13	32.0	7	1	1
"	Boston	3.03	+	.26	.85	20	15	70.0	6b	36.0	18	0	...
"	Hesley Hall [Tickhill]	1.40	—	.76	.80	20	15	68.0	12c	37.0	18	0	...
VIII.	Manchester (Plymouth Grove) ...	3.62	+	.15	.56	27	20	56.0	27	39.0	29	0	1
IX.	Wetherby (Ribston Hall) .....	...	.88	1.58	.33	30	7	...	...	...	...	...	...
"	Skipton (Arnccliffe)	5.89	+	1.13	1.23	1	22	68.0	1	35.0	5	0	1
"	Hull (Pearson Park)	1.34	—	1.10	.29	27	12	69.0	10d	39.0	4f	0	0
X.	Newcastle (Town Moor)	2.75	—	.03	.65	6	14	...	...	...	...	...	...
"	Borrowdale (Seathwaite)	25.62	+	13.89	5.80	18	23	...	...	...	...	...	...
XI.	Cardiff (Ely)	4.60	+	.86	1.55	29	17	...	...	...	...	...	...
"	Haverfordwest	3.87	—	.53	.76	7	24	64.9	10	35.0	17	0	1
"	Aberystwith, Gogerddan	4.85	+	.58	1.05	30	20	66.0	10	35.0	17	0	...
"	Llandudno	3.83	+	1.61	.75	11	22	65.2	12	45.0	30	0	0
XII.	Cargen [Dumfries]	4.34	+	.78	1.08	1	20	64.4	10	34.0	22	0	...
"	Jedburgh (Sunnyside)	2.57	—	.12	.41	27	18	65.0	4	30.0	22	1	...
XIV.	Old Cumnock	3.82	—	.01	.64	23	21	...	...	...	...	...	...
XV.	Lochgilphead (Kilmory)	7.49	+	2.36	.94	12	24	...	...	32.0	20g	3	...
"	Oban (Craigvarren)	11.60	—	...	2.33	12	25	62.9	6	36.9	22	0	0
"	Mull (Quinish)	7.37	+	2.34	1.15	17	25	...	...	...	...	...	...
XVI.	Loch Leven Sluices	2.40	—	.39	.40	13a	12	...	...	...	...	...	...
"	Dundee (Eastern Necropolis) ...	1.45	—	1.06	.40	12	18	69.2	6	36.0	30	0	...
XVII.	Braemar	3.26	+	.40	.90	26	17	61.0	6	22.5	21	3	9
"	Aberdeen (Cranford)	1.91	—	...	.41	5	19	66.0	6	30.0	20h	3	...
XVIII.	Strome Ferry	9.45	+	4.58	1.24	17	25	...	...	...	...	...	...
"	Cawdor [Nairn]	2.82	+	.07	.61	12	15	...	...	...	...	...	...
XIX.	Dunrobin	3.03	+	.44	.59	30	18	65.0	6	35.0	30	0	...
"	S. Ronaldsay (Roeberry)	2.69	+	.03	.34	12	22	60.0	6	40.0	20i	0	...
XX.	Darrynane Abbey	4.43	—	...	.86	7	21	...	...	...	...	...	...
"	Waterford (Brook Lodge)	2.89	—	.03	.98	19	18	68.0	10	34.0	17	0	...
"	O'Briensbridge (Ross)	4.88	—	...	.72	20	21	69.0	6	42.0	j	0	...
XXI.	Carlow (Browne's Hill)	2.88	+	.06	.66	20	22	...	...	...	...	...	...
"	Dublin (Fitz William Square) ...	2.63	+	.66	.52	20	19	65.6	12	40.8	17	0	0
XXII.	Ballinasloe	4.76	+	1.97	.79	1	25	65.0	14	41.0	28	0	0
"	Clifden (Kylemore)	11.90	—	...	1.73	12	25	...	...	...	...	...	...
XXIII.	Waringstown	3.12	—	.04	.68	1	19	70.0	6	36.0	21	0	...
"	Londonderry (Creggan Res.)	3.96	+	.18	.56	26	25	...	...	...	...	...	...
"	Omagh (Edenfel)	4.84	+	1.46	.68	26	23	63.0	6	36.0	21	0	0

a And 18, 27. b And 12, 15. c And 13, 19. d And 13. e And 29. f And 5, 18. g And 21, 30.

h And 21, 29. i And 29. j Various.

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

METEOROLOGICAL NOTES ON SEPTEMBER, 1892.

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.—A changeable month, with a cold snap on the 18th, causing much damage. A heavy gale on 29th, with much R; T on 20th.

ADDINGTON.—Generally fine until the 18th, then unsettled until the end. On the 18th the min. on grass fell to 29°, and tender plants were killed. On the 20th, about 7 p.m., a severe TS, with heavy R occurred, a horse being killed by L at Winslow.

BURY ST. EDMUNDS, WESTLEY.—Fine weather for finishing the harvest till the 19th, very wet after. Very heavy R and H with T on 21st, and T was heard on 19th, 20th and 30th; S.W. wind on 14 days.

LANGTON HERRING.—On the whole a beautiful month, very favourable for finishing harvest operations. Mean temp. very near the average of 20 years. A fine solar halo seen on 12th; T and L on 20th and 21st; T on 28th. Total R for the nine months of the year, 4.38 below the average.

BABBACOMBE.—A cold, cloudy, rather showery month. A large excess of S.W. and deficiency of E winds, and a large daily and total range of temp. It was showery from 1st to 3rd, 7th to 9th, 12th to 16th, 20th to 25th and 27th to 30th, but no R was recorded in the 9 days, 3rd to 11th. Distant TSS on 20th and 21st.

BODMIN.—A seasonable, but mild month. Some very warm days. A large number of rainy days.

WOOLSTASTON.—A showery month, tedious for harvest, much grain remaining in the fields at the end. Mean temp. 53°·3. Large flocks of wild geese passed over about the middle of the month.

TENBURY, ORLETON.—A cold month, not at all suitable for the harvest. More than two thirds of the total R fell on three days, but the weather was generally damp, with very little warm sun. L on 2nd and 3rd.

BARKBY VICARAGE.—The first 19 days were excellent for completing the harvest, and water was very scarce during that time. Mean temp. 54°·2.

SEATHWAITE.—Falls of R exceeding one inch occurred on 8 days, exceeding two inches on 3 days, and exceeding five inches on the 1st and 18th. Fall nearly twice the average.

WALES.

HAVERFORDWEST.—The bad weather of the last three days of August, continued more or less throughout this month, two consecutive dry days occurring only twice; consequently harvest operations were carried on with difficulty. About the 12th and 19th, exceedingly close relaxing air prevailed with high night temp. From the 27th to the end the weather was stormy and cold, as well as wet.

SCOTLAND.

CARGEN.—Another cold ungenial month; mean temp. 2°·5 below the average. The temp. of the four months, June to September, has been considerably below the average, and this, combined with an excessive rainfall in June and August, and a great want of sunshine during the whole period, has been most detrimental to vegetation.

JEDBURGH.—The weather generally was unsettled, which retarded harvesting; most of the cereal crops were still in the fields at the close, and in the higher districts much was uncut.

OBAN, CRAIGVARREN.—The excessive and continual rains of this month, following upon the previous rainy months, have been most disastrous for all crops, except turnips, the corn being specially injured.

ABERDEEN, CRANFORD.—Westerly winds prevailed almost throughout the month. A TS occurred on 30th, lasting from 7.30 p.m. to 9 p.m.

ROEBERRY.—A very good month upon the whole; R nearly half an inch below the average of 25 years; temp. also below the average. Late harvest, commenced only on the 27th.

IRELAND.

DARRYNANE ABBEY.—A cold, ungenial wintry month.

WATERFORD BROOK LODGE.—Rainfall below the average, but the weather very broken for getting in the harvest. Mean temp. 54°.

O'BRIENSBRIDGE, ROSS.—A very unfavourable month for harvesting; R frequent and often heavy; temp. low. Many gales, mostly from S.W. H showers, with T on 26th and 28th.

DUBLIN.—The month was changeable throughout. High winds from westerly points prevailed; showers fell frequently, and at times the weather was decidedly cold for the time of year; this was particularly the case during the last four days. The mean temp. (53°·8) is 2°·0 below the average, and the max. was exactly 10° lower than that of September 1891.

EDENFEL.—A wet and unsettled month with but little intermission, and characterized by strong winds, amounting at times to gales, with heavy R and humid atmosphere. Two-thirds of the grain was still in the fields at the close.

BUTTERFLIES.

To the Editor of the Meteorological Magazine.

SIR,—I do not know what is the connection between Meteorological conditions and Entomological appearances. But the fact is, that this month of September there has been an unusual number of the Clouded Yellow butterfly (*Colias Edusa*) in this neighbourhood. A good many more males than females, which I suppose is characteristic of the species. Its last appearance here was in 1877.

I remember a similar plentiful appearance of a rare moth in the year 1846 at Drumlanrig Castle, Dumfriesshire. The *Sphinx Convolvuli*, "the Convolvulus Hawk-Moth." I saw it in great numbers, but I have never seen it since that time.—I am, yours truly,

JOHN MATHISON.

Addington, Sept. 20th, 1892.

IRISH WEATHER MAXIMS.

(Suggested by six weeks of rain, with generally high and steady barometer.)

Very high and rising fast :
Steady rain and sure to last.

Steady high after low :
Floods of rain, or hail, or snow.

Falling fast :
Fine at last !

Rapid fall after high :
Sun at last, and very dry.

Yours, PADDY.

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CCCXXII.] NOVEMBER, 1892. [PRICE FOURPENCE,
or 5s. per ann. post free.

THE RAINFALL OF NEW ZEALAND.

It was a rather curious coincidence that after the article upon the Rainfall of Jamaica in this Magazine for October was in type, but before it was issued, we received from Sir James Hector, F.R.S., a table of rainfall in New Zealand* exactly such as we had pointed out as being needed to complete Mr. Maxwell Hall's capital Jamaica atlas.

We reprint on the next page Sir James Hector's table, and we shall, in making a few general remarks, avail ourselves also of a paper read by Mr. J. T. Meeson, B.A., before the Philos. Soc. of Canterbury, May 7th, 1890, and published in the *Trans. of the New Zealand Institute*. Sir James Hector's table, being prepared in response to an order of the House of Representatives (July 13th, 1892), necessarily commences only with the date therein stated, viz., 1864. Observations were made in New Zealand long before that; certainly as early as 1844,† and we trust that Sir James will be able to complete his work by compiling a second table dealing with those earlier years. He was fettered also as to the stations to be included in his table, and therefore we miss some which otherwise would doubtless have been there.

There seem to be indications that in New Zealand official records only are relied upon; and if that is the case, we think that it is a pity. Reference to Sir James Hector's table shows that, as soon as the order of the Government at the end of 1880 stopped the payment, not half of the observers cared enough for science, or their colony, to continue their records. A monthly return for July, 1892, shows that there is now an elaborate system, with about 70 observers; we therefore presume that the decision of 1880 has been reversed; but the continuity of the broken records can never be restored. Even

* Annual Rainfall (Return of) in inches, for each year from 1864 to 1891 inclusive, with diagrams for the four principal stations. Parliamentary Paper, Wellington, 1892., fol.

† R. H. Scott. Presidential Address. *Quar. Jour. Roy. Met. Soc.*, vol. xi., p. 204.

now we do not see the station at Waipawa quoted, so we print the values from the originals kindly sent yearly to us in MS.

In the table on page 148 we have incorporated the values given by Mr. Meeson and by Sir James Hector—it will be seen that they are rarely identical, because in most cases the period of observation differs—but there are other cases in which it is evident that different values have been adopted for the same station and the same year. These cases should be investigated and the error pointed out, no matter how it arose. To quote one illustration. The values in Sir James Hector's table for Invercargill are those which have been published under four different names. The original observer, Mr. Rouse Marten, quoted them as from "Martendale" (we suppose the name of his house); Sir James, in 1871, quoted them as "Southland," which was the district in which "Martendale" was situated; Mr. Meeson in his paper quoted them as "Wallacetown"; and finally, in the return to Parliament they appear under "Invercargill";

Annual Rainfall in New Zealand, 1864-91.

	Mongonui.	Auckland.	Napier.	Taranaki.	Wanganui.	Wellington.	Nelson.	Canterbury.	Hokitika.	Dunedin.	Queenstown.	Invercargill.
Altitude	70 ft. in.	258 ft. in.	14 ft. in.	42 ft. in.	80 ft. in.	140 ft. in.	34 ft. in.	21 ft. in.	12 ft. in.	550 ft. in.	1070 ft. in.	79 ft. in.
1864	67·90	37·40	49·30	43·80	30·41	44·50	63·40	22·00	...	24·20	...	51·70
5	40·80	40·00	...	56·80	...	50·70	68·30	24·30	...	46·60	...	63·60
6	...	42·00	30·00	55·70	36·58	41·10	56·00	19·40	127·50	29·00	...	47·20
7	55·20	53·18	...	60·69	38·25	41·95	46·31	30·07	110·51	39·05	...	41·62
8	...	49·09	...	50·42	34·13	55·52	79·37	30·04	120·21	33·89	...	46·35
9	48·34	52·80	...	55·13	42·96	56·77	65·23	27·29	88·21	32·92	...	42·68
1870	52·87	44·83	32·41	54·72	35·03	48·21	48·43	28·36	116·68	39·20	...	53·95
1	57·64	47·51	35·89	72·12	51·09	64·06	55·67	27·94	122·44	22·15	...	39·03
2	46·90	42·10	23·94	63·64	40·42	50·94	78·61	19·74	123·21	27·39	28·88	40·11
3	63·72	41·27	42·38	53·12	39·00	54·99	65·44	26·33	96·17	35·83	32·30	37·48
4	56·95	35·02	37·94	57·22	36·76	53·50	71·55	22·79	104·48	28·74	30·19	44·65
5	52·53	51·31	38·26	66·96	44·34	65·83	69·07	32·31	130·79	42·63	31·76	44·18
6	58·64	44·02	38·39	48·18	33·88	43·37	60·64	23·99	116·33	38·26	30·93	40·59
7	54·47	40·38	33·45	52·00	33·97	51·93	48·52	23·72	136·66	37·46	35·59	43·15
8	40·14	37·16	21·10	56·73	41·98	54·60	51·90	13·54	154·45	45·23	60·02	54·02
9	58·92	46·13	53·14	60·18	33·65	57·44	61·42	23·18	128·29	42·10	22·42	33·26
1880	55·48	38·89	38·40	47·22	36·27	46·77	37·27	17·67	122·84	33·06	27·69	39·14
1	...	34·24	...	...	30·27	50·13	...	28·07	...	26·40	...	...
2	...	45·63	...	...	33·88	55·68	...	25·39	...	41·80	...	...
3	...	52·21	...	74·87	47·29	51·99	...	30·34	...	38·31	...	...
4	...	38·07	...	60·64	45·77	62·34	...	28·45	...	33·88	...	...
5	...	28·14	...	...	23·58	36·81	...	22·08	...	24·60	...	...
6	...	32·64	...	...	46·41	54·48	...	35·29	...	52·63	...	...
7	...	37·71	...	...	38·59	56·97	...	32·89	...	39·14	...	...
8	...	34·60	...	...	31·30	41·01	...	29·16	...	48·36	...	...
9	...	41·97	...	...	35·41	31·36	...	20·38	...	23·45	...	...
1890	...	46·10	27·62	68·19	32·84	45·23	...	14·84	...	27·98	44·52	...
1	53·57	36·04	30·36	73·10	35·47	35·13	...	20·57	...	32·73	28·89	68·50?

RAINFALL AT ASHCOTT, WAIPAWA, HAWKES BAY.

By H. H. BRIDGE, Esq.

Lat. ... 39° 56' S.
Lon. ... 176° 30' E.

Lat. ... 39° 56' N. Lon. ... 176° 30' E.		Height of { Above Ground ... 9 in. Rain Gauge { Above Sea Level... 700 ft.														
Year.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Jan.....	...	3·00	...	1·97	55	1·70	4·33	1·06	3·46	...	3·48	58	43	2·12	3·78	3·05
Feb.....	...	8·68	...	72	84	1·96	41	8·53	1·47	...	1·87	2·46	1·28	1·27	1·23	8·50
March...	...	2·58	...	6·05	17·39	32	3·38	3·46	6·17	...	2·06	88	3·70	76	1·18	2·30
April ...	...	1·17	...	1·84	87	29	4·39	7·16	25	...	5·15	1·51	2·28	51	2·32	2·59
May.....	...	4·44	...	9·33	3·10	75	1·07	4·74	4·25	...	2·24	7·46	2·82	3·17	3·47	2·07
June ...	...	2·18	...	10·33	3·84	4·44	8·89	1·59	7·12	...	3·19	8·27	1·66	6·09	3·62	1·34
July ...	7·52	...	...	3·56	5·53	4·72	3·86	4·96	2·44	...	21	3·02	3·88	4·73	5·77	1·93
Aug. ...	1·25	...	...	3·81	3·64	4·24	7·07	1·75	3·60	...	4·10	1·83	5·34	2·06	89	2·82
Sept. ...	3·71	...	...	2·74	68	2·19	1·42	2·90	5·61	...	3·53	2·94	1·74	6·52	4·67	3·71
Oct.....	1·12	...	...	1·49	2·86	1·95	4·61	5·98	4·14	...	2·72	8·96	2·67	2·99	2·36	2·24
Nov. ...	5·99	...	...	7·41	3·59	3·85	6·82	6·31	5·66	...	2·55	3·00	5·32	2·59	1·45	2·91
Dec.....	6·29	...	...	5·30	1·73	2·07	1·38	4·79	3·41	...	37	2·50	64	3·95	1·59	5·60
Total...				54·55	44·62	28·48	47·63	53·23	47·58		31·47	43·41	31·76	36·76	32·33	39·06

In four cases the sum of the daily entries differs from the monthly totals, and is—for March, 1880, 17·79; March, 1883, 3·36; July, 1883, 3·96; June, 1886, 6·19 in.
The total for the three years not given above—viz., 1877, 1878, and 1885—is 96·31 in.; or on the average, 32·10 in. per annum.
The mean 1877 to 1891 inclusive is given by Mr. Bridge as 39·15 in.

Mean Rainfall at 28 Stations in New Zealand.

