Report on the Kodaikanal and Madras Observatories from 1st April to 31st December 1901.

Kodaikánal Observatory.

In accordance with the wish of the Observatories Committee of the Royal Society the annual report is hereafter to be for the calendar and not the official year, and hence the present report is for the nine months 1st April to 31st December 1901.

2. *Staff.*—The only change amongst the assistants was the transfer of Mr. C. Theodore, the fourth assistant, to the new post of Magnetic Observer, and the appointment of Mr. M. G. Subrahmania Aiyar, B.A., in his place. Mr. Theodore since his transfer has been at Dehra Dun undergoing special training in Magnetic work.

3. *Buildings and Grounds.*—The work on the main buildings was practically completed during the year, with the exception of the supply of water to the dark room. Porches, not included in the original design, have also been erected to protect the east and west doors, as it was found impossible without them to keep the laboratory and spectrograph room dry during the monsoon. These porches have greatly improved matters, but it may be necessary to take further steps to protect the parts of the buildings exposed to the strongest winds, for in gales accompanied by rain the moisture is driven through the walls in several places and the rooms become so damp that it is difficult to keep the instruments in good order. The transit room was nearly completed by the close of the year and the anemometer tower was about half built.

Work on the Magnetic buildings was begun in February, but the excavation for the underground room took much more time than was expected owing to the difficulty of blasting away a mass of very hard rock in a position not far from other buildings. The building is now ready to be roofed in and all materials for this are on the spot.

Considerable progress has been made in planting and laying out the grounds, but it will be a good many years before this will have much effect in modifying the strength of the winds to which the Observatory is exposed. The chief difficulty at present lies in the selection of suitable trees, since the ground is largely covered with gravel (where it is not rocky) and dries up very quickly, even after heavy rain.

4. *Instruments.*—The chief instruments in use in the Observatory are the following :—

(*a*) *The Cooke Equatorial.*—This is an old instrument originally bought by the Government of India for observations on the transit of Venus and afterwards used for some years at South Kensington and Poona. It is mounted in the south dome. It is of 6-inch aperture and about 7 feet focus. It is mounted on Messrs. Cooke's usual plan which is hardly suitable for such a low latitude as this. It has been fitted with a projection apparatus for roughly determining the position of sunspots and faculæ.

(*b*) *The Lerebour and Secretan Equatorial.*—This is also an old instrument from the Madras Observatory, but before setting it up here it was reconstructed by Sir Howard Grubb and provided with a new driving clock with electrical control. It is mounted in the north dome, on the English plan, which is specially suitable for this latitude, but the mounting is not quite so rigid as might be desired. The object glass has an aperture of 6 inches and the focal length is about 8 feet. It is mounted side by side with a Grubb portrait lens of 5 inches aperture and 36 inches focus.

(*c*) *Spectrograph.*—This consists of a polar siderostat with an 11-inch mirror, a 6-inch lens of 40 feet focus by Grubb and a concave

Rowland grating of 10 feet focus mounted on Rowland's plan by Hilger. The slit can be replaced by a camera so that direct photographs of the sun of about $4\frac{1}{2}$ inches diameter can be obtained at any time.

(*d*) *Table Spectroscope.*—An automatic 6-prism spectroscope (Hilger) which can be used either for eye-observations or for photographing the spectrum. It is usually employed in connection with the 40-foot lens and a right-angled prism.

(*e*) *Small grating Spectroscope*, by Hilger, is used chiefly with the Lerebour and Secretan equatorial.

(*f*) *Photo-heliograph*, similar to that used at Greenwich and Dehra Dun, giving an enlarged image of the sun 8 inches in diameter.

(*g*) *Mean time clock*, Kuhlberg, No. 6326.

(*h*) *Sidereal clock*, Shelton.

(*i*) *Mean time Chronometer*, Kuhlberg, No. 6299.

(*j*) *Sidereal Chronometer*, Kuhlberg, No. 6134.

(*k*) *Transit Instrument.*—This is one of the instruments formerly used by the G. T. Survey of India for longitude work.

(*l*) *Chronograph.*—This also belonged to the Survey of India and is of a very heavy pattern. A new tape chronograph has now been indented for.

(*m*) *Micrometer*, for measuring photographs of the spectrum, by Hilger.

(*n*) *Theodolite.*

(*o*) A pair of *Photo-Theodolites* for work on clouds.

(*p*) *Sextant.*

(*q*) *Seismometer.*—Milne's horizontal pendulum.

(*r*) *Actinometer.*—Balfour Stewart's form.

(*s*) *Solar Calorimeter.*—Buchanan's.

(*t*) *Induction coil and vacuum tubes.*

(*u*) *Small heliostat*, and a complete set of meteorological instruments, which will be referred to in detail below.

Plans and specifications have been sent home for a spectro-heliograph and for a plane grating spectroscope to be used with the 40-foot lens.

5. *Astronomical Observations.*—Instructions having been received from the Government of India to draw up a programme of observations, the following was submitted as a tentative scheme, it being recognized that some experience with the instruments was necessary before a final satisfactory plan of operations could be fixed on :—

I.—Sun spots.

(*a*) A daily examination of the sun's surface for spots.

(*b*) When a spot of sufficient size is present, one or more photographs of the spectrum with the necessary comparison spectra will be taken. It is intended to take photographs of as large a part of the spectrum as possible, so that the taking of the photographs will occupy a considerable time ; only a small part of the spectrum can be taken at a time.

(*c*) If it be found impracticable to photograph the whole of the visible spectrum, the photographs will be supplemented by eye-observations.

(*d*) The photographs will be at once developed.

(*e*) The measurement and reduction of the negatives will, as far as possible, be kept up to date, but as there will always be plenty of cloudy days on which this work can be done, the first duty on bright days will always be the making of observations.

II.—Prominences.

A similar programme to that for sun spots, but this cannot be fully carried out till some additional apparatus has been obtained.

III.—Photography of the Sun in monochromatic light.

The instrument for this has not yet been obtained.

IV.—Actinometry.

Systematic observations with Balfour Stewart's Actinometer have been carried on for a year and will be continued. Additional observations will be made with another form of instrument which has been lent by Dr. J. Y. Buchanan.

V.—Meteorological observations.

These have been carried on for nearly two years and will be continued.

VI.—Earthquake records.

This has been in progress since the beginning of 1900 and will be continued.

VII.—Cloud photography.

VIII.—Special observations.

In addition to these routine observations an observatory must always be ready to make special observations when the need for them arises. To make the best use of the solar observations much laboratory work will be required, but for this no programme can be laid down. Its nature and extent will depend entirely on the problems which suggest themselves during the progress of the work.

It is hardly likely that the whole of the above programme can be carried out by the existing staff, but I, IV, V, and VI will be carried out in full and as much as possible will be done in connection with the others.

This was submitted by the Government of India to the Observatories Committee of the Royal Society, but was not accepted by them. They instead laid down the following plan of work:—

Solar physics work.

1. That the most widened lines in the sun spots should be visually observed daily, six of such lines being observed between F and b and six between b and D.
2. That other widened lines should be noted.
3. That visual observations should be made of the prominences and chromosphere.
4. That photographs should be taken by the Hale-Deslandres method.

After the above requirements are fulfilled, it is desirable that if possible—

5. Photographs should be taken of sun spot spectra, for which, it is to be noted, comparison spectra, other than the solar spectrum, are unnecessary.

Meteorological observations.

6. As at present.

Other observations.

7. Actinometry.
8. Earthquake records.
9. Cloud photography.

The observations under the heads 7, 8 and 9 should only be undertaken if the resources of the Observatory admit of the complete fulfilment of the earlier part of the programme.

