KODAIKÁNAL AND MADRAS OBSERVATORIES.

REPORT FOR THE YEAR 1903.

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KODAIKANAL AND MADRAS OBSERVATORIES.

I —ANNUAL REPORT OF THE KODAIKÁNAL OBSERVATORY FOR THE YEAR 1903.

1. **Staff.**—The personal establishment of the observatory was as follows :—

Title.	Name.
Acting Director	Charles P. Butler, A.R.C.SC. (London); F.R.P.S.
First Assistant	K. V. Sivarama Aiyar, M.A.
Second ,, ...	S. Sitarama Aiyar, B.A.
Third ,, ...	G. Nagaraja Aiyar.
Acting Fourth Assistant	S. Balasundarum Aiyar.
Writer	L. N. Krishnaswami Aiyar.
Magnetic Observer	C. Theodore, B.A.

The fourth assistant, Mr. M. G. Subramanya Aiyar, left the observatory on March 3 in order to take up the first assistantship at the Madras Observatory. His place has been temporarily filled by Mr. S. Balasundarum Aiyar. The writer was transferred permanently to the Solar Physics Observatory on October 9. For the continuance of the meteorological observations at Periyakulam a new observer has been engaged from Madras, Mr. K. Padmanabha Mudaliar.

Mr. Theodore, the Magnetic Observer, was granted three months' sick leave on April 3, his place being taken temporarily by Mr. E. M. Meyer from the Survey of India. On Mr. Theodore's return on July 3, Mr. Meyer returned to Dehra Dun. On November 23, Mr. Theodore resigned owing to illness, and a new observer, Mr. H. N. Gupta, M.A., was appointed after a short experience with the magnetic installation at Dehra Dun. Mr. Gupta's health, however, appears to be so precarious that another change will probably be necessary.

A first-class book-binder from the Government Press, Madras, is attached to the establishment.

The subordinate staff consists of a mechanic, a book-binder's boy, five peons and two lascars.

2. **Buildings and grounds**—(*a*) *Main observatory.*—Nothing further has been done to mitigate the dampness inside the various rooms, but estimates have been sent in by the Public Works Department for providing an extra porch, and a verandah on the side most exposed to the south-west monsoon rain.

(*b*) *New observatory for Spectroheliograph.*—A new building is being erected for the accommodation of the instruments for obtaining photographs of the sun in monochromatic light by means of a spectroheliograph on the Hale plan. The building is in two parts, the northern one to house 18 inch siderostat and object lens for enlarged images has a sliding roof moving back northwards. The south building has a fixed roof with pillars to carry the spectroheliograph and a duplicate pillar for obtaining a direct image on slit.

(*c*) *Photoheliograph.*—This is a corrugated iron structure brought from Madras. The sliding semi-circular roof is very heavy and moreover the level of the slide is below the telescope so that great care has to be exercised when opening the roof or the instrument would be overturned. A small section of the end of the roof has been cut out and hinged to allow the roof to pass the telescope so that the instrument may be got partly into working order pending the construction of a more suitable cover which is under consideration. As this, however, could not be provided this year, the hinged portion was improved, and the various places through which rain leaked were boarded up. Although still unsatisfactory, these minor alterations have enabled the instrument to be employed for solar photography.

(*d*) *Transit.*—The transit building is now finished, but there is as yet no provision for keeping the place and instruments dry in wet weather.

(*e*) *Magnetic observatory.*—There has been considerable inconvenience and trouble connected with the leakage of the underground room. Throughout the year it has been necessary to place pans of calcined calcium chloride on the floor twice daily, and blankets have been suspended all round the room close to the walls to assist in absorbing the moisture.

In May a large new drain was made on the southern side, but this appears to have been ineffective, as no water has ever been seen running from it.

The eastern side of the hill has been tiled, as the two corners on this side were apparently the chief localities of the leakages and this alteration appears to have had good effect.

It seems probable that the foundations of the pillars in the absolute room above have also been affected, as they are both unsteady.

The ventilation in the underground chamber is unsatisfactory and a suggested method of improving it is under consideration.

(*f*) *Anemometer tower.*—The anemometer tower is in good condition throughout. A second room below has been constructed to contain the Dine's pressure tube anemometer (recording form), and that instrument will be installed in the new room.

There are at present no quarters provided for the fourth assistant. Up to the beginning of October the writer's quarters had been utilized for this purpose, but as the writer has now been permanently stationed here, it is advisable that quarters should be provided for the fourth assistant in the compound as early as possible and the Public Works department have been requested to furnish an estimate.

New quarters for the accommodation of the book-binder, mechanic, one peon and two lascars have been completed during the year. These are now occupied. For these new families it has been necessary to sink a new well to provide sufficient water-supply. The whole of the water for the observatory has had to be carried by hand from some distance, and as the number of photographic operations increases, this difficulty is more noticeable, and it would be a great convenience if the automatic supply by pump and windmill, which has been under construction for some time, were completed as soon as possible.

3. **Instruments.**—The following instruments are available for use in the observatory:—

Instrument.	Employed for
6″ Cooke Refractor. 7′ focus, Equatorially mounted.	Spectroscopic examination of sun and other celestial objects.
6″ Lerebour and Secretan Refractor 8′ focus. Equatorially mounted. Remodelled by Grubb.	Visual examination of sunspots.
5″ Grubb portrait lens, 36″ focus. Mounted on Lerebour Equatorial.	Photographs of comets, meteors, variable or new stars, etc., for magnitude determination.
11″ polar siderostat in conjunction with 6″ Grubb lens, 40′ focus.	Feeds the concave grating spectrograph, and can also be used for direct photographs of the sun.
Altazimuth	Dismounted at present.
4″ Rowland concave grating, 10′ focus. 14,438 lines to the inch.	Spectra of sun, chromosphere, etc., and laboratory investigation.
Revolving plate-holder with clockwork.	Compensating rotation of field of siderostat.
6″ Transit instrument from G.T. Survey of India.	For determination of standard time and general rating of chronometer.
Barrel chronograph by Hardy, Paris ..	For transit observations.
Prism Spectroscope. Six prisms with automatic deviation. (With photographic attachment and two dark slides).	For eye observations of solar and terrestrial spectra.
Small grating spectroscope	Examination of sunspot and chromospheric spectra with the Lerebour equatorial.

Instrument.	Employed for.
Photoheliograph by Dallmeyer, No. 4.	Arranged to give 8″ photographs of sun similar to others at Dehra, Mauritius and Greenwich.
	....
	....
Mean time clock. Kullberg No. 6326.	
Mean time chronometer. Kullberg No. 6299.	
Sidereal time chronometer. Kullberg No. 6134.	With electrical seconds contacts for chronographic registration.
Chronograph (old)	General recording purposes.
Sidereal clock. Shelton	
Chronograph, new, by Fuess	....
Stage micrometer. Hilger	For use with transit and magnetic work.
	For measurement of photographic spectra.
Theodolite, 6″; Cooke	General adjustment of instruments, positions of special objects and laying out new buildings.
Unifilar magnetometer. Elliott No. 16.	For absolute comparisons of magnetic elements.
Dip Circle. Barrow No. 46	
Declination and horizontal force magnetograph. Watson No. 2.	Automatic recording of magnetic elements.
2 Phototheodolites. Steinheil	Cloud photography.
Sextant	Time determination.
Seismometer. Milne's horizontal pendulum.	Continuous photographic registration of seismic disturbances.
2 Actinometers. Balfour Stewart ..	For series of comparisons of value of sun's heat.
Solar calorimeter. Buchanan	
Induction coil giving 4″ spark with 2 quart Leyden jars and vacuum tubes.	For comparison with spectra obtained from celestial sources.
Small polar heliostat	Adjustment of spectroscopes. Experimental work.
	....
Complete set of meteorological instruments.	
18-inch siderostat, by Cooke, with electrical slow motions.	To be used for supplying light for the new spectroheliograph, now on order.
2 Achromatic lenses, aperture 2 inches, 8 feet focus.	Part of additional apparatus for the spectrograph, for use with plane grating.
Dividing engine, Cambridge Scientific Instrument Company.	Not yet in use.
Double reflecting prism mounted on divided position circle, by Hilger.	Not yet in use.

All the above are now in good order.

The difficulty formerly experienced owing to the deposition of moisture on the 6-inch spectrograph lens has been largely removed by a modification of the method of mounting the lens at the end of the tube.

OBSERVATIONAL WORK OF THE OBSERVATORY.

The programme of investigations to be undertaken at the observatory was as follows:—

Solar physics—

(*a*) Observations of the six most widened lines in sunspot spectra between F and b, and other six between b and D.
(*b*) Observations of other widened lines in sunspot spectra.
(*c*) Visual observations of prominences and chromosphere.
(*d*) Photographs of solar disc in monochromatic light.
(*e*) Photographs of sunspot spectra.

Meteorological observations—

(*f*) As at present.

Other observations—

(*g*) Actinometry.
(*h*) Earthquake records.
(*i*) Cloud observations.

In addition to the above there are of necessity the astronomical observations for time, either by altitudes of the sun by means of the Sextant, or by Meridional observation with the Transit instrument.

Solar Physics.

4. **Observations of sunspot spectra.**—Instructions were communicated to the Acting Director that the routine work in solar physics was to be developed as rapidly as possible. In accordance with this, immediately on his arrival at the observatory in January, he made careful observations with all the three spectroscopes then available, viz., (*a*) a small grating spectroscope with collimator and telescope of about 4½ inches focal length; (*b*) a large six-prism spectroscope with collimator and telescope of 17 inches focus; (*c*) the four-inch concave grating spectrograph.

Of these the first was quite inadequate on account of its low power; the second was considerably better but still far from sufficient; with regard to the third, although it is possible to observe sunspot spectra by means of the concave grating by eliminating the astigmatism, the dispersion of the first and second orders was insufficient (the grating being of only 10 feet radius of curvature); the employment of higher orders was impracticable for routine visual observation, owing to the necessity for using colour screens to separate the overlapping orders. Moreover, the arrangement by which the light is fed from the siderostat, through a thick massive drain pipe, 40 feet long, made the constant attention which was necessary take an amount of time quite impossible for the establishment of this as routine duty, or in cases where only a few minutes clear sunshine were available.

This being so, it was decided to build up a spectroscope more suited to the work, and the two long focus lenses of the prism spectroscope were roughly mounted in conjunction with the grating of the small diffraction instrument. Excepting that the grating is too small to utilise the full aperture of the lenses, this gave an excellent combination, and observations were commenced on January 13 with this instrument mounted very roughly on the Lerebour and Secretan equatorial of 6 inches aperture. For some time no spots of sufficient magnitude for critical purposes were available, but on the 29th of January, a group appeared on the southern hemisphere, and the spectrum of the largest member of the group was very satisfactorily observed by Sir John Eliot, who was here on inspection at the time.

From this time onwards the sunspot spectra have been observed on every available occasion. As the assistants had had little experience in this spectroscopic work, it was necessary for the Acting Director to be responsible for the final observations until the assistants were sufficiently practised to distinguish between the objective widening due to selective absorption in the spot, and the more easily noticed subjective widening which is so often mistaken by beginners with this work.

Also the first temporary wooden mounting, which gave considerable flexure, had to be replaced by a more permanent one of metal. This was by the help of the mechanic, completed by June, and the completed instrument was thereafter erected on the 6-inch equatorial Cooke refractor, on account of this instrument being provided with a good position circle, which is necessary for the determination of the positions of prominences.

Since then the observations have been carried on very efficiently by the first and second assistants.

General result of observations.—From the examination of the observations made throughout the year, it is evident that the spectrum of the spots has been identical in every respect with that seen during the last four or five years, the twelve *most widened* lines being the same as those recorded visually at South Kensington and photographically at Yerkes. These lines are the following:—

F—b.	b—D.
5143·901	5727·873
5147·652	5731·437
5150·363	5671·071
5138·518	5737·288
5045·582	5743·645
5136·270	5426·474

These are due to Vanadium, Scandium, Titanium and some unknown element or elements.

5. **Observations of other widened lines.**—In the more complete examination of the sunspot spectra, the advantage of a greater dispersion than has previously been at my disposal has permitted the observation of lines which have either not been seen before or have been doubtful. It is extremely interesting to find on the subsequent reduction of these lines that the elements to which they are due agree in their general nature with those of the *twelve most widened* lines, *i.e.*, they are chiefly due to Vanadium, Titanium, Scandium and some unknown elements. One line of Chromium and one of Mn. or Ni. are the only representatives of the more common metallic elements.

