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FOR THE YEAR

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GILBERT T. WALKER, C.S.I., M.A., Sc.D., F.R.S.
Director General of Observatories.

CALCUTTA
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METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW.

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THE GOVERNMENT OF INDIA.

CALCUTTA, JANUARY, 1911.

INTRODUCTION.

THIS review of the weather in India during the month of January, 1911, is based on observations taken daily at 8 hrs. at 239 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 32 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review.

The brief notes on solar, seismic and magnetic disturbances are supplied by the chief observatories in the Indian area.

In the remaining monthly reviews of the present year the brief statements of the methods of recording and tabulating the data for each of the elements of observation, given in the present number at the commencement of each section, will not be repeated.

Summary of the chief features of the weather in India during the month.

2. Weather was unusually rainy, damp and cloudy over practically the whole region between Baluchistan and Upper Burma; the only subdivisions which failed to obtain their proper share of the precipitation were Bengal, Orissa, Chota Nagpur, Bihar, the Central Provinces East, Sind and Rajputana West, but in Chota Nagpur alone did the deficiency amount to half an inch. The excess in the remainder of the area was on the whole most marked in Assam, the United Provinces West, the Punjab East and North, and Baluchistan, which obtained three to four times their normal amounts. In the Peninsula south of the Central Provinces hardly any rain fell; the normal fall of the month there however does not exceed a quarter of an inch.

Day temperature was appreciably lower than usual in the Punjab, the North-West Frontier Province, Sind and Baluchistan, and about 3° above the normal in the dry region of northeast India, and also in the east of Central India. Owing to the excess of cloud, nights were warmer than usual in most parts of northern and central India.

Pressure was on the average of all plains stations ·049″ below the normal, and notwithstanding the abnormally heavy precipitation of the month, the vertical gradient over northwest India differed to no important extent from the average.

Solar, seismic and magnetic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—On three days no solar observations could be made owing to bad weather, and on four days the prominence record was imperfect.

Sun spots.—The spot activity declined rapidly and reached a very low point during the month. Only four groups were observed of which one was small spot of regular outline and the rest were mere dots which did not last more than one or two days. The daily average number was 0·5, and on 13 days only were there any spots on the sun. On no days were there more than one spot visible.

The distribution in latitudes was as follows :—

TABLE 1.

	0°—10°.	11°—20°.	Mean latitude.	Extreme latitudes.
North . . .	...	...	...	...
South . . .	2	2	11·°8	5° and 19°

Prominences.—Forty-seven large, 5 eruptive and 1 metallic prominences were recorded during the month. The highest was observed on the 29th at latitude —35° East and was 200″. For 3 days from the 28th to 30th tall prominences were seen in the same region.

Magnetic disturbances.—Moderate magnetic disturbances were noted from the 23rd to 26th. On none of these days were there any spots on the sun or any eruptive prominences recorded.

Seismological records.

TABLE 2.

No.	Date,	P. T. Commencement G. M. T.	L. W. Commencement G. M. T.	Maxima. G. M. T.	End. G. M. T.	Maximum amplitude.	Duration.	REMARKS.
	1911.	H. M.	H. M.	H. M.	H. M.	mm.	H. M.	
1	Jan. 1	10 27·4	10 32·6	10 36·2	11 47	4·3=2·1	1 20	
2	„ 3	7 31·1	7 54·9	7 56·0	8 35	0·6=0·3	1 04	
3	„ 3-4	23 32·0	23 38·5	?	4 20	18 =8	4 28	Beyond range from 23 h. 41 m. to 23 h. 54 m. Turkistan.
4	„ 4	8 33	...	...	8 57	...	0 24	Widening of line.
5	„ 4	9 48·9	9 54·3	9 55·4	10 17	1·0=0·4	0 28	
6	„ 4	21 47·3	21 52·8	21 54·4	22 07	0·4=0·2	0 20	
7	„ 7	2 25·7	2 56·6	3 00·6	4 09	0·6=0·2	1 43	
8	„ 8	13 19·2	...	...	14 20	...	1 01	Widening of line.
9	„ 9	8 53·6	4 12·9	4 16·0	4 40	0·4=0·2	0 46	
10	„ 14	18 10·5	...	...	18 41	...	0 31	Widening of line.
11	„ 16	8 59·2	...	9 25·4	9 54	0·5=0·2	0 55	Widening of line.

J. EVERSHED,

Director,

Kodaikanal and Madras Observatories.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of January, 1911, the traces showed 3 calm days, 27 days of small and 1 day of moderate disturbance.

The days of the month selected as quiet* for the purposes of the Magnetic Survey of India are the 7th, 12th, 14th, 17th and 23rd.

The following table represents the magnetic character of each day during the month.

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	S	17	C	25	S
2	S	10	S	18	S	26	S
3	S	11	S	19	S	27	S
4	S	12	C	20	S	28	S
5	S	13	S	21	S	29	S
6	S	14	S	22	S	30	S
7	C	15	S	23	S	31	S
8	S	16	S	24	M	...	...

C = calm, S = small, M = moderate, G = great, V. G. = very great.

* Calm days if available are usually selected. In absence of these, however, the least disturbed days have to be included amongst the five selected days.

The mean observed absolute values of the several magnetical elements reduced to the mean monthly tabulations of the magnetograms as also the ranges and the summed ranges of the horizontal force and declination for the month are as follow:—

Easterly declination	0° 56′ 15″
Horizontal force	0·36846 C.G.S. unit
Vertical force	0·16168 „ „
Inclination	23° 41′·5
Inclination (observed)	23° 41′·1
Horizontal force range	0·00029 C.G.S. unit
Horizontal force summed range	0·00182 „ „
Declination range	1′·4
Declination summed range	8′·2

NOTE.—Summed range means sum without regard to signs of the 24 ordinates of diurnal inequality.)

Seismic disturbances.

TABLE 4.

Date.	Commencement.	Maximum.	End.	Maximum amplitude.	Duration.
January 1911.	H. M.	H. M.	H. M.	mm.	H. M.
1st	10 21·9	10 30·7	11 1·2	8·3	0 39·3
„	15 8·7	15 11·6	Lost in shifting time.	1·4	...
2nd—3rd	23 14·5	23 53·3	0 17·5	0·3	1 3·0
3rd	7 47·3	7 56·6	8 11·5	0·3	0 24·2
3rd—4th	23 31·2	Traces overlap.	3 33·9	...	4 2·7
4th	9 49·6	9 52·0	10 7·2	1·3	0 17·6
7th	2 25·8	2 54·8	3 30·6	0·9	1 4·8
14th	18 4·1	18 6·7	18 24·3	0·5	0 20·2
16th	9 9·4	9 28·8	9 45·2	0·4	0 35·8

All times given above denote G. M. T. Sensibility to tilt, 1 mm.=0″·37.

N. A. F. MOOS,

Director,

Bombay Observatory.

CALCUTTA OBSERVATORY.

5. *List of displacements recorded by the Milne seismograph.*

TABLE 5.

Date. 1911.	P. T. Commencement. G.M.T.	L. W. Commencement. G.M.T.	Maximum. G.M.T.	End. G.M.T.	Duration.	Maximum displacement on trace from mean position.	REMARKS.
	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
Jan. 1st	10 21·9	10 27·0	10 33·6	11 59·5	1 37·6	5·00	
„ 1st	15 9·4	15 13·9	15 14·9	15 40·9 4th Jan. 1911.	0 31·5	1·00	
„ 3rd	23 31·3	...	P †	3 34·6	4 3·3	P †	† As the boom moved throughout the trace the time of maximum and its amplitude cannot be determined.
„ 4th	9 38·0	9 45·7	9 51·3	10 16·3	0 38·3	1·00	
„ 4th	21 42·2	21 44·7	21 47·3	22 9·7	0 27·5	1·00	
„ 8th	4 3·1	4 7·1	4 9·2	4 18·8	0 15·7	1·25	
„ 9th	12 52·7	...	...	13 32·3	0 39·6	...	Thickening of the line.
„ 12th	18 57·1	...	18 58·6	19 6·7	0 9·6	1·00	
„ 13th	16 13·9	...	...	17 5·3	0 51·4	...	Thickening of the line.
„ 14th	18 2·3	...	18 7·9	18 36·4	0 34·1	1·00	

Sensibility 1 mm. = 0″·38 of tilt.

C. W. PEAKE,
Meteorologist, Calcutta.

SIMLA OBSERVATORY.

6. *List of earthquakes recorded by the Omori-Ewing seismographs.*

TABLE 6.

Date.		Beginning of 1st P. T.	Beginning of 2nd P. T.	Beginning of L. W.	Time of maximum amplitude.	End approximately.	Duration.	Maximum displacement of style.	REMARKS.
		H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
1st	A	10 21·8	10 22·7	10 25·0	10 25·4	11 36	1 14	9·5	
„	B	10 21·8	10 23·5	10 25·1	10 25·5	11 1	0 39	25·0	
„	A	15 5·1	15 6·1	15 7·5	15 7·6	15 50	0 47	1·6	
„	B	15 5·1	15 6·3	15 7·8	15 6·5	15 22	0 19	2·8	
3rd	A	23 30·1	P	23 32·3	P	P	P	P	Touched stops.
3rd & 4th	B	23 30	P	P	P	1 30	2 0	P	Touched stops.
4th	A	9 43·8	P	9 45·4	9 45·8	P	P	3·5	Tremors throughout period 4½ hrs. on 4th to 4½ hrs. on 5th.
„	B	9 44·1	P	9 45·5	9 47·1	P	P	1·2	
„	A	15 7·9	P	15 9·0	15 9·3	P	P	0·5	Tremors throughout period, 4½ hrs. on 4th to 4½ hrs. on 5th.
„	B	15 8·5	P	15 9·8	P	P	P	Small*	
„	A	21 38·6	P	21 39·9	21 40	P	P	0·6	Tremors throughout period 4½ hrs. on 4th to 4½ hrs. on 5th.
„	B	21 38·6	P	21 40·4	21 40·7	P	P	0·4	
6th	A	15 15·1	P	15 16·2	15 16·3	15 42	0 27	0·3	
„	B	15 16·4	P	15 17·3	15 17·4	P	P	Small.*	
7th	A	2 24·3	2 34·1	2 49·9	2 50·2	3 46	1 22	0·5	
„	B	P	P	P	2 49	P	P	0·3	
9th	A	3 58·3	4 0·2	4 1·4	4 0·8	4 24	0 26	1·0	
„	B	3 58·2	4 0·2	4 1·5	4 1·8	4 9	0 10·8	1·	
„	A	18 13·3	18 13·8	18 14·3	18 14·4	18 16·7	0 3·4	Small.*	
13th	A	18 49·1	18 50·3	18 51·4	18 50·7	19 2·7	0 13·6	0·6	
„	B	18 50·4	P	18 51·3	18 51·5	18 58	0 7·6	Small.*	
14th	A	5 11·2	P	5 15·0	5 16·3	P	P	Small.*	Tremors from 4½ hrs. on 14th to 4½ hrs. on 15th.
„	B	5 13·8	P	5 15·1	5 15·2	5 20	0 6·2	0·3	
„	A	17 56·7	P	18 0·1	18 0·2	P	P	0·6	Tremors from 4½ hrs. on 14th to 4½ hrs. on 15th.
„	B	17 56·0	17 58·8	18 0·7	18 1·1	P	P	1·3	
„	A	18 7·5	P	18 10·3	18 10·9	P	P	0·4	Tremors from 4½ hrs. on 14th to 4½ hrs. on 15th.
„	B	18 9·5	18 10·5	18 11·5	18 11·7	P	P	0·6	
16th	A	9 0·5	9 1·9	9 8·6	9 9·7	9 46	0 45	Small.*	
„	B	...	...	...	...	...	...	...	Disturbance from about 9 h. 8 m. to about 9 h. 17 m.
17th	A	...	...	...	...	...	...	...	Disturbance from 9 h. 49·1 m. to 9 h. 56·9 m.
24th	A	20 54·0	P	20 57·7	20 55·7	21 6·7	0 12·7	0·6	
28th	A	2 9·3	P	2 10·7	2 10·9	2 11·7	0 2·4	P	Against stops.
30th	A	0 11·2	0 12·1	0 13·0	0 13·1	0 32	0 21	0·3	

All times are given in G. M. T.
A = E—W component.
R = N—S component.
Magnification of each instrument was 15.
* Displacements less than 0·2 mm. are reported as "small."

The following table contains a list of earthquakes that have been reported.

TABLE 7.

Place at which felt.	Date.	G. M. T. of earthquake.		Duration.	Intensity.	No. of shocks.	REMARKS.
		H.	M.	Sec.			
Shillong . . .	5th	12	15	1½	5	1	
„ . . .	9th	22	22	3½	5	2	
„ . . .	13th	23	35	5	6	1	
Drosh . . .	14th	0	30	3	6	1	
„ . . .	14th	5	15	15	6	3	
Chitral . . .	14th	5	20	5	7	4	
„ . . .	17th	12	15	2	7	2	
Shillong . . .	17th	15	5	1½	5	1	
„ . . .	18th	6	31	1¾	5	1	
„ . . .	19th	4	5	1	5	1	
Drosh . . .	23rd	1	0	2	5	1	
Chitral . . .	23rd	21	5	3	9	3	
Shillong . . .	24th	7	17	2	6	1	
Drosh . . .	24th	20	55	25	6	4	
Murree . . .	24th	21	38	13	6	3	
Drosh . . .	24th	22	20	2	5	1	
„ . . .	28th	13	0	30	6	3	
Shillong . . .	29th	0	30	¾	5	1	

NOTE.—The intensity has hitherto been given on a special scale specified in the Review for January, 1909. From the present issue inclusive the Rossi-Forel scale is being adopted.

Solar radiation.—The following figures give the intensity of solar radiation, as measured at Simla by Angstrom's pyrheliometer. The values are corrected to local noon, and expressed in grammecalories per square centimetre per minute.

Maximum	1·50
Minimum	1·46
Mean	1·48
Number of days of observation . . .	4

J. H. FIELD,
Imperial Meteorologist, Simla.

ROYAL ALFRED OBSERVATORY, MAURITIUS.

7. The following information relating to November, 1910, has been communicated by the Director of the Observatory.

TABLE 8.

——	Mauritius.
Departure from normal of mean pressure . . .	+·010
Actual mean wind direction	S 75° E
Normal mean wind direction	S 83° E
Actual mean wind velocity (miles per diem) . . .	297
Normal mean wind velocity (miles per diem) . .	257
Rainfall departure from normal	—0·07

Weather in the Indian monsoon region.

8. The defect of pressure which prevailed in India apparently extended southwards to equatorial regions, for both at Seychelles and Zanzibar the barometer stood below its normal height. The air movement, although normal as regards its direction, was feebler than usual.

Weather was very dry at both places, particularly at Zanzibar which received barely 20 per cent. of its normal supply.

TABLE 9.

——	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure.		—·022	—·013
Actual mean wind direction .		N 31° E	N 31° W
Normal mean wind direction .		N 33° E	N 39° W
Actual mean wind velocity (miles per diem).		174	105
Normal mean wind velocity (miles per diem).		187	147
Rainfall departure from normal.		—2·40	—6·14

Depressions and cyclonic storms.

9. During the month a series of seven disturbances affected the Indian weather, the first from the 1st to the 5th, the second between the 6th and 8th, the third from the 7th to the 12th, the fourth on the 14th and 15th, the fifth on the 17th and 18th, the sixth from the 21st to the 28th and the seventh on the 31st and the following day. Of these only the second was of local origin, all the others having advanced from the plateaux beyond the north-west frontier of India.

Barometrically the first five were unimportant, being mere surges of low pressure. The sixth and seventh on the other hand were remarkably deep, the barometer in the central area standing half an inch below its normal height; moreover in their case the deficiency of pressure was almost as great at an elevation of 7,000 to 12,000 feet as at the earth's surface, an indication that the disturbances extended upwards to a very great height.

As the disturbances followed each other very closely weather was unsettled almost continuously in northwest India, particularly in the hill and mountain districts, and in the case of the sixth disturbance rain fell as far east as Upper Burma.

Pressure.

10. In most of the observing stations in India mercurial barometers on Fortin's principle of fiducial point adjustment, with tubes of 0·4″ bore throughout, are in use. These are on the whole preferable to the pattern of barometer on the Kew principle, still in use at some Indian stations, which has its scale divided to compensate for the change of level of the mercury in the cistern as the pressure alters.

The following list contains the names of all stations equipped with instruments of the latter class:—

Aden.	Delhi.	Nowgong.
Akyab.	Dinajpur.	Perim.
Arrah.	Faridpur.	Rangoon.
Barisal.	Gorakhpur.	Rangpur.
Bhamo.	Jalpaiguri.	Ratnagiri.
Bogra.	Midnapur.	Sambhar.
Bushire.	Minbu.	Tavoy.
Chapra.	Monywa.	Toungoo.
Cochin.	Mymensingh.	Yamethin.
Comilla.	Negapatam.	Zanzibar.
Cuddapah.	Noakhali.	

The instruments at the following stations are by various makers and of various kinds:—

Colombo.	Patiala.	Trivandrum.
Dehra.	Pusa.	
Goa.	Trincomalee.	
Katmandu.		
Kurnool.		

At Calcutta and Bombay the standards are Newman instruments on the Fortin principle, with adjustable scales and fiducial points, and tubes of large bore. Some portable Wild-Fuess standards for purposes of comparison during inspections are now in use; the principle of these instruments allows of the determination at any time of changes that occur in their corrections caused by the access during transport of small quantities of air to the vacuum spaces above the mercury.

All instruments are compared at Calcutta before issue, and their corrections determined to the Calcutta standard, which is believed to be ·011″ higher than the Kew standard.

The barometers are in all cases kept in masonry buildings to protect them as much as possible from rapid changes of temperature.

Those heights above mean sea-level of the barometers of all stations given in Table B or Table A which have been obtained accurately by actual measurement are given in Roman figures. In the great majority of cases they have been referred to datum levels determined by the Great Trigonometrical Survey of India; of the remaining stations those heights which have been determined barometrically are printed in italics, and those which are only approximate are indicated by notes of interrogation.

The readings of the barometers are reduced to 32°F., and from 1st January 1905, have been corrected to constant gravity in all cases. They are reduced to sea-level in the cases of stations the elevations of which are accurately known and are below 3,200 feet. Each reading is separately corrected and the means of the month are the means of the daily corrected readings.

In Table B (2), columns 4 to 11, under the general heading "Pressure, 8 hrs., in inches," are given for each station, the 8 hrs. barometric data of the month, including—

(1) The mean 8 hrs. pressure reduced to 32°F., and its departure from the normal mean pressure (reduced to 32° F.) of the month.

(2) The mean 8 hrs. pressure corrected to sea-level and to constant gravity, or to constant gravity only in cases of stations the elevations of which are above 3,200 feet.

(3) The highest and lowest pressures recorded during the month, with their respective dates of occurrence.

(4) The total range of 8 hrs. pressure during the month.

In Table A, columns 4 to 9, under the general heading "Pressure," are given for all stations recording observations at 10 hrs. and 16 hrs.—

(1) The monthly means of the two hours of observation, at 10 hrs. and 16 hrs. reduced to 32° F.

(2) The mean daily range.

(3) The mean of daily mean pressures reduced to 32°F., and its departure from the normal.

(4) The mean of daily mean pressures reduced to 32°F., and corrected to constant gravity and to sea-level, or to constant gravity only in cases of stations the elevations of which are above 3,200 feet.

The means of daily pressures have been obtained by taking the means of the 10 hrs. and 16 hrs. observations and applying corrections for each month, derived from the observations of the same or neighbouring stations, to give true daily means.

The distribution of the mean 8 hrs. pressure of the month is shown on two charts. The first chart (Plate I) gives the distribution of the mean pressure of the month reduced to sea-level and to constant gravity (that of Lat. 45°) by means of isobars drawn for differences of pressure of 0·05 or $\frac{1}{20}$ of an inch. The second chart (Plate II) gives the departures from the normal of the actual mean 8 hrs. pressure reduced to 32°F.

The greater part of the normal 8 hrs. daily and monthly means of pressure utilized in the pressure section of the review have been deduced from the barometric observations of the whole of the twenty-two years' period 1878—99, and in all except 22 cases the periods employed equalled or exceeded ten years.

A small chart, No. 2 of Plate IV, gives the distribution of the monthly mean daily pressure corrected to standard gravity and to sea-level, and of the mean winds; it is in the same form as in the monthly charts which were issued with the annual reports on the meteorology of India previous to the year 1891. The data on which this chart is based will be found in Table A.

The monthly means employed in the determination of the departures of the mean actual from the mean normal pressures of the month given in Table A are derived from all the available trustworthy pressure data for each station. These normal means are given in the "Indian Meteorological Memoirs," Vol. XVII, pages 66 to 69.

The more important barometric changes and movements during the month are described in the statement of depressions and cyclonic storms of the month. The data that are chiefly used in that discussion are the 8 hrs. reduced observations and the departures derived from comparison of these observations with the normal daily 8 hrs. values.

Barometric pressure was universally below the normal of the month, the defect amounting to ·086″ in Kashmir, ·073″ in Baluchistan, ·06″ in the plains of northern and central India and ·03″ in the Peninsula. It may be noted that at least a portion of the deficiency was due to excessive temperature of the lower stratum of the air.

TABLE 10.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	″
Burma	—·039
Eastern Bengal and Assam	—·065
Bengal	—·063
United Provinces	—·065
Punjab	—·060
North-West Frontier Province	—·073
Sind	—·050
Rajputana	—·060
Bombay	—·038
Central India	—·059
Central Provinces	—·041
Hyderabad	—·029
Mysore	—·022
Madras	—·032

At the level of the hill stations on the southern face of the Himalayas the deficiency was appreciably less than at the plains below; in other words the vertical pressure gradient there was weaker than usual:—

TABLE 11.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	″		″	″
Quetta	—·071	Jacobabad	—·056	+·015
Leh	—·080	Lahore	—·073	+·007
Murree	—·059	Peshawar	—·071	—·012
Simla	—·029	Ludhiana	—·059	—·030
Chakrata	—·036	Roorkee	—·043	—·007
Darjiling	—·044	Dhubri	—·069	—·025
Mount Abu	—·052	Deesa	—·060	—·008
Pachmarhi	—·020	Khandwa	—·045	—·025
Kodaikanal	—·034	Madura	—·016	+·018

Temperature.

11. The mean temperature data are given in Tables A and B under the heading "Temperature of Air." In Table B they are based upon observations of the dry bulb thermometers recorded at 8 hrs. and of the maximum and minimum thermometers. In the preparation of the normal means of maximum and minimum temperature the same periods have been employed as for the normals of pressure, regarding which information has been given in the pressure section, pages 5, 6 of this review. Departures of the mean maximum and minimum temperatures from the correspond-

ing normal means for the month are given in Table B. The monthly mean of the mean between maximum and minimum, as given in this table, differs from the true mean of the day by a small amount which varies from month to month.

It should be noted that for the purposes of Table B the mean temperature of the day really denotes the mean temperature of the 24 hours preceding 8 hrs. of the day in question, and that therefore the month for which the means are given in this table terminates at 8 hrs. of the last day of the month. In the case of Table A, however, the day or 24 hours period terminates at midnight (and not at 8 hrs. as in Table B) and the monthly means apply therefore to monthly periods ending at midnight of the last day of the month in question.

In Table A the mean of daily mean temperatures for each month is obtained by taking the mean of the maximum and minimum temperatures and applying a correction given on pages XV to XXI of Volume XVII of the "Indian Meteorological Memoirs." This correction was determined from the hourly observation data given in Volumes V, IX and X of the "Indian Meteorological Memoirs." The data at once furnish the necessary corrections for the stations at which these observations were recorded. At the remaining stations the corrections were determined from the values at the nearest stations with similar conditions of exposure, etc., at which the hourly observations were recorded.

The departures from normal of the mean daily mean temperature of the month given in Table A have been obtained by a comparison of the actual means with normal means calculated in the same manner. The normal means derived from all the available trustworthy temperature data for each station are given in the "Indian Meteorological Memoirs," Volume XVII, pages 16 to 20.

The methods of exposing thermometers will be found fully described in the hand-book of instructions to observers in India, or briefly in the Annual Report on the Meteorology of India for the year 1887, page 37. All thermometers in use have been verified by comparison with Kew standard thermometers at Calcutta and are re-standardised from time to time: all thermometer readings are corrected to their true values, and hence are strictly comparable.

The mean distribution of temperature in India in each month is exhibited by the help of three charts, which show the departures of the mean maximum, mean minimum and mean daily temperature from their normal values for the month. These charts are Nos. 1 and 2 of Plates III and No. 1 of Plate IV. In them equal departures of temperature are indicated by lines, the lines being drawn for differences of 2 degrees of departure. A continuous line indicates that the temperature was in excess by the amount shown by the number given near the line, and a broken line that it was in defect by the amount indicated by the number similarly placed. The line of no departure, separating areas of excessive from areas of deficient temperature consists of a continuous and of a broken line placed parallel and near to each other, the broken line being on the side of deficient temperature, and the continuous line on that of excessive temperature. The departures of the temperature of the month from the normal at the hill stations are given in figures with a positive or negative sign to indicate excess or defect; they are not taken into account when the lines are drawn.

Tables of normal mean maximum, mean minimum and mean of daily mean temperatures for each month and for the whole year are given in pages 1 to 10 and pages 16 to 20 of the "Indian Meteorological Memoirs," Vol. XVII, and are based on the data for the twenty-two years, 1878 to 1899.

Temperature, like humidity, departed to no great extent from the normal in the Peninsula and Burma. In northern India, the usual region of winter precipitation, on the other hand, the temperature conditions were abnormal. Thus in Baluchistan, the North-West Frontier Province, Sind and the western and northern parts of the Punjab, the day temperature was between 3° and 8° in defect, while in Bengal, Orissa, Chota Nagpur, Central India and the adjacent districts of the Central Provinces the maxima recorded were 2° to 4½° higher than usual. Night temperature was higher than usual throughout the plains of northern and central India excepting Gujarat and lower Sind, the excess averaging 6° in Central India, about 5° in the United Provinces, the Punjab and Rajputana, 4° in the Central Provinces and 3° in north-east India and the North-West Frontier Province, and also in Kashmir.

Of the temperature changes which occurred during the course of the month the most noteworthy was a large fall in northern and central India between the 27th and the 29th, due to the advance from west to east across that region of a cool wave in the rear of the sixth depression of the month. Temperatures which were from 4° to 14° above the normal on the 25th were during the course of the next three days reduced below the normal to the extent of 4° to 10°.

TABLE 12.

Sub-division.	Actual temperature.					Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
1. Bay Islands	84·3	74·3	79·3	10·1	11·9	—0·2	—1·4	+1·2
2. Lower Burma	84·9	63·9	74·4	20·9	28·7	—1·0	+0·3	—1·3
3. Upper Burma	81·5	54·5	68·0	27·0	38·9	0	+2·0	—2·0

Sub-division.	Actual temperature.					Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
4. Assam	74·3	54·5	64·3	19·8	33·0	+0·6	+3·0	—2·4
5. Eastern Bengal	77·8	55·5	66·6	22·3	35·9	+1·6	+2·8	—1·2
6. Bengal	81·3	57·2	69·2	24·1	40·6	+3·0	+2·8	+0·2
7. Orissa	84·3	59·9	72·1	24·4	36·6	+3·7	+2·1	+1·6
8. Chota Nagpur	80·3	55·3	67·8	25·0	42·4	+2·9	+4·6	—1·7
9. Bihar	75·3	54·1	64·7	21·1	36·1	+1·5	+3·4	—1·9
10. United Provinces, East	74·5	52·9	63·7	21·7	39·3	+0·9	+5·1	—4·2
11. Do. do., West	70·5	50·8	60·6	19·7	39·3	—0·7	+4·2	—4·9
12. Punjab, East and North	65·1	48·1	56·6	16·9	37·1	—2·5	+5·2	—7·7
13. Do., Southwest	65·4	46·4	55·9	19·0	38·1	—3·4	+4·1	—7·5
14. Kashmir	36·3	17·8	27·0	18·5	46·8	—0·7	+3·0	—3·7
15. North-West Frontier Province	60·3	43·3	51·8	17·1	35·8	—5·9	+3·3	—9·2
16. Baluchistan	47·2	33·1	40·2	14·1	39·2	—7·0	—0·7	—6·3
17. Sind	71·0	52·0	61·5	19·1	42·6	—4·3	+1·4	—5·7
18. Rajputana, West	74·6	50·3	62·5	24·3	50·6	+1·1	+2·2	—1·1
19. Do., East	76·6	53·1	64·8	23·5	46·3	+2·3	+5·3	—3·0
20. Gujarat	82·2	57·1	69·7	25·1	47·0	+0·5	+1·5	—1·0
21. Central India, West	80·9	53·8	67·3	27·1	49·1	+2·5	+4·5	—2·0
22. Do., East	77·7	54·9	66·3	22·8	43·7	+2·7	+7·7	—5·0
23. Berar	84·3	59·3	71·7	25·0	41·7	+0·5	+3·3	—2·8
24. Central Provinces, West	81·9	55·9	68·9	26·0	44·9	+1·7	+4·1	—2·4
25. Do., East	82·1	56·1	69·1	25·9	37·7	+1·1	+2·7	—1·6
26. Konkan	85·1	68·3	76·7	16·8	29·8	—0·9	+1·0	—1·9
27. Bombay Deccan	86·5	57·1	71·8	29·4	42·3	+1·2	+2·0	—0·8
28. Hyderabad, North	85·3	59·3	72·3	26·0	39·9	+0·4	+1·5	—1·1
29. Do., South	86·8	61·2	74·0	25·5	35·9	+0·9	+0·5	+0·4
30. Mysore	83·9	58·8	71·3	25·1	34·2	+1·5	+0·9	+0·6
31. Malabar	87·1	70·3	78·7	16·9	24·5	+0·1	+0·8	—0·7
32. Madras, Southeast	86·9	68·1	77·5	18·8	28·7	+1·4	+0·2	+1·2
33. Do. Deccan	89·4	61·7	75·5	27·7	37·3	+1·1	+0·5	+0·6
34. Do. Coast, North	84·5	65·4	74·9	19·2	29·3	+2·1	+0·7	+1·4

TABLE 13.

DIVISION.	DEPARTURE FROM NORMAL OF		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	—0·5	+1·1	+0·3
Eastern Bengal and Assam	+1·2	+2·8	+2·0
Bengal	+2·7	+3·2	+3·0
United Provinces	0	+4·6	+2·3
Punjab	—2·8	+4·8	+1·0
North-West Frontier Province	—5·9	+3·3	—1·3
Sind	—4·3	+1·4	—1·5
Rajputana	+2·0	+4·7	+3·4
Bombay	+0·3	+1·5	+0·9
Central India	+2·5	+6·1	+4·3
Central Provinces	+1·4	+3·7	+2·5
Hyderabad	+0·7	+0·9	+0·8
Mysore	+1·5	+0·9	+1·3
Madras	+1·3	+0·5	+0·9

Winds.

12. The 8 hrs. wind data, consisting of observations of the direction of the wind and of the air movement as registered by Robinson anemometers, are given in Table B under the headings "Wind direction", "Wind velocity" and "Wind steadiness." In these columns are shown the number of days the wind at 8 hrs. blew from each of eight points, the resultant direction of the wind, the mean hourly air movement and the steadiness. The wind resultant is calculated in all cases by the use of Lambert's formula, in which equal values are given to each wind observation irrespective of velocity. The mean wind directions are shown in Plate I by means of arrows in the usual manner.

The wind data for 10 hrs. and 16 hrs. are given in a similar form in Table A. Under the heading "Wind direction" are shown the number of times that each of eight wind directions was observed at the hours of record, and the direction of the resultant of winds of unit strength in these directions. The ratio of the magnitude of the resultant so obtained to that which it would have if the wind always blew from the same direction (*i.e.*, throughout the whole of the observations) is called the wind steadiness and is given as a percentage, with a table of normals, under the heading "Wind steadiness." The mean diurnal movement of the air at each station and the average monthly value are to be found under the heading "Wind velocity."

The mean wind directions of the month for stations recording at 10 hrs. and 16 hrs. are indicated in the small chart No. 2 of Plate IV by means of arrows flying with the wind. The lengths of the arrows are so proportioned as to indicate the comparative wind prevalence in the mean direction on a scale such that five-eights of an inch would represent a wind blowing continuously throughout the month from the mean direction.

The figures of normal values for wind used in Tables A and B are computed from all available data previous to 1899, or in some cases 1902, and have been published in Volume XVII of the "Indian Meteorological Memoirs."

The most noticeable features were :—

(*a*) The rate of air movement was greater than usual over a large part of the area visited by the disturbances of the month, namely, northern India.

(*b*) The steadiness was very low in Burma, Eastern Bengal and Assam, the United Provinces, Rajputana, Central India, the Central Provinces and Mysore, and markedly high in Hyderabad.

(*c*) The mean wind direction at Sirsa, Ludhiana and Quetta was from south-east instead of from north-west which is normally the case.

TABLE 14.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	+0·2	—11
Eastern Bengal and Assam	—0·5	— 9
Bengal	+0·7	+ 2
United Provinces	+0·9	— 8
Punjab	+1·1	+ 2
North-West Frontier Province	—0·1	+ 3
Sind	+1·0	+ 6
Rajputana	+1·6	— 6
Bombay	—0·4	— 9
Central India	—0·4	— 5
Central Provinces	—0·1	—10
Hyderabad	—1·3	+13
Mysore	+0·7	—13
Madras	+0·5	+ 1

Humidity and cloud.

13. The hygrometric data of the month registered at certain stations are given in Table A. In that table appear columns giving the means of the wet bulb readings at 10 hrs. and at 16 hrs., of the minimum wet bulb readings, of the vapour tension and humidity at the same hours, and also the mean of daily means of these elements and of its departure from the normal mean. The hygrometric data are taken from the tables accompanying "*The Indian Meteorologist's Vade Mecum*," which were computed by means of Regnault's modification of August's formula. The means of daily means are obtained by taking the means of the minimum, 10 hrs. and 16 hrs. observations, and reducing them to true means, by applying in case of vapour tension, the corrections given on pages XXXVIII to XLII, and in case of humidity the corrections given on pages XLIV to XLVIII of Volume XVII of the "Indian Meteorological Memoirs." These corrections were determined from the hourly observation data given in Volumes V, IX and X of the "Indian Meteorological Memoirs." The normal values, which have been used for obtaining the departures, are the means calculated in the same way.

The distribution of humidity in each month in India is exhibited by means of two charts in Plate V. The first chart shows the departure from normal of 8 hrs. absolute humidity, and the second that of the relative humidity.

The proportion of cloud is estimated in tenths of the sky expanse, an overcast sky being denoted by 10 and a cloudless sky by 0. The monthly means in Table A are the arithmetical means of the cloud amounts at 10 hrs. and 16 hrs. and the normal means, with which the actual monthly means are compared, are derived from the available cloud data for the same hours.

The departure from normal of the mean distribution of cloud amount at 8 hrs. in each month in India is shown in chart No. 1 of Plate VI, and the discussion of this and of the hygrometric features is based on the data given in Table B.

Normal values are deduced chiefly from ten or more years' records previous to 1899, but in some cases from observations extending from 1877 to 1902.

The air was damper than usual, both absolutely and relatively, over the tract of country extending from the Indus valley eastwards to the western limits of Bihar and Chota Nagpur, the excess being on the whole most pronounced in the North-West Frontier Province. Elsewhere the departures from normal, although mostly upwards, were not marked.

The chief features of the cloud distribution were similar to those of absolute humidity; and the cloud proportion was high in almost all parts of the country with the exception of Mysore. In the region including the Punjab, the North-West Frontier Province and Rajputana the excess was equal to one-fifth of the total sky expanse.

TABLE 15.

Division.	Hygrometry; 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	86	+3	·525	+·020	2·5	+0·5
Eastern Bengal and Assam	90	−1	·461	+·036	3·2	+1·1
Bengal	79	0	·432	+·040	2·1	+0·6
United Provinces	84	+5	·380	+·075	3·7	+1·2
Punjab	88	+10	·330	+·075	5·7	+2·1
North-West Frontier Province.	83	+13	·269	+·065	6·1	+2·1
Sind	67	+4	·303	+·035	4·5	+1·4
Rajputana	67	+8	·319	+·061	4·4	+2·0
Bombay	66	+4	·428	+·032	1·9	+0·8
Central India	73	+7	·382	+·085	3·3	+1·7
Central Provinces	68	+6	·390	+·067	1·9	+0·6
Hyderabad	60	−1	·409	−·022	2·3	+0·7
Mysore	73	+3	·474	+·013	2·5	0
Madras	77	−1	·617	+·001	3·0	+0·6

Rainfall.

14. Rainfall observations are made at about 2,000 stations in India. The time of observation is 8 hrs. The rainfall data for each province are tabulated in the office of the Meteorologist, Director of Land Records, or other officer in the province, and are published in the provincial gazettes.

The charts illustrating the distribution of rainfall in the month under discussion are based in part upon the rainfall data of the meteorological observatories throughout India, and in part upon the rainfall statements of the month published by the Local Governments.

Plate VII is based on all the rainfall data available at the time of publication and shows the normal average rainfall and the departure of the rainfall from the normal of the month in the 34 meteorological or rainfall divisions.

The distribution of the total number of rainy days in each month is exhibited in chart No. 2 of Plate VI and is based entirely on the data furnished by the meteorological observatories. A "rainy day" is one on which 0·10 inch or more of rain is received within 24 hours.

The normal figures of rainfall, and of the number of "rainy days," in Table B are based on observations which extend in most cases over a period of 30 or 40 years ending in 1900.

There was a marked excess of precipitation over nearly the whole region stretching from Baluchistan across northern India to Upper Burma; and Bengal, Orissa, Chota Nagpur, the Central Provinces East, Bihar, Sind and Rajputana West alone recorded less than their normal quantity. The fall was exceptionally heavy in Baluchistan, Kashmir, the North-West Frontier Province, the Punjab East and North, the United Provinces West and Assam, which received total amounts from 2″ to 5″ in excess of the average.

In the Peninsula south of the Central Provinces the weather was even drier than usual.

TABLE 16.

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			″	″	″	
1. Bay Islands	0·5	1·5	0·14	0·61	−0·47	− 77
2. Lower Burma	0·1	0·1	0·05	0·05	0	0
3. Upper do.	0·4	0·3	0·14	0·10	+0·04	+ 40
4. Assam	3·3	1·9	3·04	0·75	+2·29	+305
5. Eastern Bengal	0·9	0·9	0·60	0·46	+0·14	+ 30
6. Bengal	0·3	0·8	0·14	0·37	−0·23	− 62
7. Orissa	0	0·5	0	0·26	−0·26	−100
8. Chota Nagpur	0·2	1·1	0·05	0·51	−0·46	− 90
9. Bihar	0·8	1·3	0·31	0·69	−0·38	− 55
10. United Provinces, East	3·4	1·6	1·68	0·75	+0·93	+124
11. Do., West	5·1	2·0	3·29	0·98	+2·31	+236
12. Punjab, East and North	5·7	2·4	3·96	1·29	+2·67	+207
13. Do., Southwest	3·9	1·3	1·31	0·52	+0·79	+152
14. Kashmir	12·8	5·0	8·39	3·29	+5·10	+155
15. North-West Frontier Province	8·4	2·4	3·83	1·35	+2·48	+184
16. Baluchistan	6·9	2·9	3·85	1·28	+2·57	+201
17. Sind	0·1	0·8	0·06	0·28	−0·22	− 79
18. Rajputana, West	0·1	0·5	0·05	0·16	−0·11	− 69
19. Do., East	2·1	1·0	0·74	0·39	+0·35	+ 90
20. Gujarat	0·3	0·1	0·10	0·04	+0·06	+150
21. Central India, West	1·3	0·6	0·70	0·25	+0·45	+180
22. Do., East	2·5	1·8	1·25	0·86	+0·39	+ 45
23. Berar	1·4	0·5	0·98	0·29	+0·69	+238
24. Central Provinces, West	1·2	1·0	0·70	0·55	+0·15	+ 27
25. Do., East	0·4	0·8	0·21	0·40	−0·19	− 47
26. Konkan	0	0·2	0·01	0·13	−0·12	− 92
27. Bombay Deccan	0·1	0·2	0·06	0·10	−0·04	− 40
28. Hyderabad, North	0·3	0·2	0·15	0·08	+0·07	+ 87
29. Hyderabad, South	0	0·2	0	0·08	−0·08	− 100
30. Mysore	0·1	0·1	0·02	0·06	−0·04	− 67
31. Malabar	0·1	0·2	0·04	0·22	−0·18	− 82

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
32. Madras, Southeast	0·4	1·0	0·16	0·70	—0·54	— 77
33. Do. Deccan	0	0	0	0·10	—0·10	—100
34. Do. Coast, North	0	0·2	0	0·23	—0·23	—100

TABLE 17

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	0·10	0·08	+0·02	+ 25
Eastern Bengal and Assam	1·83	0·61	+1·22	+ 200
Bengal	0·17	0·50	—0·33	— 66
United Provinces	2·43	0·86	+1·57	+ 183
Punjab	3·42	1·13	+2·29	+ 203
North-West Frontier Province	3·83	1·35	+2·48	+ 184
Sind	0·06	0·28	—0·22	— 79

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Rajputana	0·57	0·33	+0·24	+ 73
Bombay	0·07	0·09	—0·02	— 22
Central India	0·89	0·46	+0·43	+ 93
Central Provinces	0·70	0·41	+0·29	+ 71
Hyderabad	0·07	0·08	—0·01	— 13
Mysore	0·02	0·06	—0·04	— 67
Madras	0·08	0·44	—0·36	— 82
Mean of India	0·38	0·44	+0·44	+100

Snowfall.

I.—AFGHANISTAN.

15. No information regarding the snowfall in Kabul has yet arrived. Heavy precipitation is said to have occurred in the western and southern parts of Afghanistan.

II.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Wano.*—There were in all four falls on the surrounding mountains. The snowline descended from 5,000 feet on the 1st to 4,000 feet on the 14th and 3,000 feet on the 28th. The statement below shows the character of the snowfall in this region:—

TABLE 18.

Locality.	Total snowfall of month.	
	Feet.	Inches.
Marwatti, Pirghal, Bosh and Dre Nashtar	4	2
Spera	1	6
Jani Mela, Karkana, Naboti and Kundighar	1	2
Kotkun	0	8
Wano Plain	0	3½

On the last day of the month there was still an accumulation of about 4 feet on the higher passes.

(*b*) *Tochi (North Waziristan).*—Heavy snow is reported to have fallen on almost all the hills in North Waziristan on the nights of the 1st, 2nd and 3rd.

(*c*) *Dera Ismail Khan.*—Ubashta received no less than 11½ feet of snow during the period from the 21st to the 26th, and the Takht-i-Suleman 5½ feet from the 26th to the 28th. The statement below shows the depth of the unmelted residue on the 31st on the various peaks.

TABLE 19.

Name of peak.	Reported depth of accumulation on the 31st.
Takht-i-Suleman	3 feet
Kharghar Narai	½ foot
Ubashta	4 feet
Chesanghar	1 foot
Marmand	3½ feet
Zonaraighar or Turghar	1 foot
Navetza	...

(*d*) *Kurram.*—More or less snowfall occurred on the Sufed Koh on all days of the month with the exception of the 12th, 13th, 15th and 30th, and most of these falls extended to Parachinar or even lower. At the end of the month the unmelted snow on the Paiwar Kotal measured about 4 or 5 feet in depth.

(*e*) *Kohat.*—There were in all eleven falls on the Samana Range, and two falls in the Samalzai Hills and Sadda Line. The statement below shows the total fall recorded in the various localities :—

TABLE 20.

Locality.	Total amount received during the month.	
	Feet.	Inches.
Samana Range	9	6
Hangu	0	3
Samana Fort Lockhart	10	8½
Shindhand Kandan	2	0
Bilandar Hill	4	6
Baktawar Khawantar	4	0
Kotal Hill	0	2
Ali Khel Hill	8	9
Mani Khel	4	0
Feroz Khel	4	0
Marai	1	6
Ali Sherzai Hill	3	9
Mamazai „	3	9
Adam Khel „	3	9
Malla Khel „	3	9
Mishti „	3	9
Shiekan „	3	9
Skhel „	3	9

(*f*) *Hazara.*—The following statement shows the character of the snowfall in this district.

TABLE 21.

Name of Range or Station.	Total depth of snowfall.		Number of days on which snow fell.
	Feet.	Inches.	
Malkandi (Kagan range)	1	5½	2
Jared („)	6	3	9
Kagan („)	17	2	7
Paluderan („)	8	11	5
Narang („)	26	10	9
Dungagali range	14	0	11
Tandiani „	15	9	14
Panjal (Siran range)	13	0	9

The snowline came down to Balakat which is about 2,500 feet above sea-level.

III.—KASHMIR.

Weather was unusually disturbed, and in Kargil, Sonemarg and Dras snow fell almost daily. The total fall was equivalent to 22·10″ of rain at Sonemarg, 4·52″ at Kargil, 7·34″ at Dras and 5·33″ at Srinagar. On the hills near Kargil the total quantity of snowfall received during the month was at least 17 feet. On the last day of the month there were about 3 feet of snow in Kargil itself and about 12 feet on the surrounding hills.

IV.—PUNJAB.

(*a*) *Murree.*—Snow fell on eight days at Murree, and on one day on the hills near Kahuta; the total fall amounted to 3¼ feet in the former and 2 feet in latter locality.

(*b*) *Poo.*—Snowstorms were of daily occurrence during the first fifteen days and of occasional occurrence during the second half of the month. The aggregate fall was estimated at 6 feet and was regarded as exceptionally heavy by the inhabitants of the district.

All the passes were closed.

(*c*) *Kilba* (*Simla Hills*).—There were altogether thirteen falls down to 5,750 feet at which elevation the total quantity received was estimated at 3½ feet.

Weather was unusually cold.

V.—UNITED PROVINCES.

(*a*) *Garhwal.*—Snowfall occurred on twelve days. The falls of the 26th, 27th and 31st were heavy and descended as low as 5,000 feet.

Weather was mild generally.

(*b*) *Almora.*—Snowstorms were of occasional occurrence. The total fall received during the month amounted to about 27 feet on the Nuwe pass, 21 feet in Byans and 12 feet in Chaudas and Malla Johar (Untadhura and Ralamdhura). The snowline came down to the level of the inhabited region.

The statement below illustrates a comparison of the reported depth of snow accumulations on the various peaks and passes with the normal values.

TABLE 22.

Name of Pass or Peak.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
	Feet.	Feet.
Nuwe Pass	49	31
Untadhura	12	18½
Ralamdhura	12	12
Binkaru Pass	18	27½
Lipulekh „	30	17
Lampia	12	7½

SUMMARY.

16. According to the available information, which is however more limited than usual, the snowfall was excessive over the greater part of the mountainous zone bordering upper India as well as in Persia.

Snow is said to have fallen to very low levels in the Hazara hills and in the Persian region.

HEM RAJ.

The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2 miles per hour	... one	feather added to the wind arrow
,, ,,	2 to 5 ,, ,, ,,	... two	feathers ,, ,, ,, ,, ,,
,, ,,	5 to 10 ,, ,, ,,	... three	,, ,, ,, ,, ,, ,,
,, ,,	10 to 20 ,, ,, ,,	... four	,, ,, ,, ,, ,, ,,
	over 20 ,, ,, ,,	... five	,, ,, ,, ,, ,, ,,

The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020" or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MAXIMUM TEMPERATURE.

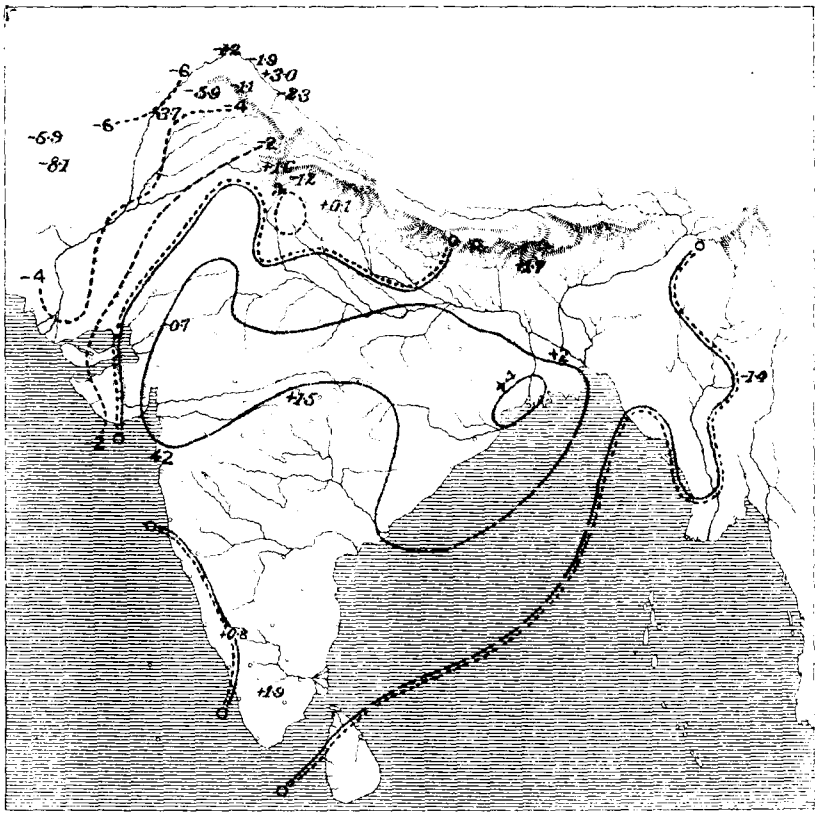
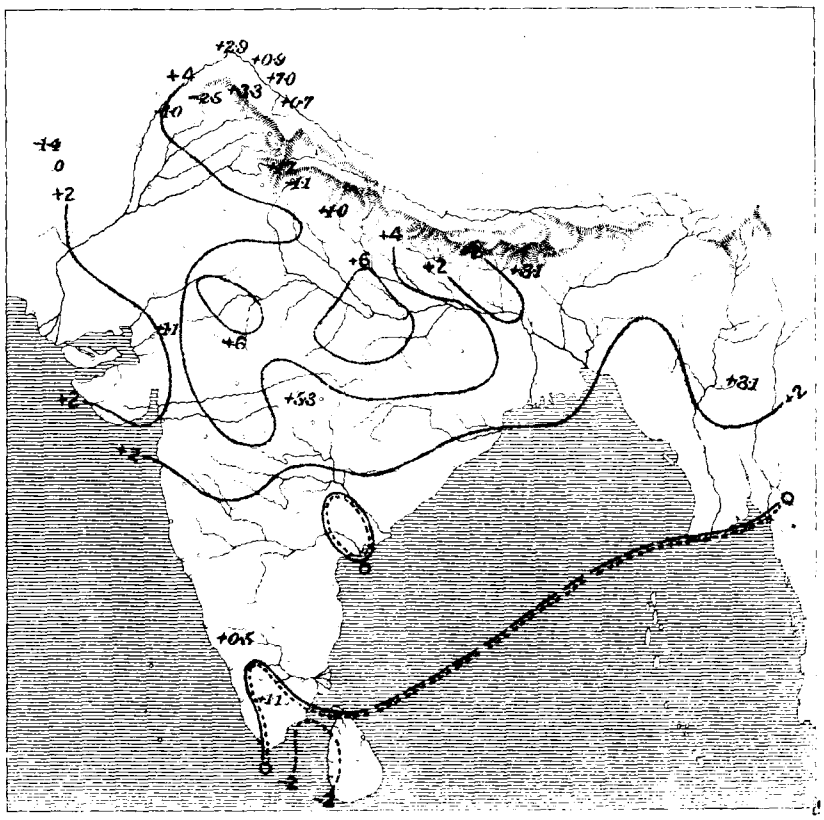


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MINIMUM TEMPERATURE.



LITHO BY S.R.M.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

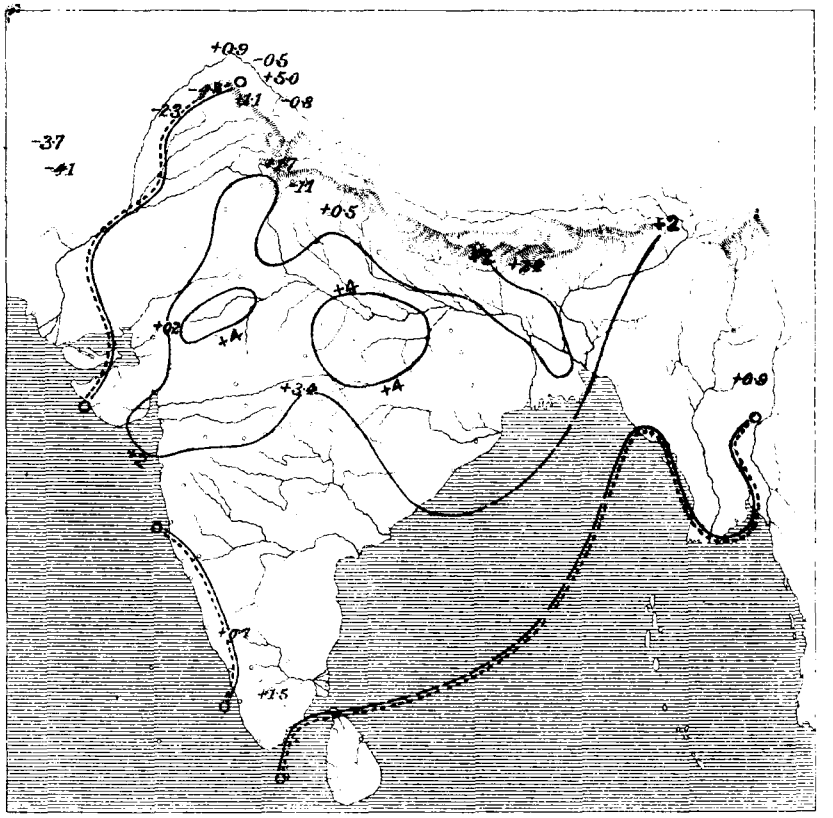
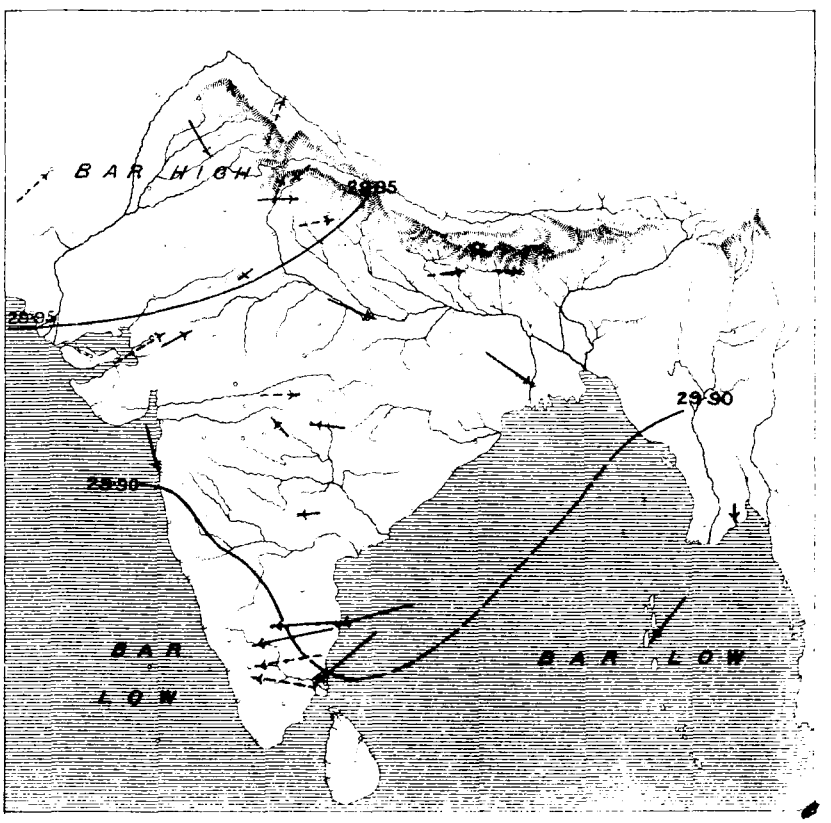


CHART SHEWING THE MONTHLY MEAN OF
PRESSURE AND RESULTANT
WIND DIRECTION.



LITHO. BY S.G.M.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

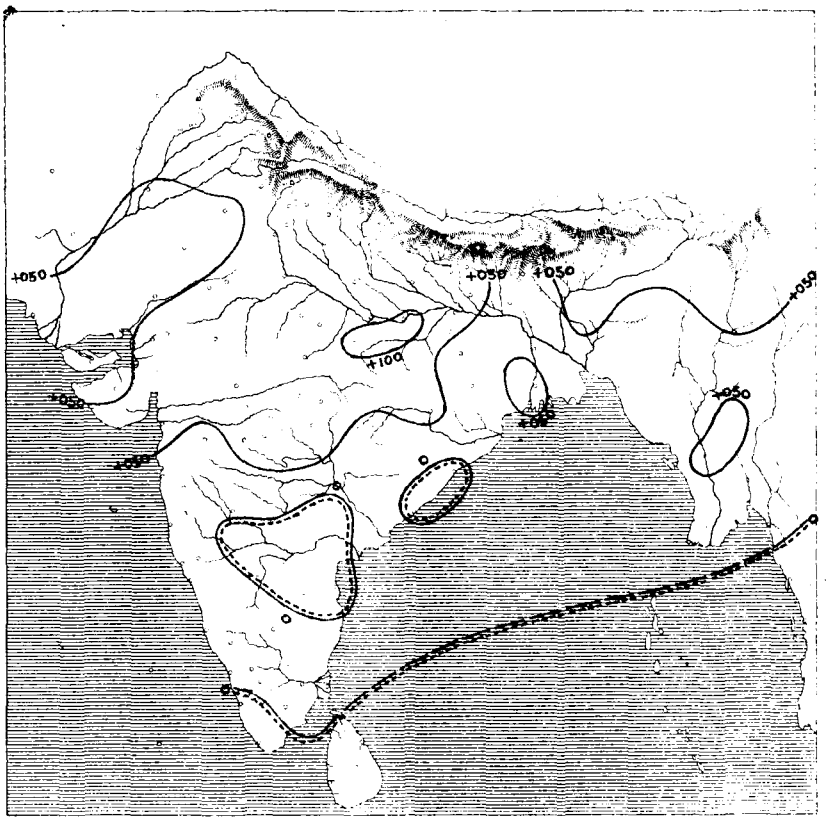


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

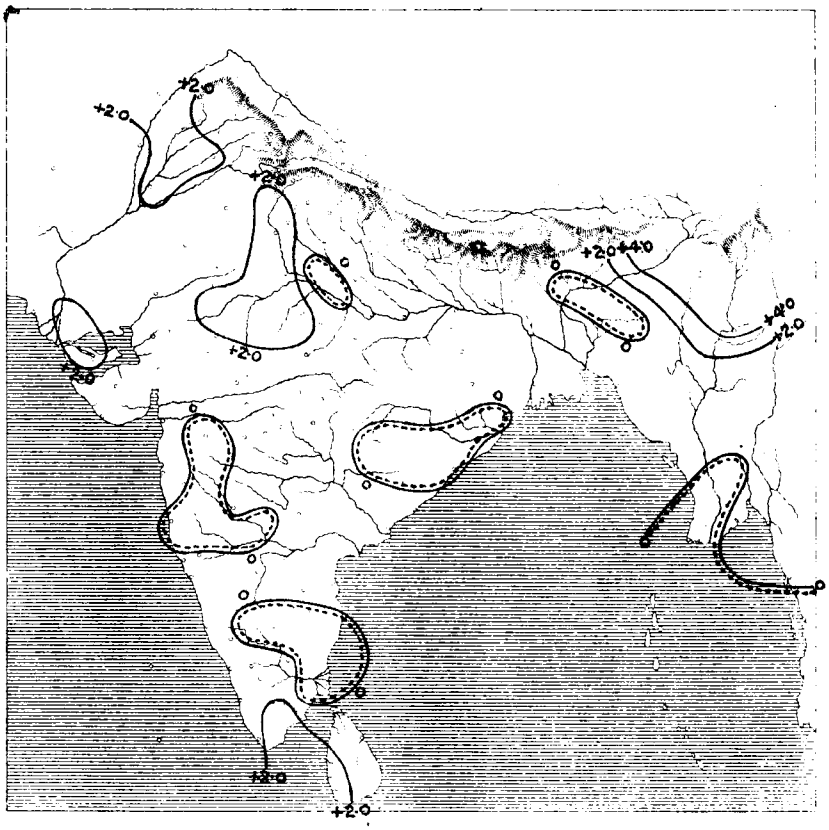
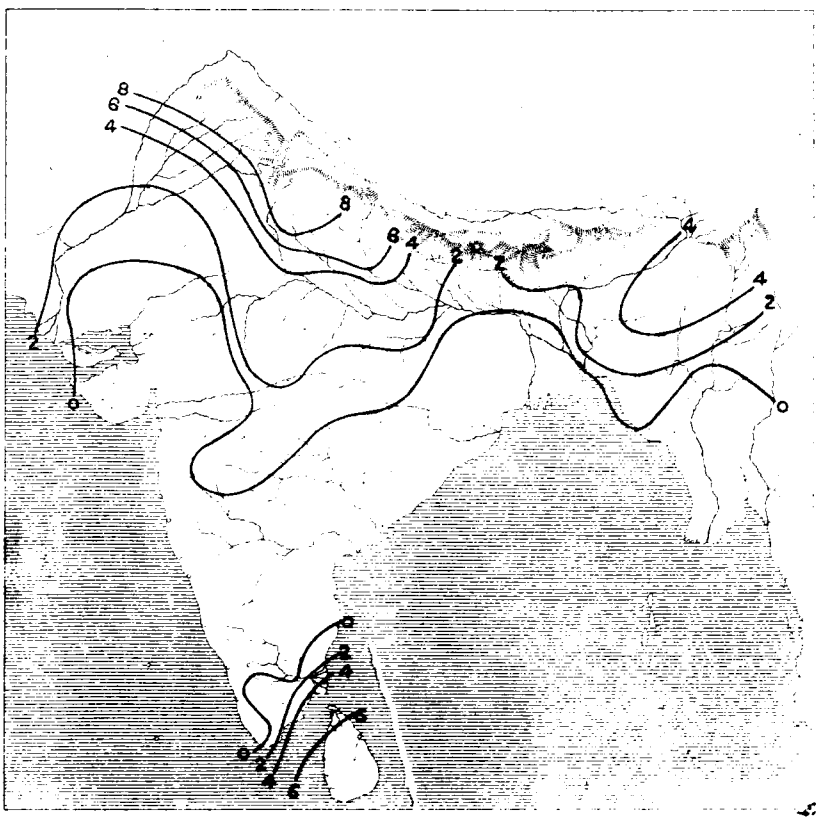
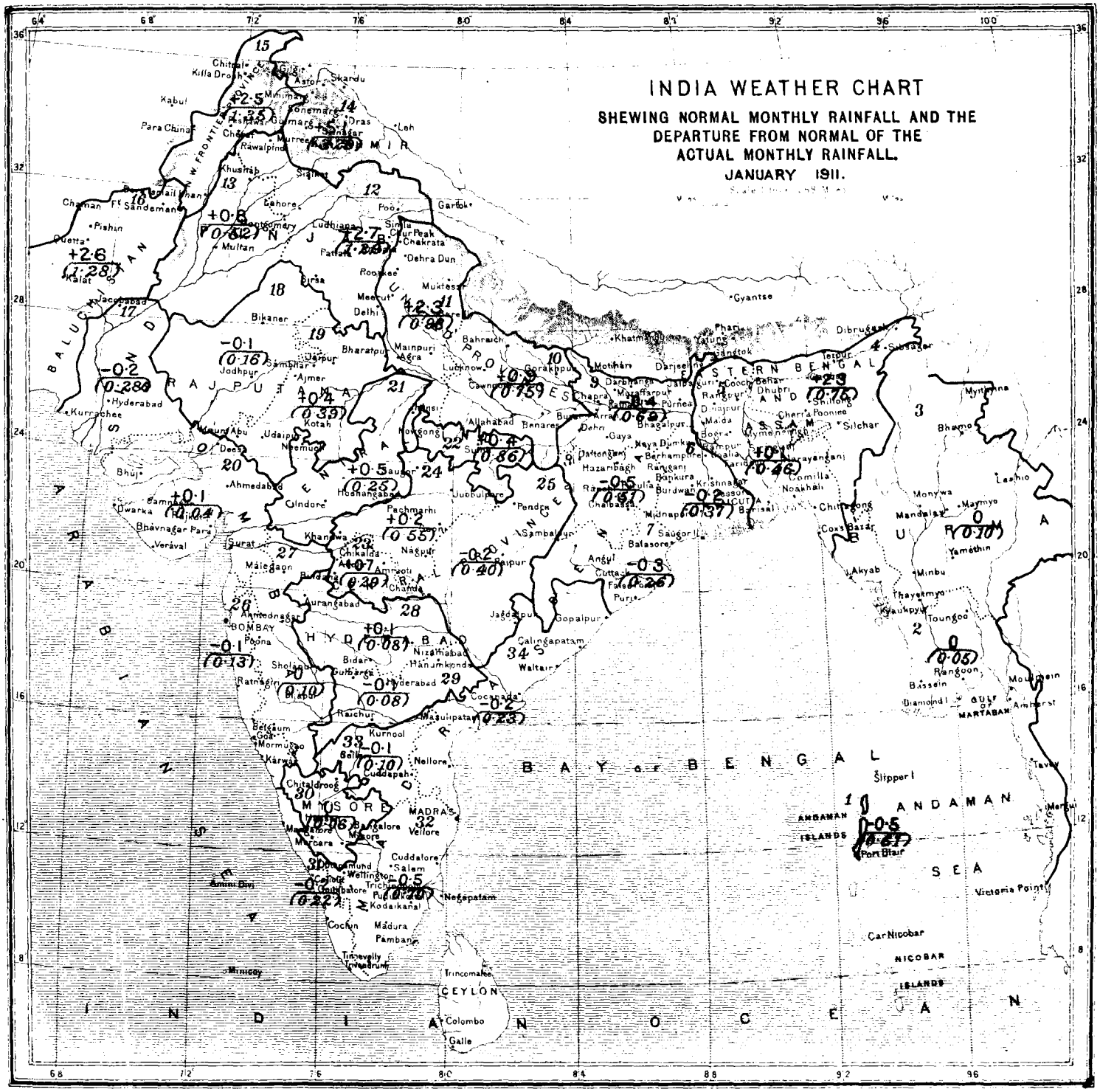


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)





The country is divided into 34 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall; the numbers above these give the departures from normal of the average actual rainfall over the divisions

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Eastern Bengal
6. Bengal
7. Orissa
8. Chota Nagpur
9. Bihar
10. United Provinces, East
11. Do., West
12. Punjab, East and North
13. Do., Southwest
14. Kashmir
15. Northwest Frontier Province
16. Baluchistan
17. Sind
18. Rajputana, West
19. Rajputana, East
20. Gujarat
21. Central India, West
22. Do., East
23. Berar
24. Central Provinces, West
25. Do., East
26. Konkan
27. Bombay, Deccan
28. Hyderabad, North
29. Do., South
30. Mysore
31. Malabar
32. Madras, Southeast
33. Madras, Deccan
34. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW.

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA. FEBRUARY, 1911.

INTRODUCTION.

THIS review of the weather in India during the month of February, 1911, is based on observations taken daily at 8 hrs. at 238 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 33 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review. The brief notes on solar, seismic and magnetic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. From a meteorological point of view February contrasted strongly with the previous month: precipitation was almost entirely wanting except in the Bay Islands, Assam, Bengal, Orissa, the Punjab, the North-West Frontier Province, Baluchistan and Kashmir; cloud and humidity were in general much in defect; and the barometer, which in January stood largely below its normal height, was in February high by ·044″.

Notwithstanding the prevalence of remarkably dry clear weather, temperature departed but slightly from the normal. Mean temperature was somewhat low in Upper Burma, Mysore, the Deccan, and the eastern districts of the Central Provinces and parts of Kashmir, owing chiefly to a defect of night temperature, and was high, in consequence of excessive day temperature, in Baluchistan, Sind excluding the maritime parts, certain districts of Rajputana and the west sub-Himalayas.

Solar, seismic and magnetic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—Observations of the sun were made on all the days during the month.

Sun spots.—The spot activity continued low, altogether 6 spot groups were observed all of which were small. The daily average number was 0·8 and on 11 days no spot was visible on the sun at the time of observation. Two spots, Nos. 1958 and 1960, were the only ones of any size, they were first observed near the east limb on the 10th and 27th, respectively. Both were heralded before the day of their appearance by metallic prominences on the limb. All the spots were on the southern hemisphere and their distribution in latitude was as follows:—

TABLE 1.

	0° - 10°.	11° - 20°.	21° - 30°	Mean latitude.	Extreme latitudes.
North.	...	...	...	...	...
South.	3	2	1	10°·4	1° and 23°

Prominences.—There were fewer large prominences than in January. Twenty-five large, 5 eruptive, and 2 metallic prominences were recorded during the month. The highest was observed on the 24th at latitude—32° west, an eruptive

rapidly changing prominence which attained to a height of 165″ at 11h 50m.

Magnetic disturbances.—A moderate disturbance was recorded which continued from the 21st to 27th.

Seismological records.

TABLE 2.

No.	Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maxima. G. M. T.	End.	Maximum Amplitude.	Duration.	Remarks.
	1911.	H. M.	H. M.	H. M.	H. M.	mm. ″	H. M.	
12	Feb. 13	14 07·6?	14 18·8	14 19·8	14 35	...	0 27?	Widening of line.
13	„ 18	18 41·3	18 51·5	18 56·1	22 30	9·5=5·4	3 49	
14	„ 23	11 26·4	...	...	12 18	...	0 52	Widening of line.
15	„ 28	5 28·2	5 47·2	5 48·1	5 59	0·3=0·2	0 31	

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of February, 1911, the traces showed 3 calm days, 23 days of small, 1 day of moderate and one day of great disturbance.

The days of the month selected as quiet* for the purposes of the Magnetic Survey of India are the 4th, 12th, 15th, 18th and 20th.

The following table represents the magnetic character of each day during the month :—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	8	S	15	C	22	M
2	S	9	S	16	S	23	S
3	S	10	S	17	S	24	S
4	S	11	S	18	S	25	S
5	S	12	C	19	S	26	S
6	S	13	S	20	C	27	S
7	S	14	S	21	G	28	S

C = calm, S = small, M = moderate, G = great, V. G. = very great.

* Calm days if available are usually selected. In absence of these however the least disturbed days have to be included amongst the 5 selected days.

The mean observed values of the several magnetical elements reduced to the mean monthly tabulations of the magnetograms as also the ranges and the summed ranges of the horizontal force and declination for the month are as follow :—

Easterly declination	0° 56′ 2″
Horizontal force	0·36840 C. G. S. unit.
Vertical force	0·16185 „ „
Inclination	23° 43′·0
Inclination (observed)	23° 43′·0
Horizontal force range	0·00044 C. G. S. unit.
Horizontal force summed range	0·00258 „ „
Declination range	1′·4
Declination summed range	8′·4

(NOTE.—Summed range means sum without regard to signs of 24 ordinates of diurnal inequality.)

Seismic disturbances.

TABLE 4.

Date.	Commencement.	Maximum.	End.	Maximum amplitude.	Duration.
	H. M.	H. M.	H. M.	mm.	H. M.
1911 February 18th	18 46·0	Traces overlap.	20 35·4	Traces overlap.	1 49·4
„ 23rd	11 30·8	11 45·9	12 9·6	0·5	0 38·8

All times given above denote G. M. T.
Sensibility to tilt, 1 mm. = 0″·37.

N. A. F. MOOS,
Director,
Bombay Observatory.

CALCUTTA OBSERVATORY.

5. *List of displacements recorded by the Milne seismograph.*

TABLE 5.

Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maximum. G. M. T.	End. G. M. T.	Duration.	Maximum displacement on trace from mean position.	Remarks.
1911	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
February 18th	18 44·9	18 48·5	18 54·6	22 35·7	3 50·8	? *	

* The maximum amplitude cannot be measured as the boom moved through out the trace.

Sensibility throughout 1mm.=0″·38 of tilt.

C. W. PEAKE,
Meteorologist, Calcutta.

SIMLA OBSERVATORY.

6. *List of earthquakes recorded by the Omori-Ewing seismographs.*

TABLE 6.

Date.		Beginning of 1st P. T.	Beginning of 2nd P. T.	Beginning of L. W.	Time of maximum amplitude.	End approximately.	Duration.	Maximum displacement of style.	REMARKS.
		H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
13th	A	14 8·4	14 9·4	14 10·0	14 10·3	14 31·1	0 22·7	0·4	
	B	14 8·6	...	14 9·8	14 10·1	14 23·2	0 14·6	0·4	
18th	A	18 42·3	18 43·4	18 44·7	?	23 8	4 26	?	Touched stops.
	B	18 42·4	...	18 44·9	?	23 9	4 27	?	Touched stops.
21st	A								Tremors from about 16h. 35m. to about 16h. 53m.
	B								Tremors from about 16h. 31m. to about 17h. 4m.
23rd	A	11 22·6	11 29·2	11 39·9	11 43·1	12 13	0 50	0·8	
	B	...	11 29·2	11 38·2	11 39·0	12 21	...	1·0	
28th	B	10 12·1	...	10 13·5	10 13·8	10 15·1	0 3·0	?	Touched stops.

All times are given in G. M. T. B = N—S component.
A = E—W component. Magnification of each instrument was 15.

The following table contains a list of earthquakes that have been reported :—

TABLE 7.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity. Rossi-Forel scale.	No. of shocks.	REMARKS.
	January.	H. M.	Sec.			
Bushire . . .	15th	21 40?	1½	5	4	
„ . . .	16th	11 30	1½	5	7	
„ . . .	17th	7 10	1½	5	...	
„ . . .	17th	13 15	3½	8	...	
„ . . .	17th	23 40	1½	5	2	
	February.					
Drosh . . .	1st	12 40	2	6	1	
Jorhat . . .	2nd	6 0	3	5	3	
Shillong . . .	4th	19 2	3	8	1	
Chitral . . .	4th	22 0	2	7	2	
Shillong . . .	5th	6 17	½	5	1	
Murree . . .	5th	22 33	4	6	1	
Drosh . . .	7th	19 0	1½	6	1	
Shillong . . .	9th	23 18	1	5	1	
„ . . .	11th	23 7	½	5	1	
„ . . .	12th	1 15	½	5	1	
„ . . .	19th	13 45	½	5	1	
Drosh . . .	22nd	17 43	3	5	1	
Chitral . . .	23rd	21 0	2	7	2	
„ . . .	26th	0 15	3	7	4	
Shillong . . .	27th	19 1	½	5	1	

Solar radiation.—The following figures give the intensity of solar radiation, as measured at Simla by Angstrom's pyrheliometer. The values are corrected to local noon, and expressed in Grammecalories per square centimetre per minute :—

Maximum	1·54
Minimum	1·22
Mean	1·42
Number of days of observation . . .	12

W. A. HARWOOD,
Imperial Meteorologist, Simla.

ROYAL ALFRED OBSERVATORY, MAURITIUS.

7. The following information relating to January and February has been communicated by the Director of the Observatory :—

Magnetic disturbances.

TABLE 8.

Date.	Time.	Disturbance.
Jan. 1911. 2nd to 4th	oh. to 6h.	Small undulations and fluctuations in H. F. with a double crested wave 19h. to 22h. (−30).
5th	20½h. to 22h.	Wave in H. F. (+30).
8th to 9th	20½h. to 6½h.	Small fluctuations in H. F., with double wave 8d. 23h. to 9d. 3h. (−20 to +20).
9th to 10th	16h. to oh.	Small irregular undulations in H. F.
10th	18½h. to 20h.	Wave in H. F. (−25).
18th to 19th	3h. to 6h.	Occasional small fluctuations in H. F.
20th to 21st	21h. to 16h.	Ditto ditto.
22nd	13h. to 20h.	Wave in H. F. (−30).

TABLE 12.

Sub-divisions.	Actual temperature.					Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean-daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
1. Bay Islands	84·7	74·3	79·5	10·5	16·1	—1·1	—1·0	— 0·1
2. Lower Burma	87·0	64·2	75·6	22·7	34·5	—1·5	—1·7	+ 0·2
3. Upper do.	84·7	54·0	69·4	30·8	45·3	—2·1	—3·3	+ 1·2
4. Assam	75·2	54·8	65·0	20·4	34·9	—1·2	0	— 1·2
5. Eastern Bengal	80·5	55·5	67·9	25·0	41·7	+0·5	—0·2	+ 0·7
6. Bengal	83·7	56·3	70·0	27·4	47·0	+0·6	—2·2	+ 2·8
7. Orissa	85·6	59·9	72·7	25·6	44·5	—0·8	—4·1	+ 3·3
8. Chota Nagpur	81·0	52·8	66·9	28·3	50·8	+0·3	—2·1	+ 2·4
9. Bihar	79·4	52·0	65·7	27·5	45·1	+0·5	—1·9	+ 2·4
10. United Provinces, East	79·3	49·5	64·4	29·9	50·9	+0·5	—2·1	+ 2·6
11. Do., West	77·0	48·8	62·9	28·2	49·7	+1·5	—1·3	+ 2·8
12. Punjab, East and North	73·5	47·2	60·4	26·4	47·9	+2·4	+0·8	+ 1·6
13. Do., Southwest	75·4	48·2	61·8	27·2	51·4	+2·7	+0·9	+ 1·8
14. Kashmir	38·6	16·8	27·7	21·7	51·1	—3·7	—3·3	— 0·4
15. North-West Frontier Province	69·9	43·9	56·9	26·1	52·5	+0·9	+0·1	+ 0·8
16. Baluchistan	65·9	43·8	54·9	22·1	49·3	+5·5	+1·9	+ 3·6
17. Sind	81·4	55·5	68·5	25·9	48·1	+2·6	+1·1	+ 1·5
18. Rajputana, West	83·1	52·9	68·0	30·2	57·1	+5·5	—0·5	+ 6·0
19. Do., East	82·5	51·5	67·0	31·1	53·9	+4·3	—0·6	+ 4·9
20. Gujarat	87·0	57·1	72·1	29·9	51·6	+2·3	—1·3	+ 3·6
21. Central India, West	83·9	50·7	67·3	33·1	57·4	+1·7	—1·3	+ 3·0
22. Do., East	81·6	49·9	65·7	31·7	54·7	+1·7	—1·9	+ 6·3
23. Berar	87·9	57·7	72·8	30·1	53·2	—0·8	—5·2	+ 4·4
24. Central Provinces, West	84·9	53·0	69·0	31·9	55·1	—0·3	—2·8	+ 2·5
25. Do., East	84·5	54·5	69·5	30·0	51·8	—2·1	—4·2	+ 2·1
26. Konkan	85·6	66·5	76·0	19·1	34·3	+0·2	—2·5	+ 2·7
27. Bombay Deccan	89·1	55·8	72·5	33·3	53·5	—1·2	—3·1	+ 1·9
28. Hyderabad, North	88·4	59·3	73·9	29·0	51·9	—1·0	—2·9	+ 1·9
29. Do., South	89·7	62·3	76·1	27·4	44·7	—1·9	—3·2	+ 1·3
30. Mysore	85·8	58·7	72·3	27·1	35·9	—1·7	—2·8	+ 1·1
31. Malabar	87·6	70·1	78·9	17·4	24·9	—0·7	—2·5	+ 1·8
32. Madras, Southeast	89·5	67·4	78·4	22·1	31·2	—0·3	—1·8	+ 1·5
33. Do. Deccan	92·3	62·2	77·4	30·3	41·1	—2·1	—4·2	+ 2·1
34. Do. Coast, North	85·8	66·0	75·9	19·9	31·7	—0·6	—3·1	+ 2·5

TABLE 13.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	−1·8	−2·4	−2·1
Eastern Bengal and Assam	0	−0·2	−0·1
Bengal	+0·1	−2·6	−1·2
United Provinces	+1·1	−1·7	−0·3
Punjab	+2·5	+0·9	+1·7
North-West Frontier Province	+0·9	+0·1	+0·5
Sind	+2·6	+1·1	+1·8
Rajputana	+4·7	−0·6	+2·0
Bombay	+0·4	−2·3	−0·9
Central India	+1·7	−1·6	0
Central Provinces	−0·7	−3·4	−2·1
Hyderabad	−1·6	−3·1	−2·4
Mysore	−1·7	−2·8	−2·3
Madras	−0·7	−2·6	−1·7

Winds.

