

# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

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## THE TEMPERATURE AND RAINFALL OF BRAZIL.

WE recently received, through the kindness of Captain Wilson Barker, a table of the rainfall for many years at Recife (often called Pernambuco, after the name of the State of which it is the capital). This table, converted into English values, we give on page 164, together with some remarks upon it.

We also received from S. H. Morize, of the Astronomical Observatory at Rio, a copy of the pamphlet,\* portions of which had already appeared in the *Revista* of the Observatory of Rio de Janeiro, in which he gives a general sketch of the climate of the country; S. Morize gave no map of the vast territory of which he treated, and for several of the places, neither their latitude nor their longitude.

By this difficulty of identifying the stations, and by the different values given in different parts of S. Morize's pamphlet, we were obliged to go back to the original authorities quoted by him, so that at last we have been led on to the compilation of the table given on pages 162 and 163. We are far from supposing that our own table is free from error. The Brazilians are not possessed of a fertile imagination in the formation of place-names, and though there may not be half-a-dozen each of S. Cruz, S. Antonio, Rio Madeira, and Victoria, there are quite enough to puzzle a stranger. Probably an Englishman, with thirteen Avons, seventeen Blackwaters, eighteen Newports, and upwards of one hundred Newtons and Newtowns, ought not to complain; but the liability to err remains. Another slight difficulty has arisen from the absence of any general survey of the country, so that the latitudes and longitudes of identical places are given differently by different writers, and by the same writer in different publications, and sometimes in the same article or book—*e.g.*, in the table on p. 47 S. Morize gives for the first station  $1^{\circ} 27' S.$  by mistake for  $2^{\circ} 31' S.$ , and his last stations as  $31^{\circ} 16'$  and  $32^{\circ} 0'$ , whereas on earlier pages he had given the former as  $31^{\circ} 45'$ , and the latter as  $32^{\circ} 6'$ . We have done our best to detect all such errors, and hope that few stations are even 10' (say 10 miles) from their true position.

\* *Esboço de uma Climatologia do Brazil*, por H. Morize. Lombaerts and Co., Rio de Janeiro. 8vo, 47 pages. 1891.

*Mean Temperature and Mean Rainfall in Brazil.*

NOTE.—The stations are grouped in order of increasing latitude in each State, and the States are taken in the same order, *i.e.*, the most northerly first, and the most southerly last.

State.	Town.	Lat. S.	Lon. W.	Alti- tude	Mean Temp.	Mean Rain.	No. of years	Authority.
		° ' /	° ' /	ft.	°	in.		
Pará .....	Belem .....	1 27	48 37	...	81·3	2121·6	2	M 47
" .....	" .....	...	...	...	...	70·4	4	D
" .....	S. Antonio .....	8 30	62 40	...	78·8	91·3	1	M 46
Maranhao ...	S. Luiz .....	2 31	44 2	141	81·3	96·7	2	M 47
" .....	" .....	...	...	...	...	280·0	1	Humboldt
" .....	" .....	...	...	...	...	108·1	...	M 46
Rio Negro ...	Manaos .....	3 8	59 58	131	79·8	87·8	5	M 47
" .....	" .....	...	...	...	...	92·1	4	M 46
" .....	" .....	...	...	...	...	55·1	1	D
Ceara .....	Fortaleza .....	3 44	38 31	...	79·9	59·1	28	M 47
" .....	" .....	...	...	...	...	58·6	28	M 46
" .....	" .....	...	...	...	...	58·7	28	D
" .....	" .....	...	...	...	...	60·6	..	Raulin
" .....	{ Quixeramobim } (or Campo Major) .....	5 16	39 25	...	84·7	...	...	M 47
" .....	Ico .....	6 13	39 0	...	79·9	...	...	M 19
" .....	Crato .....	6 50	39 45	...	82·3	...	...	M 19
Piauhy .....	Theresina .....	5 6	41 50	...	80·2	...	...	M 17
" .....	{ Valle do Alto } Paranhya .....	26°	43½°	...	...	38·0	1	D
" .....	Amarante .....	6 13	42 55	...	79·2	31·1	1	M 47
" .....	" .....	...	...	...	80·8	...	...	M 17
Pernambuco.	Recife .....	8 4	34 51	...	79·2	117·0	8	D
" .....	" .....	...	...	...	78·3	116·1	3	Beringer
" .....	" .....	...	...	...	...	91·2	13	W. Barker
" .....	Victoria .....	8 9	35 27	528	77·2	41·4	7	D
" .....	Jagueira .....	8 10	35 57	...	...	73·2	3	McGrath
" .....	Cabo .....	8 15	35 3	...	...	46·4	1	Zeits. 24
" .....	Colonia Isabel .....	8 45	35 42	751	74·7	40·8	7	D
" .....	{ S. Anna do } Sobradinho ..	9 26	40 47	1053	80·2	14·6	3	D
Bahia .....	{ S. Bento das } Lages .....	12 37	38 40	98	76·6	85·8	5	D
" .....	Bahia .....	12 58	38 32	210	78·8	85·1	5	M 47
" .....	" .....	...	...	...	...	94·3	5	D
" .....	" .....	...	...	...	...	79·3	2	D
Matto Grosso	Cuyabá .....	15 48	56 15	673	79·3	45·9	3	M 47



MONTHLY RAINFALL AT RECIFE, PERNAMBUCO, 1842-90.  
(According to the authorities stated at the foot of the Table.)

