KODAIKÁNAL AND MADRAS OBSERVATORIES.

REPORT FOR THE YEAR 1909.

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KODAIKANAL AND MADRAS OBSERVATORIES.

I.—REPORT OF THE KODAIKÁNAL OBSERVATORY FOR THE YEAR 1909.

1. **Staff.**—The staff of the observatory on the 31st December 1909 was as follows:—

Director	C. Michie Smith, B.Sc.
Assistant Director	J. Evershed.
First Assistant	S. Sitarama Aiyar, B.A.
Second Assistant	G. Nagaraja Aiyar.
Third Assistant	A. Y. Subrahmanya Aiyar, B.A.
Fourth Assistant	S. Balasundaram Aiyar.
Writer	L. N. Krishnaswami Aiyar.
Photographic Assistant	R. Krishna Aiyar.

The first assistant, M.R.Ry. K. V. Sivarama Aiyar Avargal, M.A., B.L., retired from the service on medical certificate on February 12. He had done much valuable work during his service of 15 years in the Madras and Kodaikánal Observatories and it was with great regret that the decision of the medical authorities that he could not again return to work was accepted. Mr. S. Sitarama Aiyar, Mr. G. Nagaraja Aiyar, and Mr. A. Y. Subrahmanya Aiyar were respectively confirmed as first, second, and third assistants. The first assistant was on privilege leave for 40 days from July 26, the second assistant for 1 month and 2 days from October 18, and the fourth assistant for 17 days from March 4, and for 41 days from November 12.

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

2. **Distribution of work.**—The Director is in charge of the 40-foot spectrograph and the pyrheliometer; the Assistant Director is in charge of the spectroheliograph and associated instruments. The first, second, and third assistants are in charge of the work with the Cooke equatorial (spectroscopic), the Lerebour and Secretan equatorial (visual), the photoheliograph, the transit instrument, and the seismometer. They have also to do the astronomical computing and the preparation of the observations for the press. The fourth assistant has charge of the clock comparisons and, with the help of the writer, is responsible for the whole of the meteorological work. The writer is responsible for the accounts, correspondence, and all office records. The photographic assistant has charge of most of the photographic developing, printing, etc.

3. **Buildings and grounds.**—From April 1 the responsibility for all the minor repairs to the buildings, fences, etc., was transferred from the Public Works Department to the Director and an annual grant will be made for the purpose. This, while involving a considerable amount of extra work, renders it much easier to keep all the buildings in good repair and is certainly an economical arrangement.

(*a*) *Spectroheliograph building.*—The roof of the main building has been covered with ruberoid and is now in a satisfactory condition. Two new piers have been built in it for carrying a new spectrograph (No. III.).

(*b*) *Grounds.*—A large number of pine and cypress trees have been planted to the east of the spectroheliograph building where the ground is at present very bare, and it is hoped that enough of seedlings will be available during the current year to complete the planting of this area.

The trees formerly planted in various parts of the compound are making good progress and are already exercising a most valuable influence on the observing conditions. The plantation surrounding the Observatory compound on the west and north-west was burned down on January 26, for the second time, and the Observatory compound was protected from the flames only by the strenuous exertions of the staff. A beginning has been made in planting a screen of wattle round the part of the compound most exposed to fire and it is hoped that when this grows up it will greately reduce the risk.

4. **Instruments.**—The following are the principal instruments belonging to the Observatory, or in use, at the present time :—

Six-inch Cooke equatorial.
Six-inch Lerebour and Secretan equatorial remounted by Grubb with a five-inch Grubb portrait lens of 36 inches focus attached.
Spectograph I.—consisting of slit, collimator lens of 4 or 7 feet focus, 2-inch parabolic grating, and camera tube without lens. Used in connection with an 11-inch polar siderostat and 6-inch Grubb lens of 40 feet focus.
A rhomb with ends cut at 45° mounted on a graduated circle can be placed in front of the slit so as to enable any part of the limb to be brought on to the slit.
Spectrograph II.—consisting of slit, collimator lens of 3 feet focus, 3-inch plane grating and camera lens of 7 feet focus. Used in connection with the 12-inch photo-visual lens of the spectroheliograph.
Spectroheliograph—with 18-inch siderostat and 12-inch Cooke photo-visual lens of 20 feet focus, by the Cambridge Scientific Instrument Company.
An auxiliary spectroheliograph attached to the above, made in the Observatory workshop.
Six-inch transit instrument and barrel chronograph, formerly the property of the Survey of India.
Six-prism table spectroscope—Hilger.
Photoheliograph Dallmeyer No. 4.
Theodolite, six-inch—Cooke.
Two phototheodolites by Steinheil, for cloud photography.
Sextant.
Evershed spectroscope with three prisms for prominence and sunspot work, by Hilger.
Mean time clock, Kullberg 6326.
Do. Shelton.
Mean time Chronometer, Kullberg 6299.
Sidereal chronometer, Kullberg 6134.
Tape chronograph, Fuess.
Micrometer for measuring spectrum photographs, Hilger.
Dividing engine, Cambridge Scientific Instrument Company, Limited
Two Balfour Stewart actinometers.
Buchanan's solar calorimeter
Induction coil with necessary adjuncts.
Small polar siderostat.
Universal instrument.
Complete set of meteorological instruments, including Richard barograph and thermograph, and wind recorders.
A high class screw cutting turning lathe by Messrs. Cooke & Sons.
Ångström Pyrheliometer.
Single meniscus lens 5″ aperture, 15-feet focus.
An 18-inch concave mirror by Henry of Paris belonging to the Assistant Director has been mounted in the spectroheliograph room for general spectrum work and for large scale photographs of sunspots.
Spectrograph III.—consisting of slit provided with vertical and horizontal millimetre scales for measuring position angles and a reflecting device for rotating the sun's image, collimator lens of 210 c.m focus, 6 inch Michelson grating, and camera lens of about 4 metres focus. The spectrograph is used with the 18-inch concave mirror.

The Observatory was struck by lightning twice during the year, on March 29 and in May and considerable damage was done to the electrical instruments. On the first occasion the flash apparently entered by the telegraph line and, though part of it went to earth through the lightning discharger, enough remained to splash on to the internal circuits. It stopped the standard clock through the fusing of the seconds contacts, fused the coils of one of the relays and several bells, and injured the telephones. The wire leading to the spectroheliograph house was fused where it came near the branch of a tree.

On the second occasion the only damage done was to a bell circuit. New and more sensitive lightning dischargers have now been placed on the main circuits.

OBSERVATIONS.

(*a*) Solar Physics.

5. The following table shows for each day the solar observations that were made:—

Table A.

Solar Observations in 1909.

A = Spots observed. B = Spot spectra. C = Prominences. D = Photoheliograms. E = Spectroheliograms.

Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1 ..	——	A B C D E	A— C D E	A— C D E	A— *C* D *E*	A— *C* D *E*	A— — — —	A— — — —	A— —D *E*	A— *C* D *E*	A— *C* D E	A B C D E
2 ..	——	A B C D E	A— *C* D *E*	A B C D E	A— C D E	A— *C* D *E*	A— — D *E*	A— *C* D E	A — — — —	A— *C* D E	A— C D E	A B *C* D E
3 ..	——	A B *C* D E	A B C D E	A B *C* D E	A — — — —	A — — — —	A— C D *E*	A— C D E	— — — — —	A— —D E	A— C D E	A— C D E
4 ..	A— *C* D *E*	A B C D E	A— C D E	A— *C* D E	——	——	A— *C* D *E*	A— *C* D *E*	A— *C* D *E*	A— C D E	A — — — —	A— C D E
5 ..	A B C D E	A B *C* D E	A B C D E	A B C D E	A— *C* D *E*	A — — — —	A— C D E	A— C D E	A— C D E	A— C D E	A B *C* D E	A— *C* D E
6 ..	A B — — *E*	A B C D E	A B C D E	A B C D E	——	A — — D —	A— *C* D E	A— *C* D *E*	A— C D E	A— C D E	A B C D E	A— C D E
7 ..	A B C D E	A— C D E	A— C D E	A— C D E	——	A — — — —	A — — — —	A— C D E	A— —D *E*	A— *C* D E	A *B C* D E	A— C D E
8	A B C D E	A— C D E	A— —D *E*	A B C D E	A— C D E	A— *C* D E	A— — D—	A— *C* D E	A— C D E	A— *C* D E	A— *C* D E	—— — — —
9	A— C D E	A— *C* D E	A— C D E	A— *C* D E	A B *C* D E	A B C D E	A— — D—	A— *C* D E	A B C D E	A— *C* D E	A— *C* D *E*	A— C D E
10 ..	A B C D E	A— C D E	A— C D E	A— *C* D E	A B C D E	A *B* C D E	A— — D—	A— C D E	A— *C* D E	A— *C* D E	A— C D E	A— C D *E*
11 ..	A— C D E	A— C D E	A— C D E	A— C D E	A B C D E	A— *C* D E	A— *C* D *E*	A— C D E	A— *C* D E	A B *C* D E	A— C D E	A— C D E
12 ..	A B C D E	A— C D E	A B C D E	A— *C* D E	A B *C* D E	A— C D E	——	A— C D E	A— *C* D E	A— C D E	A— C D E	A— *C* D *E*
13 ..	A B C D E	A - C D E	A— C D E	A— C D E	A B *C* D E	A— C D E	A — — D—	A —— D—	A— C D E	A— *C* D E	A B C D E	A —— D—
14 ..	A— C D E	A— C D E	A— C D E	A— C D E	A— *C* D *E*	A— C D E	A — — D *E*	A— C D *E*	A — — — —	A— C D E	A— C D *E*	A— *C* D E
15 ..	A B C D E	A— C D E	A— C D E	A— C D E	A B *C* D E	A— C D E	A — — — —	— — — —	A— *C* D E	A— C D E	A— C D E	A— C D E
16 ..	A B C D E	A B C D E	A— C D E	A— C D E	A— C D E	A— — D E	A— *C* D E	A— *C* D E	A— C D E	A— C D E	A— *C* D *E*	A B C D E
17 ..	A B *C* D E	A— C D E	A— C D E	A— C D E	A B C D E	A *B* C D E	A— — D *E*	A— C D E	A— C D E	A— —D *E*	A— —D *E*	A B C D E
18 ..	A— C D E	A— *C* D E	A— C D E	A— *C* D E	A— *C* D E	A B C D E	A— C D E	A— C D E	A— C D E	A— C D E	— — — — —	A— *C* D E
19 ..	A— *C* D *E*	A— C D *E*	A— C D E	A— C D E	A— C D E	A— C D E	A— C D E	A— C D E	A— C D E	A— C D E	A — *C* D *E*	A— *C* D E
20 ..	A B C D E	A— *C* D *E*	A— C D E	A— C D E	A— C D E	A— C D *E*	A B C D E	A— *C* D E	A B C D E	A B C D E	A— *C* D E	A B *C* D E
21 ..	A— C D E	A— *C* D *E*	A B C D E	A— C D E	A— *C* D E	A— C D E	A— C D E	A— *C* D E	A— *C* D E	A— *C* D E	A— *C* D E	A— C D E
22 ..	A B *C* D E	A— C D E	A— *C* D E	A— *C* D E	A— C D E	A— *C* D *E*	A — — — — *E*	A— — D—	A— *C* D E	A— *C* D E	A— *C* D *E*	A B C D E
23 ..	A B C D E	A B C D E	A— *C* D E	A— C D E	A— C D E	A— C D E	A— *C* D —	A— C D *E*	A B C D E	A B C D E	A— *C* D —	A B C D E
24 ..	A B C D E	A B C D E	A B C D E	A— — D *E*	A— C D E	A— *C* D E	A— — D—	A— C D E	A B C D E	A— *C* D E	A— — — —	A B C D E
25 ..	A B C D E	A B C D E	A B *C* D E	A— C D E	A— C D E	A — — *E*	A— — D—	A— —D *E*	A— C D E	A— *C* D E	A *B C* D E	A B C D E
26 ..	A— *C* D E	A B C D E	A B C D E	A B *C* D E	A— C D E	A— C D E	——	A— *C* D E	A— C— E	A— *C* D E	A— *C* D E	A B C D E
27 ..	A B C D E	A B C D E	A B C D E	A— C D E	A— C D *E*	A— *C* D E	A — — D *E*	A— C D E	A— C D E	A— C D E	A— *C* D E	A B C D E
28 ..	A— *C* D *E*	A B C D E	A B *C* D E	A— *C* D E	A— *C* D *E*	A B C D E	A— C D E	A— C D E	A— *C* D E	A B *C* D E	— — — — —	A— *C* D E
29 ..	A— *C* D E		A— C D E	A— C D E	A— C D E	A— C D E	A— C D E	A— C D E	— — — — —	A B C D E	A B C D E	— — — — —
30 ..	A B C D *E*		A— C D E	A— C D E	A— C D E	A— C D E	A— *C* D *E*	A— *C* D *E*	A— *C* D E	A B C D E	A B C D E	A— —D *E*
31 ..	A B *C* D E		A— *C* D E		A— C D E		A— C D E	A — — — —		A— *C* D E		A— C D E

Note.—When a letter is in italics it means that on that day observations were not complete.

SOLAR Observations—Abstract.

—	1909.												
	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
A	28	28	31	30	28	29	29	30	28	30	29	29	349
B	18	13	10	6	7	5	1	..	5	5	7	12	89
C	27	28	30	29	27	23	16	24	24	27	27	27	309
D	27	28	31	30	27	25	25	27	26	30	27	29	332
E	28	28	31	30	27	25	20	25	27	29	26	28	324

There was a general resemblance between the observing conditions in 1908 and 1909. July was the worst month in the year and the conditions were good in November. Sunspot observations were possible on five days more than in the previous year, but there was a slight fall in the number of days on which other solar observations and photographs were made.

6. **Photographs of the sun** with the Dallmeyer photoheliograph were taken on 352 days as against 338 in 1908. The greatest defect was in July when they were obtained on only 16 days At the request of Greenwich, double exposures are taken twice a month for determining the error of orientation of the photographs. Out of 91 solar negatives asked for by Greenwich Observatory it has been possible to supply 85.

7. **Observations of sunspots.**—The sun is examined for spots and faculae every morning when the weather permits. The sun's image is projected on an 8-inch disc and the positions of spots and faculae are marked on it. The discs are prepared by the cyanotype process from the large scale drawings of Father R. de Beaurepaire, as mentioned in last report.

8. **Sunspot spectra.**—(*a*) *Visual.*—This work is done in accordance with the suggestions issued by the committee of the International Union for Solar Research. It includes the comparison of the spot spectrum with a standard map for the region 5210 Å to F., a detailed study of C and D_3, and observations of variations in intensity of the following iron lines :—5383·58 5397·34, 5404·36, 5405·99, 5424·29, 5429·91, 5445·26, 5447·13, 4924·11, 5234·79, 5316·79 and 5535·06. Till April 30, 1909, the standard map mentioned above was the Mount Wilson provisional photographic map but since that date the map prepared in this Observatory in 1907 has been used.

(*b*) *Photographic.*— Spectrograph II. was employed early in the year in photographing spot spectra with high dispersion for the purpose of detecting relative displacements of the lines most and least affected by pressure. All the best plates of the series have been measured and the results published in the Observatory "Memoirs" (Part I.).

In the same series of photographs systematic line displacements due to radial movement of the penumbral gases were detected. The results of a preliminary investigation of this phenomenon have been published in bulletin No. 15, and in the *Monthly Notices* of the Royal Astronomical Society, Volume LXIX.

A new and very powerful spectrograph, No. III., has been constructed during the year. In this a parabolic silver-on-glass mirror forms the solar image on the slit plate, and a 6-inch plane grating by Michelson is used. Work with this instrument has been concentrated on problems connected with radial movement in sunspots, and a considerable proportion of the photographs secured with it have been measured.

The results indicate an accelerating outward movement of the gases at the base of the chromosphere in all spots, and an inward motion of calcium vapour at high levels in most spots. Particular attention was also given, in the case of large spots,

favourably situated on the disc to line displacements indicating a rotational movement, and strong evidence has been obtained in many instances of a relatively slow rotation, which is opposite in direction in the two hemispheres.

9. **General spectroscopic work.**—A series of limb and centre comparison plates of selected regions of the spectrum has been obtained with spectrograph III. These are on a scale of 1 mm. = 0·3Å and form excellent material for measurements of the displacements towards the red of the lines at the sun's limb. They will be studied with especial reference to (*a*) the lines most and least affected by pressure, and (*b*) the enhanced lines. They are also available for a study of the relative intensities of the lines at the sun's limb compared with the centre of the disc.

A spectrograph has been designed and partly constructed in the observatory workshop for photographing the spectrum of Halley's comet. It is intended to employ the 18-inch parabolic mirror for this work, and a reflecting slit made of silvered glass will be used.

10. **Prominences.**—Prominences were recorded visually on 309 days as against 310 in 1908, but on as many as 65 days the combined visual and photographic record was imperfect owing to unfavourable weather conditions. The weather was most unfavourable in July when the prominence record was complete on only 9 days. The record of the prominences is made round the disc on which spots and faculæ have been projected and with the discs now in use the apparent positions of prominences are easily read off directly. The visual record is compared with the spectroheliograms and all prominences shown in the photographs but not in the drawing as well as conspicuous extensions of Ca prominences inside the disc of the sun are added in blue pencil. Where there is much difference between the photograph and the drawing the differences are noted. In the case of eruptive or metallic prominences the spectra are examined, the most conspicuous bright lines are recorded, and all large displacements of the C line are also noted and their amounts estimated.

11. **Work with the spectroheliograph.**—This instrument was in use throughout the year. The camera slit of fixed width and fitted with windows at the two ends with automatic shutters has continued to work well. This slit, which was fitted in 1908, greatly simplifies the working of the instrument and the number of failures from imperfect adjustments has been negligible.

Photographs of the sun's disc in K_2 light were obtained on 324 days and limb photographs showing the prominences on 272 days. Most of the disc plates show the prominences also, more or less distinctly, even when the sky is too diffusive for limb photographs. It has been possible therefore to measure position angles and heights of prominences from all available plates on 312 days, the results for both prominences and flocculi were not statisfactory on 11 days owing to unfavourable weather.

The position angles and heights of the prominences photographed have been measured by Mrs. Evershed, who has also made detailed studies of the minute structure and changes of form in some of the more interesting cases.

The best disc plate of each day has been copied on an enlarged scale on bromide paper as heretofore, the prints so obtained being oriented and pasted in order on card sheets for future reference.

Prominence spectroheliograms for 39 days were received from the Solar Observatory, South Kensington, and flocculi plates for 321 days were sent in exchange.

12. **Solar radiation.**—Observations with the Ångström pyrheliometer were made on 5 days. The maximum reading obtained was 1·654 on January 11. The year as a whole has been very unfavourable for this work owing to the abundance of cirrus cloud.

The new method of estimating variations in the solar radiation mentioned in the last report has continued to occupy the attention of the Assistant Director, and a large amount of experimental work has been done.