PROVINCE.		STATION.	Lat. S.	Long. E.	Altitude	Meeson, 1890.	Hector, 1892.
			°	°	feet.	in.	in.
NORTH ISLAND.	Auckland	Mongonui.....	35 01	173 28	70	58.15 15 yrs.	54.00 16 yrs.
	„	Auckland	36 50	174 51	258	43.21 23 „	41.80 28 „
	„	Rotorua	38 24	176 36	...	(53.55) 1 „	...
	„	Gisborne	38 40	178 10	...	49.72 7 „	...
	Taranaki	Taranaki	39 03	174 05	42	58.08 15 „	58.64 21 „
	Hawkes Bay..	Napier	39 29	176 55	14	37.26 15 „	35.51 15 „
	Wellington ..	Wanganui	39 56	175 06	80	38.12 7 „	37.39 27 „
	„	Foxton	40 30	175 30	...	37.14 9 „	...
	„	Wairarapa	41 15	175 17	...	(42.59) 1 „	...
	„	Wellington	41 16	174 47	140	50.18 23 „	50.12 28 „
SOUTH ISLAND.	„	„ Reservoir..	...	...	...	(45.57) 2 „	...
	Nelson	Farewell Spit	40 30	172 44	...	(37.80) 2 „	...
	„	Pakawau, Golden Bay	40 35	172 30	...	108.30 9 „	...
	„	The Brothers .....	...	...	...	(33.33) 1 „	...
	„	Nelson	41 16	173 18	34	62.63 7 „	60.42 17 „
	Marlborough..	Blenheim	41 30	174 05	...	26.84 10 „	...
	„	Cape Campbell	41 43	174 18	7	21.20 7 „	...
	Nelson	Waiau	42 50	173 30	...	(37.38) 1 „	...
	Westland	Hokitika	42 41	170 59	12	112.16 15 „	119.92 15 „
	Canterbury ..	Bealey	43 02	171 31	2104	104.14 14 „	...
	„	Christchurch	43 32	172 39	21	25.77 19 „	25.00 28 „
	Otago	Milford Sound.....	44 35	167 45	...	...	...
	„	Queenstown.....	45 02	168 39	1070	36.61 8 „	33.93 11 „
	„	Oamaru	45 03	171 05	...	22.70 6 „	...
	„	Dunedin	45 52	170 31	550	33.61 23 „	35.25 28 „
	„	Puysegur Point	46 12	166 32	...	(110.59) 1 „	...
	„	Wallacetown* .....	...	...	...	43.67 15 „	...
	„	Invercargill*	46 28	168 17	79	...	46.18 18 „
	„	Bluff	46 33	168 10	...	(64.67) 1 „	...

* See remark on page 146.

and in three different places we have found the fall for 1864 given as 51.00, 51.15, and 51.70 in. So with Hokitika, 1866 is given in one report as 129.12, and in another as 127.50 in. These differences are not of practical importance, and we neither think nor suggest that Sir James Hector is in any way responsible for them; but we do hope that the New Zealand Government will have *all* the old observations thoroughly examined, tabulated, and published.

One great deficiency in New Zealand rainfall returns is record of the height of the gauges above the ground. In early days several stations had two gauges, one on the ground, the other on a roof; there is nothing to show of which gauge the records were given, and we do not know why the results from both were not published.

With the information in Sir James's present table, it will be easy to deduce (from the short periods of observation at the many recently established stations) means quite near enough to the truth

for most practical purposes, and thus to give the colony a series of shaded maps like the beautiful Jamaica ones.

One subject on which we naturally examine such a table as that on page 146 is the limit of fluctuation in the yearly totals of rain. Is it at all similar to that in the British Isles? Here are the values for the five* long records, and for comparison we prefix the ratios given by Mr. Symons in *British Rainfall*, 1883, and by Mr. Binnie, *Proc. Inst. C.E.*, March, 1892.

	Symons.	Binnie.	Auckland.	Wanganui.	Wellington.	Dunedin.	Mean for N.Z.
Wettest year.....	1.45	1.45	1.27	1.37	1.31	1.49	1.36
Driest year.....	.66	.66	.67	.63	.62	.63	.64
Two driest years .....	.74	.73	.71	.86	.72	.70	.75
Three driest years .....	.79	.78	.79	.89	.74	.79	.80
Total Fluctuation .....	.79	.79	.60	.74	.69	.86	.72

This proves that the New Zealand rainfall shows remarkable accordance with the fluctuation elsewhere. Except at Dunedin, they will probably have years slightly wetter than any that they have yet had. At Wellington, for instance, theoretically the wettest year should have a fall of $72\frac{1}{2}$ inches; at present the wettest there has been 66 inches in 1875; but on the other hand, it is improbable that Wellington will ever have three years in succession drier than 1889, 1890, and 1891.

OCTOBER RAIN AND FLOODS.

ONE HUNDRED and fifty feet of newspaper cuttings upon the subject, now mounted and lying before us, give ample evidence of great loss and suffering from floods during the past month. Most damage occurred in Yorkshire, but injury occurred also in other parts of the country—in Essex, Lincolnshire, North Wales, and the north of Scotland. We cannot give full details until we receive the materials for compiling *British Rainfall*, 1892, but meanwhile the following remarks and tables will indicate the general features.

In our last number we gave some details as to the rain on October 4th. The next important rains were in N. Wales, followed in the dry district of the N.E. of Scotland by heavy rains and snow, which combined to inflict serious injury on outstanding crops. Then came the Yorkshire rains of 13th to 15th, particulars of which we give in the following table, in which the stations are grouped *not* in the usual

* We have omitted Canterbury, because we regret to find that that column is made up of the record of two stations.

order but, according to the river basins in which the various stations are situated.

Rainfall, October 13th—15th. 1892.

River Basins.	Stations.	13th.	14th.	15th.	Total.
		in.	in.	in.	in.
Witham	Horncastle (Hemingby).....	·85	·85	·94	2·64
Ancholme	Brigg	1·12	1·15	·79	3·06
Don	Doncaster (Magdalens)	·75	1·39	·69	2·83
Hull	Hull (Pearson Park)	·55	1·85	·57	2·97
Foulness	Market Weighton (Houghton)...	1·05	1·55	1·50	4·10
Calder	Wakefield Prison	·92	2·38	·84	4·14
„	Slaithwaite (Blackmoorfoot).....	·54	2·48	1·00	4·02
Aire	Leeds (Museum)	·91	2·84	·61	4·36
„	Skipton (Craven Herald Office)..	·33	1·85	·10	2·28
Esk	Guisborough	·60	1·40	·48	2·48
Wharfe	Oughtershaw Hall	1·08	3·26	·47	4·81
„	Arncliffe Vicarage	·70	2·59	·44	3·73
Ouse	Hawes (Hardrow Vicarage)	1·41	3·47	·60	5·48
„	Aysgarth Vicarage	1·12	3·36	1·02	5·50
„	East Layton [Darlington]	·23	1·63	·46	2·32
„	Ripon (Mickleby)	·34	2·12	·55	3·01
„	Melmerby (Baldersby) .....	...	1·25	·30	1·55
„	Pately Bridge (Castlestead)	·85	3·25	·86	4·96
„	Knaresboro' (Farnham Hall) ...	·50	2·00	·58	3·08
„	Wetherby (Ribston)	·82	1·64	·65	3·11
„	York (Phil. Soc. Gardens)	·38	1·73	·50	2·61
Tees	Barnard Castle (Whorlton)	·25	1·32	·24	1·81
„	Mickleton	·12	1·53	·18	1·83

We have read through the newspaper cuttings, which we have received with respect to the floods produced by these rains. Rejecting duplicates, there are about *150 feet* of ordinary column width, and compressing that information into a page, is an impossibility. Moreover, although there is much that is of trivial or purely personal interest, there is a very large amount of very valuable information, which we hope to be able to utilize in *British Rainfall, 1892*.

At present, therefore, we must deal with isolated facts and generalities:—

At York, the flood was said to be the highest recorded in any month since 1831, and the highest in October since 1689; but as works were in progress in the Ouse, *just below* the City, it is possible that they artificially raised the level. At present we know nothing on this point. Upwards of 500 houses were reported to have been damaged, and many of the old records in the care of the Corporation were saturated.

At each of the following places the height is reported to have been unequalled for the number of years set against it:—Knaresboro', 128; York, 61; Bradford, 46; Wetherby, 30; Dewsbury, Keighley, Leeds, Pannal, Shipley, and S. Milford, 26; Malton, 14; Selby, 12; Pately Bridge, 11; Ripon, 10; Barnsley, Doncaster and Rotherham, 6 years. We have no reason to doubt the above figures, but accept no

responsibility for their accuracy; we shall be very thankful for any trustworthy information, as to the height of the recent or previous floods.

Few things are more uncomfortable than a flood in the dark. At Boroughbridge, Knottingley, Selby, Snaith and in parts of York, the gas supply failed, either from water getting into the mains, or from the works being inundated. In several cases there could be no service on Sunday, Oct. 16th; in some, because the church was flooded; in some, because there was no means of lighting it. The railways suffered slightly, one bridge broke, and in a few cases ballast was swept away, but no life was lost.

As far as we can gather, the chief mischief has been the flooding of thousands of the houses of the lower classes in nearly all parts of Yorkshire, and closely following thereupon, is the loss to farmers, (1) of uncarried crops, (2) of live stock. Of individual losers, it is not so easy to speak. At Pateley Bridge, an important incline, leading to a quarry, began to slide, and seems to have gone into the fields below. A pattern shop, with the entire stock of one firm, was swept into a river. Coal pits were flooded and the ponies drowned. Chemical works, tanneries, brickworks, dye works, &c., were put under water to the total destruction of the goods being operated upon. But happily, the loss of human life was almost nil, and the filthy Yorkshire rivers, were for once washed clean.

Photography.—We cannot pass from this subject without expressing our extreme pleasure at the number of gentlemen, both amateur and professional, who (in many cases at considerable personal discomfort) secured photographs of these floods. They, perhaps, looked upon their records as merely so many unusual views, but we can assure them that they have a value far beyond that. Disgracefully little is known respecting the discharge of our rivers, and as these photographs show every brick and stone in the bridges, the heights reached can be recovered and recorded within a few inches. We have already been favoured with sets from:—

Brotherton.....	Mr. W. A. Fox, per Mr. E. R. Waite, F.L.S.
Castleford	Mr. E. G. McBretney, F.I.C.
Ferrybridge	Mr. W. A. Fox, per Mr. E. R. Waite, F.L.S.
York	Mr. J. Noble.
Wakefield	Mr. Isaac Briggs, jun.

A friend has also purchased and sent us an interesting set of small views taken at York by Messrs. Smith & Co.

Mr. Creer, C.E., who formerly sent in the rain records kept under his superintendence at Lancaster, is now City Engineer at York, and we think his report to the Ouse Navigation Committee of the York Corporation so interesting that we reprint it *in extenso* from the *York Herald*.

REPORT OF THE CITY ENGINEER OF YORK.

“The flood in the river Ouse on Saturday and Sunday, the 15th and 16th October, was of such an unusual character that I have thought it desirable to draw up a short report on the subject, so that the details may be placed on record. The committee is aware that gauges are fixed at Ouse and Lendal

Bridges. These should have their zeros at 16.75 ft. above ordnance datum, this being the recognised summer level of the river. I find, however, on checking them, that they have been fixed about 2 inches too low. The Ouse Bridge gauge is read every day at noon, by Mr. Stephenson, collector of the river dues, and the result entered in his diary. The gauge at Lendal Bridge is read from my office, and recorded every morning at 9 a.m. (Sundays excepted); and during the summer months, when the gauge can be read across the river, it is read in the evening; during the winter months, when this is not possible, the level is obtained by measurement at the Common Hall landing. From the gaugings taken I find that on

Friday, the 14th,	at 9 a.m.,	the reading above summer level was 6 in.
Friday evening,	at 5 p.m.,	„ „ „ 2 ft. 3 in.
Saturday, the 15th,	at 9 a.m.,	„ „ „ 10 ft. 6 in.
Saturday,	at noon,	„ „ „ 11 ft.

Between Friday evening and Saturday morning the river rose at the rate of about $6\frac{1}{4}$ in. per hour. Between 9 a.m. and 1 p.m. on Saturday, the rise was at the rate of about $1\frac{1}{4}$ in. only. The flood ultimately rose between that hour and 10 a.m. on Sunday morning to about 16 feet at the Lendal Bridge gauge, the flood mark left on the Lendal Water Tower showing 15 ft. 11 in. above summer level.

I give hereunder a list showing the height above summer level to which the flood rose in various parts of the city on Sunday, the 16th October:—

	ft. in.		ft. in.
Love Lane, Fulford	14 1	North Street	15 8
New Walk End	14 3	Foss Islands Road	15 7
Blue Bridge Lane.....	14 5	Wellington Row	15 10
Castle Mills Lock.....	14 6	Ouse Bridge Inn (mark made	
Fishergate, near Castle Mills		by landlord)	15 8
Bridge.....	14 6	Water Works Office, Lendal	
Walmgate	14 8	Bridge	15 11
Fossgate, at Merchants' Hall..	14 6	Municipal Offices (basement)...	15 11
Skeldergate Bridge(Upper Side)	15 1	Marygate, at Hetherton Street	16 2
Tower Street.....	15 3	Scarborough Railway Bridge...	16 3
Skeldergate	15 6	Salisbury Terrace, Leeman Road	16 9

“The record of floods, as published in the press in tabulated form, does not agree with the flood marks existing in various parts of the city; this arises from the alteration in the summer level of the river by the construction and improvement of the weir at Naburn. As instances, take the following:—The published record of the flood in 1625 gives a height of 18 feet 8 inches. Fortunately, this flood is recorded on the Friars' Wall, near Tower Street, and shows that the water rose to a height of 17 ft. 10 in. above the present summer level, or 10 in. less than the published record. The flood of 1636 is also marked on the same wall, and shows the correct height to be 17 ft. $1\frac{1}{2}$ in. above summer level, or $10\frac{1}{2}$ in. below the published record of 18 ft. So with the flood of 1763, recorded on a brass plate in the Ouse Bridge Inn. This plate shows that the flood rose on the 31st December in that year to a height of 16 ft. 3 in. above the summer level, or 1 ft. $2\frac{1}{2}$ in. below the published record of 17 ft. $5\frac{1}{2}$ in. The records of 1625 and 1636 would not be affected by works at Naburn, as in those years, and up to 1757, the tide had an uninterrupted flow up to the city. In 1763 the case is different, as Naburn Lock and weir had been opened six years prior to this flood. I am not aware that any alteration was made in the height of the weir after its construction, until the year 1835. From inquiries made I am inclined to believe that the weir remained at the level at which it was constructed, until the last-mentioned year, when improved sluices were provided for dealing with floods, probably in consequence of the flood in 1831, and moveable deals fixed on the top of the stone work. The only mark of the 1831 flood that I have any knowledge of, is that at the Merchants' Hall, Fossgate; this, compared with our present summer level, gives a flood height of 15 ft. 7 in. at this place. In the recent flood the level of the Ouse was 1 ft. 5 in. higher at Lendal than at the

Merchants' Hall, and if this difference is added to the height shown on the board fixed at the Merchants' Hall, the level of the 1831 flood in the Ouse at Lendal would appear to be 17 ft. 1 in. above present summer level, and this agrees very nearly with the figures given by Mr. W. T. Walker, of the Marygate Tannery, viz., 17 ft. 2 in. In comparing old flood height records that have been measured from the summer level prevailing at the time, with recent floods, it should be borne in mind that in 1835 the summer level was raised 1 ft. 6 in., and in 1876 it was raised an additional 4 inches, or 1 ft. 10 in. in all above the summer level prior to 1835.

"It is very desirable that a correct official record should be kept of the varying height of the river, so as to ascertain the effect of the rainfall in producing floods, and the rate at which the rise takes place; this can only be done effectually by providing an automatic gauge which records on a diagram every variation in the height of the river; these gauges are extensively used in connection with water works, navigable rivers, and docks.

"The sluices fixed at Naburn some years since for the purpose of facilitating the discharge of flood waters, are useful for dealing with small floods, and enable you to lower the water below summer level, thus providing what may be termed an elongated reservoir for flood water that would, if not so provided for, add to the height of the flood. These sluices would, however, have little or no effect on such a flood as that on the 16th October. Mr. Symons, who has done an enormous amount of work in organising a system of observations on rainfall all over the country, estimates the increased volume of water passing York in consequence of the rainfall of the 13th, 14th, and 15th, at 80,000,000,000 gallons. If the sluices at Naburn were working under the most favourable circumstances, that is, with a clear fall from summer level above the Weir to low water below the Weir, they would in the three days be capable of discharging about one-fiftieth of this quantity; as a matter of fact the sluices were submerged most of the time, the water being level on both sides of the Weir, so that they were, under the circumstances prevailing at the time of the flood, of very little service.

"The improved system of draining now adopted for agricultural land, and the greater extent of land under drainage as compared with 60 years ago, leads me to believe that floods are likely to be more frequent and severe than formerly, although they are not likely to be of such long duration."

As regards the whole month, the table on p. 158 will show that in some districts October was a dry month, in others it was very wet; this was notably the case in the Eastern Counties, and the following table contains some striking values:—

STATION.	Total in October 1892.	Average in October, 1880-89.	Excess in October, 1892.	REMARKS.
	in.	in.	in.	
IV. Ipswich (Bishop's Hill).....	6.51	3.19	+3.32	Wettest month for 21 years.
„ Woodbridge (The Cedars) ..	7.32	3.31	+4.01	
„ Rendlesham Hall	6.96	3.31	+3.65	
„ Geldeston [Beccles]	7.39	3.49	+3.90	
„ Wymondham.....	7.46	...	...
„ Yarmouth	9.27	...	...
„ Blofield	7.62	...	...
„ Fakenham (Cranmer Hall)	8.07	Wettest Oct. for 22 years.
VIII. Neston, Hinderton	7.66	3.30	+4.36	
XI. Colwyn Bay, Nant-y-Glyn	10.32	3.76	+6.56	
„ Llandudno	8.56	3.39	+5.17	
XVII. Keith, H.R.S.	10.17	3.45	+6.72	
„ Forres, H.R.S.	5.10	2.43	+2.67	
XVIII. Inverness (Culloden) ...	5.37	2.25	+3.12	
„ Cawdor [Nairn].....	5.82	2.73	+3.09	

ON THE PRODUCTION OF RAIN.

By PROF. CLEVELAND ABBE.

(Concluded from p. 137.)

