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THE INTERNATIONAL AËRONAUTICAL CONFERENCE AT STRASBURG.

(Reprinted from *Science*, New York, June 24th, 1898).

THE meeting, ten weeks ago, of the International Aëronautical Committee, appointed by the Paris Meteorological Conference of 1896, was noteworthy in two respects. First, it marked the beginning of a new era in meteorological investigation, as shown by an organised effort to cut loose from observatories on the earth, and to study the conditions of the free air; and, second, by the assembling at Strasburg of French and Germans, political questions were held to be subservient to the conquest of the high atmosphere, and the extension of the common realm of science. Official and private hospitality was abundant, and the utmost good fellowship prevailed among the members of the Committee and the other meteorologists, physicists, and aëronauts who were present by invitation. It was regretted, although hardly a surprise, that there was no one from Great Britain, where, since Glaisher's remarkable balloon ascension, little has been done to explore the free air. The following named members of the Committee were in attendance:—

Professor Hergesell, *President*, of Strasburg.

MM. de Fonvielle, *Secretary*, Cailletet and Besançon, of Paris.

Drs. Assmann and Berson, of Berlin.

Professor Erk, of Munich.

General-Major Rykatcheff and Colonel Kowanko, of St. Petersburg.

Mr. Rotch, of Boston, United States.

The methods discussed for obtaining observations in the free air were: balloons with aëronauts; *ballons-sondes*, or unmanned balloons to carry self-recording instruments to the height of ten miles or more; and, for observations within a mile or two of the earth, the captive kite-balloon, and kites with self-recording instruments. Aside from technical details, the most important decisions concerning balloons related to the measurements of the height reached, and of the air temperature around them. Although, for the determination of height,

from observations in the balloon, the mercurial barometer must be considered as the standard, yet its indications are only accurate when the balloon has no vertical velocity. If aneroids are used they should be compared frequently with the standard, and, as far as possible, under actual conditions. It was decided that for the calculation of height, the barometric observations should be reduced everywhere by the same method, whatever that might be ultimately. M. Cailletet described his apparatus for photographing automatically at fixed intervals of time, a barometer in the balloon and the ground vertically below, so that the barometric heights can be calculated, and from a map the true heights, and the route of the balloon may be determined. This apparatus was recommended for use with both manned and unmanned balloons. On account of the rapid changes of temperature, it was recognised that very sensitive thermometers must be employed in *ballons sondes*, and that their artificial ventilation is essential. M. Cailletet exhibited a thermometer having a spiral silver tube for its bulb soldered to a glass tube, both being filled with the liquid toluene. This thermometer is extremely sensitive. M. Teisserenc de Bort showed a very sensitive self-recording thermometer which is, at the same time, almost insensible to shocks. It is composed of a blade of German silver set in a frame of invariable steel, and can be ventilated in a *ballon-sonde* by a fan turned by a weight attached to a long wire. For the determination of the temperature of the air around manned balloons, the proper instrument to employ is Assmann's aspiration thermometer, hung at least five feet outside the basket, but simultaneous comparisons with the sling thermometer were advised. The self-recording instruments carried in manned and unmanned balloons should be verified in pneumatic and refrigerating cabinets, under such changes of pressure and temperature as might occur in the atmosphere.

Prof. Hergesell and Dr. Berson urged the importance of simultaneous balloon ascents in the different countries when there was a barometric depression over the European continent. From a meteorological standpoint the manned ascents have an importance which the *ballons-sondes* do not possess, because the temperature of the highest atmosphere has no influence on the meteorological elements near the surface of the earth. M. de Fonvielle, however, called attention to the interest which thermometric measurements at a very high altitude would offer for the determination of the temperature of planetary space. These measures might enable us to choose between the kinetic theory of gases, which assumes the temperature of 273° Centigrade below zero, and Fourier's hypothesis, that the temperature of space is near that of the minima observed in the polar regions of the earth.

It was agreed that the fifth international ascent of *ballons-sondes* should take place early in June, and manned or unmanned ascents were promised in Austria, Belgium, and Italy, in addition to those in Germany, France, and Russia, which countries had already co-

operated. On the day designated, observations at the mountain stations, as well as with kites and captive balloons, will serve for the simultaneous study of the lower air.

Mr. Rotch read a report, which he had been asked to prepare, on the use of kites for meteorological observations, based on the experiments carried on at Blue Hill Observatory for several years past. The advantages which kites have over balloons up to a height of at least 10,000 feet, whenever there is wind, were pointed out. It was reported that, besides their use in the United States, kites were being employed to obtain meteorological records at St. Petersburg and near Paris. M. Tacchini proposes to try them on Mounts Cimone and Etna, and Professor Hann hopes to obtain data in this way above the Sonnblick, the highest permanently occupied observatory in Europe. The Conference recommended kites as being of great value to meteorology, and desired that they should be used at the chief observatories, together with the kite-balloon (described hereafter), for continuous observations. The Committee was enlarged by the addition of the following persons: M. Teisserenc de Bort and Prince Roland Bonaparte, of Paris; Professor Hildebrandsson, of Upsala; Professor Pernter and Lieutenant Hinterstoisser, of Vienna; Captain Moedebeck, of Strasburg; and Lieutenant von Siegfeld, of Berlin. The next meeting will be at Paris in 1900.

During the Conference there were two trials of the kite-balloon—a captive balloon which, unlike the ordinary spherical one, is not driven down or carried away by strong winds. It is the invention of Lieutenants von Parseval and von Siegfeld, of the German army, where it is used for reconnoitering, but the smaller Strasburg balloon, constructed by M. Riedinger, of Augsburg, for Professor Hergesell and Captain Moedebeck, is the first to lift self-recording meteorological instruments. It consists essentially of a cylinder of varnished linen, having a volume of 7,770 cubic feet, so attached to the cable that its upper end is inclined towards the wind, which thus tends to raise the balloon. The cylindrical form is preserved, notwithstanding leakage of gas, by admitting wind into an auxiliary envelope at the rear end, which also serves as a rudder, stability about the axis being secured by lateral wings. The instruments are contained in a basket, with open ends, hung far below the balloon. The azimuth, angular altitude and traction of the cable are recorded continuously by an ingenious dynamometer. In spite of unfavourable weather and gas of insufficient lifting power, the experiments were fairly successful, and previously the balloon had been maintained during several days above the city.