The practicability of the method of comparing the photographic intensity of moonlight with that of the extra focal images of certain stars has been demonstrated and a form of apparatus which satisfies the required conditions has been worked out. Unfortunately the climate of Kodaikánal appears to be unsuited for this work as may be judged from the statement that throughout the past year there has been no single night near full moon in which the sky was entirely unclouded or free from faint streaks of cirrus. The tendency to heavy dews is also a serious difficulty. It is much to be desired that so promising a method of estimating changes in the sun's output of energy may be taken up at some more suitable locality.

Summary of Results.

13. **Sunspots.**—The following table shows the monthly number of new groups observed, the mean daily number of spots visible, and the distribution between the northern and southern hemispheres:—

—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
New groups	19	16	24	22	10	15	12	16	13	23	31	20	221
Daily number	4·5	4·2	4·4	3·1	2·7	2·2	2·2	2·3	2·4	4·5	4·9	4·8	3·5
North	8	5	6	4	3	4	7	6	6	13	13	8	83
South	11	11	18	18	7	11	5	10	7	10	18	12	138

There was a marked revival in spot activity during the last three months of the year but for the year as a whole there was a slight decrease. The total number of new groups for the years 1907, 1908, and 1909 were respectively 301, 262, and 220, and the mean daily numbers were 4·4, 4·6, and 3·9.

Southern spots continued to preponderate greatly over the northern, the proportion being even higher than in 1908. So also the mean latitude of southern spots was slightly higher than that of the northern ones in every month except September and November. The mean latitudes for the whole year were 8·9 for northern spots and 10·8 for the southern.

On five days the sun's surface was recorded as free from spots. There was one day, December 25, on which ten groups were observed. A striking feature of the last three months of the year was the comparatively large number of groups which contained fairly large spots.

The following were the most important groups of spots seen during the year:—

January—

Nos. 1593, 1594, 1595 — These spots were large and were changing rapidly. Their spectrum indicated that they were active. C was frequently observed reversed and dark D_3 was seen near them. In the case of No. 1593 the D_3 line was seen bright over the whole of the main umbra on the 23rd.

February—

Nos. 1605, 1607, 1609, 1611, 1612, 1613, 1615 — All of these were large and most of them were spectroscopically active. Reversals and displacements of C as well as darkening of D_3 were frequently observed near them.

March—

Nos. 1629, 1632 — These were scattered trains of spots and were very active as indicated by the behaviour of the C and D_3 lines.

April—

Nos. 1645, 1649 were the only groups which contained fairly large spots. No. 1649 developed a large number of companions as it neared the central meridian, and by the time it had reached it, had become a train of three large spots.

May—

Nos. 1659, 1662, 1663, 1667 All of these were large. No. 1663 was the only one in which disturbances in C and D_3 were frequently observed. It was first seen as a double-spot group with the two spots nearly equal in size, but the leader gradually diminished and the following spot increased in size till on the 15th the former had almost disappeared while the latter was a large spot but of irregular outline.

June—

Nos. 1671, 1673, 1678, 1681, 1683 All of these contained large spots. Nos. 1671, 1678 and 1681 first appeared on the sun as small spots and grew in size as they advanced westwards. Nos. 1673 and 1683 came round the east limb as large spots but the former dwindled away and disappeared before it reached the west limb.

July—

Nos. 1690, 1693 were the only large spots. No. 1690, when traversing the eastern half of the sun, developed a large number of companions which began to vanish after it had crossed the central meridian. No. 1693 developed on the side of the sun turned towards us and was visible to the naked eye. The smaller companions of this spot also began to vanish when traversing the western half of the sun.

August—

No large spot appeared on the sun during the month.

September—

Nos. 1714, 1715, 1719, 1725, 1726 were the large spots of the month. Nos. 1725 and 1726 were returns of Nos. 1714 and 1715 respectively. The latter two after crossing the central meridian developed suddenly into trains of large spots. No. 1715, when it reached the west limb, was associated with a metallic and highly eruptive prominence. No. 1719 was a large spot when it came round the east limb on the 18th and for several days afterwards the C line was observed reversed on or near it. On the 28th at or a little before $10^h\ 30^m$ there was a sudden and very violent out-burst of bright gases on or near the spot. The whole area was seen as a bright prominence projected on the sun's disc though the observing conditions were poor. The prominence showed displacements of the hydrogen lines but the direction and the amount of motion indicated as well as the form of the prominence were rapidly changing. A Ca flocculus photograph taken at $10^h\ 39^m$ showed the spot region to be completely filled with bright matter and the spot itself was not visible. About the time of the outburst there was a sudden and large rise in the Horizontal Force record of the magnetograph.

October —

Nos. 1729, 1734a, 1731 These were the most important of the large spots seen during the month. Nos. 1729 and 1734a suddenly developed into trains of large spots when about 25° west of the central meridian. No. 1731 was a very large group covering nearly 15° of longitude. It was found to drift steadily westwards and its position in longitude had changed considerably before it returned as No. 1748. It underwent much change of form from day to day, C was frequently reversed in it, and D_3 was often seen dark. On October 15 when the group was within

2 days of the west limb C was brightly reversed over an extensive area near the group and it was seen as a changing prominence projected on the sun's disc. It was first observed at $9^h\ 13^m$ and there was nothing left of it by $10^h\ 30^m$.

November—

Nos. 1762, 1766, 1769, 1770, 1772 — All these contained large spots. No. 1766 formed near the central meridian and showed disturbances in C. No. 1772 also formed on the visible disc and after it had crossed the central meridian became a fine and active train of large spots.

December—

Nos. 1782, 1786, 1787, 1788, 1790, 1793, 1797 — All these lay between longitudes 57° and 253°. The other half of the sun was comparatively inactive. But even of these groups No. 1782 was the only one which showed any striking features, spectroscopically or otherwise.

14. **Prominences.**—The activity as estimated by profile areas has been well maintained throughout the year, but the numbers obtained show a reduction of 23 per cent. compared with the previous year.

The general activity of the two hemispheres compared with 1908 is given in the following table:—

Mean daily profile areas of prominences.

	1908. Square minutes.	1909. Square minutes.
North	2·41	2·10
South	2·98	2·04
Total ..	5·39	4·14

Considerable changes have taken place in the distribution of the prominences in latitude. The polar regions in both hemispheres have been inactive, that is, the mean areas in the regions comprised between latitudes 65° and the poles have fallen to less than one-tenth of the areas found in lower latitudes. A well-marked zone of activity has developed between the parallels 45° and 55° in the northern hemisphere, a corresponding active region in the south recorded in 1908 having subsided. Such alternations between north and south have been recorded previously and appear to be a characteristic feature of prominence development. This change has had the effect of restoring the balance of activity between the hemispheres which have been sensibly equal in 1909.

There has been a great reduction in the number of metallic prominences recorded, particularly in the southern hemisphere, and the mean latitudes have decreased largely. The mean and extreme latitudes observed are given in the following table:—

Metallic prominences.

—	Number observed.	Mean latitude.	Extreme latitude.	
North	21	8°·8	2°	16°
South	20	12°·2	2°	22°

The prominence activity in each month may be estimated from the following table:—

Numbers of Prominences.

Month.	Prominences one minute or more in height.	Metallic.	Eruptive.
January	57	5	4
February	64	7	8
March	52	6	6
April	73	6	6
May	43	1	1*
June	29	1	1
July	11	1	..
August	24	..	..
September	46	3	7
October	37	3	2
November	45	3	4
December	58	5	..

* The eruptive prominence was also metallic.

The following were the more noteworthy prominences of the year :—

January.—The tallest and the most active prominence of the month was photographed on the 12th at $8^h\ 3^m$, the main part of it was an arch 15° in extent and 160″ high. Subsequent photographs showed it as changing both in form and height, and at $14^h\ 27^m$ there was nothing left except a narrow slanting strip 10° long, far away from the limb and about 285″ at the highest point.

February.—Two prominences photographed on the 25th reached a height of 240″.

March.—The tallest prominence for the month was photographed on the 7th and was 175″ high.

April.—The main part of an eruptive prominence recorded on the 21st was a bright, straight jet 220″ high in Ca, but in H_α it was only a faint detached streak about 90″ high. One of the prominences seen on the 23rd was associated with spot group 1651 and was bright and metallic, but its height though changing did not exceed 30″. C was displaced, and the direction as well as the amount of displacement frequently changed during the whole time of observation—from $9^h\ 45^m$ to $11^h\ 0^m$. The greatest displacement observed corresponded to a radial velocity of 115 miles a second towards the observer. The prominence showed about 50 bright lines between C and F.

May.—Two of the largest prominences of the month were detached clouds, 270″ and 240″ high, photographed near the west limb on May 16.

June.—An eruptive prominence was recorded on the 23rd, situated at latitude + 25° west, at $8^h\ 50^m$. C was displaced to violet over the whole prominence, the maximum displacements being 4 Å. The prominence was changing rapidly. The height in Ca varied from 70″ at $8^h\ 7^m$ to 230″ at $9^h\ 21^m$ and 150″ at $9^h\ 50^m$. A rather faint prominence, 90″ high, was photographed at this position on the next day.

July.—Only one metallic prominence was observed during the month. It was seen on July 6 at latitude — 8° east.

August.—The highest prominence recorded was only 120″. The only prominence which showed any activity was a very bright one, 45″ high, seen at latitude + 9° east at $10^h\ 10^m$ on the 14th. At $10^h\ 20^m$ there was only a detached streak 20″ high left of it. An hour previously at about $9^h\ 6^m$ nothing had been seen at the same place. The Ca photographs also did not show anything.