12. (*a*) Owing to the absence of cold weather storms the rate of air movement was either normal or below it over practically the whole of northern and central India, and also in Bombay and Hyderabad. Winds were on the other hand stronger than usual in Mysore and Burma.

(*b*) The steadiness was much above the average in Mysore, Hyderabad, Central India, the Punjab, the United Provinces and Eastern Bengal and Assam, while in Burma and the North-West Frontier Province the wind was unsteady.

(*c*) Southerly winds prevailed across the Bengal coast during the last twelve days of the month, and in the region defined by Jessore, Barisal and Naraingunj the usual northerly element in the mean direction was altogether wanting.

TABLE 14.

Division.	Departure from normal of	
	Hourly wind velocity.	Wind steadiness.
Burma	+0·7	−11
Eastern Bengal and Assam	−0·4	+ 6
Bengal	0	+ 3
United Provinces	−0·5	+ 8
Punjab	+0·4	+ 7
North-West Frontier Province	−0·3	− 8
Sind	−0·8	− 4
Rajputana	+0·3	− 2
Bombay	−0·8	+ 9
Central India	−1·5	+15
Central Provinces	−0·5	+ 3
Hyderabad	−1·0	+29
Mysore	+1·2	+29
Madras	+0·5	+17

Humidity and cloud.

13. Except in Sind and at a few places elsewhere both the quantity of aqueous vapour in the air and the percentage of saturation were below the average, the dryness being on the whole most pronounced in Khandesh and the Central Provinces.

There was somewhat more cloud than usual in Baluchistan, the southern and eastern parts of Kashmir, the west of Central India, southeast Madras, Ceylon and parts of Eastern Bengal and Assam; in almost all other places the sky was comparatively clear and especially so in Bengal, the

United Provinces and the Central Provinces, where the actual amount of cloud recorded during the month was barely half of the normal.

TABLE 15.

Division.	Hygrometry; 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	78	— 1	·498	—·056	2·0	—0·2
Eastern Bengal and Assam.	83	— 3	·453	—·007	2·7	0
Bengal	66	— 6	·359	—·067	1·0	—1·1
United Provinces.	66	— 5	·299	—·032	1·2	—1·5
Punjab	70	— 5	·277	—·007	2·5	—1·2
North-West Frontier Province.	67	— 7	·227	—·029	3·3	—0·7
Sind	63	0	·351	+·032	2·1	—0·6
Rajputana	44	— 9	·226	—·057	1·9	—0·7
Bombay	54	— 8	·369	—·059	0·7	—0·4
Central India	49	— 7	·245	—·055	1·7	+0·1
Central Provinces	42	—12	·240	—·094	0·8	—0·9
Hyderabad	43	—10	·314	—·108	1·1	—0·7
Mysore	54	—10	·372	—·101	1·3	—0·6
Madras	72	— 5	·593	—·091	2·1	—0·1

Rainfall.

14. The month was conspicuously free from disturbance and practically the whole country, excepting the northwest corner, Bengal, Orissa, Assam and the Bay Islands, received little or no rain. The defect averaged an inch in amount in Baluchistan, Kashmir and the North-West Frontier Province, about three quarters of an inch in the Punjab East and North, the United Provinces West, Chota Nagpur, Bengal and Eastern Bengal and Assam, and about half an inch in Bihar, theUnited Provnces East, Central India East, the Central Provinces East, Madras Southeast, and Madras Coast North. The month was in fact one of the driest on record.

TABLE 16.

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
1. Bay Islands	1·0	0·8	0·17	0·25	—0·08	— 32
2. Lower Burma	0·1	0·3	0·06	0·20	—0·14	— 70
3. Upper do.	0·1	0·4	0·03	0·17	—0·14	— 82
4. Assam	2·2	3·3	0·81	1·46	—0·65	— 45
5. Eastern Bengal	0·2	1·4	0·07	0·83	—0·76	— 92
6. Bengal	0·4	1·5	0·14	0·95	—0·81	— 85
7. Orissa	0·5	1·3	0·38	0·77	—0·39	— 51
8. Chota Nagpur	0	1·6	0	0·76	—0·76	—100
9. Bihar	0	1·3	0	0·54	—0·54	—100
10. United Provinces, East	0	1·1	0	0·48	—0·48	—100
11. Do., West	0·2	1·6	0·06	0·87	—0·81	— 93
12. Punjab, East and North	0·8	2·1	0·29	1·07	—0·78	— 73
13. Do., Southwest	0·3	1·4	0·23	0·56	—0·33	— 59

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
14. Kashmir	3·9	4·8	1·72	2·79	—1·07	— 38
15. North-West Frontier Province	0·8	2·7	0·38	1·31	—0·93	— 71
16. Baluchistan	1·4	3·7	0·56	1·57	—1·01	— 64
17. Sind	0	0·7	0	0·25	—0·25	—100
18. Rajputana, West	0	0·3	0	0·13	—0·13	—100
19. Do., East	0·1	0·6	0·03	0·26	—0·23	— 88
20. Gujarat	0	0·2	0	0·11	—0·11	—100
21. Central India, West	0·1	0·6	0·05	0·29	—0·24	— 83
22. Do., East	0·3	1·3	0·09	0·64	—0·55	— 86
23. Berar	0	0·6	0	0·23	—0·23	—100
24. Central Provinces, West	0	0·8	0	0·38	—0·38	—100
25. Do., East	0	0·8	0	0·45	—0·45	—100
26. Konkan	0	0·1	0	0·05	—0·05	—100
27. Bombay Deccan	0	0·2	0	0·09	—0·09	—100
28. Hyderabad, North	0	0·3	0	0·16	—0·16	—100
29. Do., South	0	0·4	0	0·18	—0·18	—100
30. Mysore	0	0·2	0·01	0·09	—0·08	— 89
31. Malabar	0·1	0·2	0·08	0·18	—0·10	— 56
32. Madras, Southeast	0·1	0·7	0·03	0·50	—0·47	— 94
33. Do. Deccan	0	0	0	0·11	—0·11	—100
34. Do. Coast, North	0	0·6	0·01	0·45	—0·44	— 98

TABLE 17.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	0·05	0·19	—0·14	— 74
Eastern Bengal and Assam	0·44	1·16	—0·72	— 62
Bengal	0·10	0·73	—0·63	— 86
United Provinces	0·03	0·66	—0·63	— 95
Punjab	0·27	0·96	—0·69	— 72
North-West Frontier Province	0·38	1·31	—0·93	— 71
Sind	0	0·25	—0·25	—100

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Rajputana	0·02	0·22	—0·20	— 91
Bombay	0	0·09	—0·09	—100
Central India	0·06	0·41	—0·35	— 85
Central Provinces	0	0·34	—0·34	—100
Hyderabad	0	0·17	—0·17	—100
Mysore	0·01	0·09	—0·08	— 89
Madras	0·03	0·41	—0·38	— 93
Mean of India	0·09	0·47	—0·38	— 81

Snowfall.

I.—AFGHANISTAN.

15. Snowstorms occurred in Kabul and the surrounding hills on seven days during the month. The statement below shows the character of the snowfall in the various localities :—

TABLE 18.

Locality.	Total snowfall during the month.	
	Feet.	Inches.
Kabul	4	7
Kila Kazi	6	11
Koh Daman	9	5
Koh Baba	8	6
Paghman	7	3
Shakardara	11	8

II.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Wana.*—Snowfall occurred on the surrounding peaks on the 26th and 27th, varying in total amount from 2″ to 9″. At the close of the month the unmelted residue of snow on the greater elevations was only about 5 inches deep.

(*b*) *Kurram.*—There were altogether ten falls, and of these four extended to the level of Parachinar. At the end of the month the accumulations on the higher passes were greater than usual.

(*c*) *Kohat.*—On the points near Fort Lockhart snow fell on two days to a total depth of 4¾ feet.

III.—KASHMIR.

There were in all nine falls of snow in the main valley of Srinagar, and in and around Kargil, eight falls in Skardu and twelve falls on the adjacent mountains.

The following is a statement of the total falls recorded in the various localities :—

TABLE 19.

Station.	Total snowfall during the month.	
	Feet.	Inches.
Srinagar	1	5
Skardu	0	6
Kargil	1	7
Hills near Kargil	5	8

On the 28th snow to a depth of over 3 feet was reported to be lying in Kargil and to a depth of nearly 16 feet on its neighbouring hills.

IV.—PUNJAB.

(*a*) *Murree.*—A total fall of 8 inches was recorded on two days.

(*b*) *Poo.*—Snowstorms occurred on the 1st, 19th, 24th, and 28th: the total fall measured about 5 inches in depth. The passes remained closed.

(*c*) *Kilba* (*Simla Hills*).—Light snow fell on the surrounding heights on the 1st, 27th, and 28th. On the first occasion the fall descended to a level of about 5,700 feet, but on the 27th and 28th it did not come down lower than 7,400 feet.

V.—UNITED PROVINCES.

(*a*) *Garhwal.*—No information has yet been received.

(*b*) *Almora.*—In Malla Darma there fell on 9 days nearly 21 feet of snow, on the Binkaru pass on 7 days 10½ feet, and on the Lipulekh and Lampia passes on 7 days 19 feet. The Ralamdhura recorded a total fall of 3 feet and the Untadhura of 4 feet.

TABLE 20.

Name of pass.	Depth of accumulation at end of the month.	
	Reported.	Normal.
	Feet.	Feet.
Nuwe pass	52	35
Binkaru pass	14	37½
Lipulekh „	28	19
Lampia „	33	21½

SUMMARY.

16. So far as can be judged from the limited information available at the present time the snowfall of the month was heavier than usual in and around Kabul and in parts of the North-West Frontier Province, and was below the normal in the western Himalayas.

HEM RAJ.

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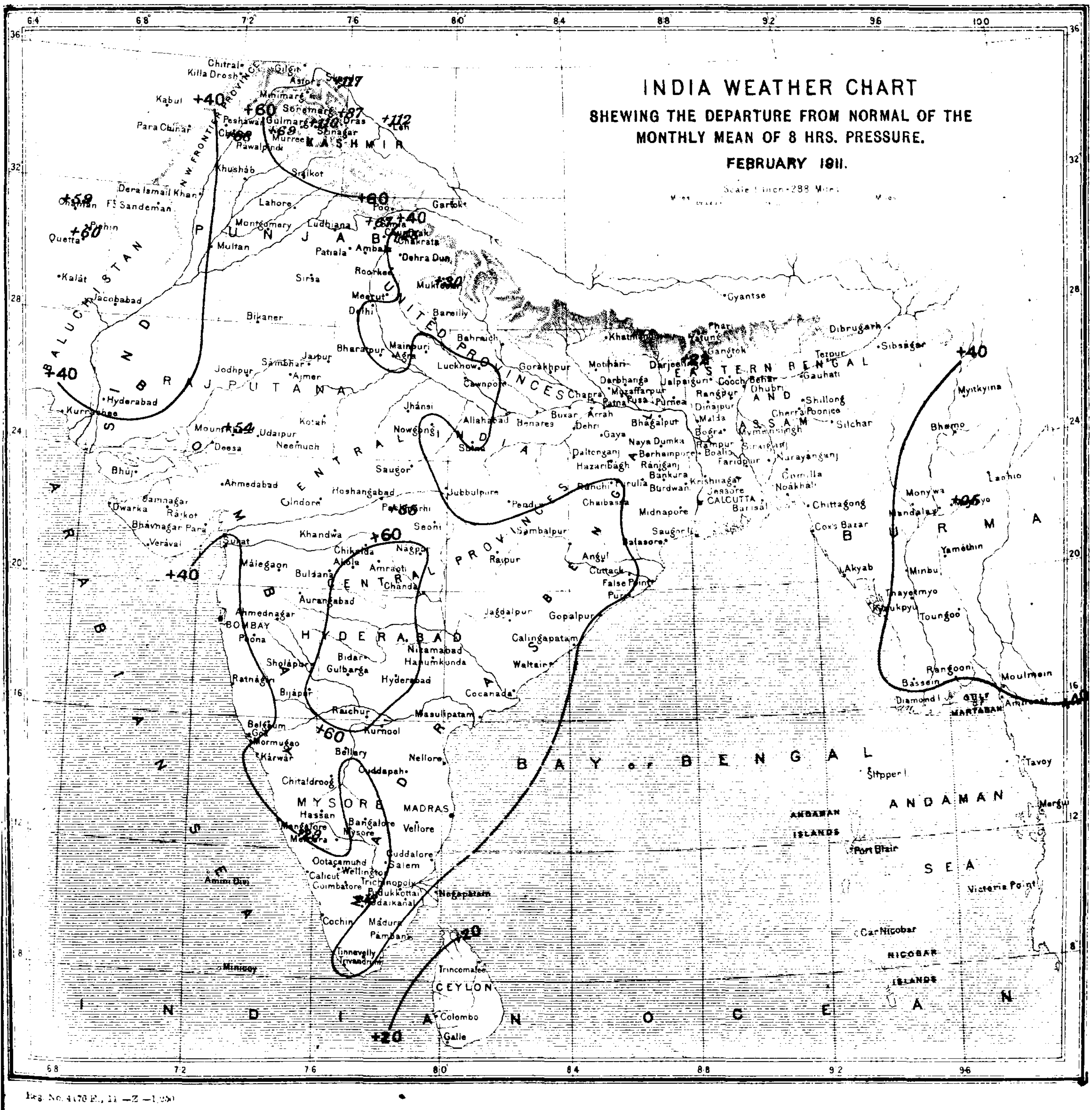
The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2 miles per hour	...	one feather added to the wind arrow
,,	,, 2 to 5 ,, ,, ,,	...	two feathers ,, ,, ,, ,,
,,	,, 5 to 10 ,, ,, ,,		three ,, ,, ,, ,, ,,
,,	,, 10 to 20 ,, ,, ,,	..	four ,, ,, ,, ,, ,,
	over 20 ,, ,, ,,	...	five ,, ,, ,, ,, ,,



LITHO. BY S. S. M.

The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020 or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MAXIMUM TEMPERATURE.

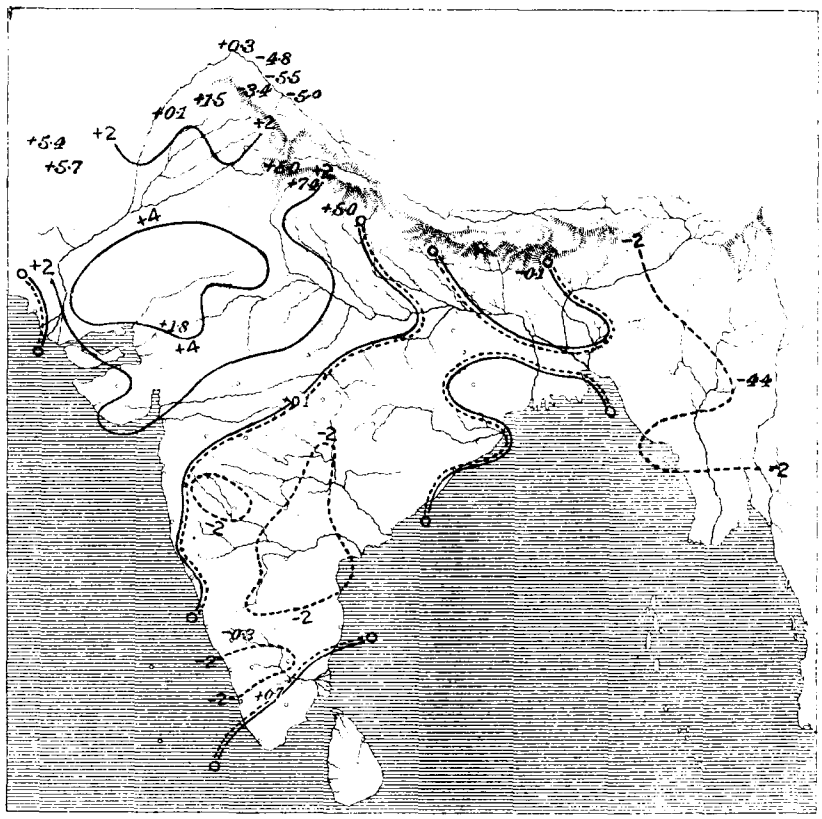


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MINIMUM TEMPERATURE.

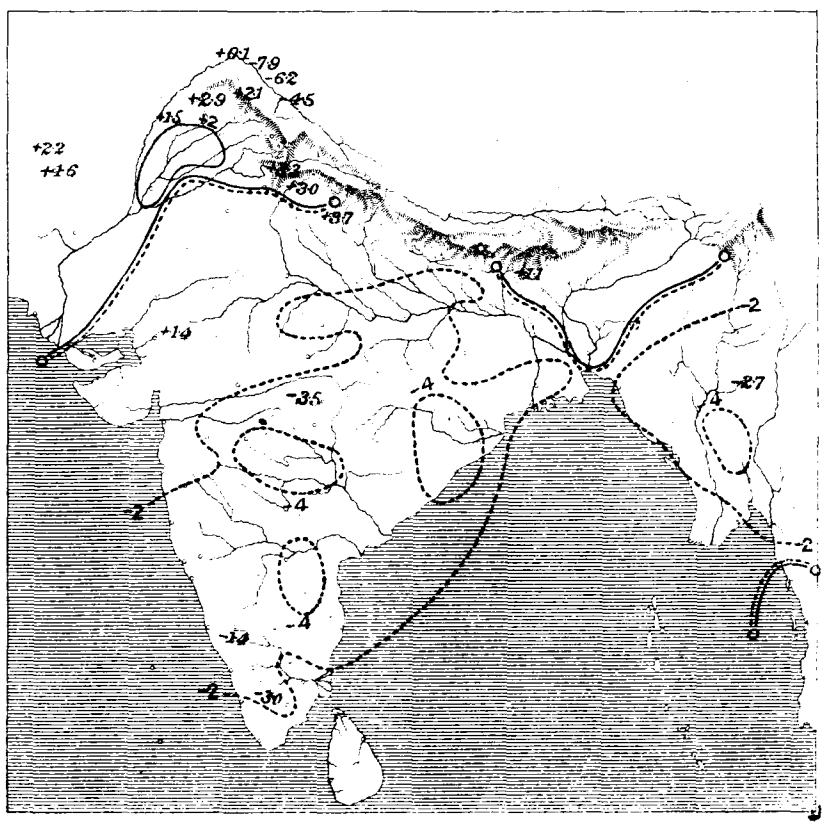


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

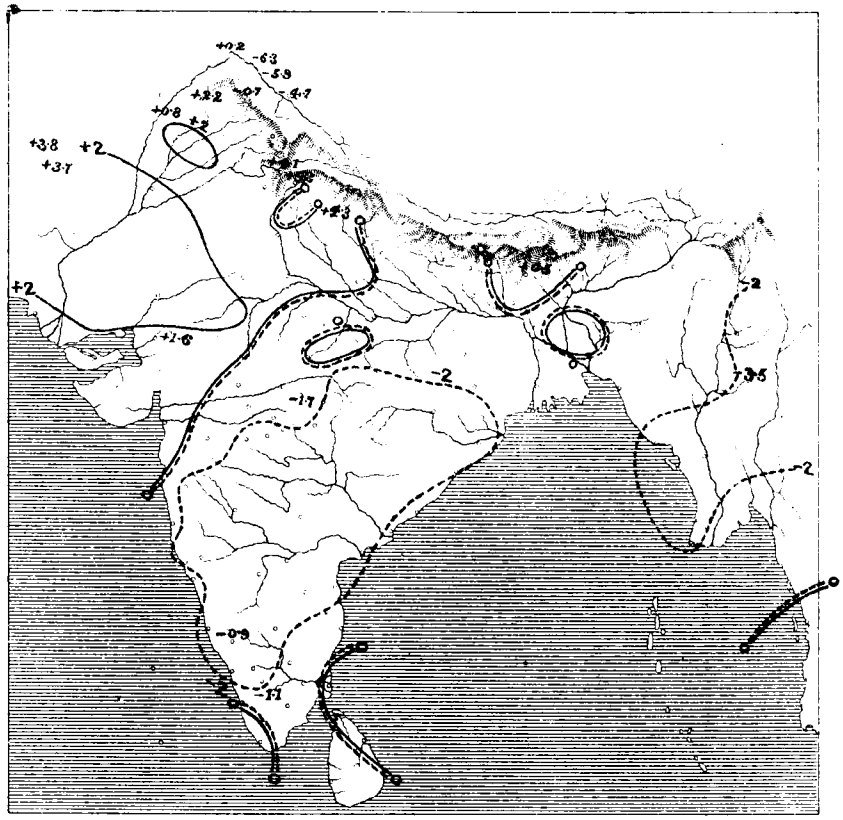


CHART SHEWING THE MONTHLY MEAN OF
PRESSURE AND RESULTANT
WIND DIRECTION.

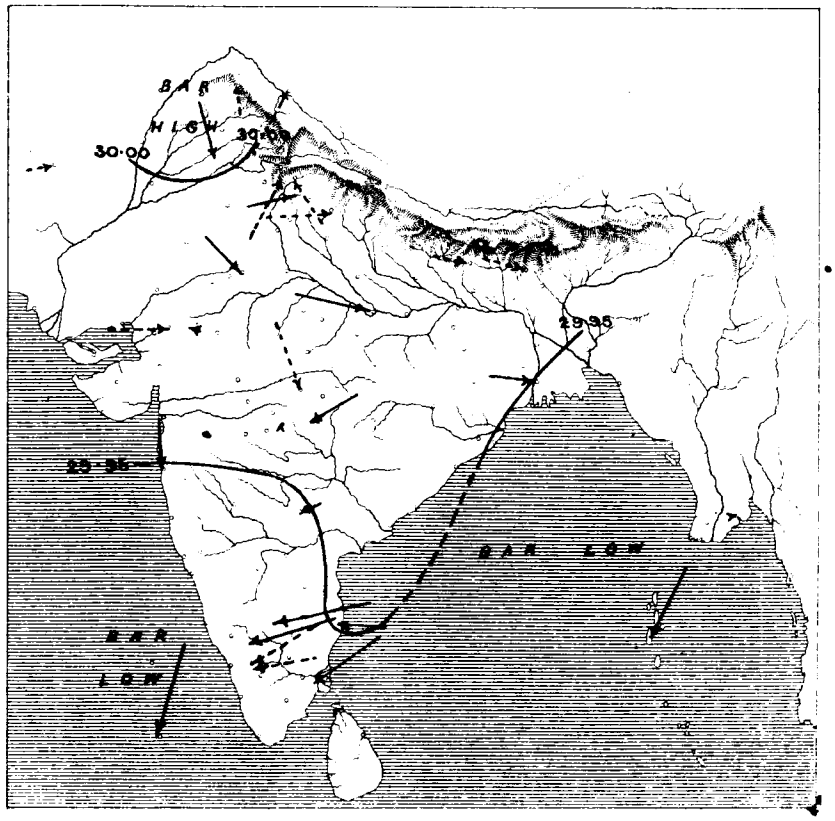


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF ABSOLUTE HUMIDITY AT 8 HRS.

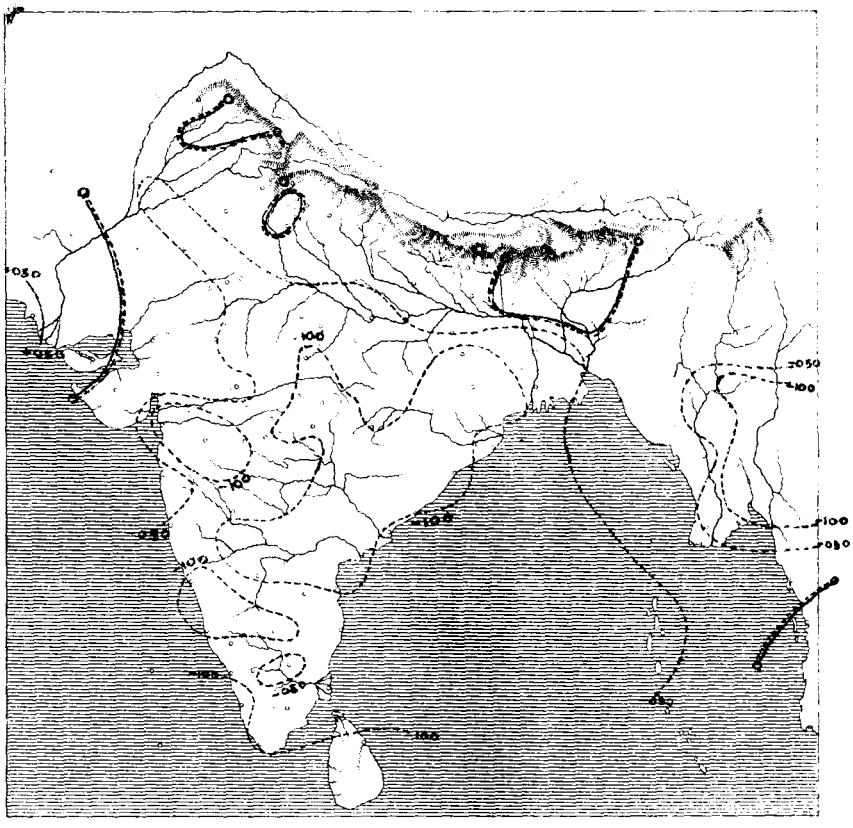


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF RELATIVE HUMIDITY AT 8 HRS.

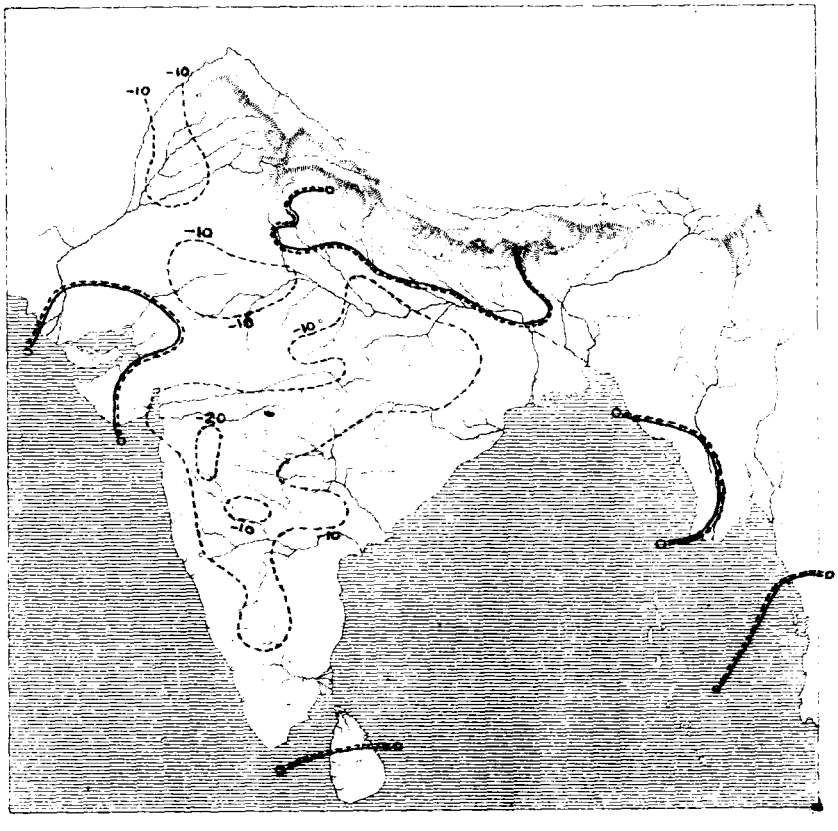


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

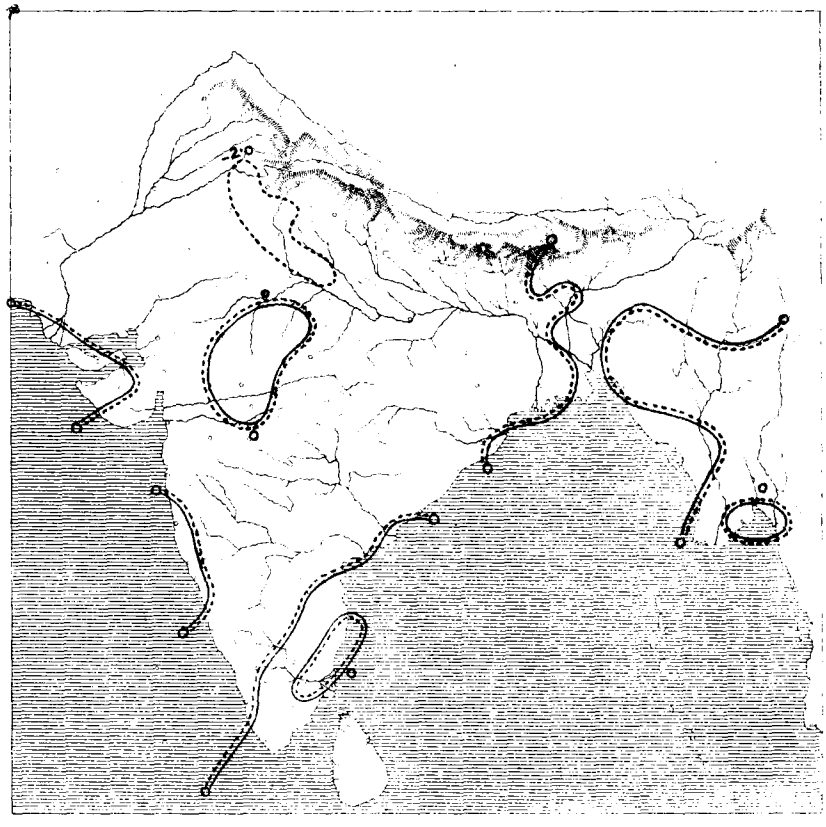
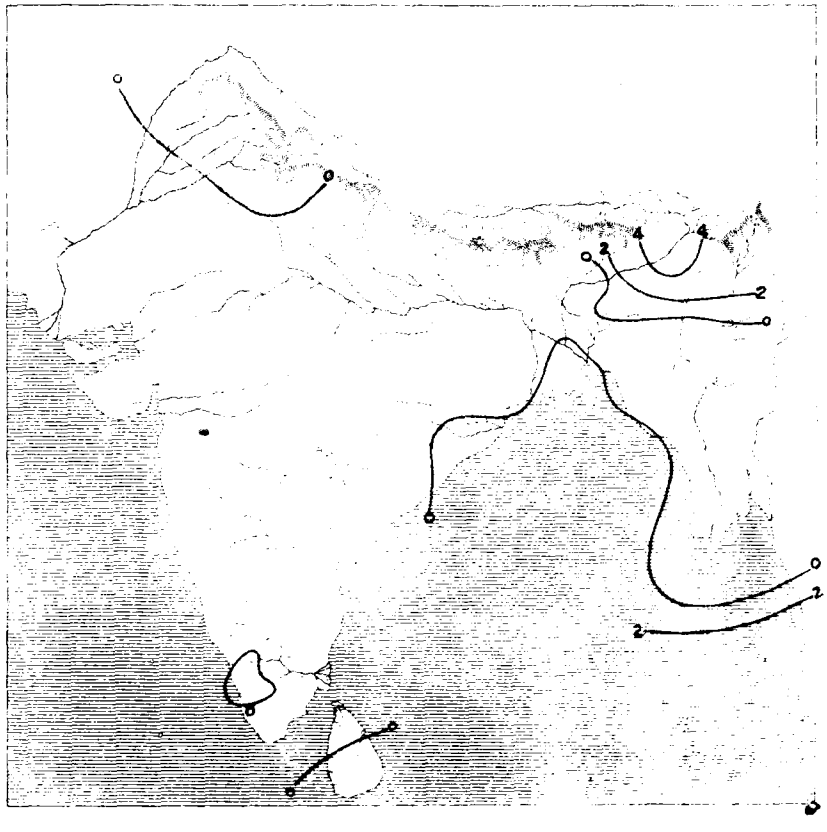
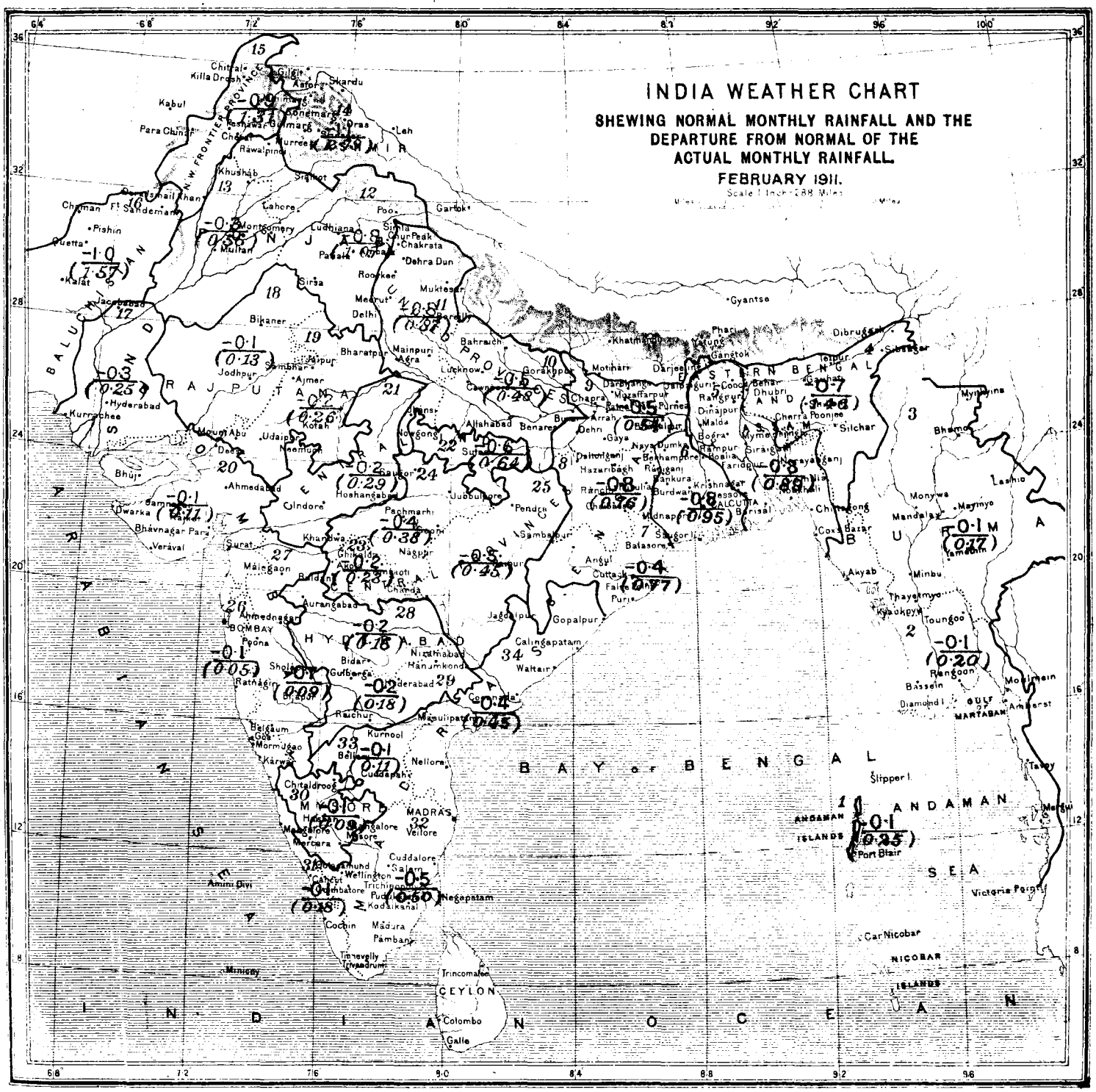


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)





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The country is divided into 34 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall; the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Eastern Bengal
6. Bengal
7. Orissa
8. Chota Nagpur
9. Bihar
10. United Provinces, East
11. Do., West
12. Punjab, East and North
13. Do., Southwest
14. Kashmir
15. Northwest Frontier Province
16. Baluchistan
17. Sind
18. Rajputana, West
19. Rajputana, East
20. Gujarat
21. Central India, West
22. Do., East
23. Berar
24. Central Provinces, West
25. Do., East
26. Konkan
27. Bombay, Deccan
28. Hyderabad, North
29. Do., South
30. Mysore
31. Malabar
32. Madras, Southeast
33. Madras, Deccan
34. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW.

PUBLISHED BY ORDER OF

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INTRODUCTION.

THIS review of the weather in India during the month of March, 1911, is based on observations taken daily at 8 hrs. at 237 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 32 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review. The brief notes on solar, seismic and magnetic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. Unlike the previous month March was remarkably disturbed owing to the advance eastwards in rapid succession of a considerable number of disturbances of the cold weather type from the highlands of Persia. The associated precipitation was unusually heavy over nearly the whole of northern India in some places surpassing all previous records for March. The influence of some of the disturbances extended eastwards as far as Upper Burma which accordingly obtained 64 per cent. more than its proper amount of rainfall. In Lower Burma, and the greater part of the Peninsula the weather was even more settled than usual.

The air was very damp, the sky unusually clouded and the temperature low in almost all parts of the area of excessive precipitation; elsewhere the conditions of humidity, cloud and temperature were in general not very different from those normal to the period.

Barometric pressure averaged over the plains was ·004″ in excess of the normal; though at the level of the hills the air was decidedly more rarefied than usual.

In years of ordinary meteorological conditions the transition from the cold to the hot weather characteristics begins early in March, but this year the winter has been considerably protracted.

Solar, seismic and magnetic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—Observations of the sun were made on all the days during the month.

Sun spots.—Seven new groups of spots were observed as against 6 in February. The daily average number was 1·0 and the average life of a spot was 4·3 days. On 11 days there was no spot on the sun at the time of observation. All the spots were small except those in group No. 1966 which were of moderate size. These first appeared on the 29th as a group of small dots but rapidly developed into two main spots with smaller dots between. All the spots observed were in the southern hemisphere and the distribution in latitude was as follows :—

TABLE 1.

	0°—10°.	11°—20°.	Mean latitude.	Extreme latitudes.
North . . .	...	...	...	...
South . . .	4	3	10°·3	2° and 18°

Prominences.—Twenty-seven large, 6 eruptive and 3 metallic prominences were recorded. Two of these were 150″ high and were observed on the 13th and 14th at latitudes +32° E. and +39° E. respectively.

Magnetic disturbances.—A "great" disturbance was recorded between the 21st and 23rd and "moderate" disturbances on the following dates :—4th to 6th, 13th to 14th and 24th to 27th. There was no spot on the visible disc of the sun at the time of the great disturbance.

Seismological records.

TABLE 2.

No.	Date,	P. T. Commencement G. M. T.	L. W. Commencement G. M. T.	Maxima, G. M. T.	End. G. M. T.	Maximum amplitude.	Duration.	REMARKS.
	1911.	H. M.	H. M.	H. M.	H. M.	mm.	H. M.	
16	March 11	3 37·7	...	...	4 44	...	1 06	Widening of line.
17	,, 14	21 08·0	...	...	22 12	...	1 04	Widening of line.
18	,, 22	5 43·6	5 54·2	6 16·4	7 09	0·3=0·3	1 25	
19	,, 22	7 46·4	7 53·5	8 07·8	8 25	0·25=0·2	0 39	
20	,, 27	9 07·2	...	...	9 18	...	0 11	Widening of line.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of March, 1911, the traces showed 7 calm days, 21 days of small, 2 days of moderate and 1 day of great disturbance.

The days of the month selected as "quiet" for the purposes of the Magnetic Survey of India are the 11th, 12th, 17th, 18th and 19th.

The following table represents the magnetic character of each day during the month.

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	C	17	C	25	S
2	S	10	C	18	C	26	S
3	S	11	C	19	C	27	S
4	S	12	C	20	G	28	S
5	M	13	S	21	M	29	S
6	S	14	S	22	S	30	S
7	S	15	S	23	S	31	S
8	S	16	S	24	S	...	...

C = calm, S = small, M = moderate, G = great, V. G. = very great.

The mean observed absolute values of the several magnetical elements reduced to the mean monthly tabulations of the magnetograms as also the ranges and the summed ranges of the horizontal force and declination for the month are as follow :—

Easterly declination	0° 55′ 57″
Horizontal force	0·36848 C.G.S. unit
Vertical force	0·16204 ,, ,,
Inclination	23° 44′·3
Inclination (observed)	23° 43′·3
Horizontal force range	0·00041 C.G.S. unit
Horizontal force summed range	0·00255 ,, ,,
Declination range	1′·7
Declination summed range	6′·8

(NOTE.—Summed range means sum without regard to signs of the 24 ordinates of diurnal inequality.)

Seismic disturbances.

No seismic disturbance has been recorded during the month at Bombay.

N. A. F. MOOS,
Director,
Bombay Observatory.

The Milne seismograph at the Alipore Observatory.

5. The driving clock of the seismograph was under repair from 8th to 28th March, 1911. There were no displacements in other days during this month.

E. P. HARRISON,
Offg. Meteorologist, Calcutta.

SIMLA OBSERVATORY.

6. *List of earthquakes recorded by the Omori-Ewing seismographs.*

TABLE 4.

Date.	Beginning of 1st P. T.	Beginning of 2nd P. T.	Beginning of L. W.	Time of maximum amplitude.	End approximately.	Duration.	Maximum displacement of style.	REMARKS.
	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
13th A	6 17·7	?	6 18·0	6 18·0	6 19·5	0 1·8	0·4	Local.
,, B	6 17·7	?	6 18·0	6 18·0	6 19·2	0 1·5	Small*	,,

All times are given in G. M. T.
A=E—W component.
B= N—S component.
Magnification of each instrument was 15.
* Displacements less than 0·2 mm. are reported as "small."

The following table contains a list of earthquakes that have been reported.

TABLE 5.

Place at which felt.	Date.	G. M. T. of earthquake. H.	M.	Duration. Sec.	Intensity Rossi Forel scale.	No. of shocks.	REMARKS.
Salonah (Assam) .	1st	21	53	10	5	1	
„ „ . .	2nd	5	50	30	6	2	
Shillong . . .	2nd	6	0	2	6	1	
„ . . .	3rd	8	7	2	5	1	
Drosh . . .	8th	23	15	2	3	1	
„ . . .	9th	15	0	3	4	1	
Shillong . . .	10th	9	33	1	4	1	
„ . . .	11th	10	14	1	5	1	
Chitral . . .	13th	21	45	3	7	2	
Drosh . . .	14th	22	14	4	5	2	
Shillong . . .	15th	21	15	1 Min.	4	1	
Raipur District .	17th	15	5	2 Sec.	4	2	
Shillong . . .	20th	15	5	1	3	1	
Salonah . . .	22nd	14	49	20	4	1	
Drosh . . .	31st	4	55	1	5	1	

Solar radiation.—The following figures give the intensity of solar radiation, as measured at Simla by Angstrom's pyrheliometer. The values are corrected to local noon, and expressed in grammecalories per square centimetre per minute.

Maximum	1·54
Minimum	1·45
Mean	1·49
Number of days of observation . . .	9

W. A. HARWOOD,
Imperial Meteorologist.

ROYAL ALFRED OBSERVATORY, MAURITIUS.

7. The following information has been communicated by the Director of the Observatory.

Magnetic disturbances.

TABLE 6.

Day.	Time.	Disturbance.
Mar. 1911.		
3rd	22½h. to 24h.	Wave in H. F. (+29).
4th to 5th	23¾h. to 2½h.	Frequent irregular fluctuations in H. F. (±5). Slight undulations continued till 6d. 2h. with larger waves 5d. 13h. to 15h. (−30); 5d. 17¾h. to 19h. (−20); 15d. 19¾h. to 21h. (−20).
5th	20¾h. to 21¼h.	In declination small wave (+20).
6th	22½h. to 24h.	Wave in H. F. (+30).
8th	14h. to 18h.	Shallow wave in H. F. (−40).
13th		Accentuated diurnal variation in H. F.
20th	4h. to 4h. of 21st	
21st, 22nd	19½h. to 22¾h.	Two successive waves in H. F. (+45) and (+30) culminating respectively at 20½h. and 22¾h.
21st	19½h. to 20½h.	Wave in declination (+30).
Do.	23h. to 1½h. of 22nd.	Wave in H. F. (+30).
26th	23h. to 24h.	Wave in H. F. (+30).
27th	23¼h. to 1½h. of 28th.	Irregular wave in H. F. (+30).

Weather in the Indian monsoon region.

8. In the subequatorial region the air movement was abnormal in character both at Seychelles and Zanzibar, and the total amount of rainfall recorded during the month was largely in defect at the former station, and markedly in excess at the latter. Barometric pressure however departed but little from the mean.

TABLE 7.

	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure.		−·003	+·014
Actual mean wind direction .		S 9° E	N 1° E
Normal mean wind direction .		S 44° E	N 17° W
Actual mean wind velocity (miles per diem).		92	132
Normal mean wind velocity (miles per diem).		130	118
Rainfall departure from normal.		+4·35	−5·23

Depressions and cyclonic storms.

9. In northern India the disturbances of the cold weather type which constitute the chief feature of the meteorology of the period December to February are in March of comparatively rare occurrence and their paths occupy a more northerly position. During the month under review no less than six such disturbances appeared over Persia and were thence transmitted eastwards into India, and of these half the number lay further south than usual and thus succeeded in reaching northeast India.

With the exception of two all the disturbances were feeble barometrically; all of them were however fruitful in precipitation.

According to the Egyptian Daily Charts at least three of the disturbances were probably the continuation of depressions which had previously affected Crete and Cyprus in the Mediterranean.

Pressure.

10. On the mean of the whole month the barometer stood lower than usual at the level of the hill stations, but all over the plains with the exception of the Indus valley, Rajputana, Central India, parts of Burma and a few places elsewhere pressure inclined to be high. The abnormalities of pressure were thus such as in the winter season are usually associated with more disturbed weather than usual.

TABLE 8.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	"		"	"
Quetta	—·049	Jacobabad	—·011	+·038
Leh	—·060	Lahore	+·006	+·066
Murree	—·048	Peshawar	—·012	+·036
Simla	—·038	Ludhiana	+·020	+·058
Chakrata	—·050	Roorkee	+·035	+·085
Darjiling	—·046	Dhubri	+·017	+·063
Mount Abu	—·028	Deesa	0	+·028
Pachmarhi	—·004	Khandwa	+·009	+·013
Kodaikanal	—·017	Madura	+·010	+·027

TABLE 9.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	"
Burma	—·002
Eastern Bengal and Assam	+·011
Bengal	+·009
United Provinces	+·017
Punjab	+·012
North-West Frontier Province	—·015
Sind	—·006
Rajputana	—·004
Bombay	+·005
Central India	—·002
Central Provinces	+·002
Hyderabad	+·001
Mysore	+·006
Madras	+·002

Temperature.

11. Temperature was below the normal throughout nearly the whole Indian region, the only exception being southeast Madras where there was a very small excess. The defect ranged between 3° and 7° over the North-West Frontier Province, the Punjab and the United Provinces and between 2° and 5° in Baluchistan, Kashmir, Sind, Rajputana, Gujarat, Central India, the Central Provinces, Bihar and Chota Nagpur, but it declined rapidly further south and east and was very small in the Deccan, Assam and Burma.

In Burma and almost all parts of northern and central India temperature was in much greater defect during the day than at night; on the west coast however this condition was reversed.

A spell of abnormally cool weather was experienced over the plains of northern India from the 14th to the 24th, the lowness of temperature was, as is usually the case during periods of precipitation, greater in the day than in the night temperature, the maxima at times being as much as 15° to 31° below the normal in several places.

TABLE 10.

Sub-division.	Actual temperature.					Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
1. Bay Islands	87·8	75·5	81·7	12·3	17·1	—1·9	—1·6	—0·3
2. Lower Burma	89·9	70·5	80·2	19·4	28·3	—2·2	—0·7	—1·5
3. Upper Burma	92·1	63·9	78·0	28·3	37·8	—2·1	—0·5	—1·6
4. Assam	80·8	61·0	70·9	19·7	32·5	—2·7	—1·0	—1·7
5. Eastern Bengal	86·1	63·9	75·0	22·2	36·8	—1·8	—0·6	—1·2
6. Bengal	90·1	66·9	78·5	23·2	37·5	—2·1	—1·4	—0·7
7. Orissa	91·0	70·1	80·6	20·9	33·2	—2·2	—0·9	—1·3
8. Chota Nagpur	88·3	61·4	74·8	26·9	42·2	—3·2	—3·0	—0·2
9. Bihar	85·5	61·5	73·5	24·1	38·7	—5·1	—1·7	—3·4
10. United Provinces, East	85·2	59·2	72·1	26·0	42·9	—6·1	—1·8	—4·3
11. Do. do., West	80·8	56·7	68·7	24·1	42·5	—6·8	—2·7	—4·1
12. Punjab, East and North	75·7	54·2	65·0	21·5	41·1	—8·2	—2·2	—6·0
13. Do., Southwest	77·0	56·0	66·5	21·0	40·6	—8·1	—0·9	—7·2
14. Kashmir	44·3	23·5	33·9	20·8	44·0	—4·8	—3·4	—1·4
15. North-West Frontier Province	70·5	52·7	61·6	17·7	37·1	—9·3	—0·9	—8·4
16. Baluchistan	68·4	49·7	59·1	18·7	41·1	—4·8	—1·0	—3·8
17. Sind	82·8	62·2	72·5	20·6	40·1	—6·0	—1·7	—4·3
18. Rajputana, West	84·3	60·7	72·5	23·5	44·3	—5·9	—3·3	—2·6
19. Do., East	85·0	59·6	72·3	25·4	44·7	—4·9	—1·6	—3·3
20. Gujarat	88·3	64·4	76·4	23·9	42·1	—5·0	—1·3	—3·7
21. Central India, West	86·9	58·9	72·9	28·0	48·9	—5·1	—2·1	—3·0
22. Do., East	86·5	60·5	73·5	26·1	42·9	—6·0	—1·9	—4·1
23. Berar	93·0	65·4	79·2	27·6	44·7	—3·9	—3·1	—0·8
24. Central Provinces, West	90·5	61·9	76·2	28·6	46·0	—4·4	—2·4	—2·0
25. Do., East	91·5	64·7	78·1	26·8	41·7	—3·6	—2·5	—1·1
26. Konkan	85·6	71·5	78·6	14·1	22·8	—1·5	—2·2	+0·7
27. Bombay Deccan	94·4	63·9	79·1	30·5	45·5	—2·2	—1·8	—0·4
28. Hyderabad, North	94·6	68·1	81·3	26·5	41·2	—2·8	—0·3	—2·5
29. Do., South	97·4	72·0	84·7	25·5	38·2	—0·9	+0·3	—1·2
30. Mysore	91·7	65·9	78·8	25·9	36·0	—0·7	—0·2	—0·5

Sub-division.	Actual temperature. Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Departure from normal of Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
31. Malabar	88·9	74·7	81·8	14·3	21·5	—0·9	—1·0	+0·1
32. Madras, Southeast	94·6	73·2	83·9	21·4	30·6	+0·4	+0·4	0
33. Do. Deccan	100·6	73·2	86·9	27·4	40·5	—0·4	+0·3	—0·7
34. Do. Coast, North	89·8	73·7	81·7	16·0	26·9	—0·9	+0·6	—1·5

TABLE 11.

Division.	Departure from normal of Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	—2·1	—0·6	—1·4
Eastern Bengal and Assam	—2·1	—0·7	—1·4
Bengal	—3·1	—1·7	—2·4
United Provinces	—6·5	—2·3	—4·4
Punjab	—8·2	—1·9	—5·0
North-West Frontier Province	—9·3	—0·9	—5·1

Division.	Departure from normal of Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Sind	—6·0	—1·7	—3·8
Rajputana	—5·2	—2·1	—3·6
Bombay	—3·0	—1·7	—2·3
Central India	—5·4	—2·0	—3·7
Central Provinces	—4·1	—2·5	—3·3
Hyderabad	—1·5	+0·1	—0·7
Mysore	—0·7	—0·2	—0·5
Madras	—0·2	+0·1	0

Winds.

12. (*a*) The rate of air movement was either almost equal to or below the average throughout the country with the exception of the Punjab and Burma.

(*b*) In the Peninsula which practically lay outside the influence of the disturbances of the month, as well as in the North-West Frontier Province the winds blew with more than their usual steadiness, while in the greater part of the region affected by the unsettled conditions the steadiness was below the average.

(*c*) The deflections from the normal course of air movement were local and of no great significance.

TABLE 12.

Division.	Departure from normal of Hourly wind velocity.	Wind steadiness.
Burma	+0·6	—14
Eastern Bengal and Assam	—1·1	— 3

Division.	Departure from normal of Hourly wind velocity.	Wind steadiness.
Bengal	—0·1	— 7
United Provinces	—0·1	—11
Punjab	+0·6	+ 1
North-West Frontier Province	—0·7	+ 7
Sind	—0·2	+ 2
Rajputana	+0·3	+ 2
Bombay	—0·4	+10
Central India	—0·7	— 9
Central Provinces	+0·2	+ 5
Hyderabad	—0·9	+ 7
Mysore	—0·4	+15
Madras	+0·2	+ 3

Humidity and cloud.

13. There was less than the usual amount of aqueous vapour in Burma, northeast India excluding the districts to the west of longitude 88° E. and nearly the whole of the Peninsula with the exception of southeast Madras and Ganjam, but elsewhere in the plains the absolute humidity was above the average. At the level of the hill stations the departures from the normal condition were feebly marked and in the case of Kashmir and Baluchistan were the opposite of those in the neighbouring plains, an indication that the disturbances of the month were active chiefly in the lower strata of the atmosphere.

The distribution of the relative humidity was in general similar to that of the absolute humidity.

The sky was covered to much more than the customary extent throughout practically the whole of northern and central India as well as on the west coast of the Bay and at a few places in Burma; while in almost all other places the cloud proportion was very low. The excess was on the whole greatest in northwest and central India and especially at Khushab where it exceeded three-tenths of the sky expanse.

TABLE 13.

Division.	Hygrometry; 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	75	+2	·630	—·013	2·2	—0·3
Eastern Bengal and Assam	78	—2	·569	—·030	3·5	0
Bengal	68	+3	·522	—·004	2·4	+0·2
United Provinces	64	+11	·400	+·033	2·9	+0·9
Punjab	76	+16	·395	+·039	4·3	+1·4
North-West Frontier Province.	83	+15	·389	+·029	5·3	+1·3
Sind	69	+12	·474	+·056	3·6	+1·1
Rajputana	53	+12	·352	+·022	3·6	+1·3
Bombay	61	+2	·504	—·017	1·5	—0·1
Central India	51	+9	·349	+·029	3·1	+1·7
Central Provinces	42	—1	·330	—·038	1·6	—0·1
Hyderabad	42	—6	·399	—·070	1·2	—0·3
Mysore	63	0	·533	—·007	0·4	—1·2
Madras	73	—1	·754	—·010	2·1	—0·1

Rainfall.

14. As occasionally happens when February is very dry, the weather in March was exceedingly disturbed. Several disturbances of the cold weather type appeared in rapid succession in Persia and were thence transferred eastwards; of these, three succeeded in reaching northeast India. Weather in northern India was accordingly unsettled almost continuously; particularly between the 8th and the 18th when there occurred in northwest India widespread and in places heavy precipitation, such in fact as has not been recorded in March for many years. In the western Himalayas snowfall occurred down to comparatively low levels as late as the 18th.

In nearly all parts of northern India as well as in Upper Burma the average precipitation was largely exceeded; in the region comprising the Punjab, Rajputana, and Gujarat more than quadrupled. So excessive indeed was the precipitation that in the case of some stations in northwest India no previous record exists of anything approaching it.

In Lower Burma, Central India East, Berar, the Central Provinces East, Madras, Hyderabad, Mysore and the greater part of Bombay there was either little or no rain, or less than the average.

TABLE 14.

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
1. Bay Islands	0	0·5	0	0·20	—0·20	—100
2. Lower Burma	0·4	0·4	0·20	0·26	—0·06	— 23

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
3. Upper Burma	1·2	0·7	0·41	0·25	+0·16	+ 64
4. Assam	6·8	7·0	3·58	4·51	—0·93	− 21
5. Eastern Bengal	3·5	2·5	2·12	1·79	+0·33	+ 18
6. Bengal	3·5	1·9	1·61	1·15	+0·46	+ 40
7. Orissa	2·3	1·9	1·35	1·09	+0·26	+ 24
8. Chota Nagpur	3·2	1·4	1·23	0·71	+0·52	+ 73
9. Bihar	2·3	0·8	0·86	0·38	+0·48	+126
10. United Provinces, East	3·0	0·7	1·17	0·31	+0·86	+277
11. Do., West	4·1	1·1	1·82	0·48	+1·34	+279
12. Punjab, East and North	6·9	1·5	4·25	0·72	+3·53	+490
13. Do., Southwest	6·3	1·3	3·24	0·50	+2·74	+548
14. Kashmir	8·6	4·8	7·02	2·46	+4·56	+185
15. North-West Frontier Province	1·2	3·5	7·07	1·85	+5·22	+282
16. Baluchistan	6·2	3·1	3·81	1·12	+2·69	+240
17. Sind	1·1	0·4	0·59	0·16	+0·43	+269
18. Rajputana, West	2·3	0·2	1·19	0·07	+1·12	+1600
19. Do., East	2·4	0·5	0·69	0·19	+0·50	+263
20. Gujarat	1·9	0·1	0·84	0·02	+0·82	+4100
21. Central India, West	0·4	0·2	0·12	0·08	+0·04	+ 50
22. Do., East	2·1	0·7	0·79	0·31	+0·48	+155
23. Berar	0·2	0·7	0·04	0·32	—0·28	− 87
24. Central Provinces, West	1·4	0·8	0·40	0·36	+0·04	+ 11
25. Do., East	1·0	1·3	0·49	0·64	—0·15	− 23
26. Konkan	0·1	0·1	0·08	0·06	+0·02	+ 33
27. Bombay Deccan	0·2	0·4	0·14	0·19	—0·05	− 26
28. Hyderabad, North	0·2	0·8	0·10	0·34	—0·24	− 71
29. Hyderabad, South	0·1	0·8	0·01	0·49	—0·48	− 98
30. Mysore	0·4	0·6	0·22	0·31	−0·09	− 29
31. Malabar	0·3	1·0	0·22	0·57	−0·35	− 61
32. Madras, Southeast	0·4	0·6	0·17	0·44	—0·27	− 61
33. Do. Deccan	0·1	0·2	0·03	0·16	−0·13	− 81
34. Do. Coast, North	0·1	0·8	0·35	0·43	−0·08	− 19

TABLE 15.

DIVISION.	RAINFALL.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	0·31	0·26	+0·05	+ 19
Eastern Bengal and Assam	2·88	3·17	—0·29	— 9
Bengal	1·22	0·77	+0·45	+ 58
United Provinces	1·47	0·39	+1·08	+ 277
Punjab	4·05	0·68	+3·37	+ 496
North-West Frontier Province	7·07	1·85	+5·22	+ 282
Sind	0·59	0·16	+0·43	+ 269
Rajputana	0·85	0·15	+0·70	+467
Bombay	0·36	0·11	+0·25	+227
Central India	0·35	0·16	+0·19	+119
Central Provinces	0·27	0·41	—0·14	— 34
Hyderabad	0·05	0·42	—0·37	— 88
Mysore	0·22	0·31	—0·09	— 29
Madras	0·21	0·41	—0·20	— 49
Mean of India	1·12	0·58	+0·54	+ 93

Snowfall.

I.—PERSIA.

15. At Meshed a total of 10 inches fell on three days.

II.—AFGHANISTAN.

No information has yet been received.

III.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Wano.*—Snowstorms occurred on the surrounding mountains on the 1st, 9th, 10th, 11th, 14th, and 16th and the last of these extended to the level of the plains of Wano (elevation 4,500 feet).

The following statement shows the character of the snowfall in this region.

TABLE 16.

Locality.	Total snowfall of month.	
	Feet.	Inches.
Marwatti and Pirghal	5	7
Jani Mela and Spera	3	1
Kotkun	1	5
Bosh and Dre Nashtar	3	0
Kundighar	1	0
Wano plain	0	3

At the end of the month only about 6 inches of snow remained unmelted on the higher passes.

(*b*) *Tochi (North Waziristan).*—Heavy snow fell from the 10th to the 16th on the hills in and near North Waziristan.

(*c*) *Kurram.*—Snowfall occurred on the Sufed Koh on the 1st, 3rd, 4th, 5th and daily from the 9th to the 17th. The falls of the 11th to the 17th extended to Parachinar.

At the end of the month the unmelted residue on the Paiwar Kotal and other passes was believed to be greater than usual.

(*d*) *Kohat.*—Snow fell on six days at Fort Lockhart and on one day in the Samalzai hills and Sudder line. The statement below shows the total fall recorded in the various localities :—

TABLE 17.

Locality.	Total amount received during the month.	
	Feet.	Inches.
Samana Range	1	½
Baktawar Khawantar	1	0
Bilandar Hill	1	0
Mani Khel Hill	1	0
Tirah Hill	2	0
Marai Hill	4	0
Mozioghar	5	0
Bur Mohammad Khel Hill	5	0
Samana Fort Lockhart	0	10

(*e*) *Hazara.*—The following statement shows the character of the snowfall in this district :—

TABLE 18.

Name of range or station.	Total depth of snowfall.		Number of days on which snow fell.
	Feet.	Inches.	
Malkandi (Kagan Range) . . .	0	3	4
Jared („) . . .	1	1	8
Kagan („) . . .	7	9	11
Paluderan („) . . .	11	6	16
Narang („) . . .	17	11	16
*Dungagali range	10	0	6
Tandiani „	19	5	12
*Panjul (Siran range)	3	0	5

* Data for the last 15 days wanting.

The snowline came down to about 3,000 feet.

On the 15th of the month the depth of the accumulations was estimated at 8 feet on the Tandiani range and at 5½ feet on the Dungagali range.

IV.—KASHMIR.

The statement below shows the character of the snowfall at the observing stations and on the surrounding hills :—

TABLE 19.

Place.	Number of days on which snow fell.	Reported depth.		Depth of accumulation at the end of the month.
		Feet.	Inches.	
Srinagar . .	6	1	2	
Skardu . .	7	1	1	
Mountains adjacent to Skardu.	15	Not known but much greater than at Skardu.		On the higher peaks not less than 8 yards.
Kargil . . .	13	1	10½	3 feet.
Hills near Kargil .	14	7	4	16 „

V.—PUNJAB.

(*a*) *Murree.*—Snow fell on five occasions in Murree and on four days on the hills adjacent to Kahuta : the total fall amounted to 2½ feet in the former locality and 3 feet in the latter.

(*b*) *Poo.*—There were altogether twelve falls giving a total depth of about 6 feet of snow. The falls were general and the passes remained inaccessible.

(*c*) *Kailang.*—Snow fell on twelve days to a total depth of 6′ 7″.

(*d*) *Kilba* (Simla Hills).—There were in all eleven falls and of these five descended as low as 5,750 feet. The falls are said to have extended over the whole of Kanawar.

VI.—UNITED PROVINCES.

(*a*) *Garhwal.*—Snow fell continuously during the month on the higher ranges in the district. The falls of the 17th and 18th were heavy and descended to a level of about 6,000 feet. Weather was generally cold.

(*b*) *Almora.*—No information has yet been received.

SUMMARY.

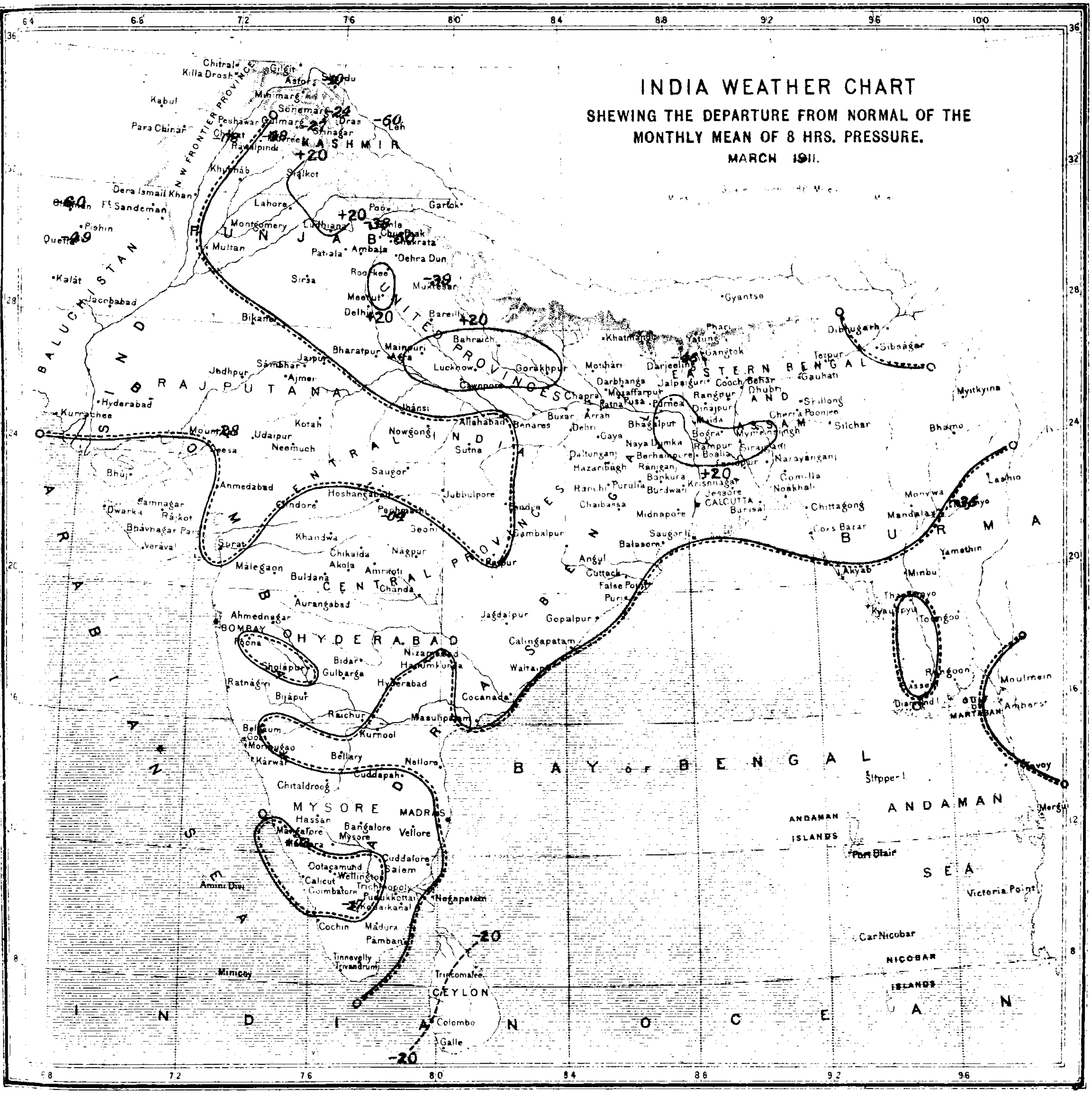
16. The information received up to the present is very scanty. It indicates, however, that the snowfall in the western Himalayas and the hill districts of the North-West Frontier Province was greater than usual. In the Hazara Hills snow is reported to have fallen as low as 3,000 feet.

HEM RAJ.

The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2 miles per hour	...	one feather added to the wind arrow
,,	,, 2 to 5 ,, ,, ,,	...	two feathers ,, ,, ,, ,,
,,	,, 5 to 10 ,, ,, ,,		three ,, ,, ,, ,, ,,
,,	,, 10 to 20 ,, ,, ,,		four ,, ,, ,, ,, ,,
	over 20 ,, ,, ,,	...	five ,, ,, ,, ,, ,,



Reg. No. 4170 E., 14—2—1250
LITHO. BY S. S. MUNDLE.

The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020 or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MAXIMUM TEMPERATURE.

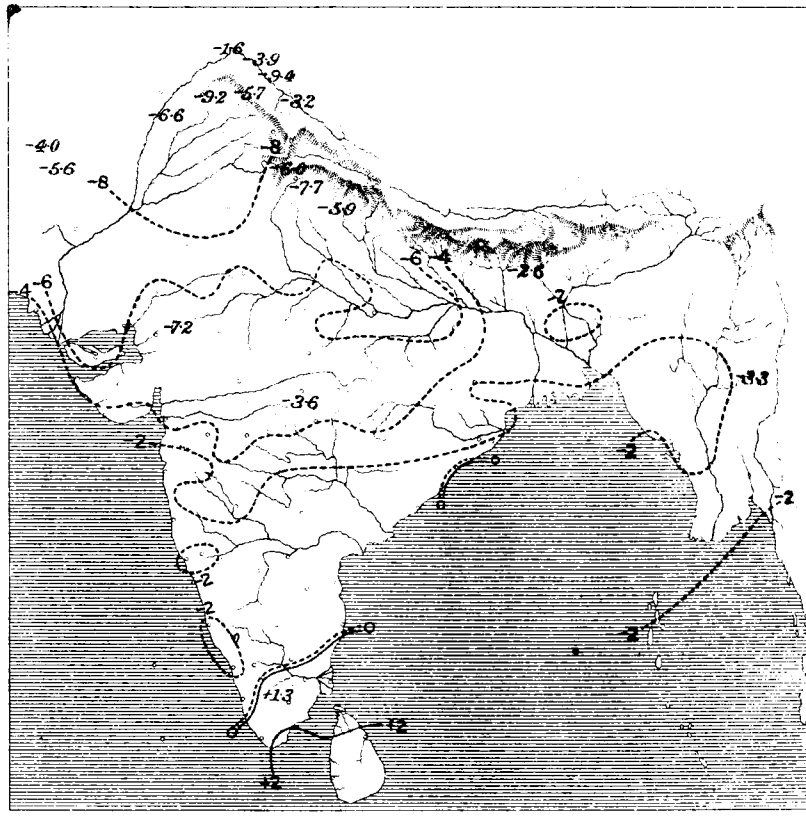


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MINIMUM TEMPERATURE.

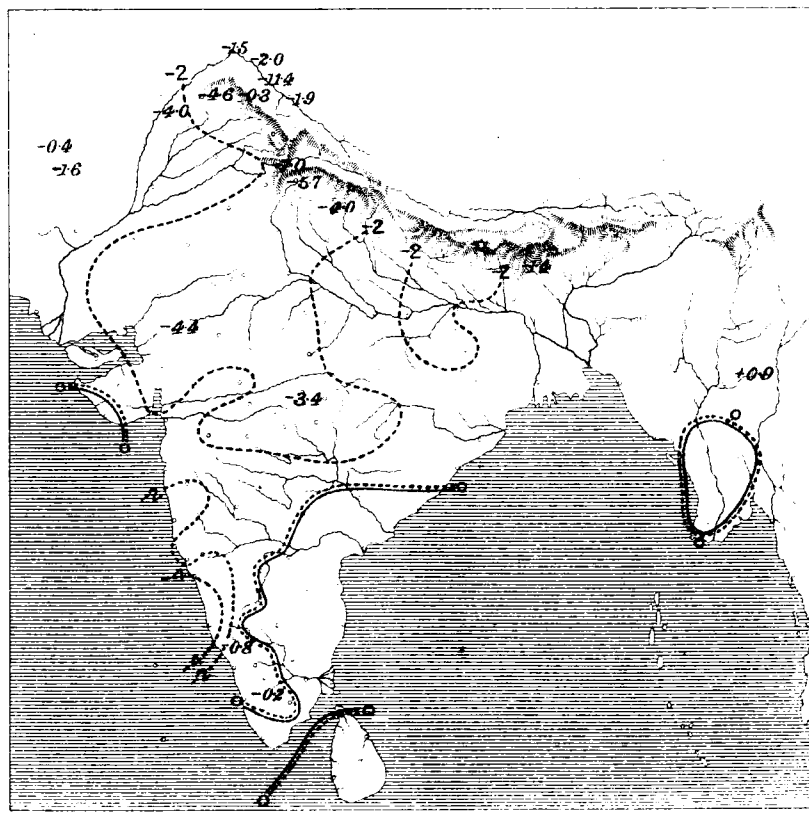


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

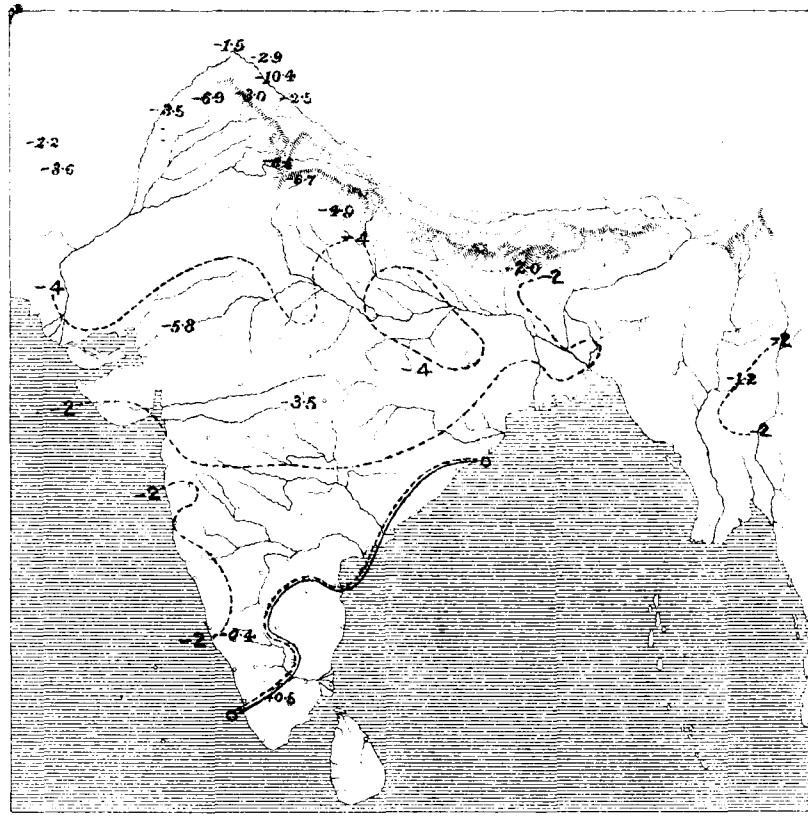


CHART SHEWING THE MONTHLY MEAN OF
PRESSURE AND RESULTANT
WIND DIRECTION.

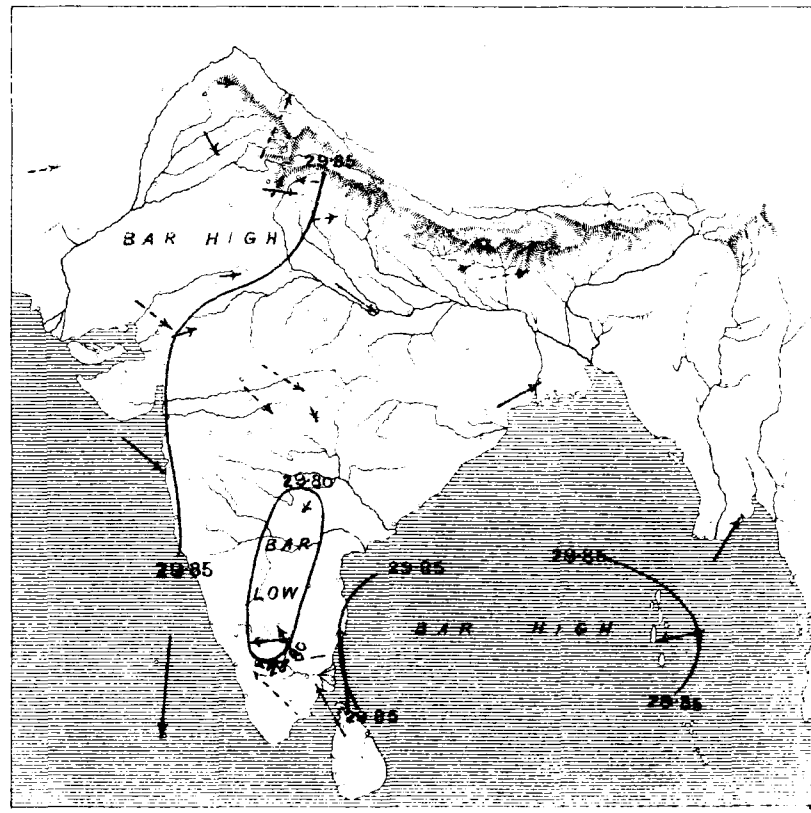


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF ABSOLUTE HUMIDITY AT 8 HRS.

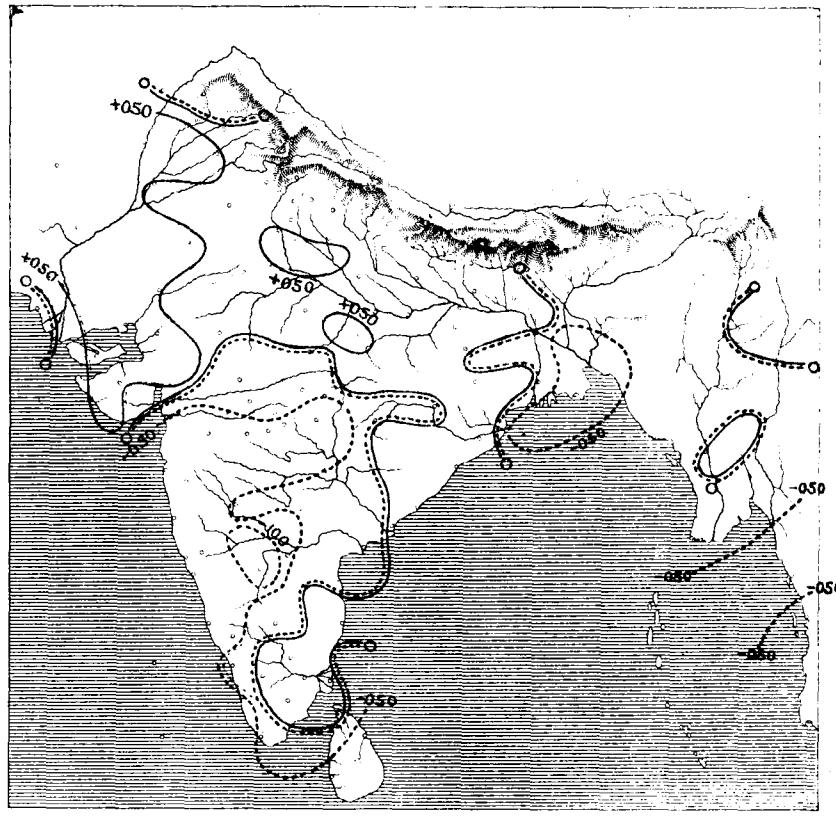


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF RELATIVE HUMIDITY AT 8 HRS.