The Committee also witnessed an ascent of the *ballon-sonde*, "Langenburg," carrying self-recording instruments. This silk balloon, when inflated with 14,000 cubic feet of coal gas, had an initial lifting force of 440 pounds in excess of its load. Owing to a premature start the ballast was left behind, and the sudden plunge upward not only emptied some of the gas, but stopped the clock

movements of the thermographs. The ascent was made in the late afternoon, and the balloon, which soon disappeared in the clouds, was found the next day about sixty miles south-east of Strassburg, having risen more than six miles, as was determined from its barometric record.

A. LAWRENCE ROTCH.

SCIENTIFIC BALLOON ASCENTS.

(From the *Times* correspondent).

PARIS, *June 8th.*

THREE balloons were sent up from La Villette this morning, as arranged at the recent Aeronauts' Conference at Strasburg. The first, measuring only 1,200 cubic feet, was sent up at 2.30 a.m. for the purpose of registering the temperature of the air before sunrise. This operation had but few spectators, whereas the two later ascents attracted about 500 persons belonging to scientific, aeronautic, and Press circles, including the Prince of Monaco and a large number of ladies, as also several members of the United States Legation, now naturally interested in ballooning.

The second balloon, measuring 14,000 cubic feet, was sent up at nine o'clock. The Prince of Monaco cut the rope attaching it to the ground. The car of the balloon contained various instruments, including a baro-thermometer by Richard, another by M. Teisserenc de Bort, director of the Trappes Observatory, a registering actinometer by M. Viollet, of the Institute, and an automatic photographic camera by M. Cailletet, taking, at five minute intervals, 20 views of the surface at the nadir of the balloon, whether land, sea, or cloud. Nothing was seen of the balloon from the top of the Tour St. Jacques, whence observations were to have been taken by M. Jaubert, director of the municipal meteorological department, and a like disappointment awaited M. Secretan on the top of the Eiffel Tower. Persons who had assembled in the grounds of the gas company watched the balloon, but only for eight minutes. It then disappeared in the clouds which were passing at an altitude of 4,000 or 5,000 feet. This shows a mean velocity of somewhat less than 10 feet per second, and indicates that the French balloon could not reach an altitude of 45,000 feet, as on former occasions, but will hardly reach 30,000 feet, owing to the increased weight of scientific instruments. When it passed out of sight it was travelling in the direction of the North Sea, but it is expected that the strong westerly wind always blowing in high altitudes above the loftiest mountains will send it eastwards. At 9.30 a slight rain set in and continued for some hours. The wind was very moderate and varied in direction.

The ascent of the Balachoff, which was sent up with an aeronaut and with M. Hermite, was a very easy and picturesque one. The car was full of scientific apparatus, so that the occupants had scanty elbow room. There were two large baskets containing Violett's registering actinometers in order to determine by accurate measurements the intensity of solar radiation.

To-day is St. Médard's, the French St. Swithin's, and many people will expect 40 days' consecutive rain, but what is certain is that to-day was

unfavourable for the balloons. Berlin, Munich, Vienna, Strasburg, Warsaw, Brussels, and Rome may perhaps have had better luck for their simultaneous ascents. The aerial district thus constituted to-day covers about 1,200 miles in longitude and as many in latitude, or 12 to 14 times the extent of England and Wales. This is the most extensive scientific operation on record, and the non-participation of England is much regretted, especially as Glaisher was one of the creators of scientific aeronautics. The collection and discussion of the observations will, of course, take some little time.

FLOODS AND STORMS IN SOUTH AFRICA.

To the Editor of the Meteorological Magazine.

SIR,—Having noticed in your Magazine for April an article on "Floods and Storms in South Africa," I thought you might be interested in the details of the rainfall all over the Colony during the month of January last. I have accordingly sent you by the same mail a complete list of the Stations, giving the amount of rainfall during that month as well as the number of "days on which rain fell."—I am, Sir, yours faithfully,

CHARLES STEWART,

Secretary.

Meteorological Commission, Cape Town, May 4th, 1898.

[WE are glad to be favoured with Mr. Stewart's letter and table, especially as the latter affords evidence of the remarkable development of rainfall work in South Africa. It is very much too long to print *in extenso*, and we have, therefore, prepared the following abstract, which not merely gives all the monthly totals which exceeded 12 inches, but also the largest in each Division and the total number of stations in it, thus giving full details as to the strength of the observing staff in South Africa.

Division.	Name.	No. of Stations.	Greatest Total, and Totals exceeding 12 in., for January, 1898.
I.	Cape Peninsula	29	St. Michael's, Table Mountain 2·39
II.	South-West	24	Houw Hoek 3·80
III.	West Coast.....	15	Piquetberg ·85
IV.	South Coast	31	Concordia 7·20
V.	Southern Karroo	9	Glenconnor 3·99
VI.	West-Central Karroo ...	13	Camfer's Kraal 4·74
VII.	East-Central Karroo.....	23	Somerset East 9·65
VIII.	Northern Karroo	39	Colesberg 10·05
IX.	Northern Border	17	Groot Boetsaap, 13·77; Bell's Bank 13·23
X.	South-East.....	49	Evelyn Valley, 15·95; Katberg, 13·25; Thaba N'doda 12·88
XI.	North-East.....	27	Barkly East, Avoca, 18·09; Palmeitfontein, 17·15; Glen Lyon, 16·48; Herschel, 16·41; Lady Grey, 15·92; Gateshead, 14·45; Barkly East, 12·95; Aliwal North 12·17