Bezold suggests that the heavy rains generally known as cloud-bursts are immediately preceded by, and may owe their origin to, a supersaturated state of the atmosphere, by reason of which a greater quantity of vapor is contained in the air than would, under other conditions, be possible at a given temperature. Following out this hypothesis, I conclude that, whatever molecular condition it be that permits the existence of a supersaturated atmosphere, it is evident that the removal, or annulment, of that condition must give rise to an immediate and heavy condensation. This principle may be extended to all ordinary rains as well as to the violent thunder showers and cloud-bursts.

The supersaturated condition must be considered as a case of adiabatic expansion* accompanied by a delay in the occurrence of the appropriate condensation; as far as we at present know, this condition can occur only in those cases where all foreign substances, or dust particles, are absent, which might serve as nuclei for the formation of fog particles. A slowly rising and cooling atmosphere first condenses its moisture on the dust nuclei and forms minute droplets; these grow very slowly, by diffusion, up to a definite size proper to the prevailing temperature and vapor tension, but the intermediate air, in which these droplets are floating, keeps on cooling as a dust-free, supersaturated vapor. If the sun shines on these droplets its heat powerfully contributes to evaporate them and further saturate the surrounding air.

In general, therefore, the ascending portions of every cloud contain supersaturated, dust-free vapor separating the isolated droplets. When by further expansion and cooling the supersaturation has proceeded to such an extent that further condensation must occur, this latter molecular change permeates the supersaturated space with a rapidity comparable to that with which any other chemical change takes place, just as when the explosive union of chlorine and hydrogen, or of oxygen and hydrogen, starting at any one point, almost instantaneously permeates a mass of those mixed gases, or, as when combustion runs along a train of gunpowder. The vapor molecules from the supersaturated spaces are quickly brought together by their molecular attractions into heavy drops of warm water which are often distinct from the intermediate cooler droplets and descend rapidly from the clouds, while the latent heat of condensation is communicated to the adjoining air and is left behind in the cloud. Thus simultaneously with the formation and fall of the big drops there is a sudden expansion of that portion of the clouds from which they came; Bezold thinks that such expansion may

* *i. e.*, without adding or subtracting heat.

possibly be felt at the earth's surface as a sudden rise in the barometer, while it is also visible to the eye as a sudden expansion of the cloud into the so-called "thunder-head." I myself doubt whether there would be any appreciable barometric result, yet I consider that the sudden expansion and ascent of the white cloud and its subsequent rapid dissipation into the surrounding air, together with the simultaneous lightning, thunder, rain, hail, and ascending whirl of wind, all conspire to make it very plausible that there really existed a supersaturated condition at the moment immediately preceding.

If the temperature of the dew-point of the ascending air, or the temperature of supersaturation is below freezing, the condensation of the vapor may at once form, not drops, but large snowflakes, such as will fall rapidly to the ground, or the small hail that is ordinarily called sleet.

Correlated phenomena occur when a cloud consists of small particles of water cooled below the freezing point, as is known to be frequently the case. When for any reason these particles are suddenly converted into ice, as will happen when they are cooled low enough or when they jostle against each other, their temperatures at once rise to the freezing point, a large quantity of heat is set free, the cloud expands and rises and the droplets of water are converted into spiculæ of ice, or small snow-flakes; large flakes and hailstones are not to be explained in this manner.

There is some plausibility in the hypothesis that the critical electrical condition, which results in lightning, is directly due to the disruption of the condition of extreme supersaturation and the sudden formation of large drops of water, or the disruption of the condition of water cooled below the freezing point and the consequent sudden formation of ice or snow, but this remains to be investigated.

Therefore, according to this latest view of the subject, the problem of the artificial formation of rain will be partially solved and, sufficiently so for practical purposes, if some method is invented by which to bring about a sudden formation of a small percentage of large drops, out of the moist air that exists between the small particles of every cloud.

At present our attention, and experiments, should be directed toward understanding and completing the natural and obscure process involved in the formation of rain within the cloud and not toward the forcing of any unnatural process.

Washington, D.C., May 20, 1892.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, APRIL, 1892.

STATIONS. (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
°		°		°	°	°	0-100	°	°	inches			
England, London	73·0	4	28·2	17	59·6	36·8	36·8	69	118·7	21·7	·99	9	3·3
Malta.....	72·5	25	49·9	21	65·8	55·5	53·4	81	131·6	43·5	2·32	9	5·3
Cape of Good Hope ...	80·7	29	44·1	18	69·1	54·2	...	...	...	...	2·34	5	4·6
Mauritius.....	83·7	4	69·0	9	82·1	72·9	70·5	81	134·5	63·7	5·68	14	5·7
Calcutta.....	102·7	26	71·2	16	94·3	77·3	76·0	74	155·5	68·4	1·65	3	3·0
Bombay.....	93·3	6	76·6	1	90·5	81·0	76·1	73	143·5	66·5	·00	0	2·3
Ceylon, Colombo	90·7	1	72·0	24	87·3	76·6	72·7	78	154·0	70·0	13·92	18	6·3
Melbourne.....	85·3	2	40·5	16	65·1	48·5	48·6	75	135·1	33·4	5·63	13	6·1
Adelaide	89·3	2	43·5	26	69·1	51·9	48·3	65	152·8	32·6	1·61	15	6·2
Tasmania, Hobart.....	...	...	...	...	...	...	...	...	...	...	...	...	...
Wellington .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Auckland	73·0	7	49·0	28	68·9	57·4	58·3	85	128·0	38·0	2·02	12	5·9
Jamaica, Kingston.....	89·7	14	66·8	7	86·1	69·3	67·0	69	...	...	·81	5	6·1
Trinidad	92·0	13	64·0	10	84·1	67·4	70·3	79	157·0	54·0	7·59	23	...
Toronto	71·6	5	20·2	25	50·4	32·4	30·3	63	...	10·2	1·26	12	4·9
New Brunswick, Fredericton	60·7	3	18·9	25	50·5	30·1	26·7	55	...	...	·97	9	4·4
Manitoba, Winnipeg ...	64·0	22	7·0	8	41·9	22·7	...	...	...	...	1·91	8	4·9
British Columbia, Esquimalt	65·6	20	30·0	7	53·2	39·8	44·0	91	...	...	2·53	21	6·4

REMARKS.

MALTA.—Mean temp. 59°·6. Mean hourly velocity of wind 12·9 miles. Sea temp. rose from 59°·8 to 62°·5. Thunderstorms on 2nd, 4th, and 21st. J. SCOLLES.

Mauritius.—Mean temp. of air 0°·8 above, of dew point 2°·2 above, and rainfall ·04 in. below, their respective averages. Mean hourly velocity of wind 8·7 miles, or 2·0 below average; extremes, 103·3 on 29th and 1·9 on 11th; prevailing direction E.S.E. Thunder and lightning on 11th, 12th, 27th, and 28th. A terrific hurricane swept over the island on 29th, causing great loss of life and property. The greatest velocity of the wind for 5 minutes was at the rate of 121 miles, and the maximum velocity for one hour 103 miles from 3.30 to 4.30 p.m. The barometer (at sea level) fell to 27·961 in. The centre passed over the island, and the wind was strongest from W.S.W. after the passage of the centre. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 1°·8, and of dew point 0°·9 below the average of 34 years. Humidity 3, amount of cloud 0·2, and rainfall 3·37 in., above the average. Prevailing wind W., strong on 6 days. Heavy dew on 9 days. Hoar frost on 2 days. R. L. J. ELLERY, F.R.S.

Adelaide.—The weather was very cold, the mean temp. being 3°·8 below the average, and the lowest on record for April. The rainfall was made up for the most part of very light showers, and is slightly less than the average. The southern portions of the colony experienced fair to moderate rains, but over the northern areas and inland the drought continued. C. TODD, F.R.S.

Auckland.—On the whole a warm and dry month. Mean temp. considerably above, but rainfall much below, the average of 25 years. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
OCTOBER, 1892.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	4·69	XI.	Rhayader, Nantgwillt..	6·10
„	Birchington, Thor	5·39	„	Corwen, Rhug	7·20
„	Brighton, Prestonville Rd	5·52	„	Carnarvon, Cocksidia ...	5·98
„	Hailsham	6·16	„	I. of Man, Douglas	6·81
„	Ryde, Thornbrough	4·48	XII.	Stoneykirk, Ardwell Ho.	4·34
„	Alton, Ashdell	4·79	„	New Galloway, Glenlee	6·11
III.	Oxford, Magdalen Col...	3·09	„	Melrose, Abbey Gate...	4·52
„	Banbury, Bloxham	2·75	XIII.	N. Esk Res. [Penicuik]	5·00
„	Northampton, Sedgebrook	3·81	„	Edinburgh, Blacket Pl..	...
„	Cambridge, Fulbourne..	...	XIV.	Glasgow, Queen's Park.	3·77
„	Wisbech, Bank House..	5·32	XV.	Islay, Gruinart School..	5·90
IV.	Southend	4·42	XVI.	Dollar	5·64
„	Harlow, Sheering	3·95	„	Balquhider, Stronvar..	6·24
„	Rendlesham Hall	6·95	„	Coupar Angus Station..	3·80
„	Diss	6·61	„	Dunkeld, Inver Braan..	2·95
„	Swaffham	6·89	„	Dalnaspidal H.R.S. ...	6·68
V.	Salisbury, Alderbury...	4·94	XVII.	Keith H.R.S.	10·17
„	Bishop's Cannings	3·82	„	Forres H.R.S.	5·10
„	Blandford, Whatcombe.	6·09	XVIII.	Fearn, Lower Pitkerrie.	3·87
„	Ashburton, Holne Vic....	6·73	„	Loch Shiel, Glenaladale	6·87
„	Okehampton, Oaklands.	6·81	„	N. Uist. Loch Maddy ...	4·01
„	Hartland Abbey	4·14	„	Invergarry	4·40
„	Lynmouth, Glenthorne.	4·91	„	Aviemore H.R.S.	5·55
„	Probus, Lamellyn	5·80	„	Loch Ness, Drumnadrochit	6·50
„	Wincanton, Stowell Rec.	4·22	XIX.	Lairg H.R.S. ....	...
„	Weston-super-Mare	2·02	„	Scourie	5·83
VI.	Clifton, Pembroke Road	2·94	„	Watten H.R.S.	5·24
„	Ross, The Graig	1·89	XX.	Dunmanway, Coolkelure	3·62
„	Wem, Clive Vicarage ...	3·78	„	Fermoy, Gas Works ...	3·19
„	Cheadle, The Heath Ho.	3·97	„	Killarney, Woodlawn ...	5·13
„	Worcester, Diglis Lock	1·40	„	Tipperary, Henry Street	3·02
„	Coventry, Coundon	2·73	„	Limerick, Kilcornan ...	1·34
VII.	Ketton Hall [Stamford]	4·03	„	Ennis	2·35
„	Grantham, Stainby	4·73	„	Miltown Malbay	2·64
„	Horncastle, Bucknall ...	4·66	XXI.	Gorey, Courtown House	3·11
„	Worksop, Hodseck Priory	4·39	„	Mullingar, Belvedere...	2·64
VIII.	Neston, Hinderton	7·66	„	Athlone, Twyford	2·53
„	Knutsford, Heathside...	4·39	„	Longford, Currygrane...	2·23
„	Lancaster .....	...	XXII.	Galway, Queen's Coll...	2·39
„	Broughton-in-Furness..	5·93	„	Crossmolina, Enniscoe..	4·29
IX.	Ripon, Mickley	7·43	„	Collooney, Markree Obs.	4·42
„	Scarborough, South Cliff	6·81	„	Ballinamore, Lawderdale	2·43
„	East Layton [Darlington]	5·34	XXIII.	Lough Sheelin, Arley ..	1·82
„	Middleton, Mickleton..	5·16	„	Warrenpoint	4·06
X.	Haltwhistle, Unthank..	4·84	„	Seaforde	4·30
„	Bamburgh	5·99	„	Belfast, Springfield	4·59
„	Newton Reigny	5·01	„	Bushmills, Dundarave...	4·33
XI.	Llanfrehfa Grange	3·34	„	Stewartstown	2·69
„	Llandovery	4·36	„	Buncrana	5·57
„	Castle Malgwyn	5·93	„	Lough Swilly, Carrablagh	5·30
„	Builth, Abergwessin Vic.	7·69			

OCTOBER, 1892.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which "01 or more fell.	TEMPERATURE.						No. of Nights below 32°	
		Total Fall.	Differ- ence from average 1880-9.	Greatest Fall in 24 hours		Max.		Min.		In shade.	On grass.				
				Dpth	Date			Deg.	Date			Deg.	Date.		
														inches.	inches.	in.
I.	London (Camden Square) ...	3.78	+ .89	1.11	30	21	60.4	29	29.2	26	3	11			
II.	Maidstone (Hunton Court)...	5.39	+ 1.93	1.75	4	21	...	...	...	...	...	...
III.	Strathfield Turgiss	4.32	+ 1.48	1.24	30	22	58.7	29	23.9	26	6	17			
IV.	Hitchin	3.31	+ .24	.74	30	24	60.0	29	25.0	25	7	...			
V.	Winslow (Addington)	3.59	+ .50	.82	27	23	60.0	29	23.0	26	8	11			
VI.	Bury St. Edmunds (Westley)	5.57	+ 2.30	1.32	29	25	58.0	30	23.0	26	...	...	
VII.	Norwich (Cossey)	7.21	+ 3.37	1.10	30	25	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring)	4.45	+ .91	1.17	28	20	60.0	6	32.0	24	1	...			
IX.	Torquay, Babbacombe	4.71	+ .25	.94	26	18	59.9	6	32.9	24	0	14			
X.	Bodmin (Fore Street)	6.79	+ .79	1.14	26	23	...	...	...	...	...	...
XI.	Stroud (Upfield)	2.50	— .53	.55	27	19	60.0	29	28.0	25	5	...			
XII.	Church Stretton (Woolstaston)	4.04	+ .27	.84	3	19	56.0	4, 7b	28.0	26	4	14			
XIII.	Tenbury (Orleton)	2.18	— 1.03	.44	27	19	59.0	4, 9b	21.5	9	15	...			
XIV.	Leicester (Barkby)	3.79	+ .64	1.03	2	22	60.0	6c	20.0	25	12	18			
XV.	Boston	4.51	+ 1.40	.68	13	21	60.0	14	26.0	26	5	...			
XVI.	Hesley Hall [Tickhill]	4.63	+ 1.53	1.04	14	22	60.0	28d	23.0	26	5	...			
XVII.	Manchester (Plymouth Grove)	4.48	+ 1.11	.69	9	19	58.0	1, 28	26.0	26	8	15			
XVIII.	Wetherby (Ribston Hall) ...	5.40	+ 2.27	1.64	14	17	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	9.86	+ 3.83	2.59	14	22	56.0	29	22.0	26	7	...			
XX.	Hull (Pearson Park)	5.64	+ 1.99	1.85	14	25	61.0	29	26.0	26	6	9			
XXI.	Newcastle (Town Moor)	4.57	+ 1.45	.80	2	26	...	...	...	...	...	...
XXII.	Borrowdale (Seathwaite)	12.11	+ 1.52	2.06	27	22	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	2.47	— 2.07	.52	27	16	...	...	...	...	...	...
XXIV.	Haverfordwest	4.39	+ .76	1.14	27	25	57.2	29	22.3	26	7	13			
XXV.	Aberystwith, Gogerddan	5.50	+ .15	.77	6	21	...	...	20.0	25	15	...	
XXVI.	Llandudno	8.56	+ 5.17	1.59	3	25	58.8	28	...	...	...	...
XXVII.	Cargen [Dumfries]	4.40	+ 1.14	.98	27	14	57.4	6	19.4	26	9	...			
XXVIII.	Jedburgh (Sunnyside)	5.00	+ 2.35	1.03	2	23	54.0	27	18.0	25	6	...			
XXIX.	Old Cumnock	3.13	— .27	.66	27	20	...	...	...	...	...	...
XXX.	Lochgilhead (Kilmory)	4.49	— .30	.86	27	16	...	...	19.0	24	13	...	
XXXI.	Oban (Craigvarren)	3.51	— .67	.5	13	13	57.6	14	26.0	25	3	...			
XXXII.	Mull (Quinish)	4.25	+ 1.04	.78	26	19	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices	4.70	+ 1.74	.80	4, 28	14	...	...	...	...	...	...
XXXIV.	Dundee (Eastern Necropolis)	3.80	+ 1.56	.90	27	20	56.9	1	25.0	25	5	...			
XXXV.	Braemar	5.51	+ 1.90	1.39	5	24	57.0	28	16.3	25	5	17			
XXXVI.	Aberdeen (Cranford)	5.13	— .71	.22	28	28	57.0	1	28.0	24e	3	...			
XXXVII.	Strome Ferry	5.34	— .33	.82	5	21	...	...	...	...	...	...
XXXVIII.	Cawdor [Nairn]	5.82	+ 3.09	1.01	9	26	...	...	...	...	...	...
XXXIX.	Dunrobin	3.78	+ .47	.67	27	18	55.5	3	27.8	25	3	...			
XL.	S. Ronaldsay (Roeberry)	4.59	+ .86	.93	5	27	55.0	4	32.0	24	1	...			
XLI.	Darrynane Abbey	3.06	— .1	1.24	26	19	...	...	...	...	...	...
XLII.	Waterford (Brook Lodge) ...	2.36	— 1.46	.89	26	9	58.0	3	26.0	24	7	...			
XLIII.	O'Brien's Bridge (Ross)	1.71	— .41	.14	14	14	60.0	3	28.0	19	4	...			
XLIV.	Carlow (Browne's Hill)	1.97	— 1.32	.32	28	16	...	...	...	...	...	...
XLV.	Dublin (Fitz William Square)	2.54	— .84	.78	14	17	58.2	28	28.3	26	4	13			
XLVI.	Ballinasloe	1.68	— 1.31	.42	26	14	56.0	28	24.0	26	10	...			
XLVII.	Clifden (Kylemore)	8.15	— .2	2.06	26	19	...	...	...	...	...	...
XLVIII.	Waringstown	3.44	+ .73	.80	14	18	63.0	28	19.0	25	8	14			
XLIX.	Londonderry (Creggan Res.) ..	5.44	+ 1.77	.91	27	29	...	...	...	...	...	...
L.	Omagh (Edenfel)	3.72	+ .62	.50	26a	24	56.0	27b	21.0	25	9	14			

a And 27. b And 28. c And 28, 29. d And 29. e And 25, 31.