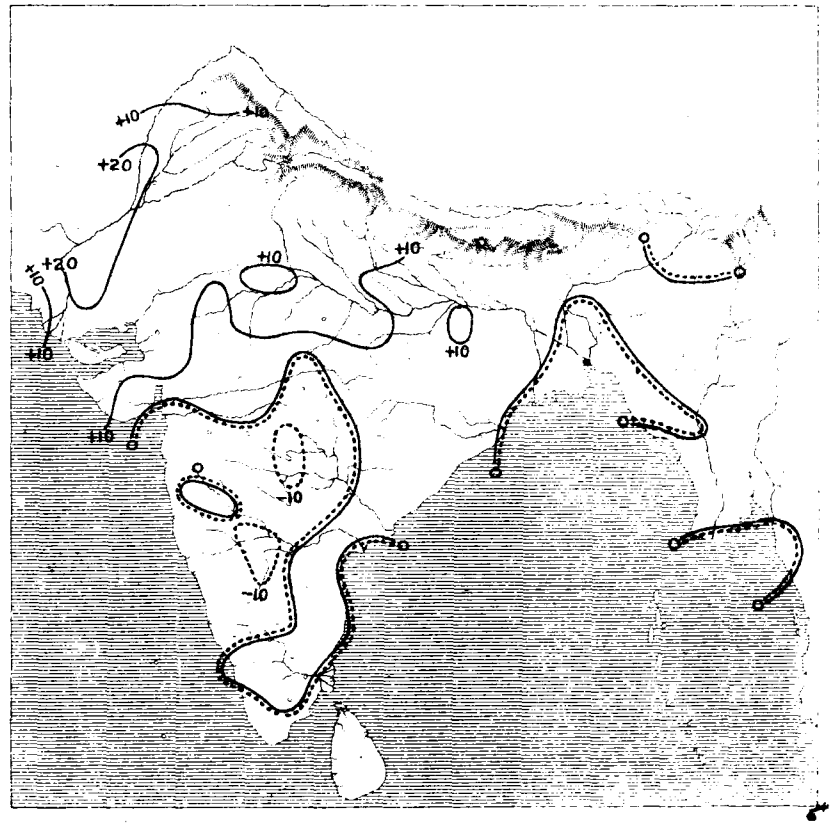


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

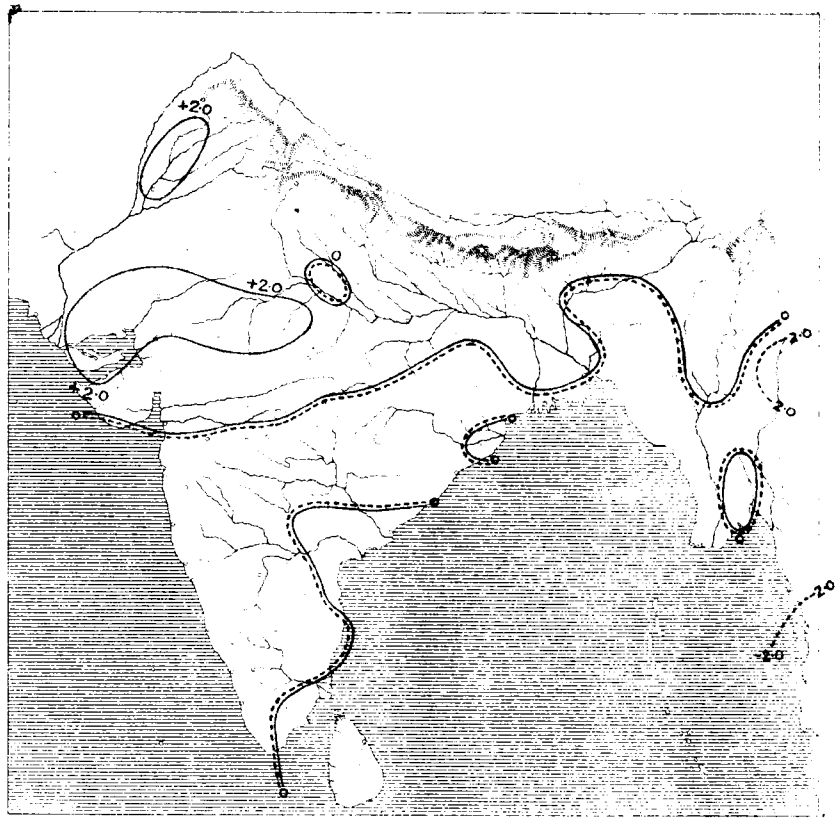


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW.

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, APRIL, 1911.

INTRODUCTION.

THIS review of the weather in India during the month of April, 1911, is based on observations taken daily at 8 hrs. at 241 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 32 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review. The brief notes on solar, seismic and magnetic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. A storm appeared over the Bay of Bengal at about the middle of the month, and travelled to the coast between Akyab and Chittagong. It was of considerable intensity and occasioned moderate to heavy rainfall in Burma. Over the land area of India the usual hot weather conditions were but feebly developed, and very dry weather prevailed over by far the greater part of the country: Indeed the Bay Islands, Burma, Eastern Bengal, Orissa and Baluchistan were the only areas which received more precipitation than usual. Little or no rain fell in the United Provinces, Sind, Rajputana, Gujarat, Central India, the Central Provinces, the Konkan, Hyderabad North and the Bombay Deccan; the normal falls in most of these areas do not exceed half an inch in amount.

In spite of the prevalence of unusually dry weather temperature, both by day and night, was low in the extra-tropical parts of India, the lowness being on the whole most marked in the Punjab and the North-West Frontier Province. In the Peninsula excluding the Konkan, on the other hand, the weather was if anything slightly warmer than usual. The air was excessively dry in Hyderabad, the Central Provinces and the Bombay Deccan, regions where the wind contained a large northerly component; and the sky was remarkably free from cloud.

Mean barometric pressure over the plains of India did not depart materially from the normal, being only ·003" in excess.

Solar, seismic and magnetic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—Observations for spots and faculæ were made on all the days during the month, but on two days prominences could not be observed owing to bad weather.

Sunspots.—Eight new groups of spots were observed as against 7 in March. Three of them, Nos. 1970, 1972 and 1973, were of moderate size. The daily average number was 1·7 and the average life of a spot was 6·5 days. On 6 days there was no spot on the visible disc of the sun at the time of observation, while there were 11 such days in March. There was a slight renewal of activity in the northern hemisphere after a period of three months without any spots. The distribution in latitude was as follows:—

TABLE 1.

	0° — 10°	11° — 20°	Mean latitude.	Extreme latitudes.
North	3	—	8°. 0	6° and 10°
South	5	—	6°. 4	2° and 8°

Prominences.—Forty-four large, 12 eruptive and 3 metallic prominences were recorded during the month. One of the highest ever recorded here was observed on the 2nd April. It first appears on the photographs as a long wide-streamer issuing from a point in latitude —34° east in a northerly direction and nearly tangent to the limb. Very soon it was found to be rising, and a series of photographs was taken which showed that the whole mass reared up to a great height and then broke into fragments which quickly faded. The highest fragment was over 10′ above the limb at 11h. 24m.

Measures of the velocity of ascent on four photographs gave the following results :—

Between	9h.	26m.	and 10h.	9m.	46 Km. per second
„	10	09	10	12	69 „ „
„	10	12	10	28	87 „ „

Magnetic disturbances.—There was a "great" magnetic disturbance from 16h. on the 8th to 21h. on the 10th and a "moderate" disturbance on the 16th and 17th.

Seismological records.

TABLE 2.

No.	Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maxima. G. M. T.	End.	Maximum Amplitude.	Duration.	REMARKS.
	1911.	H. M.	H. M.	H. M.	H. M.	mm. ″	H. M.	
21	April 4	16 14·1	16 19·2	16 21·3	16 24·4	0·3=0·1	0 10·3	
22	„ 7	7 01·4	7 06·8	7 41·3	8 07·1	0·4=0·2	1 05·7	
23	„ 10	19 02·7	...	...	19 38·2	...	0 35·5	Widening of line.
24	„ 10	20 08·6	...	...	20 22·7	...	0 14·1	Widening of line.
25	„ 11	14 29·5	14 30·5	14 44·9	15 01·8	0·2=0·1	0 32·3	
26	„ 15	11 23·8	...	...	11 28·5	...	0 04·7	Widening of line.
27	„ 15	12 01·2	12 03·8	12 04·4	12 23·8	0·7=0·3	0 22·6	
28	„ 17	5 20·3	...	...	6 27·4	...	1 07·1	Widening of line.
29	„ 18	18 20·8	18 25·8	18 34·4	20 10·0	6·0=2·9	1 49·2	
30	„ 28	10 32·0	...	...	11 28·0	...	0 56·0	Widening of line.
31	„ 29	5 32·2	5 46·0	5 48·6	6 02·6	0·5=0·2	0 30·4	
32	„ 30	9 50·3	...	...	10 29·6	...	0 39·3	Widening of line.

T. ROYDS,
for *Director*,
Kodaikanal and Madras Observatories.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of April, 1911, the traces showed 7 calm days, 20 days of small and 3 days of moderate disturbance.

The days of the month selected as quiet for the purposes of the Magnetic Survey of India are the 6th, 13th, 14th, 15th and 26th.

The following table represents the magnetic character of each day during the month :—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	M	17	S	25	S
2	S	10	S	18	S	26	C
3	S	11	S	19	S	27	C
4	S	12	S	20	S	28	S
5	C	13	C	21	S	29	S
6	C	14	C	22	S	30	M
7	S	15	C	23	S		
8	S	16	M	24	S		

C = calm, S = small, M = moderate, G = great, V. G. = very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms as also the ranges and the summed ranges of the horizontal force and declination for the month are as follow : —

Easterly declination	0° 55′ 27″
Horizontal force	0·36849 C. G. S. unit.
Vertical force	0·16208 „ „
Inclination	23° 44′·5
Inclination (observed)	23° 43′·3
Horizontal force range	0·00044 C. G. S. unit.
Horizontal force summed range	0·00250 „ „
Declination range	3′·0
Declination summed range	12′·0

(NOTE.—Summed range means sum without regard to signs of the 24 ordinates of the diurnal inequality.)

Seismic disturbances.

TABLE 4.

Date.	Commencement.	Maximum.	End.	Maximum amplitude.	Duration.
	H. M.	H. M.	H. M.	mm.	H. M.
April 7th	7 7·3	7 33·9	8 24·8	0·7	1 17·5
„ 18th	18 19·3	18 29·1	19 44·7	14·8	1 25·4
„ 29th	5 29·3	5 42·8	6 7·9	0·5	0 38·6

All times given above denote G. M. T.
Sensibility to tilt, 1 mm.= 0″·37 from 1st to 10th, 1 mm.=0″·41 from 11th to 30th.

N. A. F. MOOS,
Director,
Bombay Observatory.

CALCUTTA OBSERVATORY.

5. *List of displacements recorded by the Milne seismograph.*

TABLE 5.

Date.	P. T. Commencement. G.M.T.	L. W. Commencement. G.M.T.	Maximum. G.M.T.	End. G.M.T.	Duration.	Maximum displacement on trace from mean position.	REMARKS.
1911.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
April 7th	7 3·7	7 22·5	7 29·6	8 24·0	1 20·3	1·50 (*a*)	
„ 15th	11 54·9	...	11 57·5	12 24·4	0 29·5	4·00 (*b*)	(*a*) Measured from the base line.
„ 18th	18 20·3	18 24·9	18 33·0	20 1·9	1 41·6	13·00	(*b*) Do.

Sensibility 1 mm. = 0″·38 of tilt.

E. P. HARRISON,
Offg. Meteorologist, Calcutta.

SIMLA OBSERVATORY.

6. *List of earthquakes recorded by the Omori-Ewing seismographs.*

TABLE 6.

Date.		Beginning of 1st P. P.	Beginning of and P.	Beginning of L. W.	Time of maximum amplitude.	End approximately.	Duration.	Maximum displacement of style.*	REMARKS.
		H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
7th	A	6 54·9	7 4·1	7 20·5	7 26·4	8 14	1 19	0·8	
	B	6 54·7	7 3·7	7 18·0	7 24·9	8 12	1 17	0·9	
10th	B	19 4·4	P	P	19 56·2	20 43	1 39	0·3	
18th	A	18 18·4	18 21·7	18 23·7	18 25·8	19 39	1 21	6·2	
	B	18 18·4	18 21·4	18 23·7	—	19 59	1 41	?	Touched stops.
28th	A	10 10·5	P	?	P	10 54	0 43	Small	
	B	10 10·9	P	P	P	10 12·4	0 1·5	Small.	Resting against stops.
29th	A	5 32·9	5 36·3	5 39·8	5 40·7	6 42	1 9	0·5	
	B	5 32·9	5 36·3	5 39·9	5 41·0	6 1·4	0 28·5	Small.	

All times are given in G. M. T.
A = E—W component.
B = N—S component.
Magnification of each instrument was 15.
* Displacements less than 0·2 mm. are reported as "small."

The following table contains a list of earthquakes that have been reported :—

TABLE 7.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity. Rossi-Forel scale.	No. of shocks.	REMARKS.
		H. M.	Sec.			
Drosh . . .	4th	1 35	1	5	2	
Salonah (Assam) .	11th	6 54	20	5	?	
Shillong . . .	11th	7 4	1	4	1	
Drosh . . .	25th	14 0	1	4	1	
Shillong . . .	29th	6 31	1	4	1	
Drosh . . .	29th	7 20	1	5	1	
„ . . .	29th	16 52	2	4	2	

Solar radiation.—The following figures give the intensity of solar radiation, as measured at Simla by Angstrom's pyrheliometer. The values are corrected to local noon, and expressed in grammecalories per square centimetre per minute :—

Maximum	1·48
Minimum	1·34
Mean	1·43
Number of days of observation . . .	9

W. A. HARWOOD,
Imperial Meteorologist, Simla.

ROYAL ALFRED OBSERVATORY, MAURITIUS.

7. The following information relating to January, 1911, has been communicated by the Director of the Observatory :—

TABLE 8.

———	January, 1911.
Departure from normal of mean pressure . . .	—·039
Actual mean wind direction	N 70° E
Normal mean wind direction	S 87° E
Actual mean wind velocity (miles per diem) . . .	175
Normal mean wind velocity (miles per diem) . .	232
Rainfall departure from normal	—0·05

Weather in the Indian monsoon region.

8. In the sub-equatorial region as represented by Zanzibar and Seychelles pressure was in decided excess of the normal. The air movement was if anything weaker than usual in both places: and its direction was abnormal, being unusually easterly at Seychelles and westerly at Zanzibar.

The rainfall recorded at Seychelles was 60 per cent. below the average for April, while at Zanzibar the fall was almost identical with the normal amount.

TABLE 9.

	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure.		+·055	+·036
Actual mean wind direction		S 10° W	N 89° E
Normal mean wind direction		S 5° E	N 8° E
Actual mean wind velocity (miles per diem).		161	97
Normal mean wind velocity (miles per diem).		170	112
Rainfall departure from normal .		+0·17	—4·24

Depressions and cyclonic storms.

9. April usually witnesses the establishment of the conditions characteristic of the hot season in northwestern India and the highlands to the west of the Indus. Most of the disturbances which affect northwest India in April are locally formed and of thermal origin. In the month under review no less than four disturbances affected northwest India, but all of them were the continuation of the Persian depressions, and therefore of the class of cold weather storms. Their influence on the weather in northwest India was not very marked, and was nearly confined to the mountain zone.

As happened in the corresponding period of 1910 an early advance of humid winds occurred over the Bay about the middle of the month, and resulted in the formation of a storm of which the following is a short account:—

Cyclonic storm of the 13th to the 18th in the Bay of Bengal.—The storm was generated nearly midway between the Andamans and the south Coromandel coast on the 13th and 14th in front of a moderately strong advance of moist westerly and southwesterly winds from the equatorial regions. It apparently travelled in a northeasterly direction on the 15th, 16th and 17th, developing at the same time, and crossed the coast between Akyab and Chittagong on the evening of the 17th. It was a concentrated disturbance of considerable intensity while approaching the coast, but began to fill up rapidly after its passage inland, and by 8 hrs. of the 18th had become a diffuse low pressure area.

The steamer *Aratoon Apcar* which passed through the inner area on the 17th experienced winds of force 9 with high and dangerous seas.

A similar storm occurred in April, 1910.

Pressure.

10. Except in Hyderabad and parts of Madras April was a cool month in the Indian region, and barometric pressure everywhere exceeded the average except in Bengal, Orissa, Chota Nagpur, the western half of Bihar, the east of the United Provinces, and of the Central Provinces, Hyderabad, and Madras excluding Malabar. The excess was most marked in lower Sind, Gujarat, and the Konkan, where it ranged between ·02″ and ·05″, while the largest deficiency (about —·024″) occurred in central and south-east Madras.

At the level of the hill stations pressure was either nearly normal or in defect; this is an indication that on the mean of the month the higher atmospheric strata in northern India were less dense than usual, and the

excessive pressure in the plains was mainly due to the high density of the lower stratum.

TABLE 10.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	"
Burma	—·001
Eastern Bengal and Assam	+·004
Bengal	—·006
United Provinces	—·002
Punjab	+·014
North-West Frontier Province	+·003
Sind	+·025
Rajputana	+·012
Bombay	+·020
Central India	+·007
Central Provinces	—·004
Hyderabad	—·012
Mysore	0
Madras	—·009

TABLE 11.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference B—A.
	"		"	"
Quetta	+·011	Jacobabad	+·014	+·003
Leh	—·005	Lahore	+·012	+·017
Murree	—·004	Peshawar	+·004	+·008
Simla	—·004	Ludhiana	+·011	+·015
Chakrata	—·032	Roorkee	+·009	+·041
Darjiling	—·034	Dhubri	+·009	+·043
Mount Abu	+·008	Deesa	+·022	+·014
Pachmarhi	+·006	Khandwa	+·018	+·012
Kodaikanal	0	Madura	+·005	+·005

Temperature.

11. The effect on temperature of the abnormally heavy precipitation in March lasted throughout April, which accordingly was a somewhat cooler month than usual over the whole of northern and central India, as well as in Burma and the Konkan.

In Baluchistan, west Rajputana, the United Provinces and Chota Nagpur temperature was in greater defect at night than during the day, while in the rest of the region of deficient temperature the reverse was the case. In Madras and Hyderabad temperature inclined to be high.

TABLE 12.

SUB-DIVISION.	ACTUAL TEMPERATURE.					DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
1. Bay Islands	88·2	77·4	82·8	10·8	16·9	—3·6	—2·0	— 1·6
2. Lower Burma	91·9	74·8	83·3	17·2	27·0	—2·1	—1·0	— 1·1
3. Upper do.	95·2	70·7	83·0	24·5	37·7	—3·5	—2·0	— 1·5

Sub-division.	Actual temperature.					Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
4. Assam	83·6	68·4	76·0	15·2	30·5	—2·7	0	— 2·7
5. Eastern Bengal	90·4	72·0	81·2	18·4	32·5	—2·0	—0·4	— 1·6
6. Bengal	97·8	75·5	86·6	22·3	36·5	—1·1	—0·2	— 0·9
7. Orissa	96·1	75·9	86·1	20·2	33·4	—1·6	—0·7	— 0·9
8. Chota Nagpur	101·1	71·7	86·4	29·3	41·3	—0·5	—1·6	+ 1·1
9. Bihar	97·9	71·2	84·6	26·7	41·9	—1·9	—0·9	— 1·0
10. United Provinces, East	100·4	69·5	85·0	30·9	46·5	—1·5	—2·1	+ 0·6
11. Do., West	97·4	67·4	82·4	30·0	48·1	—1·6	—2·2	+ 0·6
12. Punjab, East and North	93·3	65·1	79·2	28·2	46·5	—3·3	—1·1	— 2·2
13. Do., Southwest	94·2	67·1	80·7	27·2	45·1	—3·9	—1·5	— 2·4
14. Kashmir	60·0	36·4	48·2	23·6	42·8	—1·6	—1·5	— 0·1
15. North-West Frontier Province	86·9	61·3	74·1	25·6	46·3	—3·7	—2·1	— 1·6
16. Baluchistan	82·6	57·8	70·2	24·7	47·5	—2·1	—4·2	+ 2·1
17. Sind	94·9	70·9	82·8	24·0	42·9	—2·5	—0·9	— 1·6
18. Rajputana, West	99·5	72·0	85·7	27·5	43·6	—1·8	—2·3	+ 0·5
19. Do., East	99·8	71·4	85·6	28·5	43·6	—0·2	—1·7	+ 1·5
20. Gujarat	96·2	70·7	83·5	25·6	39·5	—1·9	—2·0	+ 0·1
21. Central India, West	97·7	68·6	83·1	29·1	43·7	—1·4	—1·6	+ 0·2
22. Do., East	101·1	69·5	85·3	31·5	46·1	—1·5	—1·9	+ 0·4
23. Berar	103·6	74·3	89·0	29·3	39·6	+0·3	—2·1	+ 2·4
24. Central Provinces, West	102·7	71·1	86·9	31·6	43·8	—0·7	—1·6	+ 0·9
25. Do., East	102·5	74·0	88·2	28·5	39·3	+0·5	—1·6	+ 2·1
26. Konkan	86·7	76·3	81·5	10·3	16·9	—2·9	—2·0	— 0·9
27. Bombay Deccan	101·8	70·5	86·2	31·3	42·4	+1·1	—0·9	+ 2·0
28. Hyderabad, North	101·5	76·3	88·9	25·2	36·1	+1·8	—0·7	+ 2·5
29. Do., South	104·2	78·4	91·3	25·9	34·1	+2·0	+1·4	+ 0·6
30. Mysore	94·6	68·7	81·7	25·9	33·2	+1·1	—0·7	+ 1·8
31. Malabar	89·5	77·6	83·5	11·9	18·2	—1·1	+0·1	— 1·2
32. Madras, Southeast	97·8	77·0	87·1	20·9	31·4	+1·0	+0·1	+ 0·9
33. Do. Deccan	105·3	79·3	92·4	26·0	38·3	+1·3	+0·7	+ 0·6
34. Do. Coast, North	93·2	77·9	85·5	15·3	26·7	—0·2	+0·1	— 0·3

TABLE 13.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	−2·7	−1·5	−2·1
Eastern Bengal and Assam	−2·2	−0·3	−1·2
Bengal	−1·4	−0·7	−1·0
United Provinces	−1·5	−2·2	−1·8
Punjab	−3·5	−1·3	−2·4
North-West Frontier Province	−3·7	−2·1	−2·9
Sind	−2·5	−0·9	−1·6
Rajputana	−0·7	−1·9	−1·3
Bombay	−1·2	−1·7	−1·4
Central India	−1·4	−1·8	−1·6
Central Provinces	−0·2	−1·7	−1·0
Hyderabad	+2·0	+1·0	+1·5
Mysore	+1·1	−0·7	+0·2
Madras	+0·4	+0·2	+0·3

Winds.

12. (*a*) In the Peninsula and the greater part of northern and central India the winds were considerably more steady than is usual in April. Their velocity was low in Eastern Bengal and Assam, the Indus valley and Central India, and high in Madras and Mysore. These abnormalities were apparently related to the feebleness of the hot weather conditions.

(*b*) As might be expected from the character of the pressure distribution of the month the northerly element in the mean direction was considerably stronger than usual in most places in the western half of the Peninsula, upper Sind and at several stations in the Punjab and the North-West Frontier Province.

TABLE 14.

Division.	Departure from normal of	
	Hourly wind velocity.	Wind steadiness.
Burma	−0·4	−14
Eastern Bengal and Assam	−1·1	− 3
Bengal	−0·5	+ 5
United Provinces	0	+10
Punjab	+0·1	+ 8
North-West Frontier Province	−0·9	− 1
Sind	−1·8	+ 2
Rajputana	+0·5	+ 3
Bombay	+0·3	+17
Central India	−1·0	+19
Central Provinces	−0·2	+12
Hyderabad	−0·7	+13
Mysore	+1·6	+29
Madras	+1·1	+15

Humidity and cloud.

13. The air was abnormally dry over the Central Provinces, the Bombay Deccan and Hyderabad and appreciably damper than usual in the region defined by Bhuj, Ahmedabad, Deesa, and Hyderabad (Sind), but elsewhere the hygrometric conditions were nearly normal.

Cloud amount was in defect over the greater part of the country, but areas in which the sky was more clouded

than usual occurred in the western part of Burma, Eastern Bengal, lower Sind, Cutch and along the east coast of the Peninsula from False Point to Nellore.

TABLE 15.

Division.	Hygrometry; 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	73	+ 3	·749	—·031	3·8	+0·3
Eastern Bengal and Assam.	82	0	·752	—·020	4·5	—0·1
Bengal	64	+ 1	·666	—·009	2·1	—0·2
United Provinces.	40	— 1	·407	—·031	0·8	—0·6
Punjab	49	+ 3	·431	—·006	1·9	—0·3
North-West Frontier Province.	61	+ 3	·465	—·013	2·5	—0·3
Sind	60	+ 4	·589	+·014	2·0	+0·1
Rajputana	32	— 1	·344	—·055	1·1	—0·5
Bombay	60	— 1	·610	—·033	1·8	—0·4
Central India	35	0	·380	—·021	1·0	—0·2
Central Provinces	27	—11	·315	—·155	0·6	—1·4
Hyderabad	36	—12	·446	—·117	1·4	—1·3
Mysore	73	+ 3	·639	—·007	2·9	—0·9
Madras	71	— 3	·810	—·042	3·6	—0·3

Rainfall.

14. Owing to the weakness of the usual hot weather conditions the total precipitation of the mo th was below the average throughout the Indian region with the exception of the Bay Islands, Burma, Eastern Bengal, Orissa and Baluchistan. The deficit equalled or exceeded half an inch in Chota Nagpur, Kashmir, the Central Provinces East, the Bombay Deccan, Mysore, Hyderabad, and Malabar, in which areas the normal quantity of rainfall received during the month varies between half an inch and three inches. On the other hand Burma recorded 3·7″ in place of the average 1½″.

TABLE 16.

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			″	″	″	
1. Bay Islands	6·0	3·7	3·48	2·13	+1·35	+ 63
2. Lower Burma	3·8	2·5	3·92	1·87	+2·05	+110
3. Upper do.	4·2	2·2	3·47	1·15	+2·32	+202
4. Assam	11·9	11·4	9·17	9·21	—0·04	0
5. Eastern Bengal	5·8	4·6	4·95	3·75	+1·20	+ 32
6. Bengal	2·4	3·0	1·80	1·91	—0·11	— 6
7. Orissa	1·9	2·1	1·28	1·22	+0·06	+ 5
8. Chota Nagpur	0·7	1·8	0·29	0·90	—0·61	— 68
9. Bihar	1·1	1·4	0·52	0·59	—0·07	— 12
10. United Provinces, East	0·3	0·4	0·08	0·14	—0·06	— 43
11. Do., West	0·2	0·6	0·07	0·23	—0·16	— 70

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
12. Punjab, East and North	0·6	1·0	0·19	0·43	—0·24	— 56
13. Do., Southwest	1·2	0·9	0·34	0·37	—0·03	— 8
14. Kashmir	4·5	4·4	1·74	2·35	—0·61	— 26
15. North-West Frontier Province	2·7	2·6	0·95	1·32	—0·37	— 28
16. Baluchistan	1·2	1·2	0·62	0·48	+0·14	+ 29
17. Sind	0	0·3	0	0·13	—0·13	—100
18. Rajputana, West	0	0·2	0·01	0·06	—0·05	— 83
19. Do., East	0·1	0·3	0·03	0·11	—0·08	— 73
20. Gujarat	0	0·1	0	0·02	—0·02	—100
21. Central India, West	0	0·1	0	0·05	—0·05	—100
22. Do., East	0	0·3	0	0·12	—0·12	—100
23. Berar	0	0·6	0	0·24	—0·24	—100
24. Central Provinces, West	0	0·6	0	0·22	—0·22	—100
25. Do., East	0	1·2	0	0·48	—0·48	—100
26. Konkan	0·1	0·8	0·04	0·45	—0·41	— 91
27. Bombay Deccan	0·2	1·6	0·06	0·78	—0·72	— 92
28. Hyderabad, North	0	1·3	0·01	0·48	—0·47	— 98
29. Do., South	0·5	1·6	0·18	0·67	—0·49	— 73
30. Mysore	2·1	2·9	1·09	1·64	—0·55	— 34
31. Malabar	1·3	4·3	0·98	2·87	—1·89	— 66
32. Madras, Southeast	2·1	2·0	1·11	1·31	—0·20	— 15
33. Do. Deccan	1·2	1·3	0·53	0·63	—0·10	— 16
34. Do. Coast, North	1·2	1·4	0·55	0·80	—0·25	— 31

TABLE 17.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	3·68	1·49	+2·19	+147
Eastern Bengal and Assam	7·10	6·51	+0·59	+ 9
Bengal	0·99	1·13	—0·14	— 12
United Provinces	0·07	0·18	—0·11	— 61
Punjab	0·22	0·42	—0·20	— 48
North-West Frontier Province	0·95	1·32	—0·37	— 28
Sind	0	0·13	—0·13	—100
Rajputana	0·03	0·09	—0·06	— 67
Bombay	0·04	0·48	—0·44	— 92
Central India	0	0·07	—0·07	—100
Central Provinces	0	0·29	—0·29	—100
Hyderabad	0·10	0·59	—0·49	— 83
Mysore	1·09	1·64	—0·55	— 34
Madras	0·86	1·22	—0·36	— 30
Mean of India	1·16	1·08	+0·08	+ 8

Snowfall.

I.—AFGHANISTAN.

15. No information has yet been received.

II.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Wano.*—A slight fall occurred on the 25th on the summits of the Marwatti and Pirghal. It melted however and there was no accumulation at the end of the month.

(*b*) *Kurram.*—Snowstorms occurred on five occasions on the higher peaks of the Sufed Koh.

(*c*) *Kohat.*—No snow fell during the month on the ranges bordering the district.

III.—KASHMIR.

The statement below shows the character of the snowfall in the region.—

TABLE 18.

PLACE.	Number of falls.	Reported depth.	Accumulation at the close of the month.
Summits of the mountains surrounding Srinagar.	1	Slight	
Mountains adjacent to Skardu.	8	Not known	A good deal of snow said to be lying on the higher mountains.
Dras	10	2½ feet .	On the Zojila nearly 10½ feet.
Leh	1	Slight	
Minimarg* . . .	6	Nearly 6 feet	
Kargil	4	13½ inches	None.
Hills near Kargil . .	4	4½ feet	Not known.

* No data available after the 14th.

IV.—PUNJAB.

(*a*) *Kangra.*—There were many falls down to 6,500 feet.

(*b*) *Kailang.*—Snow fell on the 1st, 2nd, 3rd and 9th to a total depth of 15 inches.

(*c*) *Kilba.*—Feeble snowstorms occurred on the 1st, 2nd, 3rd, 8th and 18th. The fall of the 2nd is reported to have extended down to 5,700 feet: during all other falls the snowline was at an elevation of 9,000 feet. At the end of the month more than 4 feet of snow was lying on elevations above 9,000 feet.

V.—UNITED PROVINCES.

Almora.—The total snowfall received during the month measured about 17 feet on the Lampia pass, 12½ feet on the Lipulekh pass, 8 feet on the Binkaru pass, 7 feet on the Nüwe pass and 6 feet in the Ralamdhura and Untadhura.

The statement below gives a comparison of the depth of snow accumulations on the various passes and peaks on the last day of the month under review with the corresponding normals.

TABLE 19.

Name of pass.	DEPTH OF THE ACCUMULATION AT END OF THE MONTH.	
	Reported.	Normal.
	Feet.	Feet.
Nuwe pass	45	17½
Lipulekh pass	26	10½
Lampia „	20	11½
Binkaru „	12	20

SUMMARY.

16. (*a*) The snowfall of the month was either normal or in defect.

(*b*) At the end of the month the unmelted residue of snow accumulations was reported to be thicker than usual.

HEM RAJ.

Reg. No. 4176 E., 11.—Z.—1,250.

Reg. No. 4195 E., 11.—Z.—3,800

I., TWO. BY S.S. MUNDLE

The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2	miles per hour	...	one	feather added to the wind arrow.							
,,	,, 2 to 5	,,	,,	,,	...	two	feathers	,,	,,	,,	,,	
,,	,, 5 to 10	,,	,,	,,	...	three	,,	,,	,,	,,	,,	
,,	,, 10 to 20	,,	,,	,,	...	four	,,	,,	,,	,,	,,	
	over 20	,,	,,	,,	...	five	,,	,,	,,	,,	,,	

Reg. No. 4176 E., 11.—Z.—1,250.
Reg. No. 4195 E., 11.—Z.—3,800.

LITHO. BY S. S. MUNDLE.

The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing '020' or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MAXIMUM TEMPERATURE.

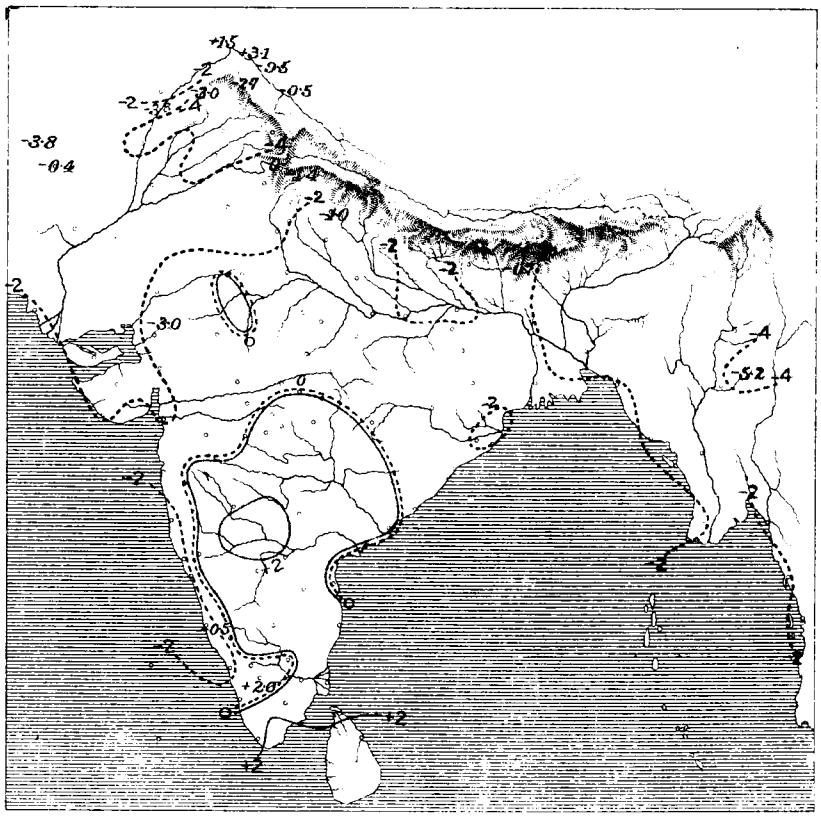


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MINIMUM TEMPERATURE.

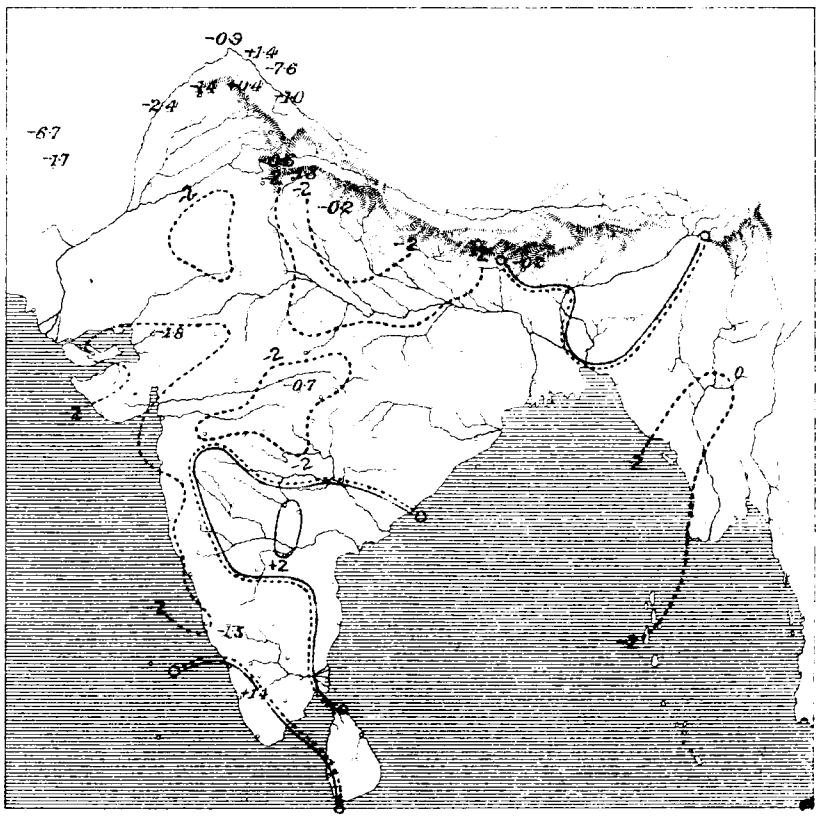


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

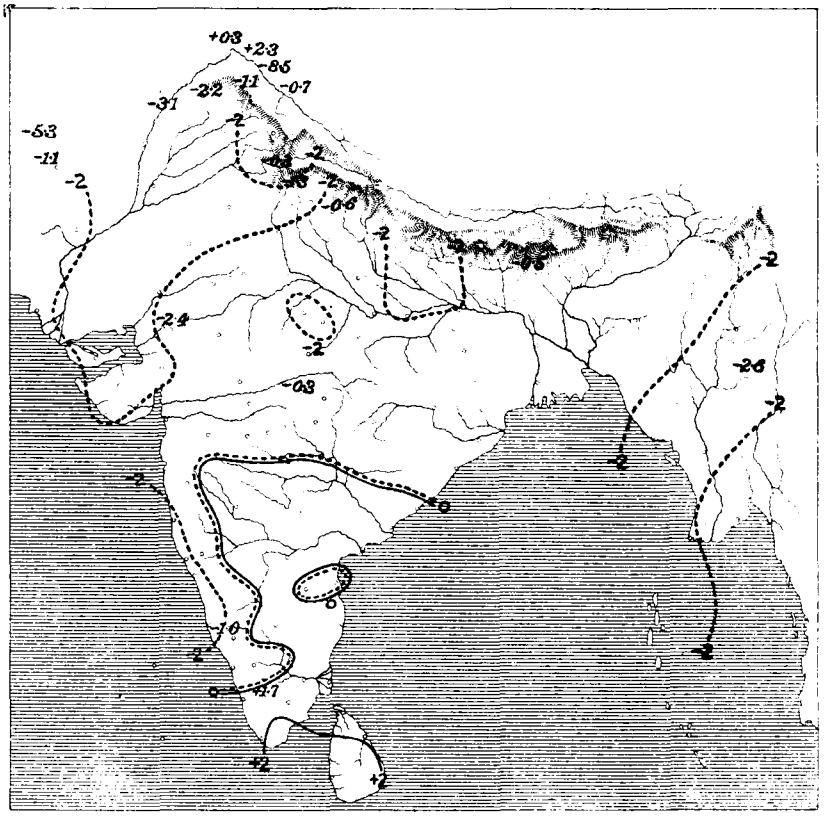


CHART SHEWING THE MONTHLY MEAN OF
PRESSURE AND RESULTANT
WIND DIRECTION.

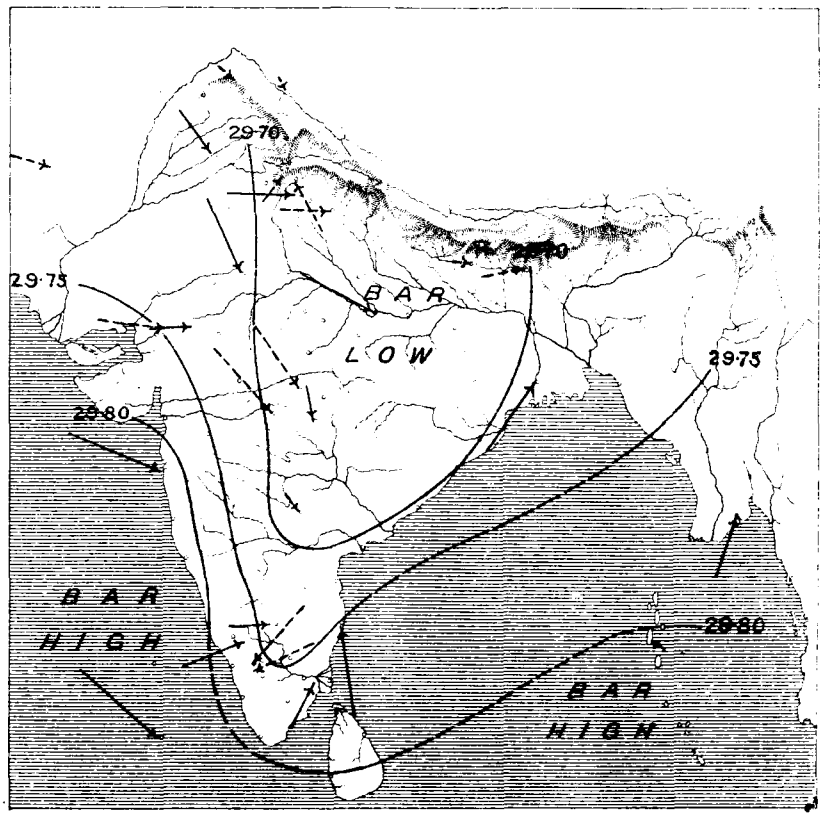


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

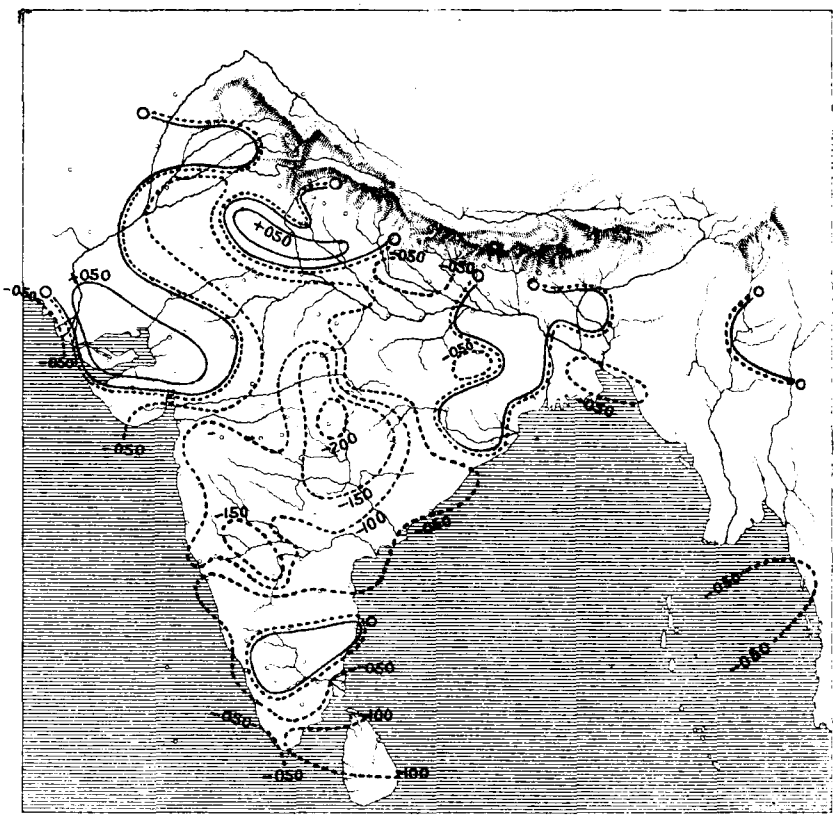


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

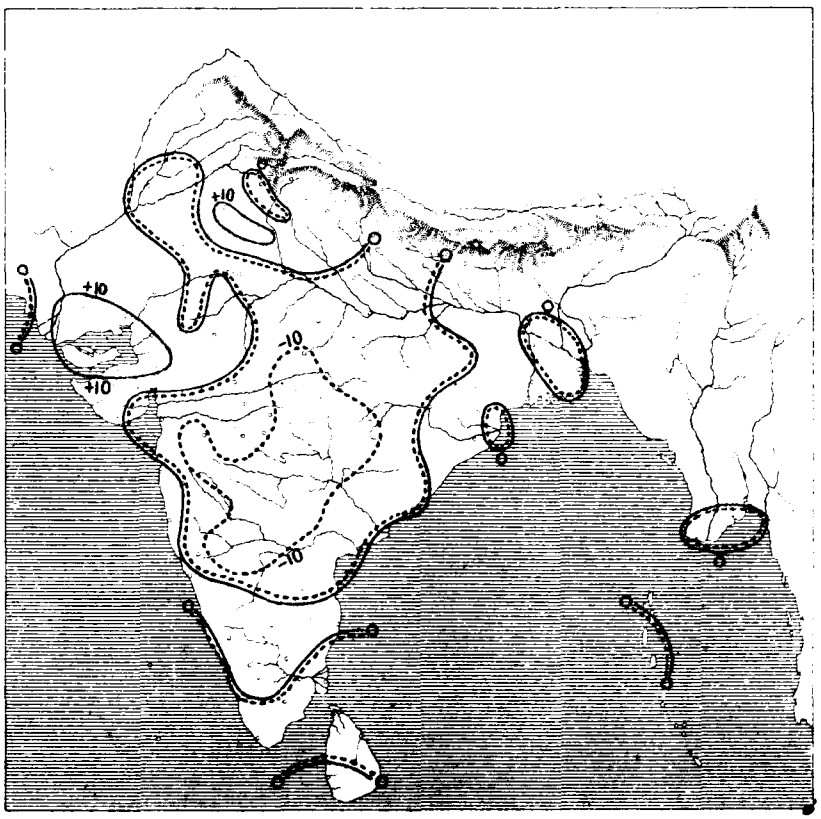


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

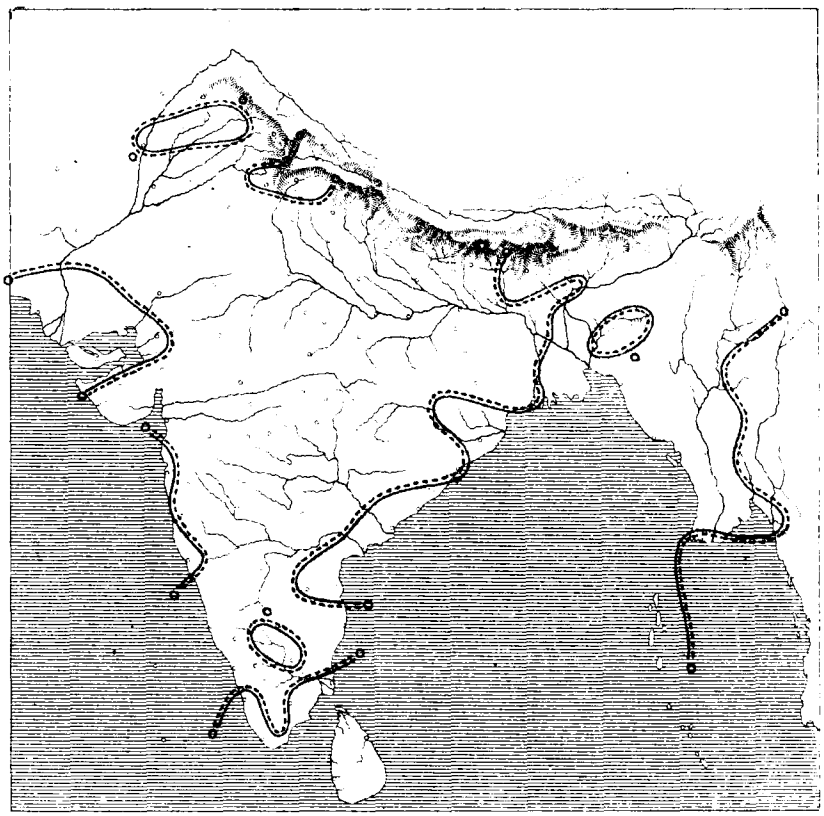
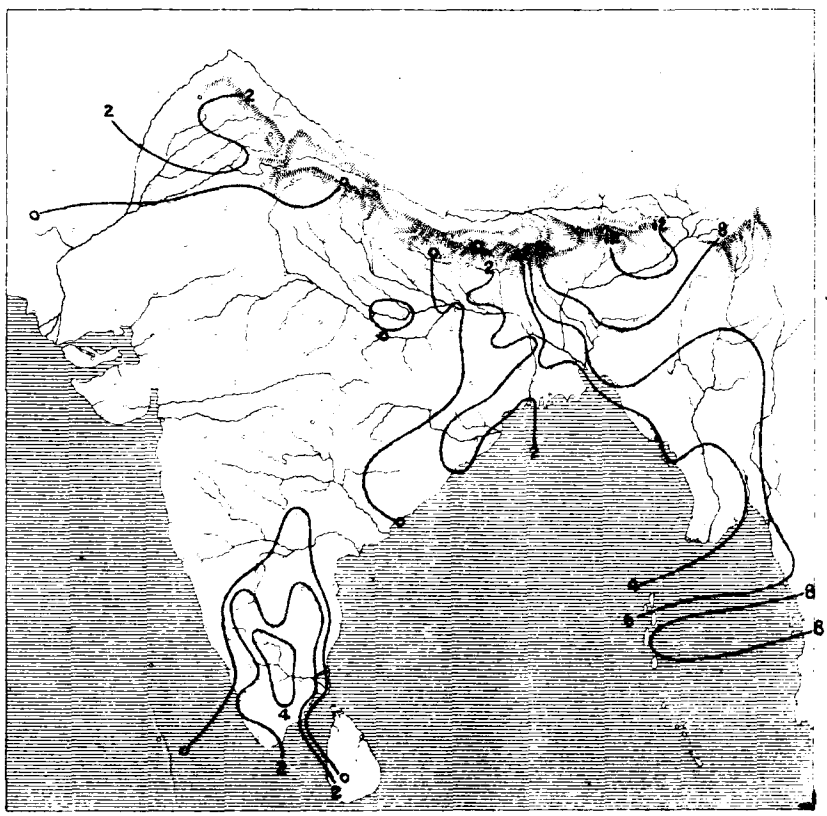


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)



Reg. No. 4176 E., 11.—Z.—1,250

Reg. No. 4195 E., 11.—Z.—3,800

LITHO. BY S.B.M.

The country is divided into 34 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall; the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Eastern Bengal
6. Bengal
7. Orissa
8. Chota Nagpur
9. Bihar
10. United Provinces, East
11. Do., West
12. Punjab, East and North
13. Do., Southwest
14. Kashmir
15. Northwest Frontier Province
16. Baluchistan
17. Sind
18. Rajputana, West
19. Rajputana, East
20. Gujarat
21. Central India, West
22. Do., East
23. Berar
24. Central Provinces, West
25. Do., East
26. Konkan
27. Bombay, Deccan
28. Hyderabad, North
29. Do., South
30. Mysore
31. Malabar
32. Madras, Southeast
33. Madras, Deccan
34. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW.

PUBLISHED BY ORDER OF

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CALCUTTA, MAY, 1911.

INTRODUCTION.

THIS review of the weather in India during the month of May, 1911, is based on observations taken daily at 8 hrs. at 240 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 33 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review. The brief notes on solar, seismic and magnetic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. Owing chiefly to the absence of the usual temporary incursions of monsoon winds into India from the neighbouring seas the total precipitation of the month was below the normal in all parts of the country with the exception of Mysore, the Madras Deccan, Hyderabad South and Eastern Bengal and Assam. Scarcely any rain fell in Baluchistan, Sind, Rajputana, Gujarat, Berar, the west of the Central Provinces and of Central India, the Panjab East and North, and the United Provinces West, areas in which ten to sixty-five cents are received in ordinary conditions. The departures from normal of climatic elements other than rainfall were in general of no great significance.

The highest temperature of the month was as usual registered at Jacobabad and was 4° lower than the highest previously recorded there in May. Barometric pressure was generally in defect by amounts averaging ·013″ for the plains stations.

Solar, seismic and magnetic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—Observations for spots and faculæ were made on all the days during the month but on 3 days prominences could not be recorded owing to bad weather.

Sunspots.—Eight new groups of spots were recorded, the same number as in April; but the average number fell from 1·7 in April to 1·1 in May. The average life of a spot was 4·2 days. All the spots were small except one (No. 1983) which was of moderate size, it first appeared on the 26th not far from the east limb of the sun. On 10 days there was no spot on the visible disc at the time of observation. The distribution of spots in latitude was as follows :—

TABLE 1.

	0°—10°.	11°—20°.	Mean latitude.	Extreme latitudes.
North . . .	2	2	6°·5	8° and 5°
South . . .	4	...	9°·8	6° and 15°

Prominences.—Thirty-three large, 1 metallic, and 5 eruptive prominences were recorded during the month.

The tallest was 2 minutes in height and was observed on the 17th at latitude +45° east.

Magnetic disturbances.—Moderate magnetic disturbances were recorded from the 7th to 8th and on the 16th.

Seismological records.

TABLE 2.

No.	Date.	P. T. Commencement G. M. T.	L. W. Commencement G. M. T.	Maxima. G. M. T.	End. G. M. T.	Maximum amplitude.	Duration.	REMARKS.
	1911.	H. M.	H. M.	H. M.	H. M.	mm.	H. M.	
33	May 4	13 34·5	13 43·5	13 46·9	14 11·7	0·7=0·3	0 37·2	
34	„ 4-5	23 48·0	23 57·9	0 30·6	3 05·0	2·5=1·2	3 17·0	
35	„ 11	4 19·7	4 24·1	4 26·4	Between 4 51·8 and 5 00·0	0·4=0·2	0 40·0?	Instrument adjusted—4 51·8 to 5 00·0.
36	„ 27	20 33·6	...	...	21 25·9	...	0 52·3	Widening of line.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of May, 1911, the traces showed 4 calm days, 25 days of small and 2 days of moderate disturbance.

The days of the month selected as quiet* for the purposes of the Magnetic Survey of India are the 4th, 10th, 13th, 23rd and the 28th.

The following table represents the magnetic character of each day during the month.

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	S	17	S	25	S
2	S	10	S	18	S	26	S
3	C	11	S	19	S	27	S
4	C	12	S	20	S	28	C
5	S	13	C	21	S	29	S
6	S	14	S	22	S	30	S
7	M	15	M	23	S	31	S
8	S	16	S	24	S	...	...

C = calm, S = small, M = moderate, G = great, V. G. = very great.

* Calm days if available are usually selected. In absence of these however, the least disturbed days have to be included amongst the 5 selected days.

The mean observed absolute values of the several magnetical elements reduced to the mean monthly tabulations of the magnetograms as also the ranges and the summed ranges of the horizontal force and declination for the month are as follow :—

Easterly declination	0° 55′ 19″
Horizontal force	0·36853 C.G.S. unit
Vertical force	0·16203 „ „
Inclination	23° 44′·1
Inclination (observed)	23° 43′·5
Horizontal force range	0·00039 C.G.S. unit
Horizontal force summed range	0·00253 „ „
Declination range	4′·2
Declination summed range	17′·8

(NOTE.—Summed range means sum without regard to signs of 24 ordinates of diurnal inequality.)

Seismic disturbances.

TABLE 4.

Date.	Commencement.	Maximum.	End.	Maximum Amplitude.	Duration.
1911.	H. M.	H. M.	H. M.	mm.	H. M.
May 4	13 42·2	13 51·8	14 25·0	0·7	0 42·8
„ 4-5	23 48·3	0 23·3	1 56·7	2·3	2 8·4
„ 11	4 25·0	4 32·9	4 58·9	0·5	0 33·9

All times given above denote G. M. T.

Sensibility to tilt . . . { 1 mm=0″·41 from 1st to 9th. 1 mm=0″·37 from 9th to 31st.

N. A. F. MOOS,
Director,
Bombay Observatory.

CALCUTTA OBSERVATORY.

5. *List of displacements recorded by the Milne seismograph.*

TABLE 5.

Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maximum. G. M. T.	End. G. M. T.	Duration.	Maximum displacement on trace from mean position.	REMARKS.
1911.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
May 4th	13 42·6	13 53·8	13 55·8	14 27·4	0 44·8	2·25	The driving clock stopped many times during this month.
„ 4th	...	23 47·0	0 17·0	? *	?	2·75	*End in morning air tremor.
„ 11th	4 12·9	...	4 32·8	5 20·6	1 7·7	1·25	

Sensibility 1 mm.=0″·38 of tilt.

E. P. HARRISON,
Meteorologist, Calcutta.

SIMLA OBSERVATORY.

6. *List of earthquakes recorded by the Omori-Ewing seismographs.*

TABLE 6.

Date.		Beginning of 1st P. T.	Beginning of 2nd P. T.	Beginning of L. W.	Time of maximum amplitude.	End approximately.	Duration.	Maximum displacement of style.*	REMARKS.
		H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
4th	A	13 36·5	...	...	13 36·7	13 48	0 11	Small.	
,,	B	13 36·9	...	...	13 43·8	13 45	0 8	,,	
4th to 5th	A	23 46·7	...	0 10·4	0 13·7	0 40	0 53	1·8	
,,	B	23 46·7	23 54·6	0 6·6	0 8·4	2 50	3 3	9·5	
8th	A	11 47·4	...	...	11 47·8	11 48·8	0 1·4	Small.	
,,	B	11 47·8	...	...	...	11 51·4	0 3·6	?	Resting against stops at beginning of shock.
17th	A	19 38·2	...	19 40·4	19 41·7	19 44	0 6	0·5	
24th	A	10 16·2	...	...	10 16·3	10 18·5	0 2·3	Small.	
,,	B	10 16·1	...	...	10 16·5	10 18·0	0 1·9	,,	

All times are given in G. M. T.
A = E—W component.
B = N—S component.
Magnification of each instrument was 15.
* Displacements less than 0·2 mm. are reported as "small."

The following table contains a list of earthquakes that have been reported :—

TABLE 7.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity, Rossi-Forel scale.	No. of shocks.	REMARKS.
		H. M.	Sec.			
Drosh . . .	4th	6 30	1	3	1	
Chitral . . .	4th	23 10	2	7	2	
Drosh . . .	4th	23 15	3	5	3	
,, . . .	16th	17 5	2	5	1	
Shillong . . .	17th	8 22	1	5	1	
Chitral . . .	22nd	6 50	3	7	3	
Drosh . . .	22nd	6 53	3	5	2	
Shillong . . .	26th	13 25	1	4	1	
,, . . .	26th	19 40	2	4	1	
Turbat-i-Haidari .	28th	10 34	3	?	?	2 shocks reported on 26th and 27th.

Solar radiation.—The following figures give the intensity of solar radiation, as measured at Simla by Angstrom's pyrheliometer. The values are corrected to local noon, and expressed in grammecalories per square centimetre per minute.

Maximum	1·49
Minimum	1·26
Mean	1·41
Number of days of observation . . .	15

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ROYAL ALFRED OBSERVATORY, MAURITIUS.

7. The following information relating to December, 1910, has been communicated by the Director of the Observatory :—

TABLE 8.

	December, 1910.
Departure from normal of mean pressure . . .	—·002
Actual mean wind direction	N 81° E
Normal mean wind direction	N 89° E
Actual mean wind velocity (miles per diem) . . .	222
Normal mean wind velocity (miles per diem) . . .	259
Rainfall departure from normal	—2·38

Weather in the Indian monsoon region.

8. The lowness of the barometer in the equatorial region was favourable for the prospects of the south-west monsoon, out the weakness of the air movement there and the occurrence of very heavy rainfall at Zanzibar indicated that the Arabian Sea current would be late in becoming established and give less rain than usual for some time after arrival.

TABLE 9.

	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure.		—·013	—·021
Actual mean wind direction .		S 3° W	S 23° E
Normal mean wind direction .		S 5° E	S 43° E
Actual mean wind velocity (miles per diem).		175	137
Normal mean wind velocity (miles per diem).		194	165
Rainfall departure from normal.		+6·09	—1·90

Depressions and cyclonic storms.

9. During May cyclonic storms are normally of fairly frequent occurrence over the Arabian Sea and the Bay of Bengal, but in the present year, this month was characterised by unusually few disturbances. During the fourth week a storm developed in the neighbourhood of the Laccadive Islands and moved in a northwesterly direction across the Arabian Sea. It was of relatively small extent but gave high seas and rough weather, the winds recorded by vessels in its neighbourhood reaching force 10. It disappeared before the end of the week, probably having passed inland across the Arabian coast, south of Kuria Muria.

In the Bay, a feeble advance of humid winds caused slightly unsettled weather at sea and on the south coast of Burma about the middle of the month and conditions were also disturbed on two or three occasions in the extreme north by shallow depressions of the winter type from the Persian area.

Pressure.

10. Barometric pressure was below the normal in almost all parts of the plains of India. The depression was greatest in the region comprising Bihar, Chota Nagpur, the United Provinces, the eastern half of Central India and of the Central Provinces where generally it ranged between ·030″ and ·045″. The deficit in northwest and central India was due largely to the low density of the air stratum below the level of the hill observatories, for in Baluchistan, the western Himalayas, the Aravalis and the Satpuras pressure was either very nearly normal or in excess.

TABLE 10.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	″
Burma	0
Eastern Bengal and Assam	—·004
Bengal	—·025
United Provinces	—·035
Punjab	—·017
North-West Frontier Province	—·014
Sind	—·004
Rajputana	—·007
Bombay	—·002
Central India	—·019
Central Provinces	—·024
Hyderabad	—·019
Mysore	—·005
Madras	—·010

TABLE 11.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	″		″	″
Quetta	+·021	Jacobabad	—·008	—·029
Leh	+·033	Lahore	—·023	—·056
Murree	+·002	Peshawar	—·008	—·010
Simla	+·011	Ludhiana	—·026	—·037
Chakrata	—·016	Roorkee	—·025	—·009
Darjiling	—·038	Dhubri	—·011	+·027
Mount Abu	+·015	Deesa	—·003	—·018
Pachmarhi	0	Khandwa	—·004	—·004
Kodaikanal	—·009	Madura	+·007	+·016

Temperature.

11. Weather was abnormally cool in the northwest and extreme north during the first half of the month while it was rather warmer than usual in the northeast. Later, the relative distribution was reversed and unusually warm conditions prevailed in the northwest, while temperature fell below normal in the northeast. These changes were associated with the occurrence of rainfall and as is usually the case under such circumstances were more strongly marked in the day temperatures than in the night temperatures. On the mean of the month conditions did not anywhere depart very largely from the normal: they were somewhat warmer than usual except along the west coast of the Peninsula, the north Madras coast and in Eastern Bengal and Assam, and Burma.

TABLE 12.

Sub-division.	Actual temperature.					Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
1. Bay Islands	88·3	78·8	83·6	9·5	17·3	—1·6	—0·9	—0·7
2. Lower Burma	90·3	76·5	83·4	13·8	22·5	—0·2	—0·2	0
3. Upper Burma	95·3	74·9	85·1	20·4	32·1	+0·3	—0·1	+0·4
4. Assam	81·3	72·0	78·1	12·2	25·1	—2·7	—0·6	—2·1
5. Eastern Bengal	89·2	74·1	81·6	15·1	27·7	—1·6	—1·0	—0·6
6. Bengal	98·7	78·1	88·5	20·6	32·9	+1·0	+0·3	+0·7
7. Orissa	98·8	80·1	89·5	18·7	30·6	+0·4	+0·4	0
8. Chota Nagpur	106·3	78·5	92·5	27·8	38·0	+3·9	+1·3	+2·6
9. Bihar	100·3	77·2	88·8	23·1	37·4	+0·5	+0·5	0
10. United Provinces, East	107·0	78·7	92·9	28·3	41·2	+2·4	+0·1	+2·3
11. Do. do., West	107·1	77·6	92·3	29·5	41·2	+3·2	+0·1	+3·1
12. Punjab, East and North	105·9	75·4	90·7	30·5	47·3	+1·8	+0·1	+1·7
13. Do., Southwest	107·3	78·4	92·8	29·0	50·1	+0·7	+0·6	+0·1
14. Kashmir	74·0	47·3	60·7	26·7	50·5	+0·2	—1·2	+1·4
15. North-West Frontier Province	102·1	72·7	87·4	29·4	56·3	+0·7	+0·3	+0·4
16. Baluchistan	93·1	66·6	79·9	26·5	46·7	—0·5	—1·8	+1·3
17. Sind	103·1	79·1	91·1	24·0	35·6	+0·5	+0·8	—0·3
18. Rajputana, West	109·3	82·3	95·8	27·1	39·6	+2·3	+0·5	+1·8
19. Do., East	108·0	82·6	95·3	25·4	38·7	+3·0	+1·3	+1·7
20. Gujarat	100·3	77·7	89·0	22·6	32·7	+0·7	—0·1	+0·8
21. Central India, West	104·5	78·3	91·5	26·1	35·7	+1·1	+1·9	—0·8
22. Do., East	110·1	80·7	95·4	29·3	41·7	+3·6	+1·2	+2·4
23. Berar	107·8	81·5	94·7	26·3	35·1	+2·5	+2·0	+0·5
24. Central Provinces, West	109·5	82·3	95·9	27·2	36·7	+2·7	+2·2	+0·5
25. Do., East	107·1	82·1	94·6	25·0	38·2	+2·5	+3·6	—1·1
26. Konkan	89·4	80·0	84·7	9·4	18·1	—0·9	—0·3	—0·6

Sub-division.	Actual temperature.					Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
27. Bombay Deccan	102·5	74·5	88·5	28·0	37·3	+1·8	+1·3	+0·5
28. Hyderabad, North	106·5	81·2	93·8	25·3	34·6	−2·0	+3·1	−1·1
29. Do., South	106·6	81·7	94·1	24·9	33·9	+2·5	+2·0	+0·5
30. Mysore	91·3	68·8	80·1	22·5	33·0	+0·1	−0·3	+0·4
31. Malabar	89·6	76·9	83·3	12·7	20·3	+0·3	−0·3	+0·6
32. Madras, Southeast	99·4	79·2	89·3	20·2	31·7	+0·7	+0·6	+0·1
33. Do. Deccan	105·8	81·0	93·4	24·8	39·5	+1·3	+0·4	+0·9
34. Do. Coast, North	96·6	81·3	88·9	15·3	28·8	−1·0	−0·4	−0·6

TABLE 13.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	0	−0·1	−0·1
Eastern Bengal and Assam	−1·9	−0·9	−1·4
Bengal	+1·3	+0·5	+0·9
United Provinces	+2·8	+0·1	+1·5
Punjab	+1·5	+0·3	+0·9
North-West Frontier Province	+0·7	+0·3	+0·5

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Sind	+0·5	+0·8	+0·7
Rajputana	+2·8	+1·0	+1·9
Bombay	+0·6	+0·2	+0·4
Central India	+2·3	+1·5	+1·9
Central Provinces	+2·6	+2·5	+2·5
Hyderabad	+2·3	+2·4	+2·3
Mysore	+0·1	−0·3	−0·1
Madras	+0·4	+0·2	+0·3

Winds.

12. (*a*) Winds were less strong than usual except in northeast India and Madras. The weakness was specially marked in Sind and Rajputana owing to the late development of the hot weather depression over northwest India.

(*b*) The relatively small number of thunderstorms and similar local eddies characteristic of the hot weather exercised a marked influence, almost throughout the country, on the variability of the wind direction. In the submontane districts of the Himalayas, Central India and Sind the flow of air was abnormally steady.

(*c*) The effect of the unusually large accumulations of snow in the hills of the extreme north was clearly shown in the directions of the Punjab winds: thus at Lahore, Montgomery, and Multan the prevailing direction was almost opposite to the normal. In other regions, however, there was no marked variation from the normal.

TABLE 14.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	—0·6	— 6
Eastern Bengal and Assam	+0·4	+15
Bengal	+1·3	+19
United Provinces	—0·2	+13
Punjab	—0·4	+15
North-West Frontier Province	—0·9	+ 3
Sind	—3·2	+13
Rajputana	—2·2	— 6
Bombay	—1·7	— 4
Central India	—0·3	+19
Central Provinces	0	+ 5
Hyderabad	—0·9	+ 3
Mysore	—0·5	+ 4
Madras	+0·7	+ 6

Humidity and cloud.

13. The air in almost all parts was drier than is normally the case. Only in the North-West Frontier Province, Sind, Bombay and Mysore was the absolute humidity in appreciable excess, while relative humidity was either normal or in defect everywhere except in the North-West Frontier Province and Mysore. The relatively dry conditions were most marked in the central parts of the country, but were decided also in the United Provinces, the Punjab and Rajputana.

Cloud was heavier than is usual at this time of year in northeast India, the North-West Frontier Province, Bombay and the central parts of the country.

TABLE 15.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	81	—1	·857	—·015	5·7	—0·3
Eastern Bengal and Assam	85	0	·834	—·030	6·3	+0·3
Bengal	70	0	·820	—·011	3·7	+0·4
United Provinces	43	— 3	·579	—·043	0·9	—0·6
Punjab	36	— 5	·487	—·041	1·1	—0·6
North-West Frontier Province.	47	+ 1	·580	+·035	1·9	+0·3
Sind	60	0	·758	+·029	1·2	—0·6
Rajputana	36	— 4	·526	—·060	1·1	—0·3
Bombay	66	0	·769	+·016	3·3	+0·4
Central India	35	—5	·495	—·049	2·0	+0·9
Central Provinces	32	—8	·449	—·084	2·4	+0·3
Hyderabad	45	—5	·585	+·007	3·6	—0·3
Mysore	77	+3	·672	+·012	5·0	—0·2
Madras	70	—1	·851	—·012	4·6	0

Rainfall.

14. Shallow depressions of the winter type continued to affect the extreme north during the first half of the month but they caused little precipitation. The effects of the long drawn out cold weather were evident also in the sparseness of the customary hot weather thunderstorms over the greater part of the country. The cyclonic storm in the Arabian Sea caused some rainfall along the west coast, but it was too far distant to give heavy falls. Rainfall was variable from week to week and for the month as a whole was below normal everywhere except in Mysore, the Madras Deccan, Hyderabad South and Eastern Bengal and Assam. The deficiency was strongly marked over almost the whole of northern and central India, and was greatest in the United Provinces and the Punjab.

TABLE 16.

SUB-DIVISION.	NUMBER OF RAINY DAYS.		RAINFALL.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
1. Bay Islands	10·0	16·1	8·59	13·07	—4·48	— 34
2. Lower Burma	11·2	13·6	9·50	12·68	—3·18	— 25
3. Upper Burma	8·1	8·3	5·79	5·89	—0·10	— 2
4. Assam	18·8	14·8	17·14	13·51	+3·63	+ 27
5. Eastern Bengal	14·2	10·5	15·84	9·83	+6·01	+ 61
6. Bengal	7·7	7·3	5·21	5·45	—0·24	— 4
7. Orissa	4·2	4·9	2·34	3·46	—1·12	— 32
8. Chota Nagpur	2·9	3·8	1·41	2·30	—0·89	— 39
9. Bihar	2·4	3·3	1·67	2·32	—0·65	— 28
10. United Provinces, East	0·3	1·3	0·12	0·67	—0·55	— 82
11. Do., West	0·1	1·4	0·03	0·60	—0·57	— 95
12. Punjab, East and North	0·2	1·5	0·07	0·65	—0·58	— 89
13. Do., Southwest	0·5	0·9	0·14	0·41	—0·27	— 66
14. Kashmir	1·8	3·7	0·59	1·67	—1·08	— 65
15. North-West Frontier Province	0·9	1·6	0·28	0·72	—0·44	— 61
16. Baluchistan	0·1	0·5	0·01	0·18	—0·17	— 94
17. Sind	0	0·3	0	0·10	—0·10	—100
18. Rajputana, West	0	0·7	0	0·31	—0·31	—100
19. Do., East	0	1·1	0·01	0·43	—0·42	— 98
20. Gujarat	0	0·4	0·03	0·23	—0·20	— 87
21. Central India, West	0	0·6	0·02	0·26	—0·24	— 92
22. Do., East	0·5	0·9	0·22	0·37	—0·15	— 41
23. Berar	0·2	0·8	0·08	0·42	—0·34	— 81
24. Central Provinces, West	0·2	0·9	0·05	0·39	—0·34	— 87
25. Do., East	0·3	1·4	0·12	0·72	—0·60	— 83
26. Konkan	1·0	1·8	0·62	1·47	—0·85	— 58
27. Bombay Deccan	1·8	2·4	0·97	1·34	—0·37	— 28
28. Hyderabad, North	0·3	1·5	0·09	0·68	—0·59	— 87
29. Hyderabad, South	2·4	1·9	1·06	0·99	+0·07	+ 7
30. Mysore	8·2	5·4	5·16	3·39	+1·77	+ 52
31. Malabar	8·1	8·2	5·62	7·11	—1·49	— 21
32. Madras, Southeast	3·5	3·8	2·51	2·78	—0·27	— 10
33. Do. Deccan	4·0	3·0	2·02	1·70	+0·32	+ 19
34. Do. Coast, North	2·2	3·2	1·09	2·21	—1·12	— 51

TABLE 17.

DIVISION.	RAINFALL.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	7·52	9·05	−1·53	− 17
Eastern Bengal and Assam	16·51	11·70	+4·81	+ 41
Bengal	2·89	3·44	−0·55	− 16
United Provinces	0·08	0·64	−0·56	− 87
Punjab	0·09	0·60	−0·51	− 85
North-West Frontier Province	0·28	0·72	−0·44	− 61
Sind	0	0·10	−0·10	− 100
Rajputana	0·01	0·40	−0·39	− 97
Bombay	0·60	1·01	−0·41	− 41
Central India	0·06	0·30	−0·24	− 80
Central Provinces	0·07	0·47	−0·40	− 85
Hyderabad	0·62	0·85	−0·23	− 27
Mysore	5·16	3·39	+1·77	+ 52
Madras	2·31	2·87	−0·56	− 20
Mean of India	2·73	2·87	−0·14	− 5

Snowfall.

I.—AFGHANISTAN.

15. No snow fell at Kabul or on the surrounding hills.

II.—NORTH-WEST FRONTIER PROVINCE.

On the Chitral hills snow to a depth of about six inches is reported to have fallen down to about 10,000 feet during the early part of the month.

The Lowarai pass remained closed. At the end of the month the unmelted residue of snow on the Sufed Koh was regarded as thicker than usual. Weather was generally very hot during the second half of the month.

III.—KASHMIR.

Snow fell on five occasions at Dras, on one day at Gulmarg, and on seven days on the mountains near Skardu. The fall at Gulmarg occurred on the 7th and was heavy for the time of year, amounting to 1⅓ feet. On this occasion the snow line is said to have descended 1,000 feet below the level of Gulmarg. At the end of the month snow lay 2½ feet deep in the valley of Gulmarg and about 8 or 9 feet deep on the higher mountains near Sonemarg and Dras.

IV.—PUNJAB.

(*a*) *Chamba.*—There was no snowfall.

(*b*) *Kangra.*—During the first twenty-five days there were two or three falls at elevations above 12,000 feet.

TABLE 18.

KULU TAHSIL.			SARAJ TAHSIL.		
Name of pass.	DEPTH OF ACCUMULATION.		Name of pass.	DEPTH OF ACCUMULATION.	
	Reported.	Normal.		Reported.	Normal.
Rohtang	12 feet	8 feet	Sirikhand	30 feet	7½ feet
Hamta	18 "	3 "	Gargarasan	14 "	2 "

KULU TAHSIL.			SARAJ TAHSIL.		
Name of pass.	DEPTH OF ACCUMULATION.		Name of pass.	DEPTH OF ACCUMULATION.	
	Reported.	Normal.		Reported.	Normal.
Barsai	2 feet	2 feet	Supakun	1 foot	½ foot
Chanderkhani	7 "	4 "	Placha	8 feet	1 "
Boja Dhar	2 "	2 "	Tirath	12 "	2 feet
Lohri Achhri	4 "	2½ "			
Sari	1 foot	1½ "			

(*c*) *Kailang.*—A feeble snowstorm on the 7th gave 2 inches of snow.

Kilba.—Snow is said to have fallen on the 6th down to 11,000 feet.

V.—UNITED PROVINCES.

(*a*) *Garhwal.*—The snowfall of the month was very light and the weather was unusually dry and hot.

(*b*) *Almora.*—The total snowfall amounted to about 5 feet on the Nuwe pass, 9 feet on the Lipulekh pass, 6 feet on the Binkaru pass and about 1 foot on the Untadhura, Ralamdhura, Pindari and Kaphini. Weather was generally mild and warm.

VI.—SIKKIM.

Gyantse.—Very slight snowfalls occurred on the 1st and 3rd.

SUMMARY.

16. (*a*) Heavy rainfall is said to have occurred in Central Asia.

(*b*) In the mountain zone bordering upper India some local falls occurred: the accumulations of snow there were decidedly greater than usual at the end of the month.

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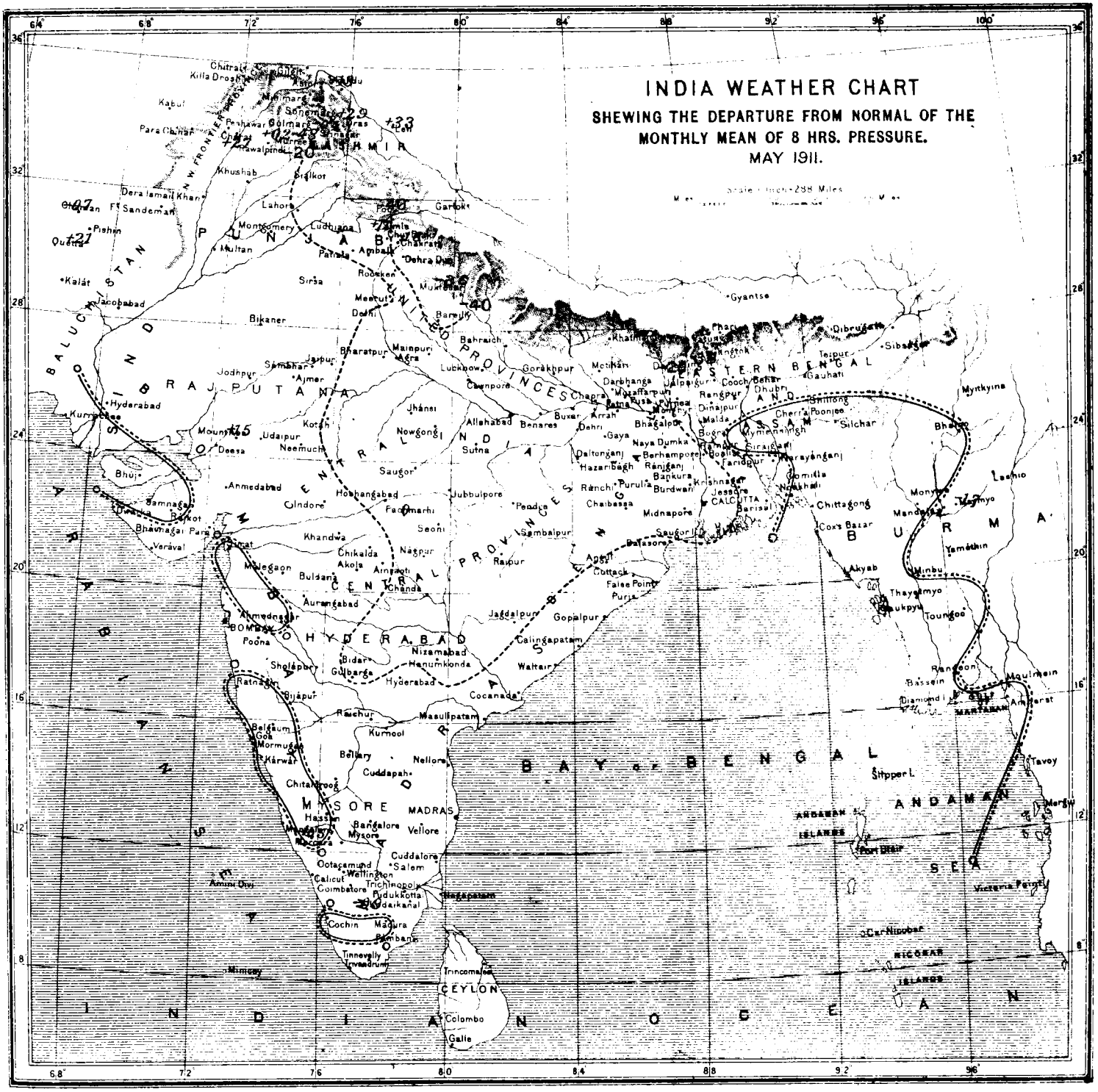
Reg. No. 4176 E., 11.—Z.—1,250.

Reg. No. 4195 E , 11.—Z.—3,800

The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2	miles per hour	...	one	feather	added to the wind arrow.					
,,	,, 2 to 5	,,	,,	,,	...	two	feathers	,,	,,	,,	,,
,,	,, 5 to 10	,,	,,	,,	...	three	,,	,,	,,	,,	,,
,,	,, 10 to 20	,,	,,	,,	...	four	,,	,,	,,	,,	,,
	over 20	,,	,,	,,	...	five	,,	,,	,,	,,	,,



Reg. No. 4176 E., 11—Z—1,250.
Reg. No 4196 E., 11—Z—3,800.

LITHO BY S.S.M.

The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020′ or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MAXIMUM TEMPERATURE.