	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
1842	5.98	1.97	8.11	24.84	15.95	24.86	15.85	3.10	1.02	1.11	3.28	1.29	104.36
1843	1.11	1.22	14.17					3.41	1.11	1.36	.50	1.85	
1861	21.20	2.15	8.49	15.46	18.09	16.00	8.42	8.45	2.17	.58	.59	1.32	102.92
1862	5.26	2.99	3.18										
1875	2.22	11.38	13.23	25.64	14.43	8.92	12.06	13.39	6.92	4.03	1.63	1.17	115.02
1876			17.89	12.96	16.72	29.39	25.56	15.02	8.66	1.43	.37	3.68	
			19.26	15.87	18.43	29.31	25.56	15.01	8.66	1.43	.37	3.68	
			4.60										
1877	3.72	1.77	4.60	1.20	18.19	4.05	22.00	7.39	4.88	.15	1.26	.26	69.47
1878	3.72	1.77	4.60	8.08	21.39	51.75	56.68	15.47	8.12	2.42	.14	2.87	173.12
1879	10.94	2.98	1.19	9.37	15.06	22.14	16.73	2.22	6.91	.23	.00	5.45	93.22
1880	3.91	13.09	26.61	15.87	17.18	33.18	21.45	37.62	6.45	.39	1.85	1.13	178.73
1881	.51	8.96	1.64	16.43	12.01	24.14	54.53	11.58	14.88	1.54	.23	.36	146.81
1882	1.22	4.30	1.23	11.40	12.37	20.77	23.17	7.91	1.50	.49	.67	3.63	88.66
1883	10.56	10.56	3.67	14.04	9.95	5.56	3.31	6.03	5.65	.18	3.82	.56	73.89
1884	1.03	.46	12.19	13.58	5.47	11.93	7.21	3.11	1.58	1.02	1.49	.26	59.33
1885	.65	4.43	.22	32.60	24.07	6.23	2.89	4.49	1.37	1.83	.45	.32	79.55
1886	4.61	2.09	4.51	15.40	9.98	16.38	9.19	9.05	1.58	.34	.79	.80	74.72
1887	.89	.08	4.43	14.75	8.50	9.74	9.95	5.27	1.10	2.57	.02	2.67	59.97
1888	1.57	1.24	6.39	6.58	8.07	11.58	8.77	3.17	.61	.70	1.73	.32	50.73
1889	2.70	2.31	3.43	2.62	6.67	7.36	5.55	2.22	1.11	.23	.50	2.23	36.93
1890	2.89	1.06	8.18	5.29	4.56	7.56	8.76	7.51	1.54	.47			

1842.—Observer unknown. Authority: Table from Capt. Wilson Barker.  
 1842 (August) to 1843 (January).—Dr. J. J. de Moraes Sarmento; 10 ft. above sea. Béringer.  
 1843 (January to March).—Dr. J. Loudon, in Boa-Vista. Béringer.  
 1861 (January) to 1862 (March).—Observed at the Arsenal. Béringer.  
 1875 (January to December).—Observed at Appuocos by the Recife Drainage Company. Béringer.  
 1876 (March) to 1877 (June).—Observed at the Model School at Recife. \*; R. G. 19 ft. above ground. Béringer.  
 1876 (March) to 1890 (October).—Unknown.—Table from Capt. Wilson Barker.  
 From July, 1877, to March, 1878, these values are identical with those furnished by Captain Wilson Barker.

Total Rainfall in various years extracted from "Revista do Observatorio do Rio de Janeiro."

State and Town.	Lat. S.	Lon. W.	Altitude.	Rainfall in							
				1883	1884	1885	1886	1887	1888	1889	
<i>Minas Geraes</i> —	°	°	'	ft.	in.	in.	in.	in.	in.	in.	in.
Barbacena .....	21	10	44	0	...	...	...	...	...	...	52·82
<i>S. Paulo</i> —											
Sao Paulo .....	23	33	46	36	...	...	...	...	58·93	49·88	...
Tatuby .....	23	34	47	40	...	...	...	...	...	54·85	...
Ponta Grossa.....	25	6	49	50	3107	...	...	...	68·33	...	...
Curytiba.....	25	25	49	25	2933	...	...	...	52·50	54·31	...
Morietes.....	25	28	48	35	46	...	...	...	73·62	74·66	...
Paranaguá .....	25	31	48	30	26	...	...	...	...	82·48	...
Palmas .....	26	29	...	3789	...	...	...	...	61·83	...	...
<i>Rio de Janeiro</i> —											
Nova Friburgo ...	22	19	42	25	...	48·29	63·99	46·85	66·18	...	...
Rio de Janeiro Ct.	22	54	43	8	...	55·42	50·20	33·90	...	...	...
„ „ Terrace	22	54	43	8	...	49·49	46·77	30·69	38·03	39·27	55·12
<i>S. Pedro do Sul</i> —											
Santa Cruz.....	29	45	52	40	...	...	...	...	66·22	67·24	37·76
						1882-4.					
Rio Grande .....	32	6	52	11	...	29·21	...	...	...	...	...

In Vol. IV. of the *Revista*, pp. 103-105, we find a summary for 1888 of the observations at twenty-one stations in the State of Rio Grande do Sul. Many of these stations were started only in the course of that year, but the yearly values seem to be perfect for the undermentioned :—

Station.	Altitude. ft.	Rain in 1888. in.
S. Borja .....	—	35·34
Itaqui .....	—	50·39
Uruguayana .....	341	52·69
Livramento .....	—	43·97
Santa Maria .....	479	21·65
Cacimbinhas.....	—	55·75
Rio Grande .....	53	28·08
Barra.....	26	33·10

As regards the accuracy of the returns, we can accept no responsibility whatever. The majority of the temperatures seem to agree better than we should have anticipated, because there are so few values based on records of adequate length, and there is hardly an iota of information as to how the thermometers have been mounted. So with the rain returns, we have no information as to the position of a single gauge, and very little as to their construction, while many of the averages (!) are noted as being merely the totals of a single year.