Each of these lines will be examined critically with still higher dispersion, to allow of their better identification with the standard lines on Rowland's photographic map of the solar spectrum, and it is proposed to publish the results of the investigation in the first of a series of *Kodaikánal Observatory Bulletins*.

The following table gives the summary of the year's observations :—

Summary of observations of sunspot spectra during 1903.

Month.	Spectrum observed.	No spots.	Spots too small for observation.	Spots, but weather unfavourable.	Sun not visible.	Total.
1903.						
January	2	10	10	6	3	31
February	14	1	8	5	..	28
March	14	12	4	1	..	31
April	13	2	11	4	..	30
May	6	6	11	5	3	31
June	5	6	9	6	4	30
July	12	..	2	14	3	31
August	1	1	16	9	4	31
September	7	7	7	7	2	30
October	20	..	1	10	..	31
November	8	..	8	12	1	30
December	12	..	4	10	5	31
Total ..	114	45	91	90	25	365

6. **Observations of prominences and chromosphere.**—With the same instrument it has been possible to organise routine observations of the prominences and chromosphere. For this, on each day of observation, the zero error of the position circle is first determined, and then the circle readings of all prominences visible are recorded, the mean time of observation being noted. The corresponding position angles are afterwards reduced during the same day.

Complete records of sunspots, faculæ, prominences and magnetic disturbances for each month have been sent to the Director-General of Indian Observatories at Simla, and have been included in the Indian Monthly Weather Review for general information.

In the following list only those prominences have been included for which latitudes have been determined :—

Latitudes of Prominences observed at the Solar Physics Observatory, Kodaikánal.

Date.	Time.	Position angle.	Latitude.	Date.	Time.	Position angle.	Latitude.
1903.	HOUR.			1903.	HOUR.		
2nd Sept. ..	8 to 9	60 (4)	+ 51 E.				
		140	— 29 E.	25th Sept. ..	9-30 to 10 ..	230	— 62 W.
3rd ,, ..	8-30 to 9-30 ..	60 (series)	+ 51 E.			175	— 59 E.
						130	— 14 E.
		237 (2)	— 55 W.			61	+ 65 E.
13th ,, ..	9 to 10	354	+ 60 W.	28th ,, ..	9-30 to 10 ..	320	+ 24 W.
		139	— 26 W.			0	+ 64 W.
14th ,, ..	9 to 10	174	— 60 E.			180	— 64 E.
		139	— 25 E.	29th ,, ..	9-30 to 10 ..	177 (3)	— 61 E.
		120	— 6 E.			297	+ 1 W.
17th ,, ..	8 to 10 ..	170	— 55 E.				
22nd ,, ..	9-30 to 10-30 ..	357	+ 62 W.	30th ,, ..	9 to 9-30 ..	257	— 39 W.
		132	— 17 E.			317	+ 21 W.
		142	— 27 E.			177 (2)	— 61 E.

Latitudes of Prominences observed at the Solar Physics Observatory, Kodaikánal—*cont.*

Date.	Time.	Position-angle.	Latitude.	Date.	Time.	Position-angle.	Latitude.
1903.	HOUR.			1903.	HOUR.		
5th Oct. ..	9 to 9–30 ..	80	+ 36 E.	18th Nov. ..	8 to 9	235 (4)	— 56 W.
		132 (2)	— 16 E.			162	— 51 E
		182 (2)	— 66 E.			133	— 22 E.
		260	— 36 W.			308	+ 17 W.
8th ,, ..	9–30 to 10 ..	66	+ 50 E.			275	— 16 W.
		62	+ 54 E.	20th ,, ..	8 to 8–45 ..	93	+ 17 E.
		90	+ 26 E.			129 (2)	— 19 E.
		127	— 11 E.			164	— 54 E.
		130	— 14 E.			344	+ 54 W.
		132	— 16 E.	21st ,, ..	8–20 to 8–40 ..	135	— 25 E.
9th ,, ..	9–30 to 10 ..	186 (3)	— 70 E.			138	— 28 E.
		236	— 60 W.			144	— 34 E.
		149	— 33 W.			147	— 37 E.
		143 (3)	— 27 W.			155	— 45 E.
		94	+ 22 E.	23rd ,, ..	8–30 to 9–20 ..	148	— 39 E.
		175	— 59 E.			(Series)	
10th ,, ..	11 to 11–30 ..	57	+ 59 E.			133	— 24 E.
		153 (2)	— 37 E.			(Series)	
		188	— 67 E.			330	+ 41 W.
		264	— 32 W.			251	— 38 W.
11th ,, ..	..	184	— 68 E.			236 (2)	— 53 W.
		274	— 22 W.	24th ,, ..	8–20 to 8–40 ..	148	— 39 E.
		60 (2)	+ 56 E.	30th ,, ..	9 to 9–30 ..	141	— 34 E.
		94 (4)	+ 22 E.			124	— 17 E.
12th ,, ..	9–30 to 10 ..	181	— 65 E.			285 (2)	— 2 W.
		147	— 31 E.			65 (3)	+ 42 E.
		99	+ 17 E.	8th Dec. ..	9 to 9–30 ..	93	+ 11 E.
		327	+ 31 W.			98	+ 6 E.
19th ,, ..	9–20 to 9–45 ..	303 (2)	+ 7 W.			100	+ 4 E.
		255	— 41 W.			248	— 36 W.
20th ,, ..	8–45 to 9–5 ..	63	+ 53 E.			253	— 31 W.
		242 (5)	— 54 W.			255	— 29 W.
		249	— 47 W.	9th ,, ..	10–20 to 11 ..	155 (2)	— 52 E.
		254	— 42 W.			318	+ 35 W.
		296 (5)	0 W.			120	— 17 E.
22nd ,, ..	8–40 to 9 ..	145 (4)	— 29 E.			300	+ 17 W.
		229	— 67 W.			260	— 23 W.
		230	— 66 W.			243 (2)	— 40 W.
23rd ,, ..	9 to 10 ..	140	— 24 E.	10th ,, ..	8–20 to 9 ..	133	— 30 E.
		316 (2)	+ 20 W.			301—310	+ 18 W. to
		272 (2)	— 24 W.				+ 27 W.
		65	+ 51 E.			295	+ 12 W.
30th ,, ..	9–15 to 10–15 ..	354	+ 59 W.			293	+ 10 W.
		149 (2)	— 34 E.			313	+ 30 W.
		164	— 49 E.			166	— 68 E.
		92 (2)	+ 23 E.			221	— 62 W.
7th Nov. ..	9–45 to 10–45 ..	50	+ 64 E.			225	— 58 W.
		145	— 31 E.			41	+ 62 E.
		260	— 34 W.			265	— 18 W.
		262	— 32 W.			250	— 33 W.
		265	— 29 W.			245	— 38 W.
		276	— 24 W.	11th ,, ..	9–20 to 10–20 ..	170	— 68 E.
10th ,, ..	9–30 to 9–50 ..	58	+ 60 E.			163	— 61 E.
		83	+ 30 E.			154	— 52 E.
		128	— 15 E.			135	— 33 E.
		135	— 22 E.			119	— 17 E.
		136	— 23 E.			52 (2)	+ 50 E.
		145	— 32 E.	15th ,, ..	7–45 to 8–15 ..	39 (2)	+ 29 E.
		146	— 33 E.			42	+ 32 E.
		242	— 51 W.			165	— 65 E.
		243	— 50 W.			219	— 61 W.
		245	— 48 W.	16th ,, ..	8–30 to 9–20 ..	226	— 54 W.
12th ,, ..	10–10 to 10–30.	45	+ 67 E.			(Several).	
		46	+ 66 E.			51 (3)	+ 49 E.
		51	+ 61 E.			257 (5)	— 23 W.
		52	+ 60 E.			250	— 30 W.
		139	— 27 E.	17th ,, ..	8–45 to 9–20 ..	49	+ 51 E.
		176	— 64 E.			51	+ 49 E.
		186	— 74 E.			53	+ 47 E.
		241	— 51 W.			51—61	+ 49 E. to
13th ,, ..	9–15 to 9–40 ..	58	+ 54 E.			(A dozen).	+ 39 E.
		177	— 65 E.			226–231 (4)	— 54 W. to
		247	— 45 W.				— 49 W.
14th ,, ..	10 to 10–40 ..	175	— 63 E.			272	— 8 W.
		326	+ 34 W.			318	+ 38 W.
		146	— 34 E.			320	+ 40 W.
		277 (3)	— 15 W.			322	+ 42 W.
		259	— 38 W.			328	+ 46 W.
16th ,, ..	10–10 to 10–50..	66	+ 46 E.	22nd ,, ..	11 to 12 ..	334	+ 57 W.
		165 (3)	— 53 E.			(Several).	
		200	— 38 E.			134	— 37 E.
		228 (6)	— 64 W.			(Several).	
		48 (2)	+ 64 E.			128 (2)	— 29 E.
		268 (2)	— 24 W.			296	+ 21 W.
17th ,, ..	11–5 to 11–30 ..	272 (2)	— 20 W.			252	— 25 W.
						(Several)	

Latitudes of Prominences observed at the Solar Physics Observatory, Kodaikanal—*cont.*

Date.	Time.	Position-angle.	Latitude.	Date.	Time.	Position-angle.	Latitude.
1903.	HOUR.				HOUR.		
23rd Dec...	9-15 to 10-30 ..	96	+ 1 E.	1903.			
		78	+ 19 E.	26th Dec. ..	8-20 to 8-45 ..	62 (2)	+ 38 E.
		(Several).				136	— 41 E.
		70—60	+ 27 E to			206	— 69 W.
			+ 37 E.			209	— 66 W.
		237	— 40 W.			211	— 64 W.
		248	— 29 W.			225	— 50 W.
		156	— 59 E.				
		336	+ 59 W.	26th ,, ..	8-30 to 10-15 ..	110 (5)	— 15 E.
		186	— 39 E.			117	— 22 E.
		126	— 29 E.			144 (2)	— 49 E.
24th ,, ..	8-15 to 8-40 ..	63	+ 34 E.			156	— 61 E.
		71	+ 26 E.			204	— 71 W.
		139	— 42 E.			221	— 54 W.
		141	— 44 E.			296	+ 21 W.
		154	— 57 E.			308	+ 33 W.
		243	— 34 W.			49	+ 46 E.
25th ,, ..	8-20 to 8-40 ..	62	+ 34 E.			56	+ 39 E.
		241 (3)	— 35 W.			79	+ 16 E.

7. **8-inch solar pictures.**—The 4-inch Dallmeyer photoheliograph No. 4 was rather dilapidated, most of the adjustment screws being rusty, and in consequence the instrument had to be dismounted for thorough overhauling and cleaning. It was then again erected and adjusted, and the resulting pictures are very satisfactory. There still requires some attention to the mounting, which is far from rigid, necessitating the frequent adjustment of the finder marks for fixing the position of the image ready for exposure.

The plates employed have been Mawson's *Photomechanical* and Cadett's *Lantern*, size 10 × 10 inches, the development of which with hydroquinone is found quite satisfactory.

The following list gives the dates of the photographs obtained since the instrument was finally focussed :—

Days on which photographs of the sun have been taken at Kodaikánal with the 4-inch Dallmeyer Photoheliograph.

1903.
August 22, 25, 26, 27, 31.
September 1, 3, 13, 14, 15, 17, 19, 25, 26, 27, 28, 29.
October 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 23, 24, 28, 28, 29, 30, 31.
November 3, 4, 7, 9, 10, 12, 13, 14, 16, 28, 30.
December 2, 3, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 21, 22, 23, 24, 25, 31.

8. **Spectroheliograph for photographing the sun in monochromatic light.**—An instrument has been ordered from the Cambridge Scientific Instrument Company, England, for obtaining photographs of the sun in monochromatic light by the Hale method. The pillars for the foot-plates of this spectroheliograph are erected, and the positions of the levelling screws marked, so that as soon as the instrument arrives (it was promised in August) it can be set up and put to work.

18-inch Siderostat.—Provision for supplying the above instrument with light has been made by the purchase of a new Foucault Siderostat, made by T. Cooke & Sons, of York, England. It has an 18-inch plane silver-on-glass mirror, with differential electrical motors for fine adjustments in right ascension and declination.

This has been erected in the new building provided for the work, and is in going order ready for observation whenever the spectroheliograph is received.

9. **Photographs of sunspot spectra.**—A few photographs of sun spot spectra have been obtained but the dispersion at our disposal was too small, and a different arrangement is being got together; it is hoped that photographs of sun spot spectra will be started with large dispersion in a short time, the apparatus for which is now being assembled and got into adjustment.