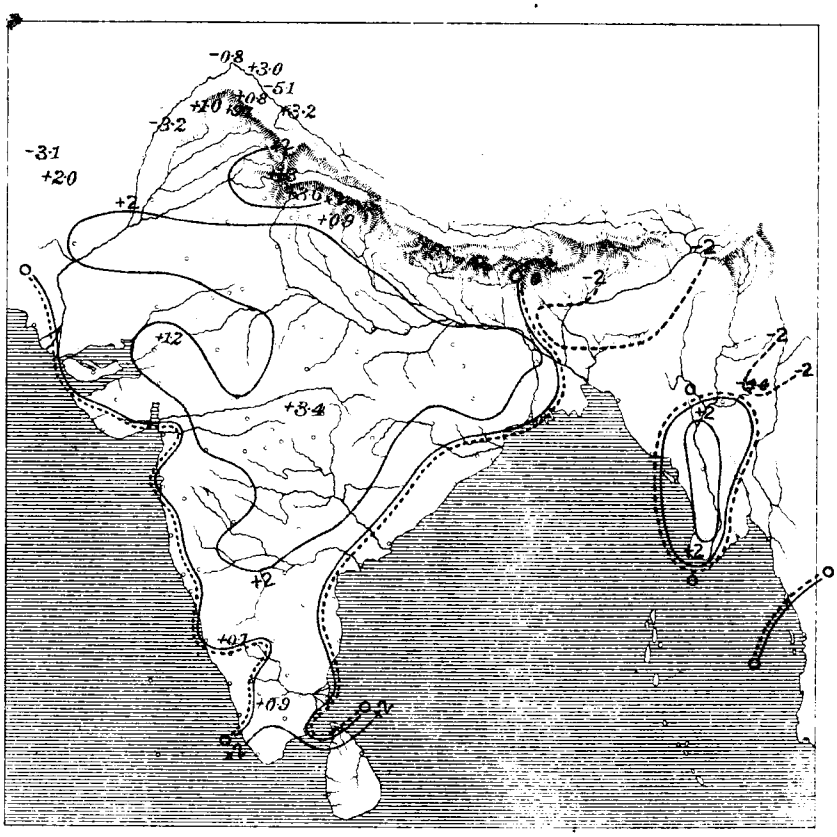
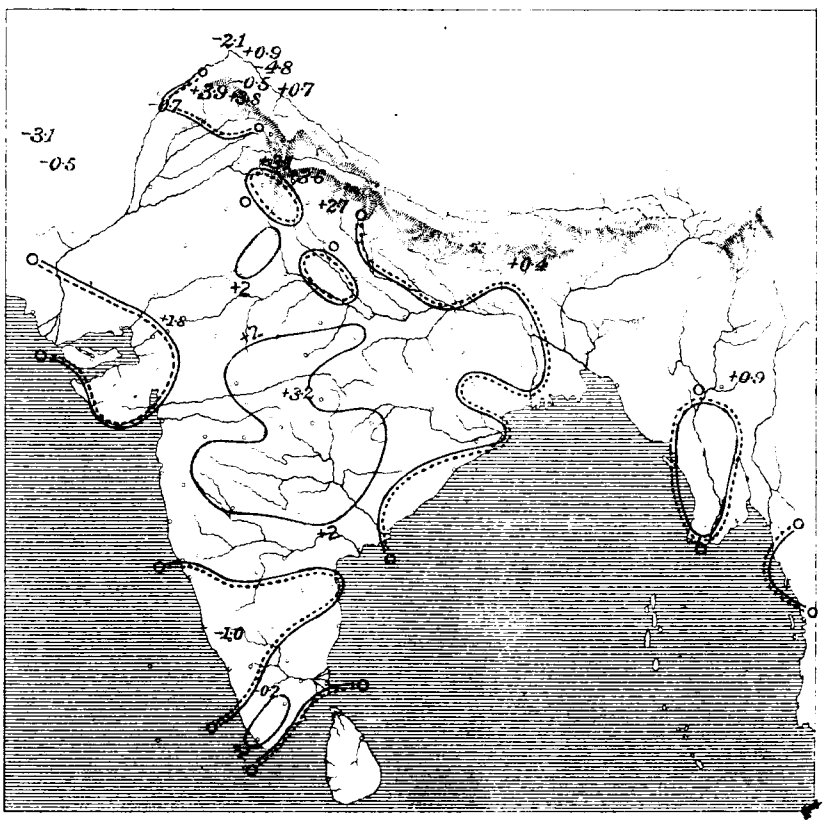


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MINIMUM TEMPERATURE.



LITHO. BY S.G.P.

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MEAN TEMPERATURE.

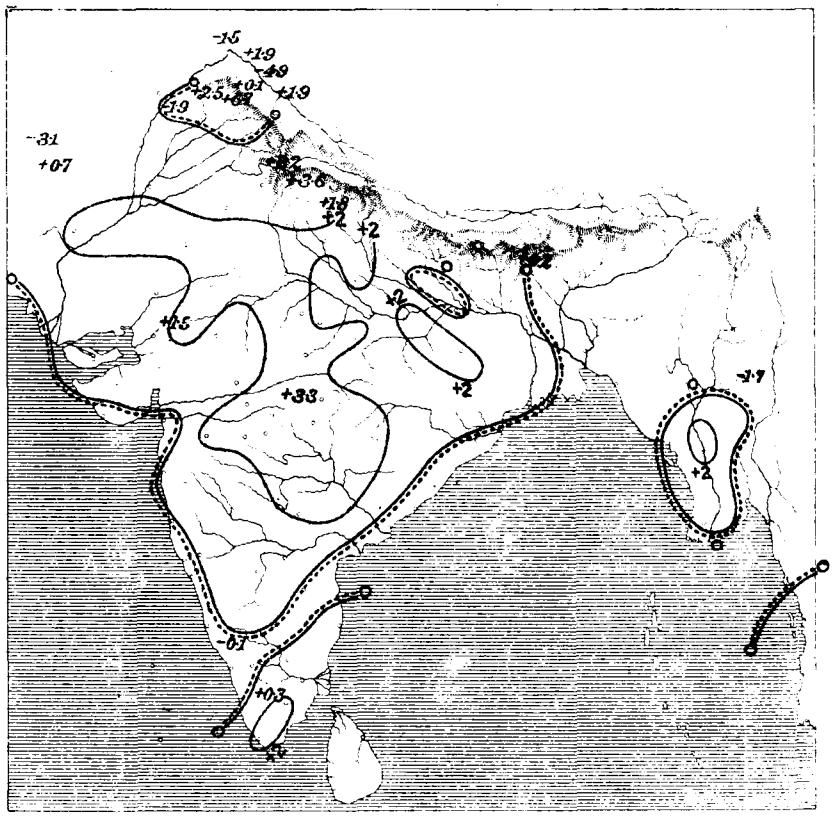
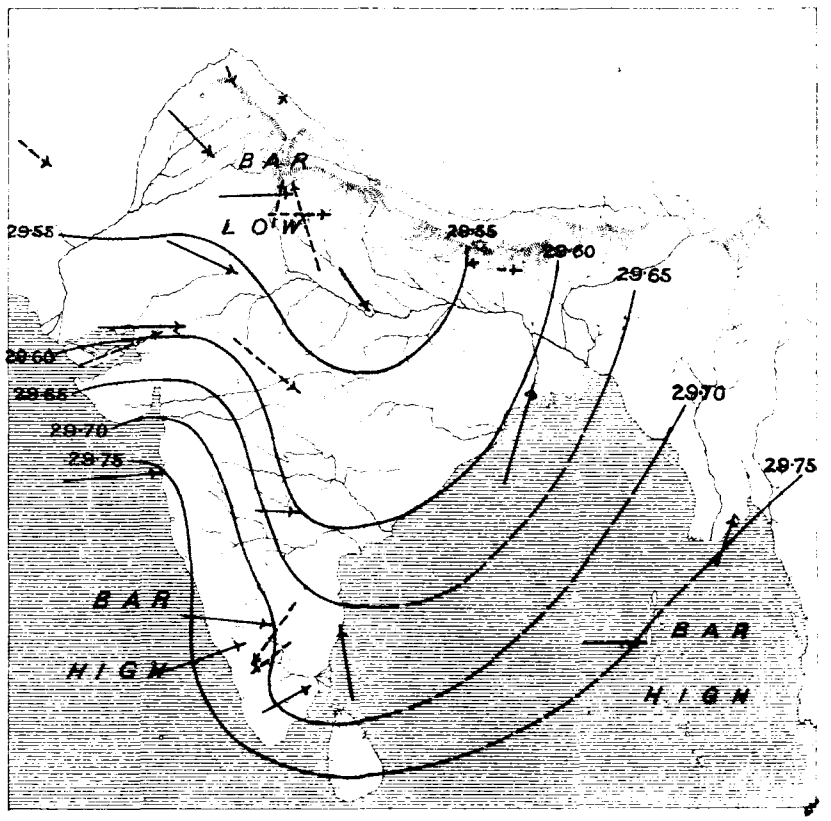


CHART SHEWING THE MONTHLY MEAN OF PRESSURE AND RESULTANT WIND DIRECTION.



LITHO. BY S.S. MUNDLE.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

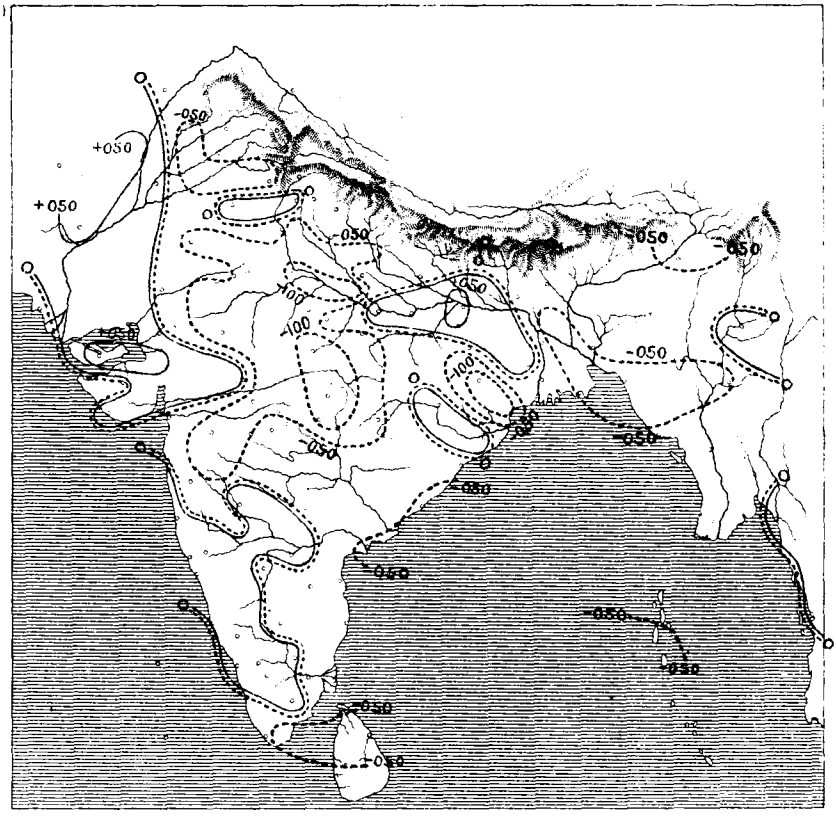


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

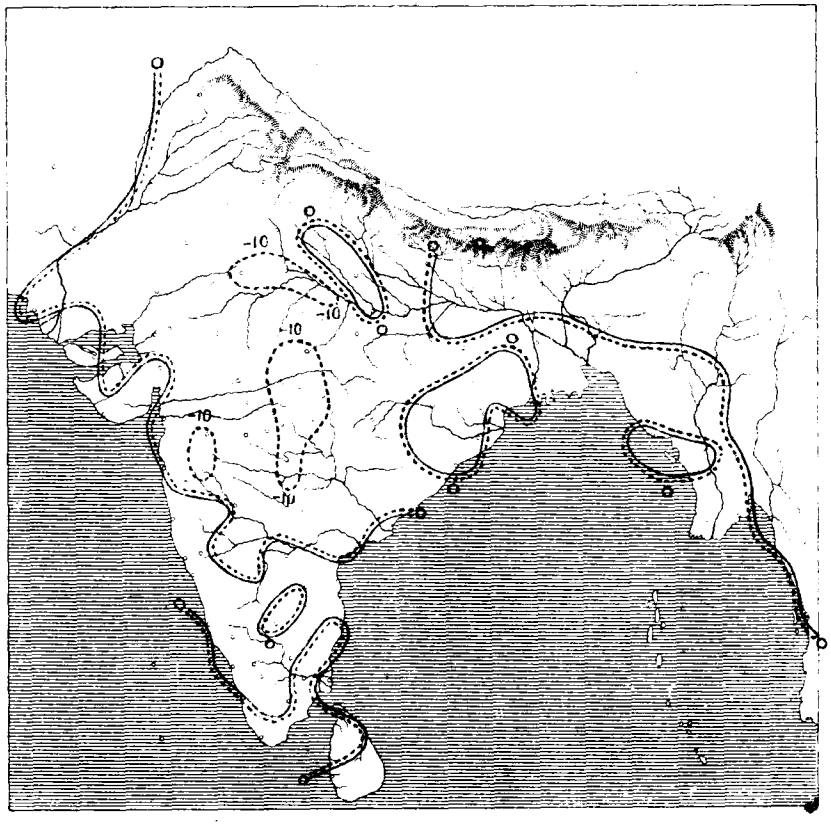


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

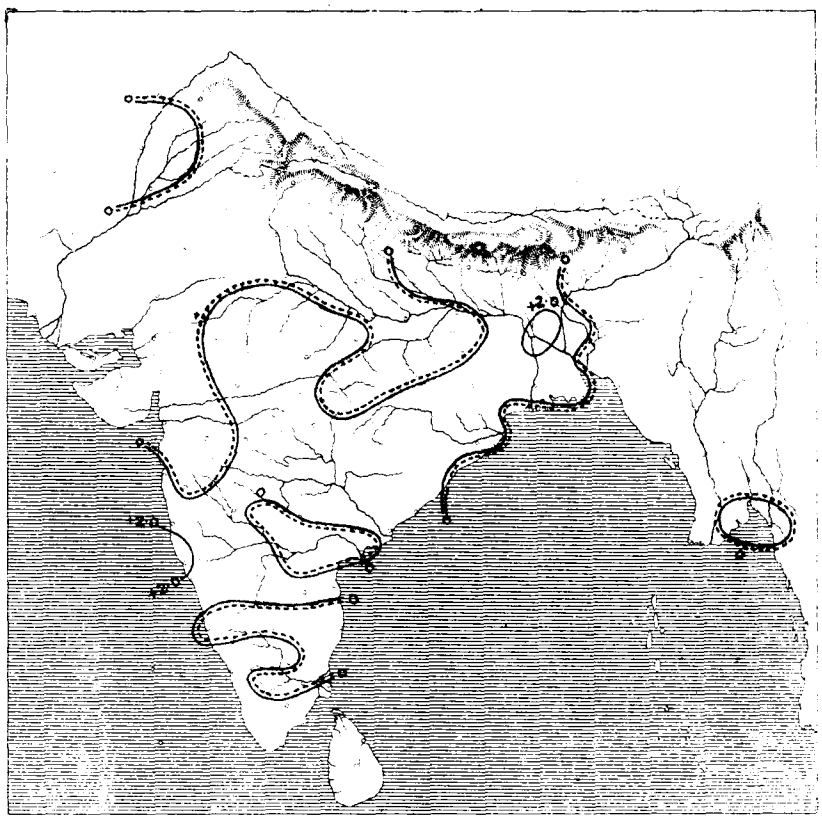
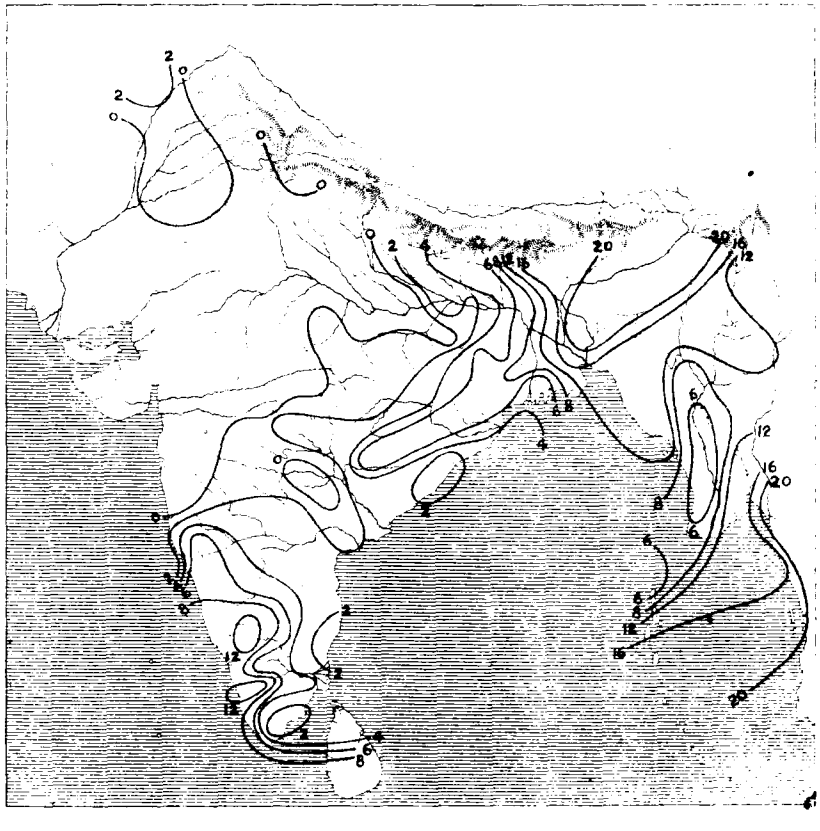


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)



Reg. No. 4176 E., 11.—Z.—1,250.

Reg. No. 4196 E., 11.—7.—3,800

LITHO. BY S.B.M.

The country is divided into 34 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall; the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Eastern Bengal
6. Bengal
7. Orissa
8. Chota Nagpur
9. Bihar
10. United Provinces, East
11. Do., West
12. Punjab, East and North
13. Do., Southwest
14. Kashmir
15. Northwest Frontier Province
16. Baluchistan
17. Sind
18. Rajputana, West
19. Rajputana, East
20. Gujarat
21. Central India, West
22. Do., East
23. Berar
24. Central Provinces, West
25. Do., East
26. Konkan
27. Bombay, Deccan
28. Hyderabad, North
29. Do., South
30. Mysore
31. Malabar
32. Madras, Southeast
33. Madras, Deccan
34. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, JUNE, 1911.

INTRODUCTION.

THIS review of the weather in India during the month of June, 1911, is based on observations taken daily at 8 hrs. at 242 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 34 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review. The brief notes on solar, seismic and magnetic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. The first burst of monsoon rainfall occurred on the 6th in Malabar, in the south Konkan on the 7th or 8th and at Bombay on the 10th; this burst takes place in ordinary years on the 3rd in Malabar and two days later in the Konkan. The current penetrated very rapidly into the interior, causing numerous thundershowers in Gujarat and the Central Provinces on the 9th, the Deccan on the 10th, Rajputana on the 13th and the Punjab on the 14th. In Bengal on the other hand the rains commenced on the 11th, a few days before the normal date, but the wave of rainfall never extended fully westwards beyond Bihar.

The Arabian Sea current weakened materially in the middle of the month and a marked break set in over its field on the 18th; by the 26th the break had extended over the region fed by the Bay current, excluding Burma.

The total rainfall of the month was in excess of the normal over a large part of the field of the Bay current, being especially heavy in Chota Nagpur and Bihar which received about 60 per cent. more than their respective normal amounts. The distribution of rainfall in the area of the Arabian Sea current was irregular: thus the precipitation was above the normal in the Central Provinces, nearly the whole of Madras, the south-west Punjab, and the North-West Frontier Province, and deficient elsewhere, the deficit being greatest in absolute amount in the Konkan.

Over the greater part of the country the deviations from normal of humidity, cloud and temperature were of little significance.

The barometer stood ·003″ higher than usual on the average of the whole of the plains. H. R.

Solar, seismic and magnetic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—Owing to bad weather no solar observations could be made on 6 days during the month and on 3 other days prominences could not be observed.

Sunspots.—There was a distinct decline in spot activity during the month. Only 4 new spots were observed as against 8 in May. The daily average number also fell to 0·5. The average life of a spot was 2·2 days. All the spots were small and, excepting one, did not last more

than 2 days. On 14 days there was no spot on the visible disc of the sun at the time of observation. The distribution in latitude was as follows:—

TABLE 1.

	0° — 10°	10° — 20°	Mean latitude.	Extreme latitudes.
North	2	—	6°. 0	10° and 2°
South	1	1	10°. 5	13° and 8°

Prominences.—Twenty-three large, 2 eruptive, and 2 metallic prominences were observed during the month. The tallest was seen on the 7th at latitude —55° East and was 170″ in height.

Prominences projected on the disc as absorption markings in hydrogen light were much more frequent in the southern hemisphere than in the northern. The daily average number recorded was 0·9 for the northern, and 4·0 for the southern hemisphere.

Magnetic disturbances.—Only small magnetic disturbances were recorded during the month. These occurred on the 4th, 21st, and 28th.

Seismological records.

TABLE 2.

No.	Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maximum. G. M. T.	End. G. M. T.	Maximum amplitude.	Duration.	REMARKS.
	1911.	H. M.	H. M.	H. M.	H. M.	mm. ″	H. M.	
37	June 1	14 41·2	...	...	14 55·0	...	0 13·8	Widening of line.
38	„ 3	21 12·4	...	...	21 48·4	...	0 36·0	Widening of line.
39	„ 7	11 24·4	12 27·4	12 43·3	14 57·2	4·5=2·3	3 32·8	
40	„ 8	0 12·0	...	...	1 02·8	...	0 50·8	Widening of line.
41	„ 15	...	14 35·1	14 47·7	18 08·0	1·3=5·5	3 32·9	No P. T.
42	„ 17	5 26·0	...	...	6 01·4	...	0 35·4	Widening of line.

All lines widened irregularly during high wind.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of June, 1911, the traces showed 12 calm days, and 18 days of small disturbances.

The days of the month selected as quiet for the purposes of the Magnetic Survey of India are the 3rd, 8th, 18th, 19th and 27th.

The following table represents the magnetic character of each day during the month :—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	S	17	C	25	C
2	C	10	S	18	C	26	C
3	C	11	S	19	C	27	C
4	S	12	S	20	S	28	S
5	S	13	S	21	S	29	C
6	S	14	S	22	S	30	C
7	C	15	S	23	S		
8	C	16	S	24	S		

C = calm, S = small, M = moderate, G = great, V. G. = very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms as also the ranges and the summed ranges of the horizontal force and declination for the month are as follow :—

Easterly declination . . .	0° 54′ 55″	
Horizontal force	0·36862	C. G. S. unit.
Vertical force	0·16221	„ „
Inclination	23° 45′·1	
Inclination (observed) . . .	23° 44′·4	
Horizontal force range . . .	0·00034	C. G. S. unit.
Horizontal force summed range .	0·00236	„ „
Declination range	4′·0	
Declination summed range . .	18′·7	

(NOTE.—Summed range means sum without regard to signs of 24 ordinates of the diurnal inequality.)

Seismic disturbances.

TABLE 4.

Date.	Commencement.	Maximum.	End.	Maximum amplitude.	Duration.
1911	H. M.	H. M.	H. M.	mm.	H. M.
June 7th .	11 24·3	12 39·7	14 31·4	5·0	3 7·1
„ 8th .	0 9·1	0 24·3	0 34·9	0·5	0 25·8
„ 15th .	14 35·1	14 58·6	17 39·9	6·9	3 4·8
„ 17th .	5 39·7	5 41·2	5 57·1	0·3	0 17·4

All times given above denote G. M. T.

Sensibility to tilt, 1 mm. = 0″·37 from 1st to 18th, 1 mm. = 0″·41 from 19th to 30th.

N. A. F. MOOS,
Director,
Bombay and Alibag Observatories.

CALCUTTA OBSERVATORY.

5. *List of displacements recorded by the Milne seismograph.*

TABLE 5.

Date 1911.	P. T. commencement. G. M. T.	L. W. commencement G. M. T.	Maximum G. M. T.	End G. M. T.	Duration.	Maximum displacement on trace from mean position.
	H. M.	H. M.	H. M.	H. M.	H. M.	mm.
June 15th .	14 32·3	...	*	18 8·3	3 36·0	*
„ 17th .	5 12·3	5 30·1	5 31·1	6 14·3	1 2·0	2·25

Sensibility 1 mm. = 0″·38 of tilt.

NOTE.—From 1st to 9th June, 1911, driving clock under repair.

* Time of max. and its amplitude cannot be determined.

E. P. HARRISON,
Offg. Meteorologist, Calcutta.

SIMLA OBSERVATORY.

6. *List of earthquakes recorded by the Omori-Ewing seismographs.*

TABLE 6.

Date.		1st P. T.	2nd P. T.	L. W.	Max. amplitude.	End approx.	Duration.	Max. displacement.*	REMARKS.
		H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
7th	A	11 24·1	11 42·6	12 6·6	12 9·1	13 42	2 18	12·5	
	B	11 23·9	11 47·0	...	11 49·6	14 45	3 21	11·0	
8th	A	0 3·9	0 8·2	0 12·7	0 15·2	0 45	0 41	0·6	
	B	0 3·8	0 8·1	0 12·7	0 16·7	1 30	1 26	1·0	
15th	A	14 33·8	...	14 40·6	?	20 30	5 56	?	Touched stops.
15th to 16th.	B	14 33·8	14 37·6	14 40·8	?	3 30?	12 56?	?	Do.
17th	A	5 17·5	...	...	5 36·5	6 2	0 44	0·3	
	B	5 25·6	...	...	5 33·0	6 5	0 39	0·8	

All times are given in G. M. T. B = N—S component.
A = E—W component. * Magnification of each instrument was 15.

The following table contains a list of earthquakes that have been reported :—

TABLE 7.

Place at which felt.	Date.	G. M. T.	Duration.	Intensity. Rossi-Forel scale.	No. of shocks.	REMARKS.
		H. M.	Sec.			
Chitral .	7th	22 15	1	7	1	
Srinagar .	9th	4 10	5	7	1	Sounds resembling thunder during shock.
Shillong .	21st	3 50	3	4	1	
Salonah (Assam).	22nd	23 33	5	3	1	Sounds resembling distant thunder during shock.
Drosh .	23rd	21 0	3	3	3	Gurgling sound during shock.
Chitral .	25th	17 15	2	7	3	From E. to W.
Drosh .	29th	9 25	2	3	1	Gurgling sound.

Solar radiation.—The following figures give the intensity of solar radiation, as measured at Simla by Angström's pyrheliometer. The values are corrected to local noon, and expressed in grammecalories per square centimetre per minute :—

Maximum	1·36
Minimum	1·20
Mean	1·29
Number of days of observation . . .	7

W. A. H.

ROYAL ALFRED OBSERVATORY, MAURITIUS.

7. No information has been received.

Weather in the Indian monsoon region.

8. Pressure was in decided excess at Zanzibar and Seychelles, but was in defect at Mauritius, though not to the same extent as in May. Winds were considerably weaker than usual at the Seychelles and the month's rainfall there was 65 per cent. below the average. At Zanzibar the departures from normal of rainfall and wind were but feebly marked.

The pressure changes that had occurred since May over the Indian Ocean were prejudicial to the prospects of rainfall in India during the following month.

TABLE 8.

—	Mauritius.*	Zanzibar.	Seychelles.
Departure from normal of mean pressure.	−·035	+·043	+·042
Actual mean wind direction	S 45° E	S 7° W	S 20° E
Normal mean wind direction	S 61° E	S 4° E	S 27° E
Actual mean wind velocity (miles per diem).	242	224	207
Normal mean wind velocity (miles per diem).	269	211	258
Rainfall departure from normal .	+ 1·19	+0·45	−3·10

* Approximate data derived from weekly telegrams.

H. R.

Depressions and cyclonic storms.

9. Under normal conditions in this month violent storms, moving generally in a north-westerly direction, may occur during the first few days over the Arabian Sea, and in the course of the month one or two storms of small intensity may be expected to develop at the head of the Bay and move into north-east India.

In the month under review a preliminary advance of monsoon winds over the centre and west of the Arabian Sea occurred during the first few days, and an area of low pressure which developed off the west coast of the Peninsula caused a temporary inflow of winds of the monsoon type into India between the 6th and the 10th. There was a strong tendency towards the formation of a storm over the south-west of the Arabian Sea during this period, but simultaneously a depression was developing at the head of the Bay. The latter formed a well marked storm by the 10th, and winds along the Bombay coast had responded to its influence, while the Arabian Sea disturbance had begun to disappear. The storm crossed the Orissa coast on the night of the 10th and introduced the first burst of true monsoon rainfall into north-east India. Travelling along a curved path through the east of the Central Provinces, Chota Nagpur and Bengal, it gave very heavy rain locally but weakened and disappeared on the 15th. Meanwhile another depression formed at the head of the Bay and this, crossing the coast on the 18th, travelled into Bihar and disappeared on the 22nd. It was shallower than the preceding storm but gave moderately heavy falls of rain.

During the remainder of the month both branches of the monsoon were abnormally weak and no further disturbances occurred.

W. A. H.

Pressure.

10. On the mean of the month a defect of pressure prevailed in northeast and upper India, greatest in Eastern Bengal and parts of Bengal and in the Indus valley between Peshawar and Jacobabad; while an excess obtained over the greater part of Burma and in the Peninsula where it was most marked in the west coast districts.

Such pressure features are usually prejudicial to a proper distribution of rainfall during the monsoon.

TABLE 9.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
Burma	+·007
Eastern Bengal and Assam	−·022
Bengal	−·022
United Provinces	−·002
Punjab	−·007
North-West Frontier Province	−·024
Sind	−·002
Rajputana	−·003
Bombay	+·026
Central India	+·006
Central Provinces	+·013
Hyderabad	+·021
Mysore	+·026
Madras	+·017

TABLE 10.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference B—A.
	"		"	"
Quetta . . .	+·003	Jacobabad . .	—·024	—·027
Leh . . .	+·008	Lahore . .	—·009	—·017
Murree . . .	—·006	Peshawar . .	—·023	—·017
Simla . . .	+·017	Ludhiana . .	+·008	—·009
Chakrata . . .	+·012	Roorkee . .	+·014	+·002
Darjiling . . .	—·040	Dhubri . . .	—·018	+·022
Mount Abu . .	+·015	Deesa . . .	+·012	—·003
Pachmarhi . .	+·013	Khandwa . .	+·026	+·013
Kodaikanal . .	—·001	Madura . .	+·031	+·032

H. R.

Temperature.

11. Day temperatures were low over a large area including the north-east of the Peninsula, the east-central parts of the country, and the west of north-east India, the departure averaging more than 4½° in the Central Provinces East, the west of Orissa and of Chota Nagpur, and the south of Bihar. They were also rather low in the extreme south, along the western Himalayas, in north Burma, and locally in Rajputana and Gujarat; but were appreciably above normal along the strip extending across the country in lat. 28° N. and markedly above normal in Kashmir. Night temperatures shewed no widespread marked departures. They were however markedly below normal locally in the extreme south and the central parts of the country and markedly above normal locally in the United Provinces and the East Punjab.

It is noteworthy that nowhere in the extreme north did temperature show any evidence of the excessive accumulations of snow later proved to have existed: in fact temperatures in Kashmir were more markedly above normal than in any other division.

As was to be expected the mean temperature distribution agreed in its larger features with that of day temperature.

TABLE 11.

SUB-DIVISION.	ACTUAL TEMPERATURE. Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	DEPARTURE FROM NORMAL OF Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
1. Bay Islands	85·7	77·3	81·5	8·5	15·9	—1·1	—0·5	— 0·6
2. Lower Burma	85·8	75·7	80·7	10·1	17·6	—0·2	—0·1	— 0·1
3. Upper do.	89·7	75·5	82·6	14·2	24·3	—1·3	—0·2	— 1·1
4. Assam	87·8	76·6	82·2	11·2	23·8	—1·0	+0·2	— 1·2
5. Eastern Bengal	87·8	77·5	82·7	10·3	21·2	—0·4	+0·4	— 0·8
6. Bengal	90·7	78·5	84·6	12·2	25·4	—2·0	—0·7	— 1·3
7. Orissa	90·1	78·5	84·3	11·7	26·0	—3·3	—1·4	— 1·9
8. Chota Nagpur	90·5	76·4	83·5	14·1	32·1	—4·6	—1·2	— 3·4
9. Bihar	92·3	78·9	85·6	13·4	31·4	—3·4	—0·3	— 3·1
10. United Provinces, East	99·6	81·6	90·6	17·9	33·8	0	+0·5	— 0·5
11. Do., West	100·5	81·3	90·9	19·2	34·2	+0·2	+0·8	— 0·6

Sub-division.	Actual temperature. Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Departure from normal of Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
12. Punjab, East and North	103·2	80·7	92·0	22·5	42·6	—0·4	+1·1	— 1·5
13. Do., Southwest	107·6	85·0	96·4	22·6	46·6	—0·7	+1·6	— 2·3
14. Kashmir	85·2	56·8	71·0	28·4	44·4	+3·9	+2·1	+ 1·8
15. North-West Frontier Province	107·9	80·3	94·1	27·6	47·3	+0·9	+1·0	— 0·1
16. Baluchistan	100·4	73·6	87·0	26·8	39·4	+2·5	—0·1	+ 2·6
17. Sind	102·5	82·9	92·7	19·6	29·8	—0·1	0	— 0·1
18. Rajputana, West	105·5	83·1	94·3	22·5	39·1	—0·3	—0·9	+ 0·6
19. Do., East	101·3	82·0	91·6	19·3	35·3	—0·7	—1·0	+ 0·3
20. Gujarat	95·2	79·7	87·5	15·5	26·7	—0·6	—0·4	— 0·2
21. Central India, West	94·7	75·5	85·1	19·3	32·6	—1·6	—0·8	— 0·8
22. Do., East	98·9	81·5	90·1	17·3	35·3	—1·3	—0·2	— 1·1
23. Berar	94·7	75·7	85·2	19·0	32·9	—1·1	—0·3	— 0·8
24 Central Provinces, West	94·6	76·1	85·3	18·5	34·5	—2·5	—1·9	— 0·6
25. Do., East	91·4	75·9	83·7	15·4	34·8	—3·5	—1·7	— 1·8
26. Konkan	86·3	77·9	82·1	8·3	16·5	—0·1	+0·2	— 0·3
27. Bombay Deccan	89·7	71·9	80·8	17·8	30·8	—0·4	—0·3	— 0·1
28. Hyderabad, North	93·1	74·1	83·6	19·0	33·2	—2·5	—0·8	— 1·7
29. Do., South	94·7	76·1	85·4	18·5	34·4	—0·8	+0·5	— 1·3
30. Mysore	83·3	67·5	75·5	15·8	25·5	—0·3	—0·1	— 0·2
31. Malabar	84·1	74·2	79·1	9·9	17·7	—0·4	+0·1	— 0·5
32. Madras, Southeast	95·4	77·6	86·5	17·8	29·0	—0·9	—0·3	— 0·6
33. Do. Deccan	97·2	77·6	87·4	19·6	31·6	+0·1	—0·1	+ 0·2
34. Do. Coast, North	94·4	80·1	87·3	14·3	29·5	—0·6	—0·6	0

TABLE 12.

Division.	Departure from normal of Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	—0·7	—0·1	—0·4
Eastern Bengal and Assam	—0·6	+0·3	—0·1
Bengal	—3·1	—0·8	—2·0
United Provinces	+0·1	+0·7	+0·4
Punjab	—0·5	+1·3	+0·4
North-West Frontier Province	+0·9	+1·0	+0·9

Division.	Departure from normal of Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Sind	—0·1	0	0
Rajputana	—0·5	—0·9	—0·7
Bombay	—0·4	—0·2	—0·3
Central India	—1·5	—0·5	—1·0
Central Provinces	—2·4	—1·5	—2·0
Hyderabad	—1·3	0	—0·7
Mysore	—0·3	—0·1	—0·2
Madras	—0·6	—0·3	—0·4

Winds.

12. The mean wind direction did not, except locally, depart to any large extent from the normal. The westerly component was, however, stronger than usual over the greater part of India and more persistent than usual almost everywhere. Thus westerly winds were in general stronger and steadier than the normal; while easterly winds were weaker and less steady than the normal. The superficial effects of the excessive snow accumulation were less marked than in May and there was no obvious departure from the normal direction or velocity in the extreme north, directly attributable to the accumulation.

TABLE 13.

Division.	Departure from normal of	
	Hourly wind velocity.	Wind steadiness.
Burma	—0·5	— 9
Eastern Bengal and Assam	—0·4	— 2
Bengal	+0·5	— 9
United Provinces	0	— 4
Punjab	—0·1	+ 1
North-West Frontier Province	—0·9	+ 1
Sind	—1·5	— 5
Rajputana	+1·6	+ 9
Bombay	—1·0	+ 6
Central India	+0·2	+ 8
Central Provinces	+1·1	— 1
Hyderabad	—0·9	+ 7
Mysore	+1·3	+ 2
Madras	+1·2	+ 4

Humidity and cloud.

13 (1) Relative humidity was markedly low in parts of the United Provinces, Rajputana and the Punjab, but on the whole did not differ much from normal. Absolute humidity varied considerably from place to place over northern India: the most marked departures from normal occurring in upper Sind and the Punjab.

(2) The amount of cloud was in defect in the western half of the Peninsula, over the United Provinces, the greater part of north-east India, and the neighbouring parts of Burma. The deficiency was most marked in the United Provinces, the east Punjab, and the north Bombay Deccan.

TABLE 14.

Division.	Hygrometry; 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	88	0	·883	—·006	8·2	+0·5
Eastern Bengal and Assam.	88	— 1	·934	—·006	7·5	—0·1
Bengal	82	+ 1	·894	—·021	6·7	+0·4
United Provinces.	64	— 3	·819	+·016	4·0	—0·8
Punjab	55	+ 2	·742	+·038	2·2	—0·6
North-West Frontier Province.	48	— 2	·666	—·029	1·9	+0·2
Sind	69	+ 5	·899	+·050	3·2	—0·2
Rajputana	59	+ 2	·744	+·020	3·1	—0·5
Bombay	77	+ 1	·834	—·009	6·5	—0·3
Central India	66	0	·741	—·012	6·1	+1·2
Central Provinces	70	+ 2	·732	—·010	6·3	+0·2
Hyderabad	68	— 1	·692	—·037	6·7	—0·2
Mysore	83	+ 1	·662	+·009	6·8	—1·3
Madras	73	0	·812	—·010	6·3	—0·2

Rainfall.

14. Malabar and the Konkan received numerous showers from the 3rd to the 5th during which period an advance of the monsoon was in progress over the Arabian Sea. Heavy rainfall such as characterises the breaking of the monsoon occurred in Malabar on the 6th, in the south Konkan on the 7th and 8th and at Bombay on the 10th: on these dates, *i.e.*, four or five days later than is normal, the monsoon rains proper may be regarded as having begun in those localities of the west coast. The humid winds advanced rapidly into the interior, occasioning numerous thundershowers in Gujarat and the Central Provinces on the 9th, and in the Deccan on the 10th. The advance of the monsoon over the sea area of the Bay of Bengal also occurred in the first week, simultaneously with that in the Arabian Sea, and gave on the 11th the first burst of true monsoon rainfall in north-east India. The Arabian Sea current diminished considerably in strength on the 13th and during the next two days its activity lay chiefly in north-west India and the central parts of the country. By the 18th this current had practically withdrawn, and there was no recurrence of rainfall attributable to it during the rest of the month. The dry westerly winds extended into north-east India after the 24th establishing a complete break in the rains over almost the whole of India which persisted until the 5th of July.

The total precipitation was above normal in Burma, north-east India, the Punjab Southwest, the North-West Frontier Province, the Central Provinces East and the south and east of the Peninsula, and about normal in the Bay Islands, the Punjab East and North, Gujarat, Berar, the Central Provinces West, the Bombay Deccan, Mysore and the Madras Deccan. Elsewhere the amount was in defect, the deficiency being most marked in the United Provinces, Central India and the Konkan.

TABLE 15.

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
1. Bay Islands	16·0	19·7	16·79	17·63	−0·84	− 5
2. Lower Burma	23·7	22·1	27·65	25·36	+2·29	+ 9
3. Upper do.	11·9	9·8	8·77	6·74	+2·03	+ 30
4. Assam	16·4	17·2	18·58	17·49	+1·09	+ 6
5. Eastern Bengal	18·4	15·4	20·95	16·71	+4·24	+ 25
6. Bengal	14·3	12·5	12·76	10·97	+1·79	+ 16
7. Orissa	13·2	10·2	13·50	9·45	+4·05	+ 43
8. Chota Nagpur	14·0	10·5	14·82	9·22	+5·60	+ 61
9. Bihar	12·2	9·0	13·13	8·29	+4·84	+ 58
10. United Provinces, East	4·4	5·9	3·80	5·34	−1·54	− 29
11. Do., West	4·1	5·3	3·15	4·61	−1·46	− 32
12. Punjab, East and North	3·3	3·1	2·37	2·36	+0·01	0
13. Do., Southwest	2·3	1·3	1·49	0·71	+0·78	+110
14. Kashmir	2·3	3·0	1·24	1·71	−0·47	− 27
15. North-West Frontier Province	2·3	1·5	1·14	0·85	+0·29	+ 34
16. Baluchistan	0	0·6	0·02	0·30	−0·28	− 93
17. Sind	0·1	0·6	0·10	0·41	−0·31	− 76
18. Rajputana, West	2·1	2·1	1·13	1·39	−0·26	− 19
19. Do., East	4·0	4·2	2·73	3·15	−0·42	− 13
20. Gujarat	5·6	5·9	5·54	5·65	−0·11	− 2
21. Central India, West	6·8	6·9	4·87	6·80	−1·93	− 28
22. Do., East	6·5	7·3	5·00	7·33	−2·33	− 32

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
23. Berar	7·0	8·1	5·45	5·57	−0·12	− 2
24. Central Provinces, West	9·0	8·6	7·77	7·17	+0·60	+ 8
25. Do., East	11·8	9·6	11·91	8·46	+3·45	+ 41
26. Konkan	17·0	18·6	20·32	26·62	−6·30	− 24
27. Bombay Deccan	7·8	8·4	5·11	5·57	−0·46	− 8
28. Hyderabad, North	7·3	8·1	4·15	5·61	−1·46	− 26
29. Do., South	7·6	6·8	3·36	4·05	−0·69	− 17
30. Mysore	7·5	7·2	5·74	5·27	+0·47	+ 9
31. Malabar	22·6	23·3	42·81	33·34	+9·47	+ 28
32. Madras, Southeast	3·8	3·0	2·04	1·59	+0·45	+ 28
33. Do. Deccan	4·4	4·7	2·34	2·54	−0·20	− 8
34. Do. Coast, North	7·5	6·3	5·79	4·36	+1·43	+ 33

TABLE 16.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	17·64	15·41	+2·23	+ 14
Eastern Bengal and Assam	19·76	17·10	+2·66	+ 16
Bengal	13·28	9·41	+3·87	+ 41
United Provinces	3·50	5·00	−1·50	− 30
Punjab	2·20	2·03	+0·17	+ 8
North-West Frontier Province	1·14	0·85	+0·29	+ 34
Sind	0·10	0·41	−0·31	− 76

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Rajputana	2·17	2·68	−0·51	− 19
Bombay	8·02	9·42	−1·40	− 15
Central India	4·91	6·98	−2·07	− 30
Central Provinces	7·75	6·81	+0·94	+ 14
Hyderabad	3·72	4·76	−1·04	− 22
Mysore	5·74	5·27	+0·47	+ 9
Madras	6·93	5·43	+1·50	+ 28
Mean of India	8·08	7·49	+0·59	+ 8

W. A. H.

Snowfall.

I.—AFGHANISTAN.

15. No snow fell on the hills around Kabul. At the end of the month the area still covered with the unmelted residue of the winter accumulations was larger than usual.

II.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Kurram.*—There was a sprinkling on the high hills in June. At the end of the month the accumulated snow on the Safed Koh was of greater depth than usual.

(*b*) *Drosh.*—Several falls occurred on elevations above 14,000 feet.

(*c*) *Hazara.*—Snow to a depth of about 4 inches fell on the 13th and 14th in the Kagan Valley down to a level of 17,000 feet.

III.—KASHMIR.

Light snow is reported to have fallen on the higher ranges near Sonemarg and Skardu and also on the Affarwata mountains near Gulmarg. Tragbal pass had become clear of snow by the end of first week in July.

No snow fell on the mountains around Leh; the accumulations there were however believed to be greater than usual.

IV.—PUNJAB.

(*a*) *Chamba.*—More than the usual quantity of snow lay on the higher hills.

(*b*) *Kangra.*—No snowfall occurred. The accumulations existing on the last day of the month were apparently of more than the average depth.

(*c*) *Kilba.*—No snow fell and all the passes were open to traffic.

V.—UNITED PROVINCES.

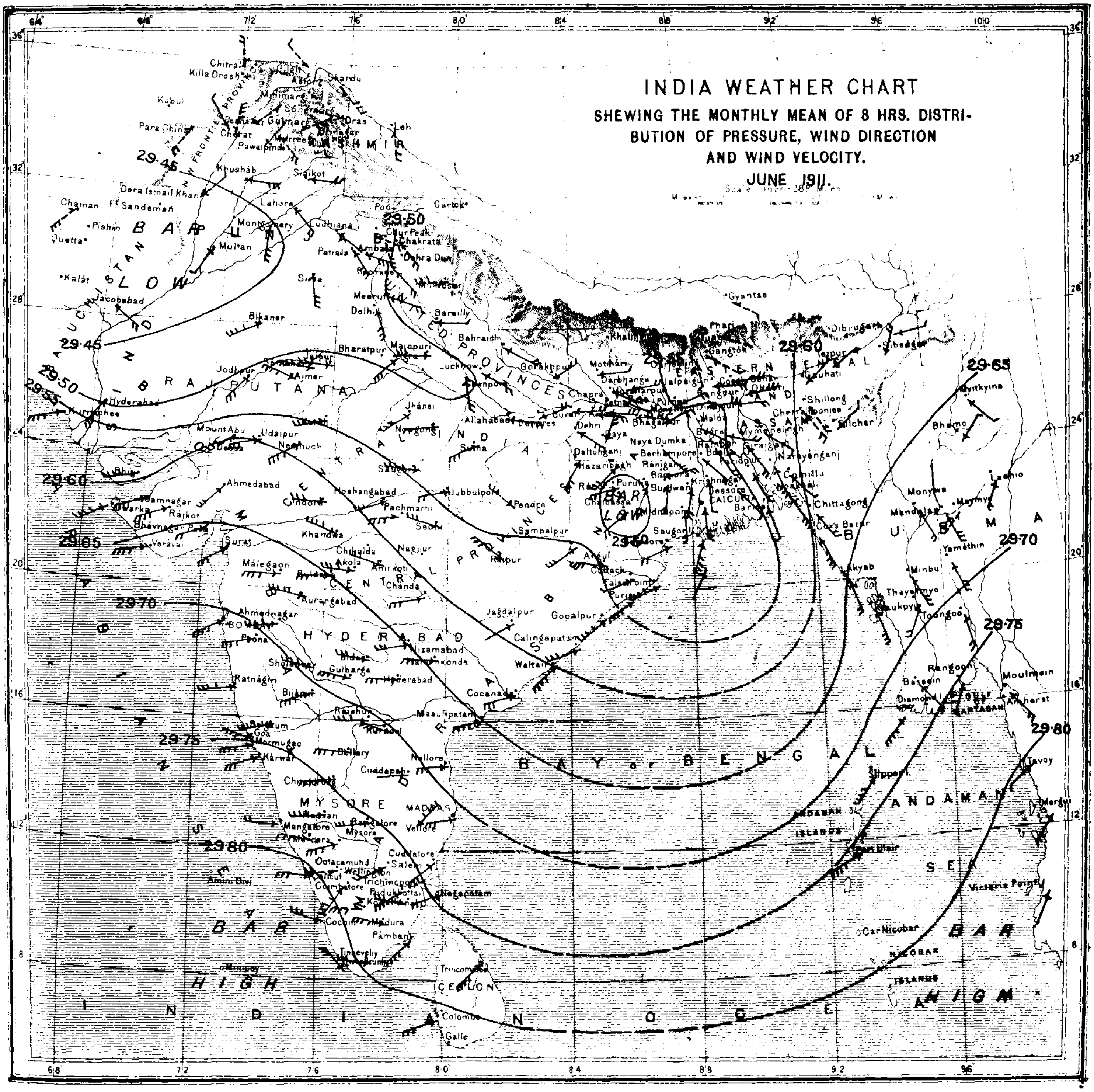
(*a*) *Gurhwal.*—About the average amount of snowfall occurred. The unmelted residue of accumulations at the end of the month was thicker than usual.

(*b*) *Almora.*—No information is forthcoming.

SUMMARY.

16. According to the available information the snow fall of the month in the mountain zone bordering upper India was light and local. The accumulations still existing at the end of the month were however of more than the usual depth.

H. R.



Reg. No. 4176 E., 11.—Z.—1,250.
Reg. No. 4195 E., 11.—Z.—3,800.
LITHO. SY. S. S. M.

The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of 0 to 2 miles per hour	...	one feather added to the wind arrow.
,, ,, 2 to 5 ,, ,, ,,	...	two feathers ,, ,, ,, ,,
,, ,, 5 to 10 ,, ,, ,,	...	three ,, ,, ,, ,, ,,
,, ,, 10 to 20 ,, ,, ,,	...	four ,, ,, ,, ,, ,,
over 20 ,, ,, ,,	...	five ,, ,, ,, ,, ,,

Reg. No. 4176 E., 11 —Z —1,250.

Reg. No. 4195 E., 11 —Z —3,800.

The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing '020' or two hundredths of an inch. &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MAXIMUM TEMPERATURE.

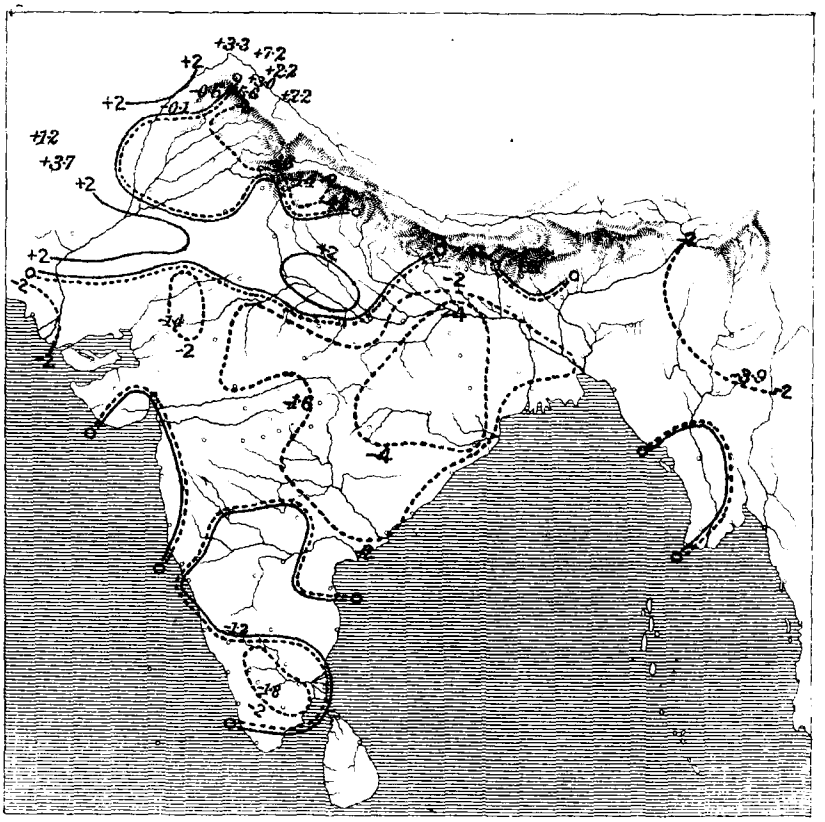
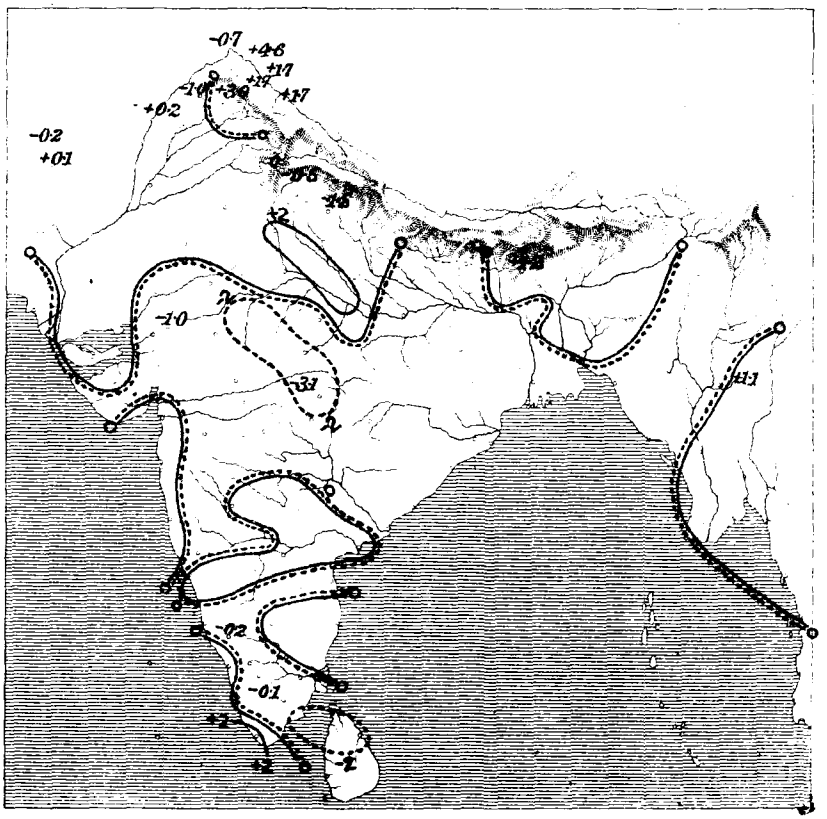


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MINIMUM TEMPERATURE.



LITHO. BY S.S.H.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

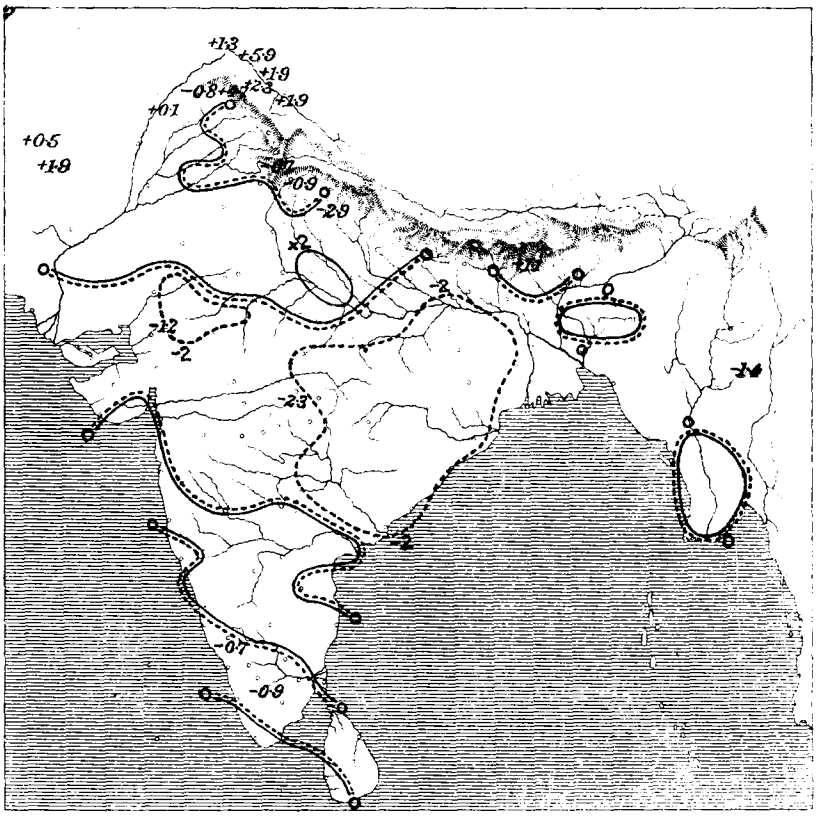


CHART SHEWING THE MONTHLY MEAN OF
PRESSURE AND RESULTANT
WIND DIRECTION.

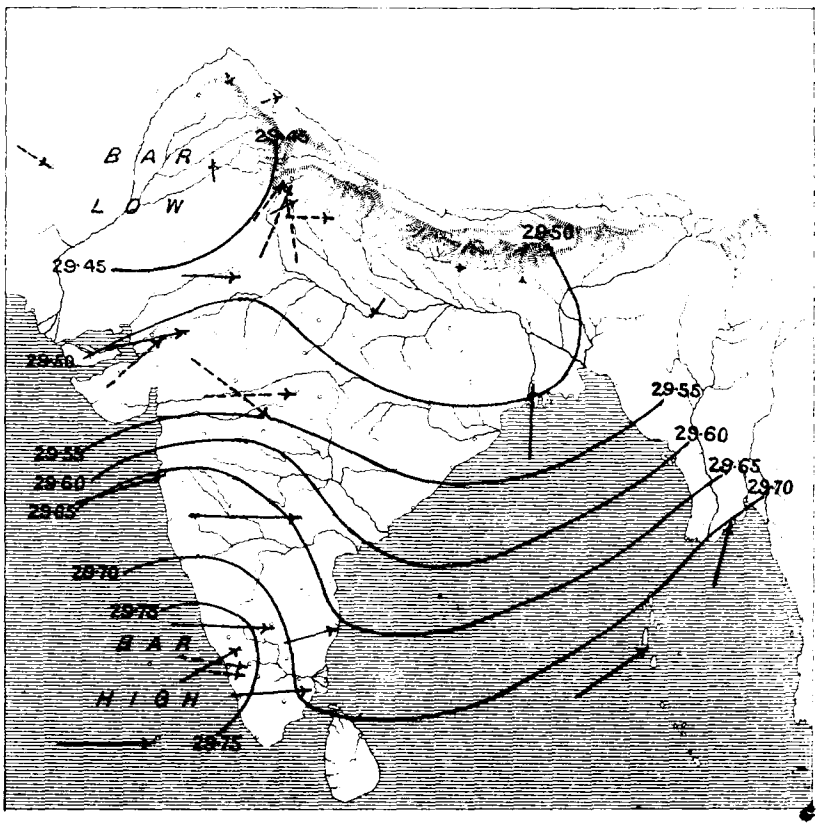


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

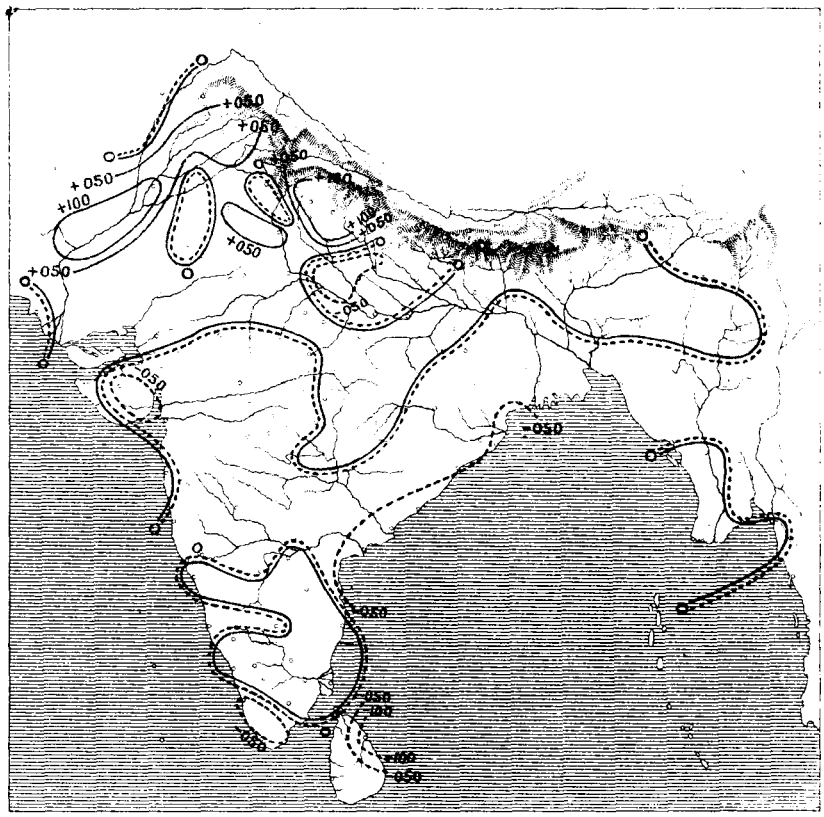


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

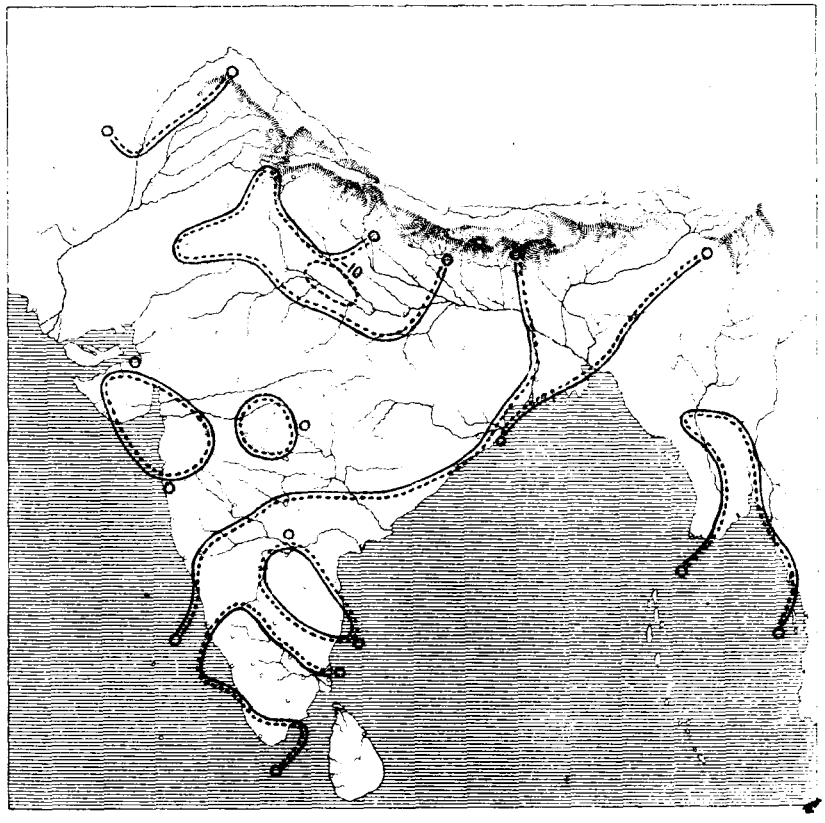


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

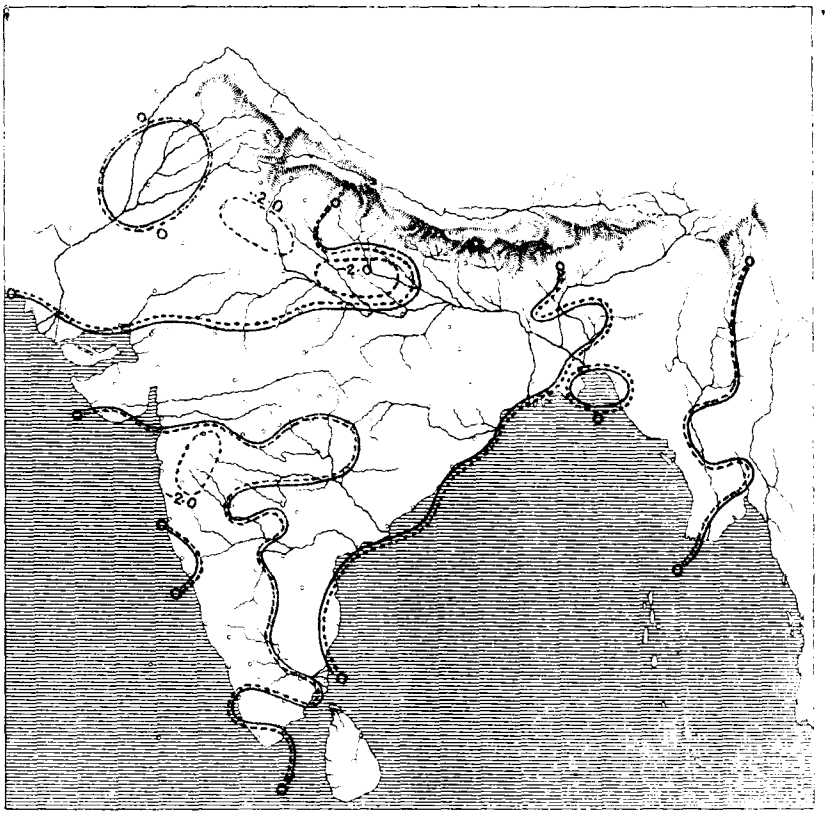
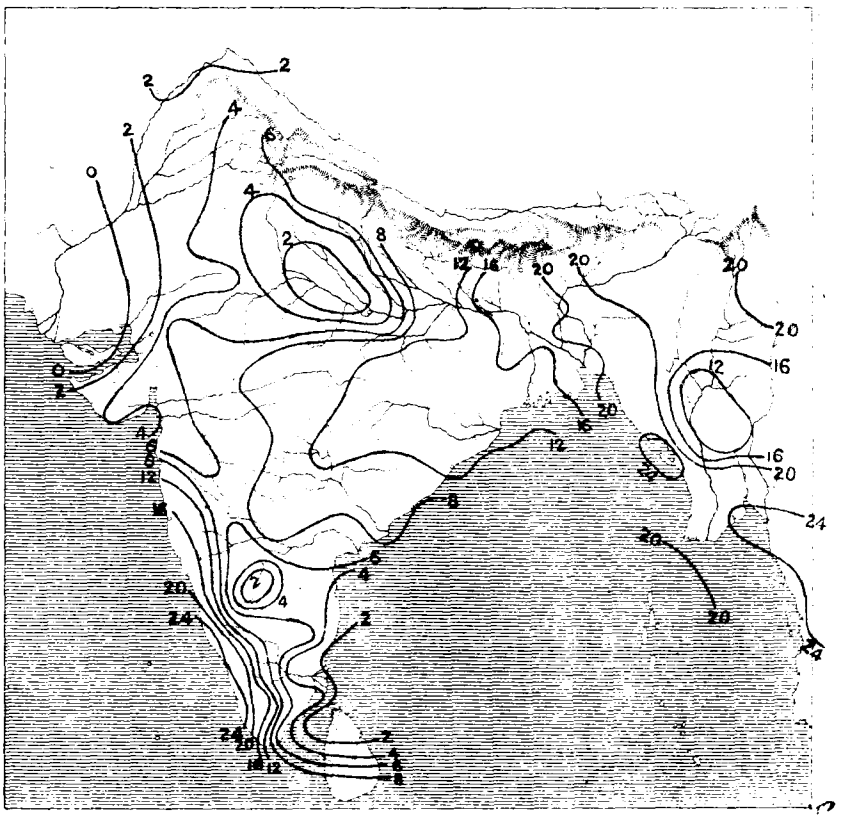


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)



Reg. No. 4176 E., 11.—Z.—1,250.

Reg. No 4196 E., 11.—Z.—3,800

LITHO. BY S & M

The country is divided into 34 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall; the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Eastern Bengal
6. Bengal
7. Orissa
8. Chota Nagpur
9. Bihar
10. United Provinces, East
11. Do., West
12. Punjab, East and North
13. Do., Southwest
14. Kashmir
15. Northwest Frontier Province
16. Baluchistan
17. Sind
18. Rajputana, West
19. Rajputana, East
20. Gujarat
21. Central India, West
22. Do., East
23. Berar
24. Central Provinces, West
25. Do., East
26. Konkan
27. Bombay, Deccan
28. Hyderabad, North
29. Do., South
30. Mysore
31. Malabar
32. Madras, Southeast
33. Madras, Deccan
34. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW.

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, JULY, 1911.

INTRODUCTION.

THIS review of the weather in India during the month of July, 1911, is based on observations taken daily at 8 hrs. at 241 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 34 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review. The brief notes on solar, seismic and magnetic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. The drought which had characterized the latter part of June lasted with only slight interruption up to nearly the end of July: it was at its height from the 15th to the 26th, during which period there was an almost complete suspension of rainfall over practically the whole of the interior.

Indeed Lower Burma, Eastern Bengal and Assam, Mysore, Hyderabad and the Madras Deccan were the only areas where the month's total rainfall measurements approached or surpassed the normal value. In the United Provinces, the Punjab, the North-West Frontier Province, Rajputana and Gujarat the deficit was more than two-thirds of the normal fall, and in Kashmir, Central India, the Central Provinces, the province of Bengal and the Konkan only about one-half. In Sind there was absolutely no rain, and in Baluchistan and Rajputana West the whole quantity received during the month was only a few cents.

As might be expected from the scantiness of precipitation the air was drier, skies less clouded and temperature higher than the average over by far the greater part of the country. Weather was very hot in the United Provinces, particularly during the first nine days when maxima from 10° to 20° above the normal were recorded at several stations.

Atmospheric pressure was low in Burma and along the foot of the Himalayas, and high elsewhere but more especially over Gujarat and the adjacent region—a type of distribution characteristic of periods of drought in the rainy season.

H. R.

Solar, seismic and magnetic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—There were 8 days during the month when no solar observations were possible and on 6 other days the weather was not good enough for prominence observations.

Sunspots.—The decline in spot activity noticed in June continued in July also. Four new spots were observed, being the same number as in the preceding month. The daily average number was 0·6 and the average life of a spot was 1·8 days. All the spots were small and none of them lasted more than 2 days. On 11 days the visible

disc of the sun was free from spots at the time of observation. The distribution in latitude of the spots was as follows :—

TABLE 1.

	0°—10°.	11°—20°.	Mean latitude.	Extreme latitude.
North . . .	1	...	8°	8°
South . . .	2	1	7°·3	3° and 12°

Prominences.—There was a large falling off in the number of prominences observed during the month. Only 14 large and 3 eruptive prominences were recorded. The highest was on the 20th at Latitude + 39° west and was 110″ high. No metallic prominences were observed.

Magnetic disturbances.—Moderate magnetic disturbances were recorded from the 27th to 29th. On the 27th and 28th no spots were observed on the visible disc of the sun, on the 29th a small dot was seen not far from the west limb.

Seismological records.

TABLE 2.

No.	Date.	P. T. Commencement G. M. T.	I. W. Commencement G. M. T.	Maxima. G. M. T.	End. G. M. T.	Maximum amplitude.	Duration.	Remarks.
	1911.	H. M.	H. M.	H. M.	H. M.	mm.	H. M.	
43	July 4	13 39·0	13 43·3	13 48·5	15 13·6	5·0=1·9	1 34·6	
44	„ 5	2 17·2	2 29·0	2 31·8	3 24·0	0·7=0·3	1 6·8	
45	„ 5	18 51·0	...	...	19 42·3	...	0 51·3	Widening of line.
46	„ 8	2 32·0	...	...	3 14·9	...	0 42·9	Do.
47	„ 12	4 17·2	4 19·8	4 42·8	9 27·9	12=4·9	5 10·7	
48	„ 19	10 29·0	10 29·7	...	11 41·2	...	1 12·2	Widening of line.
								Driving clock stopped at intervals, July, 20 and 21.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of July, 1911 the traces showed 8 calm days, and 23 days of small disturbance.

The days of the month selected as quiet* for the purposes of the Magnetic Survey of India are the 5th, 14th, 15th, 16th and the 26th.

The following table represents the magnetic character of each day during the month.

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	S	17	S	25	C
2	S	10	S	18	S	26	C
3	S	11	S	19	S	27	S
4	S	12	S	20	S	28	S
5	S	13	S	21	C	29	S
6	S	14	C	22	C	30	S
7	S	15	C	23	C	31	S
8	S	16	C	24	S	...	...

C = calm; S = small; M = moderate; G = great; V. G. = very great.
* Calm days if available are usually selected. In absence of these, however, the least disturbed days have to be included amongst the 5 selected days.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms as also the ranges and the summed ranges of the horizontal force and declination for the month are as follows :—

Easterly declination . . .	0° 54′ 33″
Horizontal force	0·36861 C.G.S. unit
Vertical force	0·16244 „ „
Inclination	23° 47′·0
Inclination (observed) . . .	23° 46′·3
Horizontal force range . .	0·00034 C.G.S. unit
Horizontal force summed range .	0·00220 „ „
Declination range . . .	3′·6
Declination summed range .	16′·8

(NOTE.—Summed range means sum without regard to signs of 24 ordinates of the diurnal inequality.)

Seismic disturbances.

TABLE 4.

Date.	Commencement.	Maximum.	End.	Maximum Amplitude.	Duration.
1911.	H. M.	H. M.	H. M.	mm.	H. M.
May 4	13 37·3	13 41·4	15 25·8	4·4	1 48·5
„ 5	2 20·1	2 24·1	2 37·2	1·2	0 17·1
„ 5	18 50·0	18 56·6	19 30·3	0·4	0 40·3
„ 12	4 16·5	4 42·9	6 53·2	6·5	2 36·7
„ 19	20 39·8	20 57·5	21 8·5	0·5	0 28·7

All times given above denote G. M. T.
Sensibility to tilt . . . . { 1 mm.=0″·41 from 1st to 18th. / 1 mm.=0″·40 from 19th to 31st.

N. A. F. MOOS,
Director,
Bombay and Alibag Observatories.

CALCUTTA OBSERVATORY.

5. *List of displacements recorded by the Milne seismograph.*

TABLE 5.

Date.	P.T. Commencement. G.M.T.	L.W. Commencement. G.M.T.	Maximum. G.M.T.	End. G.M.T.	Duration.	Maximum displacement on trace from mean position.	REMARKS.
1911.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
July 4th	...	13 37·9	13 42·0	15 17·5	1 39·6	*11·50	* Measured from base line.
„ 5th	†	2 27·1	2 28·7	3 30·6	1 3·5	2·75	† Begins in morning air tremor.
„ 5th	18 46·6	18 54·2	19 5·9	19 48·6	1 2·0	1·00	
„ 10th	17 49·0	...	...	17 56·1	0 7·1	...	Thickening of line.
„ 12th	3 31·8	4 17·1	4 32·7	9 5·6	5 33·8	‡16·50	‡ Measured from base line.
„ 19th	20 29·9	20 37·5	20 53·8	21 54·3	1 24·4	0·75	
„ 29th	10 21·2	...	...	11 24·3	1 3·1	...	Thickening of line.

Sensibility 1mm.=0″·38 of tilt.

E. P. HARRISON,
Offg. Meteorologist, Calcutta.

SIMLA OBSERVATORY.

6. *List of earthquakes recorded by the Omori-Ewing seismographs.*

TABLE 6.

Date.	Beginning of 1st P.T.	Beginning of 2nd P.T.	Beginning of L.W.	Time of maximum amplitude.	End approximately.	Duration.	Maximum displacement of style.*	REMARKS.
	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
2nd A	17 20·3	?	?	17 20·4	17 20·7	0 0·4	Small.	Local.
4th A	13 34·9	?	13 35 9	?	14 58	1 23	?	Touched stops.
„ B	13 34·9	?	13 36·0	?	15 31	1 56·	?	Touched stops.
„ A	19 37·0	?	?	19 39·4	19 48	0 11	Small.	
„ B	19 36·8	?	?	19 39·5	19 44	0 7	„	
5th A	2 16·2	2 18·7	2 21·5	2 22·4	3 8	0 52	1·5	
„ B	2 16·6	2 18·8	?	2 20·8	3 30	1 13	3·0	
„ A	18 49·0	?	18 58·3	19 3·1	19 21	0 32	Small.	
„ B	18 49·0	?	18 57·6	19 3·1	19 30	0 41	0·9	
7th A	0 54·6	?	?	0 54·6	0 54·8	0 0·2	Small	Local.
7th B	0 54·6	?	?	0 54·6	0 54·8	0 0·2	mm, Small	Local.
8th A	18 15·1	?	?	18 15·3	18 17·0	0 1·9	„	Very slight disturbance.
„ B	18 15·1	?	?	18 15·2	18 16·7	0 1·6	„	Very slight disturbance.
12th A	4 16·7	?	4 24·1	4 25·8	6 30	2 14	18·5	
„ B	4 16·7	?	4 24·1	4 32·2	7 32	3 16	23·5	
18th A	19 29·6	?	?	19 29·7	19 30·4	0 0·8	Small.	Local.
„ B	19 29·6	?	?	19 59·9	19 30·7	0 1·1	„	„

All times are given in G. M. T.
A = E—W component.
B = N—S component.
Magnification of each instrument was 15.
* Displacements less than 0·2 mm. are reported as "small."

The following is a list of earthquakes reported :—

TABLE 7.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity, Rossi-Forel scale.	No. of shocks.
		H. M.	M. S.		
Murree . . .	4th	13 4	3 0	5	1
Drosh	4th	13 30	3 0	9	8
Srinagar . . .	4th	13 30	2 0	6	2
Dera Ismail Khan .	4th	13 34	1 0	5	2
Skardu . . .	4th	13 35	1 15	5	2
Landikotal . . .	4th	13 35	4 0	8	1
Cherat . . .	4th	13 36	0 26	7	2
Lahore . . .	4th	13 37	0 50	5	2
Rawalpindi . . .	4th	13 38	1 43	5	3
Sialkot . . .	4th	13 40	0 4	5	1
Gulmarg . . .	4th	13 40	0 50	6	2
Multan . .	4th	13 44	0 6	5	3
Chitral . . .	4th	13 45	2 0	9	Several
Drosh . . .	4th	13 45	0 1	3	1
Kushab . . .	4th	14 5	...	...	...
Drosh	4th	15 30	0 2	3	2
„	4th	16 50	0 3	5	3
Chitral . . .	4th	17 15	0 2	8	3
Murree . . .	4th	19 1	0 4	3	1
Drosh	4th	19 40	0 10	4	2
Chitral . . .	4th	20 15	0 2	8	2
Drosh	4th	21 30	0 3	3	3

Place at which felt.	Date.	G. M. T. of earthquake.		Duration.		Intensity, Rossi-Forel scale	No. of shocks.
		H.	M.	M.	S.		
Drosh	5th	0	0	0	2	3	2
„	5th	4	20	0	2	3	1
Chitral	5th	4	25	0	1	7	2
Drosh	5th	6	0	0	3	5	3
Chitral	5th	6	10	0	2	9	2
„	6th	4	15	0	1	7	2
Drosh	6th	4	15	0	2	3	2
„	6th	15	0	0	2	3	2
„	6th	23	40	0	5	5	5
Chitral	6th	23	44	0	2	8	3
Drosh	7th	1	0	0	2	3	2
„	7th	20	0	0	2	4	2
Chitral	7th	20	25	0	3	7	2
Drosh	7th	23	30	0	2	4	2
„	8th	18	30	0	3	4	3
Chitral	8th	19	45	0	3	8	2
Drosh	8th	23	45	0	2	3	2
Chitral	9th	23	30	0	3	7	3
Drosh	10th	4	30	0	3	5	3
Chitral	10th	5	15	0	2	8	2
Drosh	14th	23	10	0	2	3	2
Chitral	15th	13	0	0	3	7	2
Drosh	15th	13	30	0	5	5	4
Chitral	16th	0	15	0	2	9	2
Drosh	16th	0	15	0	3	3	3
„	16th	6	0	0	3	3	3
„	16th	11	15	0	3	3	2
„	18th	14	0	0	2	3	2
„	18th	21	0	0	3	3	3
„	19th	17	30	0	2	3	2
„	19th	22	30	0	3	3	3
„	21st	9	30	0	2	3	2
„	23rd	7	55	0	3	3	3
„	24th	6	55	0	3	3	3
Chitral	24th	7	5	0	2	7	3
Drosh	24th	23	0	0	2	3	2
Landikotal	25th	15	20	0	1	3	1
Drosh	27th	18	0	0	2	3	2
Chitral	28th	6	25	0	2	7	2
Drosh	28th	6	30	0	3	3	3
„	28th	22	50	0	3	3	3
„	29th	16	50	0	3	4	3

The following account of the earthquake of the 4th July, as it was felt at Drosh (North-West Frontier Province), is summarised from the report sent in by Captain Steele Haughton, I.M.S., Superintendent of the Observatory :—

A distant rumbling preceded the earthquake. The rumbling gradually came nearer and was followed by one or two short shocks in quick succession, and a prolonged shock during which the whole ground appeared to be swaying. Large avalanches of stones came down the hill sides from heights of about 12,000 feet. The main shock lasted one minute and the whole earthquake about 3 minutes. Several Chitrali houses were thrown down and the masonry walls of the block-houses and of the mill were cracked.

Solar radiation.—The following figures give the intensity of solar radiation, as measured at Simla by Angstrom's pyrheliometer. The values are corrected to local noon, and expressed in grammecalories per square centimetre per minute :—

Maximum	1·34
Minimum	1·14
Mean	1·24
Number of days of observation	8

W. A. HARWOOD,
Imperial Meteorologist, Simla.

ROYAL ALFRED OBSERVATORY, MAURITIUS.