It may be said—Why spend time and space over such materials? The answer is obvious. The climate of the enormous\* territory of Brazil is an important subject, and we have endeavoured to collect all that we could, with the double object of showing what has been done and what remains to be done. Where we could obtain *demonstration* that printed figures were misprints we have refrained from quoting them, but in all other cases we leave our readers in possession of the English equivalents of the figures as published, and we leave the responsibility with those who first issued them—*e.g.*, we believe that the mean rainfall at S. Luiz do Maranhao is about 100 inches, and we quote the two different values of 2455 mm. (96·7 in.) and 2745 mm. (108·1 in.), given by S. Morize; but we have the high authority of Humboldt for a record for one year of 280·0 in., and therefore we quote it.

Having thus stated our standpoint, no further explanation of the table is needed, except as regards the last column:—

M = Morize—*i.e.*, the pamphlet, of which the title has just been given, and the figures following the M are those of the pages on which the values are given—*e.g.*, M 47 = the 47th page of S. Morize's book.

D = Draenert.—Dr. Draenert has done much towards making Europeans acquainted with the climate of his country, and has contributed many valuable papers to the *Zeitschrift*, notably one on "Die Vertheilung der Regenmengen in Brasilien," in the volume for 1886.

Henwood = a paper "On Subterranean Temperature," in the *Trans. Roy. Geol. Soc. of Cornwall*, vol. viii., p. 723.

Béringer = "Recherches sur le climat et la mortalité de la ville de Recife ou Pernambuco."—*Ann. Soc. Met. de France*, xxvi., 1878, p. 28.

Zeit. = The *Zeitschrift*, and the number indicates the volume.

Our original idea was to give maps showing the observations plotted, and by shading or by curves; but on making such maps, it at once becomes evident (what might have been inferred independently) that the grouping of the stations closely resembles that of the population of European origin. Along the coast, in the cooler Southern states, and in the mining district of Minas Geraes, the records are tolerably plentiful; but in the vast interior there is little except the records of two or three explorers. Some meteorologists, with not a tithe of the data we possess, have run isobars, isotherms, and isohyetal shading all over the country. We do not impugn the accuracy of their imagination, but we prefer not to follow in their steps until better information is obtainable.

We do not understand why S. Morize, who seems at one time to have been one of S. Cruls' assistants in editing the *Revista*, never mentions that work, and does not quote half the returns which are

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\* About twice as large as India, and 16 times as large as France.

given in it. We know that it contains a good many misprints, and that Brazilian meteorological records are remarkable for their fragmentary character; but without claiming to have extracted every record possible, we have found in the *Revista* the values given in the table on page 165, and we do not understand why so many of them have been ignored by S. Morize. Doubtless a tropical climate is responsible for many things, but it does seem to us rather a pity that before embarking on his great enterprise of a Climatology of the World, Senor Cruis did not first try to give us a Climatology of Brazil. Neither he nor any one can yet give us particulars as to that of Solimoes, or of Goya, or of Matto Grosso, but if a private individual in the other hemisphere can in a few weeks get together such a series of data as are shown in these tables, how infinitely better could it be done by the Director of the National Observatory of Rio de Janeiro?

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#### THE MARTINIQUE CYCLONE OF AUGUST 18TH, 1891.

THE *Monthly Weather Review* for August, 1891, issued by the U. S. Weather Bureau, contains a fac-simile of the trace of a Richard Barograph such as we have never before seen; we therefore reproduce it for the inspection of our readers, and we quote from the *Review* two paragraphs illustrative of the damage produced by this great and sudden diminution of pressure. In our last number we quoted the rise of the barometer, 0.28 in. in an hour at Fort William, as exceptional, and we are not aware of anything more rapid being on record in the British Isles; but it is not a third of the rate of fall at Martinique, which was *nearly an inch in the hour* between 7.10 to 8.10 p.m. (*See frontispiece.*)

The general track of the storm, as worked out in the *Review*, was unusual, for though it was first noticed a little N. of Barbados, and then passed W.N.Wly. towards St. Domingo, it did not then curve round and take an E. or N.E. path, but continued even more Wly. than before, and passed the extremity of Florida, going W. into the Gulf of Mexico about a week after passing Martinique.

“The night of the 18th one of the most disastrous of the type of storms known as West India cyclones devastated the Island of Martinique, in the Windward West Indies. At Martinique the storm continued four hours, from 6 to 10 p.m., and the centre passed that place between 7 and 8 p.m., apparently travelling in a west-north-west direction at a speed of about 11 miles per hour. During the day a fresh north-north-east breeze had prevailed at Martinique, with rapidly falling barometer and wind increasing in force. The storm struck the east side of the island about 6 p.m., and in its passage over the island the destruction was less complete on the elevated plains. The wind veered from E.N.E. to S.S.E., and was most destructive from the latter point. Incessant lightning, unaccom-

panied by thunder, continued throughout the storm, and at its conclusion two distinct shocks of earthquake occurred at intervals of about five seconds. It is stated that in the vicinity of Caraval Rock at 10 a.m. two immense waves passed from the direction of Saint Lucia, the sea in the vicinity being quite calm. Another notable feature was the deafness experienced by every person in Martinique during the passage of the storm. The loss of life at Martinique is reported at 700; many persons were injured; property was destroyed to the value of \$10,000,000 (£2,000,000); and all vessels about the island, some 50 sail of all classes, were wrecked.

“Mr. Léon Sully, in a report accompanying the diagram, states that from 8.10 to 8.40 p.m. this barometer vibrated excessively, but a good aneroid barometer recorded every difference of pressure, and the passage of the center over Saint Pierre was clearly marked at 28.98 in. (736). The other minima (due to rapid oscillations varying in time from 2 to 3 seconds to 2 to 3 minutes) indicated clearly the passage of secondary whirls, rendered evident by the terrific noise of tiles and broken roofs; this fact was corroborated on the following day by the appearance of certain broken trees which could not have been bent in the way they were except by a strong gyratory movement. Moreover, in certain places in the country there were long lanes or paths where the destruction was greater than elsewhere.”

