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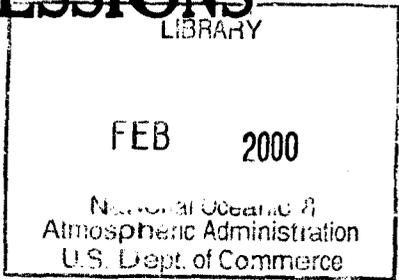
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GOVERNMENT OF INDIA
METEOROLOGICAL DEPARTMENT

INDIA WEATHER REVIEW, 1938

ANNUAL SUMMARY

PART C
STORMS AND DEPRESSIONS



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C. W. B. Normand, M.A., D.Sc., C.I.E.,

Director General of Observatories



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INDIA WEATHER REVIEW, 1938.

ANNUAL SUMMARY.

PART C.

STORMS AND DEPRESSIONS.

DEPRESSIONS AND CYCLONIC STORMS.

During the year three storms and five depressions formed in the Bay of Bengal, one storm and one depression in the Arabian Sea and one depression over Bengal. The dates on which the storms occurred and the greatest barometric depths observed are summarised in the Table below :—

Locality.	Month.	Date.	Greatest observed barometric depth.
Bay of Bengal . . .	October . . .	5th—14th	1.25"
Do.	November . . .	4th—12th	0.40"
Arabian Sea	Do.	5th—9th	0.75"
Bay of Bengal . . .	Do.	19th—26th	0.72"

The detailed descriptions of these storms and depressions are, as usual, followed by a list of western disturbances of the year, of the more important local storms and of the localities in which winds of force 9 or more were experienced by ships in the Indian Seas.

1. Depression of 20th to 26th March 1938 in the Bay of Bengal.—Pressure fell in the south Bay of Bengal on the 18th and 19th March and conditions became unsettled in the southwest Bay, to the east-southeast of Ceylon, by the evening of the 19th. By the morning of the 20th

a depression had formed with centre near Lat. $7\frac{1}{2}^{\circ}$ N., Long. $84\frac{1}{2}^{\circ}$ E. The depression moved west-northwestwards and was centred at 8 hrs. on the 21st near Lat. $8\frac{1}{2}^{\circ}$ N., Long. $81\frac{1}{2}^{\circ}$ E. Thereafter it began to weaken and at 8 hrs. on the 22nd lay as a shallow low pressure area off the Coromandel coast. While disturbed conditions persisted off the Coromandel coast for another 24 hours and died down later, a wave of low pressure moved in a northwesterly direction across the Peninsula and entered into the sea off the Konkan coast on the morning of the 25th. It then recurved and filled up by the 27th over Kathiawar.

This depression caused fairly widespread thundershowers in and around southeast Madras between the 21st and 24th. Fairly widespread thundershowers occurred also in Mysore and the Deccan on the 24th and the south Bombay Deccan and the southwest Central Provinces on the 25th.

2. Depression of 24th to 30th May 1938 in the Bay of Bengal.—The southwest monsoon was advancing into the north Bay between the 17th and 22nd. On the evening of the 22nd pressure fell rapidly over the Andaman Sea and on the morning of the 23rd there was a comparatively larger fall of pressure over the north Bay of Bengal. The upper winds over the head of the Bay also indicated a cyclonic circulation over this region up to 2 kms.

By the next morning conditions were unsettled in the north Bay of Bengal, as indicated by the observations from Sandheads and the following ships :—

Date.	Hr. of Obsn.	Name of Ship or Station.	POSITION.		WIND.		Sea.	Swell.	REMARKS.
			Lat. N.	Long. E.	Dir.	Force (B. S.)			
24th May .	0800 L. T. .	Sandheads . . .	..	..	ESE	2	Smooth .	Low swell, long .	..
	0800 L. T. .	<i>S. S. City of New Castle.</i>	19.7	87.2	NW	5	Mod. .	Mod. . . . .	..
	0800 L. T. .	<i>S. S. Binfield</i> .	17.8	86.9	SW	4	Mod. .	Mod. from SW. .	..
	0800 L. T. .	<i>S. S. Bahadur</i> .	19.1	87.4	W	3	Slight .	Low swell, long, from SW.	..
	0800 L. T. .	<i>S. S. Winkfield</i> .	18.6	90.8	SW/S	4	Mod. .	Mod. from S. .	Squally.

The unsettled conditions developed into a depression and was centred at 8 hrs. on the 25th within half a degree of

Lat. $20\frac{1}{2}^{\circ}$ N., Long. $89\frac{1}{2}^{\circ}$ E. The following observations from coast stations and ships are significant in this connection :—

Date.	Hr. of Obsn.	Name of Ship or Station.	POSITION.		WIND.		Sea.	Swell.	REMARKS.
			Lat. N.	Long. E.	Dir.	Force (B. S.)			
25th May	0800 L. T.	Barisal . . .	..	..	E	2	..	..	..
	0800 L. T.	Saugor Island .	..	..	N	4	Smooth	Low, short or average length.	..
	0800 L. T.	Sandheads . . .	..	..	NNW	4	Mod.	Mod. . . .	..
	0830 I. S. T.	<i>S. S. Incomati</i> .	20.4	88.7	NW	5	Rough	Mod. from NW. .	..
	0800 L. T.	<i>S. S. Egra</i> . . .	19.3	90.3	SW/S	6	Rough	Mod., average length from S.	Overcast.

The depression moved in a north-northeasterly direction and was centred at 17 hrs. on the same day near Lat. $21\frac{1}{2}^{\circ}$ N., Long. $89\frac{1}{2}^{\circ}$ E. The upper winds at Chittagong at this time were from a southeasterly direction and of force 9-11 on the Beaufort scale up to 1,500 ft. indicating that the depression was deepening. It lay as a deep depression near Lat. $22\frac{1}{2}^{\circ}$ N., Long. 90° E. at 8 hrs. on the 26th, the pressure deficiency in the early morning of the 26th being 0.40". Thereafter it began to move in a northwesterly direction and was centred near Jessore on the morning of the 27th and near Naya Dumka on the morning of the 28th. It then recurved north-northeastwards and became unimportant over north Bengal by the end of the month.

The storm was responsible for an extension of the monsoon in northeast India. It caused moderate to strong winds and widespread rain associated with some heavy falls along and near its track between the 26th and 31st, as a result of which, according to newspaper reports, considerable damage to property was caused in Bengal. It also dislocated the river traffic in southeast Bengal and telephone and telegraph communications in Darjiling.

Some noteworthy falls of rain of 5" and above are given below :—

District.	Station.	26th.	27th.	28th.	29th.	30th.	31st.
		"	"	"	"	"	"
24-Parganas	Canning Town	..	..	6	11	..	..
24-Parganas	Basirhat	..	..	..	9	..	..
Murshidabad	Akriganj	..	..	8	5	..	..
Jessore	Narail	..	5	7	..	..	..
Khulna	Satkhirra	..	..	5	8	..	..
Khulna	Khulna	..	..	..	6	..	..
Khulna	Kaliganj	..	..	9	..	..	..

District.	Station.	26th.	27th.	28th.	29th.	30th.	31st.
		"	"	"	"	"	"
Khulna	Dumuria	..	..	..	7	..	..
Burdwan	Asansol	..	..	..	5	..	..
Birbhum	Surf	..	..	7	..	..	..
Jalpaiguri	Jalpaiguri	..	..	..	..	..	6
Rangpur	Rangpur	..	..	..	..	9	..
Rangpur	Kurigram	..	..	..	..	5	7
Rangpur	Ulipore	..	..	..	..	9	11
Pabna	Pabna	..	..	5	9	..	..
Malda	Malda	..	..	..	..	8	..
Mymensingh	Jamalpur	..	..	..	..	..	9
Mymensingh	Dewanganj	..	..	..	8	6	..
Faridpur	Bhusna	..	8	9	9	7	..
Bakarganj	Patuakhali	..	10	5	5	..	..
Bakarganj	Gauradi	7	7	7	..	..	..
Bakarganj	Daulatkhan	..	7	7	..	..	..
Chittagong	Cox's Bazar	8	..	..	..	..	..
Chittagong	Kutubdia	9	..	..	..	..	..
Purnea	Bahadurganj	..	..	..	..	..	7

3. Depression of 28th to 30th May 1938 in the Arabian Sea.—With the strengthening of the monsoon in the southeast Arabian Sea and its advance towards Malabar, conditions became unsettled on the 27th May in the east Central Arabian Sea, where a trough of low pressure appeared by the 28th morning. The next morning a depression formed

with centre near Lat. $16\frac{1}{2}^{\circ}\text{N}$., Long. 70°E . It moved north-westwards and at about 20 hrs. on the same day, it was

centred near Lat. 18°N ., Long. 69°E . The following ships' observations are interesting in this connection :—

Date.	Hr. of Obsn. I. S. T.	Name of Ship.	POSITION.		WIND.		Sea.	Swell.	Weather Remarks.
			Lat. N.	Long. E.	Dir.	Force (B. S.)			
29th May	0830	<i>El Medina</i>	17 32	72 49	SSE	6	Rough	Mod. from SSE	Overcast, rain gloomy, squalls.
	0900	<i>C. O. Corinth</i>	17 41	67 10	NNE	3	Rough	Heavy	Passing showers, rain, squall, overcast.
	0900	<i>Corfu</i>	17 40	67 29	N/E	5	Mod.	Heavy	Overcast.
	0900	<i>Nurjehan</i>	10 30	70 54	SW	6	Rough	Heavy from SW	Generally cloudy, frequent rain, squalls.
	2100	<i>Victoria</i>	17 23	68 14	WNW	4	Very rough	..	Generally cloudy.
	2100	<i>Clan Macindoe</i>	18 23	69 58	SE	5/6	Rough	Mod.	Cloudy, squally.
	2100	<i>C. O. Corinth</i>	16 15	68 40	SW/S	5	Rough	Heavy from SW	Generally cloudy.

The depression then weakened rapidly as it moved further in a northwesterly direction and apparently moved away through Arabia as a low pressure wave by the morning of the 1st June. The depression brought in an extension of the monsoon in the Konkan and the Deccan.