Division.	Name.	No. of Stations.	Greatest Total, and Totals exceeding 12 in., for January, 1898.
XII.	Kaffraria.....	18	Woodcliff, 18·66; Maclear, 14·82; Engcobo 12·57
XIII.	Basutoland.....	5	Mafeting, 21·78; Moyeni, 19·71; Leribe, 16·35; Butha Butha 14·80
XIV.	*Orange Free State.....	1	Philipolis 9·16
XV.	*Natal.....	47	Impendhle, 15·20; Umzinto, 13·62; Nottingham Road, 13·56; Polela, 13·22; Pietermaritzburgh (Bush Valley), 12·29; Everdon (Howick)... 12·16
XVI.	South African Republic	3	Bremersdoon 17·10
XVII.	Bechuanaland.....	4	Taung 7·80
XVIII.	Rhodesia.....	2	Hope Fountain 7·75

From the above we see that there are now more than 300 rainfall stations reporting to the Cape Commission, to which it should be added that there are about 50 in Natal, and others belonging to the British Association and other bodies, further to the N. and W.; so that we think that the entire number of rain records kept in Africa, S. of the Equator, must be nearly, if not quite, 500.

As regards the intensity of the excess in January, 1898, the following table seems to show that our previous note indicated accurately the locality most affected—*viz.*, the upper portion of the watershed of the Orange River between Bloemfontein and Aliwal North.

Div.	Station.	Lat. S.	Lon. E.	Altitude.	RAINFALL IN JANUARY.		Per cent. of Mean.	Excess in 1898.
					Mean, 1885-94.	1898.		
		° ' "	° ' "	feet.	in.	in.		
XVIII.	Hope Fountain..	20 20	28 30	4700	10·73	7·75	72	-2·98
IX.	Groot Boetsaap..	28 0	24 25	—	3·82	13·77	361	9·95
XIII.	Mafeting	29 54	27 7	—	5·79	21·78	376	15·99
XIV.	Philipolis	30 13	25 18	4700	3·74	9·16	245	5·42
XI.	Herschel	30 36	27 7	5110	4·24	16·41	387	12·17
„	Aliwal N.....	30 41	26 40	4330	3·30	12·17	369	8·87
VIII.	Colesberg	30 43	25 5	4400	2·30	10·05	437	7·75
XI.	Lady Grey	30 43	27 12	—	5·64	15·92	282	10·28
„	Barkly E., Avoca	30 44	27 30	—	6·69	18·09	271	11·40
„	Gateshead	30 58	28 0	—	7·22	14·45	200	7·23
„	Barkly E.	31 2	27 35	5831	4·22	12·95	307	8·73
XII.	Maclear	31 4	28 21	4300	7·23	14·82	205	7·59
VI.	Camfer's Kraal..	32 17	23 3	3000	1·39	4·74	341	3·35
VII.	Somerset East...	32 44	25 35	2400	3·34	9·65	289	6·31
X.	Thaba N'doda...	32 50	27 1	—	3·98	12·88	324	8·90
III.	Piquetberg	32 53	18 45	700	·15	·85	566	·70
II.	Houw Hoek.....	34 12	19 10	960	·51	3·80	745	3·29

* We believe that both the Orange Free State and Natal have separate organizations; Mr. Stewart has quoted only one station for each, but as regards Natal, we have taken the full details from the *Natal Farmers' Magazine*, which some unknown Sheffield correspondent is so kind as to send us.

REVIEWS.

Science Progress. New series. Vol. II., No. 8. July, 1898, large 8vo. Scientific Press, London, 1898.

WE take the earliest opportunity of telling those of our readers who are interested in the History of Meteorites, or as the author entitles his article, "*The Fall of Meteorites in Ancient and Modern Times*," where to find a treat. It is a lecture given by Prof. H. A. Miers, F.R.S., Waynflete Professor of Mineralogy in the University of Oxford, printed in the above number of *Science Progress*. Of course, in one lecture it is impossible to deal with a literature which we suppose would, in the aggregate, take at least 30 ft. of shelving, and Prof. Miers did not attempt the impossible; but he has wisely taken only one aspect of the subject, and has concentrated in 22 pages information which few writers could have given, and which still fewer would have been willing to compress into a single lecture.

Wragge's Australasian Weather Guide and Almanac for 1898. 8vo. Sapsford & Co., Brisbane, 1898.

IT is rather more than ten years since Mr. Wragge was appointed Government Meteorologist for Queensland, and during the whole period we have not received a single annual or other summary of the observations made in that colony. We are aware that Mr. Wragge has been very busy establishing stations, and it is of course quite possible that the regular publications which used to be issued in Queensland, as well as in the other Colonies, have been continued; all that we know is that nothing, except some large scale maps, has come under our notice.

Now, however, Mr. Wragge appears as the patron of an Almanac, which the publishers hope to make an Australian "Whitaker," and although we do not know what rivals may already exist, we do not see any reason why we should not wish that their hope may be fulfilled.

The present volume is excellently printed, on very good paper, and amply illustrated,—the tree or trees in the view of the Brisbane Observatory improve its appearance, but suggest anxieties respecting their influence upon the records. Mr. Wragge is too experienced to approve of trees near his instruments, how then do they get into the photograph whence the block was prepared?

Much of the mass of information given is very good; but on the whole we are inclined to regard as the best, the article on Artesian Water Supply, by Mr. W. Gibbons Cox, C.E., in which we have noticed only one mistake—(on p. 251) there are no "waterworks at Kentish Town," and the old chalk supply pumped there, was spoiled and abandoned nearly 50 years ago.*

**Met. Mag.*, Vol III., (1868) p. 176.

While no one can feel otherwise than grateful to Mr. Wragge for his enthusiastic devotion to obtaining meteorological records from Ben Nevis, and while we have no doubt that that enthusiasm alone made possible the establishment of the permanent observatory there, we are still waiting for evidence of the utility *for forecasting purposes* of the records from it, or any other lofty station. Though there may be excitement and fun in starting stations on Mount Kosciusko, or Mount Wellington, we should have waited until the London Meteorological Council had announced that Ben Nevis records were useful for forecasting purposes. Have not the United States authorities given up Pike's Peak and Mount Washington? Does M. Fron rely upon the records from the Pic du Midi or the Puy de Dôme?