The work of the Observatory is consequently now conducted according to this plan so far as it is possible to do so with instruments designed specially for photographic work. The daily routine of work on the sun is as follows: Early in the morning the sun's surface is carefully examined with the Cooke equatorial. If any spots or prominent faculæ are present, their positions are approximately determined by projecting the sun's image on a graduated disc 8 inches in diameter. Drawings are made of the details of the spot and notes of any special features. The spectrum of the spot is then examined either with the small

grating spectroscope attached to the Lerebour and Secretan equatorial, or with the table spectroscope used in connection with the 40-foot lens. If the spot be of considerable size, or if it seems probable that the weather at Dehra Dun will be cloudy, photographs of the spot are also taken. In the case of large spots photographs of the spectrum will also be taken with the spectrograph. Daily observations of the bright lines visible in the chromosphere and prominences are made with the small grating spectroscope and with the table spectroscope.

From March 14th, when regular observations were begun, to December 31st the sun's surface was examined on 248 days, and on 62 of these, spots were recorded, but most of them were very small. Drawings were made on 48 days, and 21 photographs were taken. Eighty photographs of spectra have been taken, and diagrams have been prepared both for the grating spectrograph and the table spectroscope to facilitate the identification of lines. The work with the spectrograph was seriously interfered with by the building operations during a considerable part of the time, but this is now past and the instrument is in excellent working order. To facilitate work on the prominences an instrument for bringing any part of the limb on to the slit has been indented for. Two small electromotors for actuating the slow motions of the siderostat in right ascension and declination have also been asked for.

During the total eclipse of May 18th observations were made of the times of contact, some photographs were taken, and observations were made with the solar calorimeter. Clouds, however, rendered the last of these valueless. Preparations were made for fully observing the annular eclipse of November 10th-11th, but the day was cloudy throughout with very high wind and a thick drifting mist. Slight glimpses of the sun lasting for a few seconds, and even then only through clouds, were all that could be obtained. The only interesting observations that could be made were those on the barometer which behaved as in total eclipses.

The great comet (1901α), though looked for in the morning after the receipt of the telegram announcing its discovery, was first seen on the evening of May 8th. It was then a very brilliant object, though close to the horizon. Several photographs of it were taken with the Grubb portrait lens, but the possible exposures were short and were much interfered with by clouds near the horizon and by lightning, so that the results were not very satisfactory.

Time observations are made with a sextant twice a week pending the erection of the transit instrument.

6. *Actinometer Observations.*—These are made only on the finest days and are consequently not very numerous, except in the first three months of the year which are not included in this report. Observations with the Balfour Stewart Actinometer have been made on 29 days, on only 2 of which complete sets (*i. e.*, at 10h., 12h., 14h.,) were obtained. Observations with the Solar Calorimeter have been made on 4 days and extending over 12 hours. To avoid the effect of wind these observations are now made inside one of the domes.

7. *Meteorological Observations.*—Eye-observations of temperature (wet and dry bulb, maximum and minimum) pressure, wind direction and velocity, cloud, and rainfall are made daily at 8h., 10h. and 16h. local mean time at both Kodaikánal and Periyakulam. Readings are also taken at both stations of sun-maximum and grass minimum thermometers. Continuous records of temperature (wet and dry) and pressure are taken at both stations with Richard recording instruments. These records are at once tabulated and reduced using the eye-observations to give scale corrections. At Kodaikánal wind velocity, rainfall, and bright sunshine are also recorded continuously. No record is as yet got of wind direction owing to the anemometer tower not being completed. As soon as the tower is ready a Beckley anemograph and a Dines "pressure tube" recorder will be set up. It is hoped that this may be done early in March.

All meteorological observations are at once reduced and tabulated. A daily 8 A.M. weather telegram is sent to the Meteorological Reporter to the Government of Madras, and copies of the 8h. observations and of the 10h. and 16h. registers are sent to the Meteorological Reporter to the Government of India. Various attempts have been made to obtain a suitable formula for reducing the

Periyakulam barometer observations to sea-level. The height of the barometer cistern above mean sea-level is 944 feet, and its distance from Madura is about 40 miles. The Madura barometer is 447 feet above mean sea-level, but none of the usual formulæ will give satisfactory sea-level reductions for the Periyakulam readings, as judged by the Madura readings, even when due allowance has been made for the run of the isobars as shown by the Daily Weather Chart. The best results are got by using the maximum temperature of the previous day instead of the actual temperature at the time of observation in the reduction. This gives a good result in the mean of a number of observations, but the errors on individual observations are considerable. Similar difficulties are experienced at other stations situated near large hill masses, and for the present it has been thought best not to attempt any reduction to sea-level.

8. *Seismometer Records.*—The Milne Horizontal Pendulum is placed in the room below the south dome. The boom is placed north and south and the pier is built on the solid rock. The instrument has been in good working order throughout the whole period. A list of the principal shocks recorded during the year 1901 is given in Appendix I.

9. *Library.*—A book-binder and a book-binder's boy have now been added to the establishment, and 70 volumes have been bound. Two hundred and fifty books and pamphlets have been presented to the Observatory during the year and 12 volumes have been purchased. Two hundred and twenty-nine sheets of *L'Atlas de la Carte Photographique du Ciel* have also been received.

10. *General.*—The past year has been one of distinct progress but, of course, a great part of the work done has been more or less experimental. Much time has had to be devoted to the adjustment of instruments, the supervision of workmen, and the training of assistants. At the same time the paucity of sun spots has made it impossible to train the assistants in the special work of the spectroscopic observations of sun spots. Meteorologically the year has been an abnormal one so far as can be judged by existing statistics. The rainfall in January, February, June, and September was much above the average, and the total number of days on which rain fell was also much above the average. The period October to December is probably always the most trying period of the year, but in the past year it was very much worse than in either 1899 or 1900, and the health of the assistants and servants suffered considerably. High winds are experienced in all months of the year, and, though they are at all times trying in such an exposed situation, they are peculiarly so when accompanied by mist or rain as is usually the case during the North-East monsoon. It is interesting to note that the highest wind velocity for any one day was 88½ miles on April 26th, when a cyclone was passing up the Arabian Sea at some considerable distance from the coast. The highest velocity recorded at a coast station on the same day was 360 miles at Minicoy. The lowest dry bulb reading in the shed was 39°·1 on November 27th but the lowest reading on the grass was 23°·4 on December 6th. The temperature of the air 4 feet above the ground probably never falls below freezing point in a fairly exposed situation, but, especially in damp places, hoar frost is of frequent occurrence when the air is dry and evaporation is going on rapidly.

The Madras Observatory.

The following report has been submitted by Professor R. Ll. Jones, Deputy Director of the Madras Observatory.

This report refers to the period 1st April to 31st December 1901.

1. *Staff.*—There has been no change in the staff since the last report.

2. *Astronomical observations and reductions.*—The observations for the time determination were carried on as usual with the transit instrument by Troughton and Simms and the sidereal clock, No. 1408, by Dent. The observing weather was not very favourable during the period.

The following is a summary of the work:—

Transits observed of clock stars	222
Ditto for Azimuth	57
Separate determination of level and collimation error	59

3. *Meteorological observations.*—Meteorological observations were carried on as before and the registers brought up to date. An attempt was made to get a series of the temperatures of the air film in contact with the ground during the hot weather by means of a platinum thermometer and a Calendar Recorder. The series obtained was satisfactory but was not so complete as is desirable. They show that there is a very large difference between the temperature at the ground and the temperature at 4 feet above during the day hours when the dry westerly winds are blowing, and that this difference is smaller when the sea breeze sets in.

These observations will be continued during the year; later on an attempt will be made to determine the intervening temperature gradient.