Respecting these paragraphs we may offer one or two remarks.

The statement that the lightning was “unaccompanied by thunder” should probably be read along with the one stating that “another notable feature was the deafness experienced by every person in Martinique.”

The loss of property is stated in *La Nature* to be estimated at 150 million francs; this would be £6,000,000. Let us hope that the figures in the *Review* are nearer the truth. Two millions is a sufficiently serious loss for Martinique.

We hope that some one with leisure will take up the investigation of this storm, and ascertain why it continued to travel westwards.

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#### ROYAL METEOROLOGICAL SOCIETY.

THE first meeting of the present session was held on Wednesday evening, the 18th November, at the Institution of Civil Engineers, Mr. Baldwin Latham, M.Inst.C.E., President, in the chair.

Eleven new Fellows were elected.

Mr. R. H. Scott, F.R.S., gave an account of the proceedings of the International Meteorological Conference, which was held at Munich from August 26th to September 2nd. (*Deferred for want of space*).

The following papers were also read :—

1. “Account of an Electric Self-Recording Rain Gauge,” by Mr. W. J. E. Binnie, B.A. This is a very ingenious instrument, in which

each drop of rain collected by a small funnel causes an electric current to be sent through apparatus, whereby the recording pen makes a trace on the cylinder. The gauge is said to be one of the most sensitive and also of the cheapest yet produced.

2. "On Wet and Dry Bulb Formulæ," by Professor J. D. Everett, F.R.S. This is a criticism of the methods investigated some years ago by Prof. August and Dr. Apjohn for determining, by calculation, the maximum vapour tension for the dew point on the temperatures of the dry and wet bulb. Professor Everett also criticises the values adopted by Regnault, and says that in presence of the uncertainty as to a rational formula, he thinks that Mr. Glaisher did wisely in constructing his table of factors, which give the dew point approximately by the most direct calculation which is admissible. The inherent difficulties of hygrometric observation and deduction are great, and have not yet been fully overcome.

3. "Results of Meteorological Observations made at Akassa Niger Territories, May, 1889, to December, 1890," by Mr. F. Russell, F.R.G.S. This is a continuation of a former communication respecting the same place. After detailing the results of the various observations, the author says that this period was very unhealthy, and the year 1890 especially so. The weather was exceptionally dry, with small-pox and phthisis amongst the native population. The west coast reports generally were also unfavourable in reference to the condition of resident Europeans, and at the principal ports quarantine regulations were put in force consequent upon an outbreak of yellow fever in places situated to the south-west. At Bonny from November to February ten deaths occurred out of a population of sixteen Europeans.

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### THE UNITED STATES WEATHER BUREAU.

WE have already recorded the magnificent appropriation which Congress placed at the disposal of its Meteorological Service, and although Prof. Harrington has not yet been five months at the head of the organization, we have already received from him a report of work done in the first three months, which is certainly more than any other meteorological office ever accomplished in a year.

When a faculty for administration, vigorous health, ample funds, and freedom from meddlesome interference fall to the lot of one man, the results are always good; and, as far as we can at present judge, the U.S. Weather Bureau is going to set an example for others to follow.

The report before us\* extends to 26 pages, and we can state only a few facts.

Originally the forecasts were made in Washington for the whole

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\* Special Report of the Chief of the Weather Bureau to the Secretary of Agriculture. 8vo. Washington, 1891.

country. This branch has been largely de-centralized, and some of the best observers (and we think some of the former forecasters) have been nominated as "Local Forecast Officials" at important centres throughout the country.

Local weather maps were issued at several of the principal stations, and they were in some cases badly prepared. The attention of the issuing officers has been called to this, and they have been instructed to send to Washington daily *the worst copy produced*.

Many stations, chiefly at military posts, have been discontinued, and fresh ones started at the nearest city or town. This is the only fact that we do not like; it may have been unavoidable, but we should have preferred the old stations running on for 6 or 18 months concurrently with the new ones.

As no extra grant had been made to defray the cost of storm signals on the coasts and Great Lakes, no important development has taken place in that branch.

The special service for the cotton-growing industry has been developed, and an analogous one organized for the benefit of sugar growers.

Great attention has been given to the organizing of "State" weather services, the number having been raised from 28 to 39; and volunteer observers have been enlisted to the total number of about 200, of whom about half have received instruments from the Government, and the others have purchased theirs, or had them presented. These volunteer stations seem to be placed to a considerable extent under the supervision of the chief officer of the Bureau in each State, so that in case of a broken instrument or other accident the damage can be made good without sending across the continent to Washington; another case of de-centralization which is decidedly good.

What is called the "Records Division," but which in this country would perhaps be called the Head-Office-Staff, has been reduced, partly, no doubt, owing to the de-centralization which we have already mentioned. There is certainly no present indication of any falling off in the output of work; in fact, in some respects even America seems not to be big enough for this vigorous Bureau, as it has lately been working up the climate of the Riviera. Prof. Harrington tells us (and we do not for a moment doubt it) that there are better climates in the United States, and he half hints that his countrymen should try them. While the Americans remain as rich as they now are, we think that it will take something more than thermometers and rain-gauges to prevent their coming to Europe, but we are by no means sure that Prof. Harrington may not succeed in establishing a "return current" of Europeans to winter in the warmer Southern States.