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

METEOROLOGICAL NOTES ON OCTOBER, 1892.

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.—A pleasant month on the whole, but with very heavy R towards the close. T on the 30th. Swallows last seen on October 1st.

ADDINGTON.—A cold month, with R on 23 days; heavy falls at the end, causing large floods. The 29th was the warmest day and the warmest night of the month, with a max. temp. of 60°, and a min. of 52°. The min. fell below 40° on 21 nights.

BURY ST. EDMUNDS.—Observations were commenced in 1857, and since that time there have been only two months with more R than this month—viz., October, 1865 (5·58 in.), and July, 1872 (5·92 in.)—and no other month has had so many wet days. S fell on 21st.

LANGTON HERRING.—A cold, wet month, the mean 9 a.m. temp. being 4°·1 below the average of 21 years, and the lowest in October during that time. From the 17th to the 26th the cold was unusually severe, but a change to mild weather occurred on the 27th. In the three days 26th to 28th, 2·60 in. of R fell. L on 1st and 2nd; gales on 8th and 9th; solar halo on 30th.

BABBACOMBE.—A very cold, rather wet, but sunny month. Mean temp. 46°·9, 3°·5 below the average of 15 years. It was generally showery from 1st to 11th, 14th to 16th, and 20th to 29th, with heavy R on 26th and 27th; cold from 1st to 5th, 7th to 14th, and 16th to 26th. No R was recorded in the five days from 15th to 19th, but 2·68 in. fell in the five days from 24th to 28th. The mean temp., the mean max., the absolute max., and the mean min. were all the lowest recorded in October; the average amount of cloud (5·0) was also the smallest in the same month. L on 1st, 2nd, 13th, 14th and 15th. Solar halos on 5 days.

BODMIN.—A very seasonable month, but with a large rainfall. Stormy, with very heavy R on 26th and 27th. The last three days very mild. Occasional frost.

WOOLSTASTON.—A wet month. Mean temp. 44°·0. S fell on the 22nd, followed by a week of frost.

TENBURY, ORLETON.—With two exceptions (1880 and 1887), the coldest October in 30 years, the mean temp. being 2°·3 below the average. The frost on 26th was the most severe in October since 1859. Much fog at the end of the month.

BOSTON.—Notwithstanding the heavy R of this month there has not been, owing to the excellent system of drainage in the Fens, any flooding as in other parts of the country. There have been one or two good freshets down the river, but the water has got quickly away and fallen in a few days to ordinary summer level. The condition of the land at the surface is very wet, interfering with the completion of the harvest, and the raising of the potatoes and other roots; the main drains and ditches, however, have not yet risen to their ordinary winter level.

MANCHESTER.—The weather on the whole was cold, wet, and very unsettled. Mean temp. 44°. T and L on the 1st. Dense fogs on the mornings of the 11th, 18th, and 31st; fogs on the 19th, 20th, and 27th.

WALES.

HAVERFORDWEST.—R fell almost every night, although the total is not great. The temp. was always below the average until the 27th, when a warm wave passed over, accompanied by stormy weather, with heavy R; previous to which the weather was very bright, bracing, and intensely cold. A TS occurred about 8 p.m. on 2nd, lasting half an hour; the L was vivid and forked, of a beautiful blue colour; the T deafening, accompanied by very large H. Wind mostly N. or N.W. Temp. the lowest in October since 1881.

LLANDUDNO.—Heavy showers all day on 3rd, with T and L about 9 p.m.

SCOTLAND.

CARGEN.—The mean temp. of the month ($43^{\circ}\cdot 1$), and the low temperatures on the 25th ($21^{\circ}\cdot 6$), and on the 26th ($19^{\circ}\cdot 4$), are the lowest recorded here in October. This has been, so far, the coldest year experienced since observations were commenced; every month (with the exception of May, which had an average temp.) being below the average, and the summer and autumn exceptionally cold, with great want of sunshine.

JEDBURGH.—Weather very unsettled; much R, with N. and N.E. wind, and harvest operations much retarded. To the south and east of this place much corn is still in the fields. S on the 24th.

OBAN, CRAIGVARREN.—After the first week the weather became dry, and this lasting for some time, the crops were safely secured, though late and somewhat damaged.

BRAEMAR.—A dark, cold, and dismal month, with S and sleet. Crops all frozen, still upon the fields, and partly uncut; trees prematurely leafless. Duration of sunshine only $39\frac{1}{2}$ hours.

ABERDEEN, CRANFORD.—The grain crops at the close of the month were in the most deplorable condition ever remembered. Oats cut quite unripe, the straw damaged by wet and wind. In the glens nothing has yet been cut.

ROEBERRY.—A very wet, cold month. Average max. temp. $47^{\circ}\cdot 8$; average min. $40^{\circ}\cdot 7$.

IRELAND.

DARRYNANE ABBEY.—The first week was showery; thence to the 24th fine, but cold, with easterly winds, followed by a gale, and heavy R on the 25th. The last few days were showery.

WATERFORD, BROOK LODGE.—Sharp frost on the 18th. Heavy gale from S.E. on the 27th. Mean temp. $45^{\circ}\cdot 1$, or 3° below that of October, 1891.

O'BRIENSBRIDGE, ROSS.—The month opened cold and wintry, and so continued until the 9th, when bright though cool weather set in, and continued to the 26th. The temp. was low during the month, the first sharp frost occurring on the 19th. R much below average, and altogether a very favourable month.

DUBLIN.—The coldest October recorded in at least 28 years. The month was characterised by an overwhelming prevalence of N.W. to N.E. winds. Only between the 26th and 29th were the polar winds replaced by a southerly current and high temp. So sudden was the upward movement of the therm. that the temp. stood 30° or upwards higher on the 27th than it had been on the 26th, and the air temp. on the 27th was 14° above that of the water in the Vartry mains. Mean temp. $44^{\circ}\cdot 8$, $4^{\circ}\cdot 9$ below the average, and the lowest recorded in October. High winds on 8 days, attaining the force of a gale on the 9th, 14th, 26th, and 27th. Foggy on 5 days. T and L on 2nd and 21st. H on 7 days.

WARINGSTOWN.—Though the R did not greatly exceed the average, the distribution rendered it a damp month, and delayed the conclusion of harvest. The frost on the 24th and 25th was the most severe on record so early in the year.

EDENFEL.—Polar winds prevailed without a break until the 26th, accompanied, according to experience, by low average temp., but contrary to experience, by persistently wet and unsettled weather. The keen and unusual frost on the 26th (18° on the grass) was suddenly followed by a reversal of these conditions, and the month ended in generally soft and humid weather.

S Y M O N S ' S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCXIII.]

DECEMBER, 1892.

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

FORGOTTEN METEOROLOGICAL OBSERVATIONS.

As was shown in the *Quarterly Journal* of the Roy. Met. Soc., Vol. vii, p. 65, there has been a series of Meteorological Societies in London since 1822. The early ones were frequently in difficulties, monetary and otherwise, hence many of the books and papers which they collected have been lost or destroyed. When any of them can be found they should be placed in the care of the Royal Meteorological Society, of which the position is now so strong that there is little probability of anything entrusted to its care ever wandering again.

We have lately purchased a volume of this kind. A large folio volume of blank paper, in which newspaper cuttings and small meteorological tables received between 1837 and 1843 were pasted. The label on the side is as follows :—

METEOROLOGICAL SOCIETY
OF GREAT BRITAIN.
EXTRACTS, SUMMARIES, &c., &c.
From 18 to 18

It thus confirms the evidence (*Q. J.*, vii, p. 97) that about 1842 the name of the Society was changed from the Meteorological Society of *London* to the Meteorological Society of *Great Britain*.

Before passing the volume on to the Society we have looked through it, and made some discoveries which we think it may be of interest to mention.

BAROMETER INDICATORS.

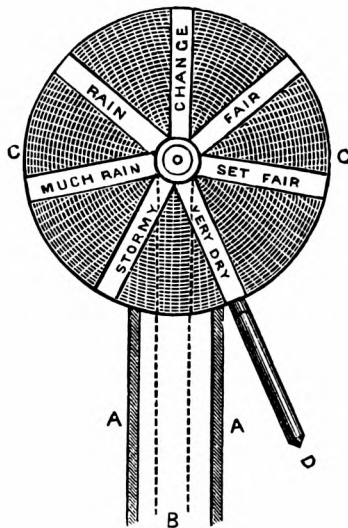
We were under the impression that the first person to suggest or design barometer indicators was the late Mr. Sopwith, F.R.S., who, in conjunction with Mr. Glaisher, F.R.S., erected three on the Northumberland coast in 1860. Mr. Sopwith read a paper, "On Barometer Indicators," at the meeting of the British Meteorological Society on January 16th, 1861, and the paper is printed *in extenso*

in the Eleventh Annual Report of the Society. As this paper contains no reference to any previous work upon the subject, we may be quite sure that the designs then brought forward originated with Mr. Sopwith.

We find, however, a cutting from a Welsh paper seventeen years earlier, giving a sketch and explanation of one, and reproduce it; if any one can trace the invention still further back we shall be glad if he will do so.

Extract from the "Carnarvon Herald" of January 21st [or 28th], 1842.

"The following are the diagram and explanation forwarded in illustration of the suggestion of our correspondent "Cymro" in the *Herald* of last week :—



A A Post.

B Cordage and machinery to adjust the indicator D.

C C A double casing of metal, to support a rack and pulley, and to hold the indicator firm, 3 feet in diameter.

D The indicator, 3 feet long, one half of which would be at all times outside the metal casing C C, which will give it a range of 6 feet."

Of course we do not suggest that the above is a good pattern—far from it; we place it upon record merely because of its date—more than half a century since.

EARLY COLONIAL OBSERVATIONS.

Another point on which we have received considerable enlightenment, is the early date at which meteorological observations were made and recorded in many of our colonies. The data are mostly

fragmentary, but they are sufficient to show that careful search through files of early Colonial newspapers will probably enable the officials of most Colonies to carry their meteorological records further back than they have done at present.

We give merely enough to enable persons interested to follow up the investigation.

Antigua.—Rainfall at St. John's Reading Room, January, 1842.

Bahama.—Rainfall returns for Nassau during 1840—42.

Barbados.—Rainfall one mile from Bridgetown, September, 1842.

Canada.—Complete Meteorological Observations at Ancaster, Wentworth, Canada West, 1842.

Rainfall at Ancaster in 1842.

Jan. ...	2·45	May ...	·90	Sept ...	3·75	} Year... 36·68
Feb. ...	2·20	June...	3·60	Oct. ...	1·75	
Mar. ...	2·48	July... 4·80		Nov....	4·05	
April..	3·50	Aug.... 2·70		Dec. ...	4·50	

Grenada (?)—Rain at the Rochester Collegiate Institute, 1840 to 1842.

New South Wales.—Met. Obs. at South Head, Sydney, at Port Jackson, and at Port Macquarie during 1840—42.

Saint Vincent.—The observations from this island are probably the most important in the book; the footnote shows that the record began with 1823. We reprint the whole of the rain tables, and are glad to add that there is indication of accuracy having been secured. It will be remembered that St. Vincent is one of the Windward Isles in the West Indies, about 100 miles W. of Barbados.

Rainfall at St. Vincent, West Indies.

OBSERVATIONS MADE AT KINGSTOWN (Lat., 13° 13' N.; Lon., 61° 13' W.),
By J. DRAPE, Esq.

	1830.	1831.	1832.	1833.	1834.	1835.	1836.	1837.	1838.	1839.	1840.	1841.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Jan.	5·82	2·56	2·96	2·39	8·53	4·81	3·79	3·22	7·78	4·11	3·90	2·03
Feb.	1·63	1·17	3·96	·59	2·36	3·27	3·88	2·87	1·81	2·54	4·80	1·56
Mar.	6·76	2·97	1·42	1·74	3·73	5·53	4·86	·39	1·82	3·25	2·93	1·97
April	6·41	1·16	3·39	3·44	1·58	3·56	2·45	4·03	6·55	2·00	4·98	2·96
May	7·64	8·58	4·53	8·32	7·11	6·39	6·32	9·44	9·49	50*	2·16	4·96
June	8·21	10·70	7·94	4·36	8·04	11·68	10·83	11·72	10·58	6·33	10·31	6·02
July	8·45	10·52	9·70	6·23	7·14	9·25	6·27	11·24	7·75	6·70	9·05	6·33
Aug.	13·99	11·18	8·56	4·36	6·05	8·49	13·55	7·90	9·27	2·53	7·60	6·16
Sept.	6·84	9·35	13·38	6·16	9·11	7·26	6·81	8·63	6·66	8·15	13·04	11·35
Oct.	8·62	6·24	9·31	13·27	9·31	11·20	9·58	7·64	9·90	8·78	6·35	9·32
Nov.	7·71	13·19	8·62	5·42	5·14	17·33	11·75	11·04	6·35	11·72	4·47	3·77
Dec.	1·72	9·84	4·33	3·68	5·07	6·20	9·81	7·74	5·39	·58	4·58	6·99
Total	83·80	87·46	78·10	59·96	73·17	94·97	89·90	85·86	83·35	57·19†	74·17	63·42

* Previous dry months :—1823, February, ·39; 1837, March, ·39.
† Driest since 1823; 1824=68·90; 1829=65·15; 1833=59·96.

OBSERVATIONS MADE AT BAYABOU* (Lat. 13° 12' N. ; Lon. 61° 11' W.)

	1831.	1832.	1833.	1834.	1835.	1836.
	in.	in.	in.	in.	in.	in.
January ...	2·43	1·98	1·20	3·08	4·40	1·09
February...	·31	1·84	·25	3·04	1·57	5·02
March.....	1·53	1·16	1·07	4·13	2·21	6·92
April	·67	3·95	·34	1·57	2·22	1·48
May.....	6·44	2·76	9·75	7·68	4·84	6·72
June	7·47	8·05	3·85	5·33	10·92	10·06
July.....	8·31	5·91	6·37	5·11	8·60	10·02
August ...	6·55	7·46	2·86	6·20	6·94	10·47
September	11·29	15·14	8·94	8·45	6·66	9·98
October ...	6·80	8·40	11·56	5·15	10·41	12·40
November	8·18	9·68	5·20	2·10	16·41	11·82
December	5·25	2·75	2·50	4·80	4·20	7·18
Total...	65·23	69·08	53·89	56·64	79·38	93·16

* On the E. side of the Island, about 6 miles E. of Kingstown.

South Australia.—Rainfall at Adelaide from August, 1838, *i.e.*, in the year prior to the first of Sir G. S. Kingston's celebrated register.

In another place we find the records *in extenso* of temperature at Charlestown, S. Carolina, at 11 a.m., 3 p.m. and 8 p.m., for every day during the years 1769—1772. This record does not appear to have been known to Blodget (*Climatology of the United States*, p. 43.)

Coming back to England there are references to four records, of which we were not previously aware:—

Penzance, Public Library.—Mr. Farrant in 1843.

Durham Observatory.—In 1843.

Newcastle-on-Tyne.—Lit. and Phil. Soc. in 1841.

Thirsk.—Mr. York, 1800 to 1837.

We shall be thankful to anyone who can put us in the way of getting the whole of these records.

THE LOW BAROMETER OF JANUARY 13TH, 1843.

We have found several notes on the remarkable depression of the barometer upon the above date, and as we are not aware that it has ever been fully discussed we have extracted them all, added a few others, and worked them all up. We prefix a verbatim reprint of a summary given at the time by Mr. Ick, the meteorological observer at the Philosophical Institution, Birmingham, because of its general interest, and as showing the then existing knowledge of the subject. Unfortunately there had then been no general levelling throughout the country, and the values given in Mr. Ick's table are not reduced to sea level. Hence the difference between his values and those we shall give further on.

Extract from Report by Mr. Ick.

The fluctuations of the mercury appear to have been general throughout Great Britain, although some places escaped the storm. I learn from Mr. Atkinson, of Harraby, near Carlisle, that at that place the barometer, at twelve at noon on the 13th, had fallen to 27·983 in., while the only result of the fall was a few gusts of wind between midnight of the 13th and sunrise on the 14th.

The following comparative table will be interesting :—

Lowest depression of the Barometer at twelve different places on Friday, January 13th, 1843.

Name of the Place.	Name of Observer.	Height of the mercury in inches.	Time of Observation
Birmingham Philosophical Inst	Mr. William Ick..	27·638	11½ a.m.
Manchester	{ Dr. Dalton	28·020*	2 p.m.
	{ Mr. Peter Clare...	27·950	noon.
Liverpool Lit. and Phil. Inst.....	—	27·830	noon.
Preston.....	Mr. M. Holden ...	27·93	11½ a.m.
Bolton-le-Moors	Mr. H. H. Watson	27·720	{ 11 a.m. 2 mer.†
Ackworth School, Pontefract, Yorkshire	—	27·920†	noon.
Harraby, near Carlisle	Mr. Atkinson.....	27·983	noon.
London, Royal Society's Rooms.....	Mr. Robertson ...	28·196	0¼ p.m.
Bruce Grove, Tottenham, Middlesex...	Mr. Luke Howard	28·270	4 p.m.
Reading, Berkshire	Mr. Bromley	27·500	11 a.m.
Sligo, Markree Observatory.....	Mr. A. Graham...	27·877	6½ a.m.
Edinburgh, from the <i>Scotsman</i>	—	27·400	—

* Lower by ·16 of-an-inch than Dr. Dalton ever observed it at Manchester. The only depression which he has found in his journal of observations, made at that place for upwards of 49 years, that approaches nearest to the present, occurred on the 23rd of November, 1824, when the mercury stood at 28·18 inches.

† Probably 2 p.m. ; the bar. remained nearly steady for about two hours.—G.J.S.

‡ By the kindness of Mr. Luke Howard, I learn that the lowest observation recorded by that gentleman occurred on Christmas day, December 25th, 1821, when the clock barometer at Ackworth fell to 27·80 in. ; which allowing twelve hundredths-of-an-inch for the difference between the scale and that of a standard upright barometer, makes the depression as near as possible that of the 13th January. At 5 a.m. on the 25th of December, 1821, a portable barometer observed by Mr. Howard at Tottenham fell to 27·83 in. “No storm of wind followed this depression near London, but a similar state of the barometer was extensively observed on the continent, and very tempestuous weather attended it far to the south of our island.”

WILLIAM ICK.