4. *Time Service.*—The time service was continued as usual. The Fort Time Signal Gun failed on 19 occasions out of 550, giving a percentage of success of 96·5. The Time Ball at the Port Office failed at 1 P.M. on 3 days, but on two occasions it was dropped at 2 P.M. and the 4 P.M. signal was received at the Central Telegraph Office every day except on December 29, when there was an interruption on the line.

The following table gives a list of failures:—

Month and date.	Signal.	Fault.	Cause.
1901.			
7th April	Noon gun	Failed	Gunner absent.
4th May	8 P.M. „	Ditto	Not known.
3rd June	8 P.M. „	Ditto	Ditto.
25th „	Noon „	Ditto	Ditto.
27th „	Ditto	Ditto	Gunner absent.
1st August	8 P.M. gun	Ditto	Ditto.
5th „	Noon „	Ditto	Bad tube.
10th „	Time ball	Failed at 1 P.M., dropped at 2.	Not known.
18th „	Noon gun	Failed	Tube failed.
21st „	Time ball	Failed at 1 P.M., dropped at 2.	Not known.
„ „	8 P.M. gun	Failed	Ditto.
31st „	Ditto	Ditto	Gunner absent.
1st September	Ditto	Ditto	Bad tube.
19th „	Ditto	Ditto	Gunner absent.
20th „	Noon gun	Ditto	Bad tube.
23rd „	8 P.M. „	Ditto	Not known.

Month and date.	Signal.	Fault.	Cause.
1901.			
29th September . .	8 P.M. gun . .	Failed . . .	Not known.
11th November . .	Ditto . .	Ditto . . .	Ditto.
20th „ . .	Ditto . .	Ditto . . .	Ditto.
22nd December . .	Noon gun . .	Fired 2^{m} late . .	Probably by hand.
„ „ . .	8 P.M. „ . .	Failed . . .	Not known.
29th „ . .	Time ball . .	Ditto . . .	Line interrupted.
„ „ . .	4 P.M. roll . .	Not received at T. O. .	Ditto.

Daily weather telegrams and special storm observations.—Daily weather messages were sent to Simla, Bombay, and Calcutta. The 10^{h} and 16^{h} observations of Madras were reduced and sent to Calcutta every month. Special storm observations were supplied to the Bengal Reporter on the following occasions :—

May 5 and 6 and 22 to 24; June 6; September 19 to 22; November 13 and 14 and 24 to 26; December 8 and 9.

6. *Instruments.*—The working of all the instruments except the "wet bulb" of the thermograph has been satisfactory. The electric clock by Shephard and Sons was cleaned and has been working very satisfactorily since.

7. The following weather summary of Madras for the year 1901 was published in the *Fort Saint George Gazette.*

Pressure.—Was above the average for March, May, June, September and December, and below the average for the remaining months. The mean pressure for the day was lowest on the 7th June, 29·529 inches, and highest on the 23rd January, 30·168 inches.

Temperature.—Was above the average for every month except December when it was 0°·2 F. below. The highest shade temperature was 108°·5 F. on the 4th June and the lowest 59°·5 F. on the 26th November. The excess of the mean temperature was greatest in February and it averaged 3°·7 F.

Humidity.—Was below the average for March, equal to the average for May and June, and above the average for all the other months. Humidity was lowest on the 23rd May when it averaged 31.

Rainfall.—Was below the average for January, March, April, May, June, September, and October and above the average for the remaining months. The deficiency was greatest for May, 2·06 inches, and the excess was greatest for December for which month it was 8·87 inches. The rainfall for the year was 10·82 inches above the average, the total fall being 59·84 inches.

Wind.—Was most abnormal in February when it was one point more southerly than usual, with a daily velocity 38 miles higher than the average. The highest daily velocity was 415 miles on the 9th December; the lowest daily velocity was 42 miles on the 3rd October.

Sunshine.—Was below normal for all months.

Storms.—A storm formed in the south of the Bay at the end of the first week in December which crossed the Coromandel Coast near Madras. It was a depression of but slight intensity, but gave somewhat stormy weather over the centre of the Bay and on the Madras Coast. The chief feature of the storm was the exceptionally heavy rain it gave at Madras and in the neighbourhood. The amount that fell at the Observatory on the 9th was 10·62 inches and this has been exceeded only on one occasion during the last 41 years, *viz.*, on the 18th May 1877, when the fall was 13·01 inches.

C. MICHIE SMITH,

Director, Kodaikánal and Madras Observatories.

KODAIKÁNAL,

The 11th February 1902.

Appendix I.

Kodaikánal Observatory Seismological Records.

No.	Date.	Commencement, G. M. T.	Maxima, G. M. T.	Amplitude.		Duration.	Remarks.
	1901.	h. m.	h m.	Mm.	Seconds.	h. m.	
2	January 7 . .	1 0·2	1 57·7	0· 5	0·3	...	P. Ts. 45m.
			2 0·2	0·75	0·4	...	
			5·9	1· 0	0·5	1 24	
5	8. .	19 51·0	20 6·3	0· 5	0·3	0 29	
16	February 15 .	8 0·0	8 10·4	0· 5	0·3	...	P. Ts. 11m.
			24·8	0· 7	0·5	...	
			36·6	0· 5	0·3	0 43	
26	March 4 . .	16 35·5	16 44·9	0· 5	0·3	...	
			48·0	0· 5	0·3	...	
			51·1	0·25	0·2	0 30	
29	15 . .	3 5·9	3 31·3	0·75	0·5	0 57	P. Ts. 24m.
31	16 . .	12 8·5	12 19·3	1· 0	0·6	...	P. Ts. 3·5m. Felt in Zanzibar.
			21·4	0·75	0·5	...	
			34·9	0·75	0·5	1 4	
32	19 . .	0 10·8	0 12·3	1·25	0·8	0 47	
33	19 . .	20 43·0	21 3·8	0·25	0·3	0 35	
34	23 . .	15 1·8	15 2·8	0· 5	0·3	0 12	
35	25 . .	11 26·6	11 31·8	0· 5	0·3	0 10	P. Ts. 4m.
36	25 . .	22 58·7	22 59·7	1· 0	0·6	...	
			23 1·8	0·75	0·4	...	
			8·9	0·75	0·4	0 32	
38	April 5 . .	23 40·7	23 51·0	1· 0	0·6	...	P. Ts. 30m.
	6 . .		0 14·7	4· 0	2·5	...	
			16·3	4· 5	2·8	...	
			21·6	3· 0	1·9	...	
			27·3	2· 0	1·3	...	
			31·4	0· 5	0·9	1 50	
39	6 . .	21 16·3	21 17·3	0· 5	0·3	0 52	Well marked, though small.
40	7 . .	3 31·0	4 4·3	0· 5	0·3	...	
			19·7	1· 0	0·7	...	
			29·5	0· 5	0·3	...	
			5 7·3	1· 0	0·7	2 0	
42	11 . .	11 58·3	.....	...	...	0 4	Widening of line.
43	15 . .	17 40·2	17 44·3	1· 0	0·6	0 7	
44	16 . .	17 18·7	.....	...	...	...	Ditto.
45	18 . .	3 18·7	3 35·3	0·75	0·4	...	P. Ts. 16m.
			39·4	1· 0	0·5	...	
			45·6	0· 5	0·3	0 37	
46	19 . .	11 14·2	11 14·2	0· 5	0·3	...	
			44·1	1· 5	0·8	...	
			12 31·7	0· 5	0·3	1 20	
50	27 . .	4 7·4	4 9·4	3· 0	1·1	0 33	P. Ts. 3m.