September.—The tallest prominence recorded for the month was also an eruptive one which was photographed at latitude — 15° west on the 23rd, and reached a height of 330″.

October.—The tallest prominence of the month was 240″ high observed in about the same position on the 9th and 10th.

November.—A highly eruptive prominence which was also the highest for the month was recorded at latitude + 13° east on the 30th. C was displaced and the amount and direction of the displacement, as well as the form of the prominence, underwent rapid changes. The maximum displacement corresponded to a velocity towards the observer of 200 miles a second and the maximum height recorded was 360″. A smaller, but equally active and brighter prominence, had been observed at the same position on the previous day. A noteworthy feature was that, during one of the transformations it was undergoing, the main part consisted of a number of bright concentric arches.

December.—The tallest prominence of the month was a detached vertical strip 360″ high which was photographed at latitude — 55° east at $8^h\ 13^m$ on December 23.

(*b*) Other observations.

15. **Time.**—The error of the standard clock is usually determined by reference to the 16^h signal sent from the Madras Observatory. This is rendered possible by the courtesy of the Telegraph department which permits the Madras wire to be joined through to this observatory. The signal is received with accuracy on most days and all failures are at once reported to the officer in charge of the Madura division who takes much interest in the accuracy of the time service. Time determinations are made with the transit instrument at frequent intervals, as a check.

The usual time signal to the station was given, by means of a flag, throughout the year.

16. **Meteorology.**—Meteorological observations were carried on as in former years. Eye observations are made at 8^h, 10^h, and 16^h local mean time. Temperatures and pressures are recorded continuously by a Richard's thermograph (wet and dry bulb) and barograph, and the mean temperature and pressure are obtained from the traces corrected by reference to the eye observations. The wind direction and velocity are obtained from a Beckley anemograph.

*Pressure.**—The mean pressure for the year was 0·029 inch below the normal. It was in defect in every month of the year. The highest mean pressure recorded was 22·919 inches on March 27 and the lowest 22·611 on June 3.

Temperature.—The mean temperature for the year was 0°·3 below normal. It was 1°·4 in excess in January normal in March and in defect in all other months. The greatest defect was 0·8 in July. The maximum shade temperature recorded was 72°·7 on March 9, and the minimum 43°·0 on February 6. The highest temperature shown by the black bulb *in vacuo* was 142°·6 on April 17 and the lowest temperature on the grass was 26°·2 on February 13.

Humidity.—The mean humidity of the year was normal. The greatest differences from normal were a defect of 15% in January and an excess of 6% in August, November, and December.

Rain.—The total rainfall for the year was considerably above normal and the distribution throughout the year was very abnormal. It was largely in excess in January and August (7 inches and 10 inches), and largely in defect in September and December ($5\frac{1}{2}$ and 4 inches). The rainfall of August was a record for that month while that of September was the smallest on record. The greatest fall in one day was 4·51 inches on January 1.

Wind.—On the average for the year the wind was somewhat weaker and two points more northerly than the average. The amount was in considerable excess in January, March, and September and in considerable defect in April, June, October, and December. The largest amount of wind in any one day was 689 miles on March 5 and the smallest 104 miles on May 28.

* There is some reason to believe that these barometer readings are about 0·01 inch too low, but no change in the barometer correction can be made till a comparison is obtained with a standard.

Transparency of the atmosphere.—The transparency of the lower atmosphere, as judged by the visibility of the Nilgiris, was much below the average. They were seen on only 147 days as against 175 in 1908.

Cloud and sunshine.—The year as a whole was rather less cloudy than usual and the amount of bright sunshine exceeded the average by 140 hours.

17. **Seismology.**—The Milne horizontal pendulum worked well throughout the year and the results are given in Appendix I. The watch had to be sent to Madras for repairs in November, but this did not affect the working of the instrument as the standard clock marks each hour on the paper by an electrical device, and the marks made by the watch are used only in case of a failure in the electric record. Sixty-eight earthquakes were recorded during the year. The original records are retained here, but copies of the traces of the more important shocks are sent to the British Association Committee, the Strassburg International Bureau, and to other workers on the subject who ask for them.

18. **Library.**—One hundred and fifty-eight books were bound during the year.

19. **Publications.**—Bulletins Nos. XIV. to XVIII. were published during the year, No. XIX. is in the press and Part I. Volume I. of the Memoirs was ready for distribution at the end of the year. Bulletins Nos. XIV. and XVII. deal with prominences observed in 1908, No. XV. with "Radial movement in spots" and No. XVIII. with "Pressure in the reversing layer"; No. XVI. is "On the curvature of lines in the spectrum formed by a plane grating," by Dr. Gilbert T. Walker. In addition to these, the following papers were published during the year:—

"Radial Movement in Sunspots" by J. Evershed. (M.N., R.A.S., LXIX., No. 5.)

"A Solar Outburst and a Magnetic Storm" by C. Michie Smith. (M.N., R.A.S., LXX., No. 1.)

20. **General**—.Sufficient observations having been obtained for comparative purposes, the Periyakulam Observatory was closed at the end of April 1909.

The Director-General of Observatories visited the Kodaikánal and Madras Observatories in January. The Director visited the Madras Observatory in November. When there, he obtained an interview with His Excellency the Governor to discuss the probable effect on the Madras Observatory of the proposed erection of a new General Hospital on the Spur Tank (see the Deputy Director's report). His Excellency promised that, if the scheme was carried out, all necessary care would be taken to safeguard the interests of the Observatory.

The Public Works Department has so far made no progress with the electric light installation in spite of various attempts made by the Director to impress upon it the urgency of the work.

The staff of the Observatory has worked well throughout the year and the First Assistant, Mr. S. Sitarama Aiyar, deserves special mention for efficiency and zeal.

THE OBSERVATORY, KODAIKÁNAL,
February 1910.

C. MICHIE SMITH,
Director, Kodaikánal and Madras Observatories.

II.—REPORT OF THE MADRAS OBSERVATORY FOR THE YEAR 1909.

1. **Staff.**—The computer went on privilege leave for one month. There were no other changes in the staff during the year.

2. **Time Service.**—No change was made in the programme of astronomical observations; these have been restricted as usual to meridian observations to determine time. The only change in the time signals distributed is the following; the 4 P.M. roll now commences 2 minutes before 4 P.M., instead of 3 minutes as hitherto. The change has been in effect since the 19th of March under the order of the Director of the Observatory. The Fort Time Signal was fired correctly at noon and 8 P.M., on 701 out of 730 occasions giving a percentage of success of 96. Some of these failures were traced to the bad earth at the Observatory; a new one was therefore put down in the bed of the river by the Telegraph Department. The time ball at the Port Office was dropped correctly at 1 P.M. on every occasion except 4 throughout the year and on 2 out of these 4 it was dropped correctly at 2 P.M.

3. **Meteorological Observations.**—Meteorological observations were continued as usual. The 10^h and 16^h observations were reduced and sent to the India Meteorological office on Form F. Observations on cloud movement were continued. Besides the ordinary weather telegrams, special storm observations were sent on two occasions to Simla and on 47 occasions to Calcutta. The tabulation of the traces of the autographic instruments at Madras and of the anemograph at Dodabetta are brought up to date.

4. **Buildings.**—Certain repairs to the quarters of the Deputy Director were effected during the year.

5. **Instruments.**—The following is the list of instruments at the Madras Observatory on the 31st December 1909:—

(*a*) *Astronomical.*

Eight-inch Equatorial Telescope—Troughton & Simms.
Sidereal Clock—Haswell.
" Dent, No. 1408.
" S. Reifler, No. 61.
Mean Time Clock with galvanometer—Shepherd & Sons.
Meridian Circle—Troughton and Simms.
Mean Time Clock—J. Monk.
Mean Time Chronometer—V. Kullberg, No. 5394.
" " No. 6544.
" Parkinson and Frodsham, No. 2352.
Portable Transit Instrument—Dolland.
Portable Telescope with stand.
Tape Chronograph—R. Fuess.
Relay for use with the Chronograph—Siemens.

(*b*) *Meteorological.*

Richard's Barograph—No. 10, L. Casella.
" Thermograph—No. 3618, L. Casella.
Beckley's Anemograph—Adie.
Sunshine Recorder—No. 149, L. Casella.
Anemoscope—P. Orr & Sons.
Nephoscope—Mons Jules Daboscq & Ph. Pellin.
Barometer, Fortin's—No. 1771, L. Casella.
" No. 725, L. Casella (spare).
" No. 1420, L. Casella (spare).
Dry Bulb Thermometer—No. 94221, L. Casella.
" No. 38037, Negretti & Zambra (spare).
Wet Bulb Thermometer—No. 94219, L. Casella.
" No. 38037, Negretti & Zambra (spare).
Dry Maximum Thermometer—No. 8581, Negretti & Zambra.
Dry Minimum Thermometer—No. 69047, L. Casella.
Wet Minimum Thermometer—No. 91753, Negretti & Zambra.
Sun Maximum Thermometer—No. 10479, Negretti & Zambra.
Grass Minimum Thermometer—No. 3377, Negretti & Zambra.
Rain-gauge (8″ diameter)—No. 1042, Negretti & Zambra.

Measure glass for above.
Rain-gauge (5″ diameter).
Measure glass for above.

The axes and bearings of the transit instrument were examined and cleaned during the visit of the Director in November. The rate of the Riefler Clock has been steady. The Haswall Clock which was taken down last year was put up again and is keeping a steady rate. The Sidereal Clock by Dent was cleaned and the cord carrying the weight was renewed.

The body of the equatorial and the pillar were painted, the clock work, circles and the eye-pieces were cleaned by Messrs. P. Orr & Sons in the early part of the year. Halley's comet was first observed on the 3rd of December.

