ANNUAL REPORT

OF THE

DIRECTOR

KODAIKANAL AND MADRAS

OBSERVATORIES

FOR 1921

MADRAS
PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS
1922

KODAIKANAL AND MADRAS OBSERVATORIES.

REPORT FOR THE YEAR 1921.

CONTENTS.

I.—KODAIKANAL OBSERVATORY.

II.—MADRAS OBSERVATORY.

KODAIKANAL AND MADRAS OBSERVATORIES

I.—REPORT OF THE KODAIKANAL OBSERVATORY FOR THE YEAR 1921.

Staff.—The staff of the Observatory on December 31, 1921, was as follows :—

Director	J. Evershed, F.R.S.
Assistant Director	T. Royds, D.Sc.
Assistants	A. A. Narayana Ayyar, B.A. P. R. Chidambara Ayyar, B.A. S. S. Ramaswami Ayyangar, B.A. S. Balasundaram Ayyar.
Recorders	L. N. Krishnaswami Ayyar. R. Krishna Ayyar. S. N. Krishna Ayyar.
Temporary Recorder	K. R. Viswanatha Ayyar.

The subordinate staff consists of a book-binder, an assistant book-binder, a mechanic, six peons, one boy peon for the dark room and two lascars.

Dr. Royds was granted combined leave for one year and was absent from the Observatory from February 25, 1921.

The head peon who also acted as engine and dynamo attendant died on August 29, 1921, from pneumonia. The accommodation for such cases at the Kodaikanal Municipal Hospital is quite inadequate, and it is considered that the life of this valuable and efficient servant might have been saved with reasonably up-to-date arrangements and nursing.

2. *Buildings and grounds.*—The main building containing the office requires outside painting, but is otherwise in good repair. There has been great delay in installing a new pump by the Public Works Department and much difficulty is experienced in carting water for photographic purposes. Repairs to the long line of wire fencing have been satisfactorily completed and the Observatory grounds have been maintained in good order.

3. *Instruments.*—With the exception of a new and very powerful prism spectrograph installed during the year in the spectroheliograph building the equipment remains essentially as in previous years. In December, the 12-inch photovisual lens was taken down and replaced by a 9-inch " skew Cassegrain " reflector for the spectroheliograph work, the lens being required for photographing star fields in preparation for the eclipse of September 1922.

The 30° reflecting prism mentioned in the last report has been thoroughly tested, alone and in combination with two 45° prisms of 6-inch aperture. Owing to want of homogeneity in the glass none of these large prisms can be used for the Hα spectroheliograph.

4. *Weather conditions.*—Notwithstanding the very heavy rainfall in certain months of the year, the general conditions for solar work, as judged by the quality of the " seeing " and the number of days in which observations were possible, were on the whole more favourable than in the previous year. The mean definition in the north dome before 10 a.m. was 3·1 on a scale in which 1 is the worst and 5 the best, while the number of days in which the definition was 4 or over was 66. The

month of November, in which the observing conditions are usually very unfavourable, had the best mean definition, viz., 3·5, with a definition of 4 on fourteen days.

5. *Photoheliograph.*—Photographs on a scale of 8 inches to the Sun's diameter were taken on 339 days, using the 6-inch visual achromatic object glass and a green colour screen.

6. *Spectroheliographs.*—Monochromatic images of the Sun's disc in K light were obtained on 335 days, prominence plates on 279 days and H*a* disc plates on 285 days.

7. *Six-inch Cooke equatorial and spectroscope.*—Work with this instrument has been continued on the same lines as formerly for visual observations of solar phenomena which cannot be readily photographed.

8. *Grating spectrograph.*—Photographs of solar spectra with iron arc comparison have been obtained in the following spectral regions:—

3870—3980	... ...	28 plates.
4325—4500	... ...	33 „
6136—6252	... ...	22 „

In each region the plates include spectra of the polar and equatorial limbs and the centre of the disc, and in the 4325—4500 region they include seven plates of general sunlight.

The results of the measures indicate a systematic difference in the sun – arc displacement between the north and south limbs, and this increases with the wave-length as is shown in the table following :—

Region.	Number of lines.	Mean shift sun – arc in angstroms.		
		North limb.	South limb.	S – N.
3870—3980	24	+ ·0092	+ ·0102	+ ·0010
4325—4500	15	+ ·0075	+ ·0100	+ ·0025
6136—6252	5	+ ·0139	+ ·0176	+ ·0037

The east and west limb measures show a closer agreement with the south limb shifts than with the north.

These results confirm the difference found in measuring the cyanogen bands in plates obtained in 1918, which gave a difference S – N of + ·0023 A (Kodaikanal Observatory Bulletin LXIV, 301). No instrumental cause can be assigned to account for these differences.

In order to determine the shifts at a comparatively high level in the reversing layer twenty-four plates of the D region were obtained, including as before the polar and equatorial limbs and the centre of the disc ; the comparison spectrum being that of a carbon arc giving very narrow sodium absorption lines. The general results show that the D lines give extremely small displacements both at the centre and at the limbs, the Sun – arc displacement of D_1 averaging – 0·001 A at the limbs and – 0·004 A at the centre, and D_2 giving + 0·002 A at the limbs and the same at the centre. The differences south limb – north limb for the mean of D_1 and D_2 is + 0·0013 A.

The difference of shift for D_1 and D_2 shows that the separation of these lines in Sun and arc in air is different, the interval $D_1 - D_2$ being about 0·004 A larger in the arc than in the Sun. This is probably a pressure effect and appears to indicate a nearly zero pressure at the D level of absorption in the Sun, since according to the measures of the D lines in the *vacuum* arc by Datta the interval $D_1 - D_2$ is practically the same as in the Sun.

The absence of appreciable shift at the centre or limbs is difficult to reconcile with the Einstein hypothesis, unless it can be shown that

the D lines in the arc in air are subject to a pressure shift which for 3/4 atmosphere (the air pressure at Kodaikanal) almost compensates the Einstein shift of + 0·0125 A. According to Perot the magnesium lines also indicate a zero pressure in the Sun, and when the known pressure shifts of these lines are added to the Sun – arc shifts the sum closely approximates to the Einstein shift.

Solar wave-lengths have been determined on the international system for 15 iron lines in the region 4337—4494 in light from the centre of the Sun's disc, the limbs, and in general sunlight ; also for 23 iron lines in the region 3885—3977 for the centre of the disc and the limbs. The results have been communicated to the President of Commission 14 of the International Astronomical Union.

The work on general sunlight has been in continuous operation during four successive years with the same equipment, and reveals apparent changes in wave-length in the annual means for some solar lines (not subject to pole effect in the arc) amounting to 0·004 A at the most. Other lines are shown to remain constant within 0·0005 A.

Mr. Narayana Ayyar has taken an active part in this work.

9. *Venus spectra.* – Fifteen plates were obtained during the first three months of the year when Venus was an evening star, the angle Venus-Sun-Earth diminishing from 67° to 27°. The measures of 13 plates taken in 1920 December and 1921 January with a mean angle at the Sun of 71° give slightly smaller wave-lengths than the plates of direct sunlight in 14 out of 17 lines measured, the mean difference being 0·0017 A. The plates taken later when the angle at the Sun was small show no appreciable difference, and the values for individual lines are in close agreement with the normal values of the Sun – arc shifts.

With the planet a morning star 5 plates were obtained in June and July, the mean angle Venus-Sun-Earth being 43°, and in September 5 more plates when the angle had increased to 95°. In neither of these series do the mean wave-lengths differ from the normal by more than 0·001 A.

To photograph the planet's spectrum when the angle Venus-Sun-Earth had become large and the exposure time short an entirely new scheme was adopted. An autocollimating prism spectrograph of 8 feet focal length was built giving the same dispersion as the grating at 4466, with much greater economy in light. An enlarged image of Venus is thrown on the slit from an 18-inch parabolic mirror combined with a convex mirror arranged in the "skew Cassegrain" form advocated by Common in 1895. This gives an image 0·8 mm. in diameter when the planet subtends 10″ only, there is therefore no uncertainty about the proper illumination of the slit while exposing, the planet covering from 25 to 30 times the slit width.

With this equipment 13 excellent spectra were photographed in November and December, the angle Venus-Sun-Earth increasing from 134° on November 21 to 148° on December 15. A preliminary discussion of the measures of these plates indicates only a small difference of wave-length in the Venus spectra compared with direct sunlight, the mean shift Sun – arc of 30 lines measured being + 0·0036 A in direct sunlight and + 0·0024 A in Venus.

A detailed discussion of the results will be published when the whole series of control plates has been measured.

10. *Rotation of Venus.*—Two attempts have been made to detect rotation by the shift of the lines. According to Rodés a direct rotation will produce a residual shift towards violet when the planet is east of the Sun, and towards red when west, assuming that the definition is imperfect and the image of the planet cannot be maintained in a definite position on the slit during the exposure. Our measures during the 5 years 1917—1921 show distinct evidence of such an effect, but the residuals

are towards violet when the planet is west of the Sun, indicating therefore a retrograde rotation : the difference of wave-length between east and west apparitions increases from 0·0018 A near elongations to 0·0025 A when the angle Sun-Venus-Earth has diminished and lies between 71° and 34°.