No.	Date.	Commencement, G. M. T.	Maxima, G. M. T.	Amplitude.		Duration.	Remarks.
	1901.	h. m.	h. m.	Mm.	Seconds.	h. m.	
51	April 29 . .	11 38·5	11 38·5	1·5	0·7	...	
			42·0	0·5	0·2	...	
			44·5	1·0	0·5	1 0	
53	May 7 . .	10 21·1	10 23·2	2·0	1·0	0 20	
54	21 . .	11 15·1	11 15·6	0·5	0·2	0 3	
55	25 . .	0 53·3	1 25·0	0·5	0·2	...	P. Ts. 30·6m.
			32·1	0·5	0·2	...	
			46·4	1·0	0·4	2 8	
56	June 12 . .	9 25·7	9 26·0	...	...	0 12	Slight.
57	24 . .	7 11·8	7 22·6	0·7	0·4	...	P. Ts. 10m.
			42·8	1·2	0·8	1 35	
59	July 16 . .	0 16·3	0 16·3	1·0	0·5	...	
			1 29·2	1·25	0·6	...	
			2 8·6	0·25	0·1	...	
			32·9	1·0	0·5	2 25	
60	16 . .	3 31·0	3 32·1	1·0	0·5	...	
			34·0	0·75	0·4	...	
			42·3	0·5	0·2	0 15	
61	21 . .	3 51·6	3 52·6	0·75	0·5	...	
			53·8	1·1	0·6	0 5	
62	22 . .	8 55·9	8 55·9	0·25	0·2	...	
			9 24·1	0·75	0·5	...	
			25·6	0·5	0·3	1 5	
63	30 . .	21 35·4	21 35·4	0·75	0·4	...	
			36·9	0·75	0·4	...	
			53·5	1·0	0·5	...	
			22 19·3	1·0	0·5	1 14	
65	August 2 . .	11 28·0	11 53·9	1·0	0·5	...	
			12 50·7	1·5	0·8	...	
			59·0	1·0	0·5	1 24	
66	3 . .	12 12·7	.....	...	...	0 7	Widening of line.
68	4 . .	8 5·6	8 5·6	0·75	0·6	} ...	Single marks.
			7·7	1·0	0·9		
			12·8	0·3	0·3		
69	6 . .	18 47·5	18 55·3	1·2	1·0	0 40	P. Ts. 6m.
70	9 .	9 33·8	9 43·2	1·0	1·0	...	P. Ts. 8m. Many small maxima. Actual maximum probably lost as sheet was marked at 9h. 57m.
			10 13·1	1·0	1·0	1 25	
71	9 . .	13 14·2	13 26·6	1·5	1·5	...	P. Ts. 6m.
			29·7	1·5	1·5	...	
			32·3	2·0	2·0	...	
			40·1	1·75	1·8	...	
			55·6	1·25	1·3	...	
			56·8	1·5	1·5	...	
			59·5	1·5	1·5	...	
			14 01·7	1·75	1·8	2 45	
72	9 . .	18 53·5	19 17·3	2·0	2·0	...	
			19·3	1·5	1·5	...	
			21·8	1·25	1·3	...	
			25·6	2·0	2·0	1 20	

No.	Date.	Commencement, G. M. T.	Maxima, G. M. T.	Amplitude.		Duration.	Remarks.
	1901.	h. m.	h. m.	Mm.	Seconds.	h. m.	
73	August 11 .	15 15·2	...	...	...	0 20	Slight.
79	September 10 .	4 23·7	4 37·5	2·0	1·3	0 43	Port Blair Tide gauge clock stopped at 10-32 A. M. (Probably local time). P. Ts. 5m.
80	24 .	8 17·3	8 22·9	1·0	0·5	0 15	
82	30 .	10 39·0	10 58·3	0·5	0·3	...	P. Ts. 17m.
			11 00·4	0·5	0·3	...	
			02·4	0·5	0·3	...	
			05·4	1·0	0·5	1 00	
84	October 4 .	11 12·6	11 14·6	...	... }	0 08	Slight.
			19·7	...	... }		
86	17 .	6 00·5	6 07·0	0·5	0·4	...	P. Ts. 6m.
			13·1	1·0	0·7	0 30	
87	19 .	10 10·6	10 10·9	1·0	0·7	1 00	Maximum probably lost. Sheet marked 10h. 20m.
88	26 .	19 22·1	19 25·7	3·0	1·5	?	A series of large movements which drove the boom over to the east where it was caught. Maximum at least 5mm.
89	29 .	8 01·5	8 29·1	0·5	0·2	1 00	Small but well marked.
90	November 15 .	20 44·2	21 16·1	0·5	0·2	0 50	Widening of line.
91	17—18 .	23 59·4	0 15·1	4·5	2·2	...	
			17·7	3·5	1·7	1 11	
92	25 .	1 50·9	1 54·5	1·0	0·5 }	1 08	
			2 01·2	1·5	0·7 }		
93	December 12 .	3 22·6	3 22·6	...	...	0 03	Slight.
94	14 .	23 05·0	23 11·6	1·5	0·9	...	P. Ts. 3m.
			13·2	1·5	0·9	...	
			27·5	2·0	1·3	1 25	
97	30 .	23 01·3	23 27·0	0·3	0·1	...	P. Ts. 24m.
			32·6	0·3	0·1	...	
			37·2	0·5	0·3	1 20	
98	31 .	6 30·1	...	...	...	0 40	Slight but quite distinct.
99	31 .	9 14·7	9 28·1	0·8	0·4	...	P. Ts. 12m.
			10 00·9	2·5	1·4	...	
			04·0	2·0	1·1	...	
			06·1	2·0	1·1	3 00	
100	31 .	13 54·2	14 08·6	0·5	0·3	1 05	Slight.

Appendix II.

Longitude 5h 09m 52s E.
Latitude 10° 13′ 50″ N.

Mean monthly and annual meteorological results at the Kodaikánal Observatory in 1901.

Height of barometer cistern above sea-level 7,688 feet.

	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.	Inch.	°	°	°	°	°	°	Inch.	Cents.	°	°	Miles.	Points.	Points.	Inches.	No.	Cents.	Hours.
January	22·866	0·070	54·0	63·0	47·5	15·5	49·0	42·0	0·299	71	129·4	40·4	335	5	NE by E	2·05	3	59	245·2
February	·857	·070	54·9	63·4	48·6	14·8	51·2	45·1	·341	78	133·5	41·5	260	4	NE	3 55	5	44	175·6
March	·863	·069	56·6	66·4	49·8	16·6	49·3	42·7	·280	61	134·8	43·4	374	5	NE by E	4·47	3	60	256·3
April	·819	·069	59·4	68 6	53·5	15·2	53·4	46·7	·350	69	141·2	47·1	280	6	ENE	4·70	9	46	202·6
May	·811	·070	59·6	67·1	54·3	12·8	54·7	50·1	·381	74	134·8	48·4	283	1	N by E	5·33	8	41	201·9
June	·776	·056	57·8	65·3	53·5	11·8	53·7	49·3	·375	78	137·1	49·3	357	28	NW	6·35	14	30	154·3
July	·753	·058	56·1	63·1	52·2	10·9	52·9	48·5	·370	82	130·9	47·4	387	28	NW	6·23	8	28	120·0
August	·772	·062	56·8	63·6	52·5	11·1	53·8	49·3	·386	83	130·5	48·9	301	31	N by W	4·67	11	27	122·8
September	·812	·074	56·8	63·6	52·8	10·8	54·5	50·8	·403	87	134·1	49·5	248	1	N by E	11 14	15	28	104·6
October	·803	·080	55·7	63·0	51·9	11·1	53·7	49·7	·384	86	128·5	47·1	269	0	N	7·10	12	36	127·9
November	·804	·078	54·0	60·7	50·1	10·6	52·1	48·4	·374	89	120·6	47·6	247	3	NE by N	8·65	17	27	100·6
December	·838	·074	52·7	60·5	47·6	12·9	47·2	41·4	·275	68	117·7	41·3	337	5	NE by E	4 45	7	57	118·0
Annual	22·814	0·069	56·2	64·0	51·2	12·8	52·1	47·0	0·352	77	131·1	46·0	306	2	NNE	68·69	112	40	1,999·8

Extreme monthly meteorological records at the Kodaikánal Observatory in 1901.