7. The following information has been communicated by the Director of the Observatory :—

TABLE 8.

Date.	Time.	Disturbance.
April 1911.		
5th	0h. to 2h.	Wave in H. F. (+20).
8th	15½h. to 16½h.	Irregular wave in H. F. (+40) followed by small fluctuation till 9 d. 5h.
9th	5½h. to 9½h.	Two successive waves in H. F. (+25) and (+20) culminating at 6½ h. and 8½ h. respectively.
9th	12h. to 18h.	Long shallow wave in H. F. (−75). Small undulations throughout in declination the principal of which was a long shallow wave (+20) from 9 d. 3 h. to 5½ h.
11th	3h. to 5½h.	Irregular sharp pointed wave in H. F. (+30).
16th	19h. to 23h.	Two successive waves in H. F. (+25) and (+60) with small undulations lasting till 18 d. 2 h.
16th	18½h. to 20h.	Wave in declination (+40).
16th	21h. to 22h.	Wave in declination (+30).
21st to 22nd	22½h. to 0h.	Wave in H. F. (+30).
24th	...	Accentuated diurnal variation in H. F.
30th	20½h. to 22h.	Wave in H. F. (+45).

Date.	Time.	Disturbance.
May 1911.		
1st	oh. to 4h.	Two successive shallow waves in H. F. (+25) and (+20).
7th	...	Accentuated diurnal variation in H. F. with small superposed wave (−30) from 20h. to 22h.
14th to 15th	21h. to 16h.	Frequent rapid fluctuations in H. F. ± 10.
15th	...	Accentuated diurnal variation in declination with wave 15d. 2h. to 4h. (−50) and small superposed fluctuations.
June 1911.		
4th to 5th	21h. to 3h.	Long irregular shallow wave in H. F. (−70)
9th to 10th	20h. to 6h.	Undulations in H. F. (±10).

TABLE 9.

	February, 1911.	March, 1911.	April, 1911.	May, 1911.	June, 1911.
Departure from normal of mean pressure.	−·015	−·061	+·054	−·036	−·024
Actual mean wind direction .	N 73° E	S 70° E	S 67° E	S 54° E	S 53° E
Normal mean wind direction.	S 83° E	S 82° E	S 72° E	S 64° E	S 63° E
Actual mean wind velocity (miles per diem).	317	306	309	234	238
Normal mean wind velocity (miles per diem).	222	226	218	217	239
Rainfall departure from normal.	+5·56	+2·92	−3·20	−2·40	+1·56

Weather in the Indian monsoon region.

8. In the south of the Indian Ocean as represented by Mauritius and at stations nearer the equator, pressure ruled above the normal. Winds were stronger and more southerly than usual at the Seychelles, and rainfall was in defect there as well as at Zanzibar.

The pressure conditions were, as usual, coincident with diminished rainfall over India.

TABLE 10.

	Mauritius.*	Zanzibar.	Seychelles.
Departure from normal of mean pressure.	+·023	+·065	+·020
Actual mean wind direction .	S 52° E	S 1° E	S 18° E
Normal mean wind direction .	S 64° E	S 6° E	S 33° E
Actual mean wind velocity (miles per diem).	300	210	327
Normal mean wind velocity (miles per diem).	287	197	289
Rainfall departure from normal.	−1·27	−1·25	−0·99

* Approximate data derived from the weekly telegrams.

H. R.

Depressions and cyclonic storms.

9. Storms in the Arabian Sea are at this season of extremely rare occurrence, but normally two or three disturbances of moderate intensity may be expected to develop at the head of the Bay and move inland across the coast of Bengal or Orissa. In the present year, owing to the abnormal feebleness of the monsoon and the prevailing steep pressure gradients, no storm occurred even in the latter area; though three feebly marked depressions were observed in the charts during the course of the month. The first of these depressions appeared over Chota Nagpur on the 8th but did not largely influence rainfall and had practically disappeared on the 12th; the second appeared over west Bengal on the 14th, and moving into Bihar on the same day caused heavy rain in the Sikkim Himalayas; while the third formed over Burma between the 21st and 22nd and passed out into the Bay, but failed to develop further. Each of them was accompanied by temporary squally conditions along the coast, but nothing of greater importance was reported.

W. A. H.

Pressure.

10. Barometric pressure during July in the plains of India as a whole differed but slightly from the normal, being only ·005″ in excess. The local features of the pressure distribution were however strongly marked : thus pressure was in decided defect in Burma and along the base of the Himalayas from Assam westwards to the North-West Frontier Province, and largely above the average in the region comprising lower Sind, Gujarat, Rajputana, the west of Central India, the Central Provinces, the Konkan and the south of Madras. The greatest excess was at Dwarka where it amounted to ·075″ ; while the defect was most marked at Yamethin and Lashio in Burma. As a result of this distribution the monsoon trough of low pressure lay considerably to the north of its normal position, its axis running roughly through Dera Ismail Khan, Sirsa, Bareilly, Gorakhpur and Gaya.

It is noteworthy that the type of pressure distribution outlined above is very similar to that of the corresponding months of 1899 and 1877, and was, as on those occasions, associated with the prevalence of intense drought over a large part of the country.

TABLE 11.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	″
Burma	—·029
Eastern Bengal and Assam	—·026
Bengal	—·009
United Provinces	—·026
Punjab	—·023
North-West Frontier Province	—·040
Sind	+·025
Rajputana	+·030
Bombay	+·043
Central India	+·028
Central Provinces	+·033
Hyderabad	+·024
Mysore	+·017
Madras	+·019

The high pressure conditions in the Peninsula extended westwards as far at least as Aden and Zanzibar and southwards to Mauritius, and were therefore due to general rather than local actions.

The table below gives the pressure departures in the hill stations and the adjacent plains and shows that while in northeast India at the level of Darjiling the deficiency of pressure was much greater than in the plains below, in upper India the condition of the lower strata tended to vary inversely with that of the higher strata. This was in part at least a temperature effect.

TABLE 12.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	″		″	″
Quetta	+·035	Jacobabad	—·004	—·039
Leh	—·010	Lahore	—·032	—·022
Murree	—·006	Peshawar	—·034	—·028
Simla	+·015	Ludhiana	—·031	—·046
Chakrata	+·001	Roorkee	—·028	—·029
Darjiling	—·053	Dhubri	—·031	+·022
Mount Abu	+·043	Deesa	+·059	+·016
Pachmarhi	+·038	Khandwa	+·047	+·009
Kodaikanal	+·015	Madura	+·030	+·015

H. R.

Temperature.

11. Except over the northern parts of north-east India, the inland and southern districts of Burma, the southern half of the Peninsula and portions of Sind day temperatures were above normal, the excess being in parts very large. The abnormality was most marked in the west United Provinces and neighbouring districts. During the first nine days when the hot conditions were very pronounced, temperatures there varied from 10 to 20 degrees above normal, and at Agra the month's mean maximum was 12° above normal. In the extreme south of the Peninsula and in east Kashmir low temperatures prevailed, those in the former area being due probably to the strong monsoon winds and in the latter to snowfall.

In almost all places where excessive day temperatures were recorded minimum temperatures were also above normal. The departures from normal in the minimum readings were however less marked than in those of the maximum. In Kashmir and Baluchistan nights were cool, but in other parts where day temperatures were low night temperatures were about normal.

The distribution of mean temperature followed closely that of day temperature. It was largely above normal over the greater part of India, about normal in Sind, Burma and north-east India, and low in Kashmir and the extreme south of the Peninsula.

TABLE 13.

SUB-DIVISION.	ACTUAL TEMPERATURE.					DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
1. Bay Islands	85·1	76·9	80·9	8·2	15·3	—0·6	—0·2	—0·4
2. Lower Burma	84·3	75·2	79·7	9·1	17·0	—0·3	+0·1	—0·4
3. Upper Burma	88·7	75·7	82·2	13·0	22·6	—0·8	0	—0·8
4. Assam	87·0	77·4	82·2	9·7	17·9	—2·0	—0·4	—1·6
5. Eastern Bengal	87·6	78·0	82·8	9·6	18·2	—0·1	—0·2	+0·1
6. Bengal	91·3	79·4	85·3	11·9	21·9	+1·7	+0·5	+1·2
7. Orissa	91·1	79·3	85·2	11·7	21·8	+3·2	+1·1	+2·1
8. Chota Nagpur	91·7	77·5	84·6	14·2	25·4	+3·6	+1·4	+2·2
9. Bihar	93·3	80·1	86·7	13·1	24·1	+2·2	+0·8	+1·4
10. United Provinces, East	100·1	82·6	91·3	17·4	32·3	+8·4	+3·3	+5·1
11. Do. do., West	100·1	81·7	90·9	18·4	33·7	+8·8	+3·3	+5·5
12. Punjab, East and North	104·3	81·9	93·0	22·3	38·5	+7·3	+2·2	+5·1
13. Do., Southwest	105·3	84·2	94·8	21·1	34·4	+1·6	+1·0	+0·6
14. Kashmir	84·2	57·5	70·8	26·7	44·5	—0·3	—2·6	+2·3
15. North-West Frontier Province	107·0	80·8	93·9	26·2	37·8	+3·9	—0·1	+4·0
16. Baluchistan	98·0	71·7	84·8	26·3	40·4	—1·5	—5·9	+4·4
17. Sind	98·3	80·5	89·4	17·8	25·6	0	—1·0	+1·0
18. Rajputana, West	103·4	82·5	92·9	20·9	30·6	+5·4	+1·4	+4·0
19. Do., East	98·7	80·6	89·6	18·1	30·6	+7·0	+2·9	+4·1
20. Gujarat	93·0	78·8	85·9	14·2	22·7	+3·7	+0·9	+2·8
21. Central India, West	90·1	74·1	82·1	16·0	27·5	+4·2	+0·8	+3·4
22. Do., East	96·3	80·7	88·5	15·6	30·5	+7·7	+3·1	+4·6
23. Berar	89·4	73·7	81·6	15·7	27·2	+2·9	+1·0	+1·9
24. Central Provinces, West	90·1	74·9	82·5	15·2	27·3	+3·9	+0·5	+3·4
25. Do., East	87·9	74·8	81·3	13·1	22·6	+2·5	+0·7	+1·8
26. Konkan	83·3	76·1	79·7	7·2	14·2	—0·2	0	—0·2
27. Bombay Deccan	85·6	70·5	78·1	15·0	26·0	+1·2	—0·1	+1·3
28. Hyderabad, North	88·2	71·9	80·1	16·3	28·7	+1·2	+0·1	+1·1
29. Do., South	89·7	73·5	81·6	16·3	28·5	+0·7	+0·3	+0·4
30. Mysore	80·5	66·3	73·4	14·1	21·7	—0·3	—0·2	—0·1
31. Malabar	82·7	73·9	78·3	8·7	15·1	—0·3	+0·5	—0·8
32. Madras, Southeast	93·5	76·4	85·0	17·1	27·4	—0·9	—0·5	—0·4
33. Do. Deccan	93·1	74·7	83·9	18·4	27·5	+0·6	—1·1	+1·7
34. Do. Coast, North	92·8	79·0	85·9	13·8	26·4	+1·0	—0·1	+1·1

TABLE 14.

DIVISION.	DEPARTURE FROM NORMAL OF		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	−0·5	0	−0·3
Eastern Bengal and Assam	−0·7	−0·3	−0·5
Bengal	+2·5	+0·9	+1·7
United Provinces	+8·6	+3·3	+5·9
Punjab	+5·6	+1·9	+3·7
North-West Frontier Province	+3·9	−0·1	+1·9
Sind	0	−1·0	−0·5
Rajputana	+6·7	+2·6	+4·6
Bombay	+1·9	+0·3	+1·1
Central India	+5·9	+2·0	+3·9
Central Provinces	+3·4	+0·6	+2·0
Hyderabad	+0·9	+0·2	+0·5
Mysore	−0·3	−0·2	−0·3
Madras	−0·2	−0·3	−0·2

W. A. H.

Winds.

12. The inflow of monsoon winds was weaker than usual both through Eastern Bengal and Bengal and through Bombay and Sind, but inland over almost the whole of northern India the westerly current was unusually strong and steady. In Rajputana and the central parts of the country the prevailing westerly winds were much in excess of their normal velocity; while over the east Punjab and the United Provinces the westerly component was very marked and persistent.

At several stations in the extreme north abnormal northerly winds prevailed. These were due partly to the excessive temperatures prevailing over the Punjab plains, and partly to snowfall in the hills, but they did not, at any rate near the ground level, penetrate far south, or moderate appreciably the prevailing high temperatures. Elsewhere there were no marked departures from normal conditions.

TABLE 15.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	+0·1	− 5
Eastern Bengal and Assam	−1·5	−15
Bengal	−0·4	+ 9
United Provinces	+0·8	+11
Punjab	+0·1	+10
North-West Frontier Province	−1·1	−11
Sind	−0·8	− 4
Rajputana	+3·2	+34
Bombay	−1·5	− 2
Central India	+1·5	+16
Central Provinces	+0·5	+ 4
Hyderabad	−2·5	+ 5
Mysore	+1·3	+ 1
Madras	+0·8	+ 7

W. A. H.

Humidity and cloud.

13. Everywhere except Mysore and Madras the air contained less than its normal amount of moisture, the deficiency being most marked in Rajputana, the Punjab and the North-West Frontier Province, where it was about 20 per cent. It was also marked in Sind, the United Provinces, and the central parts of the country.

Relative humidity was, owing to the character of the temperature distribution, most largely below normal in the United Provinces but the deficiency was also large in the Punjab, Rajputana and the North-West Frontier Province.

The amount of cloud was less than the normal everywhere except Burma, Central India, and Mysore, the defi-

ciency being greatest over the United Provinces and north-west India, and in Hyderabad.

TABLE 16.

DIVISION.	HYGROMETRY; 8 HRS.				CLOUD.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	89	0	·873	—·006	8·5	+0·4
Eastern Bengal and Assam	90	—1	·954	—·009	7·8	—0·4
Bengal	82	— 5	·918	—·021	7·0	—0·5
United Provinces	65	—18	·829	—·088	4·5	—2·5
Punjab	56	—16	·746	—·134	2·4	—2·1
North-West Frontier Province.	53	—13	·725	—·130	2·0	—0·8
Sind	70	— 2	·826	—·066	3·3	—2·0
Rajputana	57	—15	·685	—·141	3·9	—2·5
Bombay	79	— 4	·807	—·029	7·2	—0·6
Central India	73	—11	·763	—·068	7·6	+0·2
Central Provinces	77	— 8	·749	—·036	7·0	—0·8
Hyderabad	76	— 2	·699	—·023	6·3	—1·7
Mysore	85	+ 2	·642	+·009	8·7	+0·1
Madras	75	0	·793	+·001	6·7	—0·7

W. A. H.

Rainfall.

14. The break in the rains which began in June persisted until the 5th July and was followed by more or less rainfall in all parts of India excluding the north-west. By the 15th however rainfall was again confined to Burma, and hardly any rain fell in the inland districts of India during the next eleven days. Thereafter feeble monsoon conditions reappeared, but failed to penetrate into the central and north-western parts of the country.

The total rainfall during the month from the Arabian Sea current was in defect except over Hyderabad South, Mysore and the Madras Deccan; while that due to the Bay current was above normal in Assam and Eastern Bengal, but below normal over the remainder of its field. The defect was greatest in absolute amount in the United Provinces, Gujarat, and the central parts of the country; but in Rajputana and Bengal the month's fall was also markedly in defect; while in Sind the month was absolutely rainless.

TABLE 17.

SUB-DIVISION.	NUMBER OF RAINY DAYS.		RAINFALL.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
1. Bay Islands	23·5	20·9	11·25	14·79	—3·54	— 24
2. Lower Burma	25·0	25·3	29·50	29·75	—0·25	— 1
3. Upper Burma	9·2	9·9	5·55	6·86	—1·31	— 19
4. Assam	20·7	19·2	22·93	18·06	+4·87	+ 27
5. Eastern Bengal	17·8	17·7	19·72	17·71	+2·01	+ 11
6. Bengal	11·2	16·0	8·49	12·24	—3·75	— 31
7. Orissa	7·3	15·0	6·21	12·53	—6·32	— 50
8. Chota Nagpur	9·0	16·6	6·02	14·09	—8·07	— 57
9. Bihar	8·3	14·5	7·19	13·05	—5·86	— 45
10. United Provinces, East	4·3	12·7	3·21	11·97	—8·76	— 73

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
11. United Provinces, West	3·9	11·9	2·63	12·28	—9·65	— 79
12. Punjab, East and North	2·5	6·9	1·24	6·70	—5·46	— 81
13. Do., Southwest	0·8	2·9	0·37	2·43	—2·06	— 85
14. Kashmir	3·4	5·4	1·90	4·25	—2·35	— 55
15. North-West Frontier Province	1·5	4·2	0·47	3·17	—2·70	— 85
16. Baluchistan	0·2	1·5	0·07	0·87	—0·80	— 92
17. Sind	0	2·7	0	2·40	—2·40	—100
18. Rajputana, West	0·3	4·7	0·11	3·88	—3·77	— 97
19. Do., East	2·6	9·4	1·68	7·92	—6·24	— 79
20. Gujarat	3·4	13·1	2·23	13·82	—11·59	— 84
21. Central India, West	6·0	12·6	4·75	9·63	—4·88	— 51
22. Do., East	6·4	14·1	3·96	13·51	—9·55	— 71
23. Berar	9·2	12·0	5·48	9·12	—3·64	— 40
24. Central Provinces, West	9·3	15·3	6·43	14·40	—7·97	— 55
25. Do., East	10·7	16·7	10·37	16·66	—6·29	— 38
26. Konkan	21·4	26·6	22·89	40·60	—17·71	— 44
27. Bombay Deccan	8·2	11·6	5·03	7·99	—2·96	— 37
28. Hyderabad, North	11·0	12·3	7·80	8·39	—0·59	— 7
29. Do., South	12·3	10·2	6·55	5·73	+0·82	+ 14
30. Mysore	10·1	9·4	8·21	7·09	+1·12	+ 16
31. Malabar	26·7	27·5	32·84	39·25	—6·41	— 16
32. Madras, Southeast	3·5	3·7	1·60	2·07	—0·47	— 23
33. Do. Deccan	6·0	5·9	3·09	2·95	+0·14	+ 5
34. Do. Coast, North	8·7	9·8	5·71	6·45	—0·74	— 11

TABLE 18.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	16·70	17·52	—0·82	— 5
Eastern Bengal and Assam	21·69	17 89	+3·80	+ 21
Bengal	7·30	12·86	—5·56	— 43
United Provinces	2·94	12·11	—9·17	— 76
Punjab	1·06	5·83	—4·77	— 82
North-West Frontier Province	0·47	3·17	—2·70	— 85
Sind	0	2·40	—2·40	— 100

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Rajputana	1·21	6·82	—5·61	— 82
Bombay	7·37	15·80	—8·43	— 53
Central India	4·46	10·95	—6·49	— 59
Central Provinces	6·92	12·75	—5·83	— 46
Hyderabad	7·12	6·94	+0·18	+ 3
Mysore	8·21	7·09	+1·12	+ 16
Madras	5·85	6·86	—1·01	— 15
Mean of India	7·27	11·16	—3·89	— 35

W. A. H.

Snowfall.

15.(*a*) According to the imperfect information available there was no snowfall in Afghanistan. The snowline remained however much lower than usual on the hills around Kabul.

(*b*) A few falls occurred in the hill districts of the North-West Frontier Province but they were very localized and confined to the higher elevations. On the passes in Dir and Swat snow lay at a much lower level than usual.

(*c*) In Kashmir there were occasional local falls, but their total amount was small. The accumulations existing at the end of the month on the mountains surrounding Leh were greater than usual.

(*d*) In the Punjab Himalayas snow fell throughout the Pangi valley on the 19th and in the Kulu hills down to 12,000 feet two days later. Heavy snow, amounting to about three feet in depth, is said to have fallen also in the fourth week on nearly all the high hills and passes in Chamba. The accumulations at the end of the month both in Kulu and Chamba were unusually deep.

(*e*) In the Kumaon hills the snowfall conditions did not differ appreciably from the normal.

H. R.

Reg. No. 4176 E., 11.—Z.—1,250.

Reg. No. 4195 E., 11.—Z.—3,000.

LITHO. BY S.S. MUNDLE.

The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2	miles	per	hour	...	one	feather	added	to	the	wind	arrow.
,,	,, 2 to 5	,,	,,	,,	...	two	feathers	,,	,,	,,	,,	
,,	,, 5 to 10	,,	,,	,,	...	three	,,	,,	,,	,,	,,	
,,	,, 10 to 20	,,	,,	,,	...	four	,,	,,	,,	,,	,,	
	over 20	,,	,,	,,	...	five	,,	,,	,,	,,	,,	

Reg. No. 4176 E., 11 —Z —1,250.
Reg. No. 4196 E., 11 —Z —3,800

LITHO. BY S. B. MUNDLE

The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020′ or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MAXIMUM TEMPERATURE.

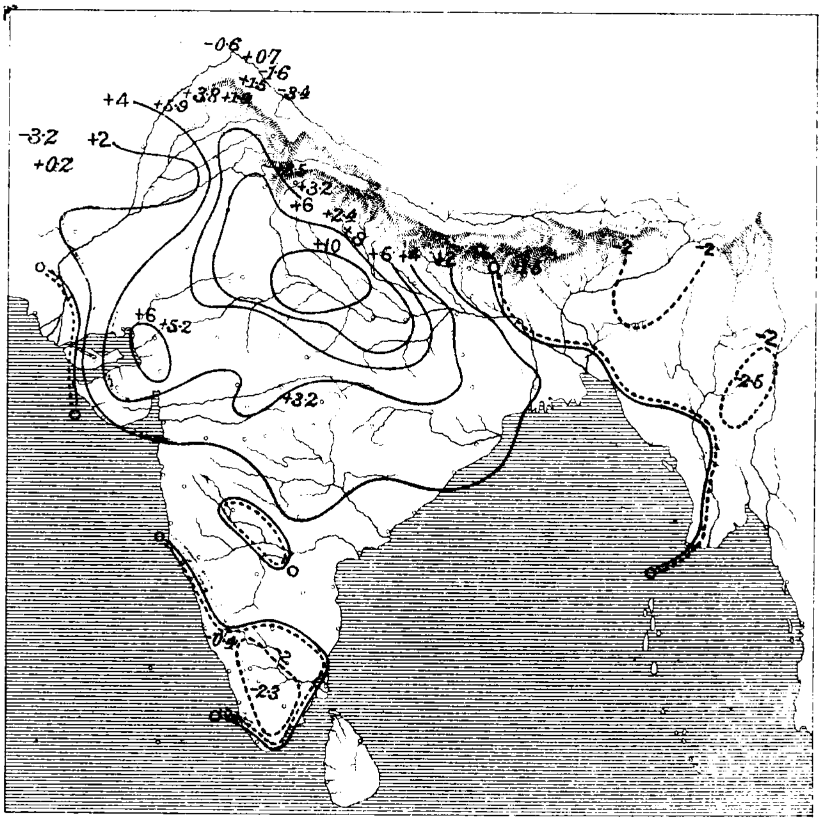
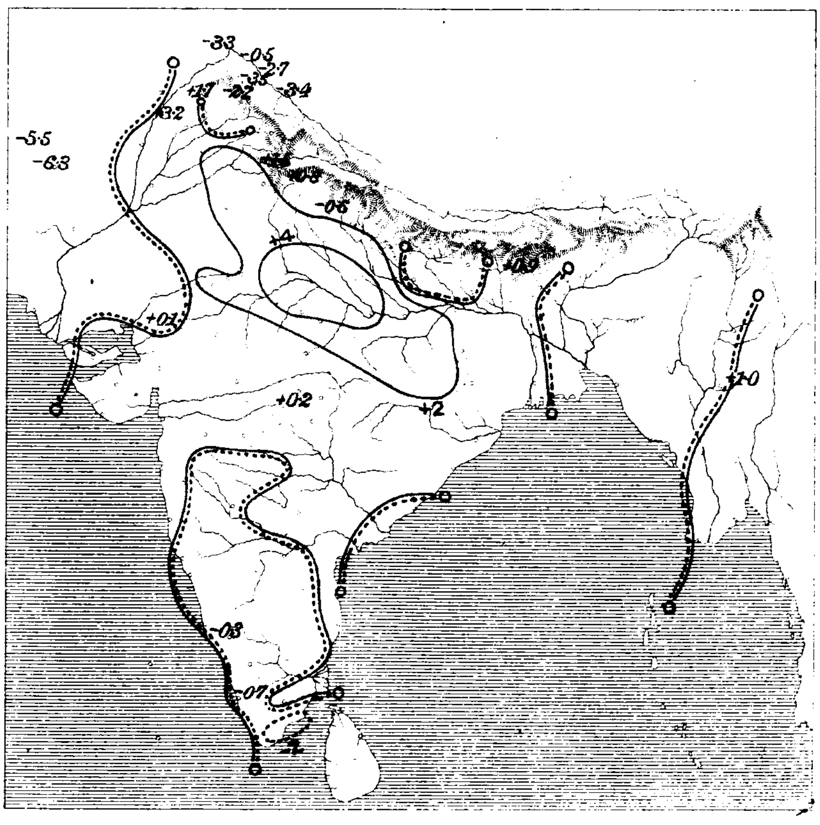


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MINIMUM TEMPERATURE.



LITHO. BY S. B. MUNDLE

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MEAN TEMPERATURE.

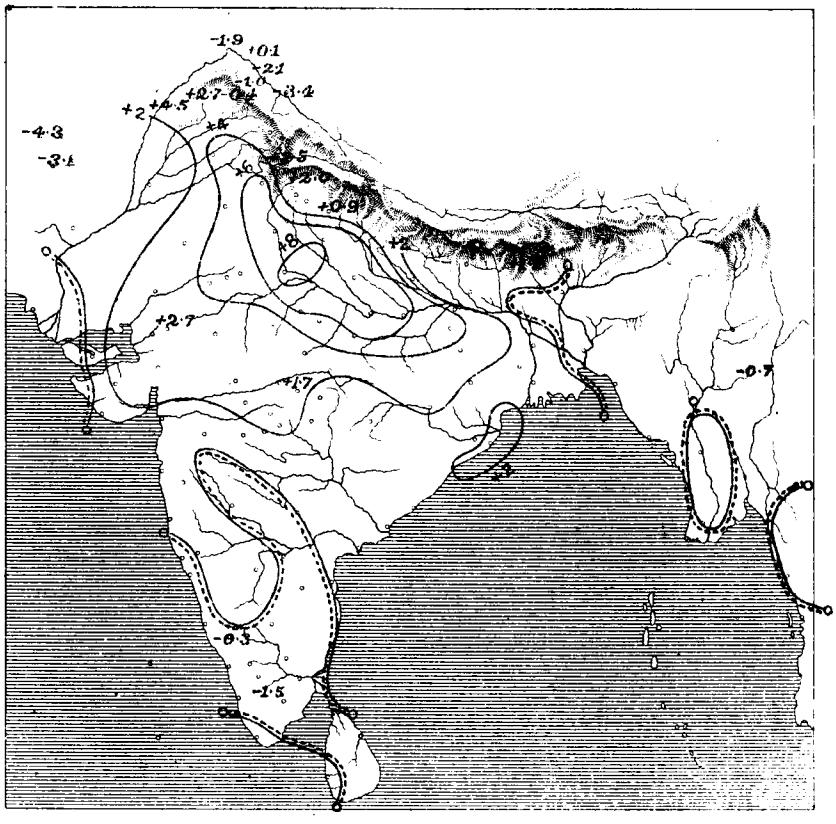


CHART SHEWING THE MONTHLY MEAN OF PRESSURE AND RESULTANT WIND DIRECTION.

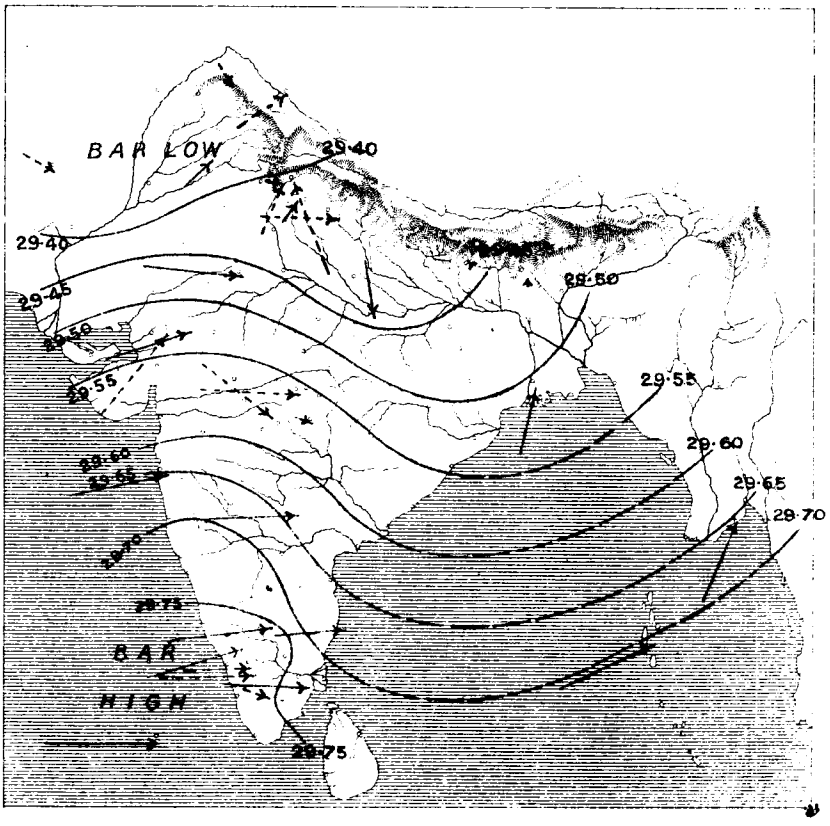


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF ABSOLUTE HUMIDITY AT 8 HRS.

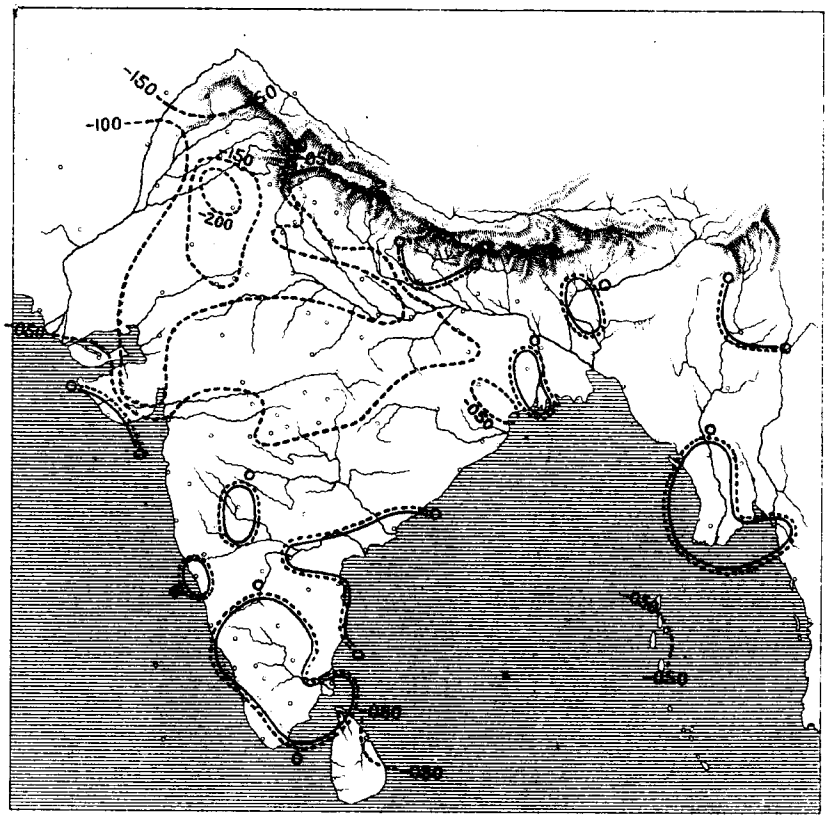
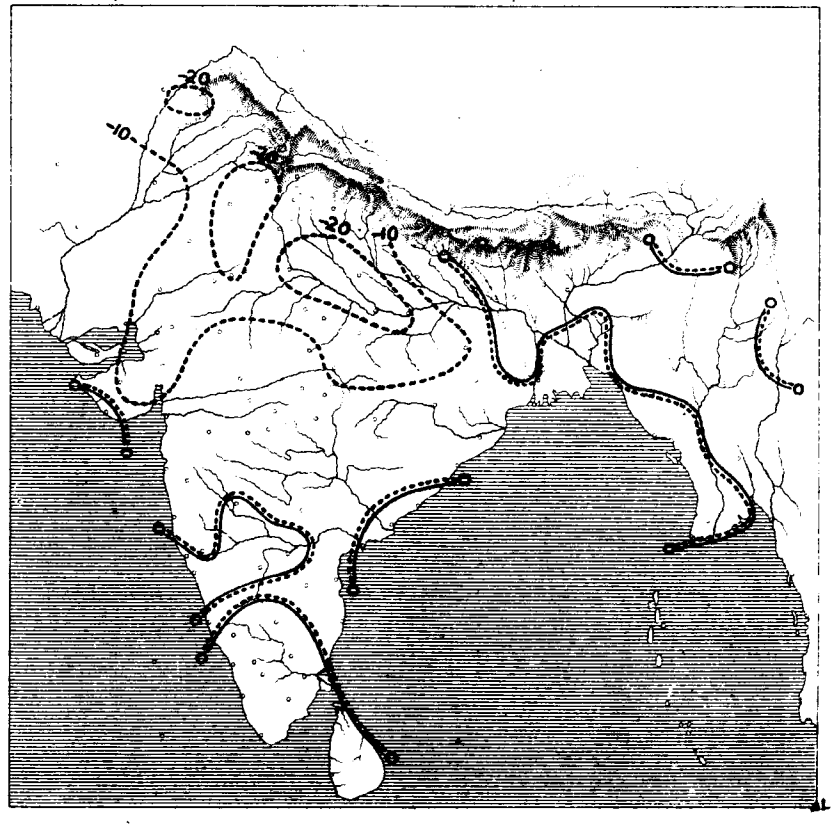


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF RELATIVE HUMIDITY AT 8 HRS.



LITHO. BY S.S.M.

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

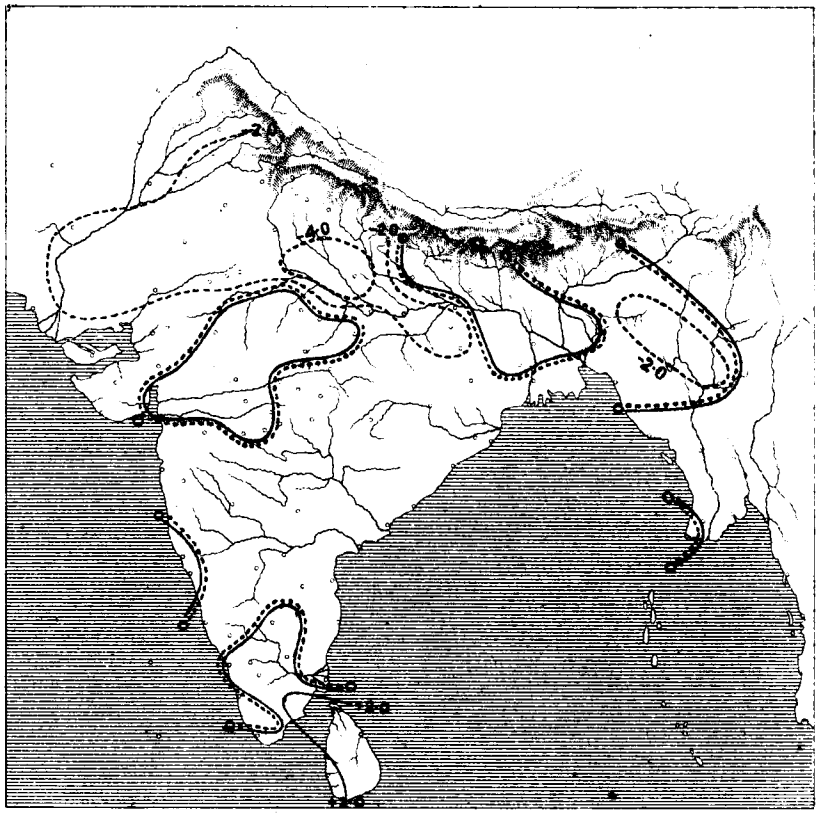
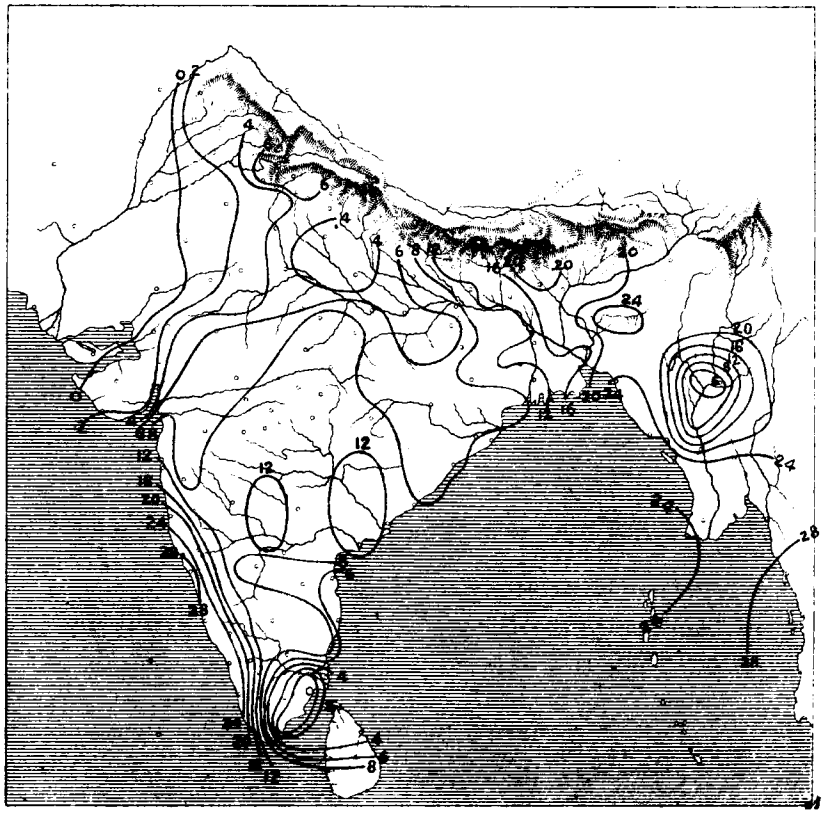
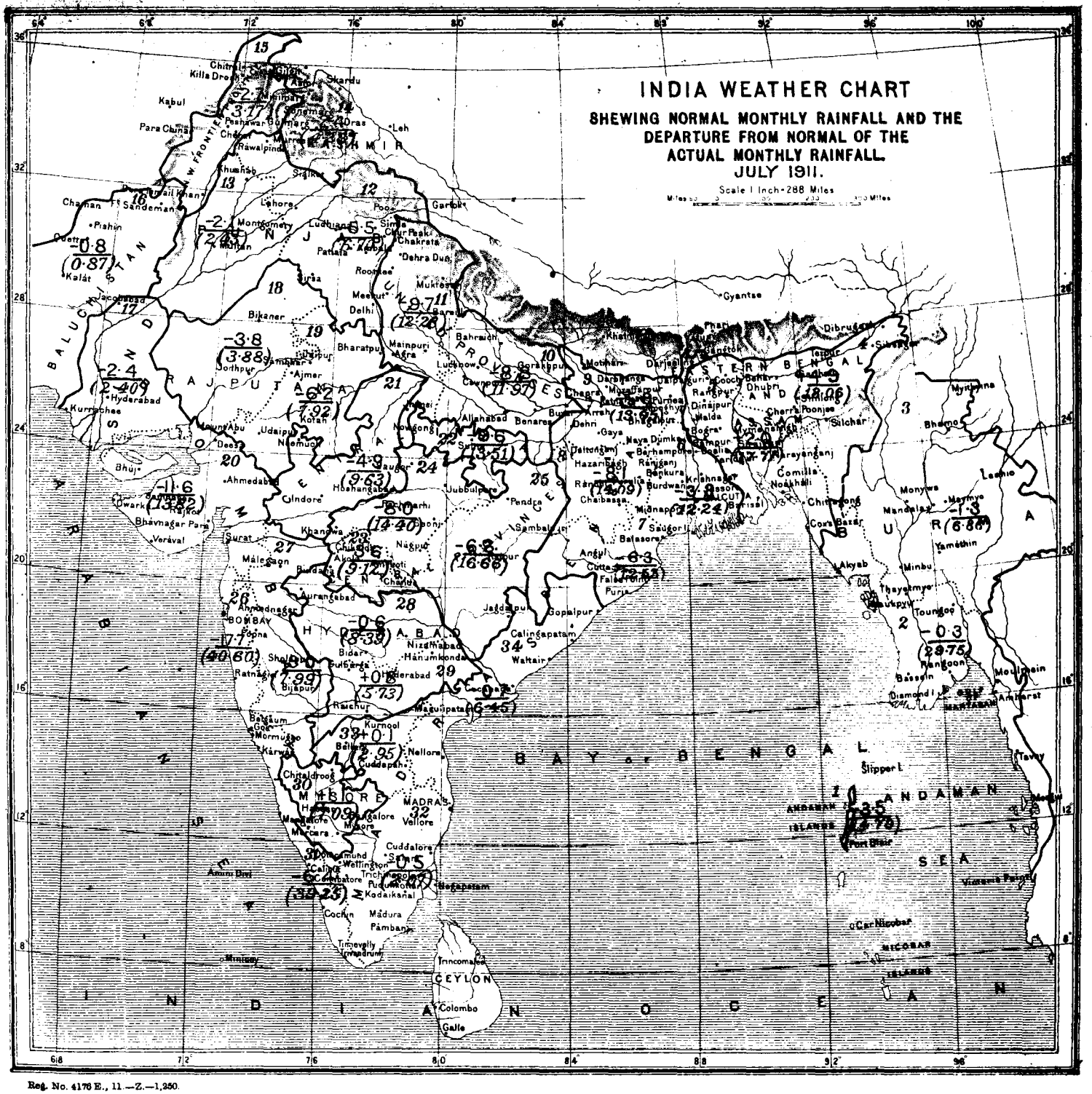


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)





Reg. No. 4176 E., 11.—Z.—1,250.

Reg. No 4196 E., 11—7—3 800

The country is divided into 34 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall; the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Eastern Bengal
6. Bengal
7. Orissa
8. Chota Nagpur
9. Bihar
10. United Provinces, East
11. Do., West
12. Punjab, East and North
13. Do., Southwest
14. Kashmir
15. Northwest Frontier Province
16. Baluchistan
17. Sind
18. Rajputana, West
19. Rajputana, East
20. Gujarat
21. Central India, West
22. Do., East
23. Berar
24. Central Provinces, West
25. Do., East
26. Konkan
27. Bombay, Deccan
28. Hyderabad, North
29. Do., South
30. Mysore
31. Malabar
32. Madras, Southeast
33. Madras, Deccan
34. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, AUGUST, 1911.

INTRODUCTION.

THIS review of the weather in India during the month of August, 1911, is based on observations taken daily at 8 hrs. at 240 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 34 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review. The brief notes on solar, seismic and magnetic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. An almost complete break in the rains held in the interior districts of India during the first fortnight of August, but during the third week the monsoon revived, though not fully, and spreading into the interior gave rain in almost all parts of northern and central India towards the close of the month.

The total rainfall of the month was about the average, or below it everywhere except in Lower Burma, Chota Nagpur, Bihar, the Central Provinces East, and the Konkan where it was distinctly in excess. The drought was very great in Sind and Rajputana West which had less than one-fifth of the normal rainfall allowance; and it was only a little less severe in Gujarat where the whole fall of the month was only about one-third of the average quantity. In the Punjab, the North-West Frontier Province, Rajputana East, Central India West, the United Provinces West, Hyderabad South, Mysore and Madras the deficiency ranged between 30 and 62 per cent.

The departures of other climatic elements were in fair accordance with the abnormalities of rainfall. In the greater part of north-west India, including the west of the United Provinces, where the rainfall was especially scanty, temperature was higher, the air drier and the cloud amounts much less than usual; while in the Peninsula, Burma and north-east India no marked variations occurred.

H. R.

Solar, seismic and magnetic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—There was one day during the month when no solar observations were possible and on 3 other days prominences could not be observed.

Sun spots.—Five new groups of spots were observed and all of them were small. The daily average number was 0·6, the same as in the preceding month; and the average life of a spot was 3·4 days. On 15 days there was no spot on the visible disc of the sun at the time of observation. The distribution in latitude was as follows:

TABLE 1.

	0° — 10°	10° — 20°	Mean latitude.	Extreme latitudes.
North	...	2	11°. 5	11° and 12°
South	1	2	7°. 7	1° and 11°

Prominences.—There was a noticeable increase in the number of large prominences observed during the month over those of May, June, and July. Forty-three large, 6 eruptive, and 2 metallic prominences were recorded. The tallest was photographed on the 23rd at latitude —28° west and was 140″ high.

Prominences projected on the disc as absorption markings in hydrogen light were more frequent in the southern hemisphere than in the northern. The daily average number recorded was 1·6 for the northern and 2·5 for the southern hemisphere.

Magnetic disturbances.—Moderate magnetic disturbances were recorded from the 19th to 20th and from the 23rd to 25th. On the 20th a small spot group appeared to the west of the central meridian of the sun.

Seismological records.

TABLE 2.

No.	Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maxima. G. M. T.	End. G.M.T.	Maximum amplitude.	Duration.	REMARKS.
	1911.	H. M.	H. M.	H. M.	H. M.	mm.	H. M.	
49	August 8	14 58·6	...	...	15 16·5	...	0 17·9	Widening of line.
50	„ 8	18 38·1	...	...	19 01·5	...	0 23·4	Do.
51	„ 16-17	22 51·4	22 09·5	23 20·3	2 42·2	6·8=2·6	3 50·8	
52	„ 18	3 10·7	...	...	3 39·2	...	0 28·5	Widening of line.
53	„ 21	16 47·3	...	...	18 14·8	...	1 27·5	Do.
54	„ 23	16 45 8	...	...	17 22·9	...	0 37·1	Do.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of August, 1911, the traces showed 10 calm days, and 19 days of small and 2 days of moderate disturbance.

The days of the month selected as quiet for the purposes of the Magnetic Survey of India are the 11th, 12th, 14th, 18th and 22nd.

The following table represents the magnetic character of each day during the month :—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	C	9	S	17	S	25	S
2	C	10	C	18	C	26	S
3	S	11	C	19	S	27	S
4	S	12	C	20	S	28	S
5	S	13	S	21	S	29	S
6	S	14	C	22	C	30	S
7	C	15	S	23	M	31	S
8	C	16	S	24	M		

C = calm; S = small; M = moderate; G = great: V. G. = very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and declination for the month are as follow :—

Easterly declination . . .	0° 54′ 1″
Horizontal force	0·36863 C. G. S. unit.
Vertical force	0·16245 „ „
Inclination	23° 46′·9
Inclination (observed) . . .	23° 46′·7
Horizontal force range . . .	0·00033 C. G. S. unit.
Horizontal force summed range .	0·00205 „ „
Declination range	4′·4
Declination summed range . .	17′·7

(NOTE.—Summed range means sum without regard to signs of 24 ordinates of the diurnal inequality.)

Seismic disturbances.

TABLE 4.

Date.	Commencement.	Maximum.	End.	Maximum amplitude.	Duration.
1911	H. M.	H. M.	H. M.	mm.	H. M.
Aug. 16th .	22 52·3	23 25·6	End lost in the beginning of the following disturbance.	2·7	... ...
„ 17th .	Beginning lost in the end of the preceding disturbance.	1 30·2	2 30·6	1·0	... ...
„ 18th .	3 29·2	3 30·2	3 38·8	0·8	0 9·6
„ 21st .	16 55·8	17 9·3	18 4·2	0·2	1 8·4
„ 23rd .	16 55·5	16 56·5	17 14·5	0·3	0 19·0

All times given above denote G. M. T.
Sensibility to tilt, 1 mm. = 0".40.

N. A. F. MOOS,
Director,
Bombay and Alibag Observatories.

CALCUTTA OBSERVATORY.

5. *List of displacements recorded by the Milne seismograph.*

TABLE 5.

Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maximum. G. M. T.	End. G. M. T.	Duration.	Maximum displacement on trace from mean position.	REMARKS.
1911.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
August 8	14 43·1	14 54·8	14 56·8	15 19·2	0 36·1	0·50	
„ 8	18 33·7	...	18 57·7	19 18·0 (17-8-11)	0 44·3	0·50	
„ 16	...	22 49·6	23 10·0	2 55·6	4 6·0	7·0*	*Measured from base line.
„ 21	16 52·7	...	17 4·4	17 51·2	0 58·5	0·50	
„ 23	16 55·1	16 57·2	17 12·9	17 30·7	0 35·6	0·75	
„ 25	3 47·6	3 56·7	3 58·2	4 10·4	0 22·8	0·75	

Sensibility 1 mm. = 0".38 of tilt.

E. P. HARRISON,
Offg. Meteorologist, Calcutta.

SIMLA OBSERVATORY.

6. *List of earthquakes recorded by the Omori-Ewing seismographs.*

TABLE 6.

Date.		Beginning of 1st P. T.	Beginning of 2nd P. T.	Beginning of L. W.	Time of Max. amplitude.	End approx.	Duration.	Max. displacement of style.	REMARKS.
		H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
4th	A	?	1 13·2	1 13·7	1 13·8	1 19·8	?	0·6	
	B	1 12·8	1 13·3	1 13·8	1 14·1	1 16 9	0 4·1	0·4	
16th and 17th.	A	22 51·0	22 59·4	23 10·8?	23 0·8	1 46	2 55	17·0	
	B	22 51·2	22 59·6	23 6·4	23 7·2	2 31	3 40	10·0	
21st	A	16 47·8	16 55·0	17 3·0	17 3·3	17 42	0 54	0·3	
	B	?	16 55·2	17 3·2?	17 17·1	19 31	?	3·0	
23rd	A	16 31?	...	...	17 2·2	17 33	1 2?	0·3	
	B	16 33·2	...	...	16 49·7	17 32	0 59	1·1	
28th*		...	...	...	...	...	...	...	

All times are given in G. M. T. B = N—S component.
A = E—W component. Magnification of each instrument was 15.
* Slight disturbances were recorded on the 28th by A from 14-41 to 14-46 and 14-55 to 14-59 and by B from 14-41 to 14-42 and 14-50 to 15-6.

The following table contains a list of earthquakes that have been reported :—

TABLE 7.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity. Rossi-Forel scale.	No. of shocks.
		H. M.	Sec.		
Shillong . .	1st	20 45	7	4	1
Drosh . .	6th	10 45	2	3	2
Shillong . .	6th	15 33	1	5	1
Shillong . .	9th	17 41	1	3	1
Turbat-i-Haidari .	11th	18 24	...	...	...
Turbat-i-Haidari .	12th	9 34	...	...	...
Drosh . .	12th	23 0	2	3	2
Turbat-i-Haidari .	13th	21 23	...	...	...
Shillong . .	15th	13 45	1	3	1
Chitral . .	15th	22 15	3	7	2
Drosh . . .	19th	4 10	2	5	2
Drosh . . .	20th	16 35	3	5	3
Shillong . .	23rd	17 45	1	3	1
Drosh . . .	24th	0 0	2	5	2
Shillong . .	24th	12 29	1	3	1
Chitral . .	26th	18 10	2	7	2
Sirajganj . .	27th	9 10	2	5	1
Nator . . .	27th	9 15	3	...	2
Jodhpur . .	28th	18 9	40	3	1
Shillong . .	30th	19 48	1	4	1

W. A. H.

ROYAL ALFRED OBSERVATORY, MAURITIUS.

7. No information has been received.

Weather in the Indian monsoon region.

8. The excess of pressure which had characterised July was in August replaced by an appreciable defect at Mauritius, and had much diminished in amount at Zanzibar and Seychelles. The air movement was not marked by any conspicuously abnormal features. Rainfall was either normal or markedly in defect.

The disappearance of high pressures from the Indian Ocean was, as usual, associated with an increase in the activity of the monsoon over India.

TABLE 8.

	Mauritius.*	Zanzibar.	Seychelles.
Departure from normal of mean pressure.	−·029	+·002	+·007
Actual mean wind direction	S 63° E	S 2° E	S 33° E
Normal mean wind direction	S 68° E	S 9° E	S 35° E
Actual mean wind velocity (miles per diem).	282	154	324
Normal mean wind velocity (miles per diem).	274	166	316
Rainfall departure from normal .	− 1·28	+0·04	−1·86

* Approximate data derived from weekly telegrams.

H. R.

Depressions and cyclonic storms.

9. Both in the Arabian Sea and in the Bay of Bengal conditions during August are normally very similar to those of July. In the Arabian Sea no storms are formed, but monsoon gales are frequent; while at the head of the Bay two or three storms of moderate intensity usually occur, and move inland in a northwesterly direction.

During the present month owing to the persistent weakness of the monsoon no cyclonic storm occurred. Several shallow depressions developed at the head of the Bay and gave squally conditions at sea, but only three were sufficiently marked to influence rainfall appreciably over the land. The first of the series was formed off the Orissa coast on the 3rd and reached Chota Nagpur on the 5th. It was shallow and disappeared on the 7th, having given no falls of rain greater than two inches. The second appeared in Bengal on the 9th, but disappeared on the 10th. The third formed off the Orissa coast on the 12th, and moved into Chota Nagpur on the 13th, but did not affect weather conditions appreciably, and on the 14th it merged into a diffuse area of low pressure covering a large part of northeast India. The fourth appeared over Chota Nagpur and the southeast of the United Provinces on the 22nd, and moved northwestwards. It disappeared between Jhansi and Agra on the 24th after giving moderate to heavy rain in Central India East and the United Provinces and light falls in the Central Provinces and the east of Rajputana. The fifth formed over the Bay on the 24th and, owing to increased strength of the monsoon, developed more than the previous ones had done. It crossed the coast near Cuttack on the 29th; moved northwestwards, and gave rainfall in the Central Provinces, Central India, the south of Rajputana, in Gujarat and the Bombay Deccan. It became diffuse on the 30th, and disappeared on the 31st.

W. A. H.

Pressure.

10. Barometric pressure over the plains of India as a whole was ·013″ below the normal. The general pressure conditions had thus altered considerably since July, when the mean reading of the barometer was ·005″ higher than usual. Pressure remained in excess in the Peninsula, but not to the same extent as in July. In Sind, Gujarat, Rajputana and Central India the excess of the previous month had disappeared, and the pressure became lower than the average. In northeast India, the United Provinces and upper India pressure was in even greater defect than in July, and the trough of low pressure on the mean of the month occupied very nearly its normal position.

The total gradient from south to north was still, as in July, in excess of the normal value; the isobars lay however much less east and west.

The statement below shows the character and magni-

tude of the change that had occurred since July in the plains of India :

TABLE 9.

DIVISION.	DEPARTURE FROM NORMAL OF MEAN 8 HRS. PRESSURE IN	
	August.	July.
	"	"
Burma	—·019	—·029
Eastern Bengal and Assam	—·034	—·026
Bengal	—·041	—·009
United Provinces	—·028	—·026
Punjab	—·036	—·023
North-West Frontier Province	—·074	—·040
Sind	—·023	+·025
Rajputana	—·002	+·030
Bombay	+·008	+·043
Central India	—·004	+·028
Central Provinces	+·001	+·033
Hyderabad	+·008	+·024
Mysore	+·018	+·017
Madras	+·009	+·019
Mean of India	—·013	+·005

As a similar decrease of pressure had occurred in the regions to the south and west of India it is obvious that it was due to some general action.

The vertical gradient was weak in northern India and somewhat stronger than usual in the Peninsula.

TABLE 10.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	"		"	"
Quetta	—·014	Jacobabad	—·038	—·024
Leh	—·015	Lahore	—·043	—·028
Murree	—·017	Peshawar	—·068	—·051
Simla	+·004	Ludhiana	—·032	—·036
Chakrata	—·007	Roorkee	—·022	—·015
Darjiling	—·052	Dhubri	—·034	+·018
Mount Abu	—·009	Deesa	+·002	+·011
Pachmarhi	—·009	Khandwa	+·018	+·027
Kodaikanal	+·004	Madura	+·023	+·019

H. R.

Temperature.

11. In north-west India and the west of the United Provinces, where rainfall continued scanty, both night and day temperatures were well above normal, the departures being most marked in the day temperatures.

In the north of the Peninsula the maxima were somewhat low and in the south-east correspondingly high ; elsewhere conditions were about normal.

TABLE 11.

SUB-DIVISION.	ACTUAL TEMPERATURE.					DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
1. Bay Islands	84·9	77·3	81·1	7·6	12·3	—0·1	+0·2	—0·3
2. Lower Burma	84·0	74·7	79·4	9·3	16·1	—0·5	—0·3	—0·2

Sub-division.	Actual temperature.					Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
3. Upper Burma	88·3	75·3	81·8	13·0	22·6	—1·2	—0·1	—1·1
4. Assam	87·9	77·5	82·7	10·4	17·3	—0·8	+0·1	—0·9
5. Eastern Bengal	87·5	78·4	82·9	9·1	16·3	+0·5	+0·4	+0·1
6. Bengal	89·0	78·9	84·0	10·1	16·0	+0·5	+0·3	+0·2
7. Orissa	86·7	77·3	81·9	9·4	18·0	—1·0	—0·6	—0·4
8. Chota Nagpur	86·1	75·4	80·8	10·7	17·9	—0·3	+0·2	—0·5
9. Bihar	88·8	78·4	83·6	10·4	18 5	—0·2	0	—0·2
10. United Provinces, East	90·1	78·2	84·1	11·9	24 7	+0·2	—0·3	+0·5
11. Do., West	94·7	79·2	86·9	15·5	30·8	+5·2	+1·9	+3·3
12. Punjab, East and North	101·5	82·2	91·9	19·3	36·4	+6·9	+4·1	+2·8
13. Do., Southwest	103·7	84·2	93·9	19·4	36·9	+2·7	+2·7	0
14. Kashmir	85·1	58·0	71·5	27·1	40·7	+3·3	+0·5	+2·8
15. North-West Frontier Province	105·1	81 7	93·5	23·4	35·8	+5·0	+2·3	+2·7
16. Baluchistan	99·4	72·0	85·7	27·3	38·3	+3·4	—0·9	+4·3
17. Sind	95·6	79·2	87·4	16·4	22·9	+1·0	+0·1	+0·9
18. Rajputana, West	99·0	80·0	89·5	19·0	29·9	+4·9	+1·4	+3·5
19. Do., East	94·6	78·6	86·6	16·0	30·2	+4·9	+2·2	+2·7
20. Gujarat	89·6	76·6	83·1	13·0	21·1	+0·8	—0·3	+1·1
21. Central India, West	86·9	72·7	79·8	14·3	25·7	+3·0	+0·8	+2·2
22. Do., East	88·5	76·9	82·7	11·5	26·0	+1·5	+0·7	+0·8
23. Berar	83·8	71·5	77·6	12·3	21·1	—1·3	—0·3	—1·0
24. Central Provinces, West	84·3	73·1	78·7	11·2	21·6	—0·6	—0·4	—0·2
25. Do., East	82·5	72·7	77·6	9·8	19·8	—3·3	—1·1	—2·2
26. Konkan	82·6	75·3	79·0	7·2	11·9	—0·5	—0·3	—0·2
27. Bombay Deccan	82·0	68·9	75·5	13·1	20·7	—2·1	—0·6	—1·5
28. Hyderabad, North	82·8	69·6	76·2	13·2	21·8	—2·1	—0·9	—1·2
29. Do., South	85·8	71·9	78·9	13·9	23·1	—1·9	—0·6	—1·3
30. Mysore	80·5	65·2	72·8	15·3	22·3	—1·1	—1·0	—0·1
31. Malabar	83·9	74·1	79·0	9·8	15·1	+0·9	+0·5	+0·4
32. Madras, Southeast	95·5	76·6	86·0	18·8	26·2	+1·7	+0·4	+1·3
33. Do. Deccan	91·7	74·3	83·1	17·4	26·3	+0·3	—0·4	+0·7
34. Do. Coast, North	90·7	78·3	84·5	12·5	23·2	+0·4	—0·1	+0·5

TABLE 12.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	−0·8	−0·3	−0·5
Eastern Bengal and Assam	+0·1	+0·3	+0·2
Bengal	−0·2	0	−0·1
United Provinces	+2·9	+0·9	+1·9
Punjab	+5·6	+3·7	+4·7
North-West Frontier Province	+5·0	+2·3	+3·7
Sind	+1·0	+0·1	+0·6
Rajputana	+4·9	+2·1	+3·5
Bombay	−0·5	−0·4	−0·5
Central India	+2·3	+0·7	+1·5
Central Provinces	−1·3	−0·5	−0·9
Hyderabad	−2·0	−0·7	−1·3
Mysore	−1·1	−1·0	−1·0
Madras	+1·0	+0·2	+0·6

W. A. H.

Winds.

12. The inflow of monsoon winds was decidedly stronger than during July, and in the central parts of the country and in the Punjab velocities had also become markedly greater. Except in Sind, winds were steadier than the normal and there were no marked departures from the normal directions.

TABLE 13.

Division.	Departure from normal of	
	Hourly wind velocity.	Wind steadiness.
Burma	+0·4	+ 1
Eastern Bengal and Assam	−1·0	+ 3
Bengal	+0·1	+ 4
United Provinces	+0·3	+ 7
Punjab	+1·1	+11
North-West Frontier Province	−0·5	+ 2
Sind	−1·0	− 6
Rajputana	+2·9	+ 1
Bombay	0	+ 5
Central India	+2·2	+15
Central Provinces	+1·2	+ 6
Hyderabad	−1·1	+ 6
Mysore	+1·5	+ 7
Madras	+0·5	+ 5

W. A. H.

Humidity and cloud.

13. Except in Eastern Bengal and Assam there was less than the normal amount of moisture in the air, the largest deficiencies occurring in the Punjab and Rajputana. In those regions relative humidity also was low, being more than 10 per cent. in defect; but in north-east India, the Central Provinces and the Peninsula relative humidity was not very different from its normal value.

Skies were unusually clear except in Burma, Bengal, the central parts of the country and Bombay.

TABLE 14.

Division.	Hygrometry; 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	90	0	·866	—·008	8·5	+0·4
Eastern Bengal and Assam.	90	— 1	·955	+·001	7·2	—0·8
Bengal	88	— 1	·935	—·012	7·7	+0·1
United Provinces.	79	— 7	·876	—·039	6·9	—0·2
Punjab	61	—15	·776	—·106	2·9	—1·5
North-West Frontier Province.	65	— 7	·844	—·059	1·3	—1·4
Sind	72	— 4	·806	—·061	4·0	—1·0
Rajputana	65	—11	·709	—·084	5·5	—1·4
Bombay	83	— 1	·790	—·017	7·8	+0·1
Central India	81	— 7	·794	—·029	8·9	+1·1
Central Provinces	85	— 3	·751	—·044	8·6	+0·5
Hyderabad	81	0	·686	—·042	7·8	—0·1
Mysore	84	+ 1	·618	—·012	7·9	—0·5
Madras	74	— 3	·770	—·035	6·5	—0·4

W. A. H.

Rainfall.

14. The drought which characterised July was not continued through August, the total rainfall over the plains being in defect by only about 11 per cent. Towards the end of the month rain extended into the United Provinces, Rajputana, and the Punjab areas, in which scarcely any rain had fallen during July.

The total rainfall of the month was normal or about normal in Burma, almost the whole of north-east India, the United Provinces East, Central India East, Berar, the Central Provinces West, the Konkan, Hyderabad North and the Bombay Deccan; in moderate excess in Bihar and the Central Provinces East; and in defect elsewhere. The deficiency was pronounced in north-west India, Central India West, the United Provinces West, Mysore and Madras.

TABLE 15.

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
1. Bay Islands	13·0	20·9	7·13	13·83	—6·70	— 48
2. Lower Burma	25·9	24·0	32·58	26·68	+5·90	+ 22
3. Upper do.	10·5	10·8	6·46	7·39	—0·93	— 13
4. Assam	19·1	17·6	16·00	16·15	—0·15	— 1
5. Eastern Bengal	19·1	16·6	15·34	15·53	—0·19	— 1
6. Bengal	16·3	15·6	10·39	11·93	—1·54	— 13
7. Orissa	14·9	15·1	11·10	12·24	—1·14	— 9
8. Chota Nagpur	18·5	16·4	15·44	13·35	+2·09	+ 16
9. Bihar	17·6	13·8	16·83	11·86	+4·97	+ 42
10 United Provinces, East	13·3	12·5	11·49	11·35	+0·14	+ 1
11. Do., West	7·8	11·8	6·43	11·71	—5·28	— 45

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
12. Punjab, East and North	4·1	6·8	3·51	6·54	−3·03	− 46
13. Do., Southwest	1·0	2·8	0·79	2·08	−1·29	− 62
14. Kashmir	3·5	4·9	2·52	3·51	−0·99	− 28
15. North-West Frontier Province	3·6	4·1	2·27	3·29	−1·02	− 31
16. Baluchistan	0·6	1·4	0·42	0·87	−0·45	− 52
17. Sind	0·3	2·2	0·15	2·21	−2·06	− 93
18. Rajputana, West	1·9	4·3	0·62	3·32	−2·70	− 81
19. Do., East	5·3	9·1	3·37	7·32	−3·95	− 54
20. Gujarat	6·3	11·1	2·97	8·40	−5·43	− 65
21. Central India, West	7·7	12·3	5·67	10·23	−4·56	− 45
22. Do., East	11·9	14·6	13·65	13·05	+0·60	+ 5
23. Berar	9·4	10·1	6·45	6·68	−0·23	− 3
24. Central Provinces, West	13·5	13·7	10·92	11·78	−0.86	− 7
25. Do., East	20·3	15·1	18·73	13·97	+4·76	+ 34
26. Konkan	26·1	24·7	28·25	24·84	+3·41	+ 14
27. Bombay Deccan	10·5	9·7	5·21	5·53	−0·32	− 6
28. Hyderabad, North	11·9	11·4	7·65	7·91	−0·26	− 3
29. Do., South	10·3	10·4	4·48	6·43	−1·95	− 30
30. Mysore	6·2	8·5	2·98	5·42	−2·44	− 45
31. Malabar	18·2	20·9	13·61	19·32	−5·71	− 30
32. Madras, Southeast	2·4	5·4	1·28	3·55	−2·27	− 64
33. Do. Deccan	6·0	6·5	2·39	3·86	−1·47	− 38
34. Do. Coast, North	8·4	10·0	4·80	6·84	−2·04	− 30

TABLE 16.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	18·64	16·37	+2·27	+ 14
Eastern Bengal and Assam	15·68	15·84	−0·16	− 1
Bengal	13·68	12·14	+1·54	+ 13
United Provinces	9·09	11·52	−2·43	− 21
Punjab	2·96	5·63	−2·67	− 47
North-West Frontier Province	2·27	3·29	−1·02	− 31
Sind	0·15	2·21	−2·06	− 93

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Rajputana	2·41	6·24	−3·83	− 61
Bombay	8·68	9·96	−1·28	− 13
Central India	8·49	11·19	−2·70	− 24
Central Provinces	10·84	10·19	+0·65	+ 6
Hyderabad	5·90	7·10	−1·20	− 17
Mysore	2·98	5·42	−2·44	− 45
Madras	3·59	6·01	−2·42	− 40
Mean of India	8·76	9·79	−1·03	− 11

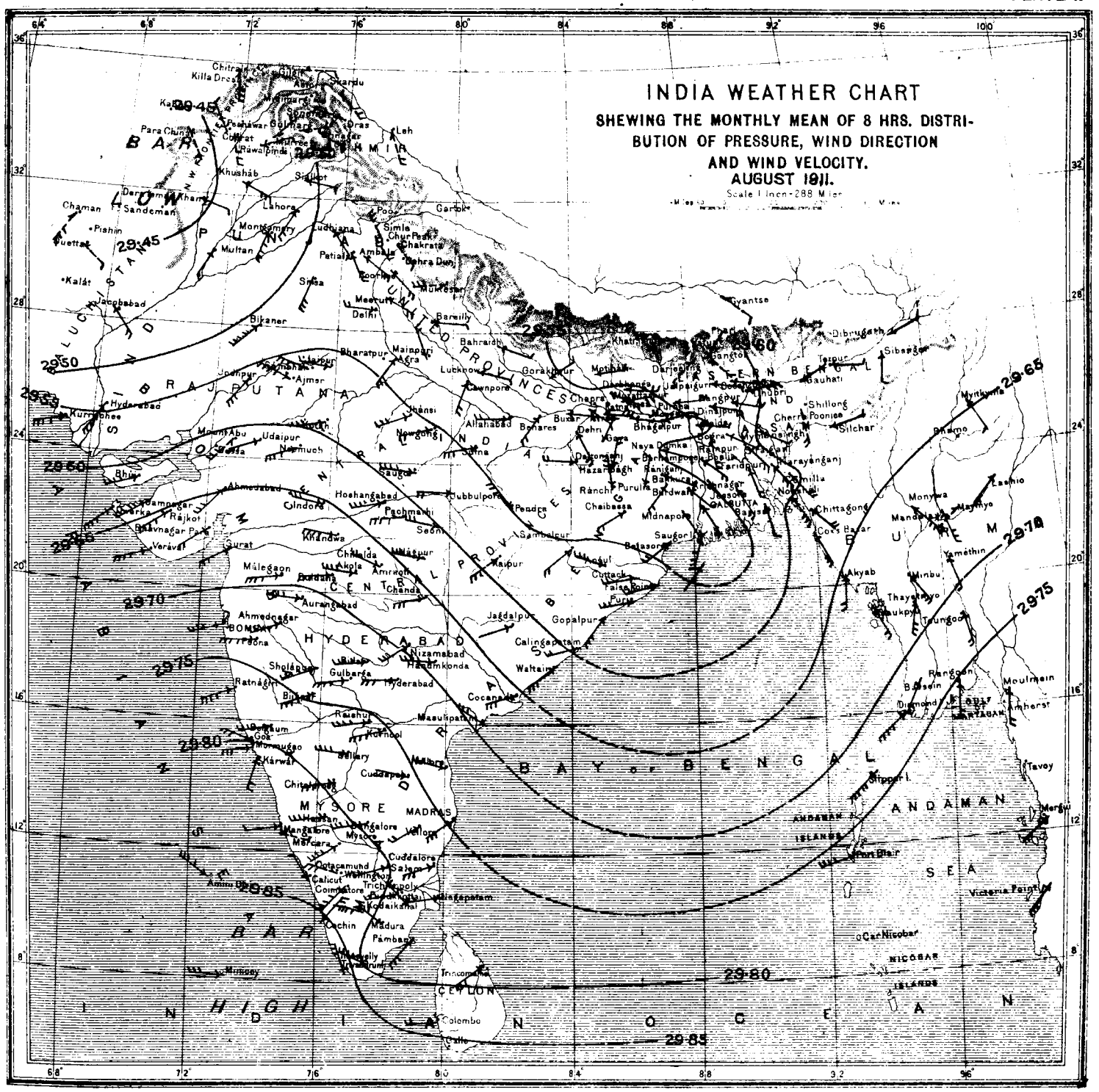
W. A. H.

Snowfall.

15. (*a*) According to available information no snow fell in the mountain region bordering upper India on the west. In Kashmir there were four falls on the higher ranges visible from Skardu; while in the Punjab Himalayas light snow fell on the hills near Kilba down to a level of about 11,000 feet on the last three days of the month. In Almora snowstorms were of occasional occurrence: the total fall measured 9½ feet on the Nuwe pass, and 4 feet on the Lipulekh and Lampia passes. At the end of the month the accumulated snow measured about 20 feet on the Nuwe pass, 11 feet on the Lampia, 9 feet on the Lipulekh, and 5 feet on the Binkaru: the quantities were greater than usual except in the case of the Binkaru pass.

(*b*) On the whole the snowfall of the month was not heavier than usual.

H. R.

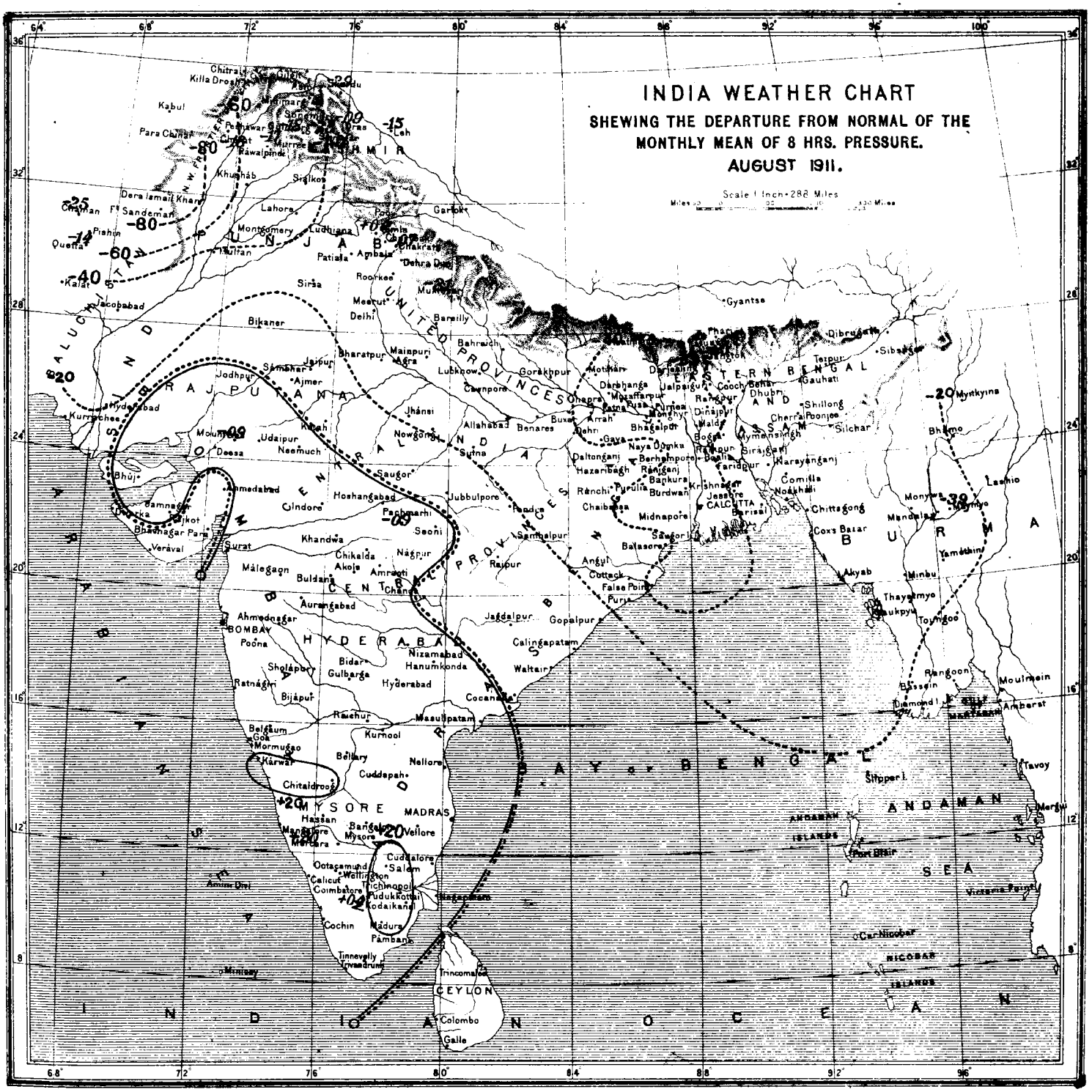


LITHO. BY S.S.M

The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2	miles per hour	...	one	feather	added to the wind arrow.						
,,	,, 2 to 5	,,	,,	,,	...	two	feathers	,,	,,	,,	,,	
,,	,, 5 to 10	,,	,,	,,	...	three	,,	,,	,,	,,	,,	
,,	,, 10 to 20	,,	,,	,,	...	four	,,	,,	,,	,,	,,	
	over 20	,,	,,	,,	...	five	,,	,,	,,	,,	,,	



Reg. No. 4176 E., 11.—Z.—1,350.

Reg. No. 4196 E., 11.—Z.—3,800.

The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020' or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

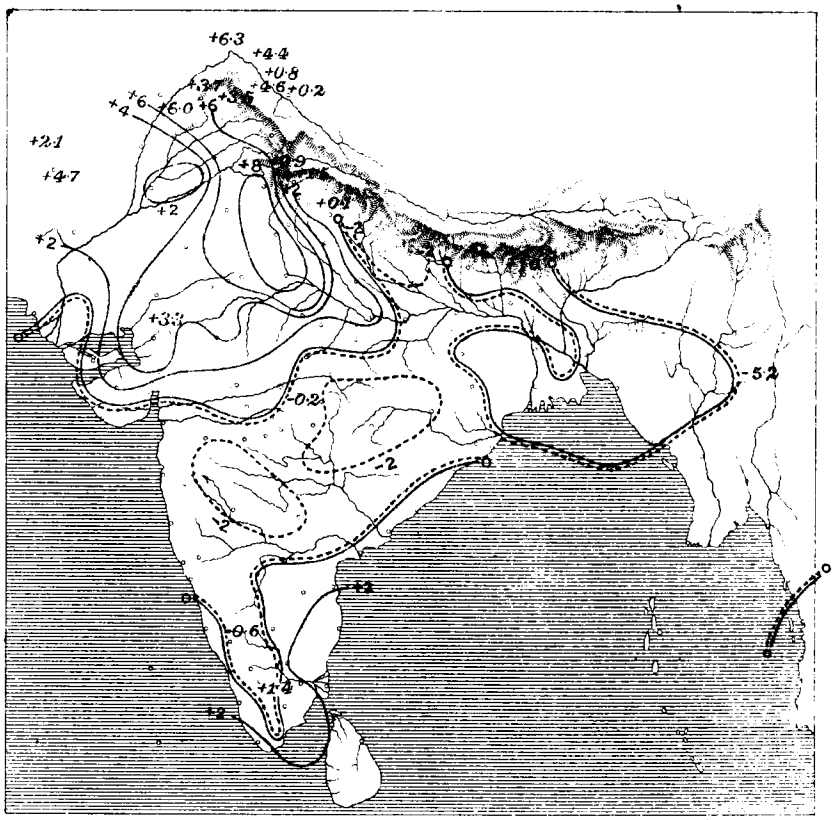


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

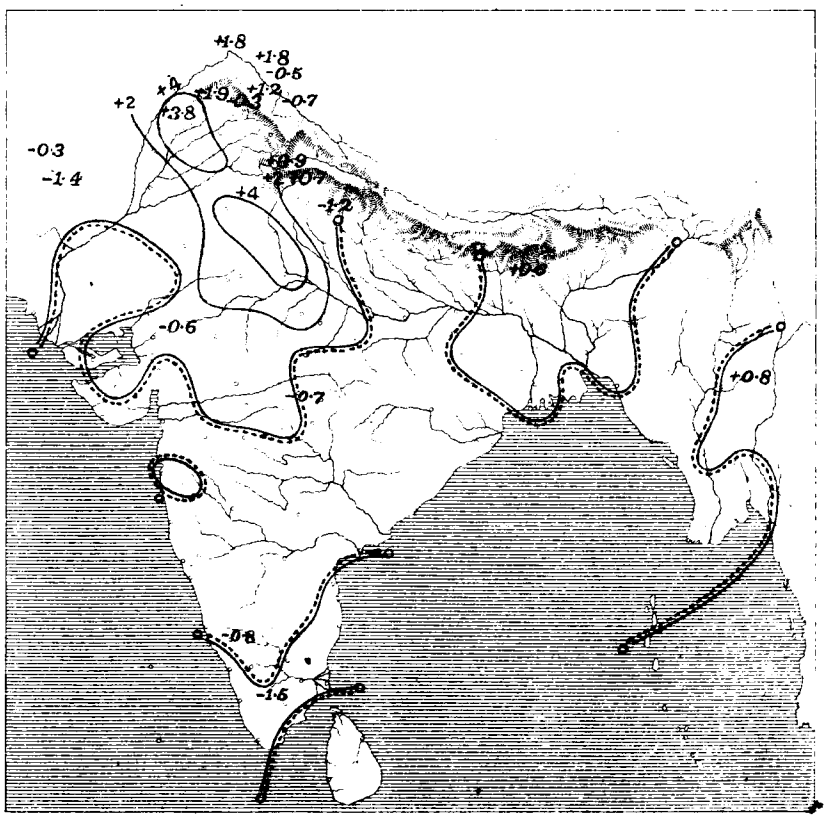


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MEAN TEMPERATURE.