10. **Time observations.**—During the greater part of the year the sky has been partially or wholly clouded over at noon, and in consequence of this the determination

of time has depended almost entirely on sextant observations made in the early morning.

The transit instrument has been got into working order, and a barrel chronograph cleaned up for use with it. When the weather has permitted, transits of the sun have been observed for determinations of time, but their number has been very few.

Great inconvenience is experienced during a long spell of cloudy weather in getting good time observations, and to mitigate this arrangements were in force for the transmission of a series of signals from Madras at 4·0 P.M. These were, however, rendered entirely useless by their being retransmitted *by hand* at intermediate stations. Representations were made to the Telegraphic authorities, and they kindly provided a new relay and sounder, at the same time arranging for a *through* connection for the time signals. This arrangement gives every satisfaction, and there will be no further difficulty excepting in cases of break down due to storms, etc.

11. **Meteorology.**—The barograph, thermograph and anemograph have been in good working order throughout the year. Eye observations of temperature (with dry and wet bulbs, dry maximum, dry minimum, wet minimum, grass minimum and sun maximum) pressure, direction and velocity of the wind, observations of cloud and rainfall have been made daily at 8h., 10h., and 16h., local mean time, at both Kodaikánal and Periyakulam, the meteorological station at the foot of the hills.

At Kodaikánal the hours of bright sunshine are recorded continuously with a Casella glass globe recorder.

All the instruments have been in working order throughout the year, and the tabulated results are given in the appendices at the end of the report. All meteorological observations are at once reduced and tabulated.

Weather telegrams are sent daily at 8–30 A.M. to the Meteorological Reporters of India and Madras.

The mean temperature for the year was 56°·5, the normal temperature for the previous three years being exactly the same value. The highest recorded temperature in shade was 74°·5 on March 23, and the lowest was 43°·5 on January 25. The highest mean daily temperature was 62°·7 on April 23, and the lowest 50°·2 on January 24.

The greatest amount of wind during the south-west monsoon occurred during the last week of July, the highest daily velocity being 751 miles on July 26. A storm of exceptional intensity occurred from the 4th to the 6th December, the total wind velocity on the 4th being 971 miles, the greatest hitherto recorded at this station. The mean hourly wind velocity during the year was 14 miles per hour, the normal for the last two years being 13 miles. The maximum hourly wind velocity during the year was 51 miles, and this occurred between 5h. and 6h. on the morning of the 4th December.

The total rainfall for the year was 69·55 inches, the average for the previous three years being 66·24 inches. The greatest rain fell early in August, there being 8·17 inches in the week ending the 11th.

12. **Actinometry.**—At Kodaikánal observations of the sun's heat are made with a Balfour Stewart actinometer whenever the sky is quite free from haze. The year under review has been remarkably poor in such days, and the number of observations are in consequence very few.

13. **Seismology.**—The Milne seismograph has been in continuous action throughout the year. During the great storm at the beginning of December the seismograph room was flooded, and the water dropping on the end of the boom caused it to sag against the bottom of the case; when the water was removed the instrument kept in good action thenceforwards.

It is interesting to note that during this storm a fairly large seismic disturbance was in progress, the greater part of the record of which was secured before the instrument became swamped. A list of the principal shocks recorded during the year under report is given in Appendix I.

14. **Cloud observations.**—The pressure of work attending the initiation of the spectroscopic observations has prevented the starting of the photographic registration of the upper clouds.

15. **Magnetic observations.**—Kodaikánal being one of the base stations for the Magnetic Survey of India now proceeding, complete records are taken (*a*) visually with the magnetometer and dip circle, (*b*) by continuous photographic registration with a Watson magnetograph recording horizontal intensity and declination.

Deflection observations were taken every morning at 10 A.M., Madras mean time, for determination of the scale co-efficient of the horizontal force magnetograph traces. Six of these deflections are read visually. Once every week the deflection is photographically recorded on the sheet carrying the traces.

The recording cylinders are so arranged that two days' photographic traces are obtained on the same sheet of paper, one above the other. The sheets are developed every second day, and are written up and read.

Temperatures in the underground vault were recorded continuously by a thermograph until March 23rd. As the curve was by that time practically a straight line, the thermograph was stopped, and temperatures have since been taken three times daily at 10h., 13h., and 16h., local mean time, from which the temperatures required for computation will be derived by interpolation.

Since the discontinuity caused by the illness of the magnetic observer in March, the checking of the reductions has been undertaken by the Magnetic Survey.

Captain H. A. D. Fraser, R.E., visited the station in January 1903 for comparison of the instruments for standardising purposes. On examination of the suspended systems of the magnetograph it was found, owing doubtless to the very damp state of the underground vault, that the systems of magnets were interlaced with fine fungoid growths, these also passing from the needles to the sides of the case, thus interfering considerably with the needles' freedom of motion. The various glass lenses were also covered with a thin film, causing considerable loss of light.

Both instruments were dismantled and thoroughly cleaned. The glass-covering cases were provided with felt packing saturated with corrosive sublimate, and sealed to the pillars with paraffin wax.

Small vessels containing pumice stone saturated with strong sulphuric acid were kept in the cases; boxes containing dry calcium chloride are placed on the floor near the dampest places, and dried blankets are suspended all round the walls of the vault. By the help of these additional precautions the instruments have been kept in good working order throughout the year.

Magnetic elements.—The mean value of the observed magnetic elements for the year 1903 are as follows:—

Mean westerly declination	0° 22′·1 (W).
Mean inclination or dip	3° 5′
Mean horizontal intensity	0·37369 C.G.S. units.

Magnetic disturbances.—With the approaching return of the maximum epoch of sun-spot activity, the present year has been characterised with an increasing number of magnetic disturbances. The most notable were those of October 12th and 31st, the latter being so violent that the light was deflected quite off the recording sheet. The curve shows so many variations that a table of the chief maxima and minima is given below:—

Time. Greenwich mean time.		Values of horizontal intensity.	
		Maxima.	Minima.
H.	M.		
6	49	·37543	..
7	46	..	·37232
8	34	·37387	..
10	24	..	·36961
10	54	·37141	..
13	6	..	·36789
14	50	..	·36784
18	55	·37164	..

The following list gives the times and durations of the chief disturbances recorded during the year :—

1903.

Date.	Kind.	Time L.M.T. From.	Time L.M.T. To.	Time L.M.T. Duration.	Remarks.
				HOURS.	
January.					
1st	..	..	..	..	
		I. II.	I. II.	1 and 1	
2nd	S	11–50 and 16	12–50 and 17	..	
3rd	S	3	13	10	
4th	M	4–30	16	11½	
5th	M	6	13	7	
6th	..	..	..	..	
7th	..	..	..	..	
8th	..	..	..	..	
9th	S	13	14	1	
10th	..	..	..	..	
11th	S	8–25	9–25	1	
12th	..	..	..	..	Instrument adjusted. No record.
13th	..	..	..	..	
14th	..	..	..	..	
15th	..	..	..	..	
16th	..	..	..	..	
17th	..	..	..	..	
18th	..	..	..	..	
19th	..	..	..	..	
20th	..	..	..	..	
21st	..	..	..	..	
22nd	S	6	9	3	
23rd	S	15	18	3	
24th	..	..	..	..	
25th	..	..	..	..	
26th	S	16	19–30	3–30	
27th	S	3–30	8	4–30	
28th	..	..	..	..	
29th	..	..	..	..	
30th	..	..	..	..	
31st	..	..	..	..	
February.					
1st	..	..	..	..	
2nd	..	..	..	..	
3rd	..	..	..	..	
4th	..	..	..	..	
5th	S	8	9	1	
6th	..	..	..	..	
7th	..	..	..	..	
8th	M	10	24	14	
9th	M	0	2	2	
10th	..	..	..	..	
11th	..	..	..	..	
12th	S	22·25	24	1·75	
13th	S	0	5	5	
14th	..	..	..	..	
15th	S	21·5	22	0·5	
16th	S	7	14	7	
17th	..	..	..	..	
18th	..	..	..	..	
19th	..	..	..	..	
20th	S	9	12	3	
21st	S	7	13	6	
22nd	M	10	13	3	
23rd	..	..	..	..	
24th	..	..	..	..	
25th	S	7·25	7·5	0·25	
26th	..	..	..	..	
27th	..	..	..	..	
28th	..	..	..	..	

1903—*cont.*

Date.	Kind.	Time L.M.T. From	Time L.M.T. To	Time L.M.T. Duration.	Remarks.
				HOURS.	
March.					
1st	S	20	24	4	
2nd	..	..	..	..	
3rd	..	..	..	..	
4th	..	..	..	..	
5th	S	2·5	16·25	13·75 and 3·25	
		20·75	24	..	
6th	S	0	2	2	
7th	S	11	13	2	
8th	S	10	19·25	9·25 and 1·5	
		22·5	24	..	
9th	S	0	15	15	
10th	..	..	..	..	
11th	..	..	..	..	
12th	M	10	24	14	
13th	M	0	23	23	
14th	..	..	..	..	
15th	..	..	..	..	
16th	..	..	..	..	
17th	..	..	..	..	
18th	..	..	..	..	
19th	..	..	..	..	
20th	..	..	..	..	
21st	..	..	..	..	
22nd	S	18	24	6	
23rd	S	0	6	6	
24th	S	11	13	2	
25th	..	..	..	..	
26th	..	..	..	..	
27th	..	..	..	..	
28th	..	..	..	..	
29th	S	6	18·5	12·5	
30th	M	7	16	9	
31st	S	0·5	13	12·5	
April.					
1st	..	..	..	..	
2nd	..	..	..	..	
3rd	..	..	..	..	No record from 13·46 to 21·25. Clock stopped.
4th	..	..	..	..	
5th	M	8·5	17	8·5	
6th	S	4·5	24	19·5	
7th	S	0	4	4	
8th	S	0·5	3	2·5	
9th	M and S	3·75 and 16	16 and 24	12·25 and 8	
10th	S	0	16	16	
11th	S	6·5	22	15·5	
12th	..	..	..	..	No record from 14·2 to 17·28. Clock stopped.
13th	..	..	..	..	
14th	..	..	..	..	
15th	S	4	23	19	
16th	..	..	..	..	
17th	S	10·75	12·5	1·75	
18th	S and S	7 and 17	13 and 24	6 and 7	
19th	S and M	0 and 6·5	3 and 12·5	3 and 6	
20th	..	..	..	..	
21st	S	7	14	7	
22nd	..	..	..	..	
23rd	..	..	..	..	
24th	..	..	..	..	
25th	..	..	..	..	
26th	M and S	1·5 and 19	16 and 24	14·5 and 5	
27th	S and S	0 and 14·5	3 and 15·5	3 and 1	
28th	..	..	..	..	
29th	..	..	..	..	
30th	S	9	11·5	2·5	

1903—*cont.*

Date.	Kind.	Time L.M.T.			Remarks.
		From	To	Duration.	
May.					
				HOURS.	
1st	..	..	..	..	
2nd	..	..	..	..	
3rd	..	..	..	..	
4th	S.	5	13	8	
5th	M.	0	16	16	20 to 21 and 22·25 to 24 very curious; brisky movements.
6th	S. and M.	0 and 6	6 and 18	6 and 12	0 to 3, 6 to 9, 23 to 24 very curious; brisky movements.
7th	S.	6	17·5	11·5	0 to 1, 2 to 4, 8·5 to 10· very curious; brisky movements.
8th	S.	..	9·25	?	15·30 to 17·30 and 20 to 21·30 no record.
9th	S.	..	..	..	
10th	S.	..	..	..	
11th	S.	..	..	..	
12th	..	..	..	..	
13th	..	..	..	..	
14th	S.	5	10	5	
15th	S.	6	11	5	
16th	..	..	..	..	
17th	M.	3	16	13	
18th	..	..	..	..	
19th	..	..	..	..	
20th	..	..	..	..	
21st	..	..	..	..	
22nd	S.	8	14	6	
23rd	S.	7	15	8	
24th	S.	0·5	11	10·5	
25th	S.	6	24	18	
26th	S.	0	1	1	
27th	..	..	..	..	
28th	S.	7·5	14·5	7	
29th	..	..	..	..	
30th	S.	8	10	2	
31st	S.	7	10	3	
June.					
1st	S.	19	24	5	
2nd	M. and S.	0 and 16	16 and 24	16 and 8	
3rd	S.	0	14	14	
4th	S.	7	15	8	
5th	S.	6	16	10	
6th	..	..	..	..	
7th	..	..	..	..	
8th	..	..	..	..	
9th	..	..	..	..	
10th	..	..	..	..	
11th	S.	6	14	8	
12th	..	..	..	..	
13th	..	..	..	..	
14th	..	..	..	..	
15th	..	..	..	..	
16th	S.	10	24	14	
17th	M.	0	10	10	
18th	S.	6	22	16	
19th	S.	6·5	21	14·5	
20th	S.	6·5	13	6·5	
21st	S.	6·5	10	3·5	
22nd	M. and S.	6 and 20	13 and 24	7 and 4	
23rd	..	..	..	..	
24th	S.	7	14	7	
25th	..	..	..	..	
26th	..	..	..	..	
27th	..	..	..	..	
28th	M.	6·5	24	17·5	
29th	M. and S. and M.	0 and 5 and 16	1 and 12 and 24	1 and 7 and 8	
30th	M.	0	16	16	