	Barometer.					Dry Bulb Thermometer.				Wet Bulb.		Humidity.		Sun Therm in Vacuo.		Grass Therm.		Wind.				Rain.	
	Highest.		Lowest.		Range.	Highest.		Lowest.		Lowest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Greatest Fall.	
	Inches.	Day.	Inches.	Day.	Inch.	°	Day.	°	Day.	°	Day.	Cents.	Day.	°	Day.	°	Day.	Miles.	Day.	Miles.	Day.	Inches.	Day.
January	22·953	23	22·762	2	0·191	67·1	24	43·2	24	33·3	24	9	25	145·7	10	34·0	7	569	26	160	20	0·90	11
February	·953	19	781	12	·172	67·0	11	43·3	1; 2	33·0	2	5	2	146·5	12	34·1	5	469	3	155	13	1·23	21
March	·953	22	·800	1	·153	70·6	31	46·8	12	34·9	11	17	27	145·5	28	39·0	9	493	31	248	22	3·74	18
April	·905	6	·730	24	·175	73·9	16	49·0	1	39·7	1	16	1	150·3	12; 18	40·0	30	882	26	194	30	1 57	25
May	·922	1	·733	10; 25	·189	71·1	29	50·7	14	42·6	10	31	9; 29	148·4	15	40·6	29	441	24	159	7	1·53	16
June	·855	20	·654	7	·201	70·2	2	50·6	17	41·4	21	36	21	156·7	6	43·0	22	778	16	122	3	1·67	2
July	·839	21	·670	2	·169	6·66	9	49·3	7	41·1	7	42	8	145·3	9	45·9	20	603	27	166	19	0·75	14
August	·865	30	·693	9	·172	66·2	19	49·6	10	41·7	25	40	25	155·0	27	43·7	24	508	15	131	20	1·10	29
September	·883	10	·722	21	·161	67·8	9	50·3	29	46·5	21	64	21	146·7	9	43·8	4	459	27	144	17	1·91	26
October	·897	23	·682	1	·215	67·0	21	48·2	29	45·0	15	56	15	145·5	23	38·8	16	720	7	141	25	1·81	24
November	·891	4	·720	27	·171	66·1	17	39·1	27	35·0	27	13	29	136·6	9	28·3	27	554	25	132	23	2·25	8
December	·939	11	·764	25	·175	67·3	25	42·2	6	33·0	5; 6	15	14	134·9	8	23·4	6	700	5	87	6	1·66	2

Appendix III.

Kodaikánal Observatory.—Mean hourly wind velocity for the year 1901.

Hours.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	Total
January . .	15	15	15	15	15	15	14	14	14	14	15	16	15	15	13	11	10	10	11	13	13	14	15	15	332
February . .	11	10	10	11	10	10	10	10	11	13	13	13	12	11	11	10	10	9	8	9	9	10	11	10	252
March . . .	18	19	18	18	18	17	18	18	20	19	19	18	16	15	14	13	11	11	10	10	10	12	17	18	377
April . . .	13	13	13	13	13	12	13	13	14	15	14	14	13	11	11	11	11	10	9	10	10	10	11	12	289
May . . .	12	12	11	11	10	10	10	11	13	13	13	13	13	13	13	13	12	10	11	11	12	12	12	12	283
June . . .	15	15	15	16	17	16	16	14	14	14	15	14	14	14	14	14	13	15	15	15	15	15	14	15	354
July . . .	17	17	16	17	16	16	15	16	16	16	16	15	15	15	16	16	17	17	16	16	16	16	16	17	386
August . . .	13	15	15	14	13	13	14	12	11	12	12	13	12	12	12	14	13	12	11	11	12	12	12	11	301
September . .	11	12	11	11	10	11	11	11	11	12	11	11	11	10	10	10	9	8	8	9	9	9	10	10	246
October . .	13	12	12	12	12	10	11	11	11	11	12	11	11	11	9	9	9	9	11	11	10	12	13	13	266
November . .	10	11	11	11	11	11	11	11	11	12	12	11	11	10	9	9	9	8	9	10	10	11	11	10	250
December . .	14	14	14	13	14	15	14	15	16	16	16	16	16	14	13	12	11	12	12	13	14	14	14	14	336
Sums .	162	165	161	162	159	156	157	156	162	167	168	165	159	151	145	142	135	131	131	138	140	147	156	157	3,672
Means .	14	14	13	14	13	13	13	13	14	14	14	14	13	13	12	12	11	11	11	12	12	12	13	13	306

Appendix IV.

Kodaikánal Observatory.—Mean hourly bright sunshine for the year 1901.

Month.	Mean bright hours of month.													
	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	...	0·2	0·8	0·9	0·9	0·9	0·8	0·8	0·7	0·7	0·6	0·4	0·1	...
February	...	0·2	0·8	0·9	0·9	0·8	0·7	0·5	0·5	0·4	0·3	0·2	0·0	...
March	...	0·3	0·8	0·9	0·9	0·9	0·8	0·8	0·7	0·7	0·6	0·5	0·3	...
April	...	0·3	0·7	0·7	0·8	0·8	0·8	0·8	0·5	0·5	0·4	0·3	0·1	...
May	...	0·3	0·6	0·8	0·8	0·8	0·8	0·6	0·5	0·5	0·3	0·3	0·1	...
June	...	0·2	0·5	0·7	0·7	0·6	0·7	0·5	0·4	0·3	0·2	0·2	0·1	...
July	...	0·1	0·4	0·6	0·5	0·5	0·5	0·4	0·3	0·2	0·2	0·2	0·1	...
August	...	0·2	0·4	0·6	0·6	0·6	0·5	0·3	0·2	0·2	0·2	0·1	0·0	...
September	...	0·1	0·4	0·7	0·6	0·5	0·5	0·3	0·2	0·1	0·1	0·0	0·0	...
October	...	0·0	0·5	0·7	0·7	0·7	0·5	0·4	0·2	0·2	0·2	0·1	0·0	...
November	...	0·0	0·3	0·5	0·5	0·4	0·4	0·4	0·3	0·2	0·2	0·1	0·0	...
December	...	0·1	0·6	0·7	0·7	0·7	0·7	0·6	0·6	0·5	0·4	0·4	0·0	...
Mean	...	0·2	0·6	0·7	0·7	0·7	0·6	0·5	0·4	0·4	0·3	0·2	0·1	...

Note—These statistics are given for solar time not for mean time.

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.
April	1	6	8	2	17
May	5	7	2	3	17
June	10	5	2	1	18
July	3	4	2	2	11
August	1	2	1	6	10
September . . .	10	4	5	2	21
October	2	2	5	1	10
November . . .	7	6	2	1	16
December . . .	6	10	3	2	21
Total . .	45	46	30	20	141

Appendix VI.

Longitude 5 h. 10 m. 10 s. E.
Latitude 10° 9′ N.

Mean Monthly and Annual Meteorological Results at the Periyakulam Observatory in 1901.

Height of barometer cistern above sea-level 944 feet.