In the latter half of September it was stated that a proposal was under consideration to build a new General Hospital in the Spur Tank—a site on the meridian through our transit and a little over one-fourth mile to the north of it. As I considered that this proposal, if carried into effect, would prejudicially affect our observations of close polar stars and might even render them valueless or impossible, it was my duty to call the attention of the Director of the Observatory and the Director-General to the matter. This was done, and representations have been made on the matter.

6. **Weather summary.**—The following is a summary of the meteorological conditions at Madras during the year 1909 :—

Pressure.—Pressure was below normal in all months except July and August. The greatest excess was 0·010 inch in August and the greatest defect 0·043 inch in January. The highest pressure was 30·104 inches on December 29, and the lowest 29·476 inches on June 5.

Temperature.—The mean temperature was above the average in January, February, June, October, November, and December and below normal during the other months. The maximum temperature was below normal in all months except October, November, and December, the greatest excess being 4°·3 in October and the greatest defect 2°·8 in September. The minimum was above normal in January, February, November, and December, normal in October and below normal during the rest of the year. The minimum on the grass was above normal in all months except May, July and October. The highest shade temperature recorded was 106°·1 on May 30 and the lowest 64°·5 on January 25.

Humidity.—The percentage of humidity was normal in October and December, below normal in November, and above normal during the remaining months. The driest day was July 18 with 34 per cent. of humidity.

Wind.—Wind direction was normal for February and May ; it differed most from normal in September when it was 3 points more westerly than usual, the average direction being south-west. The recorded air movement was apparently lower than usual throughout the year. This however is an effect due to a gradual change in exposure of the anemometer. The movement was certainly lighter than usual in May when hot weather conditions were much less intense than they often are in this month. The abnormal and heavy rain in April and May had completely changed the character of the surface of the country, and persistent high temperatures with vigorous air movement attending were impossible.

Cloud.—The percentage of cloud was above normal in February and below normal during the remaining months

Sunshine.—The percentage of bright sunshine was above normal in October and December and below normal during the rest of the year. The total number of hours of bright sunshine during the year was 2,271·1 hours.

Rainfall.—The rainfall was above the average in January, April, May, July, August and September and below during the other months, the greatest excess being 9·69 inches in April and the greatest defect 10·39 inches in October. The rainfall for the year was 46·53 inches on 86 days, being 2·49 inches below the normal. The

monsoon rainfall from 15th October to the end of the year was only 4·85 inches against an average of 26·00 inches. Several storms formed in the Bay during the period, but they formed far to the east and travelled in northerly directions taking the monsoon with them and away from the Madras Coast. The greatest fall on any day was 5·42 inches on May 4.

Storms.—A storm formed in the south-west of the Bay on May 2 and moving on a westerly course crossed the Madras Coast on May 4. It was of no great severity but was effective in directing the south-westerly winds that were blowing into the Bay at this time, towards the Madras Coast; hence heavy and general rain fell at Madras and all over the south. The depression passed out into the Arabian Sea where it depeened again, and gave very heavy rain on the West Coast.

MADRAS OBSERVATORY,
29*th January* 1910.

R. LL. JONES,
Deputy Director.

Appendix I.

KODAIKÁNAL Observatory Seismological Records in 1909.

No.	Date.	P.T. commence G.M.T.	L.W. commence G.M.T.	Maxima G.M.T.	End.	Max. Amp.	Duration	Remarks.
	1909.	H. M.	H. M.	H. M.	H. M.	MM. "	H. M.	
1	Jan. 22 ..	12 38·2	12 43·3	12 46·9	13 08	1·1 = 0·5	0 30	
2	23 ..	2 56·7	3 11·5	3 14·6	4 41	2·0 = 0·9	1 44	Luristan, Persia.
3	29 ..	1 18·8	..	..	2 03	..	0 44	Widening of line.
4	Feb. 2 ..	19 12·2	19 18·8	19 21·9	19 43	0·6 = 0·3	0 31	
5	9 ..	11 37·2?	11 55·3	11 56·9	12 47	1·0 = 0·5	1 10	
6	9 ..	14 38·0	..	..	15 53	..	1 15	Widening of line.
7	22 ..	9 41·8	9 45·4	9 45·4	10 59	0·5 = 0·2	1 18	
8	Mar. 7 ..	18 47·4	..	..	19 06	..	0 19	Widening of line.
9	12-13 ..	23 37·1	0 02·5	0 06·1	0 51	1·0 = 0·5	1 14	
10	13 ..	14 39·8	15 11·4	15 12·3 13·6	15 55	0·6 = 0·3 0·6 = 0·3	1 15	
11	17 ..	10 33·1	10 38·2	10 39·2	10 47	0·3 = 0·1	0 14	
12	17-18 ..	23 01·3	23 15·3	23 23·9	0 12	3·5 = 1·7	1 10	
13	23 ..	20 41·2	20 47·4	20 48·9	21 08	0·6 = 0·3	0 27	
14	Apl. 10 ..	5 51·5	6 44·3	6 47·4	7 59	0·7 = 0·3	2 07	
15	10 .	18 58·4	19 29·0	19 34·1	?	1·1 = 0·5	?	
16	10 ..	20 07·2?	20 25·9	20 29·0	21 38	2·0 = 1·0	1 31	These run into each other.
17	11 ..	14 45·4	14 51·5	14 53·6	15 22	0·5 = 0·2	0 37	
18	14 ..	2 51·7	2 54·3	2 54·8	3 16	0·9 = 0·4	0 24	Felt at Simla.
19	14 ..	20 01·8	20 22·3	20 25·2	20 48	0·5 = 0·2	0 46	
20	25 ..	22 08·4	..	..	23 29	..	1 21	Widening of line.
21	27 ..	12 55·6	12 36·2	13 38·2	14 42	0·9 = 0·4	1 46	
22	29 ..	22 57·6	23 03·7	23 04·8	24 08	1·1 = 0·5	1 10	
23	May 2 ..	7 49·7	..	..	8 24	..	0 34	Widening of line.
24	2 ..	22 12·7	22 13·3	22 14·3	22 42	0·6 = 0·3	0 29	
25	3 ..	0 11·2	0 12·2	0 13·3	0 22	0·8 = 0·4	0 11	
26	10 ..	20 24·9	20 24·9	20 27·4	20 57	2·3 = 1·1	0 32	
27	12 ..	1 35·6	1 40·7	1 47·4	2 21	0·5 = 0·2	0 45	
28	17 ..	8 22·3	8 35·1	8 41·3	10 22	0·6 = 0·3	2 00	
29	30 ..	21 10·5	21 30·0	21 36·1	22 27	0·6 = 0·3	1 17	
30	June 3 ..	?	18 42·3	Boom struck stops.	23 01?	18+ = +8·6	?	Boom reached stops 18h 56·7m to 19h 0·8m Gale of wind.
31	8 ..	6 06·2	7 07·2	7 19·7	8 23	1·1 = 0·5	2 17	
32	12 ..	20 44·4	21 00·3	21 20·3	22 13	1·0 = 0·5	1 29	
33	18 ..	7 46·4	..	..	8 03	..	0 17	Widening of line.
34	27 ..	7 39·2?	8 13·1	8 25·4	9 24	0·6 = 0·3	1 45	
35	July 7 ..	21 43·3	21 48·0	21 51·0 53·6	.. 23 37	12 = 5·8 14 = 6·7	.. 1 54	
36	26 ..	10 39·2 ?	11 03·3	11 04·4	11 45	1·6 = 0·7	1 06	
37	30 ..	11 07·6	12 21·9	12 40·2	13 56	1·5 = 0·7	2 47	Mexico city.
38	31 ..	20 43·7	21 04·1	21 05·7	21 44	0·5 = 0·2	1 00	
39	Aug. 1 ..	10 31·0	..	..	10 55	..	0 24	Widening of line.
40	4 ..	7 58·7	..	..	8 10	..	0 11	Widening of line.
41	14 ..	6 44·6	7 15·1	7 14·1	8 05	1·1 = 0·5	1 20	Japan.
42	16 ..	8 18·5	8 29·5	8 31·0	9 13	0·5 = 0·2	0 55	
43	22 ..	?	6 33·1	6 34·6	6 54	0·6 = 0·3	?	
44	22 ..	15 48·5	..	15 54·1	16 16	..	0 28	Widening of line.
45	Sept. 3 ..	11 38·0	..	..	11 41	..	0 08	Widening of line.
46	5 ..	9 20·6 ?	9 26·4	10 00·0 ?	9 38	1·1 = 0·5	0 17	
47	6 ..	8 36·1 ?	..	8 42·3	8 58	..	0 22	Widening of line.
47A	7 ..	15 38·2	15 43·3	15 44·0	16 07	0·4 = 0·2	0 31	
48	8 ..	17 02·3	17 15·4	..	17 46	..	0 44	Widening of line.
49	8 ..	19 56·7	..	..	20 20	..	0 23	Widening of line.
50	11 ..	5 18·7	..	..	5 42	..	0 23	Widening of line.
51	11 ..	11 09·0	11 22·7	..	12 16	..	1 07	Widening of line.
52	16 ..	19 00·2	19 08·0	19 10·0	19 28	0·5 = 0·2	0 28	
53	16 ..	19 57·7	20 23·8	20 24·4	20 39	0·4 = 0·2	0 41	
54	21 ..	19 09·0	..	..	19 51	..	0 42	Widening of line.
55	23 ..	6 31·0	6 35·1	6 36·2	6 57	0·6 = 0·3	0 26	
56	27 ..	6 02·7	..	..	6 18	..	0 15	Widening of line.
57	Oct. 17 ..	22 34·1	..	..	22 48	..	0 09	Widening of line.
58	20-21 ..	23 44·9	23 50·6	23 52·7	1 21	15+ = 7+	1 36	Quetta.
59	23 ..	10 05·4 ?	10 08·0	?	10 13	..	0 08	Widening of line.
60	30 ..	10 22·5	10 37·7 ?	10 39·3	11 27	0·6 = 0·3	1 05	
61	31 ..	11 06·9	11 58·7 ?	12 14·1	12 37	0·5 = 0·2	1 30	
62	Nov. 10 ..	*6 22·3	6 30·2	6 31·0	7 56	1·6 = 0·7	1 34	* Possibly 2nd P.Ts.
63	21 ..	7 49·7	8 03·6	8 06·2	8 53	1·1 = 0·5	1 03	
64	Dec. 9 ..	15 46·9 ?	15 42·8	16 45·4	17 46	0·7 = 0·3	1 59	2nd P. Ts. 15h 57·7m
65	9 ..	21 48·5	22 18·7	22 24·4	23 21	1·0 = 0·5	1 38	
66	9-10 ..	23 39·2	23 48·1	23 52·8	1 24	1·1 = 0·5	1 45	Possibly these two run into each other.
67	29 ..	19 35·1	..	..	19 59	..	0 24	Widening of line.