The river and flood service seems to continue much as formerly. It is true that English floods rarely do much damage, but it is humiliating to have to state that though in nearly every country in

Europe, in Australia, and in the United States the *régime* of the rivers is carefully studied and recorded, there is nothing of the kind in England. We have many "Conservancy Boards" in this country, but we never received from any one of them more than the smallest fragment of hydrological information.

We do not understand the opening statement with reference to instruments: "The instrument room is charged with the issue of instruments and accessories, except rain-gauges, to all the regular and voluntary observers of the Weather Bureau." We know that years ago some very extraordinary patterns of rain-gauges were used in the States, but why in 1891 the rain-gauges are exempted from the verification and issue of the experts in the instrument room at Washington we cannot imagine.

With respect to the Library, we are told that besides the routine work, the Librarian is keeping up to date the General Bibliography of Meteorology begun in 1884; that it now comprises about 60,000 titles; and that it is anticipated that it will be largely increased during the present fiscal year, and that an appropriation may be made for its publication.

This subject is further dealt with in a short note (upon Prof. Harrington's visit to Europe for the Munich Conference), in which he states that, "The International Bibliography of Meteorology, as begun by General Hazen, and published in part by General Greely, seems to have attracted the greatest interest among European students, as it attempts to satisfy a want that has long been recognized. We were so fortunate as to enjoy a prolonged interview with Dr. Hellman at Berlin, and Mr. Symons in London, the two Europeans who have probably done the most work in connection with the Bibliography of Meteorology. Evidently the general sentiment in Europe is to the effect that the work thus far done by the Signal Office is too important to be left unfinished, and that the interests of meteorology and of climatology alike demand that the Weather Bureau shall publish the complete work in proper style after obtaining from European co-laborers all possible corrections to the manuscript that has already been milleographed."

It is needless to say more respecting this subject than that we are delighted to see that Prof. Harrington has exactly grasped the situation, and that we do not believe that there is a meteorologist living in any quarter of the globe who will not be ready to do his share, be it large or small, to make this work a credit, even to the greatest Weather Bureau which ever existed.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, MAY, 1891.

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.									
England, London .....	80·2	13	30·7	17	60·5	43·0	42·1	80	122·7	28·0	2·72	19	6·3
Malta .....	76·6	5	50·4	20	70·5	57·1	54·8	77	134·4	42·9	·26	4	4·3
<i>Cape of Good Hope</i> ...	72·9	11a	42·0	24	65·0	52·3	...	...	...	...	7·73	13	5·1
<i>Mauritius</i> .....	79·4	8b	57·0	31	77·1	67·2	63·9	77	126·5	48·4	1·76	21	5·2
Calcutta .....	99·3	3	71·2	11	93·8	77·6	77·2	77	157·8	66·5	4·18	8	4·6
Bombay .....	91·4	26c	77·0	6	89·9	80·1	75·4	74	141·0	66·1	·00	0	3·3
Ceylon, Colombo .....	91·0	6	73·1	20	87·6	76·8	73·2	78	149·0	70·0	17·65	25	7·5
<i>Melbourne</i> .....	72·7	5	34·4	20	63·6	45·1	46·1	75	125·2	27·5	2·25	7	4·7
<i>Adelaide</i> .....	78·1	5	37·7	10	68·9	49·7	44·0	57	139·1	25·9	·20	5	3·7
<i>Tasmania, Hobart</i> .....	71·5	5	36·3	22	59·5	44·5	46·1	79	121·0	31·7	2·03	9	7·4
<i>Wellington</i> .....	65·0	13	37·0	22	58·2	45·6	47·5	85	120·0	28·0	2·08	17	4·2
<i>Auckland</i> .....	66·0	11	43·0	28	61·9	49·5	45·5	69	125·0	35·0	3·41	15	4·8
Jamaica, Kingston .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Trinidad .....	95·0	23	67·0	2, 18	90·8	70·0	70·5	73	156·5	57·0	2·54	11	...
Toronto .....	78·0	9	30·2	5	62·1	41·3	38·3	59	...	22·8	·53	12	6·1
New Brunswick, } Fredericton .....	77·7	29	29·0	6	62·8	38·1	40·7	66	...	...	2·20	22	5·7
Manitoba, Winnipeg } British Columbia, } Esquimalt .....	93·6	7	14·8	3	64·9	34·7	37·1	59	...	...	·94	14	4·5
	69·1	20	36·5	8	61·5	44·8	48·0	85	...	...	·79	13	4·0

a And 31. b And 10. c And 28, 29, and 31.

REMARKS.

MALTA.—Mean temp. 62°·2; mean hourly velocity of wind 10·4 miles. Sea temp. rose from 63°·0 to 67°·5. TS on 6th, with a little H. J. SCOLES.

*Mauritius*.—Mean temp. of air 0°·8 below; dew point 0°·2 below; and R 2·43 in. below, their respective averages. Mean hourly velocity of wind 8·9 miles, or 1·1 below average; extremes, 24·0 on 19th and 0·0 on 25th; prevailing direction S.E. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 10 days. P. S. WARREN.

*Melbourne*.—Mean temp. of air 0°·6 above the average; mean temp. of dew point same as the average; humidity 3 below, cloud 1·9 below, and R ·15 in. above, their respective averages. Prevailing direction of wind N. and N.E.; strong on 6 days. Heavy dews on 20 days. Hoarfrost on 3 days. Fog on the 12th. L on 2 days. R. L. J. ELLERY, F.R.S.

*Adelaide*.—A very dry month, the rainfall being 2·86 in. below the average of 34 years, and the smallest on record for May. Mean temp. 1°·6 above the average, and mean daily range (19°·2) the greatest observed in May. Very dry all over the colony. C. TODD, F.R.S.

*Wellington*.—Generally showery, with intervals of fine weather. Prevailing winds N.W., strong on 5 days. Some pleasant weather towards the end of the month. Rainfall less than half the average. Mean temp. 0°·1 below the average. R. B. GORE.