According to the observations of Pickering the planet rotates on an axis which lies nearly in the orbit plane and in longitude 47° approximately, the period being 68 hours. If this is correct the poles would be seen on the limb of the planet on or about 1921 September 14, and the equator would lie nearly parallel to the terminator. Spectrum photographs on a scale of 2 angstroms to the mm. were obtained on September 8, 14, 18, 19, 20 and 25 with the slit approximately parallel to the terminator. No appreciable inclination of the lines is found on any of the plates, but this would amount to 7′ only at the greatest. The rotation speed on the equator would be 0·125 Km/sec. only, and the difference of wave-length between the two edges of the spectrum would be 0·004 A or 0·002 mm. on these plates. Unfortunately the definition of the planet was extremely bad throughout the month and the edges of the spectra are indefinite. It is not, therefore, considered that the plates could reveal this difference although the spectrum lines are perfectly defined.

Summary of sunspot and prominence observations.

11. *Sunspots.*—The following table shows the monthly numbers of new groups observed at Kodaikanal, and their distribution between the northern and the southern hemispheres. The mean daily numbers of spots visible are also given :—

—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
New groups	8	14	14	11	6	13	12	11	5	6	3	9	112
North	3	3	9	6	3	7	5	5	2	4	2	5	54
South ...	5	11	5	5	2	6	7	6	3	1	1	4	56
Equator	...	...	.	...	1	...	...	...	...	1	...	...	2
Daily numbers ...	2·1	2·2	2·3	2·5	1·1	2·0	2·4	1·6	1·2	1·3	1·3	1·5	1·8

There was again a decrease, amounting to about 20 per cent in the case of new groups, the decrease being slightly more marked in the northern hemisphere. The visible disc was free from spots on 47 days during the year.

The approximate mean latitude of the spots was 9°·8 in the northern hemisphere and 10°·3 in the southern.

A large group of spots, situated on the equator crossed the central meridian on May 14–15. Its spectrum was characterised by very violent disturbances throughout the period it was visible. In addition to the hydrogen and helium lines, the lines of sodium, magnesium and the enhanced lines of iron were seen to be brightly reversed over the umbra of the spot on May 19. The meridian passage of the group synchronised with the occurrence of a magnetic storm of very great intensity and unprecedented duration.

The number of bright reversals of the Hα line in the vicinity of spots was 263, whilst the number of displacements observed near spots was 177, of which 137 were towards red. D_3 was observed as a dark line on 129 occasions.

12. *Prominences.*—The mean daily areas in square minutes of arc, derived from the photographic records are as follows :—

	North.	South.	Total.
1921—January to June	1·92	2·70	4·62
July to December	1·76	1·79	3·55

The mean numbers decreased from 14·7 in the first half of the year to 13·6 in the second.

The general distribution in latitude is similar in the two periods of six months, and differs somewhat from that obtaining in the previous year. Well marked zones of activity are shown at about 40° in the northern hemisphere and at about 25° and 55° in the south. The polar regions remained quiescent.

Metallic prominences were very much less frequent than in 1920 and all were in low latitudes in the sunspot zones.

Four hundred and eighty displacements of the hydrogen lines were observed, of which 260 were towards the red.

Prominences projected on the disc as absorption markings showed a large decrease compared with the previous year.

There was an excess of prominence area on the east limb during the second quarter of the year and on the west limb during other months, whilst H*a* absorption markings have reverted to an eastern excess for the whole year, the proportion east being 52·5 per cent of the whole in the case of areas and 51·6 per cent for numbers.

Mr. Chidambara Ayyar has brought out an interesting relationship between the heliographic latitude of the earth and prominence numbers east and west of the Sun's axis during the years 1904—1920. The results are published in Bulletin No. LXVII.

A special study of the distribution in longitude of H*a* markings for the years 1915—1920 was made by Mr. Narayana Ayyar to see if the progressive change in area of sunspots during their progress across the disc as found by Mrs. Maunder in the years 1889—1901 was indicated by the markings also. It is found that the maximum area occurs in longitudes 40° to 60° east and west of the meridian with a great reduction near the limbs. In the northern hemisphere which alone gives a marked excess of east over west there is a progressive change in the eastern excess which is greatest near the limb and least between 30° and 40° from the meridian. In the central zone between 30° and 0° there is practical equality or very slight western excess.

The monthly mean areas of the prominences have been worked out for the eight-year periods 1905—1912 and 1913—1920. The curve of mean area for the year is strikingly alike in both periods, showing a maximum in March with a secondary maximum in August and a minimum in September. The curve bears some resemblance to the curve of monthly frequencies of magnetic storms recorded at Kodaikanal during the years 1903—1921, which shows maxima in the same months and a marked depression in the curve in September.

13. *Magnetic observations.*—Continuous magnetograph records are obtained of declination, vertical force and horizontal force. Absolute observations for dip are made daily excepting Sundays, declination and horizontal force on three days per week alternately. All the records are made over to the Magnetic Survey office, Dehra Dun, and the results are published by the Survey annually.

Sixteen "Great" and 85 "Moderate" magnetic storms were registered during the year. The storm of May 13—22 was of longer duration than

any previously recorded, and there was considerable disturbance to the Indian telegraph service on May 14 and 15. This storm may be regarded as composed of several distinct storms, and that of May 14—15 appears to have formed one of a sequence recurring at 27 day intervals for 7 synodic rotations of the sun, beginning March 21 and ending September 29.

14. *Time.*—The error of the standard clock is usually determined by reference to the 16 hour signal 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 Postmaster-General, Madras.

15. *Meteorology.*—Eye observations are made at 8^h, 10^h and 16^h local mean time as in former years. The Richard thermograph (wet and dry bulb) and barograph, the Beckley anemograph and the sunshine recorder also continue in use. Cloud observations with the Nephoscope are made three times daily. Under instructions from the Director-General of Observatories, the preparation of normals of all meteorological data at Kodaikanal up to the end of 1920, was undertaken and was in progress at the end of the year.

Pressure.—The mean pressure for the year was 0·005 inches below normal. The monthly means show that it was below normal from January to March and from May to July, and above normal in September and November, the greatest defect being 0·024 inches in February and the greatest excess 0·034 inches in November. The highest pressure recorded was 22·920 inches on March 16 and the lowest 22·657 inches on July 6.

Temperature.—The mean temperature for the year was normal, and the mean maximum and mean minimum (dry and wet bulb) were not far from normal. The highest temperature recorded was 76°·5 on May 9 and the lowest was 40°·3 on February 26. The lowest minimum on grass was 27°·2 on December 8.

Humidity.—The mean humidity for the year was 3 cents below normal. The greatest deviations were a defect of 16 cents in March and 15 in December. The driest day in the year was February 28 when the humidity fell to 3 cents.

Rainfall.—The distribution of rainfall was uneven throughout the year. The total rainfall was 77·52 inches or 15·63 inches above normal. The total rainfall in January was 13·58 inches against an average of 2·88 inches, whilst the month of November had a deficit of 4·11 inches. The heaviest rainfall recorded on any one day was 6·91 inches on January 14, which is also the heaviest ever recorded at the Observatory.

Wind.—The mean wind direction for the year differed from the normal by 10 points to the west. The air movement was below normal in April, May, July, August, October and November.

Transparency of the atmosphere.—The transparency of the lower atmosphere as judged by the visibility of the Nilgiris about 100 miles distant was much below the average.

Cloud and sunshine.—The percentage of clear sky was above normal in February, March and November, and below normal in January, April, July and October. During the other months it was normal. The total number of hours of bright sunshine was 2236 as against an average of 2152.

16. *Seismology.*—The Milne horizontal pendulum recorded 105 earthquakes as against 85 during the previous year. Details of the records are given in appendix I.

17. *Library.*—Seventy-six volumes were bound during the year.

18. *Publications.*—The annual report for the year 1920, and bulletins Nos. LXVI to LXVIII were published and distributed during the year. Their titles are given below :—

No. LXVI. Summary of prominence observations for the second half of the year 1920, by T. Royds, D.Sc.

No. LXVII. An apparent influence of the earth on solar prominences, by J. Evershed, F.R.S., and P. R. Chidambara Ayyar, B.A.

No. LXVIII. Summary of prominence observations for the first half of the year 1921, by J. Evershed, F.R.S.

In addition the Director has contributed the following paper : " The Relativity shift in the solar spectrum "—Observatory 44, 243.

KODAIKANAL,
24th January 1922.

J. EVERSHED,
Director, Kodaikanal and Madras Observatories.

II.—REPORT OF THE MADRAS OBSERVATORY FOR THE YEAR 1921.

Staff.—The staff of the Observatory during the year 1921 was as follows :—

Deputy Director	Edward Barnes, B.Sc. (January 1 to May 4). S. R. U. Savoor, B.A., D.Sc. (May 5 to December 31).
Time Assistant	C. P. Venkatarama Ayyar, M.A. (March 18 to December 31).
Observers	P. Jayaram Mudaliyar (January 1 to December 31). S. S. Ranga Acharya (January 1 to October 31). K. Viswanathan (November 1 to December 31).

Since Mr. Solomon Pillai, the Time Assistant, retired from service on the 25th October 1920, the Observatory had to work understaffed till 18th March 1921, when Mr. C. P. Venkatarama Ayyar was appointed in the place. Mr. P. Jayaram Mudaliyar was absent on privilege leave from 20th May to 1st July and again from 1st November to 16th November. Mr. S. S. Ranga Acharya, having been deputed as Observer to the Humidification Expert to the Government of India, for one year from 1st November, Mr. K. Viswanathan was appointed acting Observer from that date.