Earthquakes and other Earth Movements, by J. MILNE, F.R.S., G.F.S., late Prof. of Mining and Geology, Tokio, Japan. Fourth ed. Inter. Scientific Series, Kegan Paul & Co., London, 1898. 8vo, xvi.—376 pp., map and engravings.

PERHAPS there is no stronger evidence of the widespread interest now taken in what in old times were all considered together as "Earthquakes and Volcanoes," than the fact that the International Scientific Series has, or will shortly have, three separate volumes devoted to them,—Prof. Judd's *Volcanoes*, which has reached its fifth edition, Prof. Milne's *Earthquakes*, of which we now welcome the fourth edition, and *Seismology*, by Prof. Milne, which is announced in the work before us.

The volume is crammed with facts, and with sound conclusions based upon them, and we have not noticed the omission of any aspect of the subject. We are, however, rather at a loss to know why there is not a single reference to all the labour spent upon the Krakatoa eruption. If the answer be that it belongs to the sister volume on *Volcanoes*, we should certainly reply by enquiring whether Admiral Sir William Wharton's work upon the transmission of the sea waves from Krakatoa to the English Channel is not at least equal to any of those quoted between pp. 179 and 186. Perhaps the *Report on the Eruption of Krakatoa* may have the honour of insertion in the appendix to the 5th edition, and might even be accompanied by the *Report on the East Anglian Earthquake of April 22nd, 1884*, by Prof. R. Meldola, F.R.S., and William White, and by the late W. Roper's "*A list of the more remarkable earthquakes in Great Britain and Ireland during the Christian era.*"

However, these are small matters, and the volume is already so crammed with information, that probably the only thing to be done is to jettison some of the cargo—but it would not be easy to select what should go overboard first.

PUBLICATIONS OF THE ROYAL ALFRED OBSERVATORY, MAURITUS.

It is a matter of general knowledge that the publications of this establishment have been distributed somewhat irregularly, and that most European Meteorological Libraries have only incomplete sets.

We have been in communication with the new Director, Mr. T. F. Claxton, F.R.A.S., upon the subject, and thanks to his hearty co-operation we are now able to announce that, for convenience of distribution, all surplus copies have been shipped to us.

Any society, establishment, or person wishing for any of the under-noted publications must send a clearly written list of what is desired; to reach Mr. G. J. Symons, 62, Camden Square, N.W., by October 15th, 1898, after which date he will proceed to allot the entire remaining copies of the said publications.

Royal Alfred Observatory, Mauritius.

REPORTS.

1876, 1878, 1879, 1881, 1882, 1883, 1884, 1885, 1886, 1887, 1888, 1889, 1890, 1891, 1894.

RESULTS.

1862, 1866, 1867, 1872, 1873, 1875, 1876, 1877, 1878, 1879, 1880, 1881, 1882, 1883, 1884, 1885, 1888, 1889, 1890, 1891, 1892, 1893, 1894, 1895.

Years not mentioned above cannot be supplied, and of some of those quoted there are very few copies.

No charge will be made, but where large numbers are required, applicants will be left to pay carriage.

The Royal Alfred Observatory itself has no copy of the Results for 1886 or 1887; we have had the pleasure of sending a copy for 1886; we hope that every librarian will search for a duplicate of 1887.

We desire to point out that it will be for the general benefit if all who have duplicates of any of the publications of the observatory will send them here, because what is useless to them, may be very useful to some one else.

There is similar incompleteness in the sets of the publications of the Meteorological Society of the Mauritius. We do not know of a single perfect set in Europe—and we hope that eventually we may be enabled to make a similar announcement with respect to its publications.

THE FIFTH INTERNATIONAL CONGRESS ON HYDROLOGY, CLIMATOLOGY AND GEOLOGY.

WE have been requested to announce that the above Congress will meet at Liège, in Eastern Belgium, under the patronage of H.R.H.

Prince Albert of Belgium, from September 25th to October 3rd, of the present year.

Those who had the privilege of joining the first of these Congresses (Biarritz and the Pyrenees) in 1886, will not soon, if ever, forget the boundless hospitality and kindness with which they were received. Those who have attended subsequent ones in Italy and in France, know that the example set at the outset has been followed, though not surpassed,—it would be hard, if not impossible, to beat the quaint festivities of Amélie les Bains, or the fairy-like beauty of Luchon. But now the Congress goes to a new country, Belgium, and we know that the Belgians intend to make it a red letter week for all who will go.

We cannot spare space to set out the programme, either of work or of play, but we must give the titles of some of the meteorological papers :—

- 1.—On the utilization of hygrometric records in relation to medical climatology and hygiene.
- 2.—On the hygienic importance of records of sunshine.
- 3.—The advantage of sanitary stations on plateaux in districts without mountains.
- 4.—Determination of daily mean temperature.
- 5.—On the importance of researches on the amount of ozone.
- 6.—On the mean temperature of the air, and of a spring at Spa.

There are, we see in the Geological section, several papers of interest to hydraulic engineers.

We wonder when Bath, Buxton, or Harrogate, or the three combined, will muster up courage enough to invite the Congress to England? Perhaps it is hopeless to think of it. English railway managers would be shocked at what the Continental managers do to facilitate the gathering of scientific men. So we had better not ask our foreign friends to see how much *worse* we do these things in England.

For full details respecting the Congress, railway facilities, excursions, &c., application should be made, in any language, distinctly written, to M. le Dr. G. Jorissenne,

Sécrétaire Général,

Boulevard de la Sauvinière 130,
à Liège.

RESULTS OF METEOROLOGICAL OBSERVATIONS AT CAMDEN SQUARE FOR 40 YEARS, 1858-97.

JUNE.