4. Unsettled conditions of 3rd and 4th June 1938 in the Arabian Sea.—With a further extension northwards of the monsoon which had extended up to the Konkan Coast as a result of the depression of 28-30th May, conditions again became temporarily unsettled off the Kathiawar-Konkan coast and a feeble cyclonic circulation was noticed on the morning of the 3rd June centred near Lat. 20°N ., Long. $68\frac{1}{2}^{\circ}\text{E}$. There was, however, no further development of the unsettled conditions, but a temporary extension of the monsoon occurred in Gujarat.

5. Unsettled conditions of 6th to 11th June 1938 in the Bay of Bengal.—On the morning of the 4th a larger pressure deficiency was noticed over the Andaman Sea than over other regions of the Bay; by the next morning the region of relatively greater pressure deficiency extended practically over the whole of the central Bay. On the morning of the 6th a feeble area of low pressure appeared off the Orissa-Circars coast where it persisted for the next 48 hours. It then moved westwards, passed over the central parts of the country on the 9th and filled up over east Rajputana by the 11th. This low pressure area was responsible for an extension of the monsoon into the north Madras coast, Orissa and the central parts of the country.

6. Unsettled conditions of 17th to 22nd June 1938 in the Bay of Bengal.—On the morning of the 16th, a large fall of pressure was noticed over northeast India and the north and east Central Bay. This fall of pressure continued over the head of the Bay and a well marked area of negative pressure departure was noticed there by the next morning. By the morning of the 18th a low pressure area appeared in and around the Orissa coast and travelling

westwards it was over the Central Provinces on the next morning; it remained practically stationary there till the evening of the 24th, when it became unimportant. In association with these unsettled conditions the monsoon strengthened over northeast India, the United Provinces, the central parts of the country and the Peninsula outside southeast Madras, becoming vigorous in west Central India and the adjoining areas to the east and south. Raver in east Khandesh had 8" of rain on the 19th and Khargone in west Central India 16" on the 20th.

7. Land depression of 9th to 16th July 1938.—On the morning of the 9th a marked fall of pressure was noticed over Bengal. Pressure decreased further during the next 24 hours and on the morning of the 10th a shallow depression appeared over Bengal with centre near Berhampore. The shallow depression moved in a northwesterly direction and was centred near Naya Dumka in Bihar on the 11th morning. It continued to move northwestwards and merged into the seasonal trough of low pressure over the United Provinces by the morning of the 16th.

Associated with the passage of this depression, some heavy falls of rain occurred in the United Provinces, west Central India, the Central Provinces and Bihar. Some of the noteworthy falls of 6" and over in 24 hours are given below :—

District.	Station.	11th.	12th.	13th.	14th.	15th.
Gaya	Gaya (Obey.)	..	6	..	..	..
Shahabad	Sasaram	..	6	..	..	..
Dehra Dun	Rajpur	..	..	8	..	..
Ghazipur	Ghazipur	..	..	9	..	..
Bahraich	Kaisarganj	..	..	6	..	..
Bhandara	Bhandara	6	..	..	..	..
Bhandara	Sakoli	7	..	..	..	..

District.	Station.	11th.	12th.	13th.	14th.	15th.
		"	"	"	"	"
Bhandara . . .	Charkhamara . . .	6	..	..	..	..
Bhandara . . .	Gomdho . . .	9	..	..	..	..
Chhindwara . . .	Roomal . . .	7	..	..	..	..
Nagpur . . .	Tharsa . . .	7	..	..	..	..
Nagpur . . .	Parseoni . . .	6	..	..	..	..
Mandla . . .	Bichhia . . .	8	..	..	7	..
Balaghat . . .	Ahmadpur . . .	..	..	..	6	..
Gwalior . . .	Shujalpur . . .	..	..	..	10	..
Gwalior . . .	Sonkach . . .	..	..	..	6	..
Bhopal . . .	Bilquesganj . . .	..	..	..	6	6
Bhopal . . .	Narsingharh . . .	..	..	..	9	..
Bhopal . . .	Kotra . . .	..	..	..	11	6
Bhopal . . .	Ichhawar . . .	..	..	..	..	6
Bhopal . . .	Sehore (Qasba) . . .	..	..	..	..	8
Bhopal . . .	Ashta . . .	..	..	..	..	7
Bhopal . . .	Jawar . . .	..	..	..	..	8
Bhopal . . .	Biaora . . .	..	..	..	..	7
Bhopal . . .	Talen . . .	..	..	..	..	11

8. Unsettled conditions of 18th to 21st and shallow depression of 22nd to 26th July 1938 in the Bay of Bengal.—There was a marked fall of pressure in and around the north Bay on the 17th, and on the morning of the 18th the upper winds around the head of the Bay had a cyclonic circulation. These suggested that conditions were unsettled over the north Bay. The unsettled conditions persisted for two days and on the morning of the 21st a low pressure area appeared off the Circars coast. The upper air charts also indicated a cyclonic circulation over that area. After remaining in the same position for the next 24 hours, it passed inland and developed into a shallow depression which lay over Orissa and the east Central Provinces on the morning of the 23rd. The shallow depression then moved in a west-northwesterly direction and merged into the seasonal low over northwest India on the 26th.

Under the influence of this shallow depression the monsoon first strengthened over the Orissa-Circars coast and later gradually strengthened over the whole of northwest India and in the Bombay Deccan.

9. Depression of 10th to 16th August 1938 in the Bay of Bengal.—Widespread and heavy rainfall was reported from stations along the Chittagong-Arakan coast on the morning of the 10th and by the evening of the same day a fall of pressure was noticed over that region. Pressure continued to fall there and a shallow depression appeared over the Sunderbans on the morning of the 11th. During the next 24 hours the depression intensified but remained practically stationary. It then passed inland and was centred near Burdwan on the morning of the 13th. Thereafter it took a westerly course weakening at the same time and merged into the seasonal low over northwest India by the morning of the 16th.

In association with this disturbance, the monsoon considerably strengthened in the central parts of the country

and heavy rainfall occurred along and near the track. Some of the noteworthy falls of 6" and over in 24 hours are given below :—

District.	Station.	12th.	13th.	14th.	15th.
		"	"	"	"
Chittagong . . .	Cox's Bazar . . .	6	6	..	..
Chittagong . . .	Mirasarai . . .	..	..	..	8
Bakarganj . . .	Patuakhali . . .	6	..	..	..
Bakarganj . . .	Barguna . . .	..	6	..	..
Khulna . . .	Rampal . . .	6	..	..	..
Khulna . . .	Kalaroa . . .	6	..	..	..
Khulna . . .	Khulna . . .	..	6	..	..
Khulna . . .	Dhumuria . . .	..	6	..	..
Hooghly . . .	Khanakul . . .	7	..	..	..
Singhbhum . . .	Gaikura . . .	..	..	8	..
Singhbhum . . .	Manoharpur . . .	..	..	8	..
Singhbhum . . .	Sunna . . .	..	..	6	..
Bhopal . . .	Kallakheri (Goharganj)	..	..	..	7
Bhopal . . .	Bilquesganj . . .	..	..	7	..
Bhopal . . .	Sultaupur . . .	..	..	6	..

10. Trough of low pressure of 24th to 29th August 1938.—Weather became unsettled off the Orissa-Circars coast on the 24th and on the morning of the 25th an area of low pressure appeared in that region. It then moved westwards and was lying over the west Central Provinces and east Gujarat on the 27th and over Kathiawar on the morning of the 28th. It became unimportant by the evening of the 29th. The low was most marked on the 27th.

Under the influence of this trough of low pressure, the monsoon strengthened over northwest India between the 26th and the 29th. Locally heavy rain also occurred in Sind, Gujarat, the north Konkan and the north Bombay Deccan. Some of the important falls of 5" and above are given below :—

District.	Station.	24th.	25th.	26th.	27th.	28th.
		"	"	"	"	"
Broach & Panch Mahals	Broach . . .	..	..	..	6	..
Broach & Panch Mahals	Vagta . . .	..	..	..	7	..
Surat . . .	Mandvi . . .	..	..	..	7	..
Surat . . .	Bardoli . . .	..	..	..	5	..
Surat . . .	Waghai D. . .	..	..	..	5	..
Surat . . .	Ahwa . . .	..	..	..	5	..
Rajpipla . . .	Valia . . .	..	..	..	5	..
Baroda State . . .	Navsari . . .	..	..	5	..	..
Baroda State . . .	Mangrol . . .	..	..	..	5	..
Baroda State . . .	Songadh . . .	..	..	..	6	..
West Khandesh . . .	Navapur . . .	..	..	..	5	..
Nasik . . .	Igatpuri . . .	..	..	..	6	7
Nasik . . .	Peint . . .	..	..	..	6	..
Poona . . .	Lonavla . . .	..	..	6	5	7
Satara . . .	Medha . . .	..	8	..	..	..
Satara . . .	Mahabaleshwar . . .	..	..	7	7	..

District.	Station.	24th.	25th.	26th.	27th.	28th.
Thana . . .	Kalyan . . .	..	..	..	..	5
Thana . . .	Shahapur . . .	..	..	..	5	..
Thana . . .	Mokhada . . .	..	..	..	5	..
Thana . . .	Vada . . .	..	..	..	7	..
Kolaba . . .	Karjat . . .	..	..	5	..	5
Kolaba . . .	Matheran . . .	..	..	8	5	8
Ratnagiri . . .	Chiplun . . .	..	..	..	..	5
Kanara . . .	Bhatkal . . .	5	..	..	..	..