2. *Time-service.*—The time gun at Fort St. George failed on 14 occasions out of 731, giving a percentage of success of 98. Most of the failures were due either to faults in the firing instrument at the Fort, which, owing to long use, has become much worn out, or to the mistakes on the line. The main line and the connections to the instrument therefrom require renewal. The gun was fired at 8 hrs. and 11 hrs. instead of at 12 hrs. on November 11, on account of the anniversary of the armistice. The time ball at the Harbour failed at 13 hrs. on one day, owing to the Observatory not being connected to the Signal Station till after 1-15 p.m., but it dropped correctly at 14 hrs. The 16 hr. roll of signals was sent as usual to the Central Telegraph Office.

The 7 p.m. Radio Signals were received for a few days now and then till the end of September when they ceased to arrive except on very rare occasions. The arrangement of receiving the signals over the Telephone seems to be quite unsatisfactory and arrangements are being made to supply this Observatory with a simple wireless receiving set. It is hoped that after the installation of this set, signals will be received satisfactorily so as to enable comparisons between Calcutta and Madras clocks to be made accurately.

3. *Meteorological observations.*—Eye observations were made daily at 8 hrs., 10 hrs., 16 hrs. and 20 hrs. local mean time as in former years and the records of self-registering instruments maintained as usual. Observations with Kata thermometer for the determination of the cooling power of air have been made since the beginning of this year. Extra observations were taken for storm warning purposes and telegrams sent to Calcutta on 17 occasions and to Simla on 11 occasions.

4. *Buildings.*—Though the usual annual repairs to the office and some special repairs to the quarters were carried out during the year, still there is much left to be done in this connection. The terraced roof of the

quarters, and the dome in which the equatorial is fitted up are still leaking badly and but for the scarcity of rain in November and December, it would have been extremely difficult to reside in the quarters.

5. *Instruments.*—The following is a list of instruments at the Observatory on 31st December 1921:—

(*a*) *Astronomical.*

Eight-inch Equatorial Telescope—Troughton and Simms.
Sidereal clock—Haswall.
Do. Dent, No. 1408.
Do. S. Riefler, No. 61.
Mean Time clock—J. H. Agar Baugh, No. 105.
Do. with galvanometer—Shepherd & Sons.
Meridian circle—Troughton and Simms.
Portable transit instrument—Dollond.
Tape chronograph—R. Fuess.
Relay for use with the chronograph—Siemens.

(*b*) *Meteorological.*

Richard's barograph—No. 10, L. Casella.
Do. thermograph—No. 29637, L. Casella.
Peander's self-recording rain-gauge—No. 116, Lawrence and Mayo.
Beckley's anemograph—Adie.
Sunshine recorder—No. 149, L. Casella.
Nephoscope—Mons Jules Daboseq and Ph. Pellin.
Barometer, Fortin's—No. 1771, L. Casella.
Do. do. No. 725, L. Casella (spare).
Do. do. No. 1520, L. Casella (spare).
Dry bulb thermometer—No. 94221, L. Casella.
Do. do. No. 38037, Negretti and Zambra (spare).
Wet bulb do. No. 94219, L. Casella.
Do. do. No. 38037, Negretti and Zambra (spare).
Dry maximum thermometer—No. 8581, Negretti and Zambra.
Dry minimum do. No. 54182, Casella.
Wet do. do. No. 91753, Negretti and Zambra.
Sun maximum do. No. 127618, Negretti and Zambra.
Grass minimum do. No. 3377, Negretti and Zambra.
Rain-gauge (8″ diameter)—No. 1042, Negretti and Zambra.
Measure glass for above.
Rain-gauge (5″ diameter).
Measure glass for above.
Stop watch—No. A-3.
Kata thermometer No. 273, J. Hicks & Co.

The Riefler clock, Kullberg's chronometer No. 5394 and Beckley's anemograph were all cleaned early this year, while during the visit of the Director from Kodaikanal in December, the Dent and the A.B. clocks were completely overhauled and cleaned. The level error of the Transit Circle at the beginning of the year was $-2^{s}\cdot67$. It changed gradually till it reached a maximum value of $-11^{s}\cdot36$ about the end of second week of October. As a result of continued heavy rains it went through a rapid change in the reverse direction. This continued till the end of first week of November when it remained fairly steady at about $-3^{s}\cdot60$ till the middle of December after which it again showed a slight rise.

The rate of the Riefler clock was not quite so steady as might be expected.

6. *Weather summary.*—The following is a summary of the meteorological conditions at Madras during 1921 :—

Pressure.—The mean monthly pressure was normal in April, August and September, above normal in October, November and December and below normal in the remaining months, the greatest excess being 0·060 inch in November and the greatest defect 0·075 inch in May. The highest pressure recorded was 30·124 inches on the 11th of December.

Temperature.—The mean temperature of the air was normal in February and April, below normal in July, October and November and above normal in the remaining months. The highest temperature recorded was 111°·2 on the 25th May. The minimum in shade was normal in March, August, September and October, below normal in February, July, November and December and above normal in the other months. The lowest temperature recorded was 63°·6 on the 10th November. The highest sun maximum was 168°·3 on the 9th of June and the lowest on grass was 59°·4 on the 10th of November.

Humidity.—The percentage of humidity was about normal throughout the year. The driest day in the year was the 26th May and the wettest the 16th of October.

Wind.—The wind velocity was in defect throughout the year. The wind direction was normal in January, June, September and December and very abnormal during October.

Cloud.—The amount of cloud was above normal in January, April, July and October and below normal in the other months. During November and the first half of December the sky was quite unusually less cloudy.

Sunshine.—The percentage of sunshine was normal in March and September, above normal in February, August and November and below normal in the other months. The total number of hours of bright sunshine during the year was 2189·5.

Rainfall.—The rainfall was above the average in January, April, July, August and October and below in the remaining months. The greatest excess was 13·27 inches in October and the greatest defect 11·37 inches in November. The total fall for the year was 54·43 inches on 96 days compared with an average of 49·02 inches. The monsoon rainfall from the 15th October to the end of the year was 20·81 inches. The heaviest rainfall on one day was 3·28 inches on 13th October.

Storm.—A severe storm formed in the Bay near Port Blair about the 5th of October giving very heavy rain there. It then gradually moved towards the east coast and then north west giving heavy rains on the north Madras coast. It filled up near Nellore about the 8th and then passed across the Peninsula into the Arabian Sea about the 9th. Another storm from near Port Blair moved south west to Ceylon about the 24th of the same month and then north, practically covering the whole of the east coast on the 25th and finally disappeared.

MADRAS,
14th January 1922.

S. R. U. SAVOOR,
Deputy Director, Madras Observatory.

APPENDIX I.

STATION—KODAIKANAL OBSERVATORY.

SEISMIC RECORDS.

$\phi = 10° 13' 50''$ $\lambda = 77° 28' 00''$ $h = 2343$ metres. *Subsoil*—Rock.

Apparatus—Milne's Horizontal Pendulum Seismograph.

1921.	T_o	$\frac{\tau}{T_o^2}$	1921.	T_o	$\frac{\tau}{T_o^2}$
January	17·3	2·7	July	17·3	2·8
February	17·6	2·6	August	17·5	2·8
March	17·1	2·5	September	17·3	2·9
April	17·2	3·0	October	17·4	2·8
May	17·6	2·8	November	17·2	2·9
June	17·3	2·9	December	17·5	2·6

No.	Date.	Phase.	Time G.M.T.			Period (Sec.).	Amplitude (μ).			Distance $\triangle$ (Km.).	Remarks.
							An.	Ae.	Az.		
	1921.		H.	M.	s.						
1	January 3 ...	eP	21	58	12	...	...	...	...	...	Widening of line.
		F	22	06	24	...	...	...	...	...	
2	6 ...	eP	2	35	54	...	...	...	...	...	Widening of line.
		F	2	41	18	...	...	...	...	...	
3	6 ...	eP	4	09	30	...	...	...	...	...	Widening of line.
		F	4	11	54	...	...	...	...	...	
4	6 ...	eP	4	31	36	...	...	...	...	...	Widening of line.
		F	4	36	42	...	...	...	...	...	
5	6 ...	eP	23	30	00	...	...	...	...	...	Widening of line. In continuation of hour mark.
		F	23	41	18	...	...	...	...	...	
6	7 ...	eP	1	55	36	...	...	...	...	...	
		eL	2	04	54	...	...	...	...	...	
		M	2	09	00	...	...	60	...	...	
		F	2	23	18	...	...	...	...	...	
7	7 ...	eP	3	14	06	...	...	...	...	...	
		eL	3	26	24	...	...	...	...	...	
		M	3	36	12	...	...	50	...	...	
		F	4	04	18	...	...	...	...	...	
8	9 ...	eP	14	11	54	...	...	...	...	...	
		eL	14	18	42	...	...	...	...	...	
		M	14	25	54	...	...	50	...	...	
		F	15	24	24	...	...	...	...	...	
9	19 ...	eP	15	43	18	...	...	...	...	...	
		eL	15	46	24	...	...	...	...	...	
		M	15	48	30	...	...	40	...	...	
		F	16	06	54	...	...	...	...	...	
10	24 ...	eP	11	26	24	...	...	...	...	...	
		eL	11	31	00	...	...	...	...	...	
		M	11	32	36	...	...	60	...	...	
		F	11	43	48	...	...	...	...	...	
11	February 4 ...	eP	8	50	36	...	...	...	...	...	
		eL	8	59	00	...	...	...	...	...	
		M	9	00	24	...	...	50	...	...	
		F		?		...	...	...	...	...	
12	4 ...	P		?		...	...	...	...	...	Overlapping.
		eL	9	55	36	...	...	...	...	...	
		M	9	59	42	...	...	60	...	...	
		F	10	41	48	...	...	...	...	...	
13	6 ...	eP	4	49	30	...	...	...	...	...	Widening of line.
		F	4	51	30	...	...	...	...	...	
14	6 ..	eP	7	14	00	...	...	...	...	...	Widening of line.
		F	7	24	54	...	...	...	...	...	
15	13 ...	eP	21	51	30	...	...	...	...	...	Widening of line.
		F	21	57	42	...	...	...	...	...	
16	14 ...	eP	1	17	12	...	...	...	...	...	Widening of line.
		F	1	37	12	...	...	...	...	...	
17	19 ...	eP	14	51	30	...	...	...	...	...	
		eL	15	13	06	...	...	...	...	...	
		M	15	14	36	...	...	50	...	...	
		F	15	28	36	...	...	...	...	...	