1903—*cont.*

Date.	Kind.	Time L.M.T.			Remarks.
		From	To	Duration.	
July.					
				HOURS.	
1st	S.	7	14	7	
2nd	S.	6·5	13	6·5	
3rd	S.	7·5	16	8·5	
4th	..	..	..	..	
5th	..	..	..	..	
6th	M.	1	16	15	
7th	..	..	..	..	
8th	..	..	..	..	
9th	..	..	..	..	
10th	..	..	..	..	
11th	..	..	..	..	
12th	..	..	..	..	
13th	S.	10	16	6	
14th	S.	6	14	8	
15th	..	..	..	..	
16th	S.	13	24	11	
17th	S.	0	15·5	15·5	
18th	M.	9	12	3	
19th	M.	6	16	10	
20th	S.	8	16·5	8·5	
21st	S.	7	8	1	
22nd	..	..	.	..	
23rd	..	..	..	..	
24th	..	..	..	..	
25th	S.	7	18	11	
26th	M.	0	20	20	
27th	S.	0	16	16	
28th	S.	6	22	16	
29th	S.	7	13	6	
30th	..	..	..	..	
31st	..	..	..	..	
August.					
1st	..	..	..	..	
2nd	S.	12	16	4	
3rd	..	..	..	..	
4th	S.	8	18	10	
5th	S.	6	11	5	
6th	S.	7	15	8	
7th	..	..	..	..	
8th	S.	6·5	16	9·5	
9th	..	..	..	..	
10th	..	..	..	..	
11th	M	5	24	19	
12th	S.	7	19	12	
13th	S.	7	24	17	
14th	S.	3	16	13	
15th	S.	7	15	8	
16th	S.	8	13	5	
17th	S.	10	14	4	
18th	S.	7	13	6	
19th	..	..	..	..	
20th	S.	9	15	6	
21st	S.	18	22	4	
22nd	G.	0	24	24	
23rd	S.	0	16	16	
24th	..	..	..	..	
25th	..	..	..	..	
26th	M.	4	17	13	
27th	S.	7	13	6	
28th	..	..	..	..	
29th	..	..	..	..	
30th	..	..	..	..	
31st	..	..	..	..	

1903—*cont.*

Date.	Kind	Time L.M.T. From	Time L.M.T. To	Time L.M.T. Duration.	Remarks.
				HOURS.	
September.					
1st	S	7·5	23	15·5	
2nd	..	..	..	..	
3rd	..	..	..	..	
4th	M	11	24	13	
5th	M	0	23	23	
6th	S	7	13	6	
7th	..	..	..	..	
8th	M	1·5	24	22·5	
9th	S	7	16	9	
10th	M	7	24	17	
11th	S	6	14	8	
12th	M	8	23	15	
13th	..	..	..	..	
14th	..	..	..	..	
15th	..	..	..	..	
16th	..	..	..	..	
17th	..	..	..	..	
18th	..	..	..	..	
19th	M	10	24	14	
20th	M	0	23	23	
21st	..	..	..	..	
22nd	..	..	..	..	
23rd	S	7	20	13	
24th	S	9	13	4	
25th	..	..	..	..	
26th	..	..	..	..	
27th	..	..	..	..	
28th	..	..	..	..	
29th	M	..	..	..	
30th	..	..	..	..	
October.					
1st	..	..	..	..	
2nd	S	11	20	9	No record from 3 to 10
3rd	S	6·5	11	4·5	
4th	..	..	..	..	
5th	S	7	24	17	
6th	S	8	24	16	
7th	S	0	14	14	
8th	M	7	24	17	
9th	..	..	..	..	
10th	S	8	15	7	
11th	S	7	24	17	
12th	G	0	24	24	
13th	G	0	18	18	
14th	M	0	22	22	
15th	..	..	..	..	
16th	..	..	..	..	
17th	..	..	..	..	
18th	..	..	..	..	
19th	S	6	16	10	
20th	..	..	..	..	
21st	..	..	..	..	
22nd	S	10	24	14	
23rd	..	..	..	..	
24th	..	..	..	..	
25th	M	13	24	11	
26th	M	0	24	24	
27th	S	0	14	14	
28th	..	..	..	..	
29th	S	15	21	6	
30th	M	3	16	13	
31st	V. G.	2	24	22	Record lost as the magnet was deflected off sheet.

1903—*cont.*

Date.	Kind.	Time L.M.T. From	Time L.M.T. To	Time L.M.T. Duration.	Remarks.
				HOURS.	
November.					
1st	V.G.	0	24	24	
2nd	M.	0	24	24	
3rd	M.	6	24	18	
4th	M.	0	24	24	
5th	M.	0	24	24	
6th	M.	5	14	9	
7th	S.	4	17	13	
8th	S.	0	13	13	
9th	..	..	..	..	
10th	S.	3	24	21	
11th	S.	0	18·5	18·5	Low intensity, rising to normal.
12th	S.	20·5	22	1·5	Local increase of H.
13th	S.	20·5	22	1·5	Do.
14th	..	..	..	..	
15th	S.	8·75	9·25	0·5	Small increase, sudden.
16th	S.	18·0	24	6	Sustained variation, without sudden maxima.
17th	S.	0	16	16	
18th	S.M.	0 and 17 *	17 and 19 *	17 and 2 *	* Sudden increase.
19th	S.	0	17	17	Depression in H.F.
20th	S.	0	..	..	Continual series of small variations, in general depression.
21st	S.	..	..	..	
22nd	S.	..	..	..	
23rd	S.	..	3·5	..	
24th	..	..	..	..	
25th	..	..	..	..	
26th	S.	8·0	..	..	Small variations throughout, chiefly depression.
27th	..	..	..	..	
28th	..	..	..	..	
29th	..	..	..	..	
30th	..	..	24	..	
December.					
1st	S.	10	14	4	
2nd	M.	11·5	14·5	3	Small crests but big troughs.
3rd	S.	7	14	7	Small variation usually depression.
4th	M.	18	22·5	4·5	Big crests, small troughs.
5th	S.	19	19·5	0·5	Sudden increase.
6th	S.	1	1·5	0·5	Do.
7th	S.	10	12	2	Small variation without sudden maxima.
8th	S.	8·5	14·5	6	Do. do. usually elevation.
9th	..	..	..	..	
10th	..	..	..	..	
11th	..	..	..	..	
12th	..	..	..	..	
13th	G.	14	24	10	Gradual depression.
14th	G.	0	10	10	Do. between 1 and 3 sudden rise.
15th	M.	17	24	7	Do. do.
16th	..	..	..	..	
17th	..	..	..	..	
18th	..	..	..	..	
19th	S.	7	12	5	Small variations with sudden maxima.
20th	M.	10	24	14	Usually depression.
21st	S.	8	19	11	Do.
22nd	..	..	..	..	
23rd	S.	23·75	0	0·25	Sudden increase.
24th	S.	0	0·25	0·25	
25th	S.	7	24	17	Usually elevation.
26th	S. and M.	0 and 7	7 and 15·5	7 and 8·5	Do.
27th	M. and S.	11 and 17	12·5 and 22·5	1·5 and 5·5	Elevation.
28th	S.	7	24	17	
29th	S.	0	10	10	
30th	G. and S.	6·75 and 18·75	18·75 an	12 and 3·75	Sudden maxima and minima.
31st	M. and G.	2 and 10	10 and	8 and 4	Depression.

16. **Library.**—All the large volumes of proceedings and transactions are bound up to date. One hundred and three books have been bound during the year. Five hundred and twenty-three books, periodicals and pamphlets have been received.

The general uncertain weather through the greater part of the year has made a considerable demand on the members of the staff, it having only been possible to get the solar observations by attending an hour earlier every morning; for a long time all the actual observational work had to be done between 7 and 9-30 A.M. In conclusion I wish to express my thanks to the whole establishment for the support afforded me throughout, the help of which has considerably lightened the labour which devolved on the organisation of a new series of duties.

KODAIKÁNAL,
8th January 1904.

CHARLES P. BUTLER,
Ag. Director, Kodaikánal and Madras Observatories.

II.—ANNUAL REPORT OF THE MADRAS OBSERVATORY FOR THE YEAR 1903.

1. **Staff.**—The first Assistant Mr. M. B. Subba Rao resigned his appointment in March, and Mr. M. G. Subrahmanyam from the Kodaikánal Observatory was appointed in his place.

Mr. Solomon Pillai, the computer, took one month's privilege leave from the 6th April.

At the end of the year the staff consisted of—

Mr. S. Solomon Pillai, Computer and Manager;
Mr. M. G. Subrahmanyam, B.A., First Assistant;
Mr. E. Ramanujam Pillai, Second Assistant.

Astronomical observations made during the year were as usual solely directed to time determinations. These involved the observation of 428 clock stars, and 80 azimuth stars and in addition 93 determinations of level and collimation. These observations were made by Messrs. Solomon Pillai and Subrahmanyam.

2. **Time service.**—In last year's report it was mentioned that the question of transmitting time signals to Colombo daily at 8 A.M. from the observatory had been raised. Arrangements for this were completed early in the year and since the 14th February a series of signals terminating at 8 A.M. similar to the 4 P.M. roll have been daily sent to Colombo. With this exception no change was made in the time signals controlled by the observatory.

The time gun at the Fort was fired correctly on 709 occasions out of 730 in the year, giving a percentage of successes of 97·1. Out of 21 failures, eight occurred in September and October and were due, in part, to a defect in the firing apparatus which was rectified on the 19th October. On two occasions the gun was fired by accident before the time and on seven days the gunner was absent.

The time ball at the Port office failed at 1 and 2 P.M. on two days; on one other occasion it failed at 1 P.M. and was dropped correctly at 2 P.M.

The following table shows all the failures and their causes:—

Month and date.	Signal.	Fault.	Cause.
2nd February	Noon gun	Failed	Bad tube.
3rd ,,	Do.	Do.	Tube missed fire.
31st March	8 P.M. gun	Do.	Not known.
30th April	Time ball	Failed at 1 P.M. and dropped at 2.	..
2nd May	8 P.M. gun	Failed	Gunner absent.
16th ,,	Time ball	Failed both at 1 and 2 P.M.	Line in contact.
17th ,,	8 P.M. gun	Failed	Do.
2nd June	Do.	Do.	Gunner absent.
16th ,,	Noon gun	Do.	Bad tube.
21st July	Do.	Fired 5 minutes too soon	..
9th September	Do.	Failed	Gunner absent.
22nd ,,	Do.	Fired 6 minutes too soon	..
26th ,,	Time ball	Failed both at 1 and 2 P.M.	..
28th ,,	8 P.M. gun	Failed	No clock current.
8th October	Do.	Do.	Gunner absent.
10th ,,	Noon gun	Do.	Do.
15th ,,	8 P.M. gun	Do.	Weight slipped.
18th ,,	Do.	Do.	Weight did not drop.
24th ,,	Do.	Do.	Tube failed.
10th November	Do.	Do.	Bad tube.
3rd December	Do.	Do.	Do.
7th ,,	Noon gun	Do.	Gunner absent.
25th ,,	8 P.M. gun	Do.	Do.
30th ,,	Do.	Do.	Tube failed.

3. **Meteorological observations.**—Meteorological observations were carried on as in the former year and the registers of the 10 hours and 16 hours observations were reduced and sent to Calcutta together with the observations of clouds. In addition to the ordinary weather messages sent daily, special storm observations were supplied to Simla four times and to Calcutta on the following dates:—

May 19; August 28—30; September 15—17, 22; October 4—5, 27—29; November 5—6, 25—27; December 3—5, 29—30.

In addition to the ordinary work the tabulation of the hourly traces of the anemograph at Dodabetta has been carried out at this office since April.

Harmonic analysis of pressure observations at Bangalore and Madras and the analysis of ground temperatures at five different stations [Jaipur, Allahabad, Dehra Dun, Lahore, and Calcutta (Alipore)] were worked out with the help of the Computer and the First Assistant. These and the discussion of the results obtained have been submitted to the Meteorological Reporter to the Government of India and Director-General of Indian Observatories for publication in the Indian Meteorological Memoirs.