Appendix II.

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

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

MEAN monthly and annual Meteorological Results at the Kodaikánal Observatory in 1909.

Month.	Barometer.		Dry bulb thermometer.				Wet bulb.		Tension of vapour.	Relative humidity.	Sun Max. *in vac.*	Min. on grass.	Wind.			Rain.		Clear sky.	Hours of 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	
January	22·806	0·068	54·5	63·1	48·7	14·4	45·3	40·1	0·217	51	112·1	39·5	385	5	N. E. by E.	9·87	5	66	251·2
February ..	·822	·066	54·4	65·5	47·1	18·4	46·7	40·0	·244	58	120·6	37·0	306	32	N.	0·08	..	69	251·8
March	·830	·065	57·9	68·8	51·2	17·6	48·2	41·6	·246	51	127·9	41·8	363	4	N. E.	1·84	7	63	255·6
April	·806	·072	58·9	67·6	53·3	14·3	54·3	49·0	·380	75	130·2	44·6	242	3	N. E. by N.	3·60	8	54	223·1
May	·776	·070	59·4	66·7	54·7	12·0	55·2	50·9	·397	78	123·3	47·8	268	31	N. by W.	8·17	14	42	189·3
June	·738	·060	57·2	64·4	53·0	11·4	53·2	48·4	·366	78	121·9	46·8	340	27	N. W. by W.	3·63	10	26	143·7
July	·745	·055	55·6	62·0	52·1	9·9	52·7	49·5	·371	84	113·2	48·8	443	26	W. N. W.	3·49	8	19	101·9
August	·760	071	56·3	62·0	52·8	9·2	54·5	50·9	408	89	115·7	48·3	260	26	W. N. W.	16·01	22	22	106·0
September ..	·759	·068	56·0	62·7	51·7	11·0	53·0	48·1	·374	83	119·7	47·0	344	28	N. W.	2·23	7	32	145·8
October ..	·794	·076	55·3	61 9	51·3	10·6	53·1	49·3	·385	88	116·5	46·3	205	3	N. E. by N.	11·23	16	30	130·5
November ..	·818	·071	53·5	59·9	49·5	10·4	51·6	47·7	·365	89	110·6	44·5	241	30	N. N. W.	3·77	9	31	149·9
December ..	·821	·070	52·8	61·3	46·9	14·4	48·7	42·4	·305	76	110·2	38·2	253	4	N. E.	1·32	4	48	184·3
Annual ..	22·790	0·068	56·0	63·8	51·0	12·8	51·4	46·5	0·338	75	116·8	44·2	304	0	N.	68·24	110	42	2,133·1

EXTREME monthly Meteorological Records at the Kodaikánal Observatory in 1909.

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 . ..	22·887	24	22·626	1	0·261	68·8	25	44·6	30	32·1	11,12	7	18	122·2	18	28·2	13	552	3	172	5	4·51	1
February ..	·902	11	·756	1	·146	70·7	25	43·0	6	34·0	6	11	13	129·5	19	26·2	13	415	18,24	157	14	0·08	20
March	·919	27	·762	8	·157	72 7	9	48·9	26	34·9	17	6	17	139·7	7	34·2	12	689	5	184	19	1·81	26
April	886	15	·723	20	·163	71·2	17	50·4	28	45·0	2,29	40	2	142·6	17	39·3	12	483	29	112	18	0·97	28
May	·880	23	·624	6	256	71·2	2	49·5	4	40·8	10	32	10	140·5	13	37·2	10	622	4	104	28	1·37	5
June	·864	17	·611	3	·253	70·2	19	50·8	27	42·1	17,29	38	17	138·8	19	38·1	16	575	8	138	29	0·56	3
July	·857	22	·666	12	·191	66·6	19	48·9	18	45·7	3	62	3	134·1	20	40·0	21	583	6	118	21	1·33	1
August	·853	10	·652	21	·201	65·5	6	50·7	1	47·4	1,10	68	22	138·4	6	42·3	17	484	1	150	7	2·76	27
September ..	·863	28	·650	4	·213	67·2	24	48·7	20	41·2	18	52	7	136·6	28	41·1	21	601	3	143	27	0·54	27
October ..	·877	22	·699	9	·178	66·7	2	45·9	28	40·2	28	43	28	132·5	2	34 8	29	464	27	110	5	1·78	5
November ..	·904	10	·725	20	·179	64·7	25	46·0	12	40·4	15	56	15	127·2	25	35·5	15	417	30	107	24	1·01	28
December ..	·898	22	·698	4	·200	66 0	24	43·4	28	36·1	22	11	15	130·8	6	29·0	5	437	17	116	11	0·51	8

Appendix III.

KODAIKÁNAL mean hourly wind velocity for the year 1909.

Month.	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
January ..	17	16	16	17	18	17	18	18	19	19	18	19	18	17	15	14	12	11	13	13	14	15	15	15
February .	14	14	14	15	14	14	15	15	17	17	18	16	14	12	12	10	9	8	9	9	9	10	12	12
March	17	16	16	17	17	16	17	18	18	18	19	18	15	14	13	12	10	9	9	11	13	15	16	17
April ..	10	10	9	9	10	10	10	10	11	11	13	12	11	12	12	11	9	9	8	8	8	10	10	11
May ..	11	11	11	11	11	11	10	10	12	12	12	11	12	12	12	12	11	10	10	10	10	11	11	11
June ..	15	15	16	16	16	16	14	12	13	12	12	14	13	13	14	14	14	13	13	14	15	15	15	16
July ..	21	22	20	19	19	19	18	17	17	15	18	17	17	15	16	16	17	19	20	20	20	20	18	20
August ..	12	12	11	12	12	11	12	12	11	11	12	11	10	10	10	11	11	10	11	9	9	10	11	12
September ..	17	16	17	17	17	17	17	16	16	15	15	14	13	13	12	12	11	11	11	12	13	14	14	16
October ..	9	9	9	9	9	9	8	8	9	8	9	10	9	9	9	9	8	7	7	7	8	8	9	9
November ..	10	10	11	11	10	10	10	9	9	10	10	10	10	10	10	9	9	9	10	10	10	10	11	11
December ..	10	10	10	11	11	12	12	13	12	13	13	12	10	10	9	9	8	8	9	10	9	10	10	10
Mean ..	14	13	13	14	14	14	13	13	14	13	14	14	13	12	12	12	11	10	11	11	12	12	13	13

Appendix IV.

KODAIKÁNAL Mean Hourly Bright Sunshine for the year 1909.

Month.	Hours.												Remarks.
	6-7	7-8	8-9	9-10	10-11	11-12	12-13	13-14	14-15	15-16	16-17	17-18	
January	0·15	0·65	0·77	0·81	0·85	0·79	0·80	0·83	0·83	0·73	0·70	0·22	
February	·14	·79	·91	·96	·97	·96	·89	·83	·78	·69	·72	·35	
March	·12	·85	·90	·92	·94	·90	·85	·74	·69	·61	·44	·24	
April	·21	·82	·93	·88	·89	·72	·67	·62	·56	·46	·40	·28	
May	·34	·65	·70	·70	·74	·62	·58	·53	·42	·34	·30	·19	
June	·23	·53	·57	·64	·64	·65	·49	·42	·22	·20	·17	·03	
July	·15	·29	·32	·38	·38	·39	·38	·32	·25	·19	·15	·10	
August	·20	·53	·56	·53	·50	·44	·27	·15	·12	·08	·03	·02	
September	·03	·46	·67	·67	·71	·60	·59	·47	·30	·19	·11	·06	
October	·05	·41	·60	·66	·67	·45	·34	·28	·31	·24	·15	·05	
November	·05	·42	·69	·71	·55	·54	·54	·56	40	·33	·17	·03	
December	·04	·43	·77	·78	·77	·77	·64	·57	·43	·46	·27	·03	
Mean ..	0·14	0·57	0·70	0·72	0·72	0·65	0·59	0·53	0·44	0·38	0·30	0·13	

Appendix V.

NUMBER of days in each month on which the Nilgiris were visible during 1909.

Month.	Very clear.	Visible.	Just visible.	Tops only visible.	Total.
January	10	7	1	3	21
February	2	4	6	2	14
March	..	3	4	2	9
April	..	1	4	..	5
May	1	2	1	..	4
June	5	3	2	..	10
July	1	3	1	1	6
August	11	9	3	1	24
September	8	12	3	1	24
October	5	3	..	..	8
November	..	1	1	..	2
December	10	5	4	1	20
Total ..	53	53	30	11	147

Appendix VI.