No.	Date.	Phase.	Time G.M.T.	Period (Sec.).	Amplitude (μ).			Distance △ (Km.).	Remarks.
					An.	Ae.	Az.		
	1921.		H. M. S.						
18	February 19 ...	eP	18 25 18	...	...	...	...	...	
		eL	18 37 24	...	...	...	...	...	
		M_1	18 39 30	...	...	70	...	...	
		M_2	18 53 18	...	...	80	...	...	
		F	20 14 06	...	...	...	...	...	
19	21 ...	P	...	...	...	...	...	...	No P.Ts.
		iL	2 08 00	...	...	...	...	...	
		M	2 10 30	...	...	60	...	...	
		F	2 23 18	...	...	...	...	...	
20	28 ...	eP	18 42 18	...	...	...	...	...	
		iL	18 52 36	...	...	...	...	...	
		M	18 53 48	...	...	140	...	...	
		F	?	...	...	...	...	...	
21	28 ...	P	?	...	...	...	...	...	} Overlapping.
		eL	19 17 12	...	...	...	...	...	
		M	19 40 18	...	...	260	...	...	
		F	21 27 24	...	...	...	...	...	
22	March 3 ...	eP	3 42 36	...	...	...	...	...	
		eL	3 45 30	...	...	...	...	...	
		M	3 48 24	...	...	50	...	...	
		F	3 55 48	...	...	...	...	...	
23	3 ...	eP	8 33 54	...	...	...	...	...	
		eL	8 35 42	...	...	...	...	...	
		M	8 44 12	...	...	210	...	...	
		F	9 17 24	...	...	...	...	...	
24	5 ...	P	...	...	...	...	...	...	No P.Ts.
		iL	6 32 30	...	...	...	...	...	
		M	6 35 36	...	...	640	...	...	
		F	7 23 06	...	...	...	...	...	
25	19 ...	eP	8 32 42	...	...	...	...	...	
		eL	8 42 48	...	...	...	...	...	
		M	8 45 06	...	...	30	...	...	
		F	9 01 24	...	...	...	...	...	
26	21 ...	eP	5 38 00	...	...	...	...	...	Widening of line.
		F	5 46 00	...	...	...	...	...	
27	23 ...	eP	22 57 00	...	...	...	...	...	
		eL	23 14 00	...	...	...	...	...	
		M	23 20 06	...	...	70	...	...	
		F	23 38 06	...	...	...	...	...	
28	24 ...	eP	1 50 48	...	...	...	...	...	
		eL	1 55 06	...	...	...	...	...	
		M	1 58 00	...	...	50	...	...	
		F	2 19 12	...	...	...	...	...	
29	24 ...	eP	10 15 06	...	...	...	...	...	
		eL	10 20 42	...	...	...	...	...	
		M	10 25 24	...	...	130	...	...	
		F	11 10 42	...	...	...	...	...	
30	24 ...	iP	15 04 42	...	...	...	...	...	
		eL	15 28 18	...	...	...	...	...	
		M	15 44 48	...	...	60	...	...	
		F	16 06 36	...	...	...	...	...	
31	26 ...	P	...	...	...	...	...	...	No P.Ts.
		iL	2 28 12	...	...	...	...	...	
		M	2 31 00	...	...	130	...	...	
		F	2 43 18	...	...	...	...	...	
32	28 ...	eP	8 12 18	...	...	...	...	...	
		eL	8 28 12	...	...	...	...	...	
		M	8 31 30?	...	...	50?	...	...	M falls on the hour mark.
		F	?						
33	28 ...	P	?	...	...	...	...	...	} Overlapping.
		eL	9 13 06	...	...	...	...	...	
		M	9 52 12	...	...	...	...	...	
		F	10 13 48	...	...	70	...	...	
34	29 ...	eP	23 00 48	...	...	...	...	...	
		F	23 24 54	...	...	...	...	...	Widening of line.
35	30 ...	eP	10 32 18	...	...	...	...	...	
		eL	10 38 12	...	...	...	...	...	
		M	10 47 12	...	...	...	...	...	
		F	10 56 24	...	...	30	...		
36	30 ...	eP	15 10 48	...	...	...	...	...	
		eL	15 21 30	...	...	...	...	...	
		M	15 44 12	...	...	...	...	...	
		F	16 04 18	...	...	80	...	...	
37	April 1 ...	iP	4 11 30	...	...	...	...	...	
		iL	4 15 36	...	...	...	...	...	
		M	4 19 12	...	...	...	...	...	
		F	5 56 42	...	...	380	...	...	

No.	Date.	Phase.	Time G.M.T.	Period (Sec.).	Amplitude (μ).			Distance $\overset{\triangle}{(Km.)}$.	Remarks.
					An.	Ae.	Az.		
	1921.		H. M. S.						
38	April 2	eP	9 51 30	...	...	...	...	...	
		eL	10 02 18	...	...	...	...	...	
		M	10 14 24	...	...	120	...	...	
		F	11 04 06	...	...	...	...	...	
39	17 ...	eP	22 28 12	...	...	...	..	...	Widening of line. Falls on the hour mark.
		F	22 34 54	...	...	...	...	...	
40	25 ...	eP	18 34 54	...	...	...	...	...	
		eL	18 37 42	...	...	...	...	...	
		M	18 44 24	...	...	50	...	...	
		F	18 49 30	...	...	...	...	...	
41	27 ...	eP	9 49 48	...	...	...	...	...	Widening of line.
		F	9 56 42	...	..	...	...	...	
42	May 1 ...	eP	6 52 54	...	...	...	...	...	
		eL	7 07 06	...	...	...	...	...	
		M	7 10 54	...	...	40	...	...	
		F	7 50 06	...	...	...	...	...	
43	12 ...	eP	4 34 18	...	...	...	...	...	Widening of line.
		F	4 57 36	...	..	...	...	...	
44	13 ...	eP	20 26 24	..	...	...	...	..	
		eL	20 31 00	..	...	..	...	...	
		M	20 32 06	...	...	30	...	...	
		F	20 42 54	...	...	...	...	...	
45	13 ...	eP	21 32 48	...	...	...	...	..	
		eL	21 35 54	...	...	...	...	...	
		M	21 41 36	...	...	40	...	...	
		F	21 48 00	...	...	...	...	...	
46	14 ...	eP	11 15 42	...	...	...	...	...	
		iL	11 43 42	...	..	...	...	...	
		M	11 46 00	...	...	140	...	...	
		F	12 11 06	...	...	...	...	...	
47	14 ...	eP	13 28 00	...	...	...	...	...	
		eL	?	...	...	...	...	...	
		M	13 32 36	...	...	40	...	...	
		F	13 41 36	...	...	...	...	...	
48	14 ...	eP	21 20 00	..	...	...	...	...	
		eL	21 29 00	...	...	..	.	...	
		M	21 31 48	...	...	80	...	...	
		F	21 48 12	...	...	...	...	...	
49	16 ...	eP	16 11 54	...	...	...	...	...	Widening of line.
		F	16 24 42	...	...	...	...	...	
50	20 ...	eP	0 53 06	...	..	...	...	...	
		eL	0 54 12	...	...	...	...	...	
		M	0 55 12	...	...	130	...	...	
		F	1 18 06	...	...	...	...	...	
51	21 ...	iP	8 56 06	...	...	...	...	...	
		iL	9 11 24	...	...	...	...	...	Times approximate as there is no hour mark on the sheet.
		M	9 13 54	...	...	160	...	...	
		F	9 48 54	...	...	...	...	...	
52	21 ...	eP	22 41 00	...	...	...	...	...	
		eL	23 05 00		...	...	...	...	
		M	23 10 24	...	...	90	...	...	
		F	24 06 48	...	...	...	...	...	
53	June 2 ...	eP	7 17 36	...	...	...	...	...	
		eL	7 20 12	...	...	...	...	...	
		M	7 21 30	...	...	60	...	...	
		F	7 43 30	...	...	...	...	...	
54	18 ...	eP	15 31 30	...	...	...	...	...	Widening of line.
		F	15 34 06	...	...	...	...	...	
55	20 ...	eP	2 09 48	...	...	...	...	...	Widening of line.
		F	2 16 36	..	...	...	...	...	
56	21 ...	eP	10 34 06	...	...	...	...	...	Widening of line.
		F	10 40 54	...	...	...	...	...	
57	21 ...	eP	12 56 54	...	...	...	...	...	Widening of line.
		F	12 59 00	...	...	...	...	...	
58	21 ...	eP	13 09 18	...	...	...	...	...	Widening of line.
		F	13 14 30	...	...	...	...	...	
59	25 ...	eP	12 05 00	...	...	...	...	...	Widening of line.
		F	12 08 06	...	...	...		...	
60	28 ...	eP	14 24 54	...	...	...	...	...	
		eL	15 00 48	...	...	...	...	..	
		M	15 06 54	...	...	40	...	...	
		F	15 13 06	...	...	...	...	...	
61	July 7 ...	eP	11 43 24	...	...	...	...	...	Widening of line.
		F	12 05 54	...	...	...	...	...	
62	8 ...	eP	13 36 12	...	...	...	...	...	Widening of line.
		F	13 45 30	...		...	...	...	
63	13 ...	eP	2 11 24	...	...	..	...	...	Widening of line.
		F	2 13 54	...	...	...	...	...	