*Auckland*.—A cold, showery month, but no unusual features in the weather. Rainfall ·75 in., and mean temp. 1°·5 under the average. T. F. CHEESEMAN

SUPPLEMENTARY TABLE OF RAINFALL,  
NOVEMBER, 1891.

[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.	3·72	XI.	Builth, Llanwrtyd Wells	4·78
"	Margate, Birchington...	...	"	Rhayader, Nantgwillt..	6·50
"	Brighton Prestonville Rd	3·53	"	Corwen, Rhug .....	3·88
"	Hailsham .....	3·47	"	Carnarvon, Cocksidia ...	5·62
"	Ryde, Thornbrough .....	4·41	"	I. of Man, Douglas .....	5·79
"	Alton, Ashdell.....	4·05	XII.	Stoneykirk, Ardwell Ho.	5·11
III.	Oxford, Magdalen Col...	2·18	"	New Galloway, Glenlee	6·99
"	Banbury, Bloxham .....	2·53	"	Melrose, Abbey Gate ...	2·66
"	Northampton .....	2·30	XIII.	N. Esk Res. [Penicuik]	2·65
"	Cambridge, Fulbourne..	2·21	XIV.	Ballantrae, Glendrisaig	5·19
"	Wisbech, Bank House..	2·31	"	Glasgow, Queen's Park.	3·61
IV.	Southend .....	·96	XV.	Islay, Gruinart School..	5·69
"	Harlow, Sheering .....	1·90	XVI.	Dollar.....	3·13
"	Rendlesham Hall .....	1·60	"	Balquhider, Stronvar..	7·51
"	Diss .....	1·76	"	Coupar Angus Station..	4·13
"	Swaffham .....	1·74	"	Dunkeld, Inver Braan..	4·58
V.	Salisbury, Alderbury ...	3·94	"	Dalnaspidal H.R.S. ....	5·99
"	Warminster .....	...	XVII.	Keith H.R.S. ....	3·10
"	Bishop's Cannings .....	2·57	"	Forres H.R.S. ....	1·16
"	Ashburton, Holne Vic...	9·08	XVIII.	Fearn, Lower Pitkerrie.	1·83
"	Okehampton, Oaklands.	4·53	"	Loch Shiel, Glenaladale	8·95
"	Lynmouth, Glenthorne.	4·74	"	N. Uist. Loch Maddy ...	7·71
"	Probus, Lamellyn .....	4·96	"	Invergarry .....	4·55
"	Launceston, S. Petherwin	...	"	Aviemore H.R.S. ....	1·09
"	Wincanton, Stowell Rec.	3·84	"	Loch Ness, Drumna Drochit	1·60
"	Wells, Westbury.....	...	XIX.	Lairg H.R.S. ....	4·70
VI.	Bristol, Clifton .....	2·49	"	Scourie .....	...
"	Ross, The Graig .....	3·02	"	Watten H.R.S. ....	2·28
"	Wem, Clive Vicarage ...	2·07	XX.	Dunmanway, Coolkelure	5·62
"	Cheadle, The Heath Ho.	3·07	"	Fermoy, Gas Works ...	3·57
"	Worcester, Diglis Lock	2·07	"	Darrynane Abbey.....	4·57
"	Coventry, Coundon .....	2·68	"	Tipperary, Henry Street	3·55
VII.	Ketton Hall [Stamford]	3·14	"	Limerick, Kilcornan ...	2·26
"	Grantham, Stainby .....	3·74	"	Ennis .....	2·73
"	Horncastle, Bucknall ...	2·78	"	Miltown Malbay.....	3·59
"	Worksop, Hodsck Priory	2·48	XXI.	Gorey, Courtown House	5·08
VIII.	Neston, Hinderton .....	3·00	"	Mullingar, Belvedere ...	2·69
"	Knutsford, Heathside...	2·43	"	Athlone, Twyford .....	2·47
"	Lancaster .....	4·25	"	Longford, Currygrane...	2·37
"	Broughton-in-Furness..	8·06	XXII.	Galway, Queen's Coll...	2·19
IX.	Ripon, Mickley .....	3·71	"	Crossmolina, Enniscoe..	3·80
"	Scarborough, West Bank	2·73	"	Collooney, Markree Obs.	3·17
"	East Layton [Darlington]	3·08	"	Ballinamore, Lawderdale	2·74
"	Middleton, Mickleton..	3·21	XXIII.	Lough Sheelin, Arley ..	2·44
X.	Haltwhistle, Unthank..	2·19	"	Warrenpoint .....	4·16
"	Bamburgh .....	2·76	"	Seaforde .....	4·44
"	Shap, Copy Hill .....	...	"	Belfast, New Barnsley..	3·27
XI.	Llanfrechfa Grange .....	3·92	"	Bushmills, Dundarave...	3·88
"	Llandoverly .....	4·01	"	Stewartstown .....	2·67
"	Castle Malgwyn .....	5·66	"	Buncrana .....	3·12

NOVEMBER, 1891.