11. Deep depression of 23rd September to 7th October 1938 in the Bay of Bengal and Arabian Sea.—A belt of negative pressure departures along the Martaban-Tennasserim coast and a feeble cyclonic circulation in the upper air over the Andaman Sea were noticed on the morning of the 23rd. By 0800 hrs. of the next day, weather was unsettled over the Central Bay and neighbourhood and the monsoon strengthened south of Lat. 13°N. By the 26th morning the unsettled conditions developed into a depression with central region in the neighbourhood of Lat. 14°N., Long. 91°E. On the morning of the 27th it was centred within a degree of Lat. 16°N., Long. 89° E. The following ships' observations are interesting in this connection :—

Date.	Hr. of Obsn. (I. S. T.)	Name of Ship.	POSITION.		WIND.		Sea.	Swell.	REMARKS.
			Lat. N.	Long. E.	Dir.	Force (B. S.)			
27th Sept.	0830	<i>S. S. Chilka</i>	16.3	92.4	ESE	5	Mod.	Mod. from E	Precipitation with- in sight.
	0630	<i>S. S. Goalpara</i>	14.0	91.6	SW	6	High	Mod. from SW	Squally.
	0830	<i>S. S. Isipingo</i>	17.7	91.8	ESE	6	Rough	Heavy from SE	Squally.
	0830	<i>S. S. Naringa</i>	18.7	89.9	E	5	Rough	Heavy from SE	Squally.
	0830	<i>S. S. Singu</i>	14.4	88.5	WSW	4	Rough	Confused	..

The depression moved westwards deepening as it progressed and on the morning of the 28th it was centred about 250 miles to the east of Masulipatam. It continued to move westwards and by 8 hrs. of the next day it was centred near Masulipatam. Crossing coast during the day it weakened and travelled as a trough of low pressure in a north-westerly direction through the Deccan, passing out into the Arabian Sea near Bombay on the morning of the 2nd October. It intensified again into a deep depression by the next morning with centre near Lat. 19°N., Long. 71° E. It then gradually recurved and was centred on the 5th morning near Lat. 19½° N., Long. 72½° E. It crossed coast to the north of Bombay near Danao during the 5th-6th night and was centred near Nasik at 0800 hrs. on the 6th. It became unimportant by the next morning.

This depression caused widespread and locally heavy rain over the Vizagapatam and Godavari districts before crossing coast from the Bay of Bengal. It also caused widespread rain in the Konkan and the Bombay Deccan and the rainfall was particularly heavy in the Konkan when the depression was passing out into the Arabian Sea and in the Kolaba and Nasik districts when filling up. According to newspaper reports, extensive damage to crops, cattle and building occurred at places adjoining the Kanara and the Konkan coasts, and railway services and telegraphic and telephonic communications were dislocated in the Konkan.

Some falls of 5" and over in 24 hours are listed in the table below :—

District.	Station.	29th Sept.	30th Sept.	1st Oct.	2nd Oct.	7th Oct.
		"	"	"	"	"
Vizagapatam . . .	Chipurupalli . . .	5	..	..	..	..
Vizagapatam . . .	Vizianagram . . .	7	..	..	..	..
Vizagapatam . . .	Narasapatam . . .	5	..	..	..	..
Vizagapatam . . .	Konada . . .	8	..	..	..	..
Vizagapatam . . .	Bimlipatam . . .	5	..	..	..	..
Vizagapatam . . .	Itchhapur . . .	5	..	..	..	..
Vizagapatam . . .	Narasannapeta . . .	5	..	..	..	..
East Godavari Plains . . .	Tuni . . .	6	..	..	..	..
East Godavari Plains . . .	Pithapur . . .	6	..	..	..	..
East Godavari Plains . . .	Prattipada . . .	8	..	..	..	..
East Godavari Plains . . .	Cocanada . . .	5	..	..	..	..
Ratnagiri . . .	Vengurla . . .	..	13	..	..	..
Ratnagiri . . .	Malvan . . .	..	5	..	..	..
Ratnagiri . . .	Rajapur . . .	..	5	6	..	..
Ratnagiri . . .	Ratnagiri . . .	..	..	9	..	..
Ratnagiri . . .	Devgad . . .	..	..	7	..	..
Ratnagiri . . .	Chiplun . . .	..	..	13	..	..
Ratnagiri . . .	Khed . . .	..	..	14	..	5

District.	Station.	29th Sept.	30th Sept.	1st Oct.	2nd Oct.	7th Oct.
Ratnagiri . . .	Mandangad . . .	..	..	11	7	..
Kanara . . .	Karwar . . .	..	8	..	..	..
Poona . . .	Ghoda . . .	..	..	6	..	5
Poona . . .	Junnar . . .	..	..	5	..	..
Poona . . .	Jejuri . . .	..	..	5	..	..
Poona . . .	Lonavla . . .	..	..	..	..	11
Satara . . .	Panchgani . . .	..	..	8	..	..
Satara . . .	Mahabaleshwar . . .	..	..	8	7	..
Kolaba . . .	Mangaon . . .	..	..	9	..	..
Kolaba . . .	Mahad . . .	..	..	8	..	..
Kolaba . . .	Karjat . . .	..	..	..	..	7
Kolaba . . .	Matheran . . .	..	..	..	..	10
Kolaba . . .	Panvel . . .	..	..	..	..	8
Kolaba . . .	Uran . . .	..	..	..	..	5
Kolaba . . .	Pen . . .	..	..	..	..	5
Nasik . . .	Sinnar . . .	..	..	..	6	6
Nasik . . .	Trimbak . . .	..	..	..	..	8
Nasik . . .	Igatpuri . . .	..	..	..	..	7
Nasik . . .	Kalyan . . .	..	..	..	..	10
Nasik . . .	Peint . . .	..	..	..	..	8
Thana . . .	Thana . . .	..	..	..	5	7
Thana . . .	Bhiwandi . . .	..	..	..	5	9
Thana . . .	Kalyan . . .	..	..	..	..	6
Thana . . .	Murbad . . .	..	..	..	..	11
Thana . . .	Shahapur . . .	..	..	..	..	9
Thana . . .	Mokhada . . .	..	..	..	..	7
Thana . . .	Bassein . . .	..	..	..	..	9
Thana . . .	Vada . . .	..	..	..	..	5
Thana . . .	Mahim . . .	..	..	..	..	8
Bombay Suburban	Kurla . . .	..	..	..	..	12

12. Severe storm of 5th to 14th October 1938 in the Bay of Bengal.—A trough of low pressure extended from the Arakan to the Orissa-Ganjam coast on the morning of the 5th and conditions were unsettled off the Arakan coast. By the afternoon of the same date the unsettled conditions concentrated into a depression with centre within a degree of Lat. $17\frac{1}{2}^{\circ}$ N., Long. 90° E. The depression deepened but remained practically stationary during the next twentyfour hours and under its influence there was a strengthening of the monsoon in the Bay and there was nearly general rainfall along the Arakan-Tennasserim and Orissa-Ganjam coasts. *S. S. Khosrou* bound from Calcutta to Arabian Sea Ports experienced rough seas, NW/W winds of force 5, overcast skies and heavy rain-showers near Lat. $16^{\circ} 34'$ N., Long. $88^{\circ} 18'$ E. *S. S. Egra* proceeding from Calcutta to Rangoon encountered rough seas, southerly wind of force 6, skies overcast with cumulo-nimbus and drizzles near Lat. $16^{\circ} 12'$ N., Long. $93^{\circ} 36'$ E.

The depression which was now deep moved in a north-westerly direction and at 8 hrs. on the 7th was centred near Lat. $18\frac{1}{2}^{\circ}$., Long. $89\frac{1}{2}^{\circ}$ E. It then began to move in a west-northwesterly direction and on the morning of the 8th intensified into a storm with centre near Lat. 19° N., Long. $88\frac{1}{2}^{\circ}$ E. The following extracts reproduced from the logs of *S. S. Rio Azul* which was bound to Calcutta from Cape Town and which crossed the storm field are of interest :—

S. S. Rio Azul.

Date.	Hr. of Obsn. (I. S. T.).	POSITION.		Pressure.	WIND.		Sea.	Swell.	REMARKS.
		Lat. N.	Long. E.		Dir.	Force (B. S.).			
		o	o	"					
6th October .	0800	11.5	84.6	29.74	SW	5	Very rough	Moderate	....
	2000	..	..	29.72	W	5	Very rough	Heavy	Shower.
7th October .	0800	15.3	86.0	29.68	WNW	5	Very rough	Heavy	Rain, squall.
	2000	16.9	86.6	29.61	NW	5	Very rough	Heavy	Rain, squall.
8th October .	0400	17.7	86.9	29.47	WSW	8	Very high	..	Rain, squall.
	0800	18.1	87.0	29.49	WSW	8	Very high	Heavy	Rain, squall.
	1200	18.5	87.2	29.41	WSW	8	Very high	..	Rain, squall.
	1600	18.8	87.3	29.30	WSW	7	Very high	Heavy	Rain, squall.
	2000	19.2	87.5	29.36	SSE	8	Very high	Heavy	Rain, squall.
9th October .	0000	19.5	87.7	29.41	SSE	8	Very high	Heavy	Rain, squall.
	0400	19.8	87.9	29.39	SSE	8	Very high	..	Rain, heavy squall.
	0800	20.2	88.2	29.48	SE	6	High	Heavy	Rain, squall.
	2000	..	..	29.50	SE	6	High	Heavy	Squally.
10th October .	0800	Near Sandheads	..	29.61	SE	6	High	Heavy	Rain, squally.