	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 Table.				Daily Velocity.	Mean Direction.		Amount.	Days.	
	Inches.	Inch.	°	°	°	°	°	°	Inch.	Cents.	°	°	Miles.	Points.	Points.	Inches.	No.	Cents.
January	29·026	0·144	77·4	88·8	67·1	21·8	69·6	64·8	0·620	66	...	61·1	47·0	1	N by E	5·09	4	66
February	28·992	·151	80·0	91·5	69·9	21·6	70·8	66·6	·631	61	151·5	64·7	52·0	1	N by E	2·13	3	57
March	·989	·154	80·7	92·7	69·6	23·1	70·5	66·0	·624	60	151·6	62·4	47·7	30	NNW	2·13	3	64
April	·891	·140	83·5	95·8	73·8	22·0	73·7	70·3	·691	63	155·4	69·5	51·7	4	NE	3·57	6	48
May	·865	·122	83·4	96·6	73·5	23·1	74·0	70·4	·700	63	160·0	70·0	60·4	1	N by E	1·70	7	48
June	·854	·107	81·3	93·7	71·5	22·2	72·2	68·5	·664	63	155·2	67·9	92·0	28	NW	1·48	5	39
July	·836	·110	81·0	94·2	71 2	23·0	71·1	67·4	·626	59	158·5	65·8	98·1	26	WNW	0·21	0	34
August	·855	·123	81·7	94·9	71·5	23·4	71·8	67·9	·646	61	160·5	66·8	91·3	0	N	1·36	4	36
September	·905	·122	80·5	92·3	72·4	19·8	73·0	69·9	·705	69	158·0	69·4	69·2	28	NW	4·85	8	37
October	·909	·120	78·6	88·7	70·9	17·8	72·3	68·9	·708	72	150 0	67·2	44 0	29	NW by N	4·85	12	40
November	·946	·116	76·1	84·5	70·3	14·2	71·4	68·3	·709	79	137·3	66·0	29·1	2	NNE	8·17	9	37
December	29·026	·126	73·5	84·0	65·1	18·9	67·2	63·0	·586	71	136·6	58·8	36·7	3	NE by N	1·36	2	55
Annual	28·925	0·128	79·8	91·5	70·6	20·9	71·5	67·7	0·659	66	152·2	65·8	59·9	31	N by W	37·80	63	47

Extreme Monthly Meteorological Records at the Periyakulam Observatory in 1901.

	Barometer.					Dry Bulb Thermometer.				Wet Bulb.		Humidity.		Sun Therm. in Vacuo.		Grass Therm.		Wind.				Rain.	
	Highest.		Lowest.		Range.	Highest.		Lowest.		Lowest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Greatest Fall.	
	Inches.	Day.	Inches.	Day.	Inch.	°	Day.	°	Day.	°	Day.	Cents.	Day.	°	Day.	°	Day.	Miles.	Day.	Miles.	Day.	Inches.	Day.
January	*29·184*	*24*	28·860	3	0·324	93·0	5	59·2	26	57·5	26	35	30	...	...	50·5	26, 28	77·1	4	24·5	6	*3·30*	*11*
February	·137	19	·836	12	·301	95·2	13	59·2	3	56·7	3	32	2	159·0	15	51·3	2	113·1	2	23·9	9	0·82	23
March	·126	22	·868	31	·258	97·0	29	61·7	11	56·9	11	26	26	158·8	28	51·1	11	89·9	13	22·5	17	1·38	2
April	·039	1	·732	20	·307	99·8	16, 21	68·5	1	65·4	1	24	17	164·8	19	61·1	1	91·9	7	17·3	28	1·07	5
May	·028	1	·707	10	·321	*102·3*	*29*	65·9	9	63·3	9	*20*	*9*	*174·0*	*22*	61·8	10	99·7	7	38·4	4	0·74	19
June	28·980	14	·712	6	·268	98·8	20	65·9	21	62·8	21	29	20	163·3	9	60·6	22	151·4	25	25·0	28	0·75	1
July	·937	11	*·690*	*7*	·247	100·0	7	65·9	8	60·8	9	28	7	170·5	31	57·4	8	143·6	31	34·0	16	0·07	14
August	·991	31	·725	6	·266	99·3	30	66·7	25	63·3	25	31	24	170·3	4	59·7	25	*155·0*	*14*	35·2	15	0·44	31
September	29·000	10	·701	21	·239	98·3	5	70·4	14	67·5	3, 5	34	8	167·3	1	66·1	14	133·9	6	33·7	30	0·96	8
October	·039	27	·764	6	·275	92·4	22	66·9	16	64·0	16	42	16	156·3	4	60·8	16	71·5	17	19·7	11	0·75	25
November	·043	8	·838	14	·205	89·1	17	62·0	27	59·2	27	44	30	148·8	1	53·3	27	60·0	16	*12·2*	*26*	2·31	18
December	·146	23	·911	28	·235	86·7	30	*58·0*	*6*	*56·0*	*6*	37	5, 16, 22	147·6	19	*47·3*	6	70·5	31	16·4	11	0·59	2, 10

Appendix VII.

ABSTRACT of the MEAN METEOROLOGICAL CONDITION of MADRAS in 1901, compared with the average of past years.

Mean values of	1901.	Difference from	Average.
Reduced atmospheric pressure	29·862	0·002 below	29·864
Temperature of air	82·4	1·3 above	81·1
Do. of evaporation	76·1	1·6 „	74·5
Percentage of humidity	74	2 „	72
Greatest solar heat in *vacuo*	138·8	0·9 below	139·7
Maximum in shade	91·5	0·7 above	90·8
Minimum in shade	75·5	0·8 „	74·7
Do. on grass	73·9	2·0 „	71·9
Rainfall in inches on 99 days	59·84	10·82 „	49·02
General direction of wind	SE by E	1 point E	SE
Daily velocity in miles	159	12 below	171
Percentage of clear sky	52	1 above	51
Do. of bright sunshine	51·5	9·5 below	61·0

DURATION and QUANTITY of the WIND from different points.

From	Hours.	Miles.	From	Hours.	Miles.	From	Hours.	Miles.	From	Hours.	Miles.
North	196	1,197	East	274	1,707	South	166	1,133	West	269	2,332
N by E	120	891	E by S	557	3,004	S by W	247	1,575	W by N	213	1,983
NNE	239	1,536	ESE	205	1,384	SSW	172	1,163	WNW	100	844
NE by N	481	2,826	SE by E	726	4,012	SW by S	227	1,402	NW by W	96	660
NE	233	1,865	SE	330	2,044	SW	150	954	NW	45	236
NE by E	467	3,008	SE by S	801	6,922	SW by W	137	819	NW by N	114	486
ENE	226	1,339	SSE	277	2,358	WSW	163	1,180	NNW	47	253
E by N	434	2,674	S by E	334	2,654	W by S	284	2,219	N by W	283	1,460

There were 147 calm hours during the year. The resultant corresponding to the above numbers is represented by a S.E. by E. wind, blowing with a uniform daily velocity of 45 miles.

Appendix VIII.

Madras Observatory.—Number of hours of wind from each point in the year 1901.