*Birmingham Philosophical Institution,
Cannon Street, February 6th, 1843.*

Very fortunately Mr. J. Glaisher, F.R.S., was, in January, 1843, at the Observatory at Cambridge, and noticing how low the barometer was when he took the reading at 9 a.m. on the 13th he at once began a series of readings which he continued until the minimum had passed. These readings corrected for temperature and reduced, give the absolute minimum as 28·212 in. at 1.35 p.m. Moreover in the village of Swaffham Bulbeck, about six miles N.E. of Cambridge another veteran observer (who also we still have with us), the Rev. L. Blomefield, was making equally careful observations of his barometer; and his reading corrected for temperature and reduced to sea level agrees marvellously with Mr. Glaisher's, for it gives 28·208 in. at 2 p.m. Looking at the whole of the readings by the two observers it is absolutely certain that the min. at Cambridge was 28·21 in. at 1.50 p.m.

For London (including Greenwich) we obtain for sea level pressures:—

Royal Observatory, Greenwich	28·266 at 0.53 p.m.
Melina Place, St. John's Wood	28·255 at 1. 0 p.m.
Royal Society, Somerset House	28·251 at 0·45 p.m.

Hence for London we cannot be wrong in taking 28·26 at 0·45 p.m. (Greenwich being E. of London would be a few minutes later).

Another value which we believe to be true within ·01 in. is that for Birmingham, viz., 28·09 in. at 11.30 a.m.

The value for Epping 28·19 in. at 1.30 p.m. seems to be about ·03 in. too low—but the time is doubtless correct.

At Makerstown Observatory, Roxburghshire, the minimum sea level pressure recorded is 28·067 in. at 1.15 p.m.

As regards the values in Mr. Ick's table with which we have not dealt, the reason is that we cannot ascertain the index errors of the barometers; nor whether the values quoted are reduced to 32°; nor what was the altitude of the barometers. Apparently Luke Howard did not catch the absolute minimum, the reading is a trifle too high, and the time too late by two hours.

At Reading the barometer must have been half-an-inch wrong, but the time is nearly right.

At Manchester, Dr. Dalton like Luke Howard was about two hours too late.

The following values are not to be relied upon, but may be correct:—Plymouth, 28·41 in. at 9 a.m.; Kelso, 28·09 in.; Haraby, Carlisle, 28·05 in. at noon; Bolton, 28·02 in. at 11 a.m.

Plotting the whole of the values (but paying slight attention to the doubtful ones) we arrive at the following facts:—

- 1.—The depression was travelling towards E.N.E. at the rate of about 35 miles an hour.
- 2.—The lowest indisputable sea level pressure was 28·07 in. at Makerstown in Scotland; in London it fell to 28·25 in., and at Plymouth probably to 28·40 in.

- 3.—As regards Scotland this depression had been exceeded on several occasions.
- 4.—As regards the Metropolis the pressure had not been so low since 1821. In London the only sea level pressures below 28·30 in. since 1811 have been :—

1814.	January	29th, 5	p.m.	.....	28·233 in.
1821.	December	25th, 5	a.m.	... .	28·016 in.
1843.	January	13th, 0.53	p.m.	.....	28·266 in.
1886.	December	9th, 4.45	a.m.	.....	28·295 in.

MODERN THERMOMETRY.

UNDER this title our contemporary, *l'Atmosphère* for November, has a very able paper by M. C. E. Guillaume, of the *Bureau international des Poids et Mesures*. On another occasion we may, perhaps, give an account of that unique establishment; for the present we can say only that it is recognised throughout the world as the centre of the utmost attainable precision in all questions of measurement. Temperature necessarily plays a very important part in the work of the office; the mere presence of an observer's body near a measuring bar would warm it sufficiently to alter its length; and, therefore, absolutely accurate thermometers are indispensable, and by the words "absolutely accurate" we mean thermometers not merely true to 0°·1 F., but to 0°·01 F., or 0°·001 F.—thermometers, in fact, far superior to any needed by meteorological observers.

Some portions of M. Guillaume's article deal with the thousandths of a degree; with these, meteorologists have nothing to do, but other parts are of general interest.

We assume that all our readers are aware that if the bulb of a thermometer be blown, and it be shortly after filled with mercury and closed, and the divisions be forthwith placed upon the stem, the thermometer will soon be erroneous, indicating a temperature considerably above the truth. This fact was noticed early in the present century, and up to 1881 the only known mode of avoiding this error consisted in having the bulbs blown, filled and sealed, and then stored for three years, after which the divisions were placed upon the tube. This plan was adopted because it had been found that nearly the whole of the change technically called "rise of zero" took place within the first two years after filling.

On November 15th, 1882, Mr. S. G. Denton, F.R.Met.Soc., exhibited at the meeting of the Meteorological Society a set of thermometers, with reference to which the following note appeared in the *Meteorological Magazine* for December, 1882 :—

"At the close of the meeting Mr. S. G. Denton, F.M.S., exhibited a set of 46 mercurial thermometers, which were made by him between February and June, 1881; they were all tested at Kew Observatory in June, 1881; were then

placed at the Observatory under seal, and the case was only opened for their re-verification in January, 1882, and June, 1882, when it was found that scarcely any rise of zero point had taken place. As no paper descriptive of the mode of manufacture was submitted to the Society, we can, of course, merely state the above somewhat remarkable facts. Until the method adopted is explained, we shall prefer to rely upon age as the most certain mode of escaping serious change of zero, but in cases where a thermometer of special pattern is required to be made and used within a few months, Mr. Denton's method, whatever it may be, appears likely to be very valuable."

The further history of these thermometers will be found in the *Met. Mag.* for February, 1885 (Vol. XX., p. 11); there was practically no change, nothing approaching $0^{\circ}\cdot 1$ F.

We understand that Mr. Denton's brilliant result was obtained by keeping the thermometers at a very high temperature for a long time, upwards of a week. Other opticians have adopted modifications of his method, but with Mr. Denton must remain the credit of showing the path to everyone else. Our French friends speak of a thermometer so treated as *un thermomètre recuit*; perhaps the shortest English equivalent would be "stoved"—we will use that word until someone suggests a better.

We turn now to M. Guillaume's paper, which he gracefully and justly commences by stating that he is about to treat only of modern progress, and that for elements and definitions reference must be made to classical treatises, and for facts previous to 1876 to the excellent *Histoire du thermomètre*, by M. Renou.

Passing all portions which do not interest meteorologists (such, for example, as the possibility of making a mercurial thermometer record temperatures beyond the boiling point of mercury), we come first upon an interesting note as to the extreme superiority of hard over soft (leaden) glass as the material for thermometer tubes:—

"If we keep during several days a soft glass thermometer at 700° F., the zero will rise permanently 36° F. to 45° F. (Crafts); for hard glass the displacement is only about 5° F. In the course of years a soft glass thermometer always employed at temperatures below 122° F. will rise as much as $1^{\circ}\cdot 8$ F., while for hard glass the rise will scarcely reach $0^{\circ}\cdot 2$ F. . . . Soft glass should therefore never be used for thermometers."

Of course any such rise as 36° F. never occurs with such thermometers as meteorologists use, and as we have previously shown, Denton's process does away with even the $1^{\circ}\cdot 8$ F., and gives us thermometers which are, and will remain, true to $0^{\circ}\cdot 1$ F., which is nearer the truth than many observers are able to read.

M. Guillaume then comes to a point vital as regards the work of the *Bureau international*, and which, though far beyond the requirements of meteorologists, is of general interest, viz.: When several thermometers are made of precisely similar glass, and all corrections are applied for zero point, calibration, &c., will they agree? And to this he is able to give the triumphant answer, Yes—to $0^{\circ}\cdot 02$ or

0°·03 F. Even the *Bureau international* can hardly aim at going beyond that.

The next point interesting to meteorologists is that, M. Guillaume tells us, of a substitute for alcohol in thermometers. Mercurial thermometers cannot be used below about —40° F. or 72° F. below freezing, because mercury then becomes solid—freezes, in fact—and can be made into bullets and fired from a gun. Consequently, for such low temperatures as occur in the Arctic regions, alcohol thermometers can alone be used. We are not sure that meteorologists, even in the Arctic regions, are ever troubled by the temperature falling so low that even alcohol becomes pasty, but if they have been that need not happen again, for the distinguished experts at the *Bureau* have found in *toluène*,* a substance which remains fluid when alcohol is pasty, and which hitherto has resisted every effort to freeze it.

In delicate researches we almost always come upon some of the work of the distinguished English physicist, Prof. C. V. Boys, F.R.S. Although it has nothing to do with meteorology, the following portion of M. Guillaume's article will, we are sure, be read with interest. He has been speaking of modifications of the thermopile, and continues :—"This idea, perfected by M. Boys, has led him to construct a micro-radiometer as sensitive as the bolometer of Prof. Langley. If the receiver of this instrument is placed in the focus of a telescope, it will indicate the heat radiated by a candle distant *more than a mile and three-quarters*. This result appears fabulous, but it is scrupulously accurate."

M. Guillaume closes his interesting article with the following

"*Conclusions*. Fifty years ago thermometry was as advanced as the then state of science demanded ; fifteen years ago it had made no progress, while science in general had advanced rapidly ; thermometry was therefore in the rear. Since then thermometry has been so developed that its instruments are now equal to all calls that can be made upon them, and further advance can hardly be needed before the close of the century ; in fifteen or twenty years further advances towards perfection may be necessary."

We congratulate M. Guillaume and *l'Atmosphère* on the whole paper.

* Not having the least idea of what *toluène* is, we asked Prof. Meldola, F.R.S., and his reply is Toluène—Toluene, is a coal-tar, hydrocarbon, colourless, transparent, mobile and inflammable. Sp. gr. at OC. 0·882, at 15 C. 0·872, and at 35 C. 0·851.

ROYAL METEOROLOGICAL SOCIETY.

THE first meeting of the Session was held on Wednesday evening, November 16th, at the Institution of Civil Engineers, 25, Great George Street, Westminster, Mr. A. Brewin, Vice-President, in the chair.

Mr. E. T. Adams, Mr. A. L. Jones, M.R.C.S., Mr. J. E. Prince, and Mr. W. Tattersall, C.E., were elected Fellows of the Society.

An interesting paper, by Mr. J. Lovel, was read on the "Thunderstorm, Cloudburst, and Flood at Langtoft, East Yorkshire, July 3rd, 1892." The author, after describing the thunderstorm as it occurred at Driffeld, gave an account, illustrated by photographs, of the havoc in the Wold valleys, which lie N. and N.W. of Driffeld, where torrents of water fell, and great quantities of soil and gravel were removed from the hillsides and carried to the lower districts, doing a large amount of damage; the water flowed down to Driffeld, and many houses in the lower parts were flooded, and a bridge was so much damaged that it had to be entirely rebuilt.

About six miles N. of Driffeld, to the west of the village of Langtoft, is a basin-like range of valleys about a mile wide, the only outlet from which is at the S.E. corner. Running northwards from this basin is an abrupt valley with steep declivities, where, at a place named "Round Hill," on June 9th, 1888, a waterspout tore its way into a slight hollow or comb on the hillside, taking a north-easterly course, and formed three large roughly circular holes from 8 to 9 ft. deep in the chalky rubble, scattering the stones all around, and produced a flood which inundated the village lower down the valley.

Not more than 20 yards from the site of this former cloudburst, or waterspout, and a little further to the south, three gutters or trenches were on July 3rd, 1892, scooped out of the solid rock, nearly parallel to each other and at right angles to the valley bottom; the direction they take being slightly more easterly than that on the former occasion. From the appearance of the trenches it is highly probable that there were three waterspouts moving abreast simultaneously.

Two of the trenches, or ravines, are 68 yards in length and of great size and depth, and as the hillside here is composed of strata of solid rock slightly inclined to the vertical, beneath a thin layer of earth, the force exerted in removing the ponderous mass of material, about 180 yards in circumference, must have been very great indeed. The smaller trench, 15 yards to the left and much shallower, is rather over 50 yards long, but this is discontinued before the summit of the hill is reached, as the gyratory power of the tornado had evidently become weaker. There are no definite signs of any whirling motion to be seen in the trenches, but midway of the two larger ones a perceptible widening of the ravine has taken place, and the dimensions of that on the right are $12\frac{1}{2}$ feet diameter and $8\frac{1}{2}$ feet deep. This particular locality seems to be favourable to

the formation of cloudbursts, as there are records of great floods having previously occurred at Langtoft, notably on April 10th, 1657, in June (?) 1857, and, as before mentioned, on June 9th, 1888. The author gives, in an appendix, a number of quotations from several authorities as to the formation of waterspouts, tornados, &c.

Mr. W. H. Dines read a paper entitled, "Remarks on the Measurement of the Maximum Wind Pressure, and Description of a New Instrument for Indicating and Recording the Maximum." This paper is the result of several months' study of the tube anemometer with the head designed by the author, which was described in the report on "Anemometer Comparisons," read at the April meeting.* The good opinion then expressed is confirmed, the capabilities of the instrument for exhibiting all variations of pressure, from the slightest breeze up to a pressure of 30 lbs. per square foot, are dwelt upon, and a convenient form of indicating arrangement, which was exhibited, is described.

The indicator can be so arranged as to show the ever-varying force of the wind, and to mark by an index similar to that of a spirit minimum thermometer, the greatest pressure reached between the times of observation; or by contracting the tube, the indications may be so damped, or rendered sluggish, as to give a good idea of the strength of wind which has prevailed for some preceding time. This contraction may be carried to any desired extent; it may be so slight that gusts of a few seconds duration will be the only ones eliminated; or the tube may be contracted to so fine a bore that all variations of strength which do not last for thirty minutes or an hour may be smoothed down.

SPARKLING RAIN.

RAIN which on touching the ground crackles and emits electric sparks is a very uncommon but not unknown phenomenon. An instance of the kind was recently reported from Cordova, in Spain, by an electrical engineer who witnessed the occurrence. The weather had been warm and undisturbed by wind, and soon after dark the sky became overcast by clouds. At about 8 o'clock there came a flash of lightning, followed by great drops of electrical rain, each one of which, on touching the ground, walls, or trees, gave a faint crack, and emitted a spark of light. The phenomenon continued for several seconds, and apparently ceased as soon as the atmosphere was saturated with moisture.—*Western Daily Mercury*, November 1st, 1892.

* *Quar. Jour.*, vol. xviii., p. 165.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1892.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.	Aver.	
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	Cloud.
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	0-100	°	°	inches			
England, London	84·7	31	28·4	7	66·4	45·4	43·2	65	130·2	23·1	1·51	11	5·1
Malta.....	83·2	23	53·2	4	71·9	58·1	56·5	78	138·8	46·7	3·23	5	4·2
<i>Cape of Good Hope</i>	77·9	4	40·5	17	64·6	48·7	...	...	...	...	4·15	12	6·0
<i>Mauritius</i>	83·1	12	64·2	28	80·0	69·5	64·8	73	131·7	56·0	1·25	14	4·8
Calcutta.....	97·9	4	71·0	27 ^a	95·0	78·7	77·8	75	158·1	70·5	4·29	8	4·3
Bombay.....	96·2	5	79·6	2	91·2	82·2	75·3	70	143·6	71·4	·11	1	3·2
Ceylon, Colombo	90·7	19	75·0	21	88·0	79·2	72·5	75	156·0	70·0	3·00	14	3·5
<i>Melbourne</i>	70·2	15	35·9	24	60·9	45·9	46·7	79	119·9	30·9	1·58	9	6·2
<i>Adelaide</i>	78·1	15	41·5	4	63·9	48·8	46·2	72	135·5	32·8	2·45	13	5·9
<i>Tasmania, Hobart</i>.....	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Wellington</i>	68·5	6	36·0	25	59·5	46·3	46·3	78	110·0	30·0	4·74	15	4·5
<i>Auckland</i>	70·0	6	42·0	24	62·9	51·2	52·2	84	127·0	35·0	3·10	15	5·8
Jamaica, Kingston.....	90·5	13	69·8	1	86·9	72·8	70·2	72	...	...	1·07	6	...
Trinidad	92·0	17	63·5	8	87·8	70·7	72·3	80	155·0	58·0	11·61	24	...
Toronto	75·0	31	35·1	8	59·8	44·9	36·8	74	...	28·8	3·48	18	7·0
New Brunswick, Fredericton	74·0	26	24·4	1	58·1	38·2	39·8	68	...	...	2·44	22	6·0
Manitoba, Winnipeg British Columbia, Esquimalt.....	73·8 69·6	17 19	27·5 37·9	3 3	54·0 60·3	35·2 45·0	... 50·1	... 92	... ...	... ...	1·38 1·95	13 16	6·0 6·0

^a And 28.

REMARKS.

MALTA.—Mean temp. 63°·5. Mean hourly velocity of wind 10·1 miles. The sea temp. rose from 62°·5 to 72°·0. Rainfall three times the average. J. SCOLES.

Mauritius.—Mean temp. of air 1°·5 above, dew point 0°·6 above, and rainfall 2·77 in. below, their respective averages. Mean hourly velocity of wind 10·1 miles, or 0·1 mile above average; extremes, 30·3 on 16th and 0 on 4th, 5th, and 6th; prevailing winds S.E. by E. Thunder on 5th and 6th; lightning on 19th.

C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on the 10th, 11th, and 31st.

J. C. H. CLARKE, Lt.-Col. R.E.

Melbourne.—Mean temp. of air 0°·1, rainfall ·52 in., and amount of cloud 0·4, below their respective averages; mean temp. of dew point 0°·5, and humidity 1, above their averages. Prevailing winds N. and N.E., strong on 7 days. Heavy dews on 15 days. Hoar frost on 3 days. Hail on 2 days. Thunder and lightning on 2 days.

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

Adelaide.—Mean temp. 0°·5 below, and rainfall ·53 in. below, the average of 35 years.

C. TODD, F.R.S.

Wellington.—Showery in the early part of the month; on 7th very heavy rain from 2 p.m. to 5 p.m., causing floods; from 9th to 26th showery, unpleasant, and cold, with frequently strong winds from N.W. and S.; the last few days fine, with light winds. Aurora on 1st. Mean temp. 0°·9 above, rainfall ·25 in. below, the average.

R. B. GORE.

Auckland.—Rainfall rather more than an inch below the average; mean temp. almost precisely the average.