MADRAS OBSERVATORY.—Abnormals from monthly means for the year 1909.

Abnormals of	January.	February.	March.	April	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
Reduced atmospheric pressure	— 0·043	— 0·019	— 0·009	— 0·009	— 0·019	— 0·012	+ 0·002	+ 0·010	— 0·021	— 0·013	— 0·021	— 0·019	— 0·014
Temperature of air	+ 0·2	+ 0·9	— 0·2	— 0·5	— 0·4	+ 0·1	— 0·7	— 0·9	— 0·8	+ 2·7	+ 2·6	+ 2·3	+ 0·4
Do. of evaporation	+ 1·9	+ 1·8	+ 1·0	+ 1·2	+ 1·8	+ 1·2	+ 1·5	+ 2·5	+ 2·1	+ 2·3	+ 1·6	+ 1·9	+ 1·7
Percentage of humidity	+ 5	+ 4	+ 5	+ 7	+ 8	+ 5	+ 9	+ 14	+ 12	Same as	— 3	Same as	+ 7
Greatest solar heat *in vacuo*	— 6·9	— 6·3	— 5·3	— 6·1	— 8 5	— 6·6	— 12·1	— 5·8	— 13·4	+ 0·7	— 2·4	— 3·9	— 5·6
Maximum in shade	— 0·7	Same as	— 0·1	— 1·1	— 0 4	— 0·2	— 0·9	— 2·2	— 2·8	+ 4·3	+ 3·9	+ 2·0	+ 0·2
Minimum in shade	+ 0·6	+ 1·5	— 1·3	— 0·2	— 0·6	— 0·4	— 1·0	— 0·4	— 0 2	Same as	+ 0·6	+ 1·3	Same as
Do. on grass	+ 1·7	+ 1·9	— 1·3	+ 0·2	— 0·8	Same as	— 0·8	+ 0·2	Same as	— 0·4	+ 1·1	+ 1·8	+ 0·4
Rainfall in inches	+ 3·41	— 0·23	— 0·39	+ 9·69	+ 7·37	— 0·46	+ 0·99	+ 0·51	+ 3·67	— 10·39	— 9·29	— 4·58	..
Do. since January	..	+ 3·18	+ 2·79	+ 7·01	+ 17·06	+ 16·60	+ 17·59	+ 18·10	+ 21·77	+ 11·38	+ 2·09	— 2·49	— 2·49
General direction of wind	2 points E.	Same as	1 point E.	1 point E.	Same as	1 point W.	1 point W.	2 points S.	3 points W.	2 points S.	1 point E.	2 points E.	Same as
Daily velocity in miles	— 36	— 4	— 40	— 34	— 69	— 37	— 46	— 54	— 27	— 32	— 30	— 16	— 34
Percentage of cloudy sky	— 2	+ 6	— 2	+ 3	— 2	— 5	— 3	— 13	— 2	— 27	— 8	— 17	— 7
Do. of bright sunshine	— 12·6	— 10·2	— 8·0	— 3·1	— 19·8	— 14·3	— 10·5	— 2·2	— 9·1	+ 15·5	— 8·4	+ 1·9	— 6·9

+ Means *above* normal, — *below*.

Appendix VII.

ABSTRACT of the mean meteorological condition of Madras in 1909 compared with the average of past years.

Mean values of	1909.	Difference from	Average.
Reduced atmospheric pressure	29·850	0·014 below.	29·864
Temperature of air	81·5	0·4 above.	81·1
Do. of evaporation	76·2	1·7 ,,	74·5
Percentage of humidity	79	7 ,,	72
Greatest solar heat *in vacuo*	134·1	5·6 below.	139·7
Maximum in shade	91·0	0·2 above	90·8
Minimum in shade	74·7	Same as	74·7
Do. on grass	72·3	0·4 above.	71·9
Rainfall since January 1st on 86 days	46·53	2·49 below.	49·02
General direction of wind	S.E.	Same as	S.E.
Daily velocity in miles	137	34 below.	171
Percentage of cloudy sky	42	7 ,,	49
Do. of bright sunshine	51·5	6·9 ,,	58·4

DURATION and quantity of the wind from different points.

From	Hours.	Miles.	From	Hours.	Miles.	From	Hours.	Miles.	From	Hours.	Miles.
North ..	137	869	East ..	328	1,544	South ..	173	1,102	West ..	261	1,863
N. by E. ..	183	1,101	E. by S. ..	292	1,540	S. by W. ..	190	1,026	W. by N ..	169	1,198
N.N.E. ..	251	1,290	E.S.E. ..	338	1,427	S.S.W. ..	228	1,269	W.N.W. ..	176	1,077
N.E. by N.	391	2,393	S.E. by E.	448	2,019	S.W. by S.	205	1,154	N.W. by W.	111	658
N.E. ..	507	3,242	S.E. ..	375	2,205	S.W. ..	231	1,378	N.W. ..	91	425
N.E. by E.	440	2,825	S.E. by S.	674	4,037	S.W. by W.	275	1,700	N.W. by N.	62	348
E.N.E. ..	309	1,891	S.S.E. ..	368	2,458	W.S.W. ..	256	1,643	N.N.W. ..	91	526
E. by N. ..	250	1,775	S. by E. ..	267	1,749	W. by S...	290	1,912	N. by W.	74	445

There were 219 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 28 miles.

Appendix VIII.

MADRAS OBSERVATORY—Number of hours of wind from each point in the year 1909.

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 ..	4	17	9	70	58	126	45	65	79	83	53	36	3	32	8	5	1	1	2	1	..	2	..	1	..	..	..	..	..	3	1	1	38
February ..	9	10	25	16	70	51	62	120	64	49	84	41	10	7	4	..	2	1	..	..	3	4	7	2	..	1	..	..	..	1	1	2	26
March ..	..	3	2	6	49	27	13	4	22	19	24	129	75	210	57	13	9	10	9	16	10	2	3	2	1	..	..	..	..		..	..	29
April :	4	1	9	1	16	6	15	11	34	8	38	47	133	174	71	31	15	15	26	11	9	15	4	3	4	..	1	..	..	..	1	..	17
May	6	4	..	4	4	5	7	8	10	27	23	43	41	78	102	98	31	48	25	38	23	16	12	14	18	17	8	12	3	5	5	4	5
June	1	2	2	3	1	1	..	3	..	8	11	15	22	18	36	47	38	19	54	35	55	56	66	74	79	31	31	5	5	1	1	..	..
July	2	..	1	..	..	..	1	..	1	2	3	5	8	12	11	30	25	31	38	42	16	102	63	107	59	55	31	17	14	6	8	6	8
August ..	10	1	3	1	2	3	2	2	19	11	26	51	44	89	39	11	29	26	33	31	47	37	55	25	30	19	31	18	9	4	12	6	18
September ..	4	..	2	..	1	2	2	1	9	21	8	31	14	30	24	21	16	34	31	25	21	28	26	43	54	42	59	54	46	28	23	8	12
October ..	11	9	45	20	57	40	39	64	57	54	65	50	25	20	6	3	5	2	6	6	4	8	17	17	13	3	9	5	9	4	7	7	57
November ..	46	115	93	160	88	70	28	24	13	8	3	.	.	4	..	8	.	..	1	..	..	1	..	1	1	..	4	..	..	6	15	27	4
December ..	40	27	60	110	161	109	95	48	15	2	..	..	..	..	10	..	2	3	3	..	3	4	2	1	2	1	2	..	5	4	17	13	5
Annual total ..	137	189	251	391	507	440	309	350	323	292	338	448	375	674	368	267	173	190	228	205	231	275	255	290	261	169	176	111	91	62	91	74	219

Appendix IX.

MADRAS OBSERVATORY.—Number of miles of wind from each point in the year 1909.

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	20	119	48	284	266	592	238	403	362	456	170	139	14	143	33	25	6	7	8	6	..	8	.	4	..	..	..	..	..	7	3	1	3361
February	43	48	117	136	521	357	352	486	315	264	336	149	60	25	19	.	9	2	..	..	9	18	23	8	..	3	..	..	..	1	4	9	3302
March	..	17	11	46	151	148	83	28	90	135	129	465	452	1011	313	61	51	47	47	94	52	6	9	9	4	..	..	..	..	..	..	..	3459
April	15	10	48	8	118	80	84	103	172	71	140	285	841	1326	551	226	115	100	178	80	58	16	17	13	14	..	7	..	..	..	4	..	4710
May	38	21	..	25	20	25	35	62	73	168	159	297	234	557	663	667	235	303	177	256	160	110	68	89	125	101	49	85	21	25	35	20	4903
June	9	14	19	24	4	6	..	25	..	80	90	85	146	158	347	338	239	112	318	206	401	403	535	606	729	265	221	45	36	8	5	..	5477
July	13	..	6	..	..	..	6	..	10	14	21	43	58	104	84	207	184	138	188	220	328	662	427	683	440	442	229	113	48	9	26	13	4716
August	41	10	26	11	15	14	16	12	61	52	92	211	259	470	208	93	152	133	153	136	210	224	321	131	143	106	154	103	44	22	48	41	3712
September	9	.	11	..	5	4	8	6	40	99	38	149	48	152	143	107	82	167	163	132	119	150	146	280	328	262	351	297	206	195	137	36	3870
October	47	34	149	106	260	180	172	218	267	181	242	196	93	81	34	11	15	10	21	25	16	39	86	81	67	15	48	15	36	13	34	18	2810
November	280	692	555	99	680	601	268	115	38	21	11	..		10	..	14	..	..	2	..	..	6	.	2	4	..	12	..	..	37	84	174	4598
December	354	136	300	761	1202	818	629	318	116	9	..	..	..	..	63	..	14	7	14	..	22	28	11	6	9	4	6	..	34	31	146	133	5171
Annual ..	869	1101	1290	2393	3242	2825	1891	1775	1544	1540	1427	2019	2205	4037	2458	1749	1102	1026	1269	1154	1378	1700	1643	1912	1863	1198	1077	658	425	348	526	445	50089

Appendix X.