4. **Buildings.**—The buildings have been kept in good condition throughout the year and the press room for printing the weather charts was finished. The thermometer shed was renewed before the monsoon.

Instruments.—The sidereal clock by Haswall, the meantime clock by Shepherd, the transit clock by Dent, and the post-office clock were cleaned during the year. The rate of the transit clock was very variable for some time after it was cleaned but has now become fairly steady again. The 8-inch equatorial and the transit instruments are in good order. An old one-prism spectroscope by Troughton and Simms is being modified, so as to enable a grating to be substituted for the prism. Thus modified it will be possible to use it on the 8-inch equatorial to examine the sun for prominences, etc., on days when no observations are possible at Kodaikánal in their rainy season.

A new meantime chronometer No. 6544 by Victor Kullberg was received during the year.

A new thermograph was brought into use in November; the traces of this instrument are very satisfactory.

The following is a summary of the meteorological and weather conditions at Madras during the year 1903 :—

Pressure was above normal in January, February, April and May and below normal during the rest of the year, the greatest excess being 0·046 inch in February and the greatest defect 0·051 in October. The lowest daily mean pressure was 29·547 on July 30th and the highest 30·170 on February 9th.

Temperature.—The mean temperature was normal in April and below the average in all the other months except January, February, March and October. The highest temperature recorded during the year was 103°·1 on June 27th and the lowest 65°·3 on December 8th.

Humidity.—The percentage of humidity was above normal throughout the year. It was lowest on August 6th, when it was 38.

Rainfall.—Rainfall was below the average in March, April, July and October and above the average in the other months. The greatest deficiency was 2·16 inches in October and the greatest excess 14·35 inches in December.

Notwithstanding the late establishment of the north-east monsoon, the monsoon rainfall from October 15th to December 31st was 44·50 inches, being 18·50 inches above normal and the total fall for the year was 79·62 inches, being 30·60 inches above the average.

Winds.—The wind velocity was below normal during the year except in February when southerly winds were unusually strong and prevalent. The wind direction was nearly normal in all other months except September and October. In the former it was 3 points west from normal and in the latter 7 points south.

Sunshine.—The percentage of bright sunshine was below the average during the whole year. There were 1,977·5 hours of sunshine, giving a percentage of 44·8 of the possible maximum.

Storms.—No storm crossed the Madras Coast. But a storm of moderate severity moved towards the Circars Coast on October 28th and another small storm crossed the coast near Cuddalore on December 30th. Exceptionally heavy rain amounting to 13·32 inches fell at Madras and over the Carnatic between the 28th and 31st December. Such heavy and general rain so late in the season has no parallel as far as available records go.

MADRAS,
8th January 1904.

R. LL. JONES,
Deputy Director.

KODAIKÁNAL,
8th January 1904.

CHARLES P. BUTLER,
Ag. Director, Kodaikánal and Madras Observatories.

Appendix I.

KODAIKÁNAL Observatory seismological records.

No.	Date.	P.T. Commencement G.M.T.	L.W. Commencement G.M.T.	Maxima G.M.T.	End, G.M.T.	Maxima Amplitude.	Duration.	Remarks.
	1903.	H. M.	H. M.	H. M.	H. M.	MM. ,,	H. M.	
1	Jan. 6 ..	10 39·0	..	17 56·0	..	..	..	Succession of slight disturbances during the whole of this period with distinctly indicated maxima at times shown.
				19 10·0				
				19 45·0				
				22 08·0				
				23 01·0				
	,, 7 ..	..	..	1 29·0	9 29·0	..	22 50·0	
2	,, 8 ..	..	..	0 26·8	..	0·5 0·3	..	
3	..	..	..	16 42·8	..	..	..	Thickening of line.
4	..	..	..	16 48·5	..	0·25 0·1	..	
5	..	..	..	17 00·3	..	0·5 0·3	..	
6	..	..	..	17 25·8	..	0·25 0·1	..	
7	..	..	..	17 31·5	..	0·25 0·1	..	
8	..	..	..	22 27·4	..	..	..	Thickening of line.
9	,, 9 ..	..	..	2 53·0	..	..	..	Do.
10	,, 10 ..	2 38·3	..	..	3 04·5	..	0 26·2	Slight continuous disturbance.
11	,, 10 ..	..	..	22 10·8	..	..	..	Thickening of line.
12	..	23 11·9	..	23 16·0	..	..	..	Do.
				23 22·1	..	..	..	Do.
				23 29·3	23 40·1	..	0 28·2	Do.
13	,, 14 ..	2 11·4	2 55·7	2 58 2	..	2·0 1·1		
				3 00·8	..	1·0 0·5		
				3 03·3	..	1·2 0·7		
				3 16·5	3 56·7	1·2 0·7	1 45·3	
14	,, 15 ..	..	..	10 09·9	..	..	..	Thickening of line.
15	,, 16 ..	..	..	17 04·9	..	0·4 0·2	..	
16	,, 18 ..	..	..	9 12·3	..	..	..	Do.
17	,, 24 ..	17 06·1	..	17 15·8	17 30·1	0·3 0·2	0 24·0	
18	,, 25 ..	..	..	17 16·8	..	0·5 0·3	..	
19	,, 26 ..	..	..	5 37·2	..	0·4 0·2	..	
20	,, 27 ..	..	..	3 45·7	..	0·5 0·3	..	
21	,, 28 ..	..	..	6 04·9	..	0·75 0·4	..	
22	Feb. 1	9 47·7	9 54·9	9 57·5	..	2·5 1·4	..	
				10 03·1	..	3·5 1·9	..	
				10 05 7	10 56·4	2·0 1·1	1 08·7	
23	,, 3 ..	..	..	5 39·5	..	..	..	Too near hour mark for determination.
24	,, 5 ..	19 18·5	19 41·1	19 43·9	20 01·6	0·5 0·3	0 43·1	
25	,, 6 ..	7 57·0	7 59·5	7 59·5	8 18·0	0·65 0·3	0 21·0	
26	,, 11 ..	16 17·1	16 24·8	16 32·1	..	0·5 0·3	..	
				16 42·3	16 51·1	0·5 0·3	0 34·0	

Kodaikánal Observatory seismological records—*cont.*

No.	Date.	P.T. Commencement G.M.T.	L.W. Commencement G.M.T.	Maxima G.M.T.	End, G.M.T.	Maxima Amplitude.	Duration.	Remarks.
	1903.	H. M.	H. M.	H. M.	H. M.	MM. „	H. M.	
27	Feb. 13 ..	..	..	10 32·8	..	..	..	Thickening of line.
28	„ 14 ..	..	..	10 35·4	..	..	..	Do.
29	„ 24 ..	..	..	9 47·7	..	..	..	Thickening of line (elongated)
30	„ 27 ..	0 50·3	0 54·9	1 04·1	..	7·0 4·1	..	
				1 05·7	..	8·0 4·7	..	
				1 07·2	..	6·5 3·8	..	
				1 11·8	2 32·6	7·0 4·1	1 42·3	
31	Mar. 2 ..	..	..	0 13·7	..	..	..	Thickening of line.
32	„ 10 ..	..	..	10 35·9	..	..	..	Do.
33	„ 20 ..	..	..	10 31·6	..	0·5 0·2	..	
34	„ 27 ..	..	..	10 32·3	..	..	..	Do.
	Record for March 28—30 spoiled by accident to film.							
35	Apr. 7 ..	..	..	6 15·0	..	..	..	Do.
36	„ 8 ..	2 57·8	..	..	3 00·9	..	0 03·1	Thickening of line (elongated)
37	„ 8 ..	..	..	10 30·1	..	..	..	Small shock.
38	„ 13 ..	..	..	5 03·7	..	2·0 1·1	..	?Accidental oscillation.
39	„ 13 ..	..	..	10 45·1	..	0·5 0·3	..	
40	..	..	..	10 45·6	..	1·5 0·8	..	? Accidental.
41	„ 20 ..	..	..	3 58·1	..	..	..	Thickening of line.
42	„ 25 ..	..	..	10 51·3	..	..	..	Do.
	„ 25 ..	..	..	10 52·8	..	..	..	Do.
43	„ 28 & 29.	23 56·4	23 59·0	0 11·8	0 25·2	0·5 0·3	0 28·8	
44	May 11 ..	..	..	5 16·9	..	..	..	Do.
45	„ 13 ..	6 43·1	..	6 56·6	7 36·9	0·75 0·5	0 53·8	
46	„ 13 ..	..	..	15 29·2	..	0·75 0·5	..	
47	„ 17 ..	0 49·8	0 54·4	1 01·6	..	1·0 0·6	..	
		..	..	1 02·8	1 53·4	1·5 0·9	1 03·6	
48	„ 22 ..	..	..	2 58·5	..	..	..	Thickening of line.
49	..	..	..	7 03·0	..	..	..	Do.
50	„ 23 ..	21 20·0	..	21 25·7	21 35·4	0·3 0·1	0 15·4	
51	„ 25 ..	..	..	12 24·0	..	..	..	Thickening of line.
	„ ..			12 25·0	..	..	..	Do.
52	„ 26 ..	..	..	9 14·8	..	..	..	Do.
53	June 2 ..	13 41·6	..	13 50·3	..	..	..	Series of slight connected shocks.
		..	..	13 55·4	14 25·2	..	0 43·6	
54	„ 4 ..	..	..	10 38·0	..	..	..	Thickening of line.
55	„ 6 ..	..	..	17 59·4	..	..	..	Two small sudden shocks.
		..	..	18 01·8	..	..	..	
56	„ 8 ..	5 47·2	6 08·1	6 10·7	6 19·3	0·3 0·1	0 32·1	
57	„ 22 ..	..	..	3 08·7	..	..	..	Thickening of line.

Kodaikánal Observatory seismological records—*cont.*.

No.	Date.	P.T. Commencement G.M.T.	L.W. Commencement G.M.T.	Maxima G.M.T.	End, G.M.T.	Maxima Amplitude.	Duration.	Remarks.
	1903.	M. M.	M. M.	H. M.	H. M.	M.M. „	H. M.	
58	July 16 ..	..	..	13 20·9	..	..	..	Thickening of line.
59	„ 16 ..	..	..	15 36·0	..	..	..	Do.
60	Aug. 11 ..	..	..	4 50·7	..	0·5 0·2	..	....
61	„ 16 ..	..	..	9 05·4	..	..	..	Thickening of line.
62	„ 17 ..	..	..	4 42·1	..	..	..	Slight shock.
63	„ 17 ..	..	..	5 45·6	..	..	..	Thickening of line.
64	„ 17 ..	..	..	5 48·7	..	..	..	light shock.
65	„ 21 ..	..	..	2 59·0	..	..	..	Thickening of line.
66	„ 21 ..	..	..	4 48·2	..	..	..	Do.
67	„ 26 ..	..	..	6 23·0	..	..	..	Do.
68	„ 30 ..	..	..	1 29·5	..	..	..	Do.
69	Sept. 1 ..	..	..	2 31·1	..	..	..	Do.
70	„ 1 ..	..	..	15 11·5	..	..	..	Thickening o line.
71	„ 7 ..	7 36·0	8 08·5	8 12·7	8 19·7	0·4 0·2	..	Silchar.
72	„ 8 ..	..	..	5 47·8	..	..	..	Elongated thickening of line.
73	„ 8 ..	..	..	5 51·4	..	..	..	Do.
74	„ 13 ..	..	..	3 43·6	..	..	..	Bukarest 10 A.M. Thickening of line.
75	„ 18 ..	..	..	12 42·5	..	..	..	Very slight shock?
76	„ 25 ..	..	..	2 12·6	..	..	..	Thickening of line.
77	„ 26 ..	..	..	5 34·4	..	..	..	Do.
78	Oct. 21 ..	10 14·1	10 18·7	10 20·7	11 5·4	1·9 0·6	0 51·3	Local shock.
79	„ 29 ..	14 44·1	15 14·6	15 16·1	15 49·7	0·5 0·2	1 5·6	Extended shock.
80	„ 30 ..	4 44·1	4 52·2	4 55·8	15 24·9	0·5 0·3	0 40·8	Do.
81	„ 31 ..	..	..	3 52·7	..	0·3 0·2	..	Two slight shocks.
82	„ 31 ..	..	..	4 24·2	..	0·3 0·2	..	Do.
83	Nov. 11 ..	..	..	3 08·6	..	..	..	Thickening of line.
84	„ 11 ..	..	..	4 55·3	..	..	..	Do.
85	„ 12 ..	..	..	6 30·7	..	..	..	Do.
86	„ 13 ..	..	..	2 18·4	..	..	..	Do.
87	„ 13 ..	..	..	6 26·8	..	..	..	Do.
88	„ 24 ..	..	..	11 46·5	..	..	..	Do.
89	„ 24 ..	14 54·4	15 01·6	15 10·3	15 25·7	1·75 1·1	0 31·3	Well defined shocks.
90	„ 26 ..	12 15·9	..	12 21·6	12 36·4	0·38 0·2	0 20·5	Prolonged maximum. Assam earthquake.
91	„ 28 ..	..	..	3 55·4	..	..	..	Thickening of line.