T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
 NOVEMBER, 1892.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	3·20	XI.	Rhayader, Nantgwillt..	4·77
„	Birchington, Thor	1·89	„	Corwen, Rhug	2·12
„	Brighton, Prestonville Rd	2·77	„	Carnarvon, Cocksidia ...	3·65
„	Hailsham	2·88	„	I. of Man, Douglas	3·95
„	Ryde, Thornbrough	3·04	XII.	Stoneykirk, Ardwell Ho.	2·72
„	Alton, Ashdell	3·23	„	New Galloway, Glenlee	7·14
III.	Oxford, Magdalen Col...	1·67	„	Melrose, Abbey Gate ...	1·53
„	Banbury, Bloxham	1·67	XIII.	N. Esk Res. [Penicuik]	2·40
„	Northampton, Sedgebrook	1·25	„	Edinburgh, Blacket Pl.	1·43
„	Cambridge, Fulbourne..	...	XIV.	Glasgow, Queen's Park.	3·11
„	Wisbech, Bank House..	1·47	XV.	Islay, Gruinart School..	7·28
IV.	Southend	2·15	XVI.	Dollar	2·85
„	Harlow, Sheering	1·80	„	Balquhider, Stronvar..	8·96
„	Rendlesham Hall	1·87	„	Coupar Angus Station..	1·90
„	Diss	1·62	„	Dunkeld, Inver Braan..	4·76
„	Swaffham	1·78	„	Dalnaspidal H.R.S.	6·57
V.	Salisbury, Alderbury ...	3·32	XVII.	Keith H.R.S.	·98
„	Bishop's Cannings	2·09	„	Forres H.R.S.	1·13
„	Blandford, Whatcombe..	4·37	XVIII.	Fearn, Lower Pitkerrie..	1·60
„	Ashburton, Holne Vic....	5·50	„	Loch Shiel, Glenaladale	11·09
„	Okehampton, Oaklands..	3·46	„	N. Uist. Loch Maddy ...	6·52
„	Hartland Abbey	4·76	„	Invergarry	9·09
„	Lynmouth, Glenthorne..	3·78	„	Aviemore H.R.S.	2·02
„	Probus, Lamellyn	3·69	„	Loch Ness, Drumnadrochit	2·96
„	Wincanton, Stowell Rec.	2·79	XIX.	Lairg H.R.S. ....	...
„	Weston-super-Mare	2·07	„	Scourie	4·45
VI.	Clifton, Pembroke Road	2·36	„	Watten H.R.S.	2·36
„	Ross, The Graig	2·55	XX.	Dunmanway, Coolkelure	10·34
„	Wem, Clive Vicarage ...	1·77	„	Fermoy, Gas Works ...	7·20
„	Cheadle, The Heath Ho.	2·17	„	Killarney, Woodlawn ...	9·40
„	Worcester, Diglis Lock	2·30	„	Tipperary, Henry Street	6·24
„	Coventry, Coundon	2·18	„	Limerick, Kilcornan ...	4·38
VII.	Ketton Hall [Stamford]	·93	„	Ennis	4·20
„	Grantham, Stainby	1·04	„	Miltown Malbay	6·12
„	Horncastle, Bucknall ...	1·08	XXI.	Gorey, Courtown House	4·41
„	Workshop, Hodsck Priory	1·01	„	Mullingar, Belvedere ...	3·92
VIII.	Neston, Hinderton	2·00	„	Athlone, Twyford	3·78
„	Knutsford, Heathside ...	2·51	„	Longford, Currygrane...	3·47
„	Lancaster .....	...	XXII.	Galway, Queen's Coll...	5·66
„	Broughton-in-Furness..	5·68	„	Crossmolina, Enniscoe..	8·36
IX.	Ripon, Mickley	1·78	„	Collooney, Markree Obs.	4·01
„	Scarborough, South Cliff	1·62	„	Ballinamore, Lawderdale	4·66
„	East Layton [Darlington]	1·20	XXIII.	Lough Sheelin, Arley ..	3·86
„	Middleton, Mickleton..	1·23	„	Warrenpoint	4·27
X.	Haltwhistle, Unthank..	1·59	„	Seaforde	4·66
„	Bamburgh	1·44	„	Belfast, Springfield	3·72
„	Newton Reigny	2·36	„	Bushmills, Dundarave...	3·36
XI.	Llanfrehfa Grange ...	3·58	„	Stewartstown	4·57
„	Llandovery	4·04	„	Buncrana	4·36
„	Castle Malgwyn	3·60	„	Lough Swilly, Carrablagh	5·42
„	Builth, Abergwessin Vic.	5·93			

NOVEMBER, 1892.

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 1880-9.	Greatest Fall in 24 hours		Days on which '01 or more fell.	Max.		Min.		In shade.	On grass.	
				Dpth	Date		Deg.	Date	Deg.	Date			
inches.	inches.	in.			Deg.	Date	Deg.	Date					
I.	London (Camden Square) ...	2.53	— .13	.77	15	15	60.8	14	30.8	2	1	6	
II.	Maidstone (Hunton Court)...	2.39	— .54	.80	16	15	...	...	...	...	...	...
III.	Strathfield Turgiss	2.13	— .59	.62	15	22	58.7	14	28.2	8	8	13	
IV.	Hitchin	1.49	— 1.19	.34	15	15	57.0	14	27.0	1	9	...	
V.	Winslow (Addington)	1.78	— 1.15	.33	19	16	60.0	14	23.0	2	7	11	
VI.	Bury St. Edmunds (Westley)	1.62	— .93	.39	17	10	55.0	14a	31.0	21	...	...
VII.	Norwich (Cossey)	1.39	— 1.18	.36	26	8	...	...	...	...	...	...
VIII.	Weymouth(LangtonHerring)	3.55	— .11	.53	4	18	58.0	14	32.0	2	1	...	
IX.	Torquay, Babbacombe ...	3.14	— .98	.60	4	20	58.4	3	33.3	8	0	12	
X.	Bodmin (Fore Street)	4.52	— .95	.93	18	24	...	...	...	...	...	...
XI.	Stroud (Upfield)	2.54	— .79	.66	4	19	57.0	14	30.0	1, 7	2	...	
XII.	ChurchStretton(Woolstaston)	2.21	— 1.31	.70	4	18	54.0	3, 14	30.0	2, 18	2	8	
XIII.	Tenbury (Orleton)	2.18	— .96	.53	4	12	58.0	3, 6	25.5	2	6	11	
XIV.	Leicester (Barkby)	1.04	— 1.25	.24	4	13	57.0	4, 14	23.0	1	12	20	
XV.	Boston .....	.90	— 1.30	.28	26	7	60.0	14	30.0	25	3	...
XVI.	Hesley Hall (Tickhill).....	1.11	— .91	.28	13	16	57.0	14	24.0	2	6	...	
XVII.	Manchester(PlymouthGrove)	2.46	— .54	.46	4	16	58.0	5	28.0	1	3	7	
XVIII.	Wetherby (Ribston Hall) ...	1.37	— .70	.60	15	9	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	4.41	— 2.34	.75	13	18	55.0	9, 15	23.0	2	8	...	
XX.	Hull (Pearson Park)	1.28	— .73	.31	26	16	57.0	14	28.0	1, 18	7	10	
XXI.	Newcastle (Town Moor)	1.57	— .83	.48	6	15	...	...	...	...	...	...
XXII.	Borrowdale (Seathwaite).....	11.82	— 2.97	1.46	28	20	...	...	...	...	...	...
XXIII.	Cardiff (Ely).....	3.06	— 1.85	.52	4	19	...	...	...	...	...	...
XXIV.	Haverfordwest	5.61	— .25	1.41	19	22	56.8	6	28.2	17	3	7	
XXV.	Aberystwith, Gogerddan	3.47	— 1.64	.63	26	19	58.0	5, 14	24.0	16d	7	...	
XXVI.	Llandudno.....	1.98	— 1.11	.77	5	16	...	...	...	...	...	...
XXVII.	Cargen [Dumfries]	3.79	— .77	.64	14	19	59.8	15	26.0	1	8	...	
XXVIII.	Jedburgh (Sunnyside) .....	.97	— 1.53	.28	14	11	56.0	4	20.0	19	8	...
XXIX.	Old Cumnock	3.49	— 1.48	.50	14	20	...	...	...	...	...	...
XXX.	Lochgilhead (Kilmory).....	7.67	+ .38	1.70	14	22	...	...	29.0	13e	5	...
XXXI.	Oban (Craigvarren)	7.35	... 1.30	.8	8	21	55.9	4	30.9	13	1	...	
XXXII.	Mull (Quinish)	7.06	+ .07	1.38	14	20	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices	2.60	— 1.36	.40	15g	12	...	...	...	...	...	...
XXXIV.	Dundee (Eastern Necropolis)	2.10	— .60	.45	14	17	54.3	4	30.2	1f	6	...	
XXXV.	Braemar	2.60	— 1.98	1.00	14	18	51.7	28	20.7	19	11	18	
XXXVI.	Aberdeen (Cranford)	2.74	... .73	.14	20	20	52.0	5, 28	26.0	1	11	...
XXXVII.	Strome Ferry	5.89	— 1.99	1.46	28	21	...	...	...	...	...	...
XXXVIII.	Cawdor [Nairn]	1.46	— 1.39	.41	29	12	...	...	...	...	...	...
XXXIX.	Dunrobin	1.71	— 1.12	.36	28	12	53.0	28	28.0	30	4	...	
XL.	S. Ronaldsay (Roeberry).....	3.29	— .13	.71	28	20	51.0	5, 8b	30.0	30	3	...	
XLI.	Darrynane Abbey.....	9.24	... 1.10	.21	30	30	...	...	...	...	...	...
XLII.	Waterford (Brook Lodge) ...	4.87	+ 1.20	.52	30	23	57.0	4	26.0	1	5	...	
XLIII.	O'Briensbridge (Ross)	4.11	... .76	.19	24	24	57.0	6	31.0	1	1	...
XLIV.	Carlow (Browne's Hill)	3.73	+ .67	.78	18	22	...	...	...	...	...	...
XLV.	Dublin (Fitz William Square)	2.40	— .43	.72	18	19	56.8	4	31.0	1	1	9	
XLVI.	Ballinasloe	4.47	+ .56	.76	17	27	52.0	4, 5	30.0	1, 16	7	...	
XLVII.	Clifden (Kylemore)	12.98	... 3.07	.20	26	26	...	...	...	...	...	...
XLVIII.	Waringstown	4.07	+ .97	1.06	18	24	57.0	4c	27.0	19	8	10	
XLIX.	Londonderry (Creggan Res.) ..	4.80	+ .28	.92	18	24	...	...	...	...	...	...
L.	Omagh (Edenfel)	5.54	+ 1.67	.85	18	26	54.0	4, 28	28.0	19	7	10	

a And 15. b And 27. c And 5, 6. d And 19. e And 29, 30. f And 7, 17. g And 26.

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

METEOROLOGICAL NOTES ON NOVEMBER, 1892.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; 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.

STRATHFIELD TURGISS.—A mild month, with many wet days, but no excess of R. Violets and primroses in bloom on the 8th. Much fog on the 18th.

ADDINGTON.—R on a good many days but never in any great quantity. On seven days just drizzle enough to measure, and at the same time, to make it very uncomfortable, the 11th, 12th, and 20th were the most foggy days.

BURY ST. EDMUNDS.—A mild, dull month; very little sunshine; no snow.

LANGTON HERRING.—A mild but very damp month. Mean temp. $1^{\circ}\cdot4$ above the average of 20 years. The mean min., $42^{\circ}\cdot3$, is $1^{\circ}\cdot1$ above the mean min. of October. The mean reading of the Bar. is high, but notwithstanding this, the humidity was great. There was an absence of storms. Fogs occurred on the 12th and 25th, but many other days were misty. Solar halo on 20th.

BABBACOMBE.—A warm, foggy, unprecedentedly damp month, with deficient R, sun heat, and wind. Showery from 2nd to 5th, 11th to 19th, and 23rd to 30th; fine and sunny on 1st, 3rd, 6th, 7th, and 10th. Cold on 1st, 7th, 17th, 19th, and 30th; warm from 3rd to 5th, 11th to 16th, and 21st to 29th. The mean temp. ($47^{\circ}\cdot5$) was $0^{\circ}\cdot6$ higher than that of October. The mean relative humidity (92) is the greatest recorded in any month since observations commenced in 1876. Fog on 9 days, the greatest number recorded in any November. L on 15th. Solar halos on 5th and 20th.

BODMIN.—Very mild and many rainy days. Very little frost and not many foggy days.

WOOLSTASTON.—A mild, open month, with very little frost and a good deal of fog. Mean temp. $43^{\circ}\cdot2$.

TENBURY, ORLETON.—A very foggy month, with temp. about 1° above the average, and little frost. From the 14th to the 26th neither sun, moon, nor stars were ever visible with the exception of a few minutes on the 21st and 24th. Fog on 13 days.

MANCHESTER.—Bright and sunny on the 3rd, 4th, 5th, and 29th. Fine autumn weather on the 8th, 9th, 11th, 12th, and 20th. Dense fog all day on the 1st and 17th. Damp and foggy on the 6th, 7th, 10th, 18th, 21st, 22nd, 23rd, 25th, 27th, and 30th. Mean temp. $43^{\circ}\cdot1$.

HULL, PEARSON PARK.—Fogs on 12 days.

WALES.

HAVERFORDWEST.—Very little fine weather during the entire month, but as mild as October was cold. Wind generally S. and S.W. R heavy from the 13th to 20th.

SCOTLAND.

CARGEN.—A very unsettled month, and exceptionally damp and cloudy, the hours of sunshine being not much above half the average, and the difference between the means of the wet and dry bulb thermometers only $0^{\circ}\cdot9$. The R was somewhat under the average, but owing to the constant humidity of the atmosphere the land was never in a satisfactory state for ploughing. S. and S.W. winds prevailed for two-thirds of the month; fog on 7th and 17th; S and sleet on 29th and 30th.

JEDBURGH.—The temp. was generally low, but the month was dry, which allowed out-door work to go on unchecked. Prevailing winds S.W. and S., always moderate in force except on the morning of the 29th.

OBAN, CRAIGVARREN.—The month was, on the whole, mild and free from the usual heavy gales until the close, when wintry weather commenced somewhat early.

MULL, QUINISH.—A mild, unsettled month; S. and S.E. winds prevailed throughout.

ABERDEEN, CRANFORD.—A miserable, sunless month. Crops got into the yards in very bad condition. In the glens the crops were not cut at the close.

IRELAND.

DARRYNANE ABBEY.—A very wet month, no rainless day throughout, and only two since October 19th; R for the month, 4.32 in., or 88 per cent. above the average of the ten years 1870-79.

WATERFORD, BROOK LODGE.—Mean temp. $46^{\circ}5$. Thick fogs on 7th and 25th, and fog on 10th; southerly gale on the 14th.

O'BRIENSBRIDGE, ROSS.—Full average R, with frequent fog and mist. Mean temp. 3° above that of October. Some heavy squalls of short duration. Mean temp $47^{\circ}3$.

DUBLIN.—A dull, damp, open month, with a monopoly of winds from equatorial quarters (S.E., S. and S.W.), and scarcely any frost. The most remarkable feature in the weather was the advance in temp. as compared with the preceding month. The mean of the max. and min. readings of the ther. was as much as $2^{\circ}1$ above that of October, and the mean dry bulb at 9 a.m. and 9 p.m. was $46^{\circ}1$, compared with $43^{\circ}9$ in. October, an advance of $2^{\circ}2$. High winds were noted on 10 days, and attained the force of a gale on only one occasion—the 28th. Foggy on 8 days. A lunar halo was seen on the 5th, when also there was a lunar rainbow.

EDENFEL.—The R and temp. of the month were both much above the average. Soft southerly winds prevailed till the fourth week, when stagnant, foggy, anticyclonic conditions followed, with somewhat clearer, but equally wet and humid weather, at the close.

WHEN FIRMINUS WROTE "DE MUTATIONE AERIS."

In the *Met. Mag.* for April, 1892, p. 36, we showed, upon the authority of M. Delisle, that the treatise, "De Mutatione Aeris," was written by Firmin, of Belleval, near Amiens, in the middle of the XIVth century.

Mr. Prince, of Crowborough Observatory, has a copy of the 1485 edition, on the first blank leaf of which there is the following note in XVth or XVIth century writing:—

"Iste liber composita est anno domini 1338, vide fol. 3, pte. 2a."

The back of leaf 3 (the leaves, *not* the pages, are numbered) contains a long statement as to the relative position of the stars in the zodiacal signs in the time of Ptolemy, and how they are in the year 1338.

We have already mentioned that the table on leaf 6 is made out for 1312; the above expression implies that the MS. was written in 1338, and as we have already shown, there is a MS. copy in the Bibliothèque Nationale dated 1345. It therefore appears that the treatise was written after 1312 and probably in 1338, that it was first printed in 1485, reprinted with fresh tables and notes in 1540, and its history ascertained in 1892.

SYMONS'S
MONTHLY
METEOROLOGICAL MAGAZINE.

CCCXXIV.]

JANUARY, 1893.

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

THE RECENT FROST.

SEVERAL correspondents have kindly sent us lists of temperatures during the cold weather at the end of December, 1892, and in the early part of January, 1893, but we do not see that the extremes are sufficiently important to claim publication, and as very few of the tables cover the whole of the cold period, we cannot quote comparable means.

We can therefore offer only some fragmentary notes :—

First, as to the absolute minima. Some of the lowest records ever made in the British Isles have been from stations near the Cheviots and between there and Edinburgh—and that seems to hold good in the recent frost. Mr. Selby, of Pawston, in the extreme N. of Northumberland, reports the minimum of 3° in the night between January 5th and 6th, and adds that at Shawdon, near Whittingham, about 20 miles S.E. of Pawston, on the same night it fell to -2° ; but he says nothing as to the quality of the thermometer at Shawdon, or where it was placed.

Another low record, and this time from verified instruments, is sent by the Rev. G. T. Ryves from Tean Vicarage, in the valley of the Tean, above Uttoxeter, in N. Staffordshire; he had $4^{\circ}\cdot4$ in Stevenson's screen and $-0^{\circ}\cdot6$ on grass.

We have seen no other trustworthy records below 5° , except in the following, which we reprint from the *York Herald* of January 7th :—

“INTENSE COLD ON DEESIDE.—A telegram from Braemar states that the frost of yesterday morning was the most intense experienced on upper Deeside for the last thirty-three years. The record at Braemar Observatory was 9 degrees below zero on the grass, or 41 Fahrenheit degrees of frost. The shade thermometer recorded four below zero. These readings have not been exceeded since 1860, when the mercury fell to eleven below zero, and the nearest parallel occurred in December, 1882, when seven below zero, or thirty-nine degrees of frost, were registered.”