ELEMENTS.	MONTHLY MEANS OR TOTALS.										ABSOLUTE READINGS.									
	Mean, 40 years	Highest Month and Date.	Lowest Month and Date.	MEANS 9 A.M. AND 9 P.M.						EXTREMES AT 9 A.M. AND 9 P.M.						Mean of all Highest	Mean of all Lowest.			
				Mean.	Highest Month.		Lowest Month.		Highest.	Lowest.										
					Value.	Date.	Value.	Date.		Value.	Date.	Value.	Date.							
Barometer { (cor. & red.)	1 29.995	2 30.216 1865	3 29.782 1860	4 9 a.m. 9 p.m.	5 29.995 29.994	6 30.221 30.211	7 1865 1865	8 29.773 29.792	9 1860 1860	10 30.600 30.590	11 27th, 1867 27th, 1867	12 29.312 29.173	13 30th, 1865 2nd, 1860	14 30.323 30.319	15 29.563 29.563					
{ Dry Bulb..... Solar Rad., black ...	59.8	65.8 1858	55.4 1871	9 a.m. 9 p.m.	61.5 58.1	68.1 63.5	1858 1858	57.1 53.2	1860 1871	80.8 76.1	16th, 1858 22nd, 1870	48.4 44.3	3rd, 1871 3rd, 1871	72.0 67.9	52.3 49.5					
{ Max. Min. Wet Bulb..... {	71.3 50.9 55.2	.. .. 61.0 1858	.. .. 52.2 1869	.. .. 9 a.m. 9 p.m.	.. .. 56.1 54.4	79.1 55.1 62.6 59.5	1858 1858 1858 1858	64.7 46.9 53.3 50.9	1860 1869 1886 1869	92.6 63.8 70.3 69.2	16th, 1858 25th, 1878 16th, 1858 16th, 1858	53.5 35.6 44.4 41.8	10th, 1889 1st, 1869 8th, 1890 8th, 1881	83.1 59.4 64.5 62.8	59.1 41.8 48.6 46.5	
Solar Rad., bright..	113.2	...	...	...	...	120.4	1870	106.9	1888	136.8	20th, 1870	64.7	4th, 1890	129.5	76.5	
Grass Minimum ...	47.0	...	...	...	...	87.8	1896	76.9	1879	104.3	19th, 1893	57.9	8th, 1897	95.1	63.6	
Soil, 1 foot	58.7	...	...	...	...	49.9	1889	43.4	1869	60.7	25th, 1878	31.0	1st, 1884	56.5	36.8	
Cloud	5.6	7.6 1860	3.5 1868	9 a.m. 9 p.m.	6.0 5.2	8.0 7.3	'79, '82 1860	3.5 3.1	1868	10 10	Every year Every yr. but '58	0 0	Various Various	10.0 10.0	0.4 0.1					
Rainfall	2.23	6.71 1878	.30 1895	9 a.m. 9 p.m.	.95 1.28	3.09 5.73	1863 1878	.11 -.04	1886 1895	1.55 3.28	19th, 1863 23rd, 1878	.00 -.00	Every year Every year	.41 .50	.00 .00					

Max. Rainfall in 24 hours, 3.28 in., 23rd, 1878. Mean max. daily fall, .70 in.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JANUARY, 1898.

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	55·0	30	29·2	11	47·5	39·8	40·3	86	77·8	26·9	·73	9	8·3
Malta.....	64·0	10	42·2	29	60·8	51·5	48·1	80	126·5	35·2	2·83	7	6·0
<i>Cape of Good Hope</i> ...	92·0	16	48·1	28	77·9	60·3	56·3	67	...	...	1·34	5	3·3
<i>Mauritius</i>	86·3	19	71·1	18	84·2	74·2	71·5	80	136·5	65·8	6·48	25	6·4
Calcutta.....	83·9	26	48·4	8,9	76·5	53·5	51·1	63	140·0	39·0	·36	1	4·9
Bombay.....	90·8	16	63·3	5	85·1	67·7	63·1	65	137·5	52·5	·00	0	0·0
Ceylon, Colombo ...	92·7	11	66·8	28	88·2	71·8	70·8	81	150·0	58·0	2·32	8	3·4
<i>Melbourne</i>	109·2	11	48·1	23	82·3	58·3	52·0	54	157·1	38·1	·36	2	3·9
<i>Adelaide</i>	113·3	11	53·2	22	90·1	62·0	50·4	41	173·7	43·0	·09	1	1·7
<i>Sydney</i>	98·1	19	58·3	22	79·5	66·2	69·0	71	148·7	54·0	5·40	14	6·1
<i>Wellington</i>	76·0	6	49·0	19	69·5	55·9	52·0	69	135·0	35·0	·95	5	3·8
<i>Auckland</i>	90·0	4	49·0	19	74·0	58·0	54·0	65	138·0	46·0	3·14	10	5·4
Jamaica, Kingston.....	93·5	13	63·4	4	86·8	68·1	64·7	69	...	...	·03	1	...
Trinidad	89·0	3,7	64·0	20	85·6	67·4	70·1	82	163·0	61·0	3·05	15	...
Grenada.....	86·2	3	70·0	20	82·1	72·4	68·8	69	152·2	...	2·65	21	1·1
Toronto	44·9	12	—15·0	30	31·6	17·7	23·2	83	56·2	—17·5	3·65	18	8·1
New Brunswick, } Fredericton	37·9	7	—31·5	31	21·2	—3·3	2·0	77	...	...	6·36	13	5·3
Manitoba, Winnipeg ...	31·4	5	—30·3	10	15·4	—7·9	...	...	...	...	·89	12	4·4
British Columbia, } Esquimalt.....	48·0	14	27·5	23	42·7	34·6	36·0	92	...	...	2·40	18	8·3

REMARKS.

MALTA.—Adopted mean temp. 55°·5, or 2°·6 above average. Mean hourly velocity of wind 11·3 miles, or 0·1 below average. Mean temp. of sea 60°·3. TSS on 21st and 22nd; H on 21st and 22nd. J. F. DOBSON.