Kodaikánal Observatory seismological records—*cont.*

No.	Date.	P.T. Commencement G.M.T.	L.W. Commencement G.M.T.	Maxima G.M.T.	End, G.M.T.	Maxima Amplitude.	Duration.	Remarks.
	1903.	H. M.	H. M.	H. M.	H. M.	M.M. ,,	H. M.	
92	Nov. 28 ..	..	..	4 8·7	..	..	..	Thickening of line.
93	,, 30 ..	..	..	4 38·0	..	..	..	Do.
94	Dec. 4 ..	15 29·8	16 45·1	17 17·1	End of record lost through swamping of instrument by rain.	2·0 0·8	..	....
	,, 4 ..	..	..	17 21·2		2·0 0·8	..	....
	,, 4 ..	..	..	17 26·3		2·5 1·1	..	....
	,, 4 ..	..	..	19 4·4		2·25 1·0	..	....
	,, 4 ..	..	..	19 7·5		2·25 1·0	..	....
	,, 4 ..	..	..	19 56·3		1·75 0·7	..	....
95	,, 10 ..	17 8·6	17 12·7	17 20·4	18 7·6	6·0 3·2	0 59·0	Sudden shock.
96	,, 23 ..	1 28·0	..	1 32·0	..	0·5 0·3	..	....
	..	..	..	1 33·4	1 34·2	0·4 0·2	0 6·2	....
97	Dec. 28	3 4·6	3 11·8	3 16·4	..	1·0 0·5	..	....
	..	..	..	3 23·2	3 42·1	0·3 0·4	0 37·5	....

Appendix II.

MEAN monthly and annual meteorological results at the Kodaikánal Observatory in 1903.

Month.	Barometer.		Dry bulb thermometer.				Wet bulb.		Tension of vapour.	Relative humidity.	Sun Max. in vac.	Min. on grass.	Wind.			Rain.		Clear sky.	Bright sunshine.
	Reduced to 32°.	Daily range.	Mean.	Max.	Min.	Range.	Mean.	Min.	By Blanford's tables.				Daily velocity.	Mean direction.		Amount.	Days		
	Inches.	Inches.	°	°	°	°	°	°	Inches.	Cents.	°	°	Miles.	Points.	Points.	Inches.	No.	Cents.	Hours.
January	22·865	0·075	54·0	64·0	47·6	16·4	48·8	42·2	0·295	71	117·1	38·6	287	5	NE by E	1·25	3	62	203·0
February	·891	·072	55·3	66·2	48·6	17·6	49·8	43·4	·306	70	126·7	40·5	292	6	ENE	1·00	3	62	203·1
March	·852	·067	59·0	70·6	51·4	19·2	49·6	42·9	·265	53	131·7	39·6	275	7	E by N	0·29	1	72	250·9
April	·843	·067	59·7	69·3	53·4	15·9	52·4	46·1	·322	63	133·6	45·6	317	10	ESE	4·07	5	56	208·6
May	·806	·070	59·5	67·3	54·3	13·0	55·4	50·1	·400	79	131·8	48·4	282	2	NNE	6·00	16	42	174·6
June	·766	·064	58·7	66·4	54·7	11·7	54·8	50·9	·393	79	129·0	48·9	334	29	NW by N	5·29	11	28	107·2
July	·732	·058	56·1	61·7	53·2	8·5	53·5	50·6	·387	85	119·8	50·1	618	28	NW	5·42	16	15	73·9
August	·761	·066	56·0	62·3	52·4	9·9	53·5	49·5	·387	86	123·8	48·0	323	29	NW by N	12·94	19	21	95·5
September	·774	·080	56·2	62·2	52·9	9·3	54·3	51·2	·405	89	122 2	50·2	314	29	NW by N	9·73	20	17	78·0
October	·777	·080	55·8	63·5	51·3	12·2	52·8	48·2	·373	83	125·1	46·2	273	31	N by W	5·65	10	32	135·9
November	·812	·079	55·0	62·8	50·1	12·7	50·5	44·7	·328	76	117·9	44·0	237	30	NNW	5·85	12	44	143·6
December	·810	·070	52·6	60·4	47·2	13·2	47·4	41·3	·283	71	108·8	41·7	361	5	NE by E	12·06	9	58	168·6
Annual ..	22·807	0·071	56·5	64·7	51·4	13·3	51·9	46·8	0·344	75	124·0	45·2	326	2	NNE	69·55	125	42	153·5

EXTREME monthly meteorological records at the Kodaikánal Observatory in 1903.

Month.	Barometer.					Dry bulb thermometer.				Wet bulb.		Humidity.		Sun. Th. in vacuo.		Grass therm.		Wind.				Rain.	
	Highest.		Lowest.		Range.	Highest.		Lowest.		Lowest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Greatest fall.	
	Inches.	Day.	Inches.	Day.	Inches.	°	Day.	°	Day.	°	Day.	Cents.	Day.	°	Day.	°	Day.	Miles.	Day.	Miles.	Day.	Inches.	Day.
January	22·963	8	22·793	23	0·170	71·1	18	43·5	25	35·1	31	16	30	130·5	25	28·7	29	612	5	90	1	0·50	6
February	·973	14	·812	5	·161	72·9	28	45·6	9,21	37·0	9	25	27	136·6	16, 18	33·2	16	544	2	141	6	·54	18
March	·934	27	·775	11	·159	74·5	23	46·9	2	34·9	4	12	4, 5, 20	144·8	26	32·2	2	444	22	142	9	·23	10
April	·927	6	·774	24	·153	74 3	22	50·5	8	38·4	3	13	3	145·8	30	41·2	30	474	22	146	8	1·47	7
May	·897	1, 3	·686	19	·211	71·0	5, 7	49·4	20	44·6	22	43	5	143·6	7	42·7	26	613	18	131	30	1·50	19
June	·862	4	·674	26	·188	72·3	6	52·0	19	42·5	23	38	5	152·1	29	40·2	28	642	19	141	4	1·53	2
July	·819	21	·648	13	·171	67·1	4	51 7	25	46·2	20	64	9	141·6	4	46·2	1, 6	751	26	106	7	0·87	6
August	·839	24	·656	29	·183	65·4	8, 10	50·4	10	43·9	28	53	28	144·6	16	42·1	22	604	20	132	6	1·63	11
September	·859	26	·690	14	·169	66·0	27	50·8	11	44·9	18	50	18	143·6	1	45·8	18	661	10	139	7	1·22	10
October	·891	9	·676	1	·215	67·5	20	47·4	27	38 3	26	36	29	140·1	24	35·3	30	525	6	156	23	1·91	24
November	·899	19	·731	6	·168	69·8	23	45·7	21	32·9	18	8	21	132 8	25	34·3	23	526	6	108	14	1·18	30
December	·901	20	·704	4	·197	65·3	24	42·7	14	31·5	17	15	24	129·3	1	29·2	15	991	4	146	14	5·24	5

Appendix III.

KODAIKÁNAL.—Mean hourly wind velocity for the year 1903. (From Beckley's anemograph.)

Month.	Hours.																								Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
January	13	12	12	12	13	12	12	12	13	14	16	13	13	13	12	10	8	8	9	10	11	11	12	14	287
February	14	15	14	14	14	14	14	14	15	16	17	16	14	12	11	10	8	6	6	7	8	10	11	12	292
March	12	13	12	12	13	12	13	14	15	17	17	16	14	12	11	9	7	6	6	7	8	8	10	11	275
April	14	13	13	13	13	13	13	14	15	17	16	17	15	13	13	12	12	11	11	11	11	12	12	13	317
May	12	12	11	11	11	12	11	12	13	13	14	13	13	13	13	13	10	9	10	12	11	10	11	12	282
June	14	14	14	14	15	14	14	14	15	14	15	15	14	14	14	14	12	14	14	15	13	14	13	14	337
July	27	27	26	27	28	28	26	26	24	24	24	24	25	25	25	26	24	26	27	28	26	27	27	26	618
August	15	15	16	16	17	16	15	15	14	13	14	13	12	11	11	11	11	11	12	13	13	13	13	13	323
September	15	15	16	16	16	16	15	13	13	14	13	12	10	10	10	10	10	10	10	11	12	15	16	16	314
October	12	13	13	12	13	12	12	11	12	12	13	12	12	12	12	11	10	9	10	10	10	10	11	11	278
November	10	11	10	10	10	10	10	9	10	11	11	11	10	10	9	10	8	9	10	9	9	10	10	11	237
December	17	16	16	15	15	16	15	15	16	16	17	16	15	14	13	12	11	12	14	16	15	15	15	16	361
Sums ..	175	176	173	172	178	175	170	169	175	181	187	178	167	159	154	148	131	131	139	149	147	155	161	169	3,916
Means ..	15	15	14	14	15	15	14	14	15	15	16	15	14	13	13	12	11	11	12	12	12	13	13	14	326

Appendix IV.

KODAIKÂNAL.—Mean hourly bright sunshine for the year 1903.

Month.	Hours.													Total.
	5-6.	6-7.	7-8.	8-9.	9-10.	10-11.	11-12.	12-13.	13-14.	14-15.	15-16.	16-17.	17-18.	18-19.	
January	..	0·05	0·64	0·75	0·81	0·80	0·81	0·76	0·61	0·54	0·45	0·32	0·01	..	6 5
February	..	·15	·88	·89	·93	·91	·83	·70	·61	·54	·45	·32	·02	..	7·3
March	..	·29	·95	·97	·94	·95	·89	·80	·66	·57	·51	·43	·12	..	8·1
April	..	·11	·64	·77	·78	·83	·80	·73	·66	·58	·50	·39	·10	..	6·9
May	..	·18	·65	·73	·69	·65	·61	·54	·50	·47	·34	·22	·06	..	5·6
June	..	·07	·33	·48	·54	·49	·53	·41	·28	·23	·14	·07	·01	..	3·6
July	..	·07	·30	·38	·32	·31	·28	·22	·16	·18	·09	·06	·01	..	2·4
August	..	·09	·31	·48	·45	·51	·47	·34	·17	·11	·11	·04	..	..	3·1
September	..	·07	·32	·48	·50	·44	·35	·16	·11	·08	·03	·06	..	..	2·6
October	..	·03	·36	·53	·61	·62	·49	·45	·38	·35	·31	·19	·05	..	4 4
November	..	·02	·45	·55	·59	·61	·55	·60	·46	·42	·32	·20	·01	..	4·8
December	..	..	·42	·55	·63	·68	·65	·63	·58	·52	·43	·35	·01	..	5·4
Sums ..	..	1·13	6·25	7·56	7·79	7·80	7·26	6·34	5·18	4·59	3·68	2·65	0·40	..	60·7
Means ..	..	0·09	0·52	0·63	0 65	0·65	0·60	0·53	0·43	0·38	0·31	0·22	0·03	..	5·1

Appendix V.

KODAIKÁNAL OBSERVATORY.—Number of days in each month on which the Nilgiris were visible.

Month.	Very clear.	Visible.	Just visible.	Tops only visible.	Total.
January	4	7	7	4	22
February	..	4	8	2	14
March	1	3	1	..	5
April	..	..	..	3	3
May	5	4	3	..	12
June	8	2	3	2	15
July	7	2	..	2	11
August	4	3	6	..	13
September	9	7	2	4	22
October	5	7	3	6	21
November	10	2	4	4	20
December	1	9	2	7	19
Total ..	54	50	39	34	177

Appendix VI.

MEAN monthly and annual meteorological results at the Periyakulam Observatory in 1903.