The storm continued to move in a westnorth-westerly direction and by the morning of the 9th was centred about 60 miles southeast of Puri. The observations of *S. S. Chilka*

which was proceeding to Orissa from Rangoon indicate that the storm was severe by 1900 hrs. on that day. The following observations recorded by this ship are interesting:—

S. S. Chilka.

Date.	Hr. of obsn.	POSITION.		Bar.	WIND.		Sea.	Swell.	REMARKS.
		Lat. N.	Long. E.		Dir.	Force (B. S.).			
		°	°	"					
8th October	1430 I.S.T.	18.4	84.2	29.53	W	1	Smooth	Mod., from E.	
9th October	1430 I.S.T.	19.2	85.0	29.32	W/N	6	Rough	Mod., from SW	Cont. sl. drizzle, squally.
	0400 P.M.	19.1	85.3	29.46	NW/W	6	Very rough	Heavy, confused.	
	0500 P.M.	..	..	29.40	WNW	9	Very rough	Heavy, from NW	Cont. rain, squally.
	0600 P.M.	..	..	29.29	W	9	High	Confused	Cont. rain, squally.
	0700 P.M.	..	..	29.29	SW	10	Confused	Confused from NE	Cont. rain, squally.
	0800 P.M.	18.6	86.1	29.34	SW	11	Precipitous.	Confused	Cont. rain, squally, occasional vivid lightning.
	0900 P.M.	..	..	29.44	SW	11	Confused	Confused	Violent squalls.
	1000 P.M.	..	..	29.48	SW	9	Very high	Confused	Violent squalls.
	1100 P.M.	..	..	29.53	SW	8	High	Heavy, from SW	Occasional rain squall.
	Midnight	18.3	86.6	29.60	SW	6-8	High	Heavy, from SW.	
10th October	0100 A.M.	..	..	29.62	SSW	6-7	Very rough	Heavy, confused.	
	0200 A.M.	..	..	29.63	S/W	6	Very rough	Heavy, from SSW.	
	0300 A.M.	..	..	29.64	S/W	6	Very rough	Heavy, from SSW.	
	0400 A.M.	18.1	87.0	29.64	S/W	6	Very rough	Heavy, from SSW.	
	0500 A.M.	..	..	29.70	S/W	5-6	Rough	Heavy, from S/W.	
	0600 A.M.	17.9	87.3	29.71	S/W	5	Rough	Heavy, from S/W.	
	0700 A.M.	..	..	29.77	S/W	5	Rough	Heavy, from S/W.	
	0800 A.M.	17.8	87.6	29.80	S	5	Rough	Heavy, from S/W.	
	1000 A.M.	17.6	88.4	29.85	S	5	Rough	Heavy, from S.	
	Noon	17.2	88.5	29.85	S/W	6	Very rough	Heavy, from S.	

Additional Remarks.

Sunday, 9th October 1938.—“On leaving Gopalpur an ugly threatening sky was observed eastwards with a close atmosphere, a moderate NW breeze and a long moderate easterly swell.

At 4/00 P.M. the wind increased in force from the NW×W and was soon blowing a strong gale with continuous heavy rain, and as the wind was not backing sufficiently for the assumed proximity of the cyclone, the vessel's course was altered from S. 70° E. to S. 45° E. By 6/00 P.M. the wind had “Backed” to W, and by 7/00 P.M. had come round to the SW accompanied by torrential rain, pyramidal sea, and confused swell. The barometer ceased falling about 7/00 P.M. indicating that the vessel was in the “Trough”. 8/00 P.M. showed a rapidly rising barometer with an increase in the force of the wind, but improved visibility, so the course was set S. 60° E.

At midnight conditions were much improved in all respects, and at 2/00 A.M. on 10/10/38 the wind had backed to S×W from which direction it prevailed for the remainder of the crossing.

A noticeable peculiarity was that the vessel had set to the southward when observations were obtained at noon.

The position at 7/00 P.M. on the 9th was Lat. 18°-40' N., Long. 85°-54' E. worked back from noon observation.”

With the approach of the storm centre the barometer fell rapidly at Puri and Gopalpur. Gopalpur recorded a pressure deficiency of as much as 1.25 inches at 0400 hrs. on the morning of the 10th.

By 8 hrs. on the 10th the severe storm had crossed the Orissa-Circars coast between Puri and Gopalpur close to the latter station, after which it moved westwards and lay as a deep depression near Kanker in the east Central Provinces on the morning of the next day. During the next 24 hours

the deep depression weakened further and moved northwards being centred near Saugor in the west Central Provinces on the morning of the 12th. It was over west Central India on the morning of the 13th and by 8 hrs. on the 14th it had filled up.

The observations given in the tables below and the summary of the weather conditions experienced at Puri and Gopalpur during the period 7th to 11th October will give an idea of the depth and intensity of the cyclonic storm :—

Puri.

Date.	Hour of Obsn. I.S.T.	Pressure.	Pressure departure.	Av. speed M.P.H.	WIND.		Sea.	Swell.	REMARKS.
					Dir.	Force (B. S.).			
9th October . . .	11	29.35	—45	21	NNE	6	Slight	Low	Sq., rain.
	12	29.28	—49	30	NNE	6	Mod.	Mod.	Cont. sl. drizzle.
	13	29.27	—47	..	NNE	7	Mod.	Mod.	Cont. sl. drizzle.
	14	29.23	—50	27	NNE	7	Mod.	Mod.	Cont. thick drizzle.
	15	29.19	—52	33	NNE	6	Rough	Heavy	Cont. thick drizzle.
	16	29.21	—49	27	NNE	7	Rough	Heavy	Cont. sl. rain.
	17	29.20	—51	..	NNE	7	Rough	Heavy	Cont. sl. rain.
	18	29.17	—57	32	NNE	7	..	..	Cont. sl. rain.
	19	29.22	—53	39	NNE	7	..	..	Cont. sl. rain.
	20	29.23	—55	33	ENE	7	..	..	Cont. sl. rain.
	21	29.25	—54	39	ENE	8	..	..	Cont. sl. rain.
	22	29.21	—58	48	ENE	8	..	..	Int. sl. drizzle.
	23	29.18	—61	48	ESE	10	..	..	Int. sl. drizzle.
	24	29.17	—60	48	SSE	10	..	..	Distant lightning.
10th October . . .	1	29.19	—57	40	SSE	7	..	..	Int. sl. rain.
	2	29.19	—56	40	SSE	7	..	..	Cont. sl. rain.
	3	29.21	—54	43	SSE	10	..	..	Cont. sl. rain.
	4	29.24	—51	41	SSE	9	..	..	Squally.
	5	29.32	—43	42	SSE	8	..	..	Squally.
	6	29.31	—47	41	SSE	9	Very high	Heavy	Squally.
	7	29.35	—45	43	SSE	8	Very high	Heavy	Squally.
	8	29.39	—42	45	SSE	8	Very high	Heavy	Squally.
	9	29.44	—38	46	SSE	8	Very high	Heavy	Int. sl. rain.
10	29.45	—36	37	SSE	7	Very rough	Heavy	Squally.	
11	29.45	—37	33	SSE	7	Rough	Heavy.		
17	29.44	—27	..	SSE	7	Mod.	Mod.		

Summary of weather conditions during the period 7th to 11th October 1938 at Puri.

"7th October.—Wind changed to NNE from SSE from 0300 hrs. Vivid lightning flashes seen towards east from 0300

hrs. till morning. At 0800 hrs. sky nearly overcast and cloudy. Practically the whole day was cloudy with light winds and mostly from NNW. Lightning flashes towards east from 1730 hrs. till midnight.

"8th October.—It continued so till 0500 hrs. Occasional light drizzle between 0100 and 0300 hrs. At 0800 hrs. clear weather with passing clouds. Mostly fracto-nimbus or nimbo-stratus clouds prevailing. Occasional light passing rain between 1345 and 2040 hrs. Sky was almost overcast and weather was squally.

"9th October.—Occasional light drizzles of short duration between 0000 hr. to 0800 hrs. Sky completely overcast. Wind coming in squalls. Weather looked stormy. Wind force gradually increased. Strong winds of gale force raising sand started from 1300 hrs. till midnight and between 2300 and midnight the force became maximum. Rain or drizzle from 0800 hrs. till midnight. Lightning flashed towards east and south from 1900 hrs. till midnight. Rainfall was recorded up to 2100 hrs. after which strong gusty winds blew sand to such an extent that the rain gauge was buried in sand no further rainfall could be recorded.

"10th October.—Strong gale winds continued from midnight accompanied with rain or drizzle till 0800 hrs. The wind force again rose to its highest pitch between 0300 and 0500 hrs. At 0800 hrs. drizzle ceased but strong winds continued. Weather gradually showed signs of clearing and fine sunny weather prevailed from midday but strong winds from SSE continued. Wind changed to SSW from 2000 hrs. but

the wind remained squally. Early morning sand was cleared from rain gauge but again the blowing sand filled in the funnel. Sand about one foot in depth accumulated over the rain-gauge.

"11th October.—There was rain at 0100 hr. from SSW accompanied with strong winds of gale force and lasted for about half an hour and again from 0200 to 0330 hrs. but no rain could be measured as the gauge was filled up with sand. At 0800 hrs. clear weather with passing clouds. Fine weather prevailed whole day and night and wind gradually decreased in force. Halo around the moon at 22 hrs. Variable sky at night.

General.—All communications were dislocated from 1700 hrs. of 9th October 1938 and no information from Calcutta. Even railway telegraph line was dislocated. On the night of 9th many trees were broken and roads were blocked. Thatched and corrugated tin sheds were blown off and cutcha walls collapsed. No loss of life was reported. Even the arrival and departure of trains were delayed. Very high seas were running. Sea water gushed almost to road level and boats of fishermen were washed off. The peon carrying telegrams to the post office just escaped injury from the fall of a branch of a tree and the wind instruments were read at great personal risk. The highest velocity recorded was 56 miles per hour.

Gopalpur.

Date.	Hour of obsn. I.S.T.	Bar.	Pressure departure.	Av. speed during the last hour m.p.h.	WIND.		Sea.	REMARKS.
					Dir.	Force (B. S.).		
9th October . . .	11	29.44	—35	13	NW	4	Slight . . .	Int. sl. rain.
	12	29.37	—39	13	NW	4	Slight . . .	Drizzle.
	13	29.35	—37	7	NW	2	Mod. . . .	Drizzle.
	14	29.32	—40	13	NW	4	Mod. . . .	...
	15	29.31	—39	18	NW	4	Mod. . . .	Cont. sl. drizzle.
	16	29.29	—41	19	NW	5	Mod. . . .	Cont. sl. drizzle.
	17	29.29	—41	16	NW	4	Mod. . . .	Cont. sl. drizzle.
	18	29.29	—44	18	NW	5	Mod. . . .	Cont. sl. rain.
	19	29.29	—45	25	NW	5	Mod. . . .	Cont. sl. rain.
	20	29.27	—49	25	NW	6	Mod. . . .	Cont. sl. rain.
	21	29.27	—51	14	NW	4	Mod. . . .	Cont. sl. rain.
	22	29.23	—55	25	NW	6	Rough . . .	Cont. heavy rain.
23	29.16	—62	21	NW	6	Rough . . .	Cont. heavy rain.	
24	29.07	—69	24	NW	5	Rough . . .	Cont. heavy rain.	
10th October . . .	1	28.89	—88	32	NW	7	Very rough .	Cont. heavy rain.
	2	28.75	—99	32	NW	7	Very rough .	Cont. heavy rain.
	3	28.62	—1.12	35	NW	8	Very rough .	Cont. sl. rain.
	4	28.49	—1.25	34	NW	8	Very rough .	Drizzle.
	5	28.51	—1.23	18	SSW	4	Very rough .	Drizzle.
	8	29.08	—73	40	SSW	8	Very rough .	Drizzle.
	17	29.36	—34	35	S	7	Very rough .	Squally.