Mauritius.—Mean temp. of air 0°·2 above, of dew point 1°·6 above, and rainfall ·77 in. below, their respective averages. Mean hourly velocity of wind 9·7 miles, or 1·4 below average; extremes, 24·8 on 24th and 0·0 on 16th. Prevailing direction E.S.E. to E. by N. L, T, or both, on 23 days; being the greatest number during the period 1861–98, the previous greatest number being 14 in 1877 and 1887.

CEYLON, COLOMBO.—Mean temp. 77°·9 or 1°·1 below, mean dew point 1°·2 above, and rainfall ·75 in. below, their respective averages. Mean hourly velocity of wind 9·2 miles; prevailing direction N.N.E. T on 3 days. L on 3 days. TS on 25th. H. O. BARNARD.

Adelaide.—Mean temp. 1°·7 above, and rainfall ·76 in. below, their respective averages for 41 years. An extremely hot and dry summer thus far. C. TODD, F.R.S.

Sydney.—Temp. 1°·4 above, humidity 0·3 below, and rainfall 1·71 in. above, their respective averages. H. C. RUSSELL, F.R.S.

Wellington.—A small rainfall, but strong winds almost throughout the month; prevailing direction N.W. Temp. 0°·1 above, and R 2·95 in. below, their respective averages. R. B. GORE.

Auckland.—An average month. Mean temp. slightly below the average of 31 years. The max. temp. is, however, one of the highest readings in Auckland. Rainfall slightly above the average. T. F. CHEESEMAN.

TRINIDAD.—Rainfall ·11 in. above the average of 30 years. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL,
JUNE, 1898.

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.
I.	Uxbridge, Harefield Pk..	·91	XI.	Builth, Abergwesyn Vic.	4·73
II.	Dorking, Abinger Hall ..	1·50	„	Rhayader, Nantgwillt ...	4·15
„	Birchington, Thor	2·35	„	Lake Vyrnwy	2·97
„	Hailsham	1·16	„	Corwen, Rhug	2·28
„	Ryde, Thornbrough	2·62	„	Criccieth, Talarvor	2·83
„	Emsworth, Redlands ...	2·65	„	I. of Man, Douglas	1·79
„	Alton, Ashdell	2·06	XII.	Stoneykirk, Ardwell Ho.	2·09
III.	Oxford, Magdalen Col..	1·44	„	New Galloway, Glenlee	2·86
„	Banbury, Bloxham	1·30	„	Moniaive, Maxwelton Ho. ...	...
„	Northampton, Sedgebrook	·46	„	Lilliesleaf, Riddell	1·69
„	Duddington [Stamford].	·87	XIII.	N. Esk Res. [Penicuik]	2·35
„	Alconbury	1·28	XIV.	Glasgow, Queen's Park..	1·98
„	Wisbech, Bank House...	1·82	XV.	Inverary, Newtown	4·37
IV.	Southend	1·20	„	Oban, The Corran .....	...
„	Harlow, Sheering.....	1·81	„	Islay, Gruinart School ...	1·75
„	Colchester, Lexden	1·82	XVI.	Dollar.....	3·52
„	Rendlesham Hall	2·88	„	Balquhider, Stronvar...	3·28
„	Rushall Vicarage .....	...	„	Ballinluig .....	...
„	Swaffham	2·57	„	Dalnaspidal H.R.S.....	...
V.	Salisbury, Alderbury ...	·78	XVII.	Keith H.R.S.....	1·50
„	Bishop's Cannings	1·67	„	Forres H.R.S.	1·24
„	Blandford, Whatcombe .	1·19	XVIII.	Fearn, Lower Pitkerrie..	·91
„	Ashburton, Holne Vic...	3·24	„	N. Uist, Loch Maddy ...	...
„	Okehampton, Oaklands.	3·86	„	Invergarry	2·42
„	Hartland Abbey	3·21	„	Aviemore H.R.S.	1·26
„	Lynton, Glenthorne ...	1·67	„	Loch Ness, Drumnadrochit	2·10
„	Probus, Lamellyn	1·93	XIX.	Invershin	2·56
„	Wellington, The Avenue	1·94	„	Durness	2·83
„	North Cadbury Rectory	1·81	„	Watten H.R.S.....	1·98
VI.	Clifton, Pembroke Road	1·37	XX.	Dunmanway, Coolkelure	3·32
„	Ross, The Graig	·84	„	Cork, Wellesley Terrace	1·76
„	Wem, Clive Vicarage ...	1·39	„	Killarney, Woodlawn ...	2·73
„	Wolverhampton, Tettenhall	1·96	„	Caher, Duneske	2·72
„	Cheadle, The Heath Ho.	2·15	„	Ballingarry, Hazelfort...	2·92
„	Coventry, Priory Row ..	·89	„	Limerick, Kilcornan ...	...
VII.	Grantham, Stainby	1·16	„	Broadford, Hurdlestown	2·91
„	Horncastle, Bucknall ...	1·51	„	Miltown Malbay	3·89
„	Worksop, Hodack Priory	1·33	XXI.	Gorey, Courtown House	2·48
VIII.	Neston, Hinderton	2·09	„	Athlone, Twyford	3·29
„	Southport, Hesketh Park	1·85	„	Mullingar, Belvedere ...	3·48
„	Chatburn, Middlewood.	2·83	„	Longford, Currygrane...	3·80
IX.	Melmerby, Baldersby ...	1·70	XXII.	Woodlawn	3·04
„	Scarborough, Observat'y	1·83	„	Crossmolina, Enniscooe ..	3·48
„	Middleton, Mickleton ...	2·02	„	Collooney, Markree Obs.	3·85
X.	Haltwhistle, Unthank...	2·36	„	Ballinamore, Lawderdale	...
„	Bamburgh	1·34	XXIII.	Warrenpoint	3·59
„	Duddon Valley, Ulpha School	5·20	„	Seaforde.. ..	3·21
„	Keswick, The Bank	2·92	„	Belfast, Springfield	3·53
XI.	Llanfrecifa Grange	1·82	„	Bushmills, Dundarave..	2·54
„	Llandovery	3·15	„	Stewartstown	3·00
„	Castle Malgwyn	2·21	„	Killybegs	4·50
„	Brecknock, The Barracks	2·63	„	Horn Head	3·06

JUNE, 1898.