Month.	Barometer.		Dry bulb thermometer.				Wet bulb.		Tension of vapour.	Relative humidity.	Sun Max. in vac.	Min. on grass.	Wind.			Rain.		Clear sky.
	Reduced to 32°.	Daily range.	Mean.	Max.	Min.	Range.	Mean.	Min.	By Blanford's tables.				Daily velocity.	Mean direction.		Amount.	Days.	
	Inches.	Inches.	°	°	°	°	°	°	Inches.	Cents.	°	°	Miles.	Points.	Points.	Inches.	No.	Cents.
January	29·044	0 139	75·7	86·3	66·3	20·1	68·8	64·0	0 618	69	137·2	62·7	43 3	13	S. E. by S.	1·06	2	60
February	·053	·150	78·7	91·4	67·4	24·0	69·2	64·2	·593	60	147·2	57·3	59·3	10	E.S.E.	1·15	2	68
March	28·947	·163	82·3	96·8	68·6	28·2	69·7	64·6	·561	51	152·1	61·4	49·9	13	S. E by S.	1·61	2	89
April	·916	·146	84·4	98·1	73·4	24·6	72·8	69·6	·653	55	156·3	68·3	52·2	12	S.E.	2·18	6	66
May	·865	·130	83·1	97·0	73·4	23·7	73 6	70·1	703	62	157·9	69 4	69·4	14	S. S. E.	2·85	8	60
June	·818	·113	82·8	95·9	73·2	22·7	72·8	69·3	·673	60	156·6	68·2	89·2	12	S.E	0 44	1	39
July	·811	·105	81·3	92·6	72·7	19·9	71·8	68·9	·655	61	154·6	68·3	89·9	15	S. by E.	0·31	1	26
August	·852	·112	80·4	92·5	71·6	20·9	71·6	68·3	·661	64	154·0	67·6	76·3	15	S. by E.	1·33	2	35
September	·868	·119	79·1	90·6	72·3	18·3	72·9	69·8	·726	73	152·5	69·5	60·6	13	S. E. by S	2·36	6	34
October	·886	·135	79·2	89·9	71·1	18·8	72 6	69·4	·718	72	146·4	68·1	50·4	17	S. by W.	3·88	10	44
November	·960	·122	76·6	85·6	69·5	16·2	71·1	67·6	·690	75	141·7	66·6	36·4	14	S. S. E.	3 38	9	47
December	·990	·123	73·8	83.2	66·0	17·1	68·6	64·6	·634	76	133·1	63·0	35·1	13	S. E. by S.	4·53	7	50
Annual ..	28·918	0·130	79·8	91·7	70·5	21·2	71·3	67·5	0·657	65	149·1	65·9	59·3	13	S E by S	25 08	56	52

EXTREME monthly meteorological records at the Periyakulam Observatory in 1903.

Month.	Barometer.					Dry bulb thermometer.				Wet bulb.		Humidity.		Sun Th. in vacuo.		Grass therm.		Wind.				Rain.	
	Highest.		Lowest.		Range.	Highest.		Lowest.		Lowest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Greatest Fall.	
	Inches.	Day.	Inches.	Day.	Inches.	°	Day.	°	Day.	°	Day.	Cents.	Day.	°	Day.	°	Day.	Miles.	Day	Miles.	Day.	Inches	Day.
January ..	29·187	7	28·897	20	0·290	92·1	31	60·6	31	58 4	31	32	31	146·8	16	49 5	31	73·5	5	15·7	27	0·76	6
February ..	**·196**	**9**	·875	28	·321	97·1	28	**57·4**	**8**	**54·9**	**8**	22	3	156·8	17	**47·4**	**8**	116·5	9	27·7	16	0 96	18
March ..	·046	18	·815	31	·233	101·3	30	61·2	4	57·8	4	**20**	**2**	160·3	25	51·4	7	81·2	10	32·6	8	1·27	10
April ..	·069	6	·740	24	·329	**102·1**	**23**	66·5	15	62·3	15	22	15	162·0	1	60·1	15	86·4	4	25·7	11	0·77	19
May ..	·003	3	·729	18	·274	101·6	5	69 4	8	66·4	8	31	23	168·9	18	65·2	8	111·4	24	35·9	21	C·81	8
June ..	28·938	18	**·660**	**26**	·278	101·7	7	68 3	23	63·4	23	32	22	168·8	28	60·8	23	153 9	26	47 0	20	0·24	3
July ..	·926	21	·675	13	·251	98·2	1	69 4	21	66·0	21	30	21	**170·8**	**10**	63·5	21	124·1	27	36·7	18	0·10	17
August ..	·950	15	·711	2	239	99·7	9	68 4	31	65·5	28	32	9	166·5	31	62·3	28	155·0	4	**2·9**	**12**	0·79	11
September ..	·977	23	·727	3	·250	98·2	4	68·8	18	67·0	18	45	2	166 5	27	64·3	18	**156·5**	**20**	24·6	12	0·41	6
October ..	29 022	10	·752	18	·270	96·3	10	66·6	30	64·3	30	38	5	162·8	10	63·4	30	113·5	6	16·1	29	0·73	20
November ..	·088	19	·825	6	·263	90·1	1	61·0	23	58·5	23	40	22	149 8	9	56·7	23	78·4	30	13 6	27	0·71	13
December ..	·104	21	·850	4	·254	87·4	3	58·3	25	57 8	25	41	13	147·0	14	55·0	27	68·0	4	14·8	11	**2·45**	**5**

Appendix VII.

ABSTRACT of the mean meteorological condition of Madras in 1903 compared with the average of past years.

Mean values of	1903.	Difference from	Average.
Reduced atmospheric pressure	29·855	0·009 below.	29·864
Temperature of air	81·2	0·1 above.	81·1
Do. of evaporation	76·1	1·6 ,,	74·5
Percentage of humidity	79	7 ,,	72
Greatest solar heat in sun	132·6	7·1 below.	139·7
Maximum in shade	89·7	1·1 ,,	90·8
Minimum in shade	74·9	0·2 above.	74·7
Do. on grass	73·0	1·1 ,,	71·9
Rainfall since January 1st on 104 days	79·62	30·60 ,,	49·02
General direction of wind	S.E. by S.	1 point S.	S.E.
Daily velocity in miles	143	28 below.	171
Percentage of clear sky	54	3 above	51
Do. of bright sunshine	44·8	13·6 below.	58·4

DURATION and quantity of the wind from different points.

From	Hours.	Miles.	From	Hours.	Miles.	From	Hours.	Miles.	From	Hours.	Miles.
North ..	191	1,245	East ..	264	1,216	South ..	249	1,495	West. ..	257	1,848
N. by E. ..	266	1,647	E. by S. ..	430	2,235	S. by W. ..	201	1,343	W. by N. ..	198	1,423
N.N.E. ..	321	2,099	E.S.E. ..	326	1,574	S.S.W. ..	218	1,441	W.N.W. ..	97	646
N.E. by N. ..	327	2,023	S.E. by E.	368	1,621	S.W. by S.	245	1,490	N.W. by W.	106	504
N.E. ..	186	1,203	S.E. ..	279	1,584	S.W. ..	219	1,403	N.W. ..	48	267
N.E. by E.	188	1,031	S.E. by S.	708	4,703	S.W. by W.	330	2,055	N.W. by N.	85	402
E.N.E. ..	141	924	S.S.E. ..	753	5,195	W.S.W. ..	218	1,522	N.N.W. ..	148	786
E. by N. ..	231	1,184	S. by E. ..	437	2,584	W. by S. ..	394	2,606	N. by W. ..	147	1,006

There were 184 calm hours during the year. The resultant corresponding to the above numbers is represented by a S.S.E. wind, blowing with a uniform daily velocity of 34 miles.

Appendix VIII.

MADRAS OBSERVATORY.—Number of hours of wind from each point in the year 1903.

Month.	N.	1	2	3	4	5	6	7	E.	9	10	11	12	13	14	15	S.	17	18	19	20	21	22	23	W.	25	26	27	28	29	30	31	Calm.
January	..	14	38	107	105	43	43	69	118	97	48	26	1	4	..	10	1	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	17
February	2	3	13	27	29	54	36	86	59	97	42	51	12	36	38	53	10	2	8	7	..	..	..	..	..	..	..	..	..	..	..	..	7
March	..	..	..	..	..	..	..	..	..	21	25	26	53	197	282	49	18	21	22	15	1	5	..	..	..	..	..	..	..	..	..	..	9
April	..	..	..	..	..	..	..	2	1	62	81	73	35	221	171	17	12	14	19	6	1	..	..	..	..	..	..	..	..	..	..	..	5
May	9	..	6	2	1	10	8	14	24	54	38	28	83	107	89	70	19	34	22	12	20	15	8	22	5	..	..	2	..	2	3	..	37
June	..	..	..	5	1	1	2	1	3	3	3	7	22	61	72	70	16	34	45	28	38	78	27	53	38	51	20	9	5	8	2	14	3
July	14	4	2	..	1	2	..	..	1	6	2	11	8	23	15	18	37	16	22	49	43	109	71	105	78	52	11	8	16	9	1	6	4
August	8	..	..	..	1	1	..	3	1	3	27	7	18	3	40	34	81	37	38	29	33	32	64	91	70	36	36	25	7	5	1	2	11
September	4	3	4	8	1	1	3	4	21	49	16	35	13	4	9	31	6	26	16	50	27	52	20	74	44	45	17	28	6	27	31	20	25
October	11	30	8	12	..	2	27	35	28	19	39	37	30	52	36	41	17	11	3	38	47	39	28	48	21	13	4	8	12	9	2	11	23
November	89	135	46	39	8	7	8	10	4	15	2	57	1	..	1	41	32	6	5	10	9	..	..	..	..	..	9	26	2	19	70	30	39
December	54	77	204	127	39	67	14	7	4	4	3	10	3	..	..	..	..	..	15	1	..	..	..	1	1	1	..	..	..	6	38	64	4
Annual ..	191	266	321	327	186	188	141	231	264	430	326	368	279	708	753	437	249	201	218	245	219	330	218	394	257	198	97	106	48	85	148	147	134

Appendix IX.

MADRAS OBSERVATORY.—Number of miles of wind from each point in the year 1903.

Month.	N.	1	2	3	4	5	6	7	E.	9	10	11	12	13	14	15	S.	17	18	19	20	21	22	23	W.	25	26	27	28	29	30	31	Total.
January	..	89	257	545	582	285	331	365	430	375	185	71	8	20	..	19	7	..	12	..	..	.	..	..	..	..		..	..	.	..	..	3611
February	18	6	51	166	189	266	216	445	337	553	161	198	95	248	253	267	70	16	50	58	.	.	..	..	.	..	..	..	..	..	.	..	3666
March	..	..	..	..	..	..	..	..	..	117	156	132	228	1248	1709	336	141	177	191	136	6	20	.	..	..	.	..	..	..	..	.	..	4597
April	..	..	..	..	..	..	..	14	6	315	389	298	240	1418	1403	169	99	139	218	57	11	..	..	..	..	..	..	..	..	..	..	..	4776
May	90	..	20	10	5	55	81	30	125	374	229	201	520	769	724	492	133	206	169	98	128	98	57	98	34	..	..	16	..	10	25	..	4797
June	..	..	..	14	2	6	16	13	33	29	28	62	180	575	644	489	127	230	283	190	264	464	205	391	279	418	181	88	27	29	17	60	5344
July	44	17	20	..	10	11	..	..	12	56	23	73	57	169	79	101	216	96	115	276	317	819	511	830	647	373	74	29	59	26	3	22	5115
August	26	..	..	..	8	6	..	26	10	24	152	48	101	20	206	208	438	222	201	152	178	212	410	654	516	310	232	126	34	15	5	10	4550
September	23	19	23	33	10	5	17	24	96	223	73	144	49	21	34	156	41	146	80	235	151	235	111	376	211	193	101	101	25	120	106	65	3247
October	71	188	74	63	..	13	81	121	119	101	145	99	96	215	138	189	66	66	20	227	306	207	228	252	155	121	37	58	94	81	17	96	3744
November	625	721	210	195	48	27	38	56	18	48	12	260	4	..	5	128	157	45	28	54	42	..	..	..	..	..	21	86	28	80	425	300	3661
December	348	607	1441	997	349	357	144	90	30	20	21	35	6	..	..	..	..	..	44	7	..	..	..	5	6	8	..	..	..	41	188	453	5197
Annual ..	1245	1647	2099	2023	1203	1031	924	1184	1216	2235	1574	1621	1584	4703	5195	2584	1495	1343	1441	1490	1403	2055	1522	2606	1848	1423	646	504	267	402	786	1006	52305

Appendix X.

MADRAS OBSERVATORY.—Number of inches of rain from each point in the year 1903.