Summary of weather conditions during the period from 7th to 11th October 1938 at Gopalpur.

"7th October.—Sky moderately clouded with cumulonimbus and altostratus and distant lightning seen at 0500 hrs. Variable light winds blowing throughout the day.

"8th October.—Sky clouded with cumulonimbus. Light rain began at 0700 hrs. and distant lightning seen. Light to moderate winds blowing from NW.

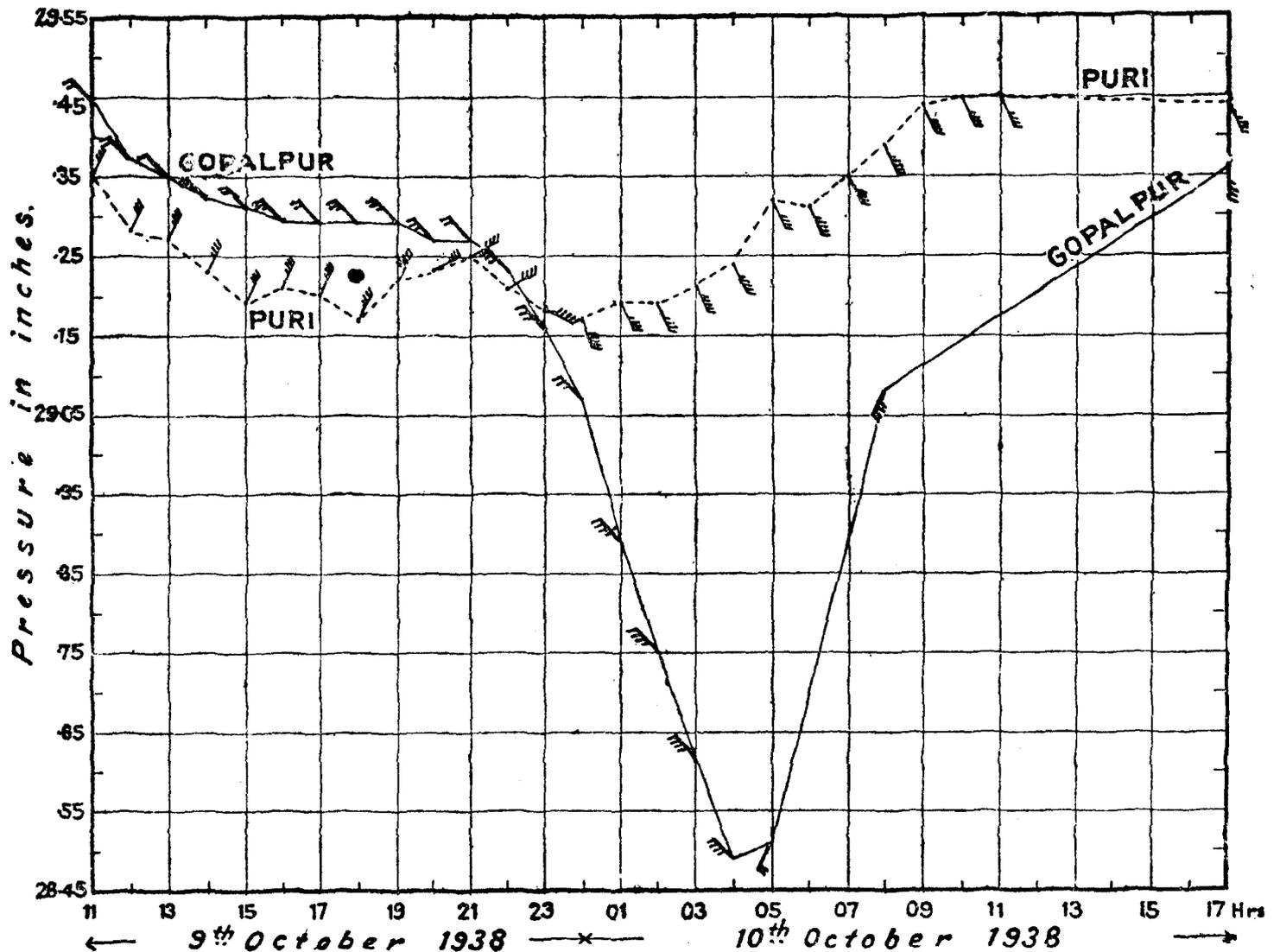
"9th October.—Sky overcast with cumulonimbus and light rain began at 0700 hrs. Moderate to strong winds began to blow from NW. from 1600 hrs. Conditions of the sea became moderate to rough. Continuous moderate rain began at 2100 hrs. and lasted till 0700 hrs. on 10th October. Strong wind began to blow from 2200 hrs. and many houses

were blown off. Kutcha houses fell down. Telegraph wires broken and communication stopped. Thunder and lightning increased. Sunshades of the observatory blown and water got into the observatory. Stevenson screen completely covered with sand.

"10th October.—There was a lull for about 30 minutes from 0430 to 0500 hrs. Winds suddenly changed from NW. to SSW. and increased in strength. The observatory anemometer was blown off. Heavy roofs and pucca houses also blown off. Almost all cocoanut tops fell down. Many big trees on the road side fell down and the bus traffic stopped.

"11th October.—Sky moderately clouded with cumulus and moderate to strong winds coming from SSW."

The pressure and wind observations recorded at Puri and Gopalpur are plotted in the figure below :—



WIND AND PRESSURE DATA RECORDED AT GOPALPUR AND PURI.

Associated with this storm there was widespread and locally heavy rain in and around the field of its activity. Some of the noteworthy falls of 5" and more in 24 hours are given in the table below :—

District.	Station.	9th.	10th.	11th.	12th.
		"	"	"	"
Puri . . .	Banpur . . .	5	..	..	..
Ganjam . . .	Purushottampur . . .	..	5	..	..
Ganjam . . .	Gopalpur (Obsy.) . . .	..	8	..	..
Ganjam . . .	Berhampore . . .	..	7	..	..
Ganjam . . .	Daringabadi . . .	..	5	5	..
Ganjam . . .	G. Udayagiri . . .	..	6	6	..
Ganjam . . .	Mohana . . .	..	12	..	..
Koraput . . .	Nowrangapur . . .	..	..	7	..
Chanda . . .	Dhanora . . .	..	..	..	6
Betul . . .	Chicholi . . .	..	..	..	5
Vizagapatam . . .	Itchchapur . . .	..	11	..	..

The cyclone caused considerable damage in the Ganjam district, particularly in its eastern and southern parts. According to newspaper reports many trees were uprooted and many thatched houses were blown off rendering the poorer classes and the cattle shelterless. A few big buildings also suffered serious damage. Many rice mills sustained heavy losses, as the buildings and stocks were both seriously damaged. Telegraph and telephone lines were snapped by the violent wind. The electric supply of Berhampore was dislocated by the violent wind of the cyclone as many of the poles carrying transmission wires were either bent or felled to the ground.

There were breaches in the railway lines between Calcutta and Madras. According to a press report, a portion of the line at Rambha was breached due to a rise of water level in the Chilka Lake rendering traffic impossible. Near Urlam station, there were also breaches. It was reported that the railway track was nearly two feet under water over a distance of about four and a half miles.

In the Palur Estate, people in nearly 20 villages were rendered homeless and all tanks and wells in these villages were filled with salt water from the Chilka Lake. Other areas like Khallikota, Humma, Rambha and Kundala in the coast were also largely affected by it. According to the older generation of people living in the affected areas, the devastation caused by the cyclone far exceeded that by any other affecting the district in the last 30 years.

13. Severe Storm of 4th to 12th November 1938 in the Bay of Bengal.—Pressure fell over the south Bay of Bengal on the morning of the 2nd November and negative departures of pressure were noticed over Tennasserim and the Andaman Sea on this day. By the 3rd morning the negative pressure departures increased and the area of its sway also extended further westwards into the southeast Bay of Bengal. On the 4th morning a feeble cyclonic circulation and the probable existence of a trough of low pressure extending from Ceylon to the Tennasserim coast were indicated on the isobaric chart. During the next 48 hours this trough of low pressure concentrated over the southeast Bay into a depression with central region at 8 hrs. on the 6th at about Lat. 8°N., Long. 91°E. The depression then deepened and moved northnorthwestwards and was centred near Lat. 10°N., Long. 90°E. at 8 hrs. on the 7th. The deep depression continued to move in the same direction intensifying at the same time, and by the morning of the 8th it was a storm centred near Lat. 11½°N., Long. 88½°E. The observations reported by ships in the following table and the extracts from the logs of *S. S. Pasha*, voyaging from Pondicherry to Port Blair, for the 8th and 9th are interesting in this connection.

Date.	Hr. of Obsn.	Name of Steamer.	POSITION.		WIND.		Sea.	Swell.	REMARKS.
			Lat. N.	Long. E.	Dir.	Force (B. S.).			
			o	o					
8th November	0830	<i>S. S. Jalaganga</i> .	12.4	89.0	E	6	Rough	Low from SW	Squally.
	0830	<i>S. S. Tanfield</i> .	10.9	87.9	W/N	8	Very Rough	Heavy from NW	Intermittent moderate rain.
	0830	<i>S. S. Jalaratna</i> .	12.9	91.2	ESE	6	Moderate	Moderate from S	Rain.
	0830	<i>S. S. Pasha</i> .	11.5	85.5	NW/W	8	Rough	Heavy from NW	Squally, continuous thick drizzle.