No	Date.	Phase.	Time G.M.T.	Period (Sec.).	Amplitude (μ).			Distance Δ (Km.).	Remarks.
					An.	Ae.	Az.		
	1921.		H. M. S.						
64	July 25 ...	eP	19 55 30	...	...	...	...	...	Widening of line.
		F	20 02 12	...	...	...	...	...	
65	August 5 ...	eP	2 19 36	...	...	...	...	...	Widening of line.
		F	2 30 00?	...	...	...	...	...	Hour mark overlaps.
66	13 ...	eP	13 23 36	...	...	...	...	...	
		eL	13 27 06	...	...	...	...	...	
		M	13 28 42	...	...	40	...	...	
		F	13 41 18	...	...	...	...	...	
67	14 ...	iP	13 28 30	...	...	...	...	...	
		iL	13 35 06	...	...	...	...	...	
		M	13 36 54	...	...	120	...	...	
		F	14 01 36	...	...	...	...	...	
68	15 ...	eP	14 13 42	...	...	...	...	...	Widening of line.
		F	14 23 18		...	...	...	...	
69	23 ...	eP	13 56 06	...	...	...	...	...	Widening of line.
		F	13 59 12	..	...	...	...	...	
70	23 ...	eP	21 01 18	...	...	...	...	...	
		eL	21 10 18	...	...		...	...	
		M	21 12 36	...	...	50	..	...	
		F	21 21 18	...		...	...	...	
71	September 1 ...	eP	10 19 12	...	...	...	..	...	Widening of line.
		F	10 25 24	...	...	...	...	...	
72	2 ...	eP	5 21 18	...	...	...	...	...	Widening of line.
		F	5 27 24	...	...	...	...	...	
73	3 ...	eP	1 33 36	...	...	...	...	...	Widening of line.
		F	1 36 12		...		...	...	
74	5 ...	eP	20 18 12	...	...	...	...	...	
		eL	20 36 12		...		...	...	
		M	20 45 06	...	...	110	...	...	
		F	21 22 18		...	...	...	...	
75	11 ...	P	...	..	...	...	...	...	No P.Ts.
		iL	4 09 00	...	...	...	...	...	
		M	4 27 42	...	...	1350	...	...	
		F	7 29 48	...	...	...	...	...	
76	13 ...	eP	3 02 06	...	...	.	...	...	
		iL	3 32 36	...	...	...	...	...	
		M	3 39 18	...	...	410	...	..	
		F	4 20 42	...	...	...	...	...	
77	21 ...	iP	11 15 18	...	...	...	...	...	
		iL	11 22 30	...	...	...	...	...	
		M	11 23 48	...	...	140	...	...	
		F	11 47 30	...	...	...	...	...	
78	22 ...	eP	6 43 48	...	...	...	...	...	
		eL	6 49 30	...	...	...	...	...	
		M	6 51 00		...	90	...	...	
		F	7 04 54						
79	October 9 ...	eP	0 25 18	...	...	...	...	...	
		eL	0 27 30	...	...	...	...	...	
		M	0 32 24	...	...	170	...	...	
		F	1 29 00	...	...	...	...	...	
80	9 ...	eP	5 07 18	...	...	...	...	...	
		eL	5 11 54	...	...	...	...	...	
		M	5 13 12	...	...	50	...	...	
		F	5 19 42	...	..	...	...	...	
81	10 ...	eP	2 18 54	...	...	...	...	...	
		eL	2 28 24	...	...	...	...	...	
		M	2 32 48	...	...	80	...	...	
		F	?	...	...	...	...	...	
82	10 ...	P	?	...	...	...	...	...	Overlapping.
		eL	2 39 00	...	...	...	...	...	
		M	2 42 42	...	...	80	...	...	
		F	3 06 30	...	...	..	...	...	
83	12 ...	eP	8 59 18	...	...	...		...	Widening of line.
		F	9 07 30	...	...	...	...	...	
84	15 ...	eP	5 10 24	...	...	...	...	...	
		iL	5 55 12	...	...	...	...	...	
		M	5 59 48	...	...	410	...	...	
		F	7 33 06	...	...	...	...	...	
85	15 ...	eP	10 16 06	...	...	...	...	...	Widening of line.
		F	10 18 36	...	...	...	...	...	
86	18 ...	eP	1 25 00	...	...	...	...	...	Widening of line.
		F	1 30 18	...	...	...	...	...	
87	18 ...	eP	12 54 12	...	...	...	...	...	Widening of line.
		F	13 01 24	...	...	...	...	...	
88	20 ...	eP	6 25 54	...	...	...	...	...	
		eL	6 39 42	...	...	...	...	...	
		M	6 40 48	...	...	50	...	...	
		F	7 44 24	...	...	...	...	...	

No.	Date.	Phase.	Time G.M.T.			Period (Sec.)	Amplitude (μ).			Distance Δ (Km.).	Remarks.
							An.	Ae.	Az.		
	1921.		H	M	S						
89	October 26 ...	eP	7	12	30	...	...		..	...	Widening of line.
		F	7	21	12	..	...	...	...	...	
90	26 ...	eP	23	09	42	..	...	.	...	.	Widening of line.
		F	23	19	00	...	..	...	...	...	
91	November 2 .	eP	9	12	12	..	...	...	..	...	Widening of line.
		F	9	28	24	...	..	..	..	...	
92	2 ...	eP	9	45	30	...	...	...	..		Widening of line.
		F	10	08	48	..	..	..	..	...	
93	7 ...	eP	16	08	36	...	...	..	...	..	
		eL	16	15	18	...			...	..	
		M	16	32	06	...	...	160	...	.	
		F	17	07	36	...	..	..	...	...	
94	11 ...	P		..		...	...	...	...	...	No P.Ts.
		iL	18	45	30	.	...		..	...	
		M	19	09	06	...	...	1200	...	...	
		F	21	49	36	..	..	...	...	..	
95	14 ..	eP	7	50	36	..	.	...	...	...	Widening of line.
		F	8	01	54	...	..	...	..		
96	15 ...	eP	20	42	24	..	...		...	..	
		iL	20	45	24	..	.	...	..	...	
		M	20	51	36	...	..	900	...	...	
		F	21	59	42	...	...	..	..	...	
97	16 ...	eP	15	41	36	...	..	...	...	...	Widening of line.
		F	15	46	12	...	...	...	.	...	
98	17 ...	eP	8	18	06	...	...	...	...	...	Widening of line.
		F	8	27	24	...	...	...	...	.	
99	18 ...	eP	3	03	54	..	..	...	...	...	Widening of line.
		F	3	10	00	.	...	...	...	...	
100	December 7 ...	eP	17	37	12	...	..	...	...	...	
		eL	17	57	24	..	..	..		...	
		M	18	00	18	...	...	60	...	...	
		F	18	12	48	...	...		.	...	
101	8 ..	eP	13	11	18	...	...	...	...	...	
		eL	13	12	36	...	...		...	..	
		M	13	15	24	...	...	40	...	...	
		F	13	23	06	...		.	...	..	
102	12 ..	eP	2	22	36	...	...	...	...	...	Widening of line.
		F		?		...	...	...	..	...	F merged in the hour mark at 2^h 30^m.
103	18 ...	eP	15	48	12	...	...	...	...	...	
		iL	16	01	48	...			..	...	
		M	16	02	18	...	...	50		...	
		F		?			..	...	...	...	} Overlapping.
104	18 ...	P		?		...	..		..	...	
		eL	17	00	00	...	...	..	...	...	
		M	17	08	42	...	...	50	...	...	
		F	17	36	42?	..	..	...	...	...	
105	18 ...	eP	23	41	00	...			..	...	Widening of line.
		F	23	45	24	..	...	...	...	...	

APPENDIX II.