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	...	1	2	35	12	111	83	216	70	138	8	...	16	24	1	2	...	1	2	2	...	...	...	...	...	...	...	...	...	...	...	...	20
February	...	...	...	1	19	113	20	43	54	104	78	114	10	42	24	14	1	3	1	2	3	6	2	2	...	...	...	...	...	...	...	...	16
March	...	...	1	29	19	78	30	45	25	122	20	290	64	8	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	13
April	...	...	...	...	...	...	...	19	2	10	12	103	47	350	68	28	14	28	20	7	1	2	...	...	...	...	...	...	...	...	...	...	9
May	...	1	...	2	1	3	4	7	5	13	17	71	23	187	51	75	33	45	30	45	1 8	11	23	10	5	15	9	12	4	11	2	2	9
June	3	1	2	2	1	1	...	1	7	7	9	22	32	72	49	72	25	43	30	39	16	14	32	78	46	58	22	25	5	3	...	3	...
July	10	1	1	2	4	3	1	3	3	6	4	4	21	19	17	34	37	28	31	49	25	38	37	82	128	64	31	20	7	14	1	13	6
August	4	...	...	...	4	...	1	5	6	25	3	28	20	18	25	56	37	49	41	49	43	30	44	61	55	46	18	21	14	22	3	9	7
September	8	1	1	11	5	9	1	23	29	70	27	70	38	24	36	25	9	47	11	22	29	20	18	28	29	23	15	6	3	15	3	48	16
October	27	20	47	45	22	59	16	12	16	31	18	13	56	49	6	6	9	2	3	12	15	15	7	23	6	7	5	12	12	29	30	74	40
November	104	56	40	57	63	43	42	44	40	29	9	8	1	8	...	22	1	1	3	...	...	1	...	...	...	...	...	...	...	20	8	111	9
December	40	39	145	297	83	47	28	16	17	2	...	3	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	23	2
Annual	196	120	239	481	233	467	226	434	274	557	205	726	330	801	277	334	166	247	172	227	150	137	163	284	269	213	100	96	45	114	47	283	147

Appendix IX.

Madras Observatory.—Number of miles of wind from each point in the year 1901.

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	...	8	22	187	153	530	460	1388	456	661	16	...	41	137	7	12	...	4	14	14	...	...	...	...	...	...	...	...	...	...	...	...	4110
February	...	...	...	8	205	840	212	274	298	680	483	728	89	306	124	121	9	25	6	16	21	16	5	4	...	...	...	...	...	...	...	...	4470
March	...	...	10	122	135	518	239	229	168	642	169	1347	377	128	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4084
April	...	...	...	...	...	...	...	70	25	97	123	532	384	3039	638	280	100	197	164	74	8	10	...	...	...	...	...	...	...	...	...	...	5741
May	...	5	...	18	11	32	36	63	45	102	172	531	212	1840	506	616	223	290	230	268	121	58	180	76	42	137	80	106	33	103	16	33	6185
June	30	10	24	15	11	7	...	4	70	63	90	216	260	729	500	664	217	273	228	300	140	131	303	773	490	675	240	265	49	22	...	24	6823
July	58	7	6	10	9	10	10	22	20	50	29	20	176	158	159	272	255	211	128	316	187	255	263	647	1174	661	204	96	25	58	4	37	5681
August	15	...	...	...	41	...	5	28	48	120	18	226	133	118	169	368	209	317	238	227	251	199	298	471	386	341	112	109	76	84	29	30	4666
September	25	8	8	48	34	33	7	167	212	305	149	273	164	177	226	186	53	243	71	112	132	86	100	163	213	131	96	27	15	54	23	203	3744
October	111	141	150	187	86	221	62	54	54	124	84	69	181	253	29	35	58	10	17	75	94	59	31	85	27	38	22	57	38	94	108	350	3013
November	694	355	284	370	411	299	181	180	157	125	51	41	9	37	.	100	9	5	13	...	..	5	...	...	...	...	...	...	...	71	73	567	4049
December	264	357	1032	1855	769	518	127	180	154	35	...	20	18	...	...	...	...	...	...	...	...	.	...	...	...	...	...	...	...	...	...	207	5554
Annual	1197	891	1536	2826	1865	3006	1339	2674	1707	3004	1384	4012	2044	6922	2358	2654	1133	1575	1163	1402	954	819	1180	2219	2332	1983	844	660	236	486	253	1460	58120

Appendix X.

Madras Observatory.—Number of inches of rain from each point in the year 1901.

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.	Total.
January	...	0·04	...	0·12	...	...	0·03	0·04	0·16	0·33	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0·72
February	...	...	...	...	...	...	...	0·55	...	...	...	0·23	0·31	...	0·42	0·13	...	0·67	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2·31
March	...	...	...	...	...	...	...	...	...	0·03	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0·03
April	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
May	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0·03	...	0·03	...	...	...	...	...	...	...	...	...	...	...	...	...	0·06
June	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0·09	0·68	...	...	...	...	...	0·15	...	0·03	0·01	0·01	...	0·01	...	...	...	0·38
July	...	...	...	...	0·07	...	...	...	0·93	0·14	0·23	0·02	0·17	0·55	0·05	0·40	0·19	0·30	0·30	0·28	0·18	0·53	0·37	0·02	0·04	1·08	0·03	0·35	...	0·41	...	...	...	6·64
August	...	...	...	...	0·22	...	...	...	...	...	...	...	...	0·99	...	0·14	0·44	0·02	0·65	1·50	0·03	0·08	0·13	0·06	0·10	0·04	0·10	1·76	0·01	0·78	0·23	...	...	7·28
September	0·37	...	...	...	...	...	...	0·44	...	...	0·10	0·35	0·53	...	0·52	0·08	0·23	...	...	...	0·22	...	...	...	...	0·06	0·01	...	...	0·64	0·03	0·57	...	4·15
October	0·29	0·39	0·08	2·15	...	1·07	0·08	0·34	....	...	...	...	...	0·04	...	...	...	...	...	...	...	...	...	0·03	0·46	...	...	...	...	...	0·17	3·91	0·10	9·11
November	0·39	0·05	1·46	0·75	0·35	0·34	1·19	2·13	1·82	0·95	2·43	0·48	1·10	0·85	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0·58	0·14	15·01
December	1·52	0·19	0·43	1·76	1·05	0·80	0·46	0·66	0·73	1·08	...	3·41	1·83	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0·23	...	14·15
Annual	2·57	0·67	1·97	4·78	1·69	2·21	1·76	4·16	3·64	2·53	2·76	4·49	3·94	2·43	0·99	0·84	0·97	0·99	0·98	1·78	0·43	0·61	0·65	0·11	0·63	1·19	0·15	2·11	0·02	1·83	0·43	5·29	0·24	59·84

Appendix XI.

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 No. of hours in a day.	Average per day.
1901	Miles.	Point.						Hours.	Hours.	Inch.
January	120	E by N	2·9	4·5	3·3	2·3	3·3	8·1	10·0	0·170
February	128	E by S	3·6	4·5	2·8	2·1	3·3	8·7	10·5	·204
March	113	E by S	2·1	3·1	1·6	1·3	2·0	9·4	10·6	·215
April	175	SE by S	5·2	4·4	3·5	2·1	3·8	8·3	11·2	·271
May	130	SSE	3·9	3·3	3·2	3·0	3·4	7·9	9·9	·288
June	115	SW by S	4·7	5·2	6·3	5·3	5·4	5·4	9·0	·336
July	156	WSW	7·7	7·3	8·2	8·3	7·8	3·2	9·5	·242
August	81	SW	7·5	6·8	7·0	5·7	6·7	4·9	10·6	·234
September	41	SE by S	6·1	5·9	5·2	3·8	5·3	4·7	10·0	·187
October	26	NE	5·4	5·7	5·8	5·1	5·5	5·6	10·7	·201
November	104	NE by N	6·2	7·2	7·2	5·7	6·7	3·5	8·4	·137
December	166	NE by N	4·4	5·4	4·8	3·5	4·5	5·4	8·5	·159
Annual	45	SE by E	5·0	5·3	4·9	4·0	4·8	6·3	...	...

Appendix XII.

Mean Monthly and Annual Meteorological Results at the Madras Observatory in 1901.