S. S. Pasha.

Date.	Hr. of Obsn.	POSITION.		WIND.		Sea.	Swell.	REMARKS.
		Lat. N.	Long. E.	Dir.	Force (B. S.).			
8th November	8 A.M.	11-05	85-50	NW/W	8/9	Very Rough	Moderate from NE	Rain, squall.
	9 A.M.	..	..	NW	8	Very Rough	Moderate from NE	Rain.
	10 A.M.	..	..	NW	10	Very Rough	Heavy from N/E	Rain.
	11 A.M.	..	..	NW	9/10	Very Rough	Moderate from NE	Rain.
	12 noon	11-03	85-52	NW	9	Very Rough	Moderate from NE	Rain, squall.
	1 P.M.	11-02	85-55	WNW	9	Very Rough	Heavy from NE	Rain.
	2 P.M.	11-02	86-05	NW/W	9	Very Rough	Heavy from N/E	Squally.
	3 P.M.	10-59	86-06	WNW	9	Very Rough	Heavy from N	....
	4 P.M.	10-56	86-07	WNW	9	Very Rough	Heavy from N	Squally.
	5 P.M.	10-50	86-14	WNW	9	Very Rough	Heavy from N/E	Rain, squall.
	6 P.M.	10-49	86-18	NW/W	8	Very Rough	Heavy from N/E	Drizzling, squally.
	7 P.M.	10-45	86-24	NW/W	8	Very Rough	Heavy from N	Squally.
	8 P.M.	10-42	86-30	NW/W	8	Very Rough	Heavy from N	Squally.
	9 P.M.	10-38	86-35	WNW	8	Very Rough	Heavy from N	Drizzling.
	10 P.M.	10-34	86-44	W/N	8/9	Very Rough	Heavy from N	....
	11 P.M.	10-33	86-52	W/N	8	Very Rough	Heavy from N	....
	Midnight	10-32	87-00	W/N	..	Very Rough	Heavy from N	....
9th November	1 A.M.	10-30	87-08	W/N	8	Very Rough	Heavy from N/W	....
	2 A.M.	10-29	87-16	W	8	Very Rough	Heavy from NNW	....
	3 A.M.	10-28	87-24	W	8	Very Rough	Heavy from NNW	....
	4 A.M.	10-27	87-32	W/S	7	Very Rough	Heavy from NNW	....
	5 A.M.	10-24	87-40	W/S	7	Very Rough	Heavy from NNW	....
	6 A.M.	10-24	87-48	W/S	7	Rough	Heavy from NNW	....
	7 A.M.	10-28	87-56	WSW	7	Rough	Heavy from NW	....
	8 A.M.	10-30	88-05	WSW	7	Rough	Heavy from NW/W	....
	10 A.M.	10-33	88-23	WSW	6	Rough	Heavy from NW/W	....
	Noon	10-36	88-38	SW/W	6	Rough	Heavy from NW/W	....

Additional remarks dated 8th November 1938.

- "00—04. Overcast with As., Fb. below. Continuous sparse drizzle. By 0200 wind had backed to NW×N and increased slightly in force. Visibility continued good. By 0400 wind increased to force 5 with slightly more sea and swell. Drizzle becoming light rain. Visibility moderate Fb. increasing. Insects coming aboard.
- "04—08. Continuous light rain. By 0600 wind had backed to NW×W force 6/7. Frequent hard gusts of wind with a tendency towards squalliness. Swell a little confused but perceptible from NE×E. Sky overcast with a thick layer of high As., and a little scud. Scud increased towards 0700 then disappeared. 0730 wind increased to force 9/10 without change of direction. Very rough sea running and high NE-ly swell. Squally. Insects and birds continue to come aboard.
- "08—12. Continuous light drizzle/rain throughout watch. Wind increased to force 10 with harder gusts at 1000. Vessel hove-to at 0830 till 1030 then steaming S×E at half speed till noon then hove-to again. Frequent hard squalls.
- "12—16. 1230 wind backed to WNW-10. Squally with light rain alternating with bright periods. 1330 D. R. Lat. 11° 16' N. Obs. Long. 85° 50'E. Sea very rough, short heavy N×E. ly swell. Since 1436 s/s running SE at reduced speed. Visibility fair. Rain obscuring horizon in patches.
- "16—20. Mainly squally with some drizzle during earlier part of watch. Some bright patches to SSE. 1900—2000. Sky overhead clear showing stars. Ci. cloud observed moving from ESE. Wind decreased to force 8. Sea still very rough. Short heavy swell running between N. & N/E.
- "20—24. Wind backed to W/N. Barometer rising. Intermittent drizzle early on. Weather generally changing for the better."

Additional Remarks dated 9th November 1938.

- "00—04. Gradual improvement in the weather. Clear patches on sky at times to south and west. Wind backed slowly two points. Sea and swell unchanged. Swell however drawing to the west of north.
- "04—08. Weather quickly cleared after 0430. Cb. & Ns. clouds became more sparse until 0630 when they disappeared. Ac. clouds predominated during early part of watch. By 0700 weather became fine and clear with a trace of Ac. to the north and a trace of Ci. to the south Stars were observed at 0530 giving Lat. 10° 27' N., Long. 87° 44'E. Sea still remains rough and swell heavy, but longer.
- "08—12. Weather fine clear and cloudy throughout watch. Predominating cloud Ci. Sea and swell remain unchanged. Wind steady force 7.
- "12—14. Gradually clouding over. Sc. and Cb. increased and there was precipitation within sight. Barometer falling slowly, and wind became gusty. Visibility moderate.
- "14—16. The above culminated in a rain squall of short duration from WNW at 1520 (2 minutes heavy rain). A leaping sky from NW. To the east clear except for small patches of Cs. Wind veered during squall to WNW then backed to WSW—7. 1600 overcast. Visibility good.
- "16—20. Frequent west south westerly squalls with moderate rain. Fine drizzle between squalls. Occasional bright patches to W & SW between heavy banks of roll Ns. cloud. Sky cleared towards 1830, but by 1930 it became heavily clouded with Ns. Intermittent drizzle throughout.
- "20—24. 2015—2045 apparent heavy rain to ESE. 2030 wind backed to SW. 2100 Sky almost clear, then clouded over again by 2200. Then mainly overcast till end of watch. Intermittent light rain and drizzle."

From the observations of *S. S. Pasha* at about 10 hrs. it appears that on the 8th the storm was a severe one with wind blowing whole gale.

The storm then slightly recurved and began to move in a northerly direction being centred near Lat. $12\frac{1}{2}^{\circ}$ N., Long. $88\frac{1}{2}^{\circ}$ E. on the morning of the 9th and near Lat. 14° N., Long. 89° E. on the morning of the 10th; on the morning of the 11th, it was near Lat. $16\frac{1}{2}^{\circ}$ N., Long. $89\frac{1}{2}^{\circ}$ E., but later it began to move more rapidly towards the Chittagong coast, being centred near Lat. 19° N., Long. 90° E. at 17 hrs. on this day. By 8 hrs. on the 12th it had weakened appreciably, being only a deep depression near Chittagong. During the course of the day the depression moved inland and filled up after causing fairly widespread rain in Bengal and Assam. Rainfalls of 6" and over in 24 hrs. are given below:—

District.	Station.	12th.	13th.
Khulna	Khulna . . . .	..	6
Khulna	Dumuria . . . .	..	6
Khulna	Rampal	6	..
Khulna	Kalaroa	6	..
Bakerganj	Patuakhali	6	..
Bakerganj	Barguna . . . .	..	6
Bakerganj	Pirojpur . . . .	..	6
Chittagong	Cox's Bazar	6	..

14. Severe Storm of 5th to 9th November 1938 in the Arabian Sea.—Associated with the gradual onset of north-east monsoon conditions, thundery weather was becoming more and more marked in the southeast Arabian Sea towards the end of October. Pressure was appreciably falling and winds were gradually veering to southeast off the Malabar-Kanara coast and, on the morning of 1st November, a well-marked low pressure area was observed over the south and central Arabian Sea. Subsequent strengthening of winds and increase of cloud and rain over the region of low pressure indicated that weather there was definitely deteriorating, several ships reporting rough seas. The shift of Minicoy

wind from southeasterly on the 2nd to southwesterly on the 3rd and a similar shift of Ameni wind a day later pointed to the establishment and northward movement of a cyclonic circulation.

The morning charts for the 5th November showed that upper winds over Mangalore were blowing from southeast to south with force 6 to 8. Observations from coastal observatories, Ameni and ships (particularly *S. S. British Sailor* and *S. S. Orna*) showed that a depression had formed with centre at 8 hrs. within a degree of Lat. 12° N., Long. 73° E. The depression moved in a northnorthwesterly direction. At 20 hrs. on the same date, *S. S. British Sailor* near Lat. $13\frac{1}{2}^{\circ}$ N., Long. 72° E. on her way from Abadan to Colombo, reported a northnortheasterly gale, with squalls and very high seas. It would appear that the depression had by this time intensified into a storm of small extent. During the night the ship experienced heavy squalls with wind reaching hurricane force. The storm continued to move northnorthwestwards and was centred near Lat. 14° N., Long. 72° E. on the morning of the 6th. Moderate rain had been reported from Minicoy and Ameni. Upper winds over Mangalore were from the south up to 2 kms. and from southwest at higher levels up to the highest level reached by the pilot balloon, viz., 4 km.

On the morning of the 7th November, the storm, still of small extent, was centred near Lat. 16° N., Long. $71\frac{1}{2}^{\circ}$ E. Cloud had extended along the west coast up to Gujarat, and widespread rain had fallen in the southwest of the Peninsula, Mangalore recording 2". The pressure deficiency at the centre of the storm was of the order of 0.75". *S. S. Gambhira*, near Lat. $16\frac{1}{2}^{\circ}$ N., Long. $71\frac{1}{2}^{\circ}$ E., reported north-easterly winds of force 9 with very rough seas. The upper winds over Bombay and Poona blew from southwest to south up to a height of 3 km.