MADRAS OBSERVATORY.—Number of inches of rain from each point in the year 1909.

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 ..	..	..	..	..	0·16	0·27	0·33	0·95	0·49	1·45	0·27	0·38	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
February ..	..	..	..	..	0·05	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
March ..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
April ..	..	0·10	..	..	0·08	1·39	..	..	..	..	..	0·04	0·03	2·64	0·72	..	..	1·00	..	0·01	..	..	..	..	0·23	..	1·27	..	..	..	..	..	0·01
May ..	..	.	..	0·03	..	0·66	0·02	1·92	..	1·36	0·10	1·12	1·25	0·81	0·29	1·19	..	..	..	0·73	..	..	..	..	..	..	..	..	..	..	0·01	..	..
June ..	0·02	..	..	..	0·02	..	..	0·98	..	..	0·02	..	0·01	..	0·04	0·07	0·03	0·08	0·05	0·10	..	0·16	..	..	..	..	0·04	..	..	0·03	..	..	..
July ..	0·12	..	..	..	..	..	..	..	..	..	0·32	..	0·04	..	0·34	0·58	0·06	6·41	0·14	0·09	0·08	0·16	0·23	0·13	0·13	0·19	0·10	0·24	0·82	0·06	0·04	0·58	..
August ..	0·04	..	..	..	0·01	..	..	..	..	0·08	..	0·27	..	..	0·11	..	0·12	0 10	0·03	0·09	0·04	0·10	1·79	0·09	0·64	0·07	0·07	0·07	..	..	1·16	0·19	..
September ..	..	..	0·03	..	..	..	0·01	.	0·37	..	0·06	..	0·19	..	..	0·02	0·03	0·05	0·02	1·07	0·04	0·02	1·62	0·13	1·75	1·37	0·32	0·18	0·10	0·30	0·60	0·06	0·02
October ..	..	0·01	0·01	..	0·35	0·04	..	..	0·16	0·03	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	0·01
November ..	0·02	0·34	0·60	0·42	0·27	0·01	0·22	0·09	0·64	0·27	0·30	..	..	0·50	..	..	..	..	..	..	..	0·24	..	..	..	..	..	..	..	..	..	..	..
December ..	0·05	0·05	0·16	..	..	0·04	0·14	0·05	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	0·05	0·16	..
Annual ..	0·25	0 50	0·80	0·45	0·94	2·41	0·72	3·99	1·66	3·19	1 07	1 81	1·52	3 95	1·50	1·86	0·24	1·64	0·24	2·09	0·16	0·68	3·64	0·35	2·75	1·63	1·80	0·49	0·92	0·39	1·86	0·99	0·04

Appendix XI.

MADRAS OBSERVATORY.—Wind, cloud, and bright sunshine, 1909.

Month.	Wind resultant.		Clouds (0—10).					Bright sunshine.	
	Velocity.	Direction.	8 H.	10 H.	16 H.	20 H.	Mean.	Average per day.	Greatest number of hours in a day.
	MILES.							HOURS.	
January	69	E.N.E.	2·9	4·7	3·5	2·4	3·5	7·0	9·0
February	92	E.N.E.	2·9	3·7	3·1	2·1	3·0	8·4	10·9
March	86	S.E.	2·4	2·9	2·0	1·6	2·2	8·5	10·5
April	123	S.E. by S.	3·8	3·9	2·8	2·3	3·1	8·6	11·3
May	98	S. by E.	4·2	3·7	3·6	2·9	3·6	6·0	8·8
June	116	S.W.	5·8	5·6	6·3	5·8	5·9	4·1	7·3
July	112	S.W. by W.	6·5	6·2	7·5	6·7	6·8	2·8	8·0
August	61	S.W. by S.	6·0	5·8	6·1	3·5	5·4	4·8	8·6
September	60	W. by S.	6·4	5·6	6·9	5 1	6·0	4·2	10·6
October	45	E. by N.	3·0	3·2	3·9	2·5	3·2	8·0	10·7
November . ..	127	N.N.E.	4·4	4·8	4·6	3·8	4 4	5·6	8·9
December	140	N.E.	3·7	4·0	4·0	2·3	3·5	6·7	8·2
Annual ..	28	S.E. by E.	4·3	4·5	4·5	3·4	4·2	6·2	—

Appendix XII.

MEAN monthly and annual Meteorological Results at the Madras Observatory in 1909.

	Barometer.		Dry bulb thermometer.				Wet bulb.		Tension of vapour.	Relative humidity.	Sun Max. *in vac.*	Min. on grass.	Wind.			Rain.		Cloudy sky.	Bright sunshine.	Dew point.
	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.	PTS.		INCHES.	NO.	CENTS.	HOURS.	°
January ..	29·954	0·118	75·3	83·9	68·1	15·8	71·1	67·6	0·709	81	131·5	64·8	108	7	E. by N.	4·30	5	35	216·9	67·9
February ..	·946	·110	77·6	86·6	69·5	17·1	72·6	69·0	·734	77	133·4	65·7	118	8	East	0·05	1	30	235·3	69·1
March ..	·896	·123	79·8	89·3	70·8	18·5	74·9	70·7	·803	79	135·2	67·3	112	11	S. E. by E.	..	..	22	263·8	71·4
April ..	·816	129	83·5	91·8	77·0	14·8	78·8	76·0	·925	81	135·6	74·9	157	12	S. E.	7·52	8	31	258·1	75·7
May ..	·716	·121	86·3	97·4	80·2	17·2	80·1	77·1	·944	75	134·5	78·1	158	15	S. by E.	9·49	4	36	186·9	76·1
June ..	·691	·121	86·5	98·1	79·9	18·2	77·8	74·7	·839	67	133·9	78·6	183	20	S. W.	1·65	9	59	124·2	72·2
July ..	·722	·129	83·8	94·7	77·5	17·2	77·4	74·2	·857	85	126·6	75·8	152	21	S.W.byW.	4·86	16	68	87·1	73·2
August ..	·758	·112	82·4	91·5	76·9	14·6	78·5	75·7	·922	84	134·2	75·6	120	17	S. by W.	5·07	16	54	150·2	75·9
September .	·756	·120	82·2	90·4	76·9	13·5	78·4	75·4	·924	84	127·9	75·0	129	21	S.W.byW.	8·36	14	60	126·7	75·9
October ..	·829	·118	83·3	93·3	75·2	18·1	77·9	74·5	·887	78	139·8	72·4	91	9	E. by S.	0·61	4	32	247·2	74·3
November ..	·903	·113	80·1	88·9	72·9	16·0	74·5	71·7	·783	76	135·0	70 6	153	3	N.E. by N.	3·92	6	44	167·9	70·7
December ..	·959	·110	77·8	85·6	71·1	14·5	72·5	69·8	·730	77	131·9	68·2	167	4	N. E.	0·70	3	35	206·8	68·8
Annual ..	29·829	0·109	81·5	91·0	74·7	16·3	76·2	73·0	0·838	79	134·1	72·3	137	12	S. E.	46·53	86	42	2,271·1	72·6

EXTREME monthly Meteorological Records at the Madras Observatory in 1909.

	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 ..	30·087	11	29·761	1	0·326	87·3	29	64·5	19·25	64·2	11	44	10	138·8	25	60·7	25	312	1	52	8	1·81	1
February ..	·096	11	·822	25	·274	89·4	16	66·2	27	65·8	13	55	12, 13	138·2	16	62·1	27	197	18	62	23	0·05	18
March ..	·031	27	·748	9	·283	97·4	31	66·3	6	66·3	6	45	1	142·3	31	62·7	13	152	19	69	14	..	..
April ..	29·961	15	·676	19	·285	98·0	27	68·4	12	68·4	12	57	1, 4	140·5	4	68·4	12	239	18	104	12	2·57	12
May ..	·874	18	·562	31	·312	106·1	30	74·2	5	73·7	21	43	21	143·6	27, 28	68·2	16	222	20	95	11	5·42	4
June ..	·870	15	·476	5	·394	102·9	9	69·5	15	69·4	15	35	8	144 0	22	70·1	15	257	5	97	15	1 03	15
July ..	·919	22	·585	12	·334	102·2	18	71·7	23	71·2	23	34	18	142·2	19	70·3	23	215	9	80	1	1·62	22
August ..	·869	15	·622	21	·247	96·5	1, 2	73·2	20	72·8	1	45	1	141·3	10	72·3	19, 20	189	2	69	28	1·43	19
September ..	·888	28	·616	4	·272	96·0	20	72·1	12	72·1	12	53	18	143·8	28	72·1	12	205	2	64	8	2·67	1
October ..	·955	29	·707	9	·248	98·1	6	68·7	27	68·3	27	42	27	149·6	29	65·2	26	128	14	69	16	0·35	13
November ..	30·015	10	·790	20	·225	93·9	2	67·2	12	66·6	12	51	6	145·8	13	63·8	12	239	29	86	27	2·53	26
December ..	·104	29	·705	4	·399	90·4	4	65·5	27	64·9	27	56	25	136·5	5	62·1	27	277	28	90	5	0·32	20