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.	Dat				
I.	London (Camden Square) ...	2.08	— .58	.40	10	18	57.2	1	29.0	28	1	14	
II.	Maidstone (Hunton Court) ...	1.78	— 1.15	.61	10	17	...	...	...	...	...	...	
III.	Strathfield Turgiss ...	2.49	— .23	.82	10	18	56.1	19	27.8	28	6	20	
III.	Hitchin ...	2.09	— .59	.55	13	20	56.0	19	27.0	24	9	...	
IV.	Winslow (Addington) ...	1.99	— .94	.42	10	18	58.0	19	26.0	8, 30	7	15	
IV.	Bury St. Edmunds (Westley) ...	1.88	— .67	.38	10	18	...	...	...	...	...	...	
V.	Norwich (Cossey) ...	1.78	— .79	.30	24	13	...	...	...	...	...	...	
V.	Weymouth (Langton Herring) ...	3.92	+ .26	1.04	10	16	55.0	18c	29.0	24	3	...	
V.	Barnstaple ...	3.39	+ 1.22	.59	26	14	58.0	19	28.0	24	...	...	
V.	Bodmin (Fore Street) ...	6.54	+ 1.07	1.51	10	21	...	...	...	...	...	...	
VI.	Stroud (Upfield) ...	2.54	— .79	.66	10	18	54.0	2	28.0	24	7	...	
VI.	Church Stretton (Woolstaston) ...	2.74	— .78	.52	10	19	54.5	18	30.0	23	7	15	
VI.	Tenbury (Orleton) ...	2.78	— .36	.79	10	15	56.9	19	23.0	25h	14	17	
VII.	Leicester (Barkby) ...	2.62	+ .33	.58	15	18	56.0	18	22.0	7	12	21	
VII.	Boston ...	2.25	+ .05	.65	28	11	54.0	4	25.0	30	9	...	
VII.	Hesley Hall (Tickhill) ...	2.33	+ .31	.42	10	20	55.0	18	26.0	28e	9	...	
VIII.	Manchester (Plymouth Grove) ...	2.33	— .67	.35	11	17	54.0	2	28.0	29	8	12	
IX.	Wetherby (Ribston Hall) ...	2.36	+ .29	.75	11	13	...	...	...	...	...	...	
IX.	Skipton (Arncliffe) ...	6.02	— .73	.77	8	18	57.0	24	23.0	27	7	...	
IX.	Hull (Pearson Park) ...	2.95	+ .94	.57	28	23	55.0	19	27.0	28e	9	19	
X.	Newcastle (Town Moor) ...	2.22	— .18	.60	10	15	...	...	...	...	...	...	
X.	Borrowdale (Seathwaite) ...	13.89	— .90	2.01	10	21	...	...	...	...	...	...	
XI.	Cardiff (Ely) ...	4.04	— .87	.78	28	15	...	...	...	...	...	...	
XI.	Haverfordwest ...	5.41	— .45	1.18	11	23	55.4	19	29.8	29	4	6	
XI.	Carno (Tybrith) ...	3.55	— 2.41	.55	11	18	47.0	18	19.0	22	14	...	
XI.	Llandudno ...	3.83	+ .74	.67	15	18	59.0	18	32.5	23	0	...	
XII.	Cargen [Dumfries] ...	4.96	+ .40	.32	8	13	55.4	2	23.0	27	7	...	
XII.	Jedburgh (Sunnyside) ...	2.23	— .27	.49	11	13	56.0	3	23.0	27	...	...	
XIV.	Old Cumnock ...	4.56	— .41	.90	11	21	...	...	...	...	...	...	
XV.	Lochgilphed (Kilmory) ...	5.29	— 2.00	.83	18	19	...	...	23.0	26	9	...	
XV.	Oban (Craigvarren) ...	5.05	... .81	.8	8	20	57.8	1	27.9	26	3	...	
XV.	Mull (Quinish) ...	5.89	— 1.10	.69	8	19	...	...	...	...	...	...	
XVI.	Loch Leven Sluices ...	3.60	— .36	.70	12a	11	...	...	...	...	...	...	
XVI.	Dundee (Eastern Necropolis) ...	3.05	+ .35	.80	11	11	51.0	20	27.3	28	8	...	
XVII.	Braemar ...	3.45	— 1.13	1.00	11	18	49.0	19	16.4	25	11	22	
XVII.	Aberdeen (Cranford) ...	4.30	... .88	.11	23	51.0	2, 7	24.0	27	8	...		
XVIII.	Strome Ferry ...	6.47	— 1.41	.90	8	18	...	...	...	...	...	...	
XVIII.	Inverness (Culloden) ...	.34	— 2.15	...	...	...	49.0	8, 19	27.0	25	10	27	
XIX.	Dunrobin ...	2.67	— .16	1.27	11	13	50.0	1	28.0	26	11	...	
XIX.	S. Ronaldsay (Roeberry) ...	2.87	— .55	1.17	11	19	52.0	1	36.0	24f	0	...	
XX.	Dromore Castle ...	4.84	— .84	1.52	28	14	55.0	10d	33.0	12g	0	...	
XX.	Waterford (Brook Lodge) ...	5.51	+ 1.84	1.62	10	17	54.5	18	26.0	23h	6	...	
XX.	O'Briensbridge (Ross) ...	2.43	... .55	.12	17	47.0	13	29.0	23	17	...		
XXI.	Carlow (Browne's Hill) ...	3.63	+ .57	1.10	10	17	...	...	...	...	...	...	
XXI.	Dublin (Fitz William Square) ...	2.91	+ .08	1.23	10	15	57.8	18	31.4	24	3	16	
XXII.	Ballinasloe ...	2.23	— 1.68	.42	10b	18	56.0	28	24.0	24	18	...	
XXII.	Clifden (Kylemore) ...	7.82	... 1.22	.27	22	22	...	...	...	...	...	...	
XXIII.	Waringstown ...	2.55	— .55	.49	27	17	55.0	18	26.0	27	15	18	
XXIII.	Londonderry (Creggan Res.) ...	2.67	— 1.85	.37	10	24	...	...	...	...	...	...	
XXIII.	Omagh (Edenfel) ...	2.66	— 1.21	.38	10	22	49.0	18	29.0	23	7	13	

α And 14. β And 27. γ And 19. δ And 14, 20 & 22. ε And 30. f And 25. g And 14, 18 & 20. h And 26.  
+ Shows that the fall was above the average ; — that it was below it.