Moving further northnorthwestwards and causing an extension of rainfall up to Ratnagiri, the storm was centred at 17 hrs. of the 7th near Lat. 17° N., Long. 71° E. It had by this time apparently become severe. *S. S. Badarpur* about 50 miles north of the storm centre was experiencing hurricane winds, very high seas and overcast skies, with continuous heavy rain. The following observations recorded on the 7th November by *S. S. Badarpur* and *S. S. Gambhira* are of interest:—

Date.	Hr. of Obsn. (I. S. T.)	Name of Ship.	POSITION.		WIND.		Sea.	Swell.	WEATHER REMARKS.
			Lat. N.	Long. E.	Dir.	Force (B. S.).			
7th November .	1200	<i>S. S. Badarpur</i>	16 51	72 00	SSE	4—5	Very Rough	Confused	Ugly threatening sky.
	1400	<i>S. S. Badarpur</i>	17 11	71 47	SE/E	6	Very Rough	Confused	Rain.
	1600	<i>S. S. Badarpur</i>	17 28	71 30	NE	9	High	Confused	Rain.
	1700	<i>S. S. Badarpur</i>	—	—	NE	10	High	Confused	Rain, thunderstorm.
	1800	<i>S. S. Badarpur</i>	17 28	71 06	NE/N	8	Very Rough	Confused	Rain, thunderstorm.
	2000	<i>S. S. Badarpur</i>	17 28	70 44	NE/N	8	Very Rough	Confused	Cloudy.
	0200	<i>S. S. Gambhira</i>	16 57	71 39	NE/E	5	Rough	Moderate	Squally, rain.
	0400	<i>S. S. Gambhira</i>	16 44	71 45	ENE	7	Rough	Moderate	Squally, rain.
	0600	<i>S. S. Gambhira</i>	16 40	71 43	ENE	8	Very Rough	Heavy	Squally, rain.
	0700	<i>S. S. Gambhira</i>	16 41	71 39	ENE	8—9	High	Heavy	Squally, rain.
	0800	<i>S. S. Gambhira</i>	16 40	71 34	NE/E	9	High	Confused	Squally, rain.
	0900	<i>S. S. Gambhira</i>	16 41	71 28	NNE	9	High	Confused	Squally, rain.
1000	<i>S. S. Gambhira</i>	16 36	71 18	NE	8	Very Rough	Confused	Cloudy, rain.	

The following is an extract from the log of *S. S. Gambhira* for 7th November 1938 :—

“ At 0000 I. S. T. Lat. 16° 45' N., Long. 71° 45' E. course SE/S the mercury barometer stood at 29.77", the wind NE/N, force 4-5, with moderate-rough sea, and heavy swell from the SE. The sky was completely overcast with continuous heavy rain; frequent hard squalls from the NE, with winds reaching gale force at times, were experienced. By 0100 hr. barometer had fallen .03" to 29.74", and wind had steadied at NE/E and was increasing in force. At 0200 hrs. barometer had fallen a further .04" to 29.70", with wind still from NE/E force 6; very gusty (occasional gusts force 9). Signs of a cyclonic storm to the southward were by now unmistakable * * * * *. Between 0200-0400 wind shifted to ENE, and increased in strength, still very gusty with occasional short lulls. Rain was very heavy, and almost continuous. At about 0330 a break in the sky was observed to westward. At 0400 barometer showed 29.57", temperature 78°F. wind ENE force 7, very rough seas and heavy swell from SSE. Between 0400-0600 the wind remained from ENE, but increased in force to 8, and barometer fell to 29.48" temperature 78, sea and swell increasing steadily, * * * * *. The swell changed to ESE at about 0700 and increased in height, whilst hard squalls with wind force 9 were becoming more frequent, continuous heavy rain throughout from 0500. Between 0745 and 0800 the storm reached maximum intensity, and the wind swung round to NE/N force 9, whilst the sea became very rough, and swell confused, visibility very poor, and no clouds could be observed. The weather remained the same between 0800 and 0900 except that the wind moved round to the northwards until 0900, when, it was NNE force 9. * * * * * From

0900-1200 weather steadily improved, and at 1200 barometer was 29.66" wind NNW force 6, sea moderate, and swell confused. By 1800 the swell was moderate also the weather, and at 2400 weather was normal.”

After the evening of the 7th the storm continued its northerly course, and, at 8 hrs. next day, was centred near Lat. 18½°N., Long. 71°E. The belt of rainfall had by this time advanced northwards up to west Central India.

By 17 hrs. of the 8th the storm had weakened, the weather charts showing a rapid rise of pressure over the affected area. By the following morning it became unimportant; weather then gradually moderated, becoming normal by the morning of the 10th.

This storm produced only widespread light to moderate rain in and near the Konkan.

15. Severe Storm of 19th to 26th November 1938 in the Bay of Bengal.—A strengthening of the northeast monsoon was noticed in the Bay of Bengal on the morning of the 19th. Heavy rain of 3" was also recorded daily at Sabang from the 18th to the 20th. On the 20th morning, while pressures were appreciably above normal over India, they were below normal near the Andamans. These conditions developed into a depression with centre near Lat. 8.5°N., Long. 91.5°E. on the afternoon of the 20th. This depression moved in a westnorthwesterly direction intensifying at the same time and it lay centred near Lat. 9°N., Long. 89° E. at 8 hrs. on the 21st. During the course of the day the depression deepened further and the following ships' observations showed that by 17 hrs. it had intensified into a cyclonic storm centred near Lat. 9½°N., Long. 88½°E.

Date.	Hr. of Obsn. (I. S. T.)	Name of Ship.	POSITION.		WIND.		Pressure.	Sea.	Swell.	Weather at time of observation.
			Lat. N.	Long. E.	Dir.	Force (B. S.).				
21st November.	1730	<i>S. S. Bohna</i>	7.6	88.6	SW/W	7	29.74	Very rough	Heavy from SW	....
	1530	<i>S. S. Bintang</i>	11.5	89.3	E	9	29.65	Confused	Heavy from S.	Fierce rain.
	1730	<i>S. S. Jalarashmi</i>	9.3	86.0	NNW	7	29.71	Very rough	Heavy from NE.	Rain other than showers.

The storm moved northwestwards and was centred near Lat. 10°N., Long. 87°E. on the morning of the 22nd. By 17 hrs. of the same day the storm had become severe and was centred near Lat. 10½°N., Long. 86½°E. *S. S. Pundit* bound from Rangoon to Colombo was then about 70 miles to the

southwest of the storm centre and had encountered by this time winds of hurricane force, violent squalls and torrential rain. The following observations recorded by this ship which was presumably close to the storm centre at 15 hrs. of this date are very interesting.

S. S. Pundit.

Date.	Hr. of Obsn.	POSITION.		WIND.		Pressure.	Sea.	Swell.	Weather at time of observation.
		Lat. N.	Long. E.	Dir.	Force (B. S.).				
22nd November	0800 A.M.	10 17	87 13	E/S	6	29.70	Very rough	Heavy from E	Squally.
	0900 A.M.	..	..	E/S	6	29.65	Very rough	Heavy from E	Squally.
	1000 A.M.	..	..	E	6	29.63	Very rough	Heavy from E	Squally.
	1100 A.M.	..	..	E	6	29.56	Very rough	Heavy from E	Squally.
	Noon.	10 04	86 59	E	6	29.51	Rough	Heavy from E	Squally.
	1250 P.M.	..	..	Variable	..	..	..	....	....
	1300 P.M.	..	..	..	..	29.50	Rough	Heavy from E	Overcast, squalls drizzle cont. rain.
	1350 P.M.	..	..	North	..	..	..	....	....
	1400 P.M.	..	..	North	3-4	29.48	Rough	Heavy confused	....
	1425 P.M.	..	..	NW	3	..	..	....	....
	1500 P.M.	..	..	WNW	4	29.48	Rough	Heavy confused	....
	1525 P.M.	..	..	W/N	5	..	..	....	....
	1600 P.M.	09 54	86 42	W/N	5	29.49	Rough	Heavy confused	....
	1630 P.M.	..	..	West	7-8	..	..	....	....
	1700 P.M.	..	..	..	7-8	29.52	Very rough	Heavy confused	Squally.
	1800 P.M.	..	..	..	8-9	29.56	Very rough	Heavy confused	Squally.
	1900 P.M.	..	..	..	9-10	29.60	Very rough	Heavy confused	Squally.
	2000 P.M.	09 35	86 19	W	10-12	29.67	Very rough	Confused, confused	Squally. Sky is obscured by blinding rain.
	2100 P.M.	..	..	WSW	9	29.72	Very rough	Confused, confused	Squally.
	2200 P.M.	..	..	WSW	8	29.74	Very rough	Confused, confused	Squally.
2300 P.M.	..	..	WSW	8	29.77	Very rough	Confused, confused	Squally.	
Midnight	09 26	86 05	W	8	29.80	Very rough	Confused, confused	Squally.	
23rd November .	0100 A.M.	..	..	W	8	29.80	Very rough	Confused, confused	Squally.
	0200 A.M.	..	..	WSW	8	29.80	Very rough	Confused, confused	Squally.
	0300 A.M.	..	..	SW	8	29.81	Very rough	Confused, confused	Squally.
	0400 A.M.	09 11	85 46	SW	7-8	29.81	Very rough	Confused, confused	Squally.
	0500 A.M.	..	..	SW	6	29.82	Very rough	Heavy confused	Squally.
	0600 A.M.	..	..	SW	6	29.84	Very rough	Heavy	Squally.
	0700 A.M.	..	..	SW	6	29.86	Very rough	Heavy	Squally.
	0800 A.M.	09 02	85 23	SW	6	29.90	Rough	Moderate from WSW	Squally.