Month.	N.	1	2	3	4	5	6	7	E.	9	10	11	12	13	14	15	S.	17	18	19	20	21	22	23	W.	25	26	27	28	29	30	31	Calm.
January	..	0·60	..	..	..	..	0·06	..	0·35	0 02	0 18	3·13	..	0·19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
February	..	..	0·80	0·21	0.27	0·21	0·41	0·25	..	..	..	..	..	..	0·02	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
March	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
April	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
May	1·12	..	0 55	0·03	..	1·15	0·24	0·18	..	..	0·11	0·02	0 96	0·37	..	0·02	0·01	..	..	..	..	0·03	0·16	0·09	..	..	..	..	..	0·16	0·12	..	..
June	..	..	..	0·20	..	0 01	..	..	0·02	..	..	..	..	..	..	..	..	0·01	..	..	0·18	0·04	0·76	0·12	..	..	..	0·12	..	..	..	..	..
July	0·10	0·01	..	..	..	..	..	..	..	..	..	..	..	0·01	..	..	0·03	0·07	0·02	0·06	0·03	1·07	0·54	0·31	0·23	0·83	0·12	..	0·04	0·34	..	0·01	..
August	..	..	..	..	..	..	..	..	..	..	0·04	..	..	..	0·10	1·66	0·12	0 01	0·08	0·20	0·31	0·15	1·40	0·39	0·19	1·15	0·76	0·35	..	0·07	0·90	..	..
September	..	0·13	0·01	0·01	..	..	..	..	..	..	0·08	..	0·64	0 09	..	0·47	..	..	..	1·13	0·03	1·08	1·06	1·18	0·07	1·51	0·13	..	0·19	0·13	0·25	0·02	..
October	0·81	0·54	0·40	0·41	..	0·51	0 10	0·30	0·42	..	0·03	..	..	..	0·45	0·05	..	0·07	0 02	1·31	..	0·05	0·03	0·25	0·12	1·43	0·29	0·44	0·29	0·09	0·39	0·04	..
November	0 12	0·83	0·41	0·75	0·02	0·14	0·19	0 57	0·31	0·04	..	0·02	..	..	0·42	..	0·74	..	0·66	0 01	0·05	..	..	..	..	..	2·46	1·59	1·72	1·75	3·51	1·35	0·09
December	0·18	0·20	2·49	2·09	1·85	1·39	3 01	1·85	0·53	0·30	..	2·08	..	..	..	..	..	..	2·17	0·10	..	..	..	0·47	0·47	0·07	..	..	..	0 09	0·04	0·25	..
Annual ..	2 33	2·31	4·66	3 71	2·14	3 41	4·01	3·15	1·63	0·36	0·44	5·25	1 60	0·66	0·99	2·20	0·90	0·16	2·95	2·81	0·60	2·42	3·95	2 81	1·08	4 99	3·76	2 50	2·24	2·63	5·21	1·67	0 09

Appendix IX.

MADRAS OBSERVATORY.—Wind, cloud, bright sunshine and evaporation.

Month.	Wind resultant.		Clouds (0—10).					Bright sunshine.		Amount of evaporation.
	Velocity.	Direction.	8 H.	10 H.	16 H.	20 H.	Mean.	Average per day.	Greatest number of hours in a day.	Average per day.
1902.	MILES.							HOURS.		INCHES.
January	99	E.N.E.	2·9	4·2	3·5	2·7	3·3	6·0	8·8	0·142
February	94	E. by S.	3·4	3·6	2·4	1·9	2·8	7·7	9·4	0·174
March	137	S.S.E.	1·1	1·7	1·0	1·0	1·2	8·5	10·2	0·202
April	115	S.E. by S.	2·6	2·8	2·0	1·2	2·2	7·9	9·6	0·244
May	110	S.S.E.	4·7	4·5	4·0	2·8	4·0	5·1	8·5	0·236
June	103	S.S.W.	5·7	5·1	5·7	5·0	5·4	4·2	7·4	0·236
July	81	S.W.	7·3	7·3	7·8	7·3	7·4	3·2	8·1	0·218
August	92	S.W. by W.	6·8	5·9	6·7	5·8	6·3	4·4	9·4	0·192
September	40	S.W. by W.	6·0	5·8	5·7	4·5	5·5	4·4	9·3	0·158
October	28	S.W. by S.	5·5	5·5	5·5	4·3	5·2	5·0	9·1	0·166
November .. .	6[illegible]	N. by E.	6·1	6·7	6·6	5·5	6·3	4·1	8·5	..*
December	118	N.N.E.	4·9	5·5	5·5	4·0	5·0	4·8	8·1	..*
Annual ..	34	S.S.E.	4·8	4·9	4·7	3·8	4·6	5·4	..	..

* Instrument out of order.

Appendix XII.

MEAN monthly and annual meteorological results at the Madras Observatory in 1903.

	Barometer.		Dry bulb thermometer.				Wet bulb.	Tension of vapour.	Relative humidity.	Sun Max in vac.	Min. on grass.	Wind.			Rain.		Cloudy sky.	Bright sun-shine.	General weather.
	Reduced to 32°.	Daily range.	Mean.	Max.	Min.	Range.	Mean.	By Blandford's tables.				Daily velocity.	Mean direction.		Amount.	Days.			
	Inches.	Inches.	°	°	°	°	°	Inches.	Cents.	°	°	Miles.	Points.		Inches.	No.	Cents.	Hours.	
January	30·004	0·122	76·6	84·2	69·9	14·3	72·6	0·748	82	131·2	66·9	116	6	ENE	4·53	3	33	185·2	..
February	·010	·124	79·2	87.0	71·9	15·1	74·0	·778	78	135·1	68·8	131	9	E by S	2·17	3	28	216·3	..
March	29·882	·134	80·7	89·9	72·6	17·3	75·6	·820	78	136·2	69·1	148	14	SSE	..	..	12	262·7	..
April	·842	125	84·0	93·0	76·7	16·3	78·0	·881	76	137·8	74 2	159	13	SE by S	..	..	22	235·5	..
May	·769	·119	85 4	94·5	78·9	15·6	79·5	·932	77	136·8	77·2	155	14	SSE	5·32	4	40	156·7	..
June	·695	·110	86·0	96 8	79·7	17·1	78·6	·883	71	135·2	78·5	178	19	SW by S	1·46	7	54	126·3	..
July	·676	·119	84·2	94·0	78·2	15·8	77·3	·845	72	131·6	76·6	165	21	SW by W	3·82	19	74	99·6	..
August	·731	·122	83·2	92·9	77·2	15·7	77·7	·875	77	132·6	76·0	147	20	SW	7·88	14	63	136·1	..
September	·757	·132	81·9	90·3	76·2	14·1	78·2	·918	84	132·0	74·8	108	21	SW by W	8·21	15	55	131·5	..
October	·791	·129	80·9	88·5	75·1	13·4	76·6	·862	82	131·0	73·3	121	14	SSE	8·84	15	52	155·8	..
November	·896	·122	76·8	82·9	72 2	10·7	73·5	·786	85	126·6	69·6	122	0	N	17·76	13	63	122·6	..
December	·955	·102	74·9	81·8	69·7	12·1	71·1	·715	82	124·8	71·1	168	2	NNE	19·63	11	50	149 2	..
Annual ..	29·834	0·122	81·2	89·7	74·9	14·8	76·1	0·837	79	132·6	73·0	143	13	SE by S	79·62	104	46	164·8	..

EXTREME monthly meteorological records at the Madras Observatory in 1903.

	Barometer.					Dry bulb thermometer.				Humidity.		Sun Th. in vacuo.		Grass therm.		Wind.				Rain.	
	Highest.		Lowest.		Range.	Highest.		Lowest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Greatest fall.	
	Inches.	Day.	Inches.	Day.	Inches.	°	Day.	°	Day.	Cents.	Day.	°	Day.	°	Day.	Miles.	Day.	Miles.	Day.	Inches	Day.
January	30·149	6	29 858	28	0·291	88·3	31	66·9	1	60	23	136 0	25	63·8	1	247	22	55	27	2·97	5
February	**·170**	**9**	·842	28	·328	91·4	15,27	67·2	8	59	5, 9	141·9	15	63 0	8	221	9	76	25	1·24	21
March	29·986	2	·749	31	·237	98·6	31	67·2	4	58	18, 20	141·9	31	63·3	4	219	26	95	10	..	..
April	30·004	6	·684	25	·320	98·0	1	72·6	16	49	25, 26	142·8	1	69·0	15	222	25	81	14	..	..
May	29·926	1	·627	17	·299	101·1	16	74·8	19	48	6	**146·0**	**9**	73·4	19	225	29	94	13	2·76	19
June	·855	16	·551	26	·304	**103·1**	**27**	74·3	14	39	23	143·7	28	73·7	17	240	11	117	17	0·74	14
July	·818	21	**·547**	**30**	·271	99·1	3	74·4	8	43	10, 20, 25	141·4	1,3,25	71·7	27	222	10	105	18	0·85	22
August	·846	23	·574	30	·272	100·5	4	72·9	17	**38**	**6**	142 8	22	72·0	17	222	1	83	12	1·45	31
September	·899	24	·631	30	·268	96·3	7	71·6	20	60	6	147·1	3	70·8	20	161	18	61	20	2·33	9
October	·920	20, 21	·629	4	·291	94·0	12	67·9	29	60	28	143·5	11	67·0	29	223	28	**53**	**22**	1·96	27
November	30·041	23	·713	6	·328	89·8	1	66·0	25	59	23	141·3	1	**60·5**	**25**	194	23	56	8	6·37	5
December	·089	21	·835	29	·254	86·2	2	**65·3**	**8**	52	15	135·2	1, 2	61·6	8	**331**	**29**	78	13	**8·20**	**30**

Appendix XIII.

MADRAS OBSERVATORY.—Abnormals from monthly means for the year 1903.

——	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Reduced atmospheric pressure	+ 0·007	+ 0·046	— 0·022	+ 0·017	+ 0·035	— 0·008	— 0·044	— 0·018	— 0·020	— 0·051	— 0·028	— 0·023	— 0·009
Temperature of air	+ 1·5	+ 2·5	+ 0·7	Same as	— 1·3	— 0·4	— 0·3	— 0·1	— 1·1	+ 0·3	— 0·7	— 0·6	+ 0·1
Do. of evaporation	+ 3·4	+ 3·2	+ 1·7	+ 0·4	+ 1·2	+ 2·0	+ 1·4	+ 1·7	+ 1·9	+ 1·0	+ 0·6	+ 0·5	+ 1·6
Percentage of humidity	+ 9	+ 5	+ 4	+ 1	+ 10	+ 9	+ 7	+ 7	+ 12	+ 4	+ 6	+ 5	+ 7
Greatest solar heat in vacuo	— 7·2	— 4·6	— 4·3	— 3·9	— 6·2	— 5·3	— 7·1	— 7·4	— 9·3	— 8·1	— 10·8	— 11·0	— 7·1
Maximum in shade	— 0·4	+ 0·4	+ 0·7	+ 0·1	— 3·3	— 1·5	— 1·6	— 0·8	— 2·9	— 0·5	— 2·1	— 1·8	— 1·1
Minimum in shade	+ 2·4	+ 3·9	+ 0·5	— 0·5	— 1·9	— 0·6	— 0·3	— 0·1	— 0·9	— 0·1	— 0·1	— 0·1	+ 0·2
Do. on grass	+ 3·8	+ 5·0	+ 0·5	— 0·5	— 1·7	— 0·1	Same as	+ 0·6	— 0·2	+ 0·5	+ 0·1	+ 4·7	+ 1·1
Rainfall in inches	+ 3·64	+ 1·89	— 0·39	— 0·62	+ 3·20	— 0·65	— 0·05	+ 3·32	+ 2·52	— 2·16	+ 4·55	+ 14·35	..
Do. since January	.	+ 5·53	+ 5·14	+ 4·52	+ 7·72	+ 7·07	+ 7·02	+ 10·34	+ 13·86	+ 11·70	+ 16·25	+ 30·60	+ 30·60
General direction of wind	1 point E.	1 point S.	2 points S.	Same as	1 point E.	Same as	1 point W.	1 point W.	3 points W.	7 points S.	2 points E.	Same as	1 point S.
Daily velocity	— 28	+ 9	— 4	— 32	— 72	— 42	— 33	— 27	— 48	— 2	— 43	— 15	— 28
Percentage of cloudy sky	+ 4	— 4	+ 12	+ 6	— 2	+ 10	— 3	+ 4	+ 7	+ 7	— 4	+ 2	+ 3
Do. of sunshine	— 21·6	— 16·0	— 8·3	— 9·2	27·5	— 13·8	— 7·3	— 5·9	— 7·8	— 9·4	— 16·4	— 14·5	— 13·6

+ Means above normal. — below.