	Barometer.		Dry Bulb Thermometer				Wet Bulb.	Tension of Vapour / Relative Humidity		Sun Max. in Vac.	Min on grass.	Wind.			Rain.		Clear Sky.	Bright sunshine.	General Weather.
	Reduced to 32°	Daily Range.	Mean.	Max.	Min.	Range.	Mean.	By Blanford's Tables.				Daily Velocity.	Mean Direction.		Amount.	Days.			
	Inches.	Inch.	°	°	°	°	°	Inch.	Cents.	°	°	Miles.	Points.	Points.	Inches.	No.	Cents.	Hours.	
January	29·989	0·120	78·4	86·5	70·1	16·4	73·0	0·741	76	139·0	67·9	133	7	E by N	0·72	7	67	252·6	
February	·952	·120	80·4	87·6	73·1	14·5	74·3	·767	74	139·7	71·4	160	9	E by S	2·31	7	67	242·9	
March	·944	·124	81·0	89·8	71·6	18·2	74·6	·771	73	140·9	69·6	132	9	E by S	0·03	1	80	291·3	
April	·820	·133	84·6	92·8	77·6	15·2	78·3	·888	75	143·1	76·0	191	13	SE by S	...	...	62	240·4	
May	·743	·122	88·0	100·0	80·6	19·4	79·3	·890	67	144·4	79·4	200	15	S by E	0·06	2	66	245·1	
June	·711	·119	88·4	101·0	82·5	18·5	78·2	·829	62	143·9	81·3	227	19	SW by S	0·38	5	46	160·7	
July	·699	·122	85·3	96·1	78·9	17·2	76·9	·810	67	133·5	77·5	183	21	SW by W	6·64	16	22	100·5	
August	·734	·135	83·8	94·2	77·7	16·5	77·5	·859	74	139·6	76·4	151	20	SW	7·28	20	33	152·0	
September	·793	·122	83·9	93·2	77·5	15·7	78·4	·898	77	142·1	76·3	125	14	SSE	4·15	12	47	142·2	
October	·819	·127	81·9	90·4	75·3	15·1	77·4	·881	81	137·9	73·5	97	3	NE by N	9·11	8	45	174·9	
November	·884	·113	77·9	84·6	72·7	11·9	74·3	·807	84	130·8	71·1	135	4	NE	15·01	14	33	104·6	
December	30·000	·114	75·3	82·3	68·9	13·4	70·6	·690	78	130·6	66·3	179	3	NE by N	14·15	7	55	166·1	
Annual	29·841	0·123	82·4	91·5	75·5	16·0	76·1	0·819	74	138·8	73·9	159	11	SE by E	59·84	99	52	2273·3	=51·5%

Extreme Monthly Meteorological Records at the Madras Observatory in 1901.

	Barometer.					Dry Bulb Thermometer.				Humidity.		Sun Therm. in Vacuo.		Grass Therm.		Wind.				Rain.	
	Highest.		Lowest.		Range.	Highest		Lowest.		Lowest.		Highest.		Lowest.		Highest.		Lowest.		Greatest Fall.	
	Inches.	Day.	Inches.	Day.	Inch.	°	Day.	°	Day.	Cents.	Day.	°	Day.	°	Day.	Miles.	Day.	Miles.	Day.	Inches.	Day.
January	*30·168*	*23*	29·826	3	0·342	89·7	19	64·0	24	46	23	144·9	19	61·6	24	225	13	77	26	0·18	10
February	·090	19	·781	2	·309	89·3	24	67·4	10	52	9	144·3	17	64·9	10	271	24	98	15	0·67	15
March	·072	3	·803	29	·269	92·0	15	69·2	7	53	7	146·8	15	66·7	7	175	10	92	5	0·03	15
April	29·975	1	·651	19	·324	95·4	19	70·9	1	49	10	151·6	8	68·8	1	261	20	128	1	...	...
May	·958	1	·589	10	·369	107·2	9	76·5	1	*31*	*23*	151·9	7	75·4	1	255	16	135	3	0·03	6, 25
June	·841	14	*·529*	*7*	·312	*108·5*	*4*	78·5	27	37	13	152·9	18	76·4	27	319	9	157	24	0·16	15
July	·812	21	·558	6	·254	102·3	12	73·5	15	34	7	152·7	8	71·8	22	280	8	82	2	1·84	25
August	·890	30	·572	5	·318	99·1	11	73·3	14	45	3	148·8	29	73·2	14	186	10	115	30	1·43	4
September	·929	29	·620	21	·309	97·5	21	72·9	20	44	21	153·7	15	72·1	20	180	24	76	18	1·08	28
October	·971	18	·655	5	·315	97·3	15	60·4	20	39	25	*156·8*	*24*	66·9	29	155	15	*24*	*3*	3·63	27
November	·994	8	·751	15	·243	90·2	16	*59·5*	*26*	37	26	143·3	4	*55·1*		243	20	75	28	3·28	7
December	30·117	23	·866	9	·251	85·5	1	63·4	13	46	4	138·4	28	60·0	5	*415*	*9*	70	13	*10·62*	*9*

Appendix XIII.

Madras Observatory.—Abnormals from monthly means for the year 1901.

	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November.	December.	Annual.
Reduced atmospheric pressure. . . .	—0·008	— 0·012	+0·039	— 0·005	+0·008	+ 0·008	—0·021	—0·015	+0·016	—0·023	— 0·040	+ 0·022	— 0·002
Temperature of air	+3·3	+ 3·7	+1·0	+ 0·6	+1·3	+ 2·0	+0·8	+0·5	+0·9	+1·3	+ 0·4	— 0·2	+ 1·3
Do. evaporation.	+3·8	+ 3·5	+0·7	+ 0·7	+1·0	+ 1·6	+1·0	+1·5	+2·1	+1·8	+ 1·4	Same as	+ 1·6
Percentage of humidity	+3	+ 1	—1	+ 1	Same as	Same as	+2	+4	+5	+3	+ 5	+ 1	+ 2
Greatest solar heat in vacuo	+0·6	Same as	+0·4	+ 1·4	+1·4	+ 3·4	—5·2	—0·4	+0·8	—1·2	— 6·6	— 5·2	— 0·9
Maximum in shade	+1·9	+ 1·0	+0·6	— 0·1	+2·2	+ 2·7	+0·5	+0·5	Same as	+1·3	— 0·4	— 1·3	+ 0·7
Minimum do.	+2·6	+ 5·1	—0·5	+ 0·4	—0·2	+ 2·2	+0·4	+0·4	+0·4	+0·1	+ 0·4	— 0·9	+ 0·8
Do. on grass	+4·8	+ 7·6	+1·0	+ 1·3	+0·5	+ 2·7	+0·9	+1·0	+1·3	+0·7	+ 1·6	— 0·1	+ 2·0
Rainfall in inches	—0·17	+ 2·03	—0·36	— 0·62	—2·06	— 1·73	+2·77	+2·72	—0·54	—1·89	+ 1·80	+ 8·87	+10·82
Do since January 1st	...	+ 1·86	+1·50	+ 0·88	—1·18	— 2·91	—0·14	+2·58	+2·04	+0·15	+ 1·95	+10·82	...
General direction of wind.	2 points E	1 point S	3 points E	Same as	Same as	Same as	1 point W	1 point W	4 points E	4 points N	2 points E	1 point E	1 point E
Daily velocity	—11	+38	—20	Do.	—27	+ 7	—15	—23	—34	—26	—30	— 4	— 12
Percentage of clear sky	+ 4	— 9	+ 4	—10	+ 4	+ 10	— 7	Same as	+ 9	+4	— 8	+ 7	+ 1
Do. bright sunshine	—4·4	—10·3	—2·9	—12·1	—6·7	—10·6	—7·2	—2·4	—5·5	—7·6	—24·9	—16·2	— 9·5

+ Means above normal, —below.