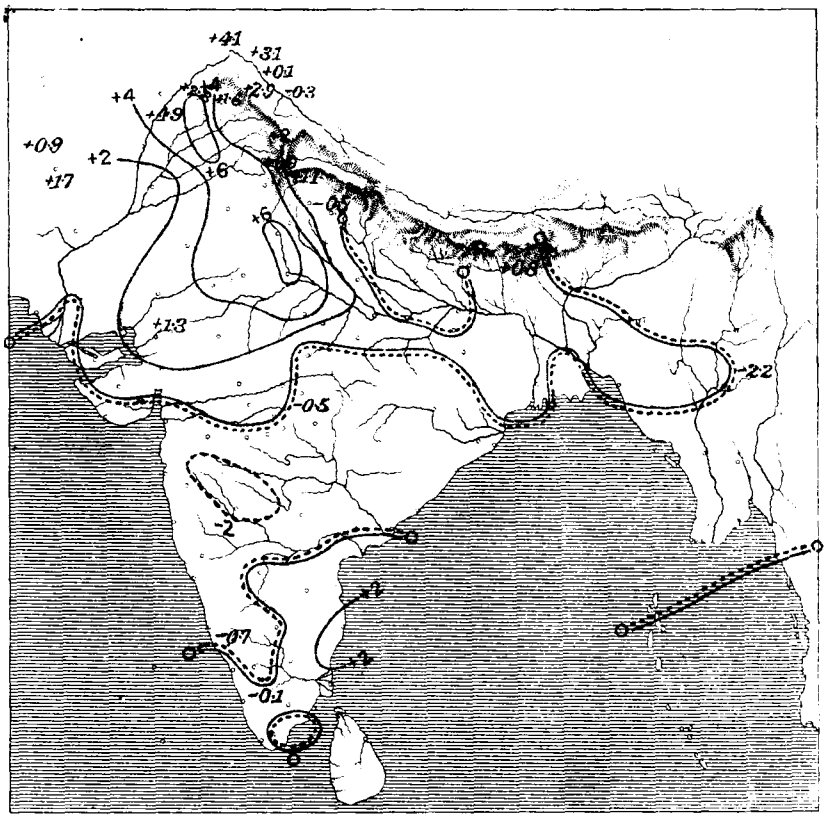


CHART SHEWING THE MONTHLY MEAN OF PRESSURE AND RESULTANT WIND DIRECTION.

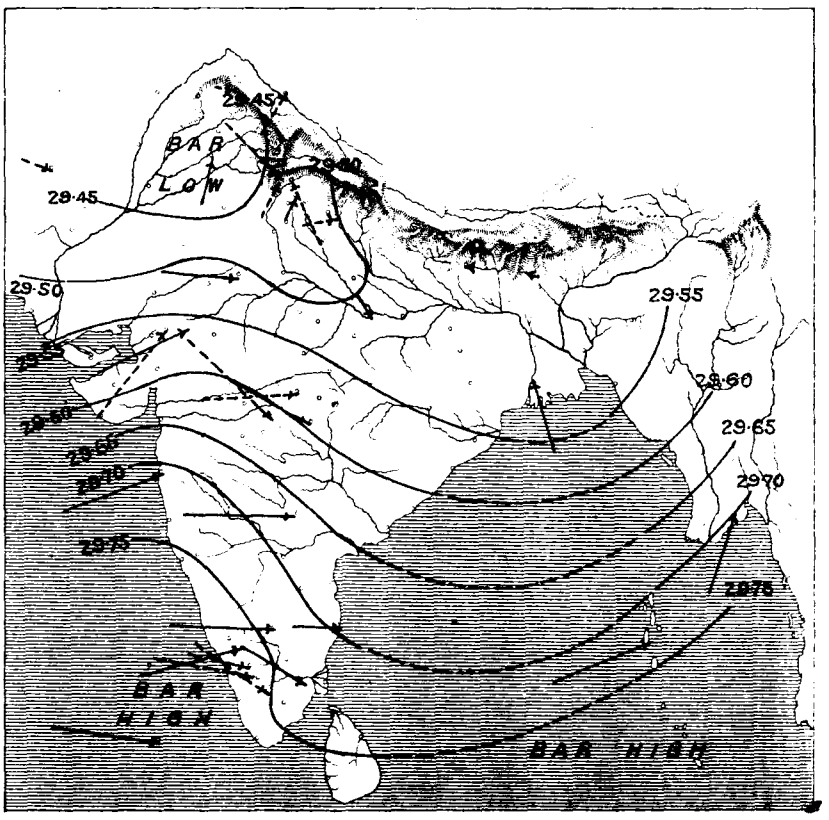


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF ABSOLUTE HUMIDITY AT 8 HRS.

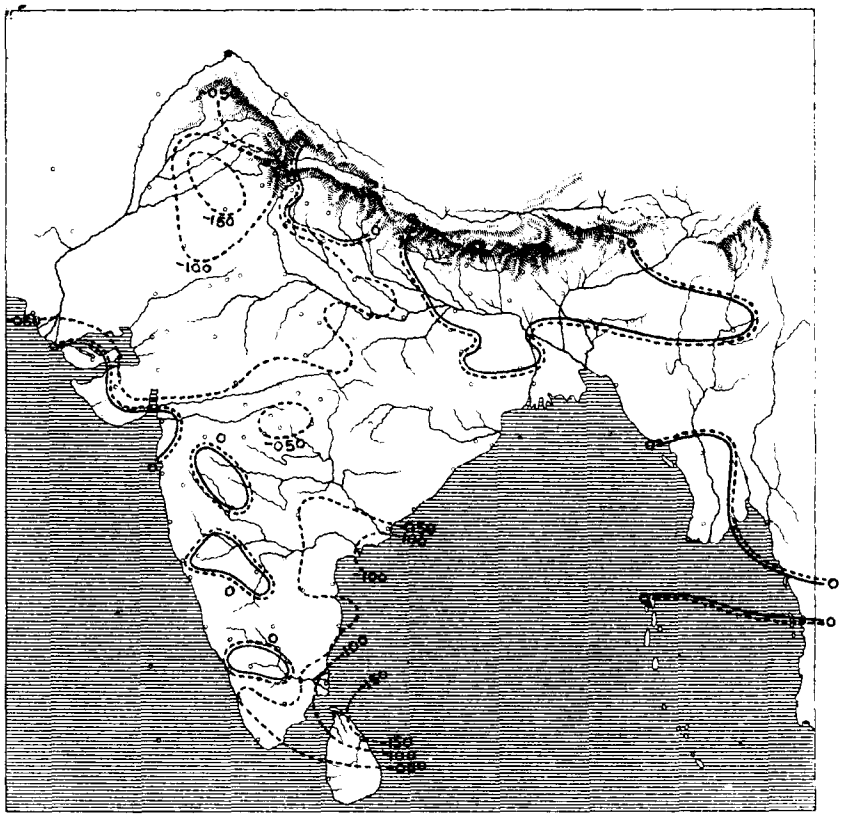


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF RELATIVE HUMIDITY AT 8 HRS.

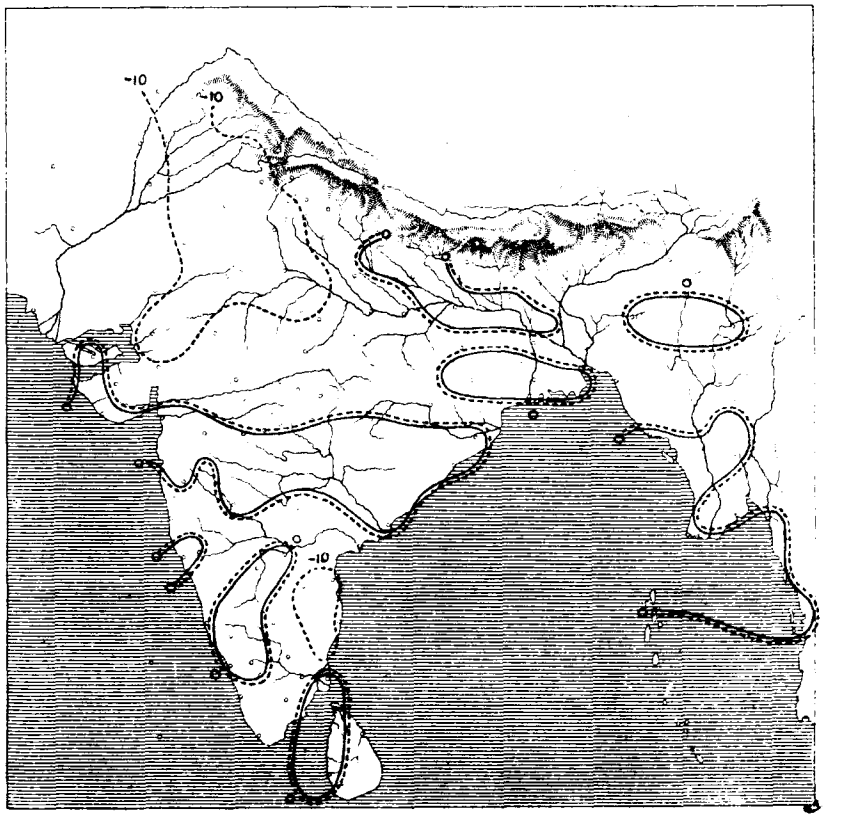


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

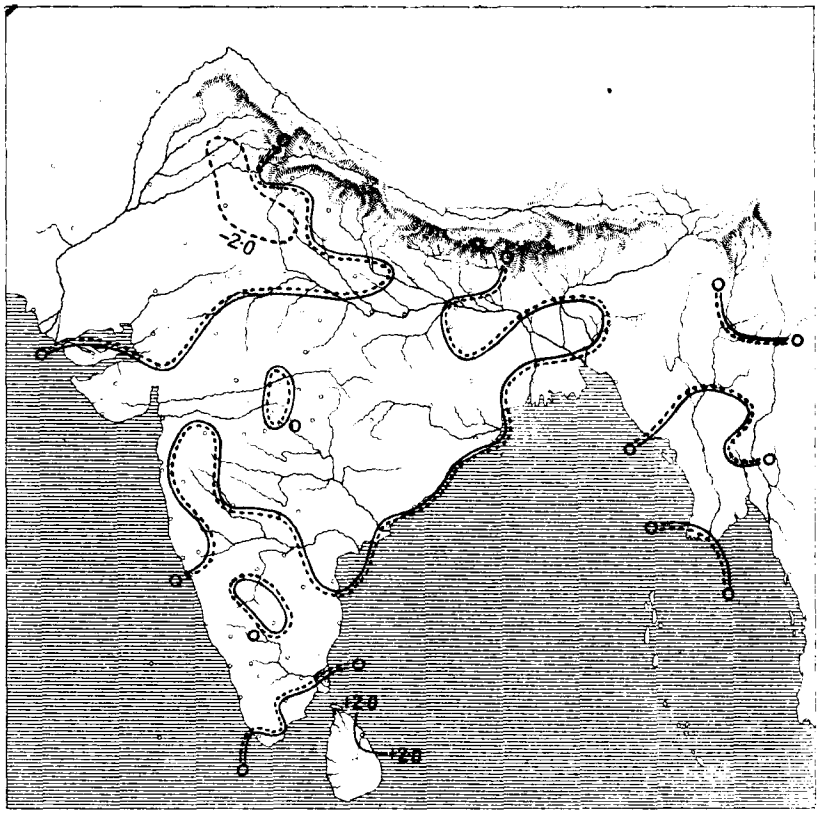
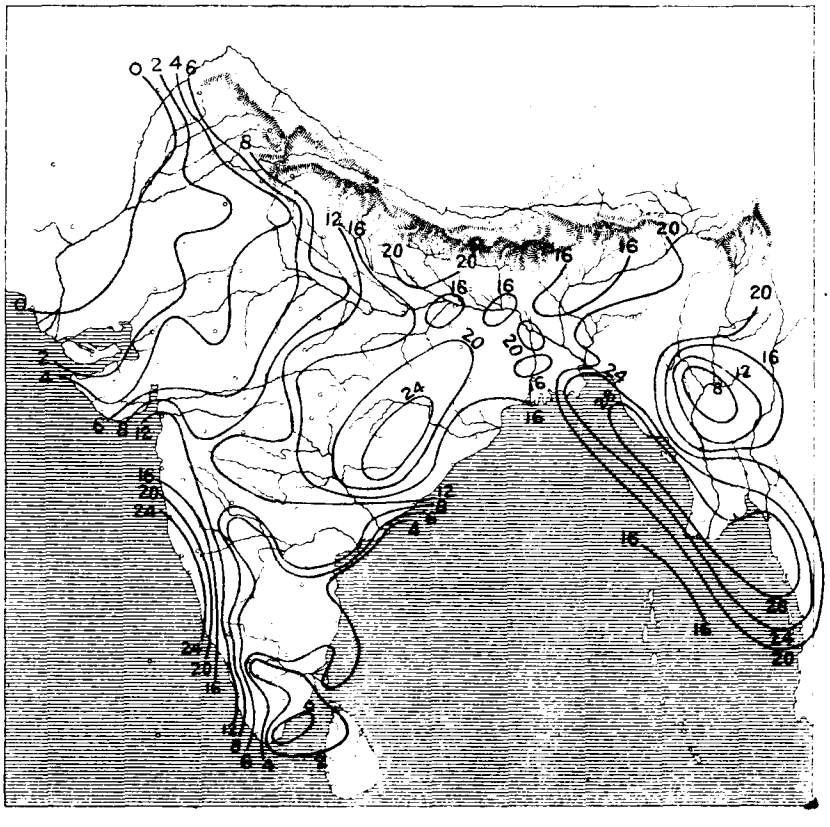


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)



Reg. No 4176 E., 11.—2.—1,250.

Reg. No. 4195 E., 11.—2.—3,900.

The country is divided into 34 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall; the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Eastern Bengal
6. Bengal
7. Orissa
8. Chota Nagpur
9. Bihar
10. United Provinces, East
11. Do., West
12. Punjab, East and North
13. Do., Southwest
14. Kashmir
15. Northwest Frontier Province
16. Baluchistan
17. Sind
18. Rajputana, West
19. Rajputana, East
20. Gujarat
21. Central India, West
22. Do., East
23. Berar
24. Central Provinces, West
25. Do., East
26. Konkan
27. Bombay, Deccan
28. Hyderabad, North
29. Do., South
30. Mysore
31. Malabar
32. Madras, Southeast
33. Madras, Deccan
34. Madras Coast, North

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CALCUTTA, SEPTEMBER, 1911.

INTRODUCTION.

THIS review of the weather in India during the month of September, 1911, is based on observations taken daily at 8 hrs. at 242 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 34 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by Provincial Governments up to the date of the preparation of the review. The brief notes on solar, seismic and magnetic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. On most days the monsoon was more vigorous than usual, but was directed chiefly to the United Provinces and Central India at the expense of northwest India and the Peninsula. Three disturbances occurred during the month and were mainly responsible for the unfavourable distribution of rainfall. The third of these was noteworthy: it advanced from Lower Burma across the Bay to the Circars coast, and thence through the Central Provinces to Delhi where it gave a downpour of rain, amounting to over 9 inches, during the 48 hours preceding 8 hrs. of the 28th.

The final cessation of the monsoon rains of 1911 occurred on the 21st in the northwest, and on the 30th in the east Punjab and the west of the United Provinces.

The total rainfall of the month was on the whole more than the average in the region served by the Bay current, and in slight defect in the field of the Arabian Sea current. The excess was more than 40 per cent. in amount in the United Provinces (126 per cent.), Rajputana East (97 per cent.) and Central India East (123 per cent.); while the largest percentage defect occurred in Malabar (77 per cent), the Bombay Deccan (78 per cent.), Gujarat (66 per cent.), Mysore (59 per cent.), Hyderabad North (54 per cent.) and the Konkan (53 per cent). In Sind the aggregate quantity received during the month was less than a tenth of an inch.

Day temperature was somewhat low in the United Provinces and the east of Central India where cloud and rainfall were markedly in excess, but in almost all other places the temperature conditions were about normal. Humidity, both absolute and relative, differed to no great extent from the average. The sky was more nearly covered than usual in northern and central India, but was comparatively clear in the greater part of the Peninsula.

The barometer in the plains of India stood ·011″ below its normal height.

H. R.

Solar, seismic and magnetic disturbances

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—There were two days during the month when no solar observations could be made, and three other days on which complete prominence records could not be obtained.

Sun spots.—Only two spots were recorded for the whole month. One of them No. 1997, was of moderate size and

was observed from the 1st to 11th at latitude + 5°. The other was a faint dot at latitude — 6° and was seen on the 5th only. The daily average number was 0·4 and the average life of a spot was 6 days. No spot was observed on the visible disc of the sun from the 13th to the end of the month.

Prominences—Large and eruptive prominences continued to be numerous during the month. There were 42 of the former class and 12 of the latter. One of the eruptive prominences was also metallic. The tallest prominence was observed on the 8th at latitude +32° east and was 200″ high.

Photographs showing the prominences projected on the disc as absorption markings in Hα light were obtained on 15 days only. The average daily numbers recorded were 1·1 for the northern and 1·5 for the southern hemispheres.

Magnetic disturbances.—A "moderate" magnetic disturbance was recorded from 7h. 20m. to 14h. 20m. on the 20th.

Seismological records.

TABLE 1.

No.	Date.	P. T. Commencement G. M. T.	L. W. Commencement G. M. T.	Maxima. G. M. T.	End.	Maximum amplitude.	Duration.	Remarks.
	1911.	H. M.	H. M.	H. M.	H. M.	mm.	H. M.	
55	Sept. 15	13 40·6	13 53·1	14 46·3	15 29·0	0·5=0·2	1 48·4	
56	„ 17	3 52·2	4 19·1	4 25·9	6 42·9	1·6=0·6	2 50·7	
57	„ 20	5 49·8	...	...	6 13·2	...	0 23·4	Widening of line.
58	„ 22	5 34·1	5 55·9	5 58·5	6 35·1	0·8=0·3	1 01·0	
59	„ 26	14 21·6	...	...	14 44·3	...	0 22·7	Widening of line.

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Director,
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BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of September 1911, the traces showed 10 calm days, 18 days of small and 2 days of moderate disturbance.

The days of the month selected as quiet for the purposes of the Magnetic Survey of India are the 2nd, 8th, 9th, 28th and 30th.

The following table represents the magnetic character of each day during the month:—

TABLE 2.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	C	17	S	25	C
2	C	10	S	18	S	26	C
3	C	11	S	19	S	27	S
4	C	12	S	20	M	28	C
5	S	13	S	21	M	29	S
6	S	14	C	22	S	30	C
7	S	15	S	23	S	31	...
8	C	16	S	24	S	...	...

C = calm; S = small; M = moderate; G = great; V. G. = very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms as also the ranges and the summed ranges of the horizontal force and declination for the month are as follow:—

Easterly declination	0° 53′ 48″
Horizontal force	0·36861 C.G.S. unit.
Vertical force	0·16252 „ „
Inclination	23° 47′·5
Inclination (observed)	23° 47′·1
Horizontal force range	0·00027 C.G.S. unit.
Horizontal force summed range	0·00151 „ „
Declination range	4′·1
Declination summed range	14′·7

(NOTE.—Summed range means sum without regard to signs of the 24 ordinates of diurnal inequality.)

Seismic disturbances.

TABLE 3.

Date.	Commencement.	Maximum.	End.	Maximum amplitude.	Duration.
1911.	H. M.	H. M.	H. M.	mm.	H. M.
Sept. 6	1 13·2	1 17·3	1 38·0	0·2	0 24·8
„ 8	23 23·3	23 30·4	23 44·5	0·4	0 21·2
„ 15	13 39·8	14 35·3	15 27·7	1·0	1 47·9
„ 17	3 44·9	4 16·4	6 39·1	3·6	2 54·2
„ 22	5 53·6	5 54·8	6 21·2	0·4	0 27·6
„ 26	14 16·6	14 23·7	14 39·6	0·4	0 23·0

All times given above denote G. M. T.
Sensibility to tilt . . . . 1 mm.=0″·40.

N. A. F. MOOS,
Director,
Bombay and Alibag Observatories.

CALCUTTA OBSERVATORY.

5. *List of displacements recorded by the Milne seismograph.*

TABLE 4.

Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maximum. G. M. T.	End. G. M. T.	Duration.	Maximum displacement on trace from mean position.	REMARKS.
1911.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
Sept. 6th	0 20·1	1 15·0	1 57·5	2 3·2	1 43·1	1·00	
„ 8th	23 2·0	...	23 23·3	23 47·1	0 45·1	0·50	
„ 13th	3 49·9	...	3 55·0	4 13·3	0 23·4	0·50	
„ 15th	13 24·0	14 38·7	14 44·3	15 28·5	2 4·5	1·50	
„ 17th	3 47·9	4 6·2	4 17·9	6 43·3	2 55·4	3·00	
„ 18th	13 48·5	...	13 53·6	14 12·4	0 23·9	0·50	
„ 20th	5 20·9	...	...	6 7·2	0 46·3	...	Thickening of line.
„ 21st	7 31·6	...	7 54·9	8 12·3	0 40·7	0·50	
„ 22nd	5 24·5	5 47·9	6 0·6	6 28·1	1 3·6	1·25	
„ 26th	14 13·0	...	14 18·1	14 51·7	0 38·7	2·00	

Sensibility 1 mm. = 0″·38 of tilt.

E. P. HARRISON,
Offg. Meteorologist, Calcutta.

SIMLA OBSERVATORY.

6. *List of earthquakes recorded by the Omori-Ewing seismographs.*

TABLE 5.

Date.		Beginning of 1st P. T.	Beginning of 2nd P. T.	Beginning of L. W.	Time of maximum amplitude.	End approximately.	Approximate duration.	Maximum displacement of style.*	REMARKS.
		H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
3rd	A	15 48·3	15 49·3	15 50·1	15 50·1	16 1	0 13	0·3	
„	B	15 48·9	...	...	15 49·4	15 59	0 10	Small.	
6th	A	1 3·8	1 9·5	1 15·5	1 8·8	2 9	1 5	0·4	
„	B	1 2·8	1 9·6	1 15·5?	1 14·8	1 36	0 33	0·4	
8th	A	23 1·9	23 9·5	23 18·5	23 22·3	23 52	0 50	0·3	
„	B	23 1·7?	...	...	23 21·5	23 30	0 23?	0·5	
15th	A	13 29·7	...	14 31·6	14 40·6	14 59	1 29	Small.	
„	B	13 29·7	13 52·7	14 15·2	14 20·3	15 23	1 53	0·9	
19th	A	3 38·7	3 48·3	4 1·6	4 11·3	P	P	1·4	
„	B	3 39·3	3 48·3	3 59·3	4 5·4	P	P	1·7	
21st	A	5 42·5	...	...	5 48·0	6 9	0 26	Small.	
„	B	5 47·2	...	...	5 47·5	6 5	0 18	0·8	
22nd	A	5 23·2?	...	5 45·2	5 45·5	6 43	1 20?	0·4	
„	B	5 23·8	...	5 45·4?	5 52·6	6 24	1 0	0·8	
23rd	A	14 0·9	...	...	14 1·0	14 2·2	0 1·3	Small.	Local.
„	B	14 0·6	...	...	14 0·9	14 2·8	0 2·2	„	„
26th	A	14 13·0	14 17·2	14 20·6	14 22·3	14 51	0 38	0·4	
„	B	14 13·2	14 17·0	14 20·2	14 20·9	14 44	0 31	0·7	

All times are given in G. M. T.
A = E—W component.
B = N—S component.
Magnification of each instrument was 15.
* Displacements less than 0·2 mm. are reported as "small."

The following table contains a list of earthquakes that have been reported :—

TABLE 6.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.
		H. M.	Sec.		
Drosh	2nd	2 35	3	5	3
Chitral . . .	8th	17 15	2	7	3
Drosh . . .	13th	8 50	2	5	2
Shillong . . .	14th	11 47	1	4	1
Drosh	15th	14 45	2	5	2
Chitral . . .	15th	19 15	1	7	1
Drosh	15th	19 58	3	5	2
„	17th	15 57	4	4	3
Shillong . . .	18th	7 40	1	4	1
Drosh	19th	14 23	2	5	1
Turbat-i-Haidari .	23rd	11 54	30	0	0
Drosh	23rd	13 59	3	5	2
Chitral . . .	23rd	14 5	3	7	3
Shillong . . .	26th	16 14	1	4	1
Drosh	29th	3 25	2	5	1
Chitral . . .	30th	18 15	2	7	2

Solar radiation.—No observations were possible, owing to continuous cloud.

W. A. H.

ROYAL ALFRED OBSERVATORY, MAURITIUS.

7. No information has been received.

Weather in the Indian monsoon region.

8. In the west of the equatorial belt pressure exceeded the average both at Zanzibar and Seychelles, the excess being as much as ·04″ at the former station. The air movement, although normal as regards velocity, was less easterly than is usual in September.

Rainfall was markedly in excess at Seychelles, where it occurred chiefly during the first fortnight.

In the south of the Indian Ocean, as represented by Mauritius, meteorological conditions were approximately normal.

TABLE 7.

	Mauritius.*	Zanzibar.	Seychelles.
Departure from normal of mean pressure.	+·002	+·041	+·012
Actual mean wind direction	S 78° E	S 5° W	S 32° E
Normal mean wind direction	S 71° E	S 6° E	S 40° E
Actual mean wind velocity (miles per diem).	270	144	297
Normal mean wind velocity (miles per diem).	263	134	288
Rainfall departure from normal.	—0·10	—0·93	+2·09

* Approximate data derived from weekly telegrams.

H. R.

Depressions and cyclonic storms.

9. Storms in the Arabian Sea are normally very rare during this month, but in the Bay on the average two develop and move generally in a north-westerly direction. During the month under review several shallow depressions appeared over various parts of northern India, and two storms from the Bay crossed the coast. Three of these disturbances are worthy of special note. The first appeared as a shallow depression over Bihar and the east of the United Provinces at the beginning of the month. It remained stationary for several days and then moved slowly north-westwards up the Gangetic plain and northwards as far as Lucknow, giving fairly general rain along its path. The second began to form at the head of the Bay on the 8th, and crossed the coast south of Balasore on the 11th. In conjunction with a shallow depression which appeared in the neighbourhood of Allahabad on the 9th, it gave moderately heavy rain in the west of Bengal, the east of the United Provinces and in parts of Central India. The third and most important disturbance of the month appeared over Burma on the 12th. It passed out into the Bay on the 13th and developed slowly into a cyclonic storm which on the 20th was of moderate intensity, and was situated to the north-north-west of the Andamans. Thereafter it began to move in a north-westerly direction and became of a severe type. It crossed the coast of the Peninsula near Calingapatam on the evening of the 23rd, causing considerable damage along the north Madras coast by violent winds, heavy rain and floods. Following a path which lay roughly through Bastar, Seoni, Nowgong, Jhansi, Agra and Delhi it gave heavy rain throughout its progress. Falls were remarkably heavy in neighbourhood of Delhi and Meerut, over 9 inches being recorded at each of these stations between the mornings of the 26th and the 28th. The storm disappeared in the Kumaon Hills between the 28th and the 29th, leaving the monsoon currents extremely weak and rainfall very scattered in character over nearly the whole country.

W. A. H.

Pressure.

10. On the average of all the observing stations in the plains of India pressure was below the normal by ·011″. The deficit was common to the whole country with the exception of the divisions of Bombay and Mysore, and was

on the whole most marked, between ·02″ and ·04″, in the tract extending from Chota Nagpur to the western limits of Rajputana.

The lowness of the barometer was not the result of the temperature variations as recorded at the earth's surface, which were either very slight or negative.

At the level of the hill stations in north-east India, the Central Provinces and southern India, pressure was markedly in defect in relation to that of the plains; while in north-western India the reverse condition obtained.

TABLE 8.

Division.	Departure from normal of mean 8 hrs. pressure.
	″
Burma	—·013
Eastern Bengal and Assam	—·005
Bengal	—·017
United Provinces	—·016
Punjab	—·008
North-West Frontier Province	—·029
Sind	—·012
Rajputana	—·025
Bombay	+·004
Central India	—·020
Central Provinces	—·018
Hyderabad	—·007
Mysore	+·009
Madras	—·006

TABLE 9.

Hill station.	Departure from normal pressure. A	Plain station.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	″		″	″
Quetta	—·008	Jacobabad	—·019	—·011
Leh	+·007	Lahore	—·007	—·014
Murree	+·001	Peshawar	—·034	—·035
Simla	+·004	Ludhiana	—·002	—·006
Chakrata	+·001	Roorkee	+·008	+·007
Darjiling	—·036	Dhubri	—·002	+·034
Mount Abu	—·007	Deesa	—·013	—·006
Pachmarhi	—·027	Khandw	—·001	+·026
Kodaikanal	—·008	Madura	+·012	+·020

H. R.

Temperature.

11. Day temperatures were markedly above normal in the central and eastern parts of the Peninsula, and in parts of Gujarat, Sind, Baluchistan and Kashmir; but over almost the whole of northern and central India they were below normal. In Central India East and parts of the United Provinces the defect in the monthly mean exceeded 5 degrees. Night temperatures on the other hand, owing to the unusually large amount of cloud, were for the most part above normal especially over northern India. Mean temperature was somewhat high in the Peninsula and over northwest India, but was low in the remainder of northern India and in the central parts of the country. This distribution was the result of the concentration of the month's rainfall in the central parts of the country to the detriment of the northwest and the Peninsula.

TABLE 10.

Division.	Actual temperature.					Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
1. Bay Islands	84·3	76·5	80·3	7·9	13·9	—1·0	—0·5	—0·5
2. Lower Burma	85·8	75·3	80·5	10·5	18·3	+0·4	+0·1	+0·3

Division.	Actual temperature.					Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
3. Upper Burma	90·0	74·9	82·4	15·1	22·5	—0·3	—0·1	—0·2
4. Assam	87·1	76·4	81·7	10·7	20·3	—0·8	—0·1	—0·7
5. Eastern Bengal	87·5	77·7	82·6	9·8	19·3	+0·1	+0·3	—0·2
6. Bengal	89·0	78·4	83·7	10·7	18·6	+0·1	0	+0·1
7. Orissa	88·2	77·9	83·1	10·3	17·3	—1·0	—0·1	—0·9
8. Chota Nagpur	86·7	74·7	80·7	12·0	20·0	—1·1	+0·5	—1·6
9. Bihar	88·3	77·6	82·9	10·7	21·6	—1·1	—0·4	—0·7
10. United Provinces, Eas	88·1	76·4	82·3	11·7	21·4	—3·3	—0·5	—2·8
11. Do. do., Wes	87·7	74·4	81·0	13·2	23·3	—2·9	—0·2	—2·7
12. Punjab, East and North	94·9	76·1	85·5	18·8	33·8	—0·2	+2·3	—2·5
13. Do., Southwest	100·3	79·7	90·0	20·7	33·2	—0·2	+3·2	—3·4
14. Kashmir	77·2	50·8	64·3	26·3	43·3	+2·1	+1·7	+0·4
15. North-West Frontier Provin	98·7	75·7	87·2	23·1	39·1	+0·5	+3·1	—2·6
16. Baluchistan	92·1	63·3	77·7	28·8	42·9	+2·0	+1·1	+0·9
17. Sind	96·4	77·7	87·1	18·7	30·8	+0·9	+1·8	—0·9
18. Rajputana, West	96·5	77·7	87·1	18·9	30·1	—0·5	+0·1	—0·6
19. Do., East	89·6	74·8	82·2	14·8	25·3	—2·3	+0·6	—2·9
20. Gujarat	91·1	75·7	83·4	15·4	25·4	+1·3	+0·6	+0·7
21. Central India, West	84·9	70·5	77·7	14·4	22·2	—1·7	+0·1	—1·8
22. Do., East	85·0	75·1	80·1	9·9	18·0	—4·2	+0·3	—4·5
23. Berar	87·0	71·5	79·2	15·5	25·5	—0·5	+0·2	—0·7
24. Central Provinces, West	85·5	72·5	79·0	13·0	20·5	—2·1	—0·1	—2·0
25. Do., East	86·3	73·7	80·0	12·6	19·9	+0·3	+0·5	—0·2
26. Konkan	83·5	75·6	79·5	7·9	11·8	0	+0·5	—0·5
27. Bombay Deccan	87·0	68·1	77·5	18·8	29·0	+1·9	—0·5	+2·4
28. Hyderabad, North	88·3	70·2	79·2	18·1	25·3	+2·1	—0·1	+2·2
29. Do., South	90·4	73·1	81·7	17·3	25·5	+2·8	+1·0	+1·8
30. Mysore	84·4	65·5	74·9	19·0	26·1	+2·0	—0·4	+2·4
31. Malabar	85·1	74·7	79·9	10·3	14·8	+1·1	+0·9	+0·2
32. Madras, Southeast	94·1	75·8	84·9	18·3	27·1	+0·9	+0·3	+0·6
33. Do. Deccan	93·3	74·4	83·8	18·9	26·3	+2·5	+0·5	+2·0
34. Do. Coast, North	91·4	78·5	85·0	12·9	22·6	+1·7	+0·6	+1·1

TABLE 11.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	+0·1	0	+0·1
Eastern Bengal and Assam	−0·2	+0·2	0
Bengal	−0·7	0	−0·4
United Provinces	−3·1	−0·3	−1·7
Punjab	−0·2	+2·6	+1·2
North-West Frontier Province	+0·5	+3·1	+1·9
Sind	+0·9	+1·8	+1·4
Rajputana	−1·8	+0·4	−0·7
Bombay	+1·1	+0·2	+0·7
Central India	−2·9	+0·2	−1·4
Central Provinces	−1·3	+0·1	−0·6
Hyderabad	+2·6	+0·6	+1·6
Mysore	+2·0	−0·4	+0·8
Madras	+1·3	+0·5	+0·9

W. A. H.

Winds.

12. As might be expected during the period when the monsoon current is due to withdraw from the land area of India, wind directions showed greater and more irregularly distributed deviations from the normal than during the prevalence of the full monsoon. Nevertheless owing to the lateness of the final withdrawal, winds this year were steadier than is normally the case, everywhere except in Burma, Eastern Bengal and Assam, the North-West Frontier Province and Rajputana.

Wind velocity was above normal in Rajputana, the central parts of the country and over the greater part of the Peninsula; but in Eastern Bengal and Assam, the North-West Frontier Province and Sind it was appreciably less than usual.

TABLE 12.

Division.	Departure from normal of	
	Hourly wind velocity.	Wind steadiness.
Burma	−0·2	− 6
Eastern Bengal and Assam	−0·7	− 5
Bengal	+0·4	+12
United Provinces	−0·1	+11
Punjab	+0·3	+ 2
North-West Frontier Province	−0·6	− 3
Sind	−0·6	+ 4
Rajputana	+0·5	− 3
Bombay	+0·6	+ 9
Central India	+1·0	+15
Central Provinces	+1·6	+19
Hyderabad	−0·3	+ 9
Mysore	+1·4	+ 5
Madras	+0·6	+ 5

W. A. H.

Humidity and cloud.

13. Relative humidity was above normal in the region of large rainfall and low temperatures, and was markedly low only in Hyderabad and Mysore. Absolute humidity was above normal not only in the region of large rainfall but also over the greater part of northwest India. It was low only in Hyderabad and the Central Provinces.

The amount of cloud was greater than usual over practically the whole of northern India, the excess being most

marked over the west of the United Provinces and Central India East. There was a defect of from 15 to 25 per cent. in Mysore and Hyderabad.

TABLE 13.

Division.	Hygrometry; 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	89	— 1	·881	—·003	7·2	+0·2
Eastern Bengal and Assam	89	— 2	·931	—·013	6·4	—0·7
Bengal	88	+ 1	·930	—·001	6·8	+0·9
United Provinces	86	+ 6	·871	+·033	6·6	+2·4
Punjab	69	0	·768	+·033	2·3	+0·3
North-West Frontier Province.	71	+ 5	·769	+·087	1·5	+0·6
Sind	71	— 1	·800	+·016	3·3	+0·9
Rajputana	71	+ 1	·724	+·001	4·2	+1·2
Bombay	81	— 2	·779	—·011	5·6	—0·5
Central India	88	+ 7	·805	+·023	7·3	+2·1
Central Provinces	83	— 1	·758	—·025	6·1	+0·5
Hyderabad	74	— 7	·686	—·055	5·2	—2·1
Mysore	81	— 3	·616	—·013	6·6	—1·3
Madras	76	— 2	·799	—·014	5·6	—0·8

W. A. H.

Rainfall.

14. The monsoon during September, judged by the aggregate amount of rain for the whole of India, was quite up to its normal strength, but much of the rainfall was due to the depressions from the Bay and consequently was concentrated in the United Provinces and Central India at the expense of northwest India and the Peninsula. The last of the series of three notable depressions caused unusually heavy rain in the districts along its path, especially on its approaching the Himalayas in the neighbourhood of Delhi and Meerut at each of which places over 9 inches were recorded between the mornings of the 26th and 28th. The month's total rainfall due to the Arabian Sea branch of the monsoon was more or less in defect over the greater part of its field, the area of deficiency covering the Punjab Southwest, Baluchistan, Sind, Gujarat, and the Peninsula excluding Madras Southeast and the Madras Coast North. Rainfall due to the Bay branch was above normal generally in north-east India and the United Provinces. The greatest excess occurred in the United Provinces and Central India East where the amount was more than twice the normal, while the deficiency was most pronounced in the Punjab Southwest, Berar, Gujarat, the Konkan, the Bombay Deccan, Hyderabad North, Malabar and Mysore. Scarcely any rain fell in Baluchistan and Sind.

TABLE 14.

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
1. Bay Islands	16·5	20·4	22·16	15·19	+6·97	+ 46
2. Lower Burma	18·0	18·7	15·61	17·27	—1·66	— 10

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
3. Upper Burma	10·0	10·2	6·80	7·45	—0·65	— 9
4. Assam	15·5	13·6	15·30	12·40	+2·90	+ 23
5. Eastern Bengal	12·8	13·0	12·38	12·91	—0·53	— 4
6. Bengal	13·4	11·6	10·38	9·42	+0·96	+ 10
7. Orissa	13·6	11·9	9·88	9·79	+0·09	+ 1
8. Chota Nagpur	14·9	10·4	10·28	8·25	+2·03	+ 25
9. Bihar	13·5	9·4	12·40	9·41	+2·99	+ 32
10. United Provinces, East	14·6	7·3	15·55	6·79	+8·76	+129
11. Do., West	13·1	5·9	13·06	5·86	+7·20	+123
12. Punjab, East and North	3·9	3·2	4·03	3·10	+0·93	+ 30
13. Do., Southwest	0·8	1·1	0·40	0·80	—0·40	— 50
14. Kashmir	2·6	2·7	1·48	1·54	—0·06	— 4
15. North-West Frontier Province	1·8	1·8	1·24	1·15	+0·09	+ 8
16. Baluchistan	0·2	0·3	0·09	0·14	—0·05	— 36
17. Sind	0·2	0·7	0·07	0·47	—0·40	— 85
18. Rajputana, West	3·2	2·3	2·40	2·08	+0·32	+ 15
19. Do., East	8·3	4·9	7·81	3·96	+3·85	+ 97
20. Gujarat	4·1	6·3	1·93	5·60	—3·67	— 66
21. Central India, West	9·5	7·5	7·98	5·75	+2·23	+ 39
22. Do., East	15·1	8·1	15·52	6·97	+8·55	+123
23. Berar	4·9	7·9	2·87	5·79	—2·92	— 50
24. Central Provinces, West	11·8	9·5	10·56	7·96	+2·60	+ 33
25. Do., East	10·8	10·3	9·07	8·40	+0·67	+ 8
26. Konkan	12·2	16·0	6·31	13·50	—7·19	— 53
27. Bombay Deccan	3·1	8·6	1·32	5·94	—4·62	— 78
28. Hyderabad, North	5·8	10·5	3·83	8·24	—4·41	— 54
29. Do., South	6·0	10·3	3·85	6·80	—2·95	— 43
30. Mysore	4·4	8·0	2·13	5·20	—3·07	— 59
31. Malabar	6·2	15·2	2·52	10·91	—8·39	— 77
32. Madras, Southeast	6·6	6·4	4·96	4·74	+0·22	+ 5
33. Do. Deccan	6·5	7·6	3·82	5·32	—1·50	— 28
34. Do. Coast, North	8·7	9·4	7·19	6·87	+0·32	+ 5

TABLE 15.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	10·97	12·02	—1·05	— 9
Eastern Bengal and Assam . .	13·85	12·65	+1·20	+ 9
Bengal	11·06	9·32	+1·74	+ 19
United Provinces	14·37	6·35	+8·02	+ 126
Punjab	3·29	2·63	+0·66	+ 25
North-West Frontier Province .	1·24	1·15	+0·09	+ 8
Sind	0·07	0·47	—0·40	— 85
Rajputana	5·97	3·45	+2·52	+ 73
Bombay	2·42	7·21	—4·79	— 66
Central India	10·54	6·16	+4·38	+ 71
Central Provinces . . .	7·09	7·17	—0·08	— 1
Hyderabad	3·84	7·45	—3·61	— 48
Mysore	2·13	5·20	—3·07	— 59
Madras	5·27	6·01	—0·74	— 12
Mean of India	7·43	7·00	+0·43	+ 6

W. A. H.

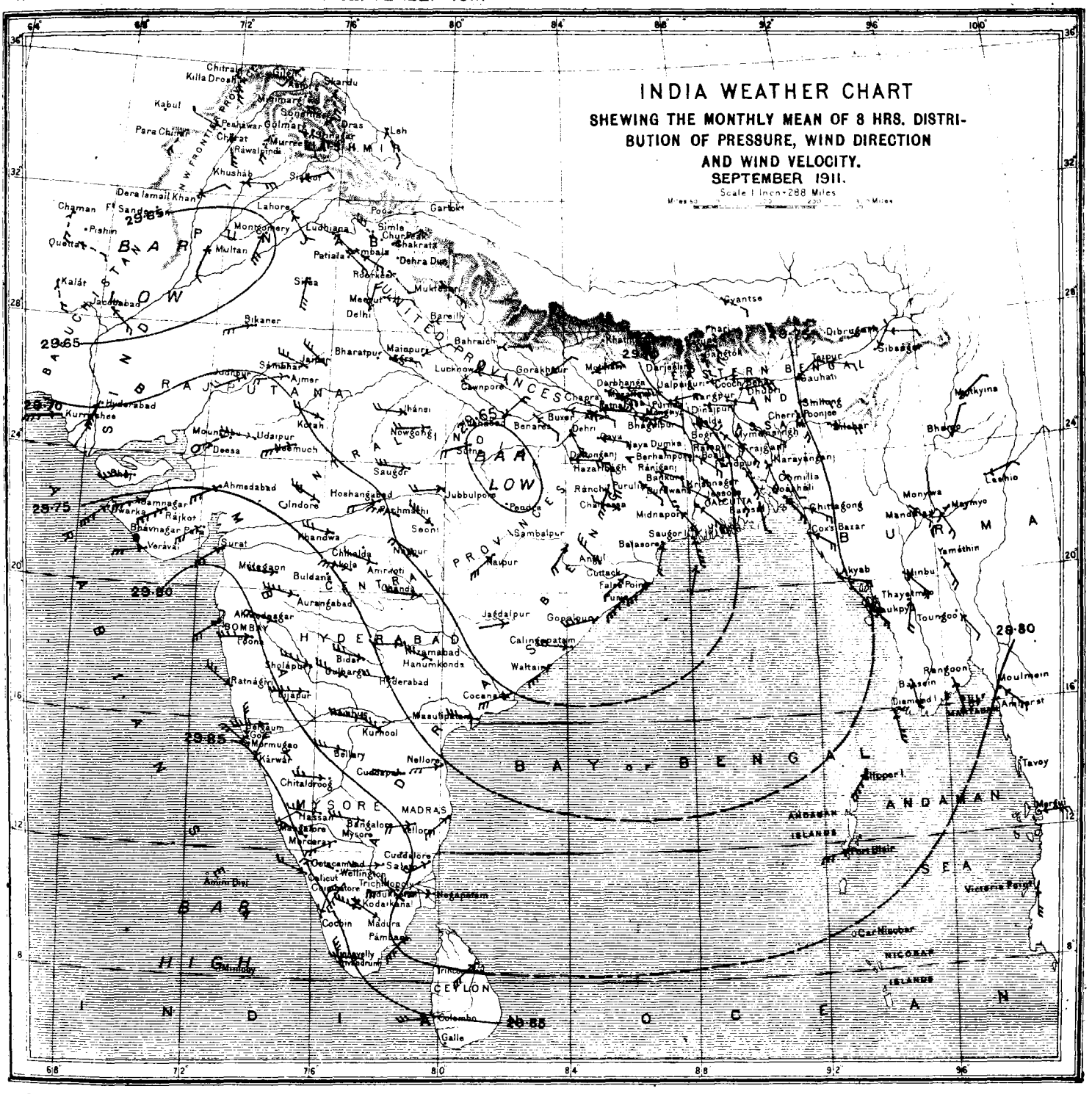
Snowfall.

15. (*a*) Heavy snow is said to have fallen in parts of central Asia about the second week.

(*b*) No information is available regarding the mountain zone bordering upper India on the west. In Kashmir there were two or three falls of snow in the second fortnight on the higher hills near Skardu and Kargil, and one fall on the Affarwata mountains.

On the passes near Kilba (Simla Hills) snow fell on nine occasions during the last twelve days of the month; the snowline during this period was at about 11,000 feet, at which level the total fall amounted to about 2 feet in depth.

H. R.



Reg. No. 4176 E., 11.—Z.—1,250.

Reg. No. 4195 E., 11.—Z.—3,800

The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0	to	2	miles	per	hour	...	one	feather	added	to	the	wind arrow.
,,	,,	2	to	5	,,	,,	...	two	feathers	,,	,,	,,	,,
,,	,,	5	to	10	,,	,,	...	three	,,	,,	,,	,,	,,
,,	,,	10	to	20	,,	,,	...	four	,,	,,	,,	,,	,,
	over	20			,,	,,	...	five	,,	,,	,,	,,	,,

Reg. No. 4176 E., 11.—Z.—1,250.

Reg. No. 4195 E., 11.—Z.—3,800.

The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020' or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

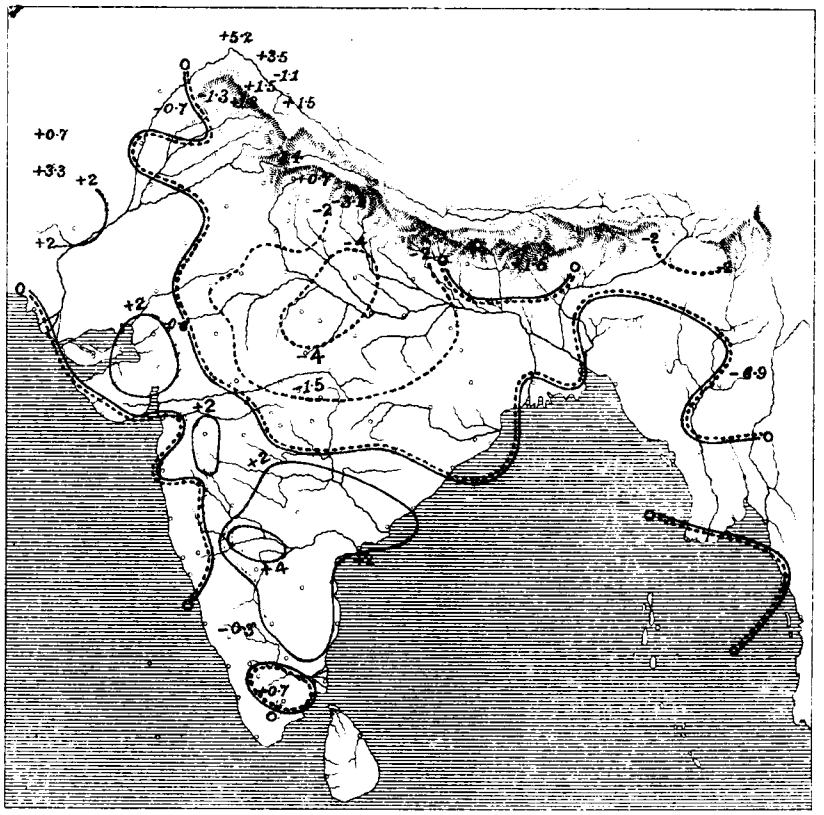


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

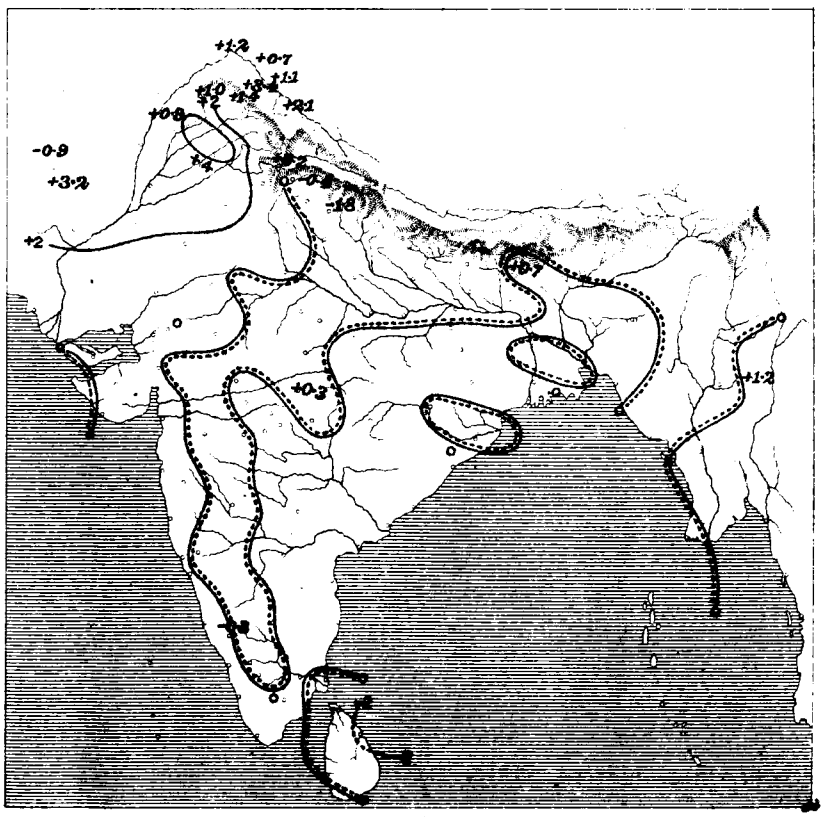


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MEAN TEMPERATURE.

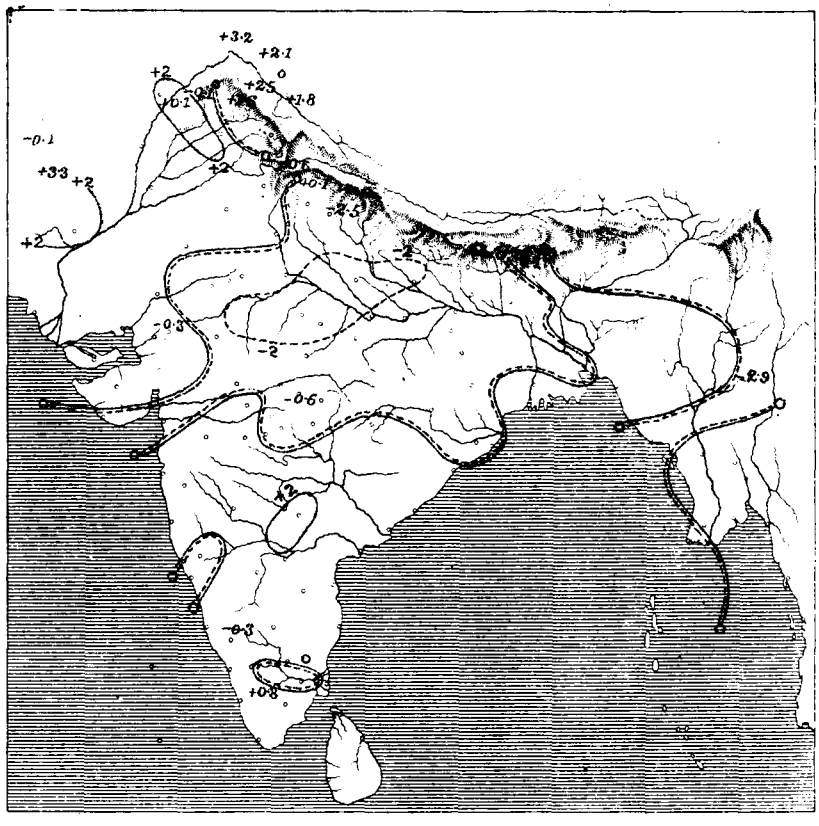


CHART SHEWING THE MONTHLY MEAN OF PRESSURE AND RESULTANT WIND DIRECTION.

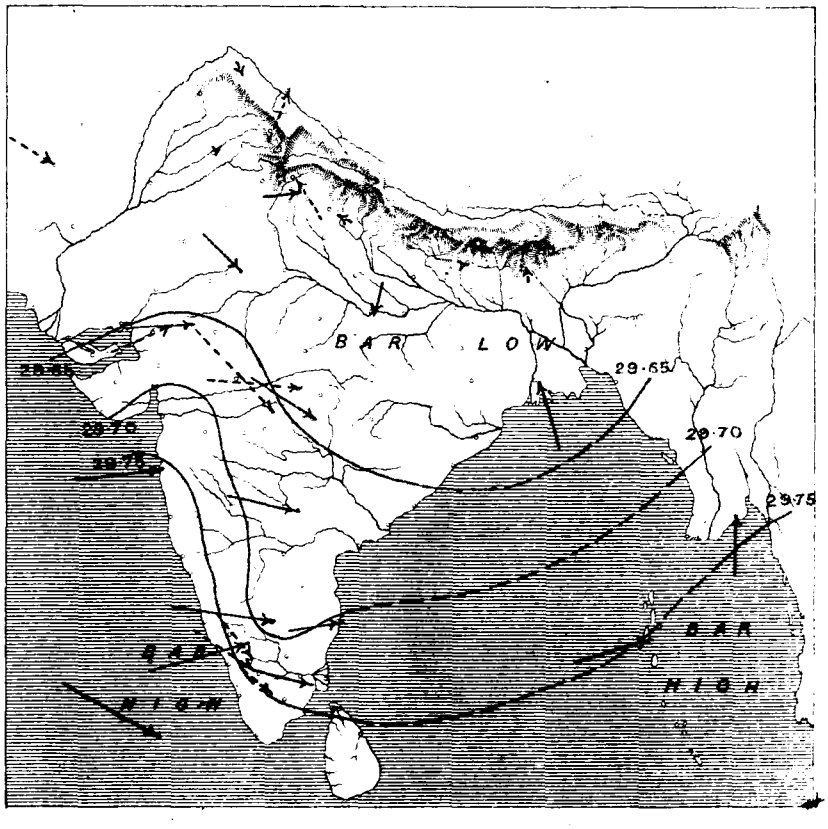


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF ABSOLUTE HUMIDITY AT 8 HRS.

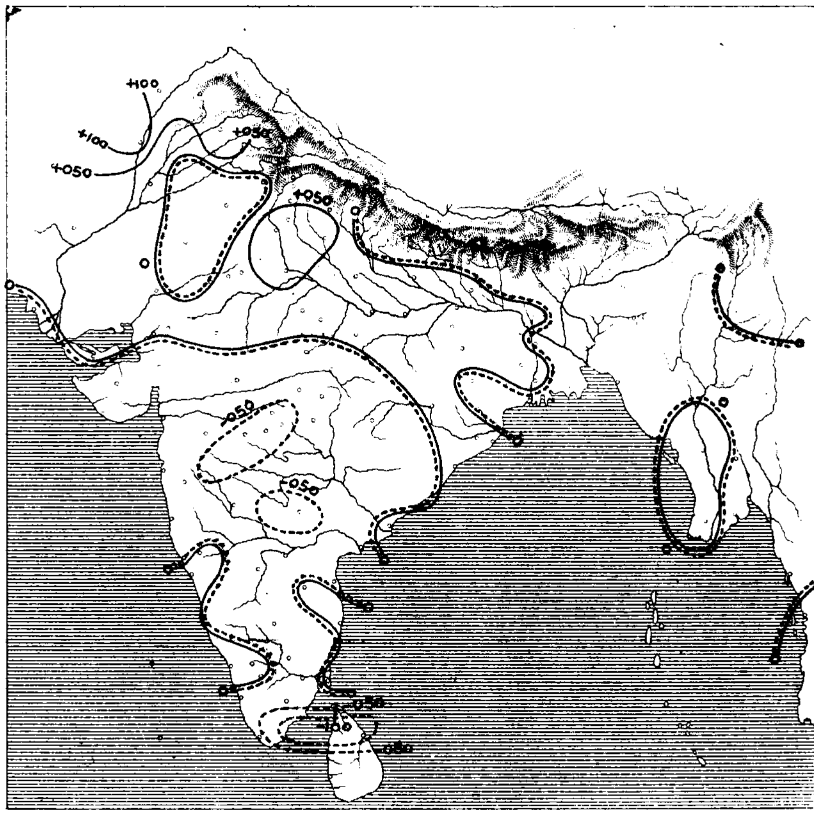


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF RELATIVE HUMIDITY AT 8 HRS.

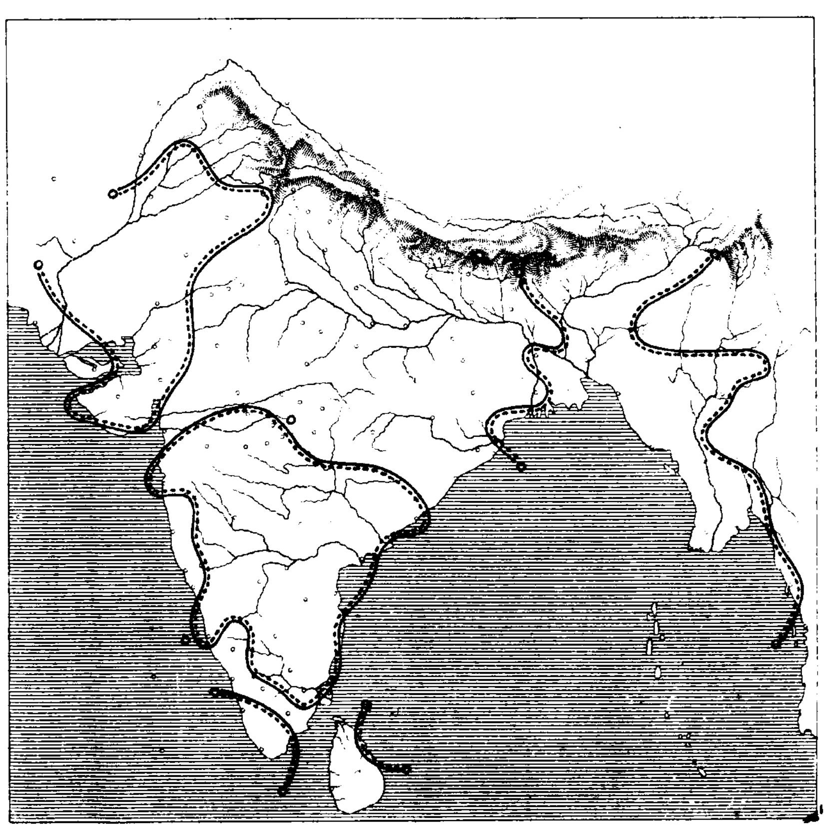


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

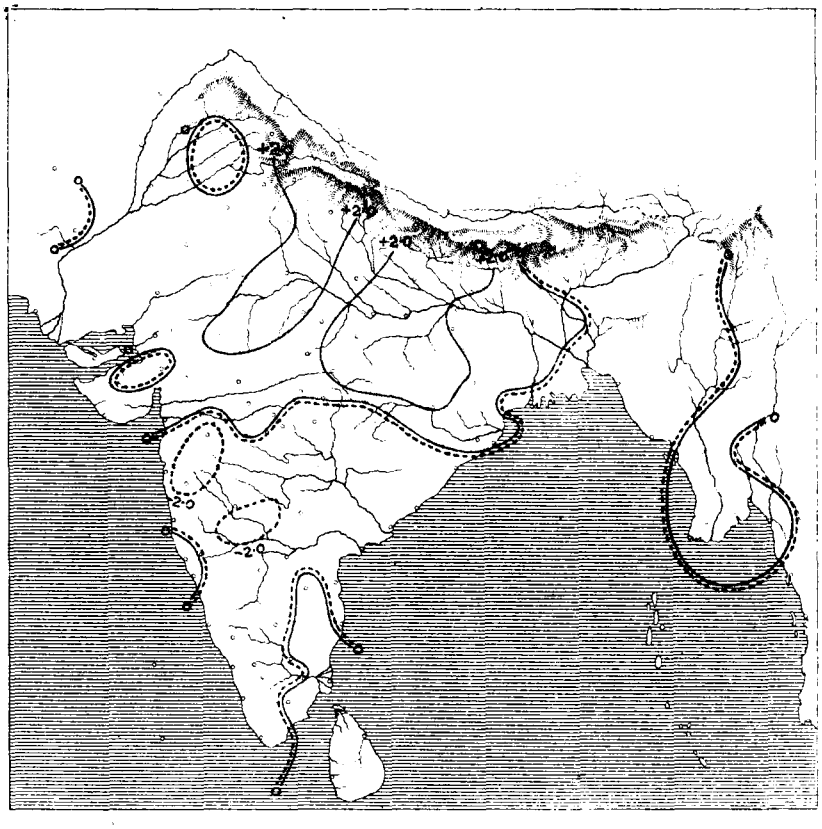
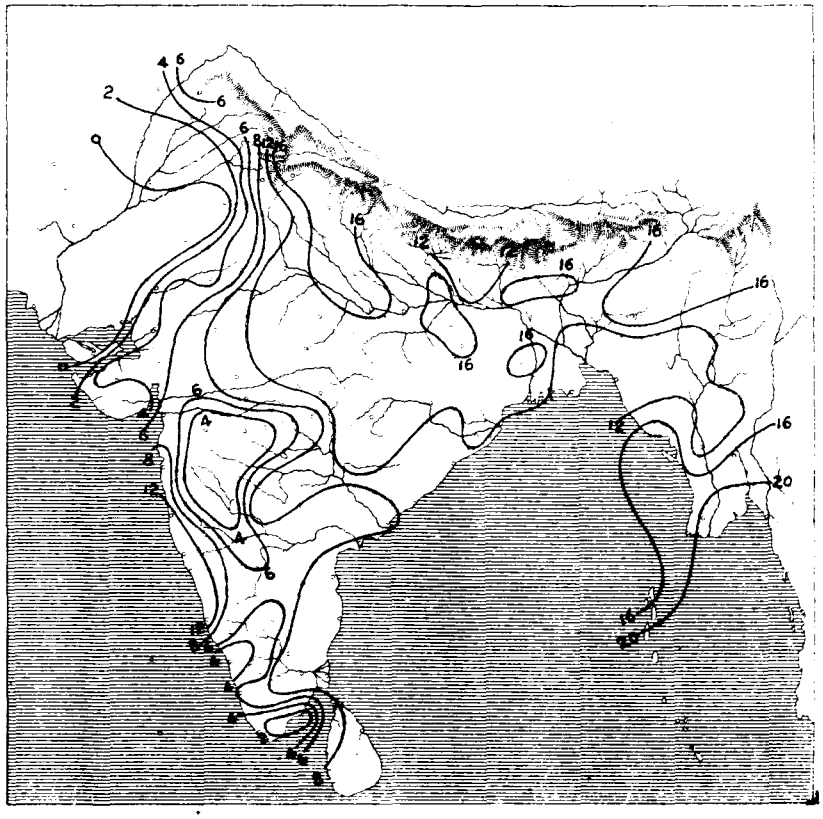


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)



Reg. No. 4176 E., 11.—Z.—1,250.

Reg. No. 4195 E., 11.—Z.—3,800.

The country is divided into 34 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall; the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Eastern Bengal
6. Bengal
7. Orissa
8. Chota Nagpur
9. Bihar
10. United Provinces, East
11. Do., West
12. Punjab, East and North
13. Do., Southwest
14. Kashmir
15. Northwest Frontier Province
16. Baluchistan
17. Sind
18. Rajputana, West
19. Rajputana, East
20. Gujarat
21. Central India, West
22. Do., East
23. Berar
24. Central Provinces, West
25. Do., East
26. Konkan
27. Bombay, Deccan
28. Hyderabad, North
29. Do., South
30. Mysore
31. Malabar
32. Madras, Southeast
33. Madras, Deccan
34. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, OCTOBER, 1911.

INTRODUCTION.

THIS review of the weather in India during the month of October, 1911, is based on observations taken daily at 8 hrs. at 244 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 34 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review. The brief notes on solar, seismic and magnetic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. As judged by its rain-producing capacity the Bay monsoon was quite up to its normal October strength, but its activity was displayed chiefly in Burma and northeast India, with the result that the greater part of the Peninsula—the usual region of the autumnal rains was deprived of its normal share of precipitation.

The retreat of the monsoon down the Bay was carried out in the usual manner, so that Madras and Mysore received their first burst of the autumnal rains during the third week, but with the subsequent appearance of a cyclonic vortex over the Andaman Sea on the 20th the rain-bearing current was drawn aside from the Peninsula to Burma. The disappearance of this storm over Burma on the 24th was succeeded by the establishment of pressure distribution characteristic of the final withdrawal of the monsoon from the Bay, an event which usually takes place about the middle of December.

In northwest India, where under ordinary conditions but little precipitation is recorded in October, a very unusual spell of rainy weather occurred between the 25th and the 29th, and seems to have been brought about by a depression of the early winter type from Persia.

Thus the distribution of rainfall was very abnormal, being characterized by a pronounced deficit throughout the Peninsula excluding Malabar and Mysore, and by a marked excess in Burma and nearly the whole of the tract extending from Assam to Baluchistan.

Of climatic elements other than rainfall temperature was very nearly normal throughout the country, while humidity inclined to be high in Central India, the United Provinces and the greater part of the plains of northwest India ; and to be low in Kashmir. The amount of cloud was low in most parts of the Peninsula where rainfall was scanty, and more or less in excess in Burma and northern India.

The barometer over the plains of India stood ·016″ above its normal height.

H. R.

Solar, seismic and magnetic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—Observations of the sun for spots and faculæ were made on every day during the month except the 15th. Prominence records were, however, incomplete on 5 days.

Sun spots.—The spot activity continued very low and was quite similar to that of September. Only two spots

were observed. The daily average number was 0·4 and the average life of a spot was 6·0 days. One of the spots No. 1999 was of moderate size and was observed from the 1st to 11th at latitude +7°. The other was a faint dot and was seen at latitude +9° on the 14th only. The visible disc of the sun was free from spots on the 12th and 13th, and from the 16th to the end of the month.

Prominences.—Fifty-one large and 4 eruptive prominences were observed during the month. The highest was recorded on the 16th at latitude —17° east and was 120″ high. Prominences were persistently present on the east limb of the sun from the 6th to 16th at about latitude —45°.

Photographs showing the prominences projected on the disc as absorption markings in Ha light were obtained on 12 days only. The average daily numbers recorded were 1·7 for the northern and 2·1 for the southern hemispheres.

Magnetic disturbances.—A moderate disturbance was recorded on the 18th beginning from 7h 30m I.S.T.

Seismological records.

TABLE 1.

No.	Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maxima. G. M. T.	End. G.M. T.	Maximum amplitude.	Duration.	REMARKS.
	1911.	H. M.	H. H.	H. M.	H.M.	mm.	H. M.	
63	October 13	2 56·1	3 22·8	3 25·4	4 14·6	1·0=0·4	1 18·5	
64	„ 14	6 42·2	...	...	7 18·8	...	0 36·6	Widening of line.
65	„ 14	12 48·0	13 17·5	13 18·0	14 22·1	0·7=0·2	1 34·1	
66	„ 14	16 59·0	17 30·0	17 31·0	18 02·5	05=0·2	1 03·5	
67	„ 14-15	23 32·8	23 34·6	23 35·9	0 40·8	>17·5=76·2	1 08·0	
68	„ 16	0 34·1	...	...	0 54·6	...	0 20·5	Widening of line.
69	„ 17	12 14·9	...	...	13 04·5	...	0 49·6	Do.
70	„ 21	0 07·4	...	...	1 02·8	...	0 55·4	Do.
71	„ 24	0 45·3	...	...	1 10·7	...	0 25·4	Do.
72	„ 29	19 33·6	...	...	20 08·8	...	0 35·2	Do.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of October, 1911, the traces showed 7 calm days, and 24 days of small disturbance.

The days of the month selected as quiet for the purposes of the Magnetic Survey of India are the 1st, 6th, 15th, 28th and 30th.

The following table represents the magnetic character of each day during the month :—

TABLE 2.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	C	9	S	17	S	25	S
2	S	10	S	18	S	26	S
3	S	11	S	19	S	27	S
4	S	12	S	20	S	28	C
5	C	13	S	21	S	29	S
6	C	14	S	22	S	30	C
7	S	15	C	23	S	31	C
8	S	16	S	24	S		

C = calm; S = small; M = moderate; G = great; V. G. = very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and declination for the month are as follow :—

Easterly declination	0° 53′ 45.″
Horizontal force	0·36859 C. G. S. unit.
Vertical force	0·16257 „ „
Inclination	23° 48′·0.
Inclination (observed)	23° 47′·8.
Horizontal force range	0·00038 C. G. S. unit.
Horizontal force summed range	0·00223 „ „
Declination range	2′·0.
Declination summed range	7′·6.

(NOTE.—Summed range means sum without regard to signs of 24 ordinates of the diurnal inequality.)

Seismic disturbances.

TABLE 3.

Date.	Commencement.		Maximum.		End.		Maximum amplitude.	Duration.	
1911.	H.	M.	H.	M.	H.	M.	mm.	H.	M.
October 6th	11	28·8	11	41·2	12	16·7	0·4	0	47·9
„ 13th	3	10·6	3	19·1	3	36·3	0·3	0	25·7
„ 14th	6	48·7	6	55·7	7	4·1	0·6	0	15·4
„ 14th	13	3·7	13	11·4	13	24·7	1·1	0	21·0
„ 14th	23	29·1	23	31·2	0	6·8	14·8	0	37·7
„ 15th	12	28·5	12	36·0	12	52·2	0·6	0	23·7
„ 17th	12	8·1	12	38·7	13	32·5	0·9	1	24·4

All times given above denote G. M. T.
Sensibility to tilt, 1 mm.= 0″·40.

N. A. F. MOOS,
Director,
Bombay and Alibag Observatories.

CALCUTTA OBSERVATORY.

5. *List of displacements recorded by the Milne seismograph.*

TABLE 4.

Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maximum. G. M. T.	End. G. M. T.	Duration.	Maximum displacement on trace from mean position.	REMARKS.
1911.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
October 1	9 37·0	...	11 26·3	11 36·5	1 59·5	3·00*	*Measured from base line.
„ 5	5 43·1	...	6 28·0	6 51·4	1 8·3	1·50	
„ 6	11 30·3	...	11 44·6	12 29·3	0 59·0	0·75	
„ 10	14 29·8	...	...	15 18·6	0 48·8	...	Thickening of line.
„ 13	2 40·9	3 6·3	3 10·4	3 22·6	0 41·7	1·50	
„ 14	6 41·5	...	6 47·6	7 6·4	0 24·9	0·50	
„ 14	12 44·0	12 59·8	13 0·8	14 3·9	1 19·9	1·75	
„ 14	16 42·9	17 13·9	17 17·5	18 2·2	1 19·3	0·75	
„ 14	23 28·2	...	23 32·2	? †	? †	16·50*	* Measured from base line, †Ends in morning air tremor.
„ 15	12 19·3	...	...	13 50·8	1 31·5	...	Thickening of line.
„ 17	12 22·0	...	12 30·6	12 59·1	0 37·1	0·75	
„ 29	19 31·3	...	...	20 21·5	0 50·2	...	Ditto.
„ 30	13 25·0	...	13 27·0	13 36·2	0 11·2	1·00	

Sensibility 1 mm. =0″·38 of tilt.

E. P. HARRISON,
Offg. Meteorologist, Calcutta.

SIMLA OBSERVATORY.

6. *List of earthquakes recorded by the Omori-Ewing seismographs.*

TABLE 5.

Date.	Beginning of 1st P. T.	Beginning of 2nd P. T.	Beginning of L. W.	Time of Max. amplitude.	End approx.	Duration.	Max. displacement of style.*	REMARKS.
	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
3th A	2 51·6	?	3 9·9	3 11·0	4 17	1 25	0·7	
B	?	?	?	3 10·8	3 53	?	1·0	1st P. T. hidden by other disturbances
A	23 1·3	...	...	23 1·9	23 2·9	0 1·6	Small	Local.
B	23 1·5	...	...	23 1·8	23 3·9	0 2·4	0·3	Local.
14th A	6 41·8	?	6 46·9	6 47·7	7 7	0 25	Small	
B	?	?	?	6 47·5	7 27	?	0·3	1st P. T. hidden by tremors.
A	12 44·3	?	13 0·5	13 4·0	13 51	1 7	0·6	
B	12 43·6	?	13 0·6	13 3·6	13 51	1 7	0·8	
A	16 56·4	?	17 15·4	17 17·5	?	?	0·4	Slight tremors continued until next shock.
B	?	?	17 14·7	17 18·8	?	?	0·7	1st P. T. and end hidden by tremors.
14th and 15th A	23 24·6	?	?	23 25·7	3 53	4 28	20·5	
B	23 24·5	?	23 25·1	?	0 10	0 45	?	Touched stops.
17th and 18th A	23 51·4	?	23 52·2	23 52·3	0 1	0 10	0·5	
17th B	23 51·0	?	23 52·4	23 52·4	23 59	0 8	0·7	
24th A	19 35·5	?	?	19 25·8	?	?	0·7	Local. End hidden by slight tremors.
B	19 25·2	?	?	19 25·6	19 31	0 6	1·1	Local.

All times are given in G. M. T. B = N—S component.
A = E—W component. Magnification of each instrument was 15.
* Displacements less than 0·2 mm. are reported as "small."

The following table contains a list of earthquakes that have been reported :—

TABLE 6.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity. Rossi-Forel scale.	No. of shocks.
		H. M.	Sec.		
Drosh . . .	1st	10 40	3	5	2
„ . . .	3rd	11 30	2	5	2
Turbat-i-Haidari .	4th	7 44	15	...	...
„ .	4th	8 14	...	...	2
„ .	4th	10 24	...	...	2
„ .	4th	12 34	11	...	...
„ .	4th	16 14	...	...	1
„ .	4th	18 49	...	...	1
„ .	5th	0 4	...	...	1
Shillong . .	5th	6 36	4	8	2
Akyab . . .	5th	7 25	3 Min.	5	...
Borjuli . . .	5th	22 8	1 Sec.	5	1
Chitral . .	9th	17 0	20	7	.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.
		H. M.	Sec.		
Drosh . . .	9th	17 5	10	5	3
Chitral . .	12th	17 35	3	7	1
Drosh . .	12th	17 42	2	5	2
Mukteswar . .	14th	23 40	5	4	3
Drosh . . .	17th	21 45	5	5	3
„ . . .	17th	23 53	10	5	6
„ . . .	18th	0 5	3	5	3
Chitral . . .	18.h	0 5	5	7	1
Shillong . .	20th	6 22	3	8	2
Drosh . . .	20th	15 35	4	5	3
„ . . .	21st	23 15	4	5	4
Chitral . . .	21st	23 25	7	7	1

Solar radiation.—The following figures give the intensity of solar radiation, as measured at Simla by Angström's pyrheliometer. The values are corrected to local noon, and expressed in grammecalories per square centimetre per minute :—

Maximum	1·46
Minimum	1·39
Mean	1·42
Number of days of observation . . .	14

W. A. HARWOOD,
Imperial Meteorologist, Simla.

ROYAL ALFRED OBSERVATORY, MAURITIUS.

7. No information has been received.

Weather in the Indian monsoon region.

8. In the western half of the equatorial belt pressure was as largely above the average as in Burma and the Peninsula—an indication that the high pressure conditions of the month were due to general rather than local actions. The air movement was fairly normal both as regards direction and intensity. Rainfall was 46 per cent. in excess at Seychelles and 21 per cent. in defect at Zanzibar.

TABLE 7.

——	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure.		+·044	+·044
Actual mean wind direction		S 9° W	S 42° E
Normal mean wind direction		S 6° E	S 39° E
Actual mean wind velocity (miles per diem).		112	199
Normal mean wind velocity (miles per diem).		120	191
Rainfall departure from normal .		—0·78	+2·22

H. R.

Depressions and cyclonic storms.

9. Weather was fairly settled over the Indian seas during the first fortnight of the month, but on the 15th a shallow depression appeared off the Coromandel coast and, travelling westwards, was situated over the region between Madras and Bangalore on the morning of the 16th. It continued to advance westwards during the day and by 8 hrs. of the 17th had passed out into the Arabian Sea near Mangalore.

The marine information received up to the present is too imperfect to enable the further career of the disturbance to be followed with any certainty. According to the few observations available the centre of wind convergence lay in about long. 72°, lat. 12½° on the morning of the 18th, in long. 67½°, lat. 13° on the 19th, in long. 61½°, lat. 13½° on the 20th and somewhere between Socotra and Kuria Muria on the 21st.

As the strongest winds actually experienced in the disturbed area did not exceed force 7 at any time, it is very probable that the disturbance was, throughout its existence, of not more than moderate intensity. It was however instrumental in introducing the autumnal rains into Madras.

On the 19th, whilst the previous disturbance was moving away from the west coast of India, a storm was approaching the south Tenasserim coast from the Gulf of Siam. By the morning of the 20th the storm had entered the Andaman Sea as a well-defined and vigorous cyclonic circulation of which the centre lay in about lat. 10½°,

long. 97°, or about 100 miles to the west of Victoria Point. The disturbance intensified considerably during the day while travelling northwestwards, and at 8 hrs. of the 21st when its centre was about 60 miles south-by-west of Slipper Island, it was a small but dangerous cyclone with an inner area of violent winds and probably a calm centre. The centre had reached long. 91½°, lat. 15° by 8 hrs. of the 22nd: it had thus travelled over a distance of only about 150 miles as compared with 330 miles on the previous day. The *Breconian* which was involved in the inner area experienced "a heavy cyclone of wind with terrific squalls and a high confused sea."

The line of advance of the storm changed to northeast during the day and by 8 hrs. of the 23rd the centre had reached a position about 80 miles south-by-west of Kyaukpyu on the Arakan coast. The storm crossed the coast some time during the day and was speedily broken up by the resistance offered to its rotary motion by the Arakan Yoma, so that on the morning of the 24th only a slight residual low pressure in Upper Burma marked its continued existence.

The dispersion of the above storm was followed on the 25th by the appearance of unsettled weather over northwest India. So far as can be ascertained from the available records the disturbance was transmitted from the neighbourhood of Baghdad on the 21st or 22nd into the Punjab on the 26th. Although a mere wave of low pressure it produced general precipitation in Baluchistan, upper India and the hill tracts of Afghanistan.

The fact that the highlands beyond the Indus were included within the area of precipitation would suggest that the disturbance was very extensive and of great elevation.

H. R.

Pressure.

10. In October an excess of pressure was quite as general as was the opposite condition in September. Indeed the only region where a defect remained outstanding included Rajputana, parts of central India, the North-West Frontier Province and the adjacent districts of the Punjab.

The excess was on the whole greatest in Mysore (·04″), and was but little less in Burma and Madras.

Over the greater part of the country the excess of pressure accompanied normal or rather high temperatures.

The vertical gradient was remarkably steep in the south of the Peninsula and in northeast India, and nearly normal in northwest and central India.