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	Deg.			Date.
I.	London (Camden Square) ...	1.11	— .90	.20	24	15	77.4	18	40.1	1	0	0				
II.	Tenterden	2.11	+ .26	.52	9	13	72.0	21	38.0	1	0	1				
III.	Hartley Wintney	1.52	...	.50	8	13	78.0	29	...	...	...	...
III.	Hitchin .....	...	...	...	...	...	...	...	...	...	...	...
IV.	Winslow (Addington)	1.88	+ .02	.66	25	14	77.0	18	39.0	3, 15	0	0				
IV.	Bury St. Edmunds (Westley)	3.37	+ 1.58	2.13	9	13	71.0	21 ^a	39.0	1	0	..				
V.	Norwich (Brundall)	3.22	...	1.80	9	16	74.4	18	36.8	1	0	0				
V.	Winterbourne Steepleton ...	1.02	...	.24	5	7	75.0	11	35.0	3	0	2		
"	Torquay (Cary Green)	1.39	...	.35	5	10	74.1	11	42.9	15	0	0		
"	Polapit Tamar [Launceston]..	2.04	— .17	.60	12	14	75.7	11	35.9	15	0	1				
VI.	Stroud (Upfield) .....	.98	— 1.41	.29	26	12	78.0	20	43.0	2	0	...			
"	Churchstretton (Woolstaston)	1.37	— 1.18	.25	25	12	73.0	10	39.0	1	0	0				
"	Worcester (Diglis Lock)	1.34	— 1.09	.40	25	11	...	...	...	...	...	...
VII.	Leicester (Rotherby Hall) ...	.91	...	.29	21	14	...	...	...	...	...	...
"	Boston .....	.99	— .90	.20	23	13	80.0	8	35.0	1	0	...			
"	Hesley Hall [Tickhill] .....	.69	— 1.23	.21	21	14	75.0	8	32.0	15	1	...			
VIII.	Manchester (Plymouth Grove)	3.20	+ .55	.75	21	15	77.0	11	40.0	14	0	...				
IX.	Wetherby (Ribston Hall) ..	1.82	— .07	.32	21	11	...	...	...	...	...	...
"	Skipton (Arnccliffe)	4.95	+ 1.59	1.07	26	16	...	...	...	...	...	...
"	Hull (Pearson Park)	1.66	— .09	.41	21	14	75.0	29	34.0	1	0	1				
X.	Newcastle (Town Moor)	2.31	+ .67	.45	1	13	...	...	...	...	...	...
"	Borrowdale (Seathwaite)	8.40	+ 1.82	3.27	23	18	...	...	...	...	...	...
XI.	Cardiff (Ely)	1.99	— .44	.31	22	17	...	...	...	...	...	...
"	Haverfordwest	1.95	— .61	.44	23	14	75.0	11	39.6	15	0	6				
"	Aberystwith (Gogerddan) ...	3.34	...	.70	12	15	83.0	11	...	...	...	...
"	Llandudno	1.91	+ .14	.43	24	15	70.0	11 ^b	44.0	2	0	...				
XII.	Cargen [Dumfries]	2.88	+ .93	.56	23	10	78.6	9	38.0	1	0	...				
XIII.	Edinburgh (Blacket Place) ...	1.39	...	.28	3	12	73.3	17	41.6	1	0	0		
XIV.	Colmonell	2.99	...	.61	6	13	79.0	10	40.0	1	0	...		
XV.	Tighnabruaich	4.09	...	.98	23	13	69.0	9 ^c	43.0	1	0	...		
"	Mull (Quinish)	3.55	+ .26	1.05	23	14	...	...	...	...	...	...
XVI.	Loch Leven Sluices	2.20	+ .45	.50	24	9	...	...	...	...	...	...
"	Dundee (Eastern Necropolis)	1.45	— .05	.40	24	12	77.3	17	39.9	1	0	...				
XVII.	Braemar	1.27	— .72	.28	6	12	73.0	28	32.4	28	1	6				
"	Aberdeen (Cranford)	1.36	...	.30	6	13	73.0	29 ^d	34.0	27	0	...		
"	Cawdor (Budgate)	1.84	+ .44	.56	22	14	...	...	...	...	...	...
XVIII.	Strathconan [Beaul]	3.31	+ .82	.72	1	8	...	...	...	...	...	...
"	Glencarron Lodge	4.09	...	.80	24	20	66.8	17 ^e	39.0	1	0	...		
XIX.	Dunrobin	1.60	— .42	.30	4	10	67.0	29	40.8	1, 3	0	0				
"	S. Ronaldshay (Roeberry) ...	2.20	+ .44	.53	6	16	64.0	9, 29	40.0	2	0	...				
XX.	Darrynane Abbey	2.28	...	.42	23	17	...	...	...	...	...	...
"	Waterford (Brook Lodge) ...	3.04	+ .97	1.36	5	13	73.0	10 ^f	38.0	3	0	...				
"	O'Briensbridge (Ross)	3.25	...	.66	23	16	...	...	...	...	...	...
XXI.	Carlow (Browne's Hill)	2.89	+ 1.05	.90	5	14	...	...	...	...	...	...
"	Dublin (FitzWilliam Square)	1.55	— .11	.43	5	14	74.9	17	41.8	2	0	0				
XXII.	Ballinasloe	2.99	+ .69	.55	23	17	70.0	10 ^g	40.0	2	0	...				
"	Clifden (Kylemore)	5.20	...	1.09	5	18	...	...	...	...	...	...
XXIII.	Waringstown	3.83	+ 1.76	.85	5	14	75.0	10 ^b	36.0	27	0	0				
"	Londonderry (Creggan Res.) ..	3.23	+ .81	.51	24	20	...	...	...	...	...	...
"	Omagh (Edenfel)	3.40	+ .93	.92	5	17	73.0	10	41.0	6	0	0				

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

a—and 29. b—and 17. c—and 10, 11. d—and 30. e—and 18. f—and 16. g—and 11.