Latitude 10° 13′ 50″ N.

Height of Barometer cistern above mean sea level 7688 feet.

Longitude 5h 9m 52s E.

MEAN Monthly and Annual Meteorological Results at the Kodaikanal Observatory in 1921.

Month.	Barometer.		Dry Bulb Thermometer.				Wet Bulb.		Tension of Vapour.	Relative Humidity.	Sun Max. in Vac.	Min. on Grass.	Wind.			Rain		Clear sky.	Bright sunshine.
	Reduced to 32°.	Daily Range.	Mean.	Max.	Min.	Range.	Mean.	Min.	By Simpson's Tables.				Daily Velocity	Mean Direction.		Amount.	Days.		
	Inches.	Inches.	°	°	°	°	°	°	Inches.	Cents.	°	°	Miles.	Points	Points.	Inches.	No.	Cents.	Hours.
January	22·839	0·064	55·4	62·4	48·3	14·1	49·7	44·1	0·307	71	114·2	42·1	316	7	E. by N.	13·58	11	41	196·6
February	·831	·064	55·7	66·1	45·3	20 8	45·9	40 1	·213	50	126·4	36·8	285	19	S.W. by S.	...	...	77	285·4
March	·838	·060	60·7	71·5	49·9	21·6	47·7	40·0	·204	39	133·8	38·9	303	6	E.N.E.	...	..	85	323·1
April	·838	·066	59·1	69·1	52·4	16·7	54·0	48·7	·360	72	131·4	45·4	236	12	S.E.	9·86	11	41	207·4
May	·792	·062	62·0	72·8	55·2	17·6	55·4	49·8	·370	66	133·4	46·8	194	1	N. by E.	4·36	8	45	211·3
June	·745	·057	58·3	66·4	53·4	13·0	54·8	50·7	·303	81	126·0	48·1	252	23	W. by S.	4·11	10	27	126·2
July	·743	·052	53·3	63·2	52·7	10·5	54·2	50·8	·307	88	114·0	48·6	313	25	W. by N.	7 53	17	12	77·9
August	·773	·062	56·9	64·8	52·3	12·5	54·3	50·6	·349	89	122 1	48·1	238	23	W. by S.	11·72	16	26	136·2
September	·794	·062	56·0	63·7	51·1	12·6	52·5	47·8	·350	80	121·7	46·9	276	23	W by S.	4·25	11	27	160·6
October	·809	·068	55·7	63·3	51·0	12·3	53·6	49·4	·390	88	118·1	47·1	207	30	N.N.W.	12·59	19	18	123·9
November	·854	·055	54·7	63·0	48·0	15·0	51·3	45·4	·344	80	116·2	42·2	199	18	S.S.W.	3 70	6	43	172·7
December	·833	·057	54·8	65·7	47·1	18·6	46·3	39·6	·231	55	116·3	38·4	301	9	E by S.	5·82	5	49	214·6
Annual	22·807	0·061	57 1	66·0	50·6	15·4	51·6	46·4	0·326	72	122·8	44·1	260	22	W.S.W.	77·52	114	41	2235·9

EXTREME Monthly Meteorological Records at the Kodaikanal Observatory in 1921.

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	22·896	3, 5	22·760	12	0·136	69·7	1	42·0	27	34·6	29, 30	15	6, 30	132·9	1	30·3	29	546	9	144	24	**6·91**	**14**
February	·902	25	·764	6	·138	72·4	27	**40·3**	**26**	33·1	27	**3**	**28**	134·9	15	29·4	6	470	17	165	8	...	...
March	**·920**	**16**	·735	3	·185	74·6	24	45·6	5	33·2	5	7	14	136·9	10	32 5	14	463	5	175	31	..	...
April	·902	19	·753	6	·149	73·5	5	49·4	3	43·3	26	34	26	**141·9**	**12**	39·6	3	370	30	114	17	2·58	14
May	·881	1	·701	13	·180	**76·5**	**9**	50·3	1	40·7	1	29	6	**141·9**	**17**	41·7	1	300	12	125	15, 23	1·32	25
June	·821	4	·668	19	·153	72·2	2	51·2	30	47·1	16	52	1	135·9	11	42·5	30	515	21	108	28	0·94	7
July	·834	19	**·657**	**6**	·177	66·7	1	51·2	8	46·3	8	61	2	126·3	20	43 2	2	516	30	100	2	0·90	11
August	·835	1	·702	20	·133	68·2	28	50·7	21	48·2	18	58	9	138·9	24	44·0	15	432	1	120	25	1·37	1
September	·873	26	·696	2	·177	66·3	22	49·4	4, 30	40·6	15	34	15	136·1	22	43 5	15	565	3	111	9	0·64	10
October	·889	19	·705	8	·184	65·7	13	44·2	23	37·6	23	44	23	132·8	6	37·2	23	334	27	133	8	1·29	29
November	·918	29	·773	6	·145	68·3	30	41·4	21	**32·7**	**21**	15	15	129·6	13	30·4	15	376	20	118	12	1·76	1
December	·918	5	·755	29	·163	72·8	2	40·8	25	34·2	22	9	25	131·4	12	**27·2**	**8**	**610**	**30**	**89**	**26**	2·62	30

APPENDIX III.

KODAIKANAL mean hourly wind velocity for the year 1921.

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	13	13	14	14	13	14	15	14	15	16	15	14	14	12	12	11	11	11	12	12	13	12	12	14
February	14	14	14	14	14	13	13	12	13	14	13	13	12	11	9	8	7	7	8	10	11	12	14	15
March	13	14	13	13	13	13	13	15	16	17	17	16	15	13	12	10	9	7	7	9	10	12	13	13
April	10	10	10	10	12	11	11	11	12	11	11	11	11	10	9	8	8	7	7	8	9	9	10	10
May	10	10	9	10	9	9	8	7	7	8	8	8	7	7	8	8	7	7	7	7	7	8	9	9
June	11	12	11	11	11	11	11	10	10	9	10	10	10	10	10	10	9	9	11	11	11	11	11	12
July	14	15	14	15	16	15	13	15	13	12	12	12	12	10	10	10	12	12	13	14	13	14	13	14
August	12	12	11	11	12	11	11	9	7	7	8	8	8	8	8	9	9	10	11	11	10	10	12	13
September	12	12	13	14	14	14	13	13	12	11	11	11	11	9	9	9	9	10	11	11	12	11	12	12
October	9	9	9	10	9	10	9	9	9	9	9	8	8	8	8	8	7	8	7	8	9	9	9	9
November	8	8	10	9	10	9	9	9	10	10	10	10	9	8	8	7	6	6	6	4	8	8	8	9
December	14	13	13	13	12	12	13	12	13	16	15	14	13	13	12	10	9	10	11	12	13	13	13	12
Mean	12	12	12	12	12	12	12	11	11	12	12	11	11	10	10	9	9	9	9	10	11	11	11	12

APPENDIX IV.

KODAIKANAL mean hourly bright sunshine for the year 1921.

Month.	Hours.											
	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	0·52	0·61	0·69	0·76	0·68	0·68	0·66	0·59	0·54	0·38	0 07
February	·43	·99	95	·97	97	·97	·98	·95	·91	·86	·79	·41
March	·61	1·00	99	1·00	1·00	·96	·93	·90	·89	·83	·79	·53
April	·32	0·70	·81	0·86	0·82	·82	·73	·63	·51	·38	·24	·12
May	·23	·69	·87	·90	·95	·88	·68	·59	·46	·29	·18	·09
June	·12	·41	·54	·60	·56	·43	·35	·38	·36	·30	·13	·03
July	·06	·23	·40	·43	·41	·41	·29	·14	·08	·04	·03	...
August	·16	·51	·68	·69	·60	·53	·48	·28	·21	·12	·12	·01
September	·15	·55	·66	·72	·70	·68	·56	·47	·36	·25	·19	·07
October	·12	·33	·42	·57	·60	·48	·42	·36	·37	·22	·09	·02
November	·14	·57	·66	·72	·71	·64	·60	·58	·42	·41	·30	·01
December	·09	·65	·74	·77	·77	·75	·72	·74	·67	·57	·46	...
Mean	0·22	0·60	0·69	0·74	0·74	0·69	0 62	0·56	0·49	0·40	0·31	0·11

APPENDIX V.

NUMBER of days in each month on which the Nilgiris were visible in 1921.

Month.	Very clear.	Visible.	Just visible.	Tops only visible.	Total.
January	1	11	1	...	13
February	...	3	1	...	4
March	1	1	1	...	3
April	...	1	2	1	4
May	..	1	...	...	1
June	3	5	2	...	10
July	2	3	...	...	5
August	1	1	2	...	4
September	3	2	3	...	8
October	6	4	1	1	12
November	2	6	1	1	10
December	1	17	...	3	21
Total	20	55	14	6	95

APPENDIX VI.

MADRAS OBSERVATORY.—Abnormals from monthly means for the year 1921.