Not one of our own correspondents has given emphasis to his figures by any such comparison with previous years as is given above for Braemar, and our impression is that when (at the end of the month) we receive the report direct from Mr. Aitken, the above will not be confirmed. Translated into meteorological language, the above statement probably is—

1893, Jan. Min. in air, $-4^{\circ}\cdot 0$; on grass, $-9^{\circ}\cdot 0$
but in 1882, Dec. „ „ $-8^{\circ}\cdot 0$

Therefore the recent is *not* the most intense for 33 years.

Certainly, as far as London is concerned, several more intense frosts have occurred even within comparatively recent periods. The lowest at Camden Square was $15^{\circ}\cdot 4$ on the 5th, but as recently as 1890 we had $15^{\circ}\cdot 6$ in *March*, and $14^{\circ}\cdot 9$ in December; in 1887 we had the shade minimum down to $14^{\circ}\cdot 5$; and to go farther back, both in 1860 and in 1867 we had a minimum of $6^{\circ}\cdot 7$.

The absolute shade minima at Camden Square on the original Glaisher stand have been as under :—

Year.	Min.	Year.	Min.	Year.	Min.	Year.	Min.
	deg.		deg.		deg.		deg.
1859	14·4						
1860	6·7	1870	14·0	1880	19·2	1890	14·9
1861	14·3	1871	19·7	1881	11·8	1891	16·8
1862	18·1	1872	26·1	1882	24·5	1892	16·7
1863	24·5	1873	22·9	1883	22·4	1893	15·4 ?
1864	15·1	1874	18·4	1884	25·3		
1865	15·4	1875	20·7	1885	22·3		
1866	22·5	1876	18·9	1886	19·4		
1867	6·7	1877	23·5	1887	14·5		
1868	23·4	1878	18·7	1888	19·1		
1869	20·8	1879	16·1	1889	19·2		

It is, of course, very unsafe to generalize from a table of extremes, but as the average for the 34 years is $18^{\circ}\cdot 4$, whereas for the last eight years it has been only 17° , it may be as well to point out that for the first eight years it was only $16^{\circ}\cdot 4$, and for the first nine only $15^{\circ}\cdot 3$. Again, for the first seventeen years the average was $17^{\circ}\cdot 9$; for the second seventeen years $19^{\circ}\cdot 0$. There is, therefore, evidence both for and against an increasing tendency towards low winter temperatures, and the question is far too important for any opinion to be founded upon such slight information as this table affords.

It is probable that so cold a fortnight rarely occurs; the mean at 9 a.m. for the two weeks, December 24th to 31st and January 1st to 7th, was respectively $26^{\circ}\cdot 4$ and $24^{\circ}\cdot 6$, or for the fortnight $25^{\circ}\cdot 5$; this is $0^{\circ}\cdot 7$ colder than the coldest which we can remember, viz., December 12th to 25th, 1890, but there may be others which we have forgotten.

FROST FIGURES.

ALL who have studied the forms of snow crystals, or of the formation of ice on clean, calm and free water surfaces, are aware that the crystals are always *straight*, and join one another at an angle of 60° . Under some conditions this rule does not hold good, and beautiful *curved* designs are produced. Extremely graceful curves of this kind were abundant upon the smooth paving stones of London on the morning of December 4th, and attracted the attention of Prof. Meldola, F.R.S., who sketched some of them and sent a description of them to *Nature*. He very appropriately described the patterns as "arborescent tracery," and said that some of the "fronds" were nearly two feet long, and many were most gracefully curved. He added that "the flagstones had evidently been coated with a thin layer of mud from the previous night's rain," and that he attributed the pattern "to the rapid freezing and evaporation of the water in this surface layer of mud which was going on during the morning."

This letter was followed in *Nature* of December 15th by numerous notes as to similar appearances elsewhere, and by a few remarks which may be regarded as explanatory—three of these we reprint:—

"The interesting 'fronds' of muddy ice observed by Prof. Meldola are not very uncommon on the pavements in these 'Northern Heights.' I saw them on the date which he named, and have more than once studied them. I then noticed that the 'interstitial' pavement seemed partly cleared of mud, as if the water had drawn this towards the groups of crystals. The mode of formation recalled to my mind certain phenomena in crystal building within rocks, and I suspect the mud has its influence. Indeed, it seems to me very probable that all these 'dendritic' growths of crystals are the results of 'impeded' or 'constrained' crystallization, to some of which I have called attention in noticing a structure in the Charnwood syenite (*Quart. Jour. Geol. Soc.*, 1891, p. 101). On this point Prof. Sollas makes some important remarks in his well-known paper on the Wicklow granites."

T. G. BONNEY.

"The beautiful curved forms assumed by the ice on the paving flags last Sunday were very noticeable in this neighbourhood and Hampstead as well as in other parts of London. What I observed were not quite like those described and figured by Prof. Meldola, but resembled rather the scrolls and volutes which are frequently used in decorative art. The finest piece that I saw was in this square, where several of these scrolls radiated from a central point and spread over several feet of the pavement. A friend, Mr. E. Swain, observed that where one of these scrolls came upon a puddle of clear water, the crystals were continued in a straight line. Such forms are not at all unusual in the freezing of muddy water, and at the present moment the puddles in the road opposite my house are filled with rectilinear crystals of ice, which assume a curved form in the mud at their margins. The peculiarity on Sunday was their large size and beauty."

J. H. GLADSTONE.

17, Pembridge-square, December 10th.

"Prof. Meldola's letter has been interesting to me, as I noticed a striking and similar phenomenon here on Thursday, December 8th, in the forenoon. The trottoirs of several streets (east, west, north and south) were covered all over with beautiful patterns, somewhat different from Prof. Meldola's illustration, there being innumerable dark, broad, sharply contoured leaf-like patches, distant several inches from each other, and connected by finely curved and branched tendril-like stalks. Foggy, with a faint north breeze. I should presume the 'leaves' were due to sparse drops of sleet fallen during the night."

Freiburg, Badenia, December 10th.

D. WETTERHAN.

A fortnight later *Nature* contained some other notes.

Admiral Maclear sent a copy of an exquisite design traced from a muddy flagstone at Guildford.

Prof. Lebour referred to the illustrations of these curved crystals given in the article "Meteorology," contributed (in 1834) to the *Encyclopædia Metropolitana* by G. Harvey, F.R.S., but he does not mention (what Harvey does) that Giacinto Carena, in 1813, sent a memoir to the Academy of Turin, "Sur le givre figuré dont se couvrent les vitres pendant les fortes gelées," in which the causes of curved crystallization are pointed out.

REVIEW.

Observations on Dew and Frost, by the Hon. R. RUSSELL, F.R.Met.Soc.

London: Stanford, 1892. 8vo, 47 pp.

THIS work consists of the record of a rather elaborate series of observations made on about 75 nights between June, 1891, and August, 1892, of the dew and hoar frost deposited on various vessels—pans, trays, plates, tumblers, &c.—of china, glass, and metal, placed in varying relation to the soil and atmosphere, and over and upon different kinds of soil. The deposition upon the surrounding vegetation and upon the innumerable materials which go to make up a country landscape were also carefully noted. Accurate quantitative measurements were apparently not aimed at, and were probably not possible with the apparatus used; but much attention was devoted to the deposition of dew on the inside of vessels so sunk in the soil as to prevent the circulation of air into their interiors—a point which Wells did not enlarge upon, though he clearly recognised the emanation of moisture, or moisture-laden air, from the earth.

The author refers to the effect (in displacing air from the ground) of recently fallen rain as it soaks in, and this is a point which we do not remember to have seen mentioned before. In fact, it has always appeared to us that in all observations on dew far too little attention has been paid to the temperature and humidity of the soil, the rise or fall of subsoil water, &c., in short, to all the conditions which control the passage of air into and out of the soil.

The results are summed up in ten pages, and the author states that—"In nearly all the conclusions of Wells, as stated in his admirable *Essay on Dew*, my observations lead me to concur." No

reference is made to the more recent work of Aitken on the same subject, whose results are by some considered subversive of Wells's theories.

UNUSUAL SNOW CRYSTALS.

To the Editor of the Meteorological Magazine.

SIR,—Shortly after 11 a.m. this morning, when the shade temperature was about 25° , snow was falling slightly, chiefly in single crystals, but interspersed with flakes consisting of groups of crystals of any number up to ten or a dozen, but few exceeded that number. The crystals were nearly all perfect, and even in the larger flakes it was exceptional to find any debris or single spicula; and, of course, at a temp. of 25° , it was easy to examine them at one's leisure. The crystals were almost entirely of two sizes, about one-eighth inch and one-sixteenth inch in diameter, the larger being perhaps twice as numerous as the smaller. The first point which attracted my attention was that in about one-fourth of the specimens examined (not fewer than 50) a small crystal was attached to the end of one of the spiculæ of a larger one, not at right angles, but in the same plane. Whether the smaller crystals had all formed on the larger ones and become detached in falling, it is, of course, impossible to say.

About a couple of minutes before the cessation of the fall, I observed one crystal of a form which I have no recollection of having seen described. Instead of being a flat object with six points all in the same plane, the points radiated in all directions, preserving the regular angle of crystallization of water. I regret that I omitted to count the number of rays, but from models subsequently constructed, believe that it was 14. The diameter did not exceed two-tenths of an inch, but was larger than that of the crystals, above described as about one-eighth of an inch. The crystal was received on a dark cloth sleeve, where it could be well seen, and was examined carefully and for a considerable time by myself and by another witness. Although I endeavoured to catch on my arm or umbrella all promising looking specimens, I did not succeed in finding another of this form.

Highgate, January 1st, 1893.

H. SOWERBY WALLIS.

P.S.—On January 3rd my wife and sister observed several snow crystals of the above-described form.

[We have never seen or heard of any description of other than flat snow crystals—but it seems almost more reasonable to consider the form of ball more probable than that of disc—why then have they never been engraved or described? In Mr. Glaisher's beautiful series of engravings, there is nothing like such a figure, the only departure from the flat disc is a case of two discs united by a crystal perpendicular to the centre of each—i.e., the two crystals may be represented by the two wheels of a gig, and the single uniting crystal by the axle—but this is a very long way from a system of radii starting at angles of 60° from a common centre, and in various planes, so that the extremities form a sort of spiky ball.—*Ed.*]

ROYAL METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this Society was held on Wednesday evening, December 21st, at the Institution of Civil Engineers, 25, Great George-street, Westminster. Dr. C. Theodore Williams, President, in the chair.

Dr. R. H. Beardsley, Dr. T. C. Beatty, Dr. R. Brocklesby, Mr. C. H. Cotton, Dr. P. Fraser, and Dr. G. H. Ward-Humphreys, were elected Fellows of the Society.

The following papers were read :—

(1.) "Moving Anticyclones in the Southern Hemisphere," by Mr. H. C. Russell, F.R.S., Government Astronomer New South Wales. The author describes the results of his practical study of the daily weather charts for Australasia, and states that the leading fact brought out, is that the weather south of 20° S. latitude, is the product of a series of rapidly moving anticyclones, which follow one another with remarkable regularity, and are the great controlling force in determining local weather. These anticyclones are more numerous in summer than in winter; the average number for the year being 42. They usually take 7 or 8 days to travel across Australia in summer, and 9 or 10 days in winter; the average daily rate of translation being 400 miles. The shape of the anticyclone over the comparatively flat lands of Australia is an ellipse with axes in ratio of 2 to 1, the longer axis being east and west. The shape is, as a rule, modified when the anticyclone reaches the east coast range of mountains, the result being a shortening of the major axis, and a bending of it towards north and south. The winds on the north side of the anticyclone are not so strong as those on the south side, and the intensity of the weather is in proportion to the difference in pressure between the anticyclone and the V-depression, but the relation of the pressure varies frequently before the wind responds, the pressure appearing to be controlled from above by the more or less rapid descent of air which feeds the anticyclone. Cyclonic storms are very unusual, and do not occur more than once in two or three months.

The author having found that the average daily translation of anticyclones over Australia eastwards is 400 miles, endeavoured to ascertain if they maintained the same velocity over the ocean, and from a study of the Natal observations, obtains an average period of 15 days for the translation of the waves from Natal to Sydney, or a velocity of 458 miles per day.

The two determinations of velocity, that is over Australia alone where it is 400 miles per day, and over the space from Natal to Sydney where it is 458 miles per day, seem to leave no doubt as to their persistence. For if they can thus be followed one-third of the circumference of the earth, *i.e.* from Natal to Sydney, it may safely be assumed that they travel the other two-thirds of the way, and that they keep up their general characteristics.

(2.) "The Tracks of Ocean Wind Systems in transit over Australasia," by Capt. M. W. C. Hepworth, F.R.Met.Soc. The author has examined the daily weather charts of Australia and New Zealand, and has prepared maps showing the daily positions of the centres of high and low pressures for a whole year. He finds that the wind systems, which make their first appearance to the westward and south-westward, advance to the eastward rapidly, and frequently very rapidly, during the winter months; but during the summer months they usually move more slowly and not unfrequently recurve. Their progress is retarded by contact with the areas of high pressure which they encounter; the mean of the tracks of these anticyclones, moving also from west to east, appears to be across the southern portion of Australia and onward, crossing the islands of New Zealand, during the winter months; but to the southward of Western and South Australia, across Victoria and New South Wales, and thence to the north-eastward, avoiding New Zealand, during the summer months.

This paper being on a similar subject to Mr. Russell's, the two were discussed together, the speakers being—Mr. Scott, Mr. C. Harding, Rev. Clement Ley, Mr. Harries, Mr. Laughton, Mr. Strachan, Captain Wilson Barker and Mr. Symons. Several speakers commented on the paucity of observations in central Australia, and it appeared to be the general opinion that that portion of Mr. Russell's paper which dealt with the passage of anticyclones over the ocean was based on insufficient data.

(3.) "Rainfall of Nottinghamshire, 1861-90," by Mr. H. Mellish, F.R.Met.Soc. The author has collected and discussed all the recent rainfall records in or near the county extending over 10 or more years. The mean annual fall is given for 65 stations, and varies from about 30 in. on the borders of Derbyshire in the S.W., to about 23 in. in the N.E. The wettest year was 1872, with a mean for the whole county of 142 per cent., and the driest, 1887, with 68 per cent. of the average. Dividing the 30 years into three decades, the means are respectively 90 per cent., 109 per cent., and 101 per cent. of the average. The mean monthly rainfall for the 30 years, varies from 2.74 in. in October to 1.64 in. in February, the latter result being in part due to the shortness of that month. Mr. Symons called attention to the fact that the records were to a slight extent affected by the height of the gauges above ground. Mr. Southall, Mr. Wallis, Mr. Tripp and Mr. Marriott took part in the discussion.

(4.) "A new Instrument for Cloud Measurements," by Dr. Nils Ekholm, Hon. Mem. R.Met.Soc. The instrument is practically a modified equatorial telescope, and the paper gives full details of the methods of observation. The Rev. Clement Ley spoke enthusiastically of Dr. Ekholm's valuable work in connection with cloud observation.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JUNE, 1892.

STATIONS. (Those in <i>italics</i> are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
°		°		°	°	°	0-100	°	°	inches			
England, London	82·7	10	38·6	15	69·6	49·6	47·9	70	129·6	31·9	2·46	13	5·0
Malta.....	91·8	25	60·1	4	82·4	65·7	62·4	70	147·1	54·8	·01	1	7·9
Cape of Good Hope ...	69·9	19	38·0	13	61·5	49·6	...	...	...	...	11·41	21	6·0
Mauritius.....	78·7	16	64·5	19	76·6	67·9	62·1	72	122·9	53·0	4·02	22	5·7
Calcutta.....	95·1	2	72·9	25	90·4	78·3	78·8	83	160·3	73·7	8·59	10	6·9
Bombay.....	90·9	1	76·4	9	86·3	78·9	77·2	83	142·7	72·6	13·30	25	6·8
Ceylon, Colombo	87·7	29	76·4	25	86·0	77·4	73·5	80	150·0	70·0	6·62	26	6·8
Melbourne.....	63·6	7	34·6	14	56·8	45·8	44·7	79	113·4	30·5	1·29	13	7·6
Adelaide	66·6	6	39·9	24	59·2	46·2	45·5	78	128·8	29·5	2·30	16	6·3
Tasmania, Hobart.....	...	...	...	...	...	...	...	...	...	...	...	...	...
Wellington	58·5	11	35·5	17	55·1	45·1	42·9	77	105·0	30·0	5·95	24	5·3
Auckland	65·0	11	39·5	17	59·2	49·2	49·6	84	114·0	31·0	5·05	21	6·2
Jamaica, Kingston.....	91·5	30	70·2	22	87·0	73·5	70·8	72	...	...	3·23	10	...
Trinidad	90·0	22	68·5	26	86·0	70·0	72·3	84	154·0	57·0	16·26	28	...
Toronto	85·9	12a	48·1	11	74·2	56·7	58·1	78	...	41·2	5·81	18	6·3
New Brunswick, Fredericton	85·5	2	35·5	10	71·0	48·3	52·1	69	...	...	5·71	24	5·7
Manitoba, Winnipeg ...	83·0	11	37·5	16b	72·1	48·9	...	...	...	...	5·03	10	4·9
British Columbia, Esquimalt	74·0	28	42·5	9	63·8	48·6	50·2	82	...	...	·60	11	4·6

a And 16. b And 30.

REMARKS.

MALTA.—Mean temp. 72°·7. Mean hourly velocity of wind 8·2 miles. The temp. of the sea rose from 72°·0 to 77°·0. Lightning on the 15th. J. SCOLES.

Mauritius.—Mean temp. of air 1°·7 above, of dew point 1°·4 above and rainfall 1·98 in. above, their respective averages. Mean hourly velocity of wind 13·8 miles, or 2·5 above average; extremes 27°·0 on 27th and 1·9 on 20th; prevailing direction, E S.E. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 5 days and Lightning only was seen on one day. J. C. H. CLARKE, Lt.-Col. R.E.

Melbourne.—Mean temp of air 1°·5, of dew point 1°·1, and amount of cloud 1·0 above their respective averages. Mean humidity 1 and rainfall ·68 in. below their averages. Prevailing winds N. and W., strong on 9 days. Thunderstorms with heavy squalls, rain and hail on 22nd and 23rd. Heavy dew on 6 days. Hoar frost on 14th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean temp. 52°·7, or 0°·9 below the average of 27 years. Rainfall ·49 in. below the 35 years' average. Cloud about the average. C. TODD, F.R.S.