TABLE 8.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	″
Burma	+·035
Eastern Bengal and Assam	+·020
Bengal	+·016
United Provinces	+·005
Punjab	−·002
North-West Frontier Province	−·021
Sind	+·001
Rajputana	−·003
Bombay	+·025
Central India	+·003
Central Provinces	+·011
Hyderabad	+·023
Mysore	+·039
Madras	+·034

TABLE 9.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	″		″	″
Quetta	+·007	Jacobabad	−·009	−·016
Leh	+·003	Lahore	−·005	−·008
Murree	+·004	Peshawar	−·015	−·019
Simla	+·021	Ludhiana	+·009	−·012
Chakrata	+·019	Roorkee	+·020	+·001
Darjiling	−·027	Dhubri	+·018	+·045
Mount Abu	+·013	Deesa	+·015	+·002
Pachmarhi	+·018	Khandwa	+·017	−·001
Kodaikanal	+·018	Madura	+·055	+·037

H. R.

Temperature.

11. On the whole the mean temperature was 1° to 2° above the average in northwestern and central India and the Deccan, 1° in defect in Burma, Assam and Baluchistan, and within ½° of the average elsewhere.

The temperature conditions of the month were thus nearly normal: —

TABLE 10.

Sub-division.	Actual temperature.					Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
1. Bay Islands	85·3	76·5	80·9	8·8	15·3	—1·8	—1·9	+0·1
2. Lower Burma	86·4	74·4	80·4	11·9	18·9	—1·3	—0·5	—0·8
3. Upper Burma	86·9	71·4	79·3	15·5	30·5	—2·4	—0·9	—1·5
4. Assam	83·3	71·0	77·2	12·3	25·7	—2·8	—0·7	—2·1
5. Eastern Bengal	86·1	73·3	79·7	12·7	23·9	—0·5	+0·1	—0·6
6. Bengal	87·8	74·2	81·0	13·6	24·2	—0·2	+0·1	—0·3
7. Orissa	88·5	73·9	81·2	14·6	24·4	—0·1	+0·1	—0·2
8. Chota Nagpur	86·7	69·1	77·9	17·6	29·7	+0·2	+1·0	—0·8
9. Bihar	87·4	72·3	79·9	15·1	27·1	—0·6	+0·7	—1·3
10. United Provinces, East	88·5	70·1	79·3	18·4	29·9	—1·9	+2·6	—4·5
11. Do., West	88·8	66·9	77·9	21·8	33·6	—1·3	+2·5	—3·8
12. Punjab, East and North	92·4	64·2	78·3	28·2	42·2	—0·1	+2·5	—2·6
13. Do., Southwest	96·0	66·7	81·4	29·3	45·1	+0·7	+3·9	—3·2
14. Kashmir	69·4	40·3	54·9	29·1	46·1	+3·9	+1·7	+2·2
15. North-West Frontier Province	91·1	61·2	76·1	29·9	43·5	—0·1	+2·3	—2·4
16. Baluchistan	81·4	51·6	66·5	29·8	49·7	—0·7	—1·7	+1·0
17. Sind	94·5	69·3	81·9	25·2	39·3	0	+1·4	—1·4
18. Rajputana, West	97·2	70·6	83·9	26·6	44·3	+0·5	+0·8	—0·3
19. Do., East	94·9	68·2	81·6	26·7	38·5	+1·5	+3·1	—1·6
20. Gujarat	95·4	72·5	83·9	22·9	35·3	+1·8	+1·5	+0·3
21. Central India, West	92·3	65·5	78·9	26·9	34·5	+3·2	+1·5	+1·7
22. Do., East	87·2	68·9	78·1	18·3	28·7	—1·9	+3·5	—5·4
23. Berar	94·2	68·9	81·5	25·3	34·7	+4·3	+1·2	+3·1
24. Central Provinces, West	90·0	67·6	78·8	22·4	33·1	+1·3	+1·7	—0·4
25. Do., East	86·4	68·9	77·7	17·5	27·8	—0·3	+1·5	—1·8
26. Konkan	86·2	75·5	80·8	10·7	19·8	—0·3	+0·5	—0·8
27. Bombay Deccan	92·5	67·8	80·1	24·7	36·9	+4·5	+1·5	+3·0
28. Hyderabad, North	92·2	68·1	80·2	24·1	35·1	+3·4	+0·3	+3·1
29. Do., South	92·6	70·9	81·8	21·7	32·3	+3·4	+0·8	+2·6
30. Mysore	83·3	65·3	74·3	18·0	28·4	+0·5	—0·8	+1·3
31. Malabar	85·4	74·4	79·9	11·0	17·0	—0·1	+0·5	—0·6
32. Madras, Southeast	90·5	74·4	82·5	16·1	30·3	+0·9	—0·1	+1·0
33. Do. Deccan	93·4	72·2	82·8	21·2	33·6	+2·6	+0·1	+2·5
34. Do. Coast, North	89·0	75·3	82·7	13·8	24·5	+0·5	—0·3	+0·8

TABLE 11.

DIVISION.	DEPARTURE FROM NORMAL OF		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	−1·7	−0·6	−1·2
Eastern Bengal and Assam	−1·2	−0·1	−0·6
Bengal	−0·2	+0·4	+0·1
United Provinces	−1·6	+2·6	+0·5
Punjab	+0·2	+2·9	+1·5
North-West Frontier Province	−0·1	+2·3	+1·1
Sind	0	+1·4	+0·7
Rajputana	+1·2	+2·5	+1·9
Bombay	+2·1	+1·2	+1·7
Central India	+0·7	+2·5	+1·5
Central Provinces	+1·6	+1·5	+1·6
Hyderabad	+3·4	+0·7	+2·0
Mysore	+0·5	−0·8	−0·1
Madras	+0·9	0	+0·4

H. R.

Winds.

12. (*a*) The rate of movement approximated closely to the normal, but the degree of steadiness was remarkably high in Sind and Hyderabad, and very low in Rajputana :—

TABLE 12.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	+0·1	+ 4
Eastern Bengal and Assam	−0·1	− 1
Bengal	+0·4	+ 2
United Provinces	−0·1	− 1
Punjab	0	+ 4
North-West Frontier Province	−0·3	− 3
Sind	+0·5	+18
Rajputana	−0·5	−17
Bombay	+0·6	+ 8
Central India	−0·3	− 7
Central Provinces	0	+ 6
Hyderabad	−1·6	+18
Mysore	+0·4	+ 2
Madras	+0·5	− 4

(*b*) The direction of the wind differed greatly from the average in some parts of the country. Thus it contained an undue southerly element in Bengal and an abnormal easterly component in the submontane districts of the United Provinces, while in Central India and the Central Provinces the usual northerly element was either very weak or altogether suppressed.

In the Deccan the prevailing direction was from some westerly point instead of from some easterly quarter as is usual in this month.

H. R.

Humidity and cloud.

13. Except in Rajputana, the southwest Punjab, Eastern Bengal and Assam, October was a damp month, both absolutely and relatively, throughout northern and central India. In the Peninsula and Burma on the other hand the humidity was either about the average or slightly below it. These variations were generally coincident with those of rainfall.

The distribution of cloud resembled closely that of rainfall. There was a deficiency in Hyderabad, Mysore and Madras, but elsewhere the proportion of cloud was more or less above the average.

TABLE 13.

Division.	Hygrometry, 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma . . .	88	0	·819	—·035	6·0	+0·9
Eastern Bengal and Assam.	88	0	·821	—·013	4·4	+0·5
Bengal . . .	84	+ 3	·803	+·026	3·1	+0·1
United Provinces .	77	+ 8	·683	+·104	1·8	+0·6
Punjab . . .	59	+ 2	·480	+·042	1·2	+0·6
North-West Frontier Province.	62	+ 4	·431	+·037	1·7	+0·9
Sind	66	+ 9	·625	+·095	0·9	+0·2
Rajputana . . .	47	— 3	·444	—·001	1·2	+0·3
Bombay . . .	71	0	·694	+·006	3·0	+0·2
Central India . .	69	+ 7	·607	+·074	2·9	+1·4
Central Provinces .	69	+ 1	·615	+·028	2·9	+0·6
Hyderabad . . .	63	— 6	·610	—·025	3·1	—1·0
Mysore . . .	78	— 3	·601	—·038	5·1	—1·4
Madras . . .	79	— 2	·795	—·012	5·0	—0·5

H. R.

Rainfall.

14. Over the plains as a whole the month's rainfall was 5 per cent. in excess of the average. Its local distribution was considerably different from the normal type. Thus the recorded fall was in large defect in Orissa, Gujarat, Berar, Bombay, Hyderabad and Madras excluding Malabar, more or less in defect in Bengal, the United Provinces West, Sind, Central India West, and the Central Provinces West, and more or less above the normal elsewhere. The excess was least in amount in Malabar, Rajputana East, and the Punjab East and North (less than a fifth of an inch) and greatest in Eastern Bengal and Assam (nearly 4″ or 76 per cent.) : it was considerable also in Lower Burma (2″ or 30 per cent.) and the region comprising the United Provinces East, and the Central Provinces East (1½″ or 77 per cent.). In the Punjab Southwest, the North-west Frontier Province and Rajputana West, the fall, although not large in actual amount, was unusually heavy for the time of year.

In the mountain zone bordering upper India the distribution was very irregular, Kashmir recording a defect of 36 per cent. and Baluchistan an excess of 683 per cent.

TABLE 14.

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure.
			″	″	″	
1. Bay Islands	11·5	14·1	10·23	8·71	+1·52	+ 17
2. Lower Burma	10·5	9·6	9·08	6·98	+2·10	+ 30
3. Upper do.	8·0	6·2	5·64	4·45	+1·19	+ 27

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure.
			"	"	"	
4. Assam	10·1	6·4	9·43	5·24	+4·19	+ 80
5. Eastern Bengal	8·8	5·1	8·50	4·93	+3·57	+ 72
6. Bengal	6·6	4·8	3·67	4·04	—0·37	— 9
7. Orissa	6·4	5·9	3·56	5·37	—1·81	— 34
8. Chota Nagpur	5·4	3·7	3·36	2·77	+0·59	+ 21
9. Bihar	5·6	2·9	5·32	2·69	+2·63	+ 98
10. United Provinces, East	4·3	1·6	3·34	1·87	+1·47	+ 79
11. Do., West	1·3	0·7	0·62	0·68	—0·06	— 9
12. Punjab, East and North	1·1	0·5	0·44	0·26	+0·18	+ 69
13. Punjab, Southwest	0·9	0·2	0·53	0·07	+0·46	+657
14. Kashmir	0·8	1·4	0·39	0·61	—0·22	— 36
15. North-West Frontier Province	1·8	0·6	0·92	0·28	+0·64	+229
16. Baluchistan	1·0	0·2	0·47	0·06	+0·41	+683
17. Sind	0	0	0·01	0·02	—0·01	— 50
18. Rajputana, West	0·5	0·1	0·25	0·07	+0·18	+257
19. Do., East	0·8	0·3	0·23	0·19	+0·04	+ 21
20. Gujarat	0	1·1	0·01	0·83	−0·82	— 99
21. Central India, West	0·8	1·0	0·46	0·60	−0·14	— 23
22. Do., East	3·5	1·7	2·83	1·55	+1·28	+ 83
23. Berar	0·4	2·3	0·25	1·71	—1·46	— 85
24. Central Provinces, West	2·4	2·3	1·49	1·70	−0·21	— 12
25. Do., East	4·8	2·7	3·41	1·95	+1·46	+ 75
26. Konkan	3·3	6·1	1·92	4·49	—2·57	— 57
27. Bombay Deccan	2·9	5·1	1·65	3·54	−1·89	— 53
28. Hyderabad, North	0·7	3·7	0·23	2·59	—2·36	— 91
29. Do., South	2·3	4·6	0·83	2·98	—2·15	— 72
30. Mysore	8·1	7·9	6·68	5·29	+1·39	+ 26
31. Malabar	11·0	12·0	9·92	9·76	+0·16	+ 2
32. Madras, Southeast	6·9	8·8	4·90	7·16	—2·26	— 32
33. Do., Deccan	4·5	6·3	2·85	4·64	—1·79	— 39
34. Do., Coast, North	5·7	7·3	5·22	7·20	—1·98	— 27

TABLE 15.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	7·22	5·63	+1·59	+ 28
Eastern Bengal and Assam	8·96	5·08	+3·88	+ 76
Bengal	4·27	3·53	+0·74	+ 21
United Provinces	2·05	1·31	+0·74	+ 56
Punjab	0·46	0·23	+0·23	+100
North-West Frontier Province	0·92	0·28	+0·64	+229
Sind	0·01	0·02	—0·01	— 50
Rajputana	0·24	0·16	+0·08	+ 50
Bombay	1·17	2·84	—1·67	— 59
Central India	1·28	0·92	+0·36	+ 39
Central Provinces	1·41	1·76	—0·35	— 20
Hyderabad	0·56	2·80	—2·24	— 80
Mysore	6·68	5·29	+1·39	+ 26
Madras	5·21	7·11	—1·90	— 27
Mean of India	3·07	2·91	+0·16	+ 5

H. R.

Snowfall.

I.—AFGHANISTAN.

15. A snowstorm occurred on all the higher hills on the 26th. The fall was however light, and soon melted except at the highest points.

II.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Wano.*—Snow to a depth of about six inches fell on the 26th on the Marwatti and Pirghal down to about 11,000 feet.

(*b*) *Kurram.*—Snow fell on the highest parts of the Sufed Koh on the 26th, 28th and 29th.

(*c*) *Chitral.*—Light snow fell on the northern and eastern hills on the 8th, and moderate to heavy snow on all the surrounding hills on the 26th, 27th and 29th. The total fall is believed to have amounted to 5½ feet.

At the end of the month the unmelted residue was from 2 to 6 inches deep on the eastern ranges and about 1 inch deep on the western ranges.

III.—KASHMIR.

(*a*) *Gulmarg.*—Light snow fell on the Affarwata mountains on the 15th.

(*b*) *Srinagar.*—There was a slight fall on the 29th on the higher ranges around Srinagar.

(*c*) *Skardu.*—Snowstorms of feeble intensity were of daily occurrence on the higher mountains from the 7th to the 11th, the 20th to the 23rd and the 28th to the 31st.

(*d*) *Dras.*—A snowstorm occurred at Dras and on the neighbouring mountains on the 23rd. The fall in the grounds of the observatory measured 2 inches in depth.

(*e*) *Kargil.*—Snow fell on the surrounding hills on three days, *viz.*, the 23rd, 28th and 29th, but none of the falls extended down to the level of the observatory.

IV.—PUNJAB.

Kilba (Simla Hills).—On the hills near Kilba there were altogether five falls, *viz.*, on the 15th, 24th, 27th, 28th and 29th. The snowstorms of the 27th and 28th were severe, and on the latter date the snowline came down to 9,500 feet. At the level of about 10,000 feet the total quantity of snowfall received during the month was estimated at about 1½ feet.

According to the Deputy Conservator of Forests, Bashahr Division, over 4 feet of snow fell between the 26th and 29th on the Changsil pass (elevation 12,500 feet).

V.—UNITED PROVINCES.

(*a*) *Garhwal.*—Snow fell on the 20th, 27th, 28th, and 29th. The falls were heavy and were confined to the higher peaks in the north.

In the hills to the north of Chakrata snow is reported to have fallen as low as 8,500 feet on the 28th.

(*b*) *Almora.*—The aggregate fall during the month amounted to about 15 feet in Byans, 10 feet in Malla Johar and 6 feet in Chaudas: it was apparently much greater on the Nuwe pass. The snowline descended to a distance of about 4 miles from the region of perpetual snows.

VI.—SIKKIM.

According to newspaper accounts there was a heavy snowstorm on the Nathu pass (height 14,300 feet) as early as the 19th.

SUMMARY.

16. (*a*) The winter conditions are reported to have set in earlier than usual in Central Asia and in the mountain zone to the north and west of India. Thus in west Turkestan the first fall of snow occurred early in October, in Afghanistan on the 26th and in the Sikkim Himalayas on the 19th.

(*b*) The total snowfall of the month was undoubtedly much in excess of the average except in Kashmir, and the snowline at the end of the month was considerably lower than is normally the case at the time of year. In the hills to the north of Chakrata snow is reported to have fallen as low as 8,500 feet.

HEM RAJ.

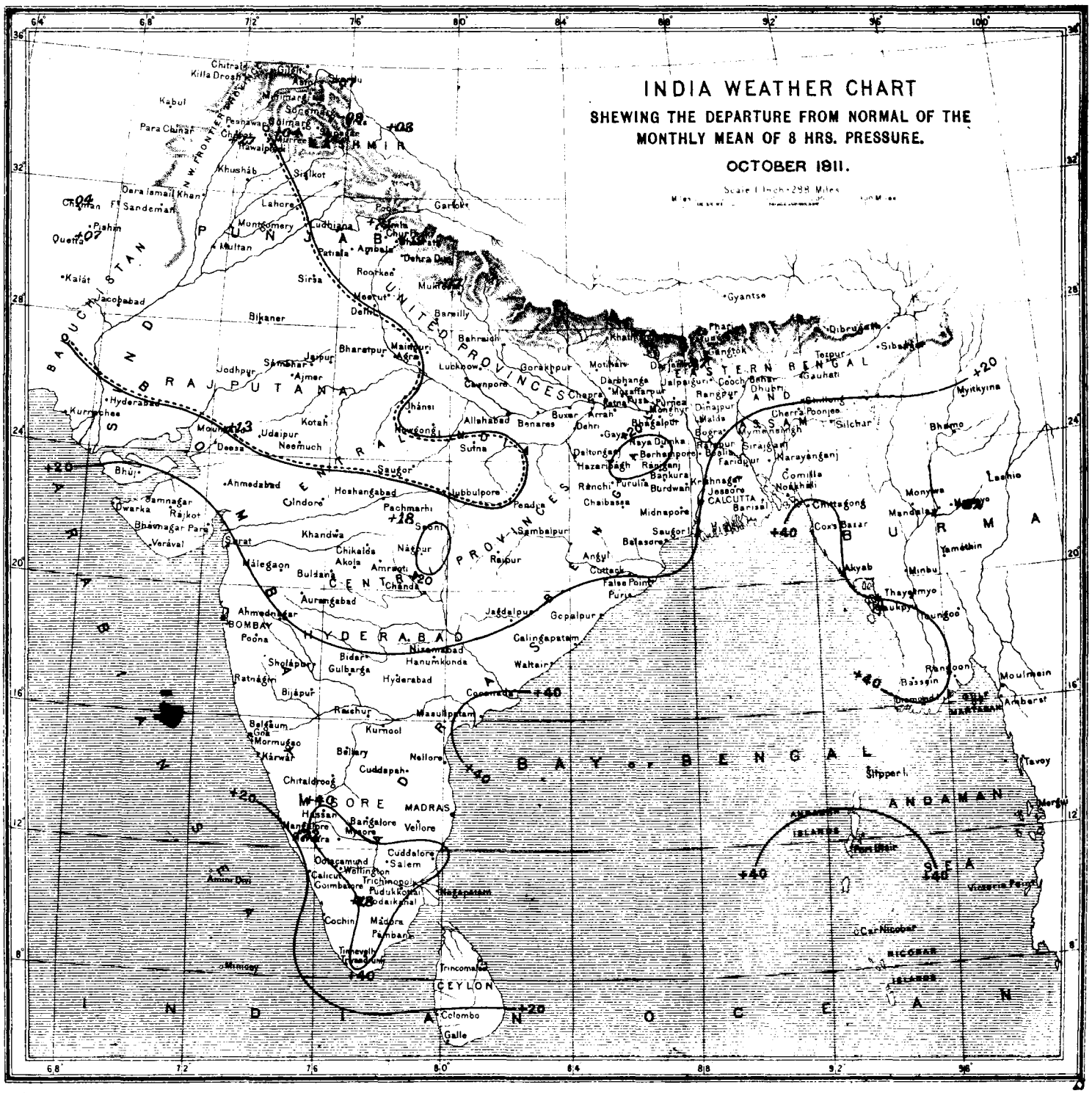
Reg. No. 4176 E., 11.—Z.—1,250.

Reg No. 4195 E , 11.—Z —3,800

The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2	miles	per	hour	...	one	feather	added	to	the	wind	arrow.
,, ,,	2 to 5	,,	,,	,,	...	two	feathers	,,	,,	,,	,,	
,, ,,	5 to 10	,,	,,	,,	...	three	,,	,,	,,	,,	,,	
,, ,,	10 to 20	,,	,,	,,	...	four	,,	,,	,,	,,	,,	
	over 20	,,	,,	,,	...	five	,,	,,	,,	,,	,,	



Reg. No. 4176 E., 11—Z—1,250.

Reg. No. 4196 E., 11—Z—3,500.

The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020′ or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MAXIMUM TEMPERATURE.

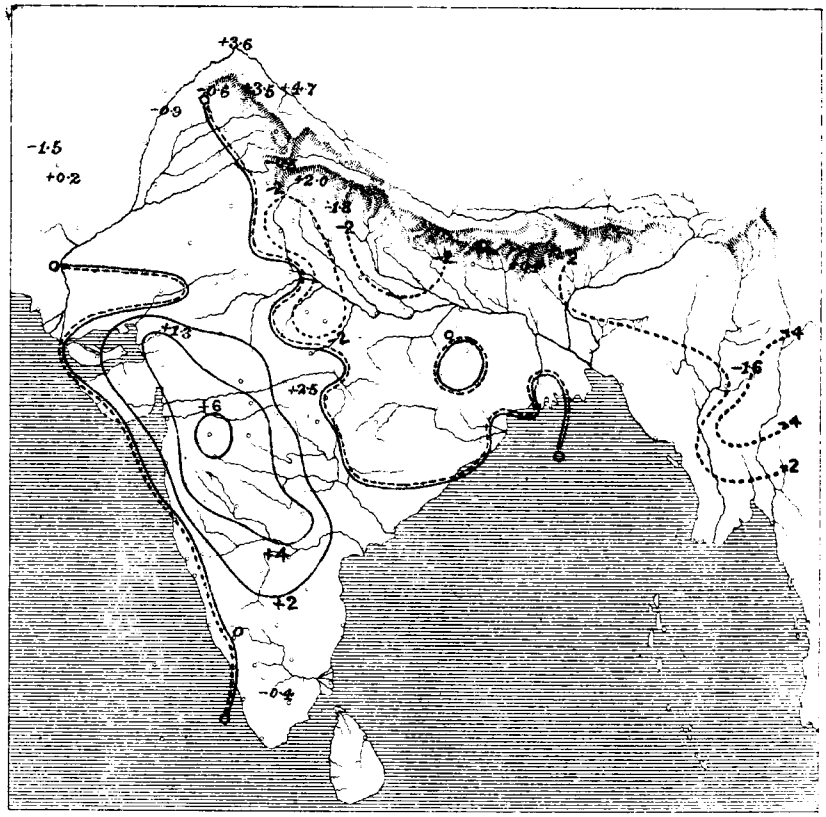


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MINIMUM TEMPERATURE.

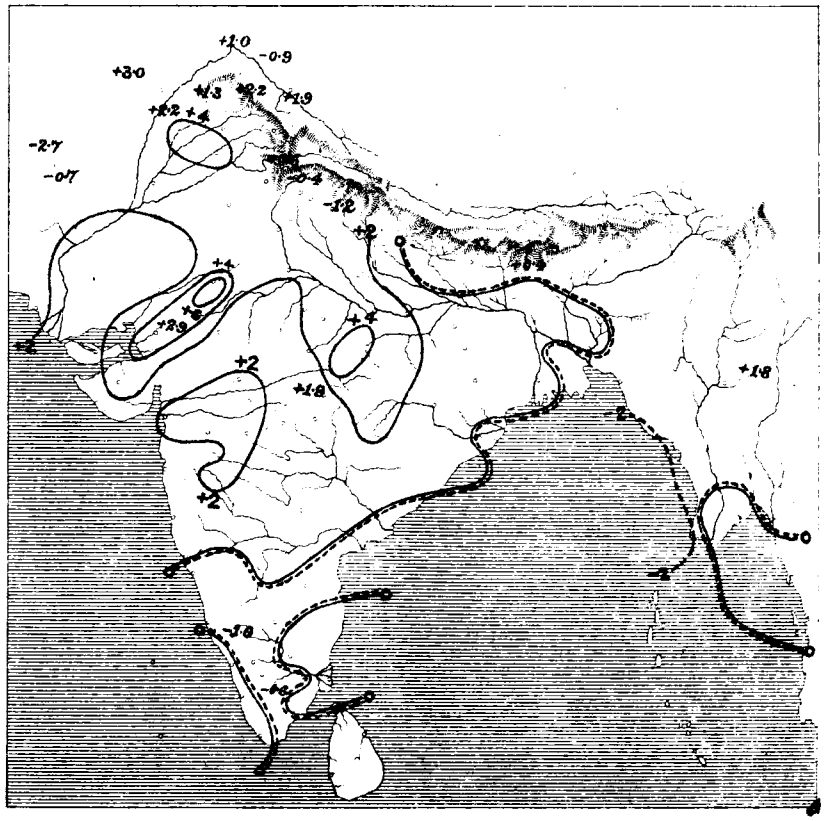


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

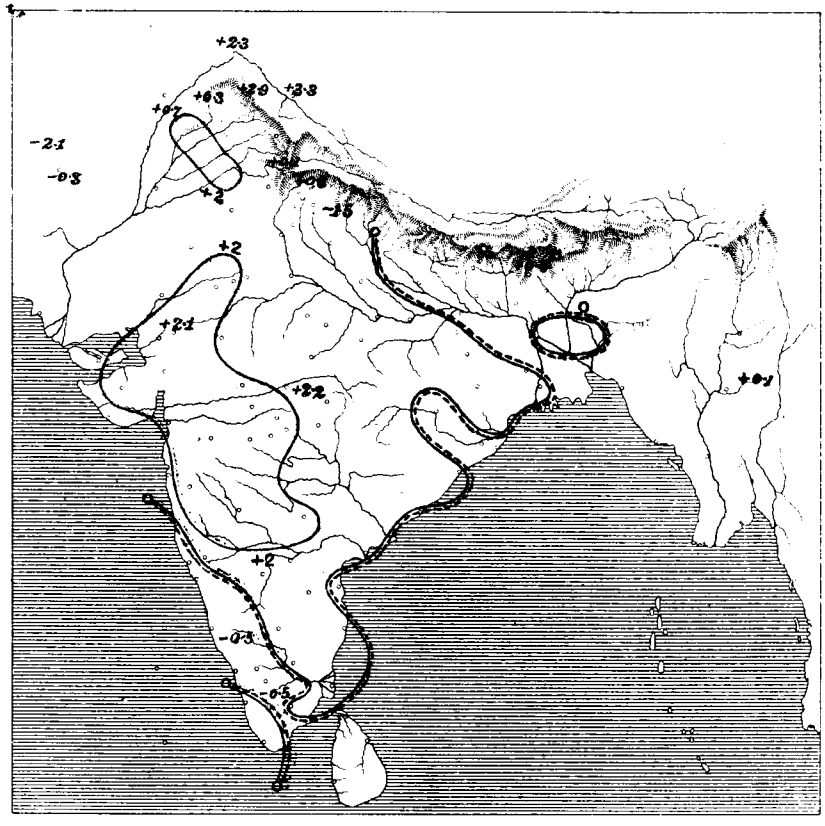


CHART SHEWING THE MONTHLY MEAN OF
PRESSURE AND RESULTANT
WIND DIRECTION.

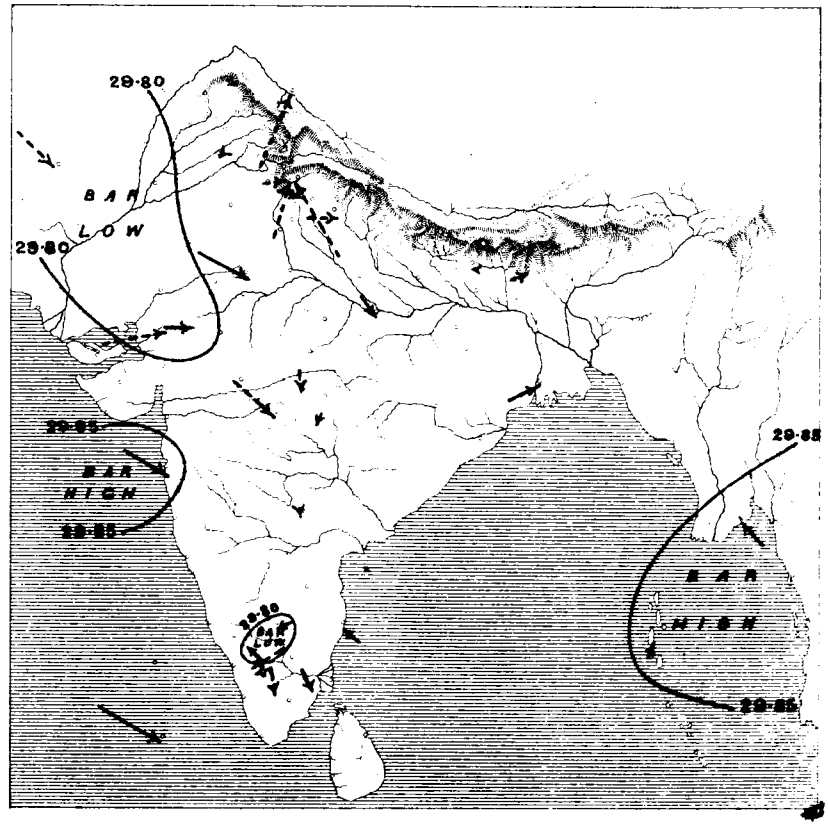


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

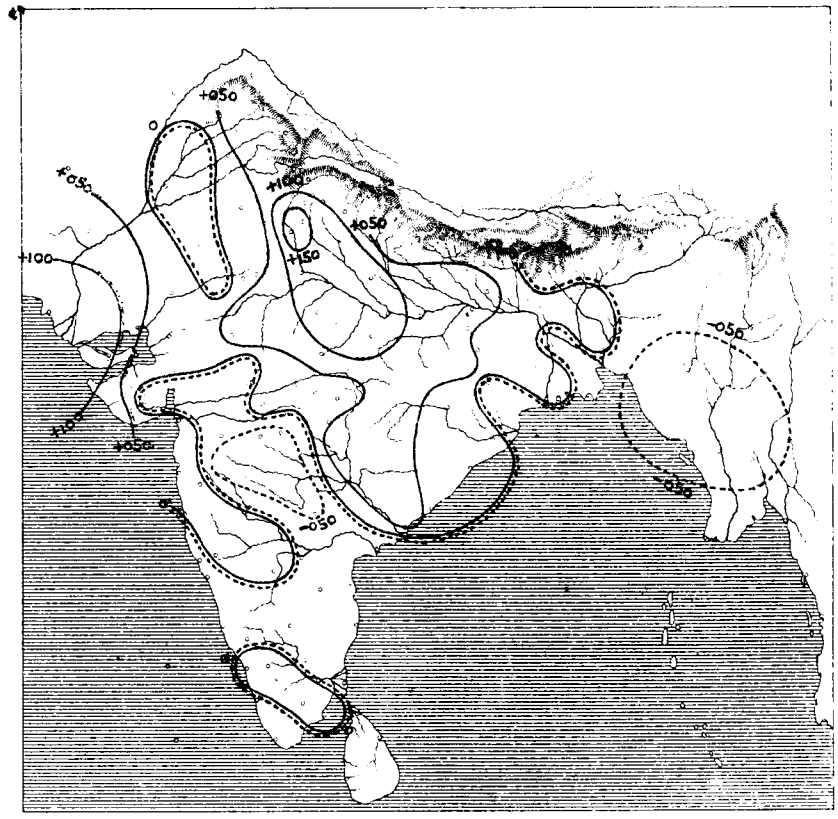


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

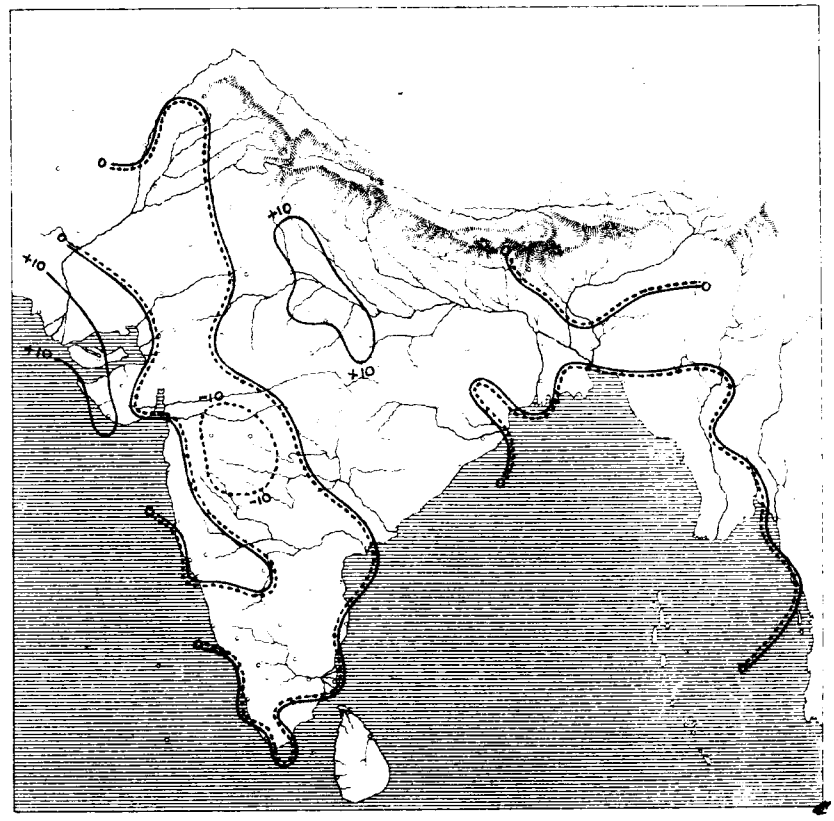


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

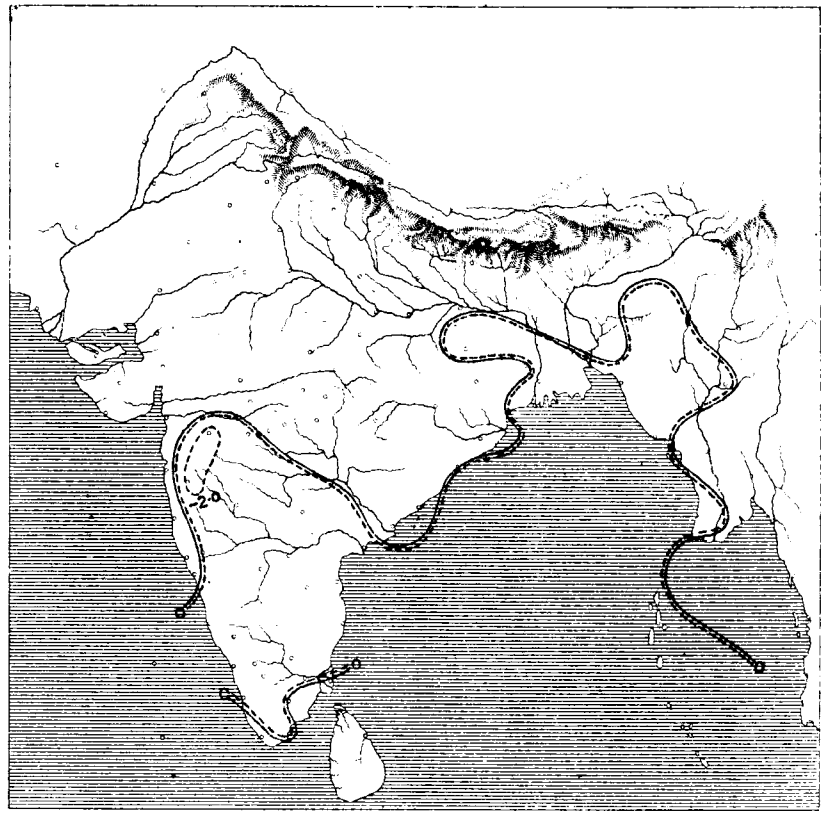
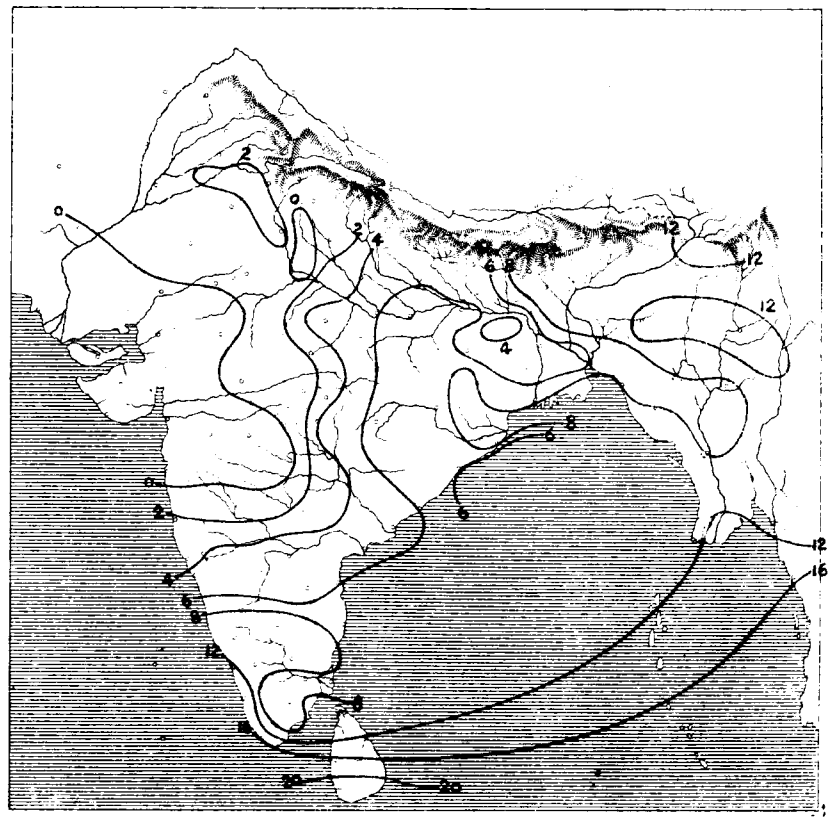


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)



Reg. No. 4176 E., 11.—Z.—1,250.

Reg. No. 4196 E., 11.—Z.—3,800.

The country is divided into 34 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall; the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Eastern Bengal
6. Bengal
7. Orissa
8. Chota Nagpur
9. Bihar
10. United Provinces, East
11. Do., West
12. Punjab, East and North
13. Do., Southwest
14. Kashmir
15. Northwest Frontier Province
16. Baluchistan
17. Sind
18. Rajputana, West
19. Rajputana, East
20. Gujarat
21. Central India, West
22. Do., East
23. Berar
24. Central Provinces, West
25. Do., East
26. Konkan
27. Bombay, Deccan
28. Hyderabad, North
29. Do., South
30. Mysore
31. Malabar
32. Madras, Southeast
33. Madras, Deccan
34. Madras Coast, North

GOVERNMENT OF INDIA.

METEOROLOGICAL DEPARTMENT.

MONTHLY WEATHER REVIEW.

PUBLISHED BY ORDER OF

THE GOVERNMENT OF INDIA.

CALCUTTA, NOVEMBER, 1911.

INTRODUCTION.

THIS review of the weather in India during the month of November, 1911, is based on observations taken daily at 8 hrs. at 242 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 33 stations. In the rainfall summary the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review, have been utilized. The brief notes on solar, seismic and magnetic disturbances have been supplied by the chief observatories.

For a statement of the methods adopted in recording and tabulating the data for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. During the month very abnormal weather was experienced, particularly over the region stretching eastwards from Persia to the western limits of Bengal. Three disturbances of the class of cold weather storms appeared over Persia during the first fortnight and reached northern India. All three were productive of precipitation, but more especially the third of the series which gave a heavy burst of rainfall in the plains of the United Provinces and much snow in the western Himalayas from the 17th to the 19th. In the Pabar valley the snowline is said to have come down as low as 4,000 feet.

The Bay of Bengal was singularly free from disturbance, and but little rain fell in Burma during the month. In the Peninsula the weather was unusually dry up till the 19th, but thereafter much wet weather occurred due to a somewhat peculiar disturbance over the Arabian Sea.

The aggregate precipitation of the month in the plains of India was 35 per cent. above the normal. The excess was, however, not quite general, for Burma, Eastern Bengal, Orissa, Bengal, Rajputana West, Gujarat, Hyderabad South, Mysore and the Madras Deccan reported short supplies, the deficit being greatest (1½″ or 92 per cent.) in the case of Lower Burma. Rainfall was unusually heavy for the time of year in Chota Nagpur (366 per cent. in excess), the United Provinces (1,200 per cent. in excess), the Punjab East and North (877 per cent. in excess), Rajputana East (405 per cent. in excess), Central India (446 per cent. in excess) and the Central Provinces West (561 per cent. in excess). Precipitation was as abundant in Kashmir and Baluchistan as in the plains of upper India.

Over by far the greater part of India proper the abundance of rainfall was as usual associated with high humidity and excess of cloud. In Burma, the region of scanty rainfall, the quantity of cloud was decidedly low.

Day temperature was distinctly lower than usual in Rajputana, the United Provinces, the east of Central India, Sind, the Punjab the North-West Frontier Province, Kashmir and Baluchistan in most of which areas precipitation was unusually heavy, and was rather above the average in the Deccan. Night temperature, on the other hand, was in decided excess over the Deccan, the Central Provinces and the east of Central India and of the United Provinces where the sky was most cloudy; and low in Baluchistan, the western Himalayas and central Burma.

Pressure was on the average for the whole of the plains of India high by ·01″: it was, on the other hand, markedly in defect at the level of the hill stations in northwest India.

H. R.

Solar, seismic and magnetic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—No observations of the sun could be made on 7 days during the month.

Sunspots.—The spot activity still continued low. Only three new spots were observed of which one seen from the 22nd November to 2nd December was of moderate size. The daily average number was 0·6 and the average life of a spot was 5·3 days. The visible disc of the sun was free from spots at the time of observation on 10 days. The distribution in latitude of the spots was as follows :—

TABLE 1.

	0° 10°	30° 40°
North	...	...
South	2	1

Prominences.—Forty-nine large, six eruptive, and two metallic prominences were recorded during the month. The tallest of them photographed on the 28th at 50°W was rapidly changing and reached 240″ in height at 10h. 35m.

Magnetic disturbances.— "Moderate" magnetic disturbances were recorded on the 13th, 14th, and 26th. The large spot No. 2003 was on the central meridian on the 27th, and was probably on the central meridian on the other side of the sun on the 13th.

J. EVERSHED,
Director,
Kodaikanal and Madras Observatories.

Seismological records.

TABLE 2.

No.	Date.	P. T. Commencement G. M. T.	L. W. Commencement G. M. T.	Maxima. G. M. T.	End.	Maximum amplitude.	Duration.	Remarks.
	1911.	H. M.	H. M.	H. M.	H. M.	mm.	H. M.	
72	Nov. 1	10 52·0	...	...	11 28·7	...	0 36·7	Widening of line.
74	,, 10	...	4 50·3	{4 50·3 / 4 52·1}	5 04·6	{0·5 / 0 6} = 0·2	0 14·3	No. P. T. S.
75	,, 11	3 16·2	3 18 3	3 18·8	3 26·7	0·5=0·2	0 10·5	
76	,, 11	3 43·0	3 44·8	3 44·8	3 52·7	0·4=0 2	0 09·7	
77	,, 13	16 36·1	17 02·3	17 07·8	18 01·7	1·8=0·7	1 25·6	
78	,, 18	8 54·0	...	...	9 40·7	...	0 46·7	Widening of line.
79	,, 20	15 16·0	15 27·2	15 28 7	15 46·3	0·5=0·2	0 30·3	
80	,, 21	19 41·6	...	...	20 00·1	...	0 18·5	Widening of line.
81	,, 22, 23	23 18·3	...	...	0 21·3	...	1 03·0	Do.
82	,, 28	16 04·9	...	...	16 51·5	...	0 47·6	Do.
83	,, 30	11 07·8	...	...	11 52·8	...	0 45·0	Do
84	,, 30	...	23 48·4	23 49·4	23 59·6	0·4=0·2	0 11·2	No. P. T. S.

T. ROYDS,
for *Director,*
Kodaikanal and Madras Observatories.

BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of November 1911, the traces showed 10 calm days, 19 days of small and 1 day of moderate disturbance.

The days of the month selected as quiet for the purposes of the Magnetic Survey of India are the 2nd, 11th, 18th, 23rd and 24th.

The following table represents the magnetic character of each day during the month :—

TABLE 3.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	S	17	S	25	S
2	C	10	S	18	C	26	S
3	S	11	C	19	S	27	C
4	S	12	S	20	S	28	C
5	S	13	M	21	S	29	S
6	C	14	S	22	C	30	C
7	S	15	S	23	C	...	...
8	S	16	S	24	C	...	...

C = calm; S = small; M = moderate; G = great; V. G. = very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and declination for the month are as follow :—

Easterly declination	0° 53′ 22″
Horizontal force	0·36864 C.G.S. unit.
Vertical force	0·16271 ,, ,,
Inclination	23° 48′·9
Inclination (observed) . . .	23° 49′·1
Horizontal force range . .	0·00035 C.G.S. unit.
Horizontal force summed range .	0·00210 ,, ,,
Declination range . . .	1·4′
Declination summed range . .	7·2′

(NOTE.—Summed range means sum without regard to signs of 24 ordinates of the diurnal inequality.)

Seismic disturbances.

Only one seismic disturbance was recorded during the month on the 13th :—

TABLE 4.

Date.	Commencement.	Maximum.	End.	Maximum amplitude.	Duration.
1911.	H. M.	H. M.	H. M.	mm.	H. M.
Nov. 13	16 36·1	17 0·8	17 41·9	5·7	1 5·8

All times given above denote G. M. T.
Sensibility to tilt . . . . 1 mm. = 0″·40.

N. A. F. MOOS,
Director,
Bombay and Alibag Observatories.

CALCUTTA OBSERVATORY.

5. *List of displacements recorded by the Milne seismograph.*

TABLE 5.

Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maximum. G. M. T.	End. G. M. T.	Duration.	Maximum displacement on trace from mean position.	Remarks.
1911.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
Nov. 1	10 19·4	...	11 8·7	11 34·1	1 14·7	0·50	
„ 8	14 30·4	14 39·1	14 44·1	15 32·4	1 2·0	1·75	
„ 9	4 42·8	...	...	5 14·8	0 32·0	...	Thickening of line.
„ 13	16 28·4	16 36·0	16 55·3	18 10·0	1 41·6	5·50†	†Measured from base line.
„ 20	15 15·5	...	...	15 58·8	0 43·3	...	Thickening of line.
„ 21	19 36·4	...	19 43·0	19 57·7	0 21·3	0·50	
„ 22	19 46·7	...	...	19 52·2	0 5·5	...	Thickening of line.
„ 22	23 25·9	...	23 28·5	23 36·6	0 10·7	0·75	

Sensibility 1 mm. = 0·38″ of tilt.

E. P. HARRISON,
Offg. Meteorologist, Calcutta.

SIMLA OBSERVATORY.

6. *List of earthquakes recorded by the Omori-Ewing seismographs.*

TABLE 6.

Date.	Beginning of 1st P. T.	Beginning of 2nd P. T.	Beginning of L. W.	Time of maximum amplitude.	End approximately.	Duration.	Maximum displacement of style.*	Remarks.
	H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
13th A	7 44·1	...	...	7 44·3	7 45·0	0 0·9	Small	Local.
„ B	7 44·2	...	...	7 44·5	7 45·0	0 0·8	„	„
13th A	16 33·5	16 41·2	16 52·5	16 54·6	?	?	2·2	End obscured by other disturbances.
„ B	16 33·6	...	16 51·6	16 52·5	?	?	3·0	
22nd A	19 43·5	19 43·8	19 44·2	19 44·6	19 46·2	0 2·7	Small	
„ B	19 43·4	19 43·8	19 44·3	19 44·3	19 45·7	0 2·3	0·5	
30th-1st Dec. A	23 40·8	23 42·6	23 44·2	23 44·3	0 17	0 36	0·5	
30th B	23 40·8	23 42·8	23 44·7	23 45·0	23 57	0 16	0·5	

All times are given in G. M. T.
A = E—W component.
B = N—S component.
Magnification of each instrument was 15.
* Displacements less than 0·2 mm. are reported as "small."

The following table contains a list of earthquakes that have been reported :—

TABLE 7.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity Rossi-Forel scale.	No. of shocks.	Remarks.
		H. M.	Sec.			
Sambhar . .	1st	3 28	30	...	...	Severe.
Drosh . . .	4th	13 45	2	5	3	
Chitral . . .	4th	13 53	5	5	1	
Shillong . .	11th	5 50	1	3	1	
Drosh . . .	12th	16 45	4	5	4	
Jodhpur . .	13th	20 41	10	5	3	
Shillong . .	14th	17 55	5	7	1	
Mukteswar . .	22nd	19 32	20	5	2	
Drosh . . .	24th	17 15	3	5	3	
Shillong . .	24th	23 10	?	7	1	
Leh . . .	25th	0 0	...	...	...	Violent.
Shillong . .	25th	18 25	2	7	1	
Drosh . . .	27th	20 30	2	5	2	
„ . . .	28th	17 45	2	5	2	
Salonah . .	29th	2 49	5	5	1	
Shillong . .	29th	8 55	1	7	1	

Solar radiation.—The following figures give the intensity of solar radiation, as measured at Simla by Angstrom's pyrheliometer. The values are corrected to local noon, and expressed in grammecalories per square centimetre per minute :—

Maximum	1·51
Minimum	1·42
Mean	1·48
Number of days of observation . . .	10

W. A. HARWOOD,
Imperial Meteorologist, Simla.

ROYAL ALFRED OBSERVATORY, MAURITIUS.

7. No information has been received.

Weather in the Indian monsoon region.

8. Pressure was low both at Zanzibar and Seychelles and at the former station the mean wind direction was almost due west instead of south-east which is normally the case.

Precipitation was 25 per cent. in excess at Seychelles, and about 30 per cent. in defect at Zanzibar.

The absence of the usual easterly element in the wind direction would suggest that the equatorial belt of low pressure lay to the south of its normal November position.

TABLE 8.

	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure.		—·009	—·014
Actual mean wind direction		S 8° E	S 85° W
Normal mean wind direction		S 36° E	S 56° E
Actual mean wind velocity (miles per diem).		99	140
Normal mean wind velocity (miles per diem).		110	127
Rainfall departure from normal.		—2·38	+2·60

H. R.

Depressions and cyclonic storms.

9. November is the first month of the winter season in which depressions of the cold weather type begin to appear in the Persian region. Occasionally the low pressure conditions pass eastwards and cause some precipitation in the mountainous zone bordering upper India on the north and west. As a rule the disturbances are very faintly marked and exercise no appreciable influence on the weather in the plains of northern India. On the other hand cyclonic weather is experienced occasionally in the Bay of Bengal and sometimes also in the Arabian Sea. During November 1911 the conditions were almost the opposite of the normal. Thus the weather was conspicuously wet over the greater part of northern India (owing to the advance into that area from Persia of three depressions of the early cold weather type), remarkably quiet in the Bay of Bengal, and comparatively disturbed in the Arabian Sea. The following is a very brief history of the disturbances of the month :

(*a*) The first depression of the Persian series appeared over Syria and Mesopotamia on the 1st, passed through Persia on the 2nd and 3rd, Baluchistan on the 4th and 5th, and Sind on the 6th, into Rajputana on the 7th where it disappeared during the 8th. Although very feebly marked at the earth's surface it gave moderate precipitation over the area extending from Persia to the northwest of the United Provinces.

(*b*) The second of the series became visible over west Persia on the 8th and 9th and advancing eastwards through Baluchistan on the 10th, lay over the west of Rajputana on the following morning. It was passing through Central India on the 12th and west Bengal on the 13th. It was slightly deeper than its predecessor and occasioned precipitation as far east as Assam.

(*c*) The third or the last of the series began to affect Persia on the 11th. It followed a more southerly course than the first two and presumably crossed into Gujarat on the 16th. Judging by the isabnormal chart it drifted very slowly eastwards during the next three days, disappearing finally on the 20th. It was remarkable for the heavy rain it gave to the United Provinces, Bihar and the east of Central India and of the Central Provinces.

(*d*) The passing away of the third depression was followed immediately by the appearance of disturbed conditions over the Arabian Sea. The marine information available at the present time does not throw much light on the origin and real character of the disturbance. Presumably it was developed in an area of low barometer and rainy weather which first showed itself to the west of Ceylon on the 20th and thence advanced northwards up the Malabar coast on the succeeding two days. On the coast the lowest pressure occurred at Mangalore on the 23rd and 24th, at Marmagao and Karwar on the 25th and at Marmagao and Ratnagiri on the 26th, an indication that the disturbance was moving northwards slowly along the coast on these days. A nucleus or centre was developed on the 27th and 28th about 200 miles west-by-south of Ratnagiri. A slow northwestward movement of the disturbance would appear to have occurred on the 29th, for on the morning of the 30th the centre of wind convergence was situated at a distance of about 300 miles to the west northwest of Ratnagiri. So far as can be judged by the scanty information forthcoming up to the present it was dissipated rapidly over the sea during the next 24 hours.

The disturbance was probably not of a severe character, but it was the cause of moderate to heavy rain over the greater part of the Peninsula excluding the Central Provinces.

H. R.

Pressure.

10. Pressure was markedly in defect at the level of the observing stations in the Himalayas and in slight defect at Quetta in Baluchistan. The deficiency at these high levels was however more than compensated by the high density of the lower layers of the atmosphere, so that at the plains pressure was in excess by amounts averaging about ·03″ in Sind and the Punjab, and ·025″ in the United Provinces and northeast India.

Pressure was higher than usual also in Burma and in the north and southeast of Madras, but in the Central Provinces generally, the west of Central India, southern Rajputana, Malabar and the division of Bombay, the barometer stood slightly below its normal height.

In the plains, temperature was high generally in the region of deficient pressure and low in the area of excessive pressure, an indication that the abnormalities of pressure distribution were, in part at least, determined by those of temperature.

TABLE 9.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	"
Burma	+·017
Eastern Bengal and Assam	+·026
Bengal	+·024
United Provinces	+·023
Punjab	+·030
North-West Frontier Province	+·014
Sind	+·029
Rajputana	+·002
Bombay	—·014
Central India	+·001
Central Provinces	—·009
Hyderabad	—·012
Mysore	—·003
Madras	+·005

TABLE 10.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	"		"	"
Quetta	—·014	Jacobabad	+·034	+·048
Leh	—·067	Lahore	+·029	+·096
Murree	—·033	Peshawar	+·010	+·043
Simla	—·015	Ludhiana	+·037	+·052
Chakrata	+·001	Roorkee	+·045	+·044
Darjiling	—·050	Dhubri	+·026	+·076
Mount Abu	—·014	Deesa	—·011	+·003
Pachmarhi	+·004	Khandwa	—·014	—·018
Kodaikanal	—·013	Madura	+·020	+·033

H. R.

Temperature.

11. Day temperature was between 3° and 10° below the normal over the whole of the region lying to the north of a line through Karachi, Deesa, Neemuch, Jubbulpore, Hazaribagh and Darbhanga ; about 3° in excess in Hyderabad and about the average elsewhere. Night temperature was from 3° to 8° higher than usual in the Central Provinces, Central India, Hyderabad and the Bombay Deccan, and in defect by 5° in the western Himalayas and by 2° to 3° in Kashmir, Baluchistan and central Burma ; but in the rest of the country the recorded values of the minimum thermometer differed to no great extent from the normal. Thus on the whole, night temperature had a distribution very similar to that of the day temperature, except that the positive departures were more marked than the negative.

Weather was unusually cold over northwest India during the last thirteen days of the month, and Simla and Chakrata recorded unprecedentedly low temperatures for November on the night of the 18th.

TABLE 11.

SUB-DIVISION.	ACTUAL TEMPERATURE.					DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
1. Bay Islands	86·7	78·7	82·7	8·0	12·3	+0·9	+1·4	—0·5
2. Lower Burma	87·7	71·1	79·4	16·6	22·8	+1·0	—0·5	+1·5
3. Upper Burma	85·7	63·6	74·6	22·0	30·9	—0·8	—2·1	+1·3
4. Assam	77·8	61·8	69·8	16·0	27·7	—2·9	—0·4	—2·5
5. Eastern Bengal	81·0	63·3	72·1	17·7	28·5	—1·1	—0·3	—0·8
6. Bengal	82·4	66·0	74·2	16·5	26·4	—0·1	+1·9	—2·0
7. Orissa	85·2	67·3	76·2	17·9	28·9	+1·1	+2·8	—1·7
8. Chota Nagpur	79·3	61·3	70·3	18·0	30·6	—1·5	+2·7	—4·2

Sub-division.	Actual temperature.					Departure from normal of		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
9. Bihar	79·4	60·2	69·8	19·2	33·5	—2·5	+0·4	—2·9
10. United Provinces, East	78·3	57·0	67·7	21·4	38·4	—4·5	+1·3	—5·3
11. Do. do., West	75·2	53·7	64·6	21·6	40·8	—6·4	+0·3	—6·7
12. Punjab, East and North	74·3	49·7	62·0	24·6	44·5	—7·4	—0·1	—7·3
13. Do., Southwest	76·7	50·2	63·5	26·5	49·2	—7·1	—0·8	—6·3
14. Kashmir	51·3	26·4	38·8	24·9	48·2	—5·1	—2·3	—2·8
15. North-West Frontier Province	72·7	45·9	59·3	26·8	47·3	—6·9	—0·1	—6·8
16. Baluchistan	67·6	44·1	55·8	23·6	44·6	—8·3	—3·2	—5·1
17. Sind	83·4	59·1	71·3	24·3	48·1	—2·8	+0·3	—3·1
18. Rajputana, West	81·9	56·3	69·1	25·6	46·9	?	?	?
19. Do., East	81·0	56·3	68·7	24·7	47·8	—4·5	+0·4	—4·9
20. Gujarat	90·1	65·5	77·8	24·5	41·6	+0·5	+2·1	—1·6
21. Central India, West	82·3	58·1	70·2	24·2	39·7	—1·5	+3·6	—5·1
22. Do., East	77·6	58·4	68·0	19·2	39·5	—4·1	+4·9	—9·0
23. Berar	86·7	65·4	76·0	21·3	32·8	+1·4	+6·1	—4·7
24. Central Provinces, West	82·7	61·6	72·1	21·1	36·6	—·09	+5·0	—5·9
25. Do., East	82·4	63·1	72·7	19·3	31·3	+1·1	+5·2	—4·1
26. Konkan	88·1	73·4	80·7	14·8	23·7	+0·3	+1·8	—1·5
27. Bombay Deccan	87·9	64·7	76·3	23·2	33·8	+2·2	+5·3	—3·1
28. Hyderabad, North	87·4	65·1	76·3	22·3	31·9	+2·1	+5·3	—3·2
29. Do., South	88·6	67·3	77·9	21·3	30·3	+2·9	+3·2	—0·3
30. Mysore	82·5	63·5	73·0	19·0	25·8	+1·6	+1·0	+0·6
31. Malabar	87·1	74·3	80·7	12·9	20·1	+0·3	+0·7	—0·4
32. Madras, Southeast	86·2	72·4	79·3	13·8	21·8	+0·3	+0·4	—0·1
33. Do. Deccan	90·0	68·1	79·1	21·9	31·6	+2·3	+1·8	+0·5
34. Do. Coast, North	85·1	71·3	78·2	10·8	20·7	+0·5	+1·1	—0·6

TABLE 12.

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	+0·4	—1·0	—0·3
Eastern Bengal and Assam	—1·6	—0·4	—1·0
Bengal	—0·8	+1·8	+0·5
United Provinces	—5·5	+0·7	—2·4
Punjab	—7·3	—0·3	—3·8
North-West Frontier Province	—6·9	—0·1	—3·5
Sind	—2·8	+0·3	—1·3

Division.	Departure from normal of		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Rajputana	—4·5	+0·4	—2·0
Bombay	+1·0	+3·0	+2·0
Central India	—2·8	+4·2	+0·7
Central Provinces	0	+5·2	+2·6
Hyderabad	+2·6	+3·9	+3·3
Mysore	+1·6	+1·0	+1·3
Madras	+0·6	+0·8	+0·7

H. R.

Winds.

12 (*a*) On the mean of the month the velocity of air motion was greater than usual over a large part of the Peninsula including the Central Provinces and also in Sind; and distinctly below the average in Burma and Eastern Bengal and Assam.

(*b*) The steadiness was low in Burma, northeast India, the United Provinces, the Central Provinces and Mysore, and markedly high in the North-West Frontier Province and Sind.

(*c*) In some parts of the country owing to the peculiarities of pressure distribution the direction of movement was very different from that which is usually characteristic of November. Thus on the coast from Waltair to Trincomalee the usual westerly component was either very weak or altogether wanting, and in the Deccan there was an unusual preponderance of east and southeast winds; while in the region comprising north Rajputana, Central India East, and the United Provinces excluding the submontane districts, the normal westerly winds were replaced by those from the opposite quarter.

TABLE 13.

Division.	Departure from normal of	
	Hourly wind velocity.	Wind steadiness.
Burma	—0·7	— 7
Eastern Bengal and Assam	—0·7	—15
Bengal	+0·1	— 7
United Provinces	+0·1	— 7
Punjab	+0·2	+ 1
North-West Frontier Province	—0·1	+ 5
Sind	+0·6	+ 8
Rajputana	—0·1	— 2
Bombay	+0·6	+ 3
Central India	+0·2	0
Central Provinces	+0·7	— 5
Hyderabad	—0·3	+ 5
Mysore	+1·8	— 8
Madras	+1·0	+ 4

H. R.

Humidity and cloud.

13. The abnormal features of the hygrometric conditions were roughly in accord with those of rainfall. Thus humidity, both absolute and relative, was in defect in Cutch, Kathiwar, Eastern Bengal and Assam and parts of Burma, and over that area generally precipitation was below the normal. The air was damper than usual over the Peninsula and the rest of the plains of northern and central India where rainfall was generally in excess. In Baluchistan both vapour tension and percentage of saturation were greater than usual, but in Kashmir notwithstanding the excess of precipitation the airwas dry.

The sky was clouded to more than the customary extent in most divisions, the only important exceptions being Burma and Baluchistan. The excess was most marked in the Central Provinces, Central India and the Konkan where it was equal to nearly one-third of the total sky expanse.

TABLE 14.

Division.	Hygrometry; 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma	85	+ 1	·635	—·005	2·9	—1·2
Eastern Bengal and Assam	86	— 1	·591	—·033	3·0	+0·5
Bengal	82	+ 3	·575	+·033	3·1	+1·7
United Provinces	78	+ 7	·436	+·025	2·7	+1·6
Punjab	73	+11	·326	+·029	2·3	+0·8
North-West Frontier Province.	77	+12	·297	+·027	2·7	+0·5
Sind	55	+ 1	·366	+·004	1·7	+0·2
Rajputana	57	+ 7	·337	+·025	2·4	+0·9
Bombay	60	— 1	·525	+·020	3·4	+2·0
Central India	70	+11	·436	+·067	4·2	+3·1
Central Provinces	71	+ 7	·507	+·087	4·3	+2·7
Hyderabad	67	+ 2	·560	+·037	4·5	+1·3
Mysore	77	+ 2	·571	+·014	5·1	+0·3
Madras	81	+ 2	·757	+·025	5·1	+0·8

H. R.

Rainfall.

14. As already pointed out in a previous section the rainfall in the greater part of northern India was due almost entirely to three depressions of the cold weather type, and in the Peninsula to a disturbance which affected the Arabian Sea during the last ten days of the month.

Owing to the abnormally early withdrawal of the monsoon from the Bay in the third week of October weather was unusually dry throughout in Burma.

For the month as a whole there was an excess of precipitation over by far the greater part of the country; Burma, Eastern Bengal, Bengal, Orissa, Rajputana West, Gujarat, Mysore, Hyderabad South and the Madras Deccan alone being exceptions to this condition.

In the region including Chota Nagpur, Bihar, the United Provinces, the Punjab, Kashmir, Central India, Rajputana East, Berar and the Central Provinces West, the month's total fall ranged between three and sixteen times the normal.

TABLE 15.

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
1. Bay Islands	4·5	10·3	1·93	7·75	−5·82	− 75
2. Lower Burma	0·3	2·4	0·13	1·61	−1·48	− 92
3. Upper Burma	0·6	2·1	0·23	1·22	−0·99	− 81
4. Assam	2·2	1·5	1·03	0·93	+0·10	+ 11
5. Eastern Bengal	0·7	0·9	0·38	0·72	−0·34	− 47
6. Bengal	1·8	0·8	0·52	0·64	−0·12	− 19
7. Orissa	0·7	1·5	0·24	1·34	−1·10	− 82
8. Chota Nagpur	3·2	0·6	1·63	0·35	+1·28	+366
9. Bihar	1·5	0·3	0·71	0·18	+0·53	+294
10. United Provinces, East	2·9	0·2	1·48	0·15	+1·33	+887
11. Do., West	2·8	0·3	1·93	0·12	+1·81	+1,508
12. Punjab, East and North	2·3	0·2	1·27	0·13	+1·14	+877
13. Do., Southwest	1·3	0·2	0·42	0·11	+0·31	+282
14. Kashmir	3·4	1·0	1·68	0·41	+1·27	+310
15. North-West Frontier Province	2·4	0·6	0·95	0·47	+0·48	+102
16. Baluchistan	2·4	1·1	0·99	0·50	+0·49	+ 98
17. Sind	0·1	0·2	0·05	0·09	−0·04	− 44
18. Rajputana, West	0·2	0·3	0·08	0·19	−0·11	− 58
19. Do., East	1·6	0·4	0·96	0·19	+0·77	+405
20. Gujarat	0·2	0·4	0·07	0·28	−0·21	− 75
21. Central India, West	2·4	0·4	1·18	0·21	+0·97	+462
22. Do., East	3·4	0·6	1·53	0·29	+1·24	+428
23. Berar	4·4	0·9	2·18	0·58	+1·60	+276
24. Central Provinces, West	4·1	0·6	2·38	0·36	+2·02	+561
25. Do., East	1·9	0·8	0·65	0·54	+0·11	+ 20
26. Konkan	2·0	1·4	0·89	0·87	+0·02	+ 2
27. Bombay Deccan	2·5	1·5	1·45	0·89	+0·56	+ 63
28. Hyderabad, North	1·6	1·5	0·90	0·90	0	0

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
29. Hyderabad, South	1·8	2.1	0·61	1·14	−0·53	−46
30. Mysore	3·1	3·2	1·42	2·11	−0·69	− 33
31. Malabar	4·5	5·3	3·95	4·03	−0·08	− 2
32. Madras, Southeast	8·7	7·6	7·77	6·61	+1·16	+ 18
33. Do. Deccan	2·4	3·2	1·24	2·14	−0·90	− 42
34. Do. Coast, North	3·9	3·7	4·27	3·76	+0·51	+ 14

TABLE 16.

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	0·19	1·40	−1·21	− 86
Eastern Bengal and Assam	0·70	0·83	−0·13	− 16
Bengal	0·68	0·52	+0·16	+ 31
United Provinces	1·69	0·13	+1·56	+1200
Punjab	1·09	0·12	+0·97	+ 808
North-West Frontier Province	0·95	0·47	+0·48	+ 102
Sind	0·05	0·09	−0·04	− 44
Rajputana	0·72	0·19	+0·53	+ 279

Division.	Rainfall.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Bombay	0·90	0·69	+0·21	+ 30
Central India	1·31	0·24	+1·07	+ 446
Central Provinces	1·91	0·49	+1·42	+ 290
Hyderabad	0·74	1·03	−0·29	− 28
Mysore	1·42	2·11	−0·69	− 33
Madras	5·59	4·99	+0·60	+ 12
Mean of India	1·38	1·02	+0·36	+35

H. R.

Snowfall.

I.—BALUCHISTAN.

15. Slight snow fell on the heights around Quetta on the 6th, 7th, 11th and 16th, but melted away quickly.

II.—AFGHANISTAN.

Snow is reported to have fallen on the 7th-8th throughout the country down to the level of Kabul. In the plain around Kabul the fall measured about 2 inches in depth.

III.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Wano.*—On the Marwatti and Pirghal snow fell on the 7th and 11th to a total depth of 1¾ feet.

(*b*) *Kurram.*—Snow fell daily on the Safed Koh from the 6th to the 9th, and again on the 16th to the 18th. The fall of the 18th descended to the level of Parachinar.

(*c*) *Chitral.*—Snow fell on three days on the surrounding hills; the total fall amounted to about 3½ feet. At the end of the month the unmelted residue on the eastern and western ranges varied between 2″ and 6″.

(*d*) *Drosh.*—There was more than the normal amount of snowfall on the surrounding hills. The snow line descended to 6,500 feet on two occasions. At the end of the month snow to a depth of about 3 feet was said to be lying on the northern slopes of the Lowarai Pass.

(*e*) *Hazara.*—Snow fell at Punjul (elevation 6,500 feet) on three days to a total depth of 4½ feet.

IV.—KASHMIR.

(*a*) *Srinagar.*—Snow storms occurred on the surrounding hills on the 8th, 12th, 14th and 17th but none of these extended to the level of Srinagar.

(*b*) *Skardu.*—Snow is reported to have fallen on the higher mountains near the observatory on the 6th, 7th, 11th, 12th, 14th, 16th, 18th and 19th.

(*c*) *Dras.*—The aggregate fall during the month measured about 4½ feet in depth on the Zoji-la and about 1 foot in the grounds of the observatory.

(*d*) *Kargil.*—There were altogether seven falls on the surrounding hills, resulting in 3½ feet of snow. During the storms of the 12th, 13th, 18th and 19th which were moderately severe the snow line came down to the level of Kargil.

V.—PUNJAB.

(*a*) *Kangra.*—There was a general fall on the 19th down to about 5,800 feet. At the end of the month the Bhubu pass was still under snow and impassable for mules.

(*b*) *Kilba* (*Simla Hills*).—On the ranges near Kilba snowfall occurred on seven days during the 2nd and 3rd weeks. The most severe storm was that of the 18th and 19th when snow fell as low as 5,750 feet.

According to the Deputy Conservator of Forests, most unusual and widespread storms occurred between the 10th and the 26th during which period snow and rain fell above Chini and in the Kilba tract down to 6,500 feet and in places even lower. Narkanda is reported to have had 1½ feet of snow on the 19th.

VI.—UNITED PROVINCES.

(*a*) *Garhwal.*—Snow storms occurred on the higher ranges on the 11th, 13th, 14th, 16th and 17th to 19th. The storm of the 18th was severe.

(*b*) *Hills north of Chakrata.*—According to newspaper accounts moderate snow fell in these hills on the 11th and heavy snow on the 17th and 18th. On the 18th snow lay two feet deep at an elevation of about 8,000 feet and 18 inches deep at 7,000 feet. The snow line descended as low as Arakot (4,000 feet high).

(*c*) *Almora.*—There was a total fall of about 8 feet in Malla Johar and of 6 feet in Chaudas. No information is forthcoming for the rest of the district.

TABLE 17.

Name of pass.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
	Feet.	Feet.
Nuwe pass	35	19½
Binkaru pass	9	16
Lipulekh „	12	4
Lampia „	14	7
Untadhura pass	6	8
Ralamdhura „	5	6½

SUMMARY.

16. So far as can be judged from the information available at the present time the snowfall of the month in the greater part of the mountain zone bordering upper India on the north and west was very heavy for the time of year and in some places occurred down to exceptionally low levels.

Very severe weather is said to have prevailed in Central Asia.

H. R.

Reg. No. 4176 E., 11.—Z.—1,250.
Reg. No. 4195 E., 11.—Z.—3,800

The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	0 to 2 miles per hour	...	one feather added to the wind arrow.
,, ,,	2 to 5 ,, ,, ,,	...	two feathers ,, ,, ,, ,,
,, ,,	5 to 10 ,, ,, ,,	...	three ,, ,, ,, ,, ,,
,, ,,	10 to 20 ,, ,, ,,	...	four ,, ,, ,, ,, ,,
	over 20 ,, ,, ,,	...	five ,, ,, ,, ,, ,,

Reg. No. 4176 E., 11.—Z.—1,250.

Reg. No. 4195 E., 11.—Z.—3,800.

The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020″ or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MAXIMUM TEMPERATURE.

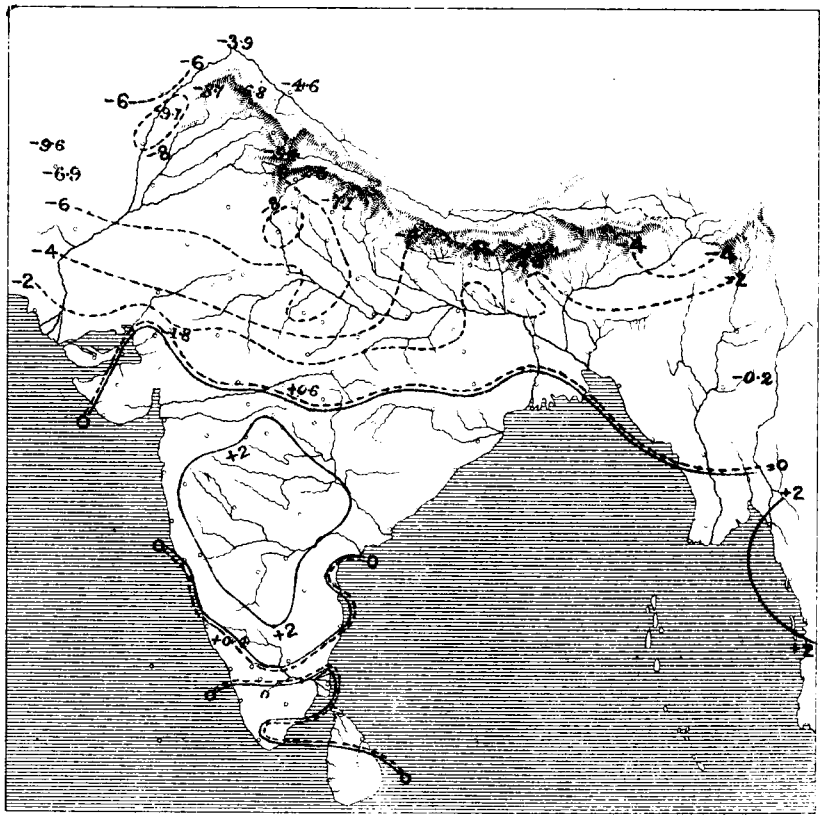


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MINIMUM TEMPERATURE.

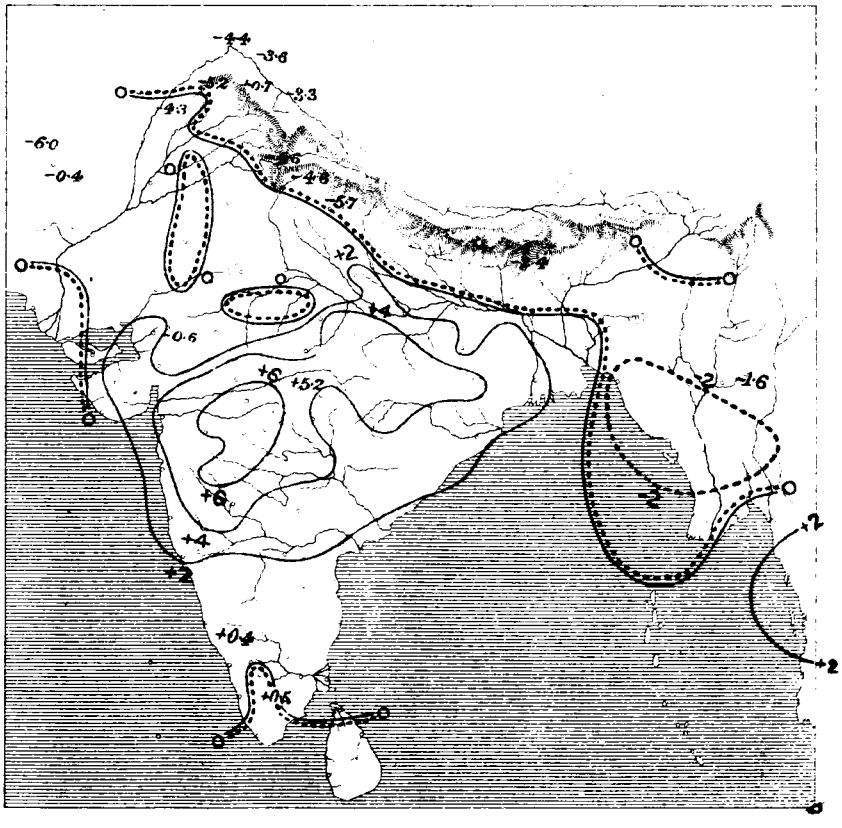


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF DAILY MEAN TEMPERATURE.

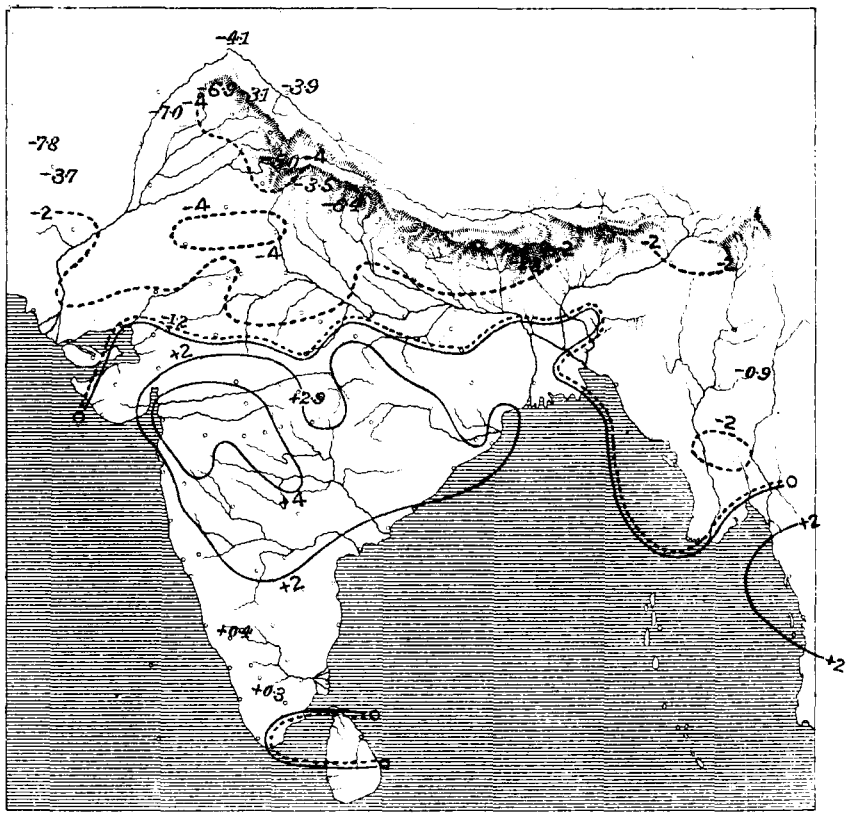


CHART SHEWING THE MONTHLY MEAN OF PRESSURE AND RESULTANT WIND DIRECTION.