Abnormals of	January.	February.	March.	April.	May.	June.	July.	August.	September	October.	November.	December.	Annual.
Reduced atmospheric pressure	− 0·033	− 0·030	− 0·043	+ 0·003	− 0·075	− 0·044	− 0·021	− 0·008	+ 0·005	+ 0·021	+ 0·060	+ 0·015	− 0·012
Temperature of air	+ 2·3	Normal	+ 0·8	Normal	+ 3·1	+ 2·1	− 0·6	+ 0·4	+ 0·3	− 0·9	− 0·3	+ 0·4	+ 0·6
Do. of evaporation	+ 3·3	− 1·1	+ 0·6	+ 0·3	+ 0·2	+ 0·2	+ 1·5	+ 1·5	+ 0·2	+ 0·7	− 1·3	− 0·1	− 2·5
Percentage of humidity	+ 5	− 5	− 1	+ 1	− 8	− 5	+ 10	+ 5	Normal	+ 7	− 4	− 2	Normal
Greatest solar heat in *vacuo*	+ 6·5	+10·6	+10·7	+10·7	+12·2	+10·1	+ 2·1	+ 7·7	+ 8·8	+ 0·3	+12·2	+ 8·6	+ 8·4
Maximum in shade	− 0·2	− 0·3	+ 0·9	− 0·5	+ 6·8	+ 2·2	− 2·4	− 0·1	− 0·1	− 3·1	+ 0·1	+ 0·6	+ 0·3
Minimum in shade	+ 4·1	− 0·6	+ 0·2	+ 0·8	+ 2·0	+ 1·9	− 0·6	+ 0·2	− 0·1	− 0·3	− 2·2	− 0·4	+ 0·4
Do. on grass	+ 6·0	− 0·1	+ 0·3	+ 1·3	+ 2·3	+ 2·2	− 0·3	+ 0·3	Normal	+ 0·8	− 2·9	− 0·2	+ 0·9
Rainfall in inches	+ 4·57	− 0·28	− 0·39	+ 1·37	− 2·12	− 1·46	+ 4·47	+ 2·73	− 2·14	+13·27	−11·37	− 3·24	−
Do. since January 1st	+ 4·57	+ 4·29	+ 3·90	+ 5·27	+ 3·15	+ 1·69	+ 6·16	+ 8·89	+ 6·75	+20·02	+ 8·65	+ 5·41	+ 5·41
General direction of wind	Normal	2 points S.	2 points S.	2 points S.	2 pointsW.	Normal	1 point S.	2 points S.	Normal	8 points S.	3 pointsW.	Normal	3 points S.
Daily velocity of wind in miles	− 38	− 75	− 69	− 65	− 55	− 49	− 49	− 36	− 26	− 12	− 29	− 18	−44
Percentage of cloudy sky	+ 16	− 6	− 12	+ 11	− 13	− 5	+ 4	− 7	− 5	+ 15	− 22	+ 2	− 2
Do. of bright sunshine	− 14·3	+ 3·2	+ 0·5	− 3·3	− 6·5	− 2·7	− 11	+ 4	+ 1·0	− 21·1	+ 14	− 10·7	− 8·8

+ means *above* normal ; — means *below* normal.

APPENDIX VII.

ABSTRACT of the Mean Meteorological Condition of Madras in the year 1921 compared with the average of past years.

Mean values of	1921.	Difference from	Average.
Reduced atmospheric pressure	29·852	0·012 below.	29·864
Temperature of air	81·7	0·6 above.	81·1
Do. of evaporation	72·0	2·5 below.	74·5
Percentage of humidity	72	Normal	72
Greatest solar heat in *vacuo*	148·1	8·4 above.	139·7
Maximum in shade	91·1	0·3 „	90·8
Minimum in shade	75·1	0·4 „	74·7
Do. on grass	72·8	0·9 „	71·9
Rainfall in inches on 96 days	54·43	5·41 „	49·02
General direction of wind	S. by E.	3 points S.	S.E.
Daily velocity in miles	127	44 below.	171
Percentage of cloudy sky	47	2 „	49
Do. of bright sunshine	49·6	8·8 „	58·4

DURATION and quantity of the wind from different points.

From	Hours.	Miles.	From	Hours.	Miles.	From	Hours.	Miles.	From	Hours.	Miles.
North.	193	914	East.	79	413	South.	176	1181	West.	111	758
N. by E.	343	2457	E. by S.	240	1257	S. by W.	295	1755	W. by N.	112	746
N.N.E.	604	3823	E.S.E.	282	1390	S.S.W.	361	2284	W.N.W.	124	704
N.E. by N.	191	1398	S.E. by E.	243	1224	S.W. by S.	290	1871	N.W. by W.	67	411
N.E.	73	557	S.E.	166	970	S.W.	190	1182	N.W.	54	298
N.E. by E.	148	918	S.E. by S.	378	2026	S.W. by W.	312	2073	N.W. by N.	73	443
E.N.E.	99	563	S.S.E.	532	2917	W.S.W.	420	2834	N.N.W.	159	963
E. by N.	104	639	S. by E.	391	2713	W. by S.	220	1456	N. by W.	590	3433

There were 1120 calm hours during the year. The resultant corresponding to the above numbers is represented by a S.S.E. wind, blowing with a uniform daily velocity of 9·4 miles.

APPENDIX VIII.

MADRAS OBSERVATORY.—Number of hours of wind from each point during the year 1921.

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	...	46	86	74	17	97	36	48	18	46	25	7	..	...	3	13	1	10	3	...	..	...	.	.	...	...	...	...	...	...	...	...	214
February	...	...	6	4	12	25	10	17	18	57	34	37	14	43	35	4	11	3	7	2	1	2	4	...	...	...	..	...	...	...	...	..	326
March	....	...	...	...	..	..	...	...	...	...	5	56	20	163	83	41	6	40	33	23	1	7	...	...	.	...	.	...	...	...	...	...	266
April	3	6	8	3	1	1	5	4	5	10	2	52	50	62	137	40	25	35	51	21	9	11	8	..	.	1	2	3	3	8	10	5	139
May	1	...	...	1	5	...	2	2	3	2	8	18	22	57	92	100	62	53	60	45	28	44	49	15	13	13	16	4	3	2	1		23
June	6	...	2	..	1	2	7	1	11	22	27	15	16	18	53	66	10	18	19	41	19	56	105	60	22	33	17	4	10	25	9	3	22
July	2	1	...	..	3	...	3	10	4	27	29	3	9	10	36	32	23	12	46	94	58	86	91	35	23	13	14	19	11	20	3	8	19
August	...	..	1	2	2	2	2	5	3	31	52	11	2	19	49	51	27	55	103	31	29	57	82	41	22	14	17	8	3	1	1	1	...
September	24	...	1	10	5	13	3	8	12	38	31	16	2	3	29	31	7	13	37	25	34	44	71	67	30	32	41	20	10	16	17	14	16
October	59	40	80	12	5	3	18	4	2	7	69	28	31	3	15	13	4	56	2	8	11	5	10	2	1	6	17	9	14	1	118	44	47
November	96	36	41	8	1	.	.	...	...		...	...	...	...	...	...	...	...	...		...	...	..	..	...	...	...	...	...	...	...	515	23
December	2	214	379	77	21	5	13	5	3	...	...	...	...	...	...	...	...	...		...	...	...	...	...	...	..	...	...			...	...	25
Annual	193	343	604	191	73	148	99	104	79	240	282	243	166	378	532	391	176	295	361	290	190	312	420	220	111	112	124	67	54	73	159	590	1120

APPENDIX IX.

MADRAS OBSERVATORY.—Number of miles of wind from each point during the year 1921.

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	..	273	577	584	117	659	253	303	77	204	93	35		..	6	30	6	55	21	...	..	...	...	...	.	.	..	...	...	...	..	...	3293
February	...	...	17	19	105	112	40	64	66	222	119	96	35	159	121	12	48	14	28	4	5	5	11	...	...	..	...	...		..	...	..	1302
March		...		...	...	..	...	...	..	...	24	234	100	726	435	281	47	309	226	131	11	39	...	..	...	...	...	..	..	...	...	..	2563
April	12	45	105	45	8	2	29	29	35	50	11	288	278	364	697	295	192	312	457	181	72	36	24	...	...	7	8	22	16	64	61	25	3770
May	5	...	...	6	25	..	7	6	5	16	54	155	182	364	668	873	441	384	444	309	190	306	415	111	104	115	125	28	17	9	5	...	5369
June	46	.	26		5	18	43	8	73	163	215	118	133	124	349	470	88	130	129	284	121	507	756	383	159	260	115	23	94	185	89	20	5134
July	15	8	..	.	19	..	21	71	29	128	160	18	46	89	247	221	122	68	239	543	372	588	629	202	110	76	59	70	46	79	18	19	4312
August	...	...	3	16	12	13	14	35	21	192	287	56	6	113	248	283	162	287	560	194	161	341	532	318	155	71	90	59	19	7	4	8	4267
September	93	...	6	63	39	40	19	53	68	264	96	67	8	65	102	151	47	67	155	139	201	228	425	426	221	185	252	141	59	95	81	54	3910
October	318	252	326	23	17	24	63	28	16	18	331	157	182	22	44	97	28	129	25	86	49	23	42	16	9	32	55	68	47	4	706	203	3440
November	399	207	283	83	14	...		...			...			.	.	...	...	..	..	..		...	..	...	..	...	...	...	.	..	.	3104	4090
December	26	1672	2480	559	196	50	74	42	23	..	...	..	.	...	...	...	..	...	..	...	..	.	...	.	...	...	...	..	...	...	...	...	5122
Annual	914	2457	3823	1398	557	918	563	639	413	1257	1390	1224	970	2026	2917	2713	1181	1755	2284	1871	1182	2073	2834	1456	758	746	704	411	298	443	964	3433	46572

APPENDIX X.