METEOROLOGICAL NOTES ON JUNE, 1898.

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.

TENTERDEN.—Cold and cloudy, with seven days with a max. temp. below 60°, four being from 12th to 15th. Showery from 1st to 9th also in the last week, but a remarkable absence of TSS. Duration of sunshine 176 hours, being the least in 8 years. Heavy showers and H on 26th, 14 in. fell in ten minutes.

HARTLEY WINTNEY.—An unkind month; cold showers for the first 8 days, followed by a fortnight of dull and cloudy weather with keen dry N. wind. The last week was wet. Distant T on 27th and 28th. Ozone on 19 days. Hay crop good. Dog rose in flower on 9th.

ADDINGTON.—A little R during the first week, then very dry from 7th to 22nd, and from 23rd to 26th a copious rainfall, doing an immense amount of good to the root crops. The 12th, 13th and 14th were cold, the max. temp. being respectively 55°, 53° and 55°. TS on 25th and T on 26th.

BURY ST. EDMUNDS, WESTLEY.—Cold to the 18th, and showery from the 23rd to the end. Remarkable for the heavy R of the 9th and 10th, 2.30 in. falling continuously. Unfavourable for hay-making. TS on 25th. Distant T on 2nd, 6th and 26th.

NORWICH, BRUNDALL.—The month was cool and generally unsettled, with some very cold bleak weather from 12th to 17th, the max. temp. being below 60° on 5 days in succession. Torrential R all night on 10th, particularly from 2 to 3 a.m., and again at 6 a.m. with T and distant L, the fall being the greatest recorded in 24 hours since July 13th, 1889. Sharp TS from 3 to 4 p.m. on 2nd, and at 1 p.m. on 25th. Distant TS from 5.30 to 7.30 p.m. on 6th. T and L on 22nd.

WINTERBOURNE STEEPLETON.—The month was dry and cold, the mean temp. being only 54°.9. The deficiency was greater in the max. readings than in the min. Many of the days on which no R was registered were dull and gloomy, but 10 were noted as bright and beautiful. H on 1st. Distant T on 26th. Foggy on 6th and 21st.

TORQUAY, CARY GREEN.—R 1.25 in. below the average of 22 years. Mean temp. 1°.2 below the average. Duration of sunshine 229 hours 45 minutes, being 7 hours 15 minutes below the average. No sunless day.

POLAPIT TAMAR.—The temp. generally was unseasonably low, and the night of 15th was unusually cold, the temp. on grass touching 32°. T and L on 12th. H on 1st and 2nd.

WOOLSTASTON.—A rather cold month. Mean temp. 57°.1. The hay crop was unusually large.

MANCHESTER, PLYMOUTH GROVE.—On the whole the weather was very unsettled and cold for the season, and there was only one week of summer weather from 7th to 12th inclusive. Mean temp. 57°.3. H shower on 1st. Distant T on 6th. T and L on 26th.

WALES.

HAVERFORDWEST.—June commenced cool and cloudy, with some hours of sunshine and little R. Fine and warm weather set in on 7th and continued to 18th, interrupted by a TS on 12th, followed by a week of broken weather. Bright but cool from the 26th to the end. Hay crop above the average. Sharp TS at 7 p.m. on 12th, with several near flashes of L.

GOGERDDAN.—Very heavy T lasting for two hours on 12th, followed by heavy R.

SCOTLAND.

CARGEN [DUMFRIES].—The temp., rainfall, and sunshine during the month were chiefly remarkable for their very close approximation to the average of 39 years. A period of warm dry weather was experienced for 10 days commencing on 7th, when half of the sunshine of the month (232 hours) was registered, and the max. temp. from 9th to 17th averaged $70^{\circ}\cdot 1$. The remainder was characterised by unsettled weather, low temp., and cloudy sky. Light S. and E. winds prevailed on 25 days. On 25th a sharp H storm occurred which did considerable damage to foliage, in some instances beating down the young corn. Farm crops hardly ever looked better at this season, and hay promises to be a heavy crop.

EDINBURGH, BLACKET PLACE.—Mean temp. $0^{\circ}\cdot 3$ above, and R 34 per cent. below the average. H on 1st. Slight TS on 24th. T on 21st. Fog on 9th and 10th.

COLMONELL.—R $\cdot 12$ in., and mean temp. $0^{\circ}\cdot 4$, above the average of 22 years.

TIGHNABRUACH.—A good summer month.

ABERDEEN, CRANFORD.—A cold month with little sunshine.

S. RONALDSHAY, ROEBERRY.—A very good month upon the whole. Mean temp. $51^{\circ}\cdot 6$ or $0^{\circ}\cdot 4$ below the average of 8 years.

IRELAND.

DARRYNANE ABBEY.—Fine and hot from 6th to 21st; the rest of the month cold, and the last part misty and foggy.

O'BRIENSBRIDGE, ROSS.—A bad month for hay-making. T and L on 12th.

DUBLIN, FITZWILLIAM SQUARE.—An average month. Pressure temp. and R all about the normal value. Conducive to health and propitious to vegetation. It was, however, eminently changeable, and the fluctuations of temp. were abrupt and considerable. Mean temp. $58^{\circ}\cdot 0$ or $0^{\circ}\cdot 2$ above the average. High winds were noted on 8 days, but there were no gales. The temp. reached or exceeded 70° on 4 days. TS on 12th. T on 26th. H on 1st and 22nd.

OMAGH, EDENFEL.—June was a blustering unsettled month, with rainfall above and temp. below the average. On only 3 days did the temp. reach 70° , but on the other hand there were no night frosts. Oats, barley, turnips, and potatoes luxuriant, and the hay crop heavier than for many years.