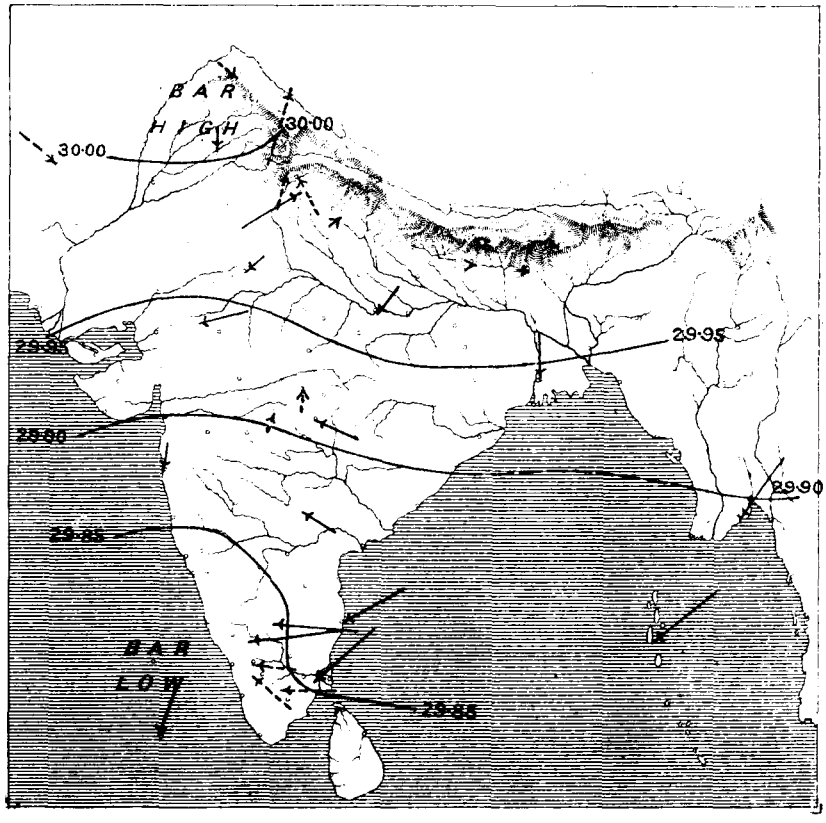


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

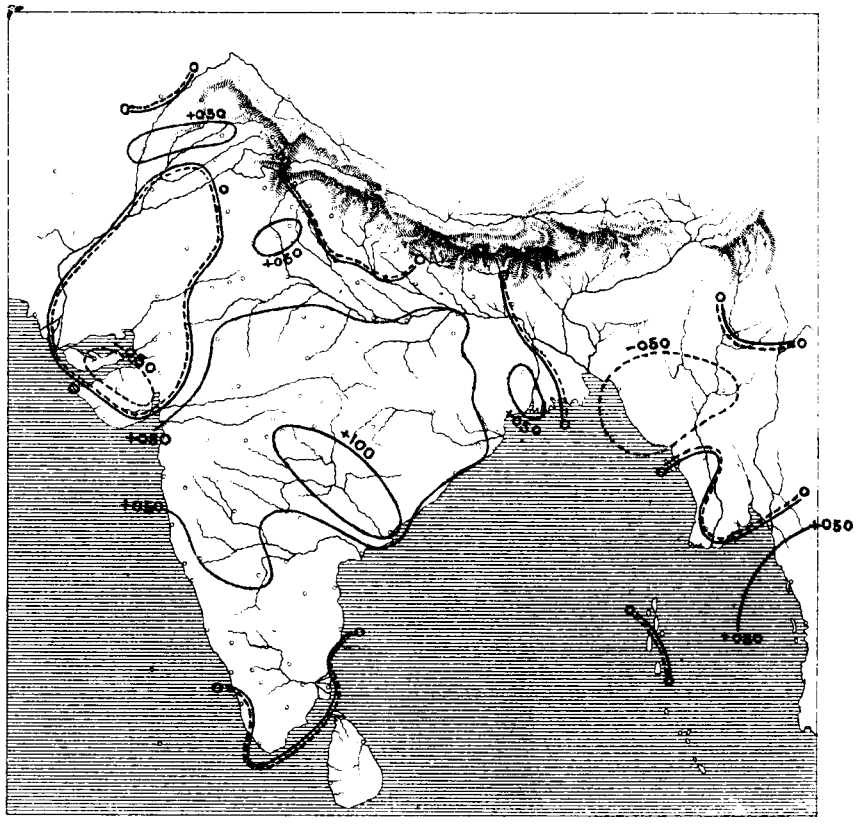


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

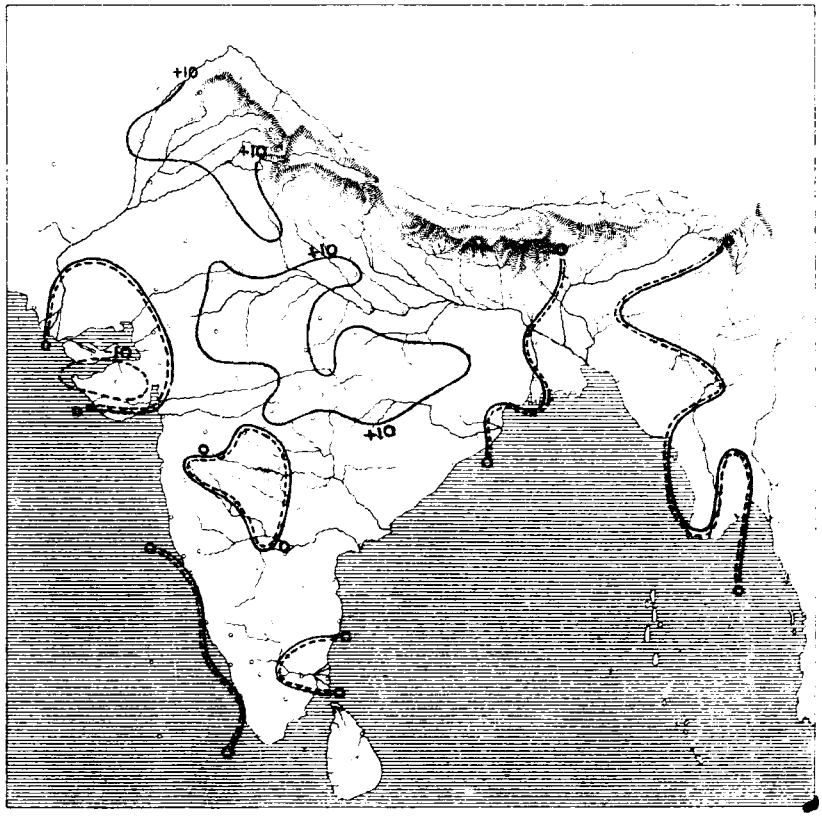


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

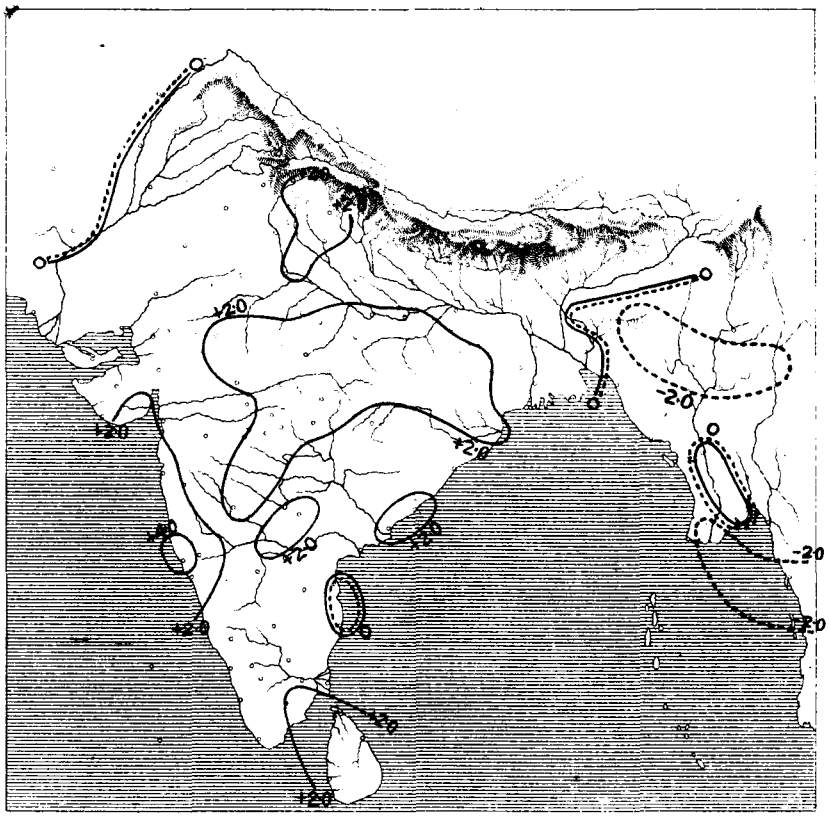
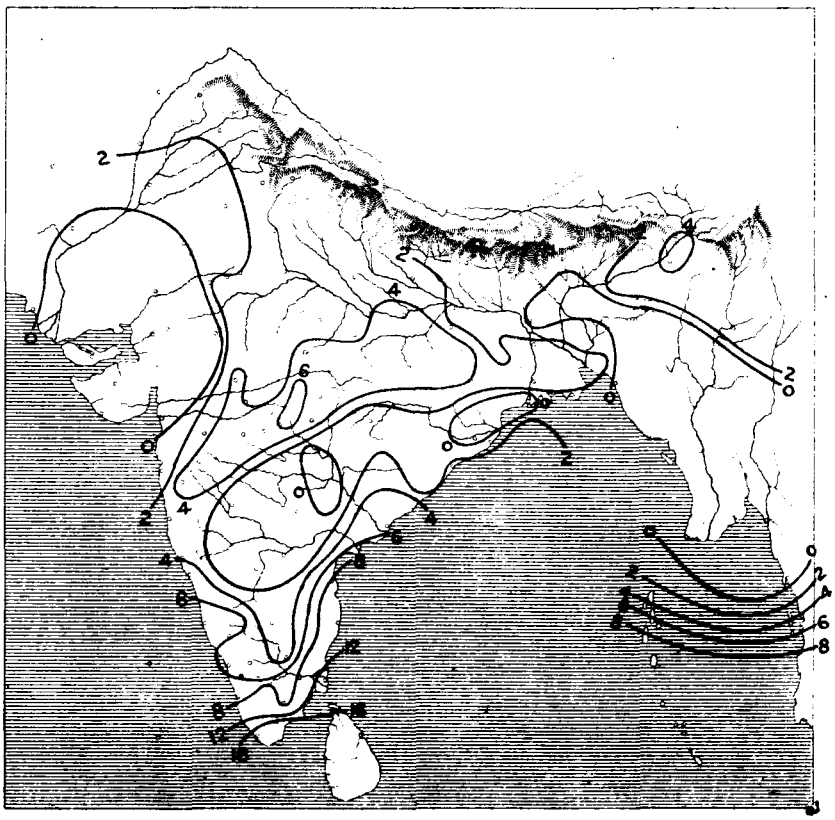
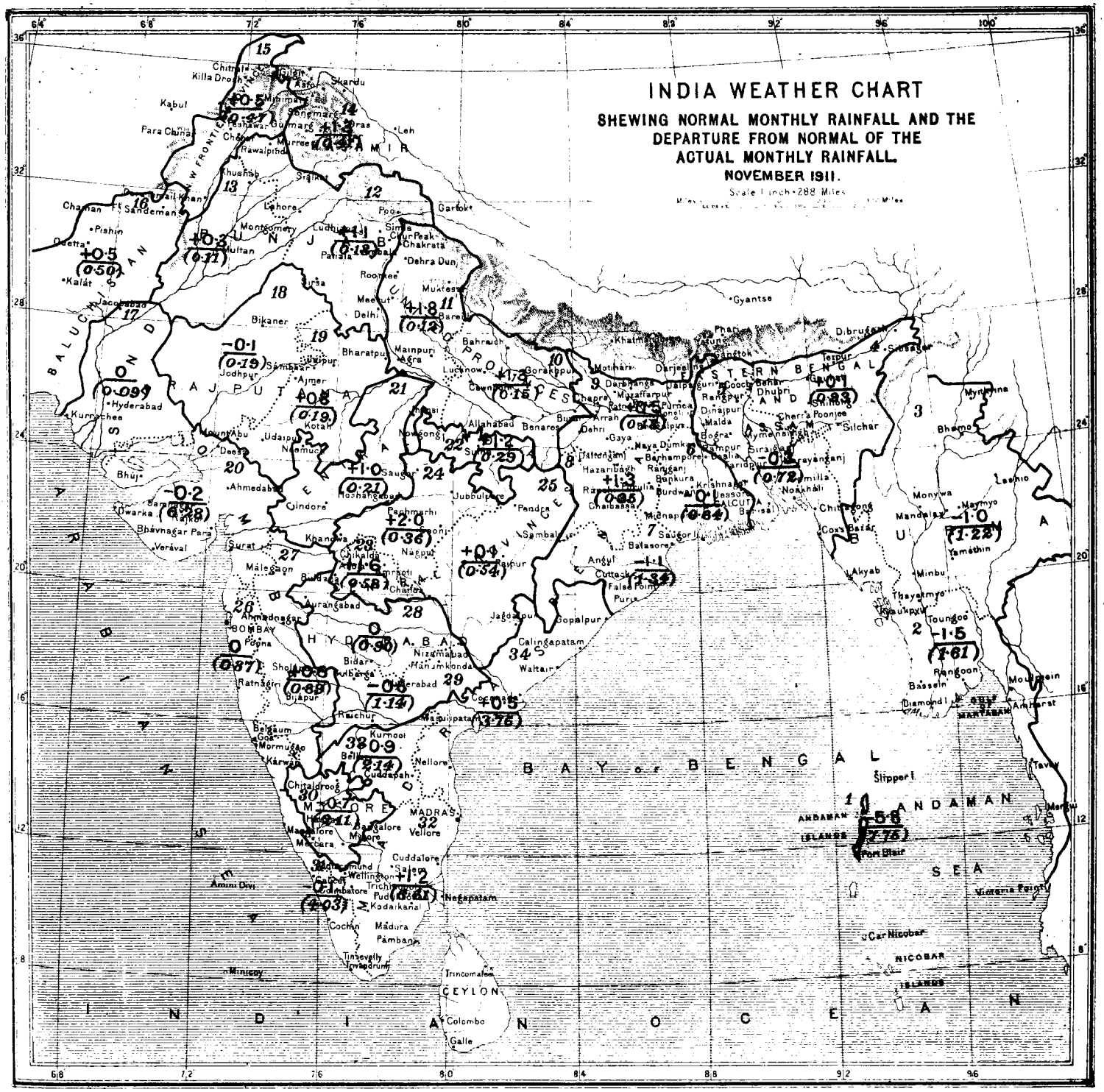


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)



LITHO. BY S.S. MUNDLE.



The country is divided into 34 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall; the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Eastern Bengal
6. Bengal
7. Orissa
8. Chota Nagpur
9. Bihar
10. United Provinces, East
11. Do., West
12. Punjab, East and North
13. Do., Southwest
14. Kashmir
15. Northwest Frontier Province
16. Baluchistan
17. Sind
18. Rajputana, West
19. Rajputana, East
20. Gujarat
21. Central India, West
22. Do., East
23. Berar
24. Central Provinces, West
25. Do., East
26. Konkan
27. Bombay, Deccan
28. Hyderabad, North
29. Do., South
30. Mysore
31. Malabar
32. Madras, Southeast
33. Madras, Deccan
34. Madras Coast, North

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CALCUTTA, DECEMBER, 1911.

INTRODUCTION.

THIS review of the weather in India during the month of December, 1911, is based on observations taken daily at 8 hrs. at 243 stations, and on additional observations taken at 10 hrs. and 16 hrs. at 23 stations. In the rainfall summary have been utilized the data furnished by the meteorological observatories, and such rainfall statements of the month as had been published by the Provincial Governments up to the date of the preparation of the review. The brief notes on solar, seismic and magnetic disturbances are supplied by the chief observatories in the Indian area.

For a statement of the methods adopted in recording and tabulating the data, for each of the elements of observation, reference should be made to the introductory portion of the review for January.

Summary of the chief features of the weather in India during the month.

2. In northern and central India the remarkably wet weather which had characterized November did not persist into December during which month little or no precipitation occurred except in Baluchistan, Kashmir and the North-West Frontier Province. In the Peninsula, on the other hand, conditions were more disturbed than usual, and the recorded rainfall was in many places either normal or above it.

The sky was unusually clear in the Punjab, upper Sind, Rajputana, the United Provinces, Bihar, the Surma valley and the northern and southern parts of Burma, but elsewhere the cloud proportion was higher than usual.

The absolute humidity was high in the Peninsula and the greater part of Burma, and low in northern India. The percentage of saturation equalled or exceeded the normal except in Gujarat, Sind, Rajputana, the southern Punjab and the west Himalayas.

Day temperature was slightly lower than usual in Baluchistan, Kashmir, the North-West Frontier Province, the United Provinces and Chota Nagpur, and night temperature in deltaic Bengal. On the other hand, temperature, both by day and by night, was appreciably above the normal in south Burma, Gujarat, the Konkan and the west of Central India and of the Central Provinces.

The mean 8 hrs. pressure over the plains of India was only ·002″ in defect, and the vertical gradient in north-west India departed but little from the normal value.

H. R.

Solar, seismic and magnetic disturbances.

KODAIKANAL OBSERVATORY.

3. *Solar observations.*—There were four days on which no solar observation was possible and four others on which there was no prominence record. On 7 days the latter was imperfect.

Sunspots.—Three new groups of spots were observed—all very small dots. The daily average was 0·6. The average life of a spot was 2·7 days. The latitudes of the 3 groups were —15°, —18°, and + 7°.

A very striking feature in the month was the appearance of faculæ in very high latitudes—between 50° and 70°—observed on the 16th and 17th.

Prominences.—Forty large, 2 eruptive and 3 metallic prominences were recorded during the month. The only one worth noting was an eruptive prominence recorded at the north-west limb on the 27th. It reached a height of 145″ at 11h. 44m.

Magnetic disturbances.—There was a "moderate" magnetic disturbance which continued from the 10th to the

12th, but nothing corresponding to it was observed on the sun.

KODAIKANAL OBSERVATORY.

Seismological records.

TABLE 1.

No.	Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maxima. G. M. T.	End. G.M. T.	Maximum amplitude.	Duration.	REMARKS.
	1911.	H. M.	H. M.	H. M.	H.M.	mm.	H. M.	
84	Dec. 2	?	4 31·3	4 32·0	4 41·7	0·6=0·2	0 10·4	Hour signal at 4h. 30m.
85	„ 7	0 22·8	...	0 25·9	1 14·9	0·4=0·2	0 52·1	
86	„ 7	15 05·2	...	...	15 16·5	...	0 11·3	Widening of line.
87	„ 11	11 06·2	11 10·1	11 13·2	13 22·8	2·2=0·8	2 16·6	
88	„ 13	9 03·2	...	...	9 29·7	...	0 26·5	Widening of line.
89	„ 13	23 08·3	...	...	23 44·3	...	0 36·0	Do.
90	„ 16	19 38·2	20 41·8	20 42·6 20 46·9	22 11·0	2·9=1·0 2·6 0·9	2 32·8	
91	„ 20	6 14·2	6 47·5	6 52·7	8 29·5	1·0=0·4	2 15 3	
92	„ 22	14 20·8	...	...	14 46·4	...	0 25·6	Widening of line.
93	„ 23	22 33·0	...	...	23 21·9	...	0 48·9	Do.
94	„ 29	16 22·9	...	...	16 55·9	...	0 33·0	Do.
95	„ 31	6 19·0	6 32·8	6 33·6	7 34·1	0·6=0·2	1 15·1	

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BOMBAY OBSERVATORY.

Alibag magnetic record.

4. During the month of December 1911, the traces showed 14 calm days, 16 days of small and 1 day of moderate disturbance.

The days of the month selected as quiet for the purposes of the Magnetic Survey of India are the 5th, 9th, 16th, 20th and 29th.

The following table represents the magnetic character of each day during the month :—

TABLE 2.

Day.	Character.	Day.	Character.	Day.	Character.	Day.	Character.
1	S	9	C	17	S	25	S
2	C	10	S	18	S	26	S
3	S	11	M	19	C	27	S
4	C	12	S	20	C	28	C
5	C	13	C	21	C	29	C
6	S	14	S	22	C	30	S
7	S	15	S	23	S	31	S
8	C	16	C	24	C		

C = calm; S = small; M = moderate; G = great; V. G. = very great.

The mean observed absolute values of the several magnetic elements reduced to the mean monthly tabulations of the magnetograms, as also the ranges and the summed ranges of the horizontal force and the declination for the month, are as follow :—

Easterly declination	0° 53′ 16.″
Horizontal force	0·36863 C. G. S. unit.
Vertical force	0·16281 „ „
Inclination	23° 49′·8.
Inclination (observed)	23° 50′·1.
Horizontal force range	0·00024 C. G. S. unit.
Horizontal force summed range	0·00123 „ „
Declination range	2′·0.
Declination summed range	9′·2.

(NOTE.—Summed range means sum without regard to signs of the 24 ordinates of the diurnal inequality.)

Seismic disturbances.

Six seismic disturbances were recorded during the month on the 11th, 13th, 16th, 20th, 29th and 31st.

TABLE 3.

Date.	Commencement.	Maximum.	End.	Maximum amplitude.	Duration.
1911.	H. M.	H. M.	H. M.	mm.	H. M.
December 11th	11 11·6	11 18·0	12 16·6	1·4	1 5·0
„ 13th	9 3·3	9 9·8	9 16·3	0·5	0 13·0
„ 16th	19 35·9	20 43·4	21 44·5	3·3	2 8·6
„ 20th	6 19·2	6 46·4	7 12·9	1·4	0 53·7
„ 29th	16 18·2	16 23·3	16 33·7	0·3	0 15·5
„ 31st	6 28·4	6 53·2	7 13·1	0·4	0 44·7

All times given above denote G. M. T.
Sensibility to tilt, 1 mm. = 0″·40.

N. A. F. MOOS,
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CALCUTTA OBSERVATORY.

5.—*List of displacements recorded by the Milne seismograph.*

TABLE 4.

Date.	P. T. Commencement. G. M. T.	L. W. Commencement. G. M. T.	Maximum. G. M. T.	End. G. M. T.	Duration.	Maximum displacement on trace from mean position.	REMARKS.
1911.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
December 2	4 10·6	4 41·1	4 43·6	4 53·8	0 43·2	0·75	
„ 4	15 16·4	15 18·4	15 22·0	15 35·7	0 19·3	0·75	
„ 7	14 57·0	...	14 57·0	15 7·2	0 10·2	4·00*	*Measured from base line.
„ 11	11 7·3	11 10·9	11 15·5	13 25·6	2 18·3	7·00*	

Date.	P. T. Commencement G. M. T.	L. W. Commencement G. M. T.	Maximum. G. M. T.	End G. M. T.	Duration.	Maximum displacement on trace from mean position.	REMARKS.
1911.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
December 13	8 56·1	9 0·8	9 8·8	9 48·0	0 51·9	1·75	*Measured from base line. †Ends in morning air tremor.
„ 16	19 37·0	20 29·4	20 46·7	? †	? †	4·50*	
„ 20	6 0·9	6 32·4	6 41·6	7 23·8	1 22·9	1·75	
„ 29	15 45·0	...	...	16 49·1	1 4·1	...	Thickening of line.
„ 31	6 23·4	...	6 47·3	7 36·1	1 12·7	0·75	

Sensibility 1 mm. =0·38″ of tilt.

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SIMLA OBSERVATORY.

6.—*List of earthquakes recorded by the Omori-Ewing seismographs.*

TABLE 5.

Date.		Beginning of 1st P. T.	Beginning of 2nd P. T.	Beginning of L. W.	Time of Max. amplitude.	End approx.	Duration.	Max. displacement of style.*	REMARKS.
		H. M.	H. M.	H. M.	H. M.	H. M.	H. M.	mm.	
2nd	A	19 46·4	19 47·4	19 48·5	19 48·6	19 55	0 9	Small	
	A	21 54·3	...	...	...	22 7	0 13	„	Tremors.
5th	A	17 43·8	17 47·5	17 53·3	17 55·3	?	?	„	End obscured by other disturbances.
7th	A	15 1·8	15 3·7	15 5·1	15 5·3	15 15	0 13	„	
	B	15 2·1	15 3·7	15 5·3	15 5·4	15 7	0 5	„	
11th	A	11 5·9	11 11·4	11 15·8	11 16·9	12 59	1 53	1·0	Apparently two shocks at an interval of a few minutes.
	B	?	11 11·6	11 15·9	11 18·6	?	?	2·0	End obscured by other disturbances.
13th	A	9 4·0	9 6·5	9 9·2	9 16·5	9 42	0 38	Small	
16th	A	14 11·2	...	...	14 11·3	14 12·3	0 1·1	„	Local.
	B	14 11·3	...	...	14 11·3	14 11·8	0 0·5	„	Do.
	A	19 54·6	19 53·4	20 17·8	20 24·9	?	?	3·6	End obscured by other disturbances.
	B	?	?	?	20 36·3	?	?	4·0	Phases obscured by other disturbances.
20th	A	6 1·8	6 11·2	6 26·9	6 38·7	7 5	1 3	0·6	
	B	?	?	?	6 28·4	?	?	2·5	Phases obscured by other disturbances.
24th	A	10 56·3	...	10 58·3	10 58·4	11 7	0 11	Small	
30th	A	9 35·3	...	9 37·0	9 37·4	9 45	0 10	„	
	B	9 35·1	...	9 37·5	9 37·6	9 42	0 7	„	
31st	A	6 17·6	...	6 26·8	6 27·1	6 56	0 38	0·3	

All times are given in G. M. T. B = N—S component.
A = E—W component. Magnification of each instrument was 15.
* Displacements less than 0·2 mm. are reported as "small."

The following table contains a list of earthquakes that have been reported :—

TABLE 6.

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity. Rossi-Forel scale.	No. of shocks.	REMARKS
		H. M.	Sec.			
Drosh . . .	1st	17 15	2	5	2	
„ . . .	1st	19 45	3	5	3	
Chitral . . .	2nd	1 35	5	5	1	
Drosh . . .	2nd	1 40	4	5	4	
„ . .	5th	17 45	4	5	3	
Chitral . .	5th	17 53	50	6	3	Three shocks. Time is approximate only
Midnapur . .	7th	14 30	2	6	2	
Raniganj . .	7th	14 55	3	7	4	
Shillong . .	7th	15 0	2	5	1	
Naya Dumka . .	7th	15 0	6	...	...	
Sirajganj . .	7th	15 0	3	...	...	Severe.
Bankipur . .	7th	15 0	3	...	...	
Berhampore . .	7th	15 1	30	7	2	
Drosh . . .	7th	16 40	5	5	4	
Shillong . .	7th	21 35	2	5	1	
Drosh . .	14th	16 15	10	5	5	
Jodhpur . .	16th	16 29	40	3	1	
Drosh . . .	16th	20 15	20	5	6	
„ . . .	19th	20 30	5	5	3	
„ . . .	19th	21 30	3	5	2	
„ . . .	19th	22 30	7	5	6	
„ . . .	20th	0 30	2	5	2	

Place at which felt.	Date.	G. M. T. of earthquake.	Duration.	Intensity. Rossi-Forel scale.	No. of shocks.	REMARKS.
		H. M.	Sec.			
Drosh . . .	25th	16 20	2	5	1	
Chitral . . .	25th	16 30	10	6	1	
Turbat . . .	30th	2 37	15	4	1	

Solar radiation.—The following figures give the intensity of solar radiation, as measured at Simla by Angstrom's pyrheliometer. The values are corrected to local noon, and expressed in grammecalories per square centimetre per minute:—

Maximum	1·51
Minimum	1·51
Mean	1·50
Number of days of observation . . .	4*

* (Pressure of work in Simla during December prevented proper attention to these measurements, and this accounts for the small number of days on which records were taken.)

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ROYAL ALFRED OBSERVATORY, MAURITIUS.

7. No information has been received.

Weather in the Indian monsoon region.

8. The only noteworthy feature of the weather in the equatorial regions was a marked deficiency of rainfall, indicating that the ascensional movement over that area was much less than usual.

TABLE 7.

——	Mauritius.	Zanzibar.	Seychelles.
Departure from normal of mean pressure.		—·011	—·013
Actual mean wind direction .		N 38° E	N 39° W
Normal mean wind direction .		N 35° E	N 44° W
Actual mean wind velocity (miles per diem).		123	140
Normal mean wind velocity (miles per diem).		151	150
Rainfall departure from normal .		—3·68	—7·36

H. R.

Depressions and cyclonic storms.

9. During the month under review several disturbances appeared in Persia, but of these only one produced precipitation of any consequence in north-west India. This began to affect stations in Persia on the 6th and caused a spell of rainy weather in that area during the next three days. Precipitation was reported from Baluchistan on the 10th and 11th and from the extreme north of India on 11th, 12th and 13th, but the amounts were by no means heavy. Barometrically the disturbance was indefinite throughout.

In connection with the abnormally dry weather experienced in northwest India and the highlands to the west it is interesting to note that in Europe also the meteorological conditions during December were of an extraordinary character. Thus according to London reports while an uninterrupted succession of depressions affected the British Isles making December the most disturbed, the wettest and the stormiest month of the whole year, high pressure systems were found over Continental countries between Russia and the Spanish Peninsula.

No storms were developed over the Indian seas, although during the first five days of the month a marked tendency to the establishment of cyclonic conditions was shown in the southwest of the Bay.

H. R.

Pressure.

10. On the mean of the month the barometer read lower than usual in Burma, Madras excluding Ganjam, Mysore, Hyderabad, the Bombay Deccan, the Konkan, Gujarat, Rajputana, the North-West Frontier Province and the submontane districts from Bareilly to Sibsagar. The defect was most marked in the centre of Burma, and on the coast of the Peninsula extending from Veraval to Cuddalore in which areas it ranged between ·02″ and ·045″. Over

the rest of the plains barometric pressure was slightly in excess of the normal.

On the average of all the observing stations in the plains of India atmospheric pressure differed but little from the normal, being only ·002″ in defect.

TABLE 8.

DIVISION.	Departure from normal of mean 8 hrs. pressure.
	″
Burma	—·017
Eastern Bengal and Assam	—·002
Bengal	+·012
United Provinces	+·007
Punjab	+·009
North-West Frontier Province	—·007
Sind	+·007
Rajputana	—·003
Bombay	—·013
Central India	+·003
Central Provinces	+·002
Hyderabad	—·003
Mysore	—·006
Madras	—·013

The vertical distribution was on the whole very nearly normal in north-west India and the south of the Peninsula, but in north-east India the vertical gradient was considerably steeper than usual.

TABLE 9.

HILL STATION.	Departure from normal pressure. A	PLAIN STATION.	Departure from normal pressure. B	Departure of pressure difference. B—A.
	″		″	″
Quetta	+·014	Jacobabad	+·015	+·001
Leh	—·034	Lahore	+·004	+·038
Murree	—·010	Peshawar	—·008	+·002
Simla	—·001	Ludhiana	+·017	+·018
Chakrata	+·016	Roorkee	+·021	+·005
Darjiling	—·047	Dhubri	0	+·047
Mount Abu	+·009	Deesa	—·017	—·026
Pachmarhi	+·020	Khandwa	+·004	—·016
Kodaikanal	—·001	Madura	—·001	0

The vertical distribution had thus altered considerably since November, in which month a marked defect of pressure prevailed at the level of the hill stations in northern India, relatively to the neighbouring plains.

H. R.

Temperature.

11. Over the region lying between Assam and Baluchistan, notwithstanding the prevalence of very dry clear weather, temperature, both by day and by night, was unduly low. The deficit, although not large in amount, persisted through the greater part of the month, and was in part at least due to the abnormally heavy precipitation of November.

In the remainder of India proper temperature was more or less above the average; but the excess was very small in amount except in the area comprising Gujarat, the Konkan, the west Deccan, and the western districts of Central India and of the Central Provinces where both day and night temperatures were between 2° and 6° higher than usual.

In Burma temperature throughout the 24 hours was about 3° above the normal in the coast districts from Mergui to Bassein, and normal elsewhere.

No marked hot or cool waves were recorded during the month in northern India.

TABLE 10.

SUB-DIVISION.	ACTUAL TEMPERATURE.					DEPARTURE FROM NORMAL OF		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
1. Bay Islands	85·6	78·1	81·9	7·5	13·3	0	+1·1	—1·1
2. Lower Burma	86·8	68·3	77·6	18·5	27·5	+2·0	+1·8	+0·2

Sub-division.	Actual temperature.					Departure from normal of.		
	Mean maximum.	Mean minimum.	Monthly mean of mean between maximum and minimum.	Mean daily range of temperature.	Absolute range during month.	Maximum.	Minimum.	Daily range.
	°	°	°	°	°	°	°	°
3. Upper Burma	82·3	57·3	69·8	25·0	35·6	+0·7	+0·9	—0·2
4. Assam	73·2	51·2	62·2	22·0	30·4	—1·4	—1·9	+0·5
5. Eastern Bengal	75·6	53·2	64·4	22·5	32·1	—1·0	—1·7	+0·7
6. Bengal	76·2	52·9	64·6	23·3	32·5	—1·3	—2·7	+1·4
7. Orissa	79·1	56·5	67·8	22·6	33·4	—1·3	—0·5	—0·8
8. Chota Nagpur	73·8	49·6	61·7	24·2	33·8	—2·4	—0·9	—1·5
9. Bihar	73·2	49·2	61·2	24·0	32·6	—1·9	—2·6	+0·7
10. United Provinces, East	72·9	46·2	59·5	26·7	36·3	—2·4	—1·8	—0·6
11. Do., West	72·4	45·6	59·0	26·8	37·1	—2·0	—2·1	+0·1
12. Punjab, East and North	70·5	41·5	56·0	29·0	36·9	—1·4	—0·9	—0·5
13. Do., South-west	72·1	42·8	57·5	29·3	36·9	—0·7	—0·3	—0·4
14. Kashmir	41·3	20·1	30·7	21·3	36·8	—2·1	—0·8	—1·3
15. North-West Frontier Province	68·0	39·9	53·9	28·1	37·5	—2·0	+0·4	—2·4
16. Baluchistan	65·0	40·5	52·8	24·5	40·6	—2·5	—1·9	—0·6
17. Sind	78·0	51·7	64·8	26·3	35·8	—0·3	—0·4	+0·1
18. Rajputana, West	78·9	50·2	64·5	28·7	36·3	+1·6	+0·3	+1·3
19. Do., East	77·7	50·6	64·1	27·2	38·3	—0·1	+0·9	—1·0
20. Gujarat	87·6	60·0	73·8	27·6	38·4	+3·3	+3·2	+0·1
21. Central India, West	81·9	53·9	67·9	28·1	40·5	+3·1	+4·5	—1·4
22. Do., East	73·8	47·1	60·5	26·7	37·7	—1·3	+0·4	—1·7
23. Berar	83·1	57·9	70·5	25·2	34·8	+1·1	+3·3	—2·2
24. Central Provinces, West	79·5	52·7	66·1	26·8	38·7	+0·3	+2·0	—1·7
25. Do., East	77·8	52·9	65·3	24·9	39·5	—0·3	+1·4	—1·7
26. Konkan	88·1	71·6	79·8	16·4	24·7	+1·0	+3·1	—2·1
27. Bombay Deccan	84·7	59·1	71·9	25·7	34·4	+1·0	+4·4	—3·4
28. Hyderabad, North	83·5	58·5	71·0	25·0	34·3	+0·1	+2·8	—2·7
29. Do., South	84·4	61·8	73·1	22·6	33·5	+0·4	+2·0	—1·6
30. Mysore	80·7	61·4	71·1	19·3	30·3	+0·6	+2·7	—2·1
31. Malabar	86·7	73·5	80·1	13·1	21·0	—0·7	+2·5	—3·2
32. Madras, South-east	83·4	70·7	77·0	12·7	24·2	—0·6	+1·2	—1·8
33. Do., Deccan	87·6	64·3	76·0	23·2	35·6	+1·1	+2·6	—1·5
34. Do. Coast, North	80·6	66·2	73·4	14·4	24·3	—1·3	+1·1	—2·4

TABLE 11.

DIVISION.	DEPARTURE FROM NORMAL OF		
	Mean maximum temperature.	Mean minimum temperature.	Mean temperature.
	°	°	°
Burma	+1·6	+1·5	+1·5
Eastern Bengal and Assam	—1·1	—1·7	—1·4
Bengal	—1·7	—1·8	—1·8
United Provinces	—2·3	—1·9	—2·1
Punjab	—1·2	—0·7	—0·9
North-West Frontier Province	—2·0	+0·4	—0·8
Sind	—0·2	—0·4	—0·3
Rajputana	+0·3	+0·8	+0·5
Bombay	+1·8	+3·6	+2·7
Central India	+0·9	+2·4	+1·6
Central Provinces	+0·3	+2·2	+1·3
Hyderabad	+0·3	+2·3	+1·3
Mysore	+0·6	+2·7	+1·7
Madras	—0·5	+1·6	+0·6

H. R.

Winds.

12. Winds were neither so steady nor so strong as usual in Burma, Eastern Bengal and the United Provinces. In Rajputana, Sind and Hyderabad the air movement was of about the average strength and was very steady in direction.

As in November, the westerly component in the mean wind direction on the north Madras coast was either very weak or altogether suppressed.

TABLE 12.

DIVISION.	DEPARTURE FROM NORMAL OF	
	Hourly wind velocity.	Wind steadiness.
Burma	—0·6	— 7
Eastern Bengal and Assam	—0·8	—13
Bengal	+0·1	— 3
United Provinces	—0·4	— 6
Punjab	0	+ 8
North-West Frontier Province	—0·3	0
Sind	—0·6	+10
Rajputana	+0·2	+19
Bombay	+0·2	+ 5
Central India	—0·9	+ 3
Central Provinces	+0·5	+ 6
Hyderabad	—0·5	+13
Mysore	+0·7	+ 1
Madras	+0·7	— 3

H. R.

Humidity and cloud.

13. On the mean of the month the air was distinctly dry, both absolutely and relatively, in Kathiawar, Sind, Rajputana, the southern parts of the Punjab, the western Himalayas and the deltaic portion of Eastern Bengal; while the opposite condition prevailed in Central India, the greater part of the Peninsula and south Burma. In Bihar and

Chota Nagpur where there was a depression of temperature, the relative humidity was high notwithstanding that the absolute humidity was if anything below the normal.

The distribution of cloud followed that of absolute humidity closely. Cloud was in excess almost everywhere except in upper Sind, the Punjab, the United Provinces, Bihar, the Surma valley and the extreme north and south Burma. The greatest excess occurred on the east coast of the Peninsula from False Point to Masulipatam, in Mysore, and along the Malabar coast: it was equal to about four-tenths of the whole sky area.

TABLE 13.

Division.	Hygrometry, 8 hrs.				Cloud.	
	Mean humidity.	Departure from normal.	Mean vapour tension in inches of mercury.	Departure from normal in inches of mercury.	Mean cloud amount at 8 hrs.	Departure from normal.
	%					
Burma . . .	84	+ 1	·593	+·036	3·1	—0·1
Eastern Bengal and Assam.	89	—1	·427	—·037	2·0	+0·2
Bengal . . .	81	+ 2	·380	—·022	1·8	+0·9
United Provinces .	78	+ 1	·307	—·015	1·0	—0·5
Punjab . .	72	0	·227	—·017	1·9	—0·9
North-West Frontier Province.	75	+ 4	·211	0	4·0	+0·8
Sind	51	— 8	·243	—·036	2·2	—0·2
Rajputana . . .	50	— 9	·218	—·051	1·6	—0·6
Bombay . . .	54	— 5	·402	+·002	2·6	+1·2
Central India . .	66	+ 3	·317	+·020	2·5	+1·3
Central Provinces .	66	+ 3	·352	+·013	2·2	+0·6
Hyderabad . . .	61	— 2	·423	+·009	3·5	+1·5
Mysore . . .	81	+ 8	·541	+·061	6·0	+2·5
Madras . . .	82	+ 4	·679	+·037	5·5	+1·8

H. R.

Rainfall.

14. Little or no rain fell in Burma, north-east India, the United Provinces, the Punjab, Sind, Rajputana, Gujarat, Central India and the Central Provinces; but as the normal fall of December is less than half an inch in most of these areas, the deficit was not large in absolute amount. Many falls occurred in the North-West Frontier Province, Kashmir and Baluchistan, but only in the first-named area did the month's aggregate reach the normal value. In the Peninsula, on the other hand, the month's rainfall was in excess of the normal except in Hyderabad, Mysore and the Madras Deccan. The excess was greatest actually in Madras South-east (1½″ or 39 per cent.) and by percentage comparison with the normal in the Konkan (143 per cent.)

TABLE 14.

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			″	″	″	
1. Bay Islands	5·0	5·2	5·13	4·27	+0·86	+ 20
2. Lower Burma	0·1	0·3	0·03	0·16	—0·13	— 81
3. Upper do.	0	0·7	0·01	0·35	—0·34	— 97

Sub-division.	Number of rainy days.		Rainfall.			
	Actual.	Normal.	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
			"	"	"	
4. Assam	0·4	0·8	0·13	0·36	−0·23	− 64
5. Eastern Bengal	0	0·3	0	0·19	−0·19	−100
6. Bengal	0	0·2	0	0·12	−0·12	−100
7. Orissa	0·1	0·4	0·01	0·23	−0·22	− 96
8 Chota Nagpur	0	0·3	0	0·20	−0·20	−100
9. Bihar	0	0·3	0	0·12	−0·12	−100
10. United Provinces, East	0	0·6	0·01	0·29	−0·28	− 97
11. Do., West	0·1	0·9	0·02	0·45	−0·43	− 96
12. Punjab, East and North	0·1	0·9	0·02	0·52	−0·50	− 96
13. Punjab, South-west	0·1	0·5	0·02	0·22	−0·20	− 91
14. Kashmir	1·8	2·8	0·76	1·34	−0·58	− 43
15. North-West Frontier Province	0·9	0·9	0·50	0·48	+0·02	+ 4
16. Baluchistan	0·7	2·2	0·26	0·96	−0·70	− 73
17. Sind	0	0·3	0	0·11	−0·11	−100
18. Rajputana, West	0	0·4	0	0·15	−0·15	−100
19. Do., East	0	0·9	0·01	0·40	−0·39	− 97
20. Gujarat	0	0·1	0·01	0·05	−0·04	− 80
21. Central India, West	0	0·9	0	0·37	−0·37	−100
22. Do., East	0	0·9	0	0·45	−0·45	−100
23. Berar	0	0·4	0	0·29	−0·29	−100
24. Central Provinces, West	0	0·6	0	0·36	−0·36	−100
25. Do., East	0	0·4	0	0·23	−0·23	−100
26. Konkan	0·3	0·2	0·17	0·07	+0·10	+143
27. Bombay Deccan	0·5	0·4	0·27	0·22	+0·05	+ 23
28. Hyderabad, North	0·1	0·7	0·03	0·41	−0·38	− 93
29. Do., South	0·3	0·3	0·18	0·18	0	0
30. Mysore	0·9	0·7	0·28	0·38	−0·10	− 26
31. Malabar	2·7	1·7	1·83	1·20	+0·63	+ 53
32. Madras, South-east	7·4	4·7	5·69	4·09	+1·60	+ 39
33. Do., Deccan	0·9	0·7	0·35	0·41	−0·06	− 15
34. Do. Coast, North	2·1	1·0	1·27	0·84	+0·43	+ 51

TABLE 15.

DIVISION.	RAINFALL.			
	Actual.	Normal.	Departure from normal.	Percentage departure from normal.
	"	"	"	
Burma	0·02	0·26	−0·24	− 92
Eastern Bengal and Assam	0·07	0·27	−0·20	− 74
Bengal	0	0·15	−0·15	−100
United Provinces	0·01	0·37	−0·36	− 97
Punjab	0·02	0·46	−0·44	− 96
North-West Frontier Province	0·50	0·48	+0·02	+ 4
Sind	0	0·11	−0·11	−100
Rajputana	0·01	0·33	−0·32	− 97
Bombay	0·17	0·14	+0·03	+ 21
Central India	0	0·40	−0·40	−100
Central Provinces	0	0·30	−0·30	−100
Hyderabad	0·11	0·29	−0·18	− 62
Mysore	0·28	0·38	−0·10	− 26
Madras	3·37	2·41	+0·96	+ 40
Mean of India	0·37	0·49	−0·12	− 24

H. R.

Snowfall.

I.—AFGHANISTAN.

15. Snow-storms occurred in Kabul and the surrounding hills on the 8th, 10th, 11th, 19th and 24th. The following is a statement of the total falls recorded during the month and of the accumulations existing on the 31st in the various localities :—

TABLE 16.

LOCALITY.	Total snowfall during the month.		Depth of accumulation at the end of the month.
	Ft.	In.	Feet.
Paghman range	3	3	2
Koh Killa Qazi	3	11	1
Koh Shakar Dara	8	0	2
Koh Hazara Jat	5	9	3
Koh Kohistan	...	...	1½
Koh Turkistan	...	...	4
Koh Baba range	4	6	...
Koh Kabul	4	7	...

II.—NORTH-WEST FRONTIER PROVINCE.

(*a*) *Wano.*—The statement below shows the character of snowfall on the surrounding hills :—

TABLE 17.

LOCALITY.	Elevation.	Number of falls.	Total amount of snowfall.	
	ft.		Ft.	In.
Marwatti	11,000	3	0	11
Pirghal	11,000	4	1	0
Jani Mela	9,000	3	0	9
Kundighar	9,000	1	0	5
Kotkun	7,900	1	0	5

At the end of the month the unmelted residue on the highest peaks measured only 4 inches in depth.

(*b*) *Dera Ismail Khan.*—Ubashta received 8½ feet of snow during the period 21st to 31st, and the Takht-i-Suleman 4 feet on the 30th and 31st. The statement below shows the depth of the unmelted residue on the 31st on the various peaks :—

TABLE 18.

NAME OF PEAK.	Reported depth of accumulation on the 31st.
	Feet.
Takht-i-Suleman	4
Kharghoza	2
Ubashta	4½
Chesanghar	1
Marmand	2
Zmaraighar or Turghar	2
Naveteza	1

(*c*) *Kurram.*—There were in all nine falls on the Sufed Koh. On four occasions the snow line descended to the level of Parachinar and on two even lower.

(*d*) *Kohat.*—Snow varying in depth from 6 inches to 1½ feet was received on the 11th on the Samalzai hills and the Samana range.

(*e*) *Chitral.*—On the 11th there were about 3 inches of snow in Chitral itself and about 2 feet on the surrounding heights.

(*f*) *Hazara.*—At Panjul (elevation 6,500 feet) snow fell on four days to a total depth of 5½ feet. At the end of the month the accumulations on the higher peaks of the Siran range were estimated at 5½ feet.

III.—KASHMIR.

The statement below shows the character of snowfall in this area :—

TABLE 19.

Locality.	Number of days on which snow fell.	Aggregate amount of snowfall.		Approximate depth of unmelted residue at the end of month.	
		Ft.	In.	Ft.	In.
Hills surrounding Kargil . .	9	8	0	5	0
Kargil	9	1	0	...	
Srinagar	3	0	5	...	
Skardu	9	0	2½	Not reported.	
Dras	...	2	Nearly	,,	

IV.—PUNJAB.

Kilba (Simla Hills).—There was only one fall during the month, *viz.*, on the 12th. All the passes were closed.

V.—UNITED PROVINCES.

Almora.—The aggregate fall received during the month amounted to 8¾ feet in Byans, 4½ feet in Malla Darma, 3½ feet in Chaudas and about 1½ feet in Malla Danpur and Malla Johar.

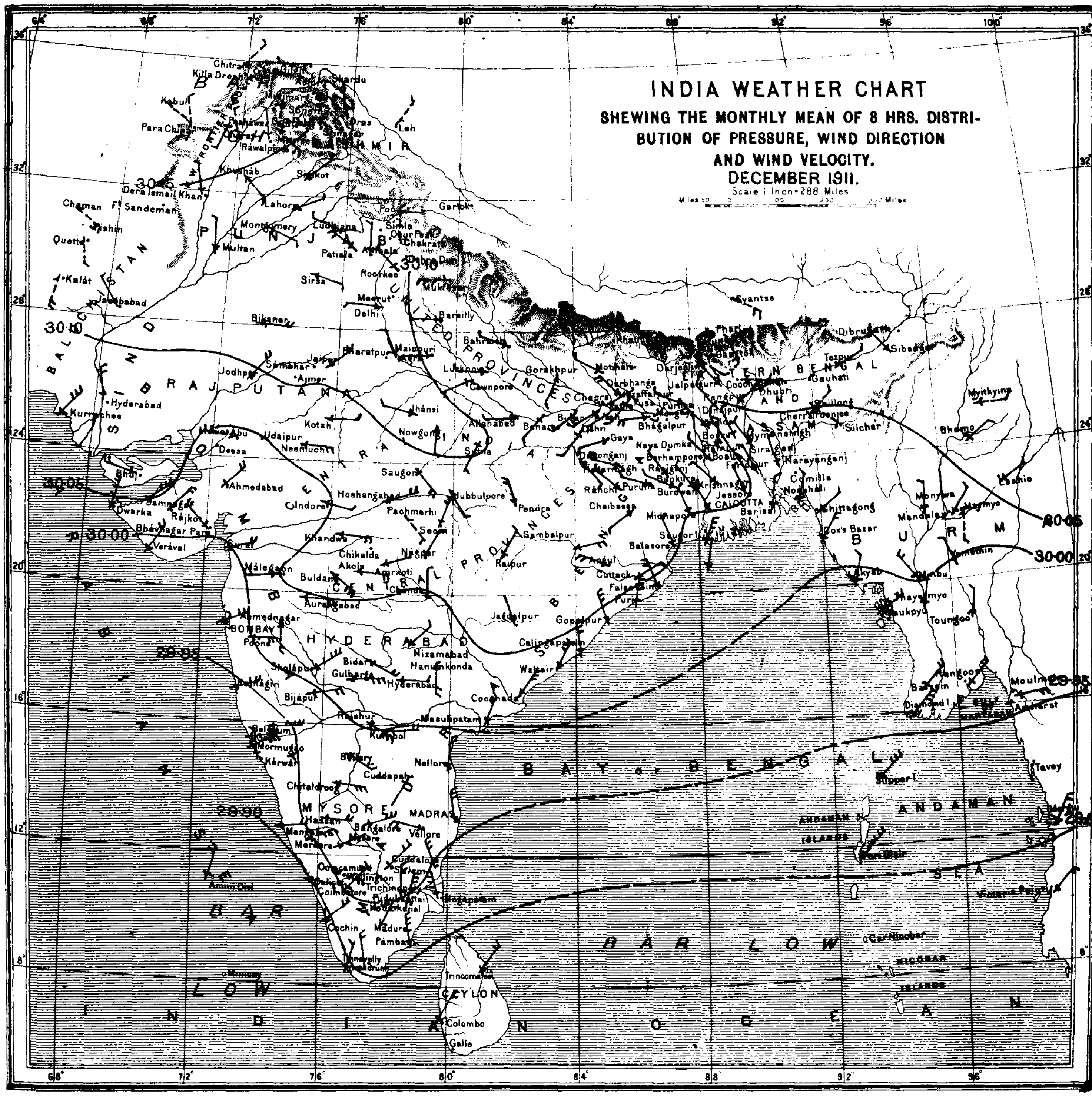
TABLE 20.

NAME OF PASS.	Depth of accumulation at the end of the month.	
	Reported.	Normal.
	Feet.	Feet.
Nuwe Pass	40	33
Binkaru ,, ...	12	26
Lipulekh ,, ...	16	5
Lampia ,, ...	18	3
Untadhura ,, ...	7	11½
Ralamdhura ,, ...	6	9

SUMMARY.

16. So far as can be judged from the scanty information received up to the present, the snowfall of the month over the greater part of the mountain zone bordering upper India was below the normal.

H. R.



Reg. No. 4176 E., 11.—Z.—1,250.
Reg. No. 4195 E., 11.—Z.—3,800
LITHO. BY S. S. MUNDLE.

The lines of the above chart represent isobars or lines of equal barometric pressure, the numbers attached indicating the barometric pressure in inches and being drawn for differences of pressure of ·05 inch. The isobars in the Bay of Bengal are filled in by means of the shore observations, and by comparison with the normal distribution of pressure.

The mean 8 hrs. wind directions of the month are shewn by means of arrows flying with the wind, and are calculated by means of Lambert's formula applied to the winds as given in Table B of the 8 hrs. observations. The mean wind directions for the hill stations are indicated by broken arrows to distinguish them from the wind arrows for the plain stations. The mean velocity of the winds during the month is shewn by the following notation:—

Velocity of	**0 to 2 miles per hour**	**...**	**one feather added to the wind arrow.**
" "	**2 to 5 " " "**	**...**	**two feathers " " " "**
" "	**5 to 10 " " "**	**...**	**three " " " " "**
" "	**10 to 20 " " "**	**...**	**four " " " " "**
	over 20 " " "	**...**	**five " " " " "**

Reg. No. 4176 E., 11.—Z.—1,350.
Reg. No. 4196 E., 11.—Z.—3,500
LITHO. BY S.B. MUNDLE.

The chart shows the departure from normal of the mean during the month of 8 hrs. pressure by means of lines drawn for equal amounts of departure. The numbers are given in thousandths of an inch, 20 representing ·020″ or two hundredths of an inch, &c. Continuous lines indicate that the pressure was in excess by amounts indicated by the numbers attached to the lines, and broken or dotted lines that it was in defect by amounts indicated by the numbers attached to the lines. Two parallel lines near to each other, one continuous and the other broken or dotted, represent the line of no departure, the dotted line facing the area of deficient pressure or negative departures.

CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MAXIMUM TEMPERATURE.

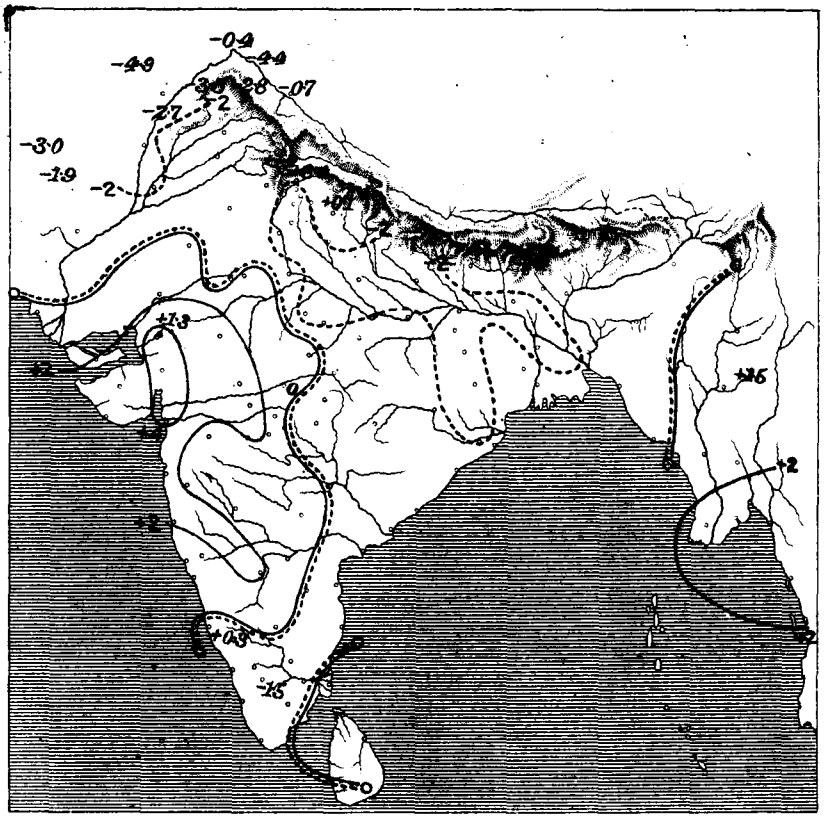


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MINIMUM TEMPERATURE.

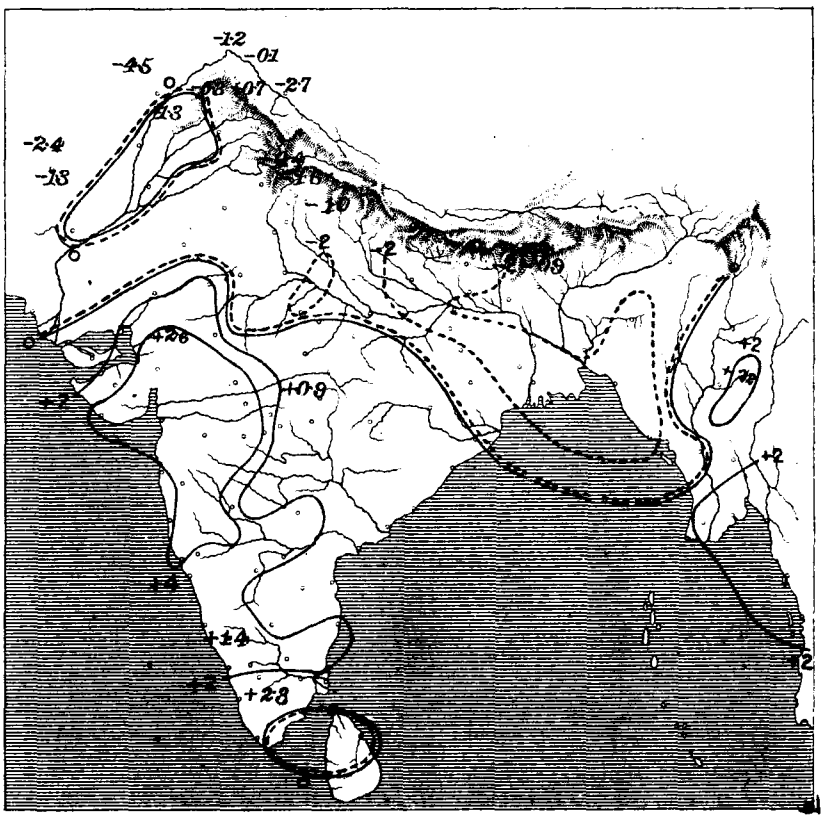


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF DAILY
MEAN TEMPERATURE.

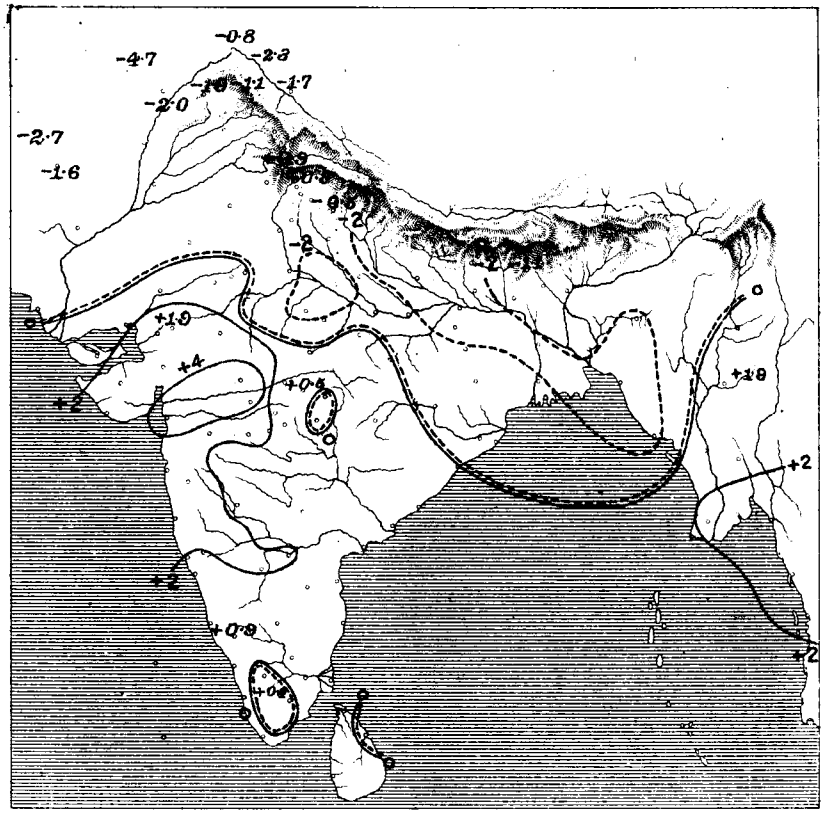


CHART SHEWING THE MONTHLY MEAN OF
PRESSURE AND RESULTANT
WIND DIRECTION.

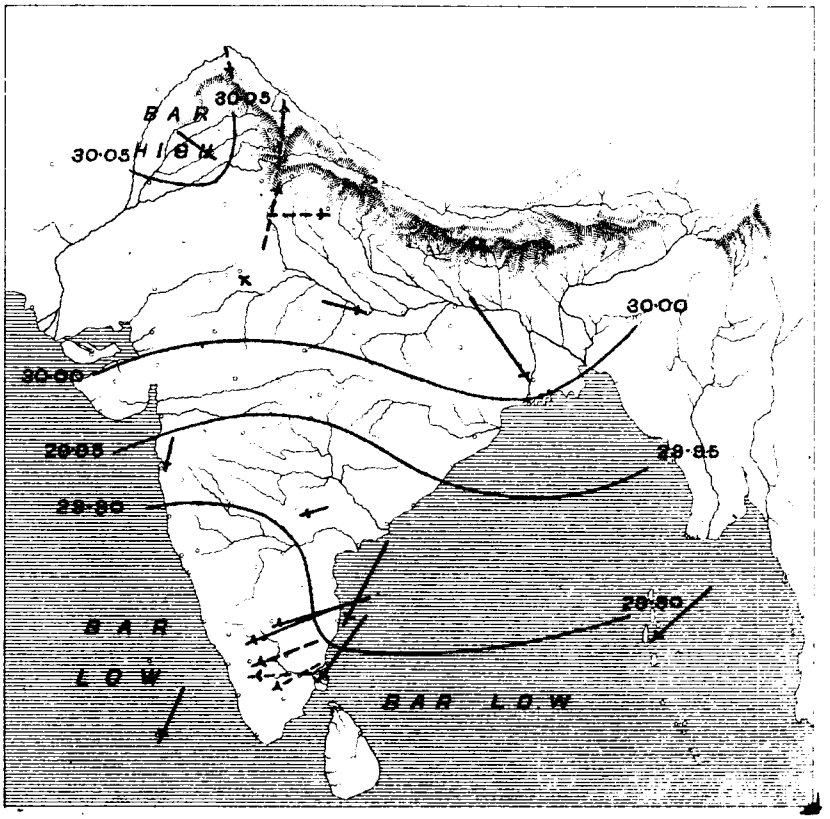


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF ABSOLUTE
HUMIDITY AT 8 HRS.

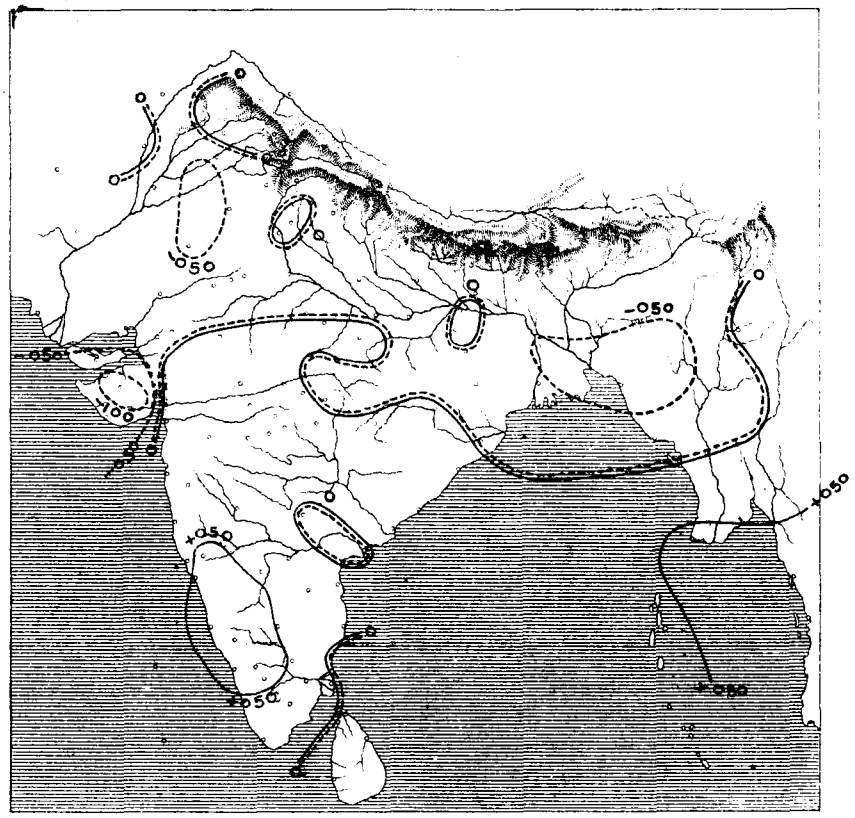


CHART SHEWING THE DEPARTURE FROM NORMAL
OF THE MONTHLY MEAN OF RELATIVE
HUMIDITY AT 8 HRS.

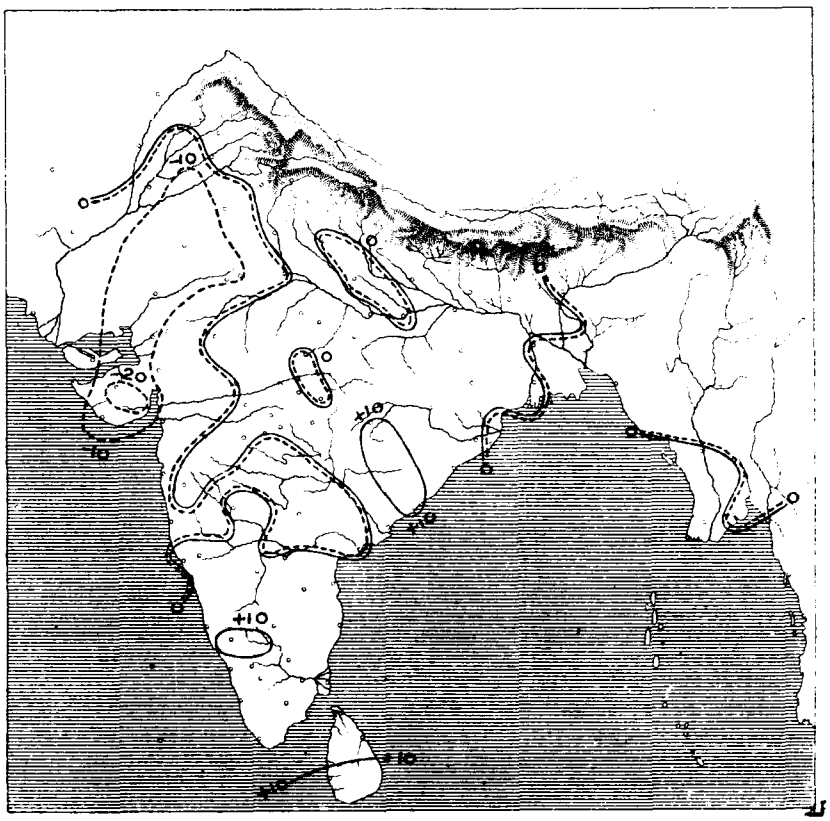


CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

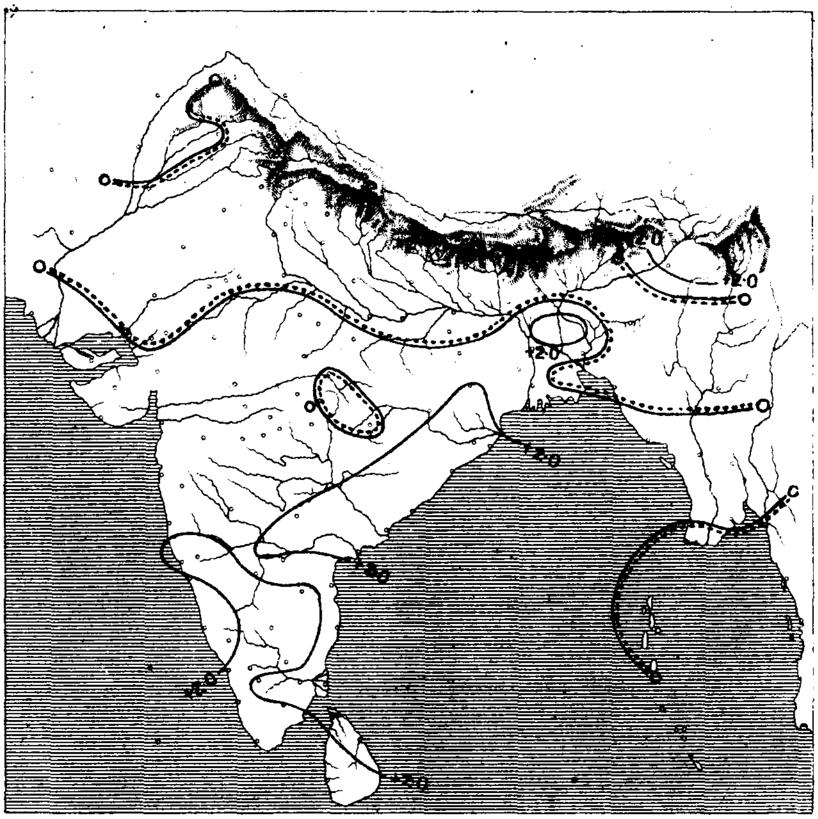
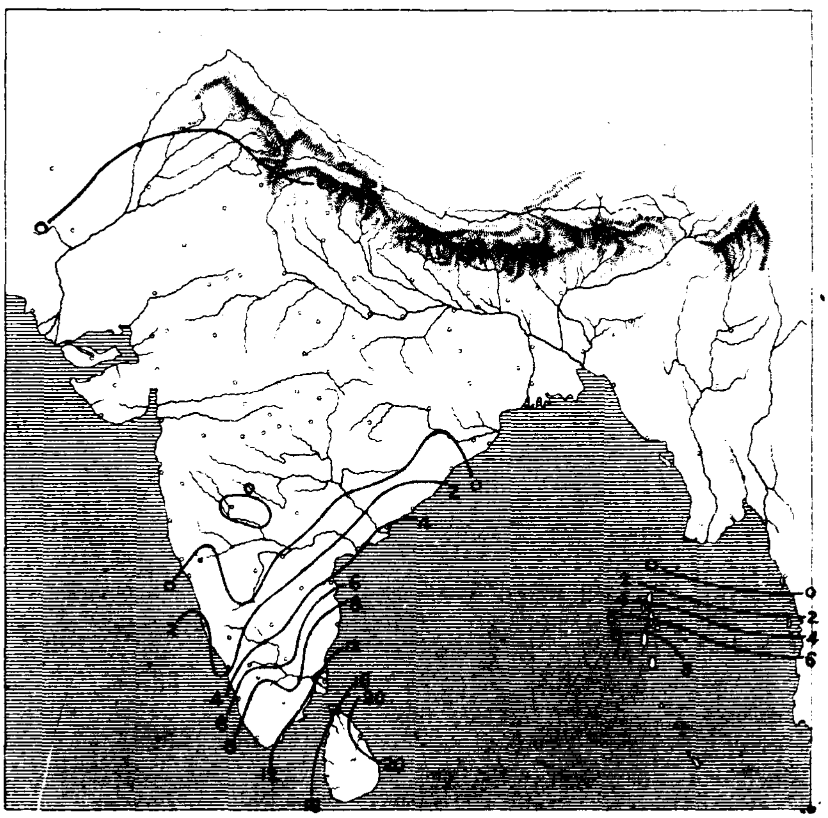
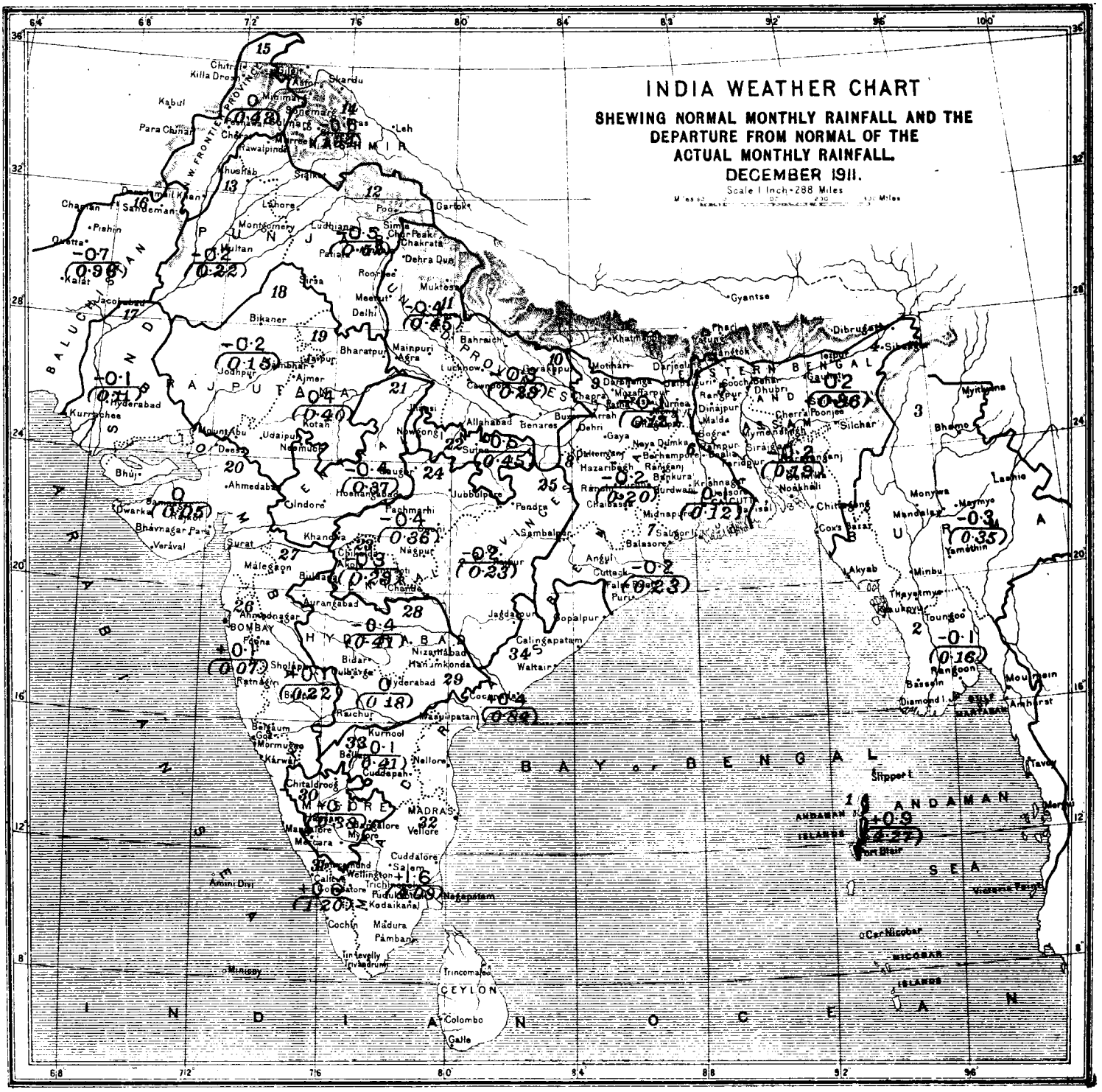


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)





Reg. No. 4176 E., 11.—Z.—1,250.

Reg. No 4196 E., 11.—Z.—3,800

The country is divided into 34 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall; the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Eastern Bengal
6. Bengal
7. Orissa
8. Chota Nagpur
9. Bihar
10. United Provinces, East
11. Do., West
12. Punjab, East and North
13. Do., Southwest
14. Kashmir
15. Northwest Frontier Province
16. Baluchistan
17. Sind
18. Rajputana, West
19. Rajputana, East
20. Gujarat
21. Central India, West
22. Do., East
23. Berar
24. Central Provinces, West
25. Do., East
26. Konkan
27. Bombay, Deccan
28. Hyderabad, North
29. Do., South
30. Mysore
31. Malabar
32. Madras, Southeast
33. Madras, Deccan
34. Madras Coast, North

CHART SHEWING THE DEPARTURE FROM NORMAL OF THE MONTHLY MEAN OF CLOUD AMOUNT AT 8 HRS.

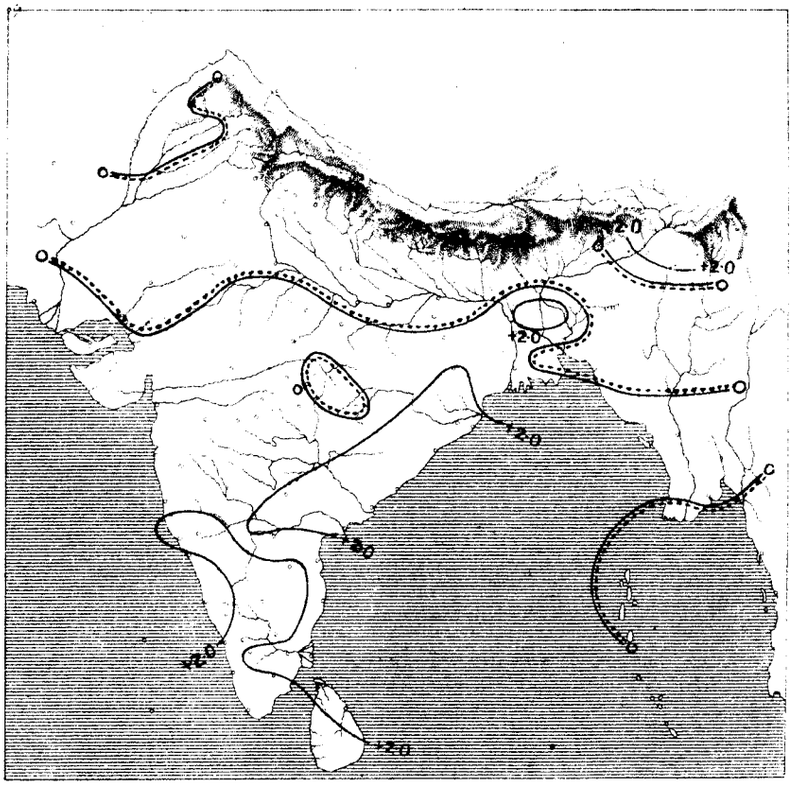
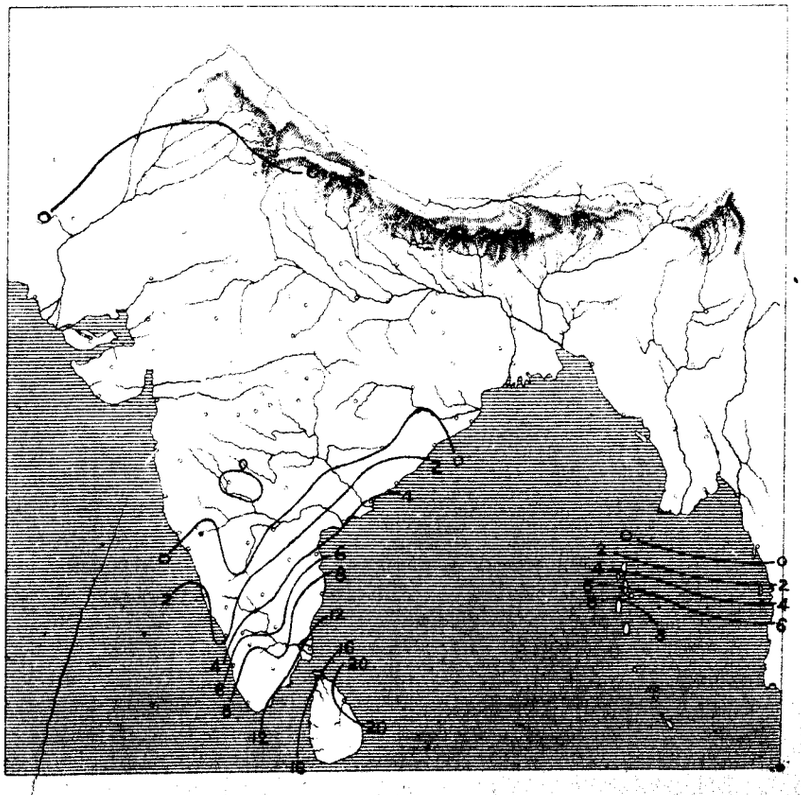


CHART SHEWING THE TOTAL NUMBER OF DAYS IN THE MONTH ON WHICH RAINFALL EQUALLED OR EXCEEDED 0·10 INCH.

(BASED ON THE RETURNS OF TABLE B.)



Reg. No. 4176 E., 11.—2.—1,250.

Reg. No 4196 E., 11.—2.—3,800

The country is divided into 34 areas as shewn in the list below. The numbers in that list correspond with the red numbers on the chart, and serve to identify the areas. The numbers in brackets on the chart give the average over the divisions of the normal monthly rainfall; the numbers above these give the departures from normal of the average actual rainfall over the divisions.

1. Bay Islands
2. Lower Burma
3. Upper Burma
4. Assam
5. Eastern Bengal
6. Bengal
7. Orissa
8. Chota Nagpur
9. Bihar
10. United Provinces: East
11. Do., West
12. Punjab, East and North
13. Do., Southwest
14. Kashmir
15. Northwest Frontier Province
16. Baluchistan
17. Sind
18. Rajputana, West
19. Rajputana, East
20. Gujarat
21. Central India, West
22. Do., East
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24. Central Provinces, West
25. Do., East
26. Konkan
27. Bombay, Deccan
28. Hyderabad, North
29. Do., South
30. Mysore
31. Malabar
32. Madras, Southeast
33. Madras, Deccan
34. Madras Coast, North