MADRAS OBSERVATORY.—Number of inches of rain from each point during the year 1921.

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	...	...	0·49	0·59	0·34	0·63	1·60	1 21	0·04	0·09	0·14	0·04	...	...	...	...	...	0·13	...	...	...	..	...	.	...	...	...	...	...	...	...	...	0·16
February	...	...	...	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	.	...	...	...	...	...	...	...	...	...	...	...	...
March	...	...	...	...	...	...	...		...	...	..	...	...	...	...	...	...	...	...	...	...	...	..	...	...	...	...	.	...	...	...	...
April	...	...	0·29	0·05	...	0·15	0·09	...	0·10	0·03	..	...	...	...	..	...	...	...	..	0·95	...	0·02	...	...	...	...	0·04	...	...	...	0·06	...	0·21
May	...	...	...	..	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
June	...	...	...	...	...	...	...	.	...	...	...	...	...	...	..	...	...	...	. .	...	0·04	...	...	0·04	0·05	..	...	0·01	0·04	...	0·47	..	...
July	0·40	...	...	...	...	.	...	...	...	...	0 03	0·44	...	0·07	1·19	0·38	...	0·14	0·99	0·42	0 79	...	1·06	0·47	1·51	0·02	...	0·10	0·12	0·02	...	...	0·19
August	...	...	...	...	...	..	...	...	...	..	0 10	...	..	...	0·03	1·49	0·01	0·51	0·24	..	1·07	0·13	1·24	0·83	0·40	...	0·50	...	0·64	...	0·10	...	...
September	0·27	...	.	...	...	...	0·02	0·03	...	0·06	0·04	..	...	0·33	0·24	0·12	0 02	0·07	0·01	0·01	0·05	0·15	0·26	0·29	0·39	0·02	0·04	0·13	...	..	...	...	...
October	4·74	0·53	0·67	0·06	0·24	...	0·68		...	0·68	0·10	...	0·72	0·30	...	0·06	0·42	0·84	0·19	0·14	0·99	0·95	0·37	0·01	...	1·14	0·91	0·59	0·08	...	7·79	1·06	0·01
November	1·12	...	...	...	.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0·72	...
December	...	0·05	1·49		0·24	...	0·21	...	0·05	...	...	...	...	...	...	.	...	...	...	...	...	...	..	...	...	...	...	...	...	...	...	...	...
Annual	6·53	0·58	2·94	0·70	0·82	0·78	2·60	1·24	0·19	0·86	0·41	0·48	0·72	0·70	1·46	2·05	0·45	1·69	1·43	1·52	2·94	1·25	2·93	1·64	2·35	1·18	1·49	0·83	0·88	0·02	8·42	1·78	0·57

APPENDIX XI.

MADRAS OBSERVATORY.—Wind, cloud and bright sunshine, 1921.

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.	POINTS.						HOURS.	HOURS.
January	91	N.E.	5·3	7·2	4·6	4·1	5·3	6·1	9·5
February	34	S.S.E.	1·6	2·6	2·4	0·6	1·8	9·4	10·9
March	74	E. by S.	1·1	3·0	0·5	0·2	1·2	8·9	10·6
April	82	S.S.E.	4·5	4·1	3·6	3·2	3·9	8·2	10·7
May	126	S. by W.	3·2	2·8	2·4	1·4	2·5	6·9	9·4
June	84	S.W.	6·1	5·4	6·8	5·0	5·9	4·8	8·4
July	87	S.W. by S.	8·0	7·8	8·1	6·0	7·5	2·5	8·2
August	82	S.S.W.	6·3	6·0	5·9	5·8	6·0	5·5	10·4
September	52	W.S.W.	5·7	5·3	7·1	4·5	5·7	4·9	10·1
October	20	E.N.E.	7·8	8·4	6·6	6·8	7·4	3·4	9·8
November	14	N.N.E.	4·0	4·7	4·0	1·8	3·7	7·1	9·6
December	161	N.N.E.	3·1	5·2	5·0	3·4	4·2	4·8	8·1
Annual	9	S.S.E.	4·7	5·2	4·8	3·6	4·6	6·0	...

APPENDIX XII.

MEAN Monthly and Annual Meteorological Results at the Madras Observatory in 1921.

Month.	Barometer.		Dry Bulb Thermometer.				Wet Bulb.		Tension of Vapour.	Relative Humidity.	Sun Max. in Vac.	Min. on Grass.	Wind.			Rain.		Cloudy sky.	Bright sunshine.
	Reduced to 32°.	Daily Range.	Mean.	Max.	Min.	Range.	Mean.	Min.	By Simpson's Tables.				Daily Velocity.	Mean Direction.		Amount.	Days.		
	Inches.	Inches.	°	°	°	°	°	°	Inches.	Cents.	°	°	Miles.	Points	Points.	Inches.	No.	Cents.	Hours.
January	29·964	0·108	77·4	84·4	71·6	12·8	72·5	69·8	0·734	78	144·9	69·1	106	3	N.E. by E.	5·46	8	53	190·1
February	·935	·124	76·7	86·3	67·4	18·9	69·7	65·9	·632	68	150·3	63·7	47	10	E.S.E.	...	.	18	262·8
March	·862	·139	80·8	90·1	72·3	17·8	74·5	70·8	·767	73	151·2	68·9	83	14	S S.E.	...	..	12	277·1
April	·828	·127	84·0	92·4	78·0	14·4	77·9	76·0	·871	75	152·4	76·0	126	15	S. by E.	1·99	6	39	246·2
May	·660	·123	89·8	104·6	82·8	21·8	78·5	75·8	·821	59	155·2	81·2	172	17	S by W.	.	..	25	213·9
June	·662	·109	88·5	100·5	82·2	18·3	76·8	74·6	·762	57	150·6	80·8	171	19	S.W. by S.	0·65	5	59	142·4
July	·699	·112	83·9	93·2	77·9	15·3	77·4	73·9	·850	75	140·8	76·3	139	19	S.W. by S.	8·34	18	75	78·8
August	·741	·126	83·7	93·6	77·5	16·1	77·5	74·3	856	75	147·7	75·7	138	17	S. by W.	7·29	14	60	164·8
September	·783	·129	83·3	93·1	77·0	16·1	76·5	73·5	·820	72	150·1	75·0	130	18	S S W.	2·55	14	57	146·8
October	·862	·122	79·7	85·9	74·9	11·0	76·3	73·8	·859	85	139·4	73·6	111	15	S by E.	24·27	22	74	106·0
November	·983	·114	77·2	85·1	70·1	15·0	71·6	68·5	·699	75	149·6	66·6	136	31	N. by W.	1·84	2	37	212·6
December	·993	·110	75·9	84·2	69·4	14·8	70·5	67·4	·672	75	144·4	66·2	165	2	N.N.E.	2·04	7	54	148·0
Annual	29·831	0·120	81·7	91·1	75·1	15·2	75·0	72·0	0·779	72	148·1	72·8	127	15	S by E.	54·43	96	47	2189·5

EXTREME Monthly Meteorological Records at the Madras Observatory in 1921.

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	30·079	5	29·854	21	0·225	87·6	2	65·8	31	64·4	31	53	6	154·0	6	62·1	6	210	9	**15**	**31**	3·13	12
February	·075	25	·834	1	·241	93·7	28	64·6	27	62·8	18	32	28	154·3	10	60·5	20&27	125	17	21	14	...	.
March	·025	6	·699	3	·326	94·5	2	68·2	1 & 5	66·1	5	46	1	155·3	5	63·5	1	167	8	33	5	..	.
April	29·995	15	·697	9	·298	95·9	22&23	73·5	15 & 16	71·3	16		5 & 26	158·4	15& 17	72·3	5	231	7	53	16	0·91	16
May	·883	1	**·512**	**13**	**·371**	**111·2**	**25**	76·2	1	71·5	14& 17	**21**	**26**	168·0	25	73·9	1	246	18	107	12	..	..
June	·760	4	·518	18	·242	106·7	1	78·2	13	72·3	2	28	22	**168·3**	**9**	76·6	13	286	21	92	12	0·47	11
July	·869	19	·569	6	·300	102·6	2	72·4	19	70·5	1	38	2	155·2	3	71·4	20	219	2	68	13	2·66	19
August	·845	4	·613	23	·232	98·2	23	72·6	25	70·7	25	40	17	159·4	28	73·2	3 & 4	167	10	91	31	1·62	1
September	·906	11	·615	5	·291	98·7	23	73·4	11	70·6	11	39	5	165·0	24	72·0	11	192	4	87	14	0·47	1
October	30·028	18	·682	7	·346	92·6	6	72·4	8	70·7	8	59	16	162·1	12	70·2	23	**290**	**8**	39	14	**3·28**	**13**
November	·116	29	·828	6	·288	86·8	18	**63·6**	**10**	**62·5**	**10**	42	9	155·5	12	**59·4**	**10**	235	27	49	2	1·19	1
December	**·124**	**11**	·889	29&31	·235	86·3	2	63·9	22	63·0	22	49	2	154·0	21	59·5	22	264	27	83	21	0·81	29