Wellington.—The first few days were fine, but the remainder of the month was very showery and unpleasant with strong winds. Hail on 11th, 14th and 15th, and light snow on the last date. Fog on 25th. Mean temp. 1°·1, and rainfall ·82 in., above the average. R. B. GORE.

Auckland.—A showery unsettled month, but with no heavy falls of rain, or severe storms. Rainfall very slightly above the average. Mean temp. and pressure both considerably above the average. T. F. CHEESEMAN.

TORONTO.—On the 19th 2·42 in. of rain fell, and of this 1·45 in. fell in 25 minutes.

C. CARPMAEL.

SUPPLEMENTARY TABLE OF RAINFALL,
DECEMBER, 1892.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger Hall.	2·07	XI.	Rhayader, Nantgwillt..	3·88
"	Birchington, Thor	2·15	"	Corwen, Rhug	1·78
"	Brighton, Prestonville Rd.	2·62	"	Carnarvon, Cocksidia ...	2·75
"	Hailsham	2·52	"	I. of Man, Douglas	4·23
"	Ryde, Thornbrough	2·43	XII.	Stoneykirk, Ardwell Ho.	3·42
"	Alton, Ashdell	1·90	"	New Galloway, Glenlee	2·89
III.	Oxford, Magdalen Col...	·89	"	Melrose, Abbey Gate ...	1·52
"	Banbury, Bloxham	1·17	XIII.	N. Esk Res. [Penicuik]	1·85
"	Northampton, Sedgebrook	1·53	"	Edinburgh, Blacket Pl..	1·36
"	Cambridge, Fulbourne..	·96	XIV.	Glasgow, Queen's Park.	1·67
"	Wisbech, Bank House..	·96	XV.	Islay, Gruinart School..	5·34
IV.	Southend	1·17	XVI.	Dollar	1·53
"	Harlow, Sheering	1·63	"	Balquhider, Stronvar..	3·22
"	Rendlesham Hall	1·41	"	Coupar Angus Station..	·93
"	Diss	1·19	"	Dunkeld, Inver Braan..	·97
"	Swaffham	1·35	"	Dalnaspidal H.R.S. ...	3·78
V.	Salisbury, Alderbury...	·96	XVII.	Keith H.R.S.	·98
"	Bishop's Cannings	1·47	"	Forres H.R.S.	1·34
"	Blandford, Whatecombe.	1·67	XVIII.	Fearn, Lower Pitkerrie.	1·40
"	Ashburton, Holne Vic...	3·08	"	Loch Shiel, Glenaladale	8·06
"	Okehampton, Oaklands.	3·29	"	N. Uist, Loch Maddy ...	3·70
"	Hartland Abbey	3·41	"	Invergarry	3·36
"	Lynmouth, Glenthorne.	2·77	"	Aviemore H.R.S.	2·34
"	Probus, Lamellyn	2·61	"	Loch Ness, Drumnadrochit	2·73
"	Wincanton, Stowell Rec.	1·75	XIX.	Lairg H.R.S.	·96
"	Weston-super-Mare	1·34	"	Scourie	4·18
VI.	Clifton, Pembroke Road	1·38	"	Watten H.R.S.	2·07
"	Ross, The Graig	·78	XX.	Dunmanway, Coolkelure	6·77
"	Wem, Clive Vicarage ...	1·75	"	Fermoy, Gas Works ...	3·08
"	Cheadle, The Heath Ho.	2·46	"	Killarney, Woodlawn ...	4·68
"	Worcester, Diglis Lock	·84	"	Tipperary, Henry Street	2·37
"	Coventry, Coundon	1·75	"	Limerick, Kilcornan ...	2·11
VII.	Ketton Hall [Stamford]	1·03	"	Ennis	2·39
"	Grantham, Stainby	1·20	"	Miltown Malbay	2·39
"	Horncastle, Bucknall ...	·71	XXI.	Gorey, Courtown House	·91
"	Worksop, Hodsock Priory	·44	"	Mullingar, Belvedere ...	1·91
VIII.	Neston, Hinderton	2·19	"	Athlone, Twyford	1·89
"	Knutsford, Heathside ...	2·29	"	Longford, Currygrane...	2·24
"	Lancaster	·96	XXII.	Galway, Queen's Coll...	2·01
"	Broughton-in-Furness..	4·63	"	Crossmolina, Enniscoe..	3·17
IX.	Ripon, Mickley	·55	"	Collooney, Markree Obs.	3·54
"	Scarborough, South Cliff	1·06	"	Ballinamore, Lawderdale	3·28
"	East Layton [Darlington]	·25	XXIII.	Lough Sheelin, Arley ..	2·73
"	Middleton, Mickleton..	·82	"	Warrenpoint	1·70
X.	Haltwhistle, Unthank..	1·58	"	Seaforde	2·30
"	Bamburgh	1·03	"	Belfast, Springfield	3·73
"	Newton Reigny	1·23	"	Bushmills, Dundarave...	3·07
XI.	Llanfrechfa Grange	1·56	"	Stewartstown	2·28
"	Llandovery	3·25	"	Buncrana	2·53
"	Castle Malgwyn	2·17	"	Lough Swilly, Carrablagh	3·96
"	Builth, Abergwessin Vic.	4·66			

DECEMBER, 1892.

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 1880-9.	Greatest Fall in 24 hours		Days on which ≥ 0.1 or more fell.	Max.		Min.				
				Dpth	Date		Deg.	Date	Deg.	Date.			
											inches.	inches.	in.
I.	London (Camden Square) ...	1.37	— .70	.44	1	11	54.5	15	16.7	27	18	24	
II.	Maidstone (Hunton Court)...	1.39	— .85	.36	1	10	...	...	...	...	...	...
III.	Strathfield Turgiss	1.04	— .97	.25	1	13	52.3	15	13.2	27	20	24	
III.	Hitchin	1.39	— .64	.46	1	10	48.0	14 ^a	15.0	26 ^f	23	...	
IV.	Winslow (Addington)	1.45	— 1.00	.51	1	10	53.0	15	11.0	27	24	24	
IV.	Bury St. Edmunds (Westley)	1.41	— .83	.37	1	10	52.0	16	22.0	26	...	...
V.	Norwich (Cossey)	1.08	— 1.15	.24	1	8	...	...	...	...	...	...
V.	Weymouth(LangtonHerring)	1.93	— 1.17	.54	2	11	52.0	3, 15	24.0	30	15	...	
VI.	Torquay, Babbacombe ...	1.27	— 2.14	.37	2	14	52.6	3, 15	23.7	27	7	17	
VI.	Bodmin (Fore Street)	3.02	— 2.32	.58	1	20	...	...	...	...	...	...
VI.	Stroud (Upfield) .....	.85	— 1.60	.26	1	13	50.0	14 ^b	18.0	26	21	...
VII.	ChurchStretton(Woolstaston)	1.80	— 1.25	.44	1	14	51.0	15	19.5	26	21	24	
VII.	Tenbury (Orleton)	1.29	— 1.08	.40	1	9	55.6	15	11.6	27	22	24	
VII.	Leicester (Barkby)	1.25	— .89	.50	8	10	53.0	15	9.0	26	24	28	
VIII.	Boston .....	.58	— 1.27	.19	10	5	50.0	15 ^c	15.0	26	20	...
VIII.	Hesley Hall (Tickhill).....	.35	— 1.63	.16	8	7	54.0	18	10.0	29	23	...	
VIII.	Manchester(PlymouthGrove)	2.08	— 1.36	.31	4	13	53.0	18	15.0	26	20	25	
IX.	Wetherby (Ribston Hall) ...	.33	— 2.11	.11	16	4	...	...	...	...	...	...
IX.	Skipton (Arncliffe)	3.22	— 3.59	.44	8	14	...	...	14.0	28	...	...
IX.	Hull (Pearson Park)	1.16	— 1.11	.29	9	13	53.0	17 ^d	16.0	26	22	25	
X.	Newcastle (Town Moor)	1.22	— 1.08	.34	8	13	...	...	...	...	...	...
X.	Borrowdale (Seathwaite).....	9.06	— 5.75	1.80	16	16	...	...	...	...	...	...
XI.	Cardiff (Ely).....	2.83	— 1.72	.71	1	15	...	...	...	...	...	...
XI.	Haverfordwest	3.43	— 1.56	.60	9	17	52.9	16	15.0	27 ^g	10	15	
XI.	Aberystwith, Gogerddan	3.95	— .93	.79	14	13	51.0	18	12.0	26 ^f	18	...	
XII.	Llandudno.....	2.09	— .87	.27	5	16	...	...	...	...	...	...
XII.	Cargen [Dumfries]	2.17	— 1.85	.41	16	12	51.6	18	13.6	26	21	...	
XIV.	Jedburgh (Sunnyside)	1.20	— 1.00	.45	3	10	56.0	17	12.0	2, 3 ^h	21	...	
XIV.	Old Cumnock	2.31	— 2.76	.60	8	15	...	...	...	...	...	...
XV.	Lochgilphead (Kilmory).....	4.62	— 2.75	.90	10	17	...	...	16.0	1, 25	21	...
XV.	Oban (Craigvarren)	3.46	...	.45	13	17	53.0	19	23.6	2	12	...
XVI.	Mull (Quinish) .....	...	...	...	...	...	...	...	...	...	...	...
XVI.	Loch Leven Sluices	1.10	— 2.21	.30	10	8	...	...	...	...	...	...
XVII.	Dundee (Eastern Necropolis)	.90	— 1.18	.20	13	14	53.1	18	15.8	25	20	...	
XVII.	Braemar .....	.71	— 1.76	.15	3	11	51.3	18	8.0	10	26	29
XVIII.	Aberdeen (Cranford)	1.23	...	.31	6	18	52.0	17	18.0	25	17	...
XVIII.	Strome Ferry	5.22	— 2.57	.82	5	24	...	...	...	...	...	...
XIX.	Cawdor [Nairn]	1.57	— .89	.50	3	15	...	...	...	...	...	...
XIX.	Dunrobin	1.48	— 1.89	.40	13	11	56.0	18	16.8	3	20	...	
XX.	S. Ronaldsay (Roeberry).....	2.66	— 1.00	.75	10	20	50.0	17	28.0	1	14	...	
XX.	Darrynane Abbey.....	5.25	...	.83	2	25	...	...	...	...	...	...
XX.	Waterford (Brook Lodge) ...	2.27	— 1.37	.45	24	18	54.0	14	24.0	27	12	...	
XXI.	O'Briensbridge (Ross)	3.19	...	.67	8	17	53.0	...	30.0	...	9	...
XXI.	Carlow (Browne's Hill)	1.57	— 1.55	.26	8	14	...	...	...	...	...	...
XXII.	Dublin (Fitz William Square)	.80	— 1.36	.18	8	10	55.5	18	21.9	27 ^g	14	20	
XXII.	Ballinasloe	2.34	— 1.08	.41	24	18	50.0	17 ^d	19.0	27	17	...	
XXIII.	Clifden (Kylemore)	5.76	...	.81	8	23	...	...	...	...	...	...
XXIII.	Waringstown	2.15	— .89	.31	5	17	56.0	18	14.0	26	18	20	
XXIII.	Londonderry (Creggan Res.) ..	3.78	— .43	.56	8	22	...	...	...	...	...	...
XXIII.	Omagh (Edenfel)	2.60	— 1.08	.39	13	22	53.0	17	20.0	26 ^f	16	21	

^a And 16, 18. ^b And 15. ^c And 17, 18. ^d And 18. ^e And 27. ^f And 28. ^g And 26.

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

METEOROLOGICAL NOTES ON DECEMBER, 1892.

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 first half of the month was damp and mild, but from the 16th to the close it was remarkably dry. The last ten days of the year were severely cold, the grass min. ther. recording $8^{\circ}\cdot0$, or 24° below the freezing point.

ADDINGTON.—The max. temp. was rather high from the 14th to the 18th, but with that exception the month was cold, particularly so after the 22nd, when a steady frost set in. At 9 a.m. on the 27th the ther. stood at 12° , and on the 28th the max. was only 26° . On the 25th the lake was covered with ice strong enough to carry skaters, and during the last week trees were beautifully covered with rime.

BURY ST. EDMUNDS.—No R or S fell after the 14th, and sharp, dry frost prevailed from the 24th to the end of the month. S on the 3rd, 6th, 8th, 9th, and 10th.

LANGTON HERRING.—In the early part of the month the changes of temp. were sudden and great. The ther. rose from 31° to 45° in the night of 8th–9th, and from 32° to 47° in the night of 14th–15th. Mean temp. $1^{\circ}\cdot6$ below the average. The last 15 days of the month were fine, bright, very cold, and without any fall whatever. A solar halo was observed on Christmas Day.

BABBACOMBE.—A dry, variable month, with temp. slightly below the mean. Showery (though on many days less than $\cdot01$ in. fell) every day from November 23rd to December 22nd, except on the 18th; dry during the last 9 days of December. Cold from 4th to 10th, and from 25th to 31st. The temp. at 9 a.m. fell $16^{\circ}\cdot3$ from $49^{\circ}\cdot7$ on 3rd to $33^{\circ}\cdot4$ on 4th, and at 9 p.m. rose $15^{\circ}\cdot5$ from $35^{\circ}\cdot0$ on 13th to $50^{\circ}\cdot5$ on 14th. The max. in shade rose to or above $50^{\circ}\cdot0$ on 4 days; glazed frost on morning of 6th. The relative humidity (84) was lower than in any of the preceding 16 Decembers. Gales from W.S.W. on 1st and from E. on 31st. Solar halos on 2nd, 10th, and 24th. Lunar halos on 3rd and 4th. S and soft H on 4th and 5th. Fog on 3rd, 20th, and 28th.

BODMIN.—Rather wet the first fortnight; a little S on the 4th, and very cold on the 5th. Fine and frosty from the 25th to the end of the month, but very cold N.E. wind, especially on the 26th. A very stormy night for the last of the year; splendid moonlight for several nights.

WOOLSTASTON.—The first fortnight was very cold, and S fell on five days; this was succeeded by a few mild, warm days, but on the 22nd the frost set in again with great severity, and continued till the end of the month. Mean temp. $35^{\circ}\cdot4$.

TENBURY, ORLETON.—A very cold month, the mean temp. being nearly $4^{\circ}\cdot5$ below the average. From the 11th to the 21st was fairly warm, but all the rest of the month was very much below the average, and from the 23rd to the end the cold was intense. S 2 inches deep at night on 5th.

MANCHESTER.—Damp, foggy, and very mild for the season from the 14th to 21st. Hard frost and fine wintery weather on the 22nd, 24th, 25th, and 30th. Mean temp. 34° . Heavy falls of S on the 4th and 5th. Thick fog on 2nd, 26th, and 27th, and very thick fog up to noon on the 28th. A decided thaw on the 11th.

WALES.

HAVERFORDWEST.—The month commenced wet, and continued so up to the 19th, with occasional frost, but the general character of the weather was mild and wet, occasionally blowing very fresh. The wind shifted to S.E. on the 20th, and from that time to the 25th it was gloomy, the air very dry, with low mean temp., and blowing half a gale. On the night of the 25th a severe frost set in, with clear sky and calm air, which continued to the end of the month, the day temp. being below 32° , except on the 29th, skating going on every day; large ice floes in the river Cleddau.

SCOTLAND.

CARGEN.—With the exception of a week of mild weather about the middle of the month, the temp. was very low, the mean ($34^{\circ}3$) being $4^{\circ}2$ below the average, and the mean of the last 10 days of the month as low as $28^{\circ}6$. Fluctuations were experienced on several occasions to the extent of 20° and upwards in 24 hours. N. and N.E. winds prevailed for 16 days.

JEDBURGH.—The temp. was low, with much black frost; out-door work a good deal hindered; ponds and rivers frozen over. S 3 inches deep on 1st, and 1 inch deep on 8th.

OLD CUMNOCK.—Frequent S from 3rd to 8th; almost continuous frost from the 20th to the close.

CAWDOR.—S every day except 7th from 2nd to 8th.

ROEBERRY.—The first part of the month until the 19th was very rough and wet, a heavy gale from W. to N.W. occurring on the night of the 17th and morning of 18th.

IRELAND.

DARRYNANE ABBEY.—A very mild month, excepting a few days at the beginning. Constant fog during the last fortnight.

WATERFORD, BROOK LODGE.—Slight S on the 4th. Mean temp. $41^{\circ}3$.

O'BRIENBRIDGE, ROSS.—Low temp. prevailed in the early part of the month; it was then unusually high from the 14th to the 25th, and low again to the close. No storms or fogs.

DUBLIN.—A generally cold, dry, breezy month. Two periods of severely cold weather were separated from each other by a singularly mild and even warm spell, extending from the 14th to the 22nd inclusive. The cold weather in the earlier part of the month came from the N.W., and was accompanied by a good deal of S and E. That at the close of the month spread westward from the Continent to the British Isles, and was accompanied by strong S.E. winds and unusually dry weather. No serious gales were felt, and calms, with fog, prevailed during the frosty spells at the beginning and end of the month. The mean temp. ($39^{\circ}6$) is $1^{\circ}7$ below the average. A lunar halo appeared on the 31st. High winds were noted on 15 days, but attained the force of a gale on only two occasions, the 11th and 23rd. S or sleet on 4 days; E on 3 days. There were "silver thaws" on the 6th and 29th.

EDENFEL.—Heavy falls of S, with frost, prevailed during the first week, followed by a dull thaw. The third week and up to Christmas was mild, even to warmth, the mean temp. of the 17th reaching $50^{\circ}5$, and the weather gradually brightening. The last week was clear and dry, with no snow, but keen frost, the temp. on grass falling to 13° on the morning of the 27th.

A LIGHTNING STORY.

BALL LIGHTNING.—The captain of the German steamer "Flandria" reports a curious instance of lightning on March 6th, 1892, in latitude 38° north and longitude 41° west. In the midst of a violent tempest a luminous ball, like a huge star, appeared in the midst of the blackened clouds, grew to a maximum, and then burst, followed by long rolls of thunder. Flashes of lightning spread in every direction, giving an intense light that blinded everyone for some minutes. This phenomenon was observed twice, the duration being about five seconds.—*Electrical Engineer*, December 25th.