## METEOROLOGICAL NOTES ON NOVEMBER, 1891.

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 fairly seasonable month, with about an average rainfall. A remarkable fall of the bar. of about 1·7 in. occurred between the 8th and the 11th. Gales on the 10th and 11th. Primroses in bloom on 13th, and blackbirds singing on 22nd.

HITHIN.—The most severe gale ever experienced here, occurred on the 11th.

ADDINGTON.—There were very few fine days during the month. On the 11th a heavy gale occurred, uprooting many trees; the bar. was very low at 9 a.m. (28·44 in. corrected), and continued to fall until after midday; a rapid rise set in during the afternoon. Dense fog on 24th and 30th.

BURY ST. EDMUNDS, WESTLEY.—A mild, foggy month, with frequent R in small quantities. Remarkable for the very high reading of the bar. on the 5th, and the very low reading on the 11th. S on 26th.

LANGTON HERRING.—The feature of the month was the great storm on the 11th and 12th, when many trees were uprooted; no loss of life, however, occurred on this coast. The mean temp. at 9 a.m. was 1°·1 below the average of 19 years. From the 1st to the 7th inclusive very fine weather prevailed, but the rest of the month was showery.

BODMIN.—Dry and cold during the first week, but rainy and stormy from the 7th to the end of the month, and very cold on some days. Frost and fog on the 24th and four following days.

WOOLSTASTON.—A dark, foggy month. An exceptionally rapid fall of the bar. on the morning of the 11th was followed by a very severe gale, which raged for seven or eight hours, and did not subside till the following evening. S fell on the 26th. Mean temp. 40°·6.

TENBURY, ORLETON.—The beginning and end of the month were fine and dry, but a good deal of R fell in the middle—*i.e.*, from 8th to 18th. A great gale occurred on the 11th, with the lowest bar. since December, 1886. Severe frost prevailed from the 22nd to the end of the month, the mean temp. for the 8 days being 33°. The mean temp. of the month was 2° below the average and the lowest in November during 10 years, except 1887. Fog on 2nd, 24th, 25th, 29th, and 30th.

LEICESTER, BARKBY.—Several days of very thick fog occurred. Mean temp. 40°·7; corrected bar. on the 11th, 28·29 in.

MANCHESTER, PLYMOUTH GROVE.—Fine autumn weather on the 2nd, 12th and 14th; heavy fog all day on the 6th and 27th; wet mist and heavy fog on the 23rd and 29th; very stormy on the 11th; S and sleet on the 26th. Mean temp. 42°.

SKIPTON, ARNCLIFFE.—Stormy, with the lowest bar. pressure of the year on the night of the 10th.

## WALES.

HAVERFORDWEST.—The first week was fine, dry and pleasant, with clear and cold nights; the rest of the month was a constant succession of R, gales, and mildness. The gales of 9th & 10th, and 12th & 13th were of great violence, and the corrected reading of the bar. at 8.30 a.m. on 11th was 28·390 in. The month may be summed up as mild, very stormy and wet, though the total R has been exceeded. Prevailing winds, S. and S.W.

## SCOTLAND.

CARGEN.—A very wet and gloomy month; only 46 hours of sunshine, the average being 84 hours. The bar. pressure was unusually high for the first week, with easterly winds, fogs, and no sunshine. The remainder of the month was very wet and stormy, impeding agricultural work, which, owing to the wet October, was very backward. H on the 24th.

JEDBURGH.—The weather was generally calm, with little sunshine, a good deal of fog about the middle of the month, and almost continuous rainfall. Out-door work was never stopped.

OLD CUMNOCK.—Fog on the 3rd and 4th; stormy on the 11th; H on 16th; H and S on 25th and 26th.

S. RONALDSAY, ROEBERRY.—A very fine month upon the whole.

## IRELAND.

WATERFORD, BROOK LODGE.—Mean temp.  $42^{\circ}9$ .

O'BRIENSBRIDGE, ROSS.—Calm and foggy days, with low temp., occurred up to the 9th, followed by R and high winds, and a severe gale on the 12th. Frosts slight during the month, and a considerable rise of temp. at the close.

DUBLIN.—Opening with a week of quiet, fine, dry, anticyclonic weather, this month ultimately proved very cold and changeable. On the 11th, a disastrous cyclone occurred, causing destructive gales. After this date, the temp. remained low to the end of the month with one or two exceptions, and R fell frequently, though not as a rule heavily. Mean temp.  $43^{\circ}4$ . High winds occurred on nine days, and attained the force of a gale on three occasions, 11th, 12th, and 28th. Prevailing direction, S.W. and W. Fogs on eight days.

BALLINASLOE.—Heavy gales and R on 12th and 27th. Fogs from 13th to 16th.

KYLEMORE.—Stormy and wet from S. on the 7th, and from N.W. on 10th. Very stormy also on the 27th.

OMAGH, EDENFEL.—The month commenced with ideal late-autumn weather, calm, fine, often bright, and without night frosts, and although more or less R fell daily from the 8th to the end (excepting 14th and 15th), it did not interfere with outdoor work.

## ANALYSIS OF RAIN COLLECTED IN ENGLISH TOWNS.

WE understand that Mr. W. H. Watson, F.C.S., of The Folds, Bolton, desires the co-operation of a few careful rainfall observers in our large towns and cities, each of whom is to collect all the rain and snow found in his gauge during 1892, and to send it to Mr. Watson in two consignments, one in July (the rain from Jan. 1 to 9 am. July 1), and the other in January, 1893 (the rain in the second half of 1892). Those who may find it inconvenient to do this for the entire twelve months would much oblige by undertaking the careful collection of the rain up to July 1st. Mr. Watson will readily reply to any letters from observers willing to help.