Remarks.—“ Lowest barometer reading was at 1500 29.29. Wind backed between 1500 and 1600 to west increasing rapidly in force until 1630 when it had reached gale force accompanied by violent squalls of torrential rain which continued till 2400.”

The severe storm continued to move in a northwesterly direction and was centred near Lat. $11\frac{1}{2}^{\circ}$ N., Long. 85° E. on the morning of the 23rd. During the next two days it moved in the same direction being centred about 150 miles to the east of Madras at 8 hrs. on the 24th and about 60 miles to the south of Masulipatam at 8 hrs. on the 25th respectively. By 17 hrs. of the 25th the storm lay centred close to coast near Masulipatam when this station recorded a barometric deficiency of 0.72 inches. By the next morning the storm had passed inland near Masulipatam and having weakened, lay as a depression centred about 100 miles to the northwest of Cocanada. The depression filled up during the next 24 hours.

Associated with this storm, widespread and locally heavy rain occurred on the north Madras coast. A few heavy falls of 6" and over in 24 hours are given below :—

District.	Station.	25th.	26th.	27th.
		"	"	"
Vizagapatam . .	Salur . . . .	..	..	7.5
Vizagapatam . .	Vizianagram . .	..	..	8.0
Vizagapatam . .	Srungavarapakota . .	..	..	8.1
Vizagapatam . .	Narasapatam . .	..	8.4	..
Vizagapatam . .	Konaria . . . .	..	..	6.2
Vizagapatam . .	Bimlipatam . . . .	..	..	9.9
Vizagapatam . .	Waltair . . . .	..	6.0	..
Vizagapatam . .	Anakapalle . . . .	..	6.0	..
Vizagapatam . .	Yellamanchili . . . .	..	7.2	..
Vizagapatam . .	Polavaram . . . .	..	8.2	..
East Godavari Agency.	Chodavaram . . . .	..	8.3	..
East Godavari (Plains).	Tuni . . . .	..	6.3	..
East Godavari (Plains).	Pithapur . . . .	..	6.5	..
East Godavari (Plains).	Prattipada . . . .	..	9.3	..
East Godavari (Plains).	Peddapur . . . .	..	6.3	..
East Godavari (Plains).	Cocanada . . . .	..	9.0	..
East Godavari (Plains).	Ramchandrapur . . . .	..	7.4	..
East Godavari (Plains).	Alamur . . . .	..	6.1	..
East Godavari (Plains).	Coringa	6.0	..	..
West Godavari . .	Kovvur . . . .	..	8.3	..
West Godavari . .	Tadepalligudam . . . .	..	8.4	..
West Godavari . .	Tanuku . . . .	..	7.7	..
West Godavari . .	Bhimavaram . . . .	..	9.1	..
Kistna	Bandar (Masulipatam).	..	14.0	..
Kistna	Manginapudi . . . .	..	11.7	..
Kistna	Pandraka . . . .	..	10.0	..

The storm caused many casualties among cattle and considerable damage to property. According to press reports, the M. S. M. Railway line between Madras and Waltair was breached in several places and three boats laden with cargo sank at Bandar Port, Masulipatam. The following newspaper extract taken from the appeal issued by His Excellency the Governor of Madras for funds for the relief of the sufferers in the cyclone gives a graphic account of the extent of damage caused by it :—

" On the 24th and 25th of November the Kistna, West Godavari and East Godavari districts were struck by a severe cyclone and great damage was caused to houses, crop and gardens by the wind and torrential rains which caused widespread floods. It is reported also that a very large number of cattle and sheep have been lost and stores of grains and food stuffs washed away or ruined. The areas reported to be most affected are : in the Kistna District Bandar, Divi, Gudivada and Kaikalur Taluks ; in the West Godavari District Narasapur, Bimavaram, and Tadepalligudem Taluks and to some extent, Ellore."

WESTERN DISTURBANCES.

The following is a list of the western disturbances which affected the weather in northern India on different days during the year with brief notes on the precipitation which they produced :—

Serial No.	Date.	REMARKS.
—	29th December 1937 to 3rd January 1938.	Fairly widespread rain or snow in the western Himalayas and the North-West Frontier Province on the 1st and a few falls of rain or snow in Kashmir on the 2nd and 3rd. (This is the last disturbance of December 1937 which continued into January 1938).
	<i>January.</i>	
1	4—6	Local thunderstorms over the region from the southeast Punjab and the United Provinces to Berar on the 4th, local rain or snow in the western Himalayas and a few light showers in the North-West Frontier Province, the east United Provinces, Central India and the west Central Provinces on the 5th.
2	7—10	A few light showers in Kashmir on the 8th, 9th and 10th.
3	10—17	Local rain or snow in Kashmir with a few falls in the north-west frontier on the 11th. Many showers of rain or snow in the north-west frontier on the 12th, along and near the western Himalayas from the 12th to 15th and over the region from Central India and the Central Provinces to Assam from the 13th to 17th.
4	15—18	Local showers of rain or snow over the region from the north-west frontier to the western Himalayas from the 16th to 18th.
5	21—23	Scattered thunderstorms, almost dry, in the United Provinces on the 22nd.
6	23—26	Fairly widespread rainfall over the region from the north-west frontier to Bihar and in the central parts of the country on the 24th and 25th.

Serial No.	Date.	REMARKS.
	<i>January—contd.</i>	
7	25—27 . . .	A few light showers in Baluchistan on the 25th, fairly widespread rain or snow over the region from northeast Baluchistan to Kashmir with a few showers in Mekran and the southwest Punjab on the 26th and local rain or snow in Kashmir and the Punjab hills on the 27th.
8	27th January to 2nd February.	Local falls of rain or snow in Baluchistan with light showers in the North-West Frontier Province and Kashmir on the 28th, widespread rain over the region from Baluchistan and Sind to the western Himalayas on the 29th and 30th and over the region from the north Central Provinces to the central and western Himalayas on the 31st. Fairly widespread showers in Bihar, Chota Nagpur and north Bengal on the 1st February with scattered showers in Bihar and Chota Nagpur on the 2nd.
	<i>February.</i>	
9	1—3 . . .	Local showers in the North-West Frontier Province and the Punjab hills on the 1st, fairly widespread showers over the region from the North-West Frontier Province to the western Himalayas on the 2nd and a few showers in the western Himalayas on the 3rd.
10	3—7 . . .	A few falls of rain in northeast Baluchistan on the 3rd, fairly widespread rain in Baluchistan and the North-West Frontier Province on the 4th, widespread rain over the region from the northwest frontier to the western Himalayas and local drizzle or light rain in Sind and south Rajputana on the 5th; fairly widespread rain along and near the western Himalayas and local rain or a few falls in the plains of the United Provinces and in the North-West Frontier Province on the 6th and fairly widespread showers in the western Himalayas on the 7th.
11	8—10 . . .	A few light showers in Kashmir on the 9th and isolated showers in the western Himalayas on the 10th.
12	11—15 . . .	A few light showers in Baluchistan and local rain or drizzle in the extreme north on the 11th, fairly widespread rain or snow over the region from the northwest frontier to the western Himalayas on the 12th and 13th with light thundershowers in the plains of the United Provinces on the later date and fairly widespread rain along and near the western Himalayas, in Bihar, Chota Nagpur and Bengal with a few falls in Assam on the 14th.
13	17—18 . . .	Scattered light showers in Baluchistan on the 17th.
14	19—21 . . .	Scattered drizzles along the northwest frontier on the 19th and local showers in the North-West Frontier Province, the north Punjab and Kashmir on the 20th.
15	21—22 . . .	Local rain in the northwest frontier on the 21st and widespread light showers over the region from the northwest frontier to the western Himalayas on the 22nd.
16	24—26 . . .	No precipitation.

Serial No.	Date.	REMARKS.
	<i>February—contd.</i>	
17	27—28 . . .	A few showers in the extreme north on the 27th and local showers in the North-West Frontier Province and Kashmir on the 28th.
	<i>March.</i>	
18	3—6 . . .	Local rain or snow in Kashmir with scattered light showers in the north Punjab hills on the 3rd, fairly widespread rain or snow in Kashmir and the Punjab hills with a few thundershowers and duststorms in the northwest frontier on the 4th and local thundershowers in the western Himalayas on the 5th.
19	7—10 . . .	Isolated light showers in the northwest frontier on the 7th, fairly widespread rain or snow in the extreme north on the 8th, fairly widespread light rain or snow in Kashmir and the north Punjab hills with a few showers in the North-West Frontier Province on the 9th and scattered thundershowers along and near the western Himalayas on the 10th.
20	14—17 . . .	A few light showers in the northwest frontier on the 14th, widespread rain or snow over the region from the northwest frontier to Kashmir on the 15th, widespread rainfall over the region from the northwest frontier to the western Himalayas on the 16th and local thundershowers in the western Himalayas on the 17th.
21	17—19 . . .	Local thundershowers along and near the northwest frontier on the 17th, widespread rainfall over the region from the northwest frontier to the western Himalayas on the 18th and scattered showers in the Punjab hills and Kashmir on the 19th.
22	19—22 . . .	Scattered light drizzle in the northwest frontier on the 19th, local falls of rain or snow in the extreme north with isolated light showers in northeast Baluchistan on the 20th and widespread rainfall over the region from the northwest frontier to Kashmir on the 21st and in Kashmir and the Punjab hills on the 22nd.
23	24—25 . . .	Light showers in Kashmir on the 24th.
24	27—29 . . .	Local falls of rain or snow in the extreme north on the 28th and a few showers on the next day.
	<i>April.</i>	
25	1—10 . . .	Local showers in the northwest frontier on the 3rd, fairly widespread thundershowers over the region from Baluchistan to Kashmir on the 4th, fairly widespread rain or snow over the region from the North-West Frontier Province to Kashmir and in the Punjab hills with local showers in Baluchistan on the 5th, widespread thundershowers over the region from the North-West Frontier Province to the United Provinces hills with scattered showers or duststorms in north Rajputana on the 6th, fairly widespread thundershowers over the region from the northwest frontier to the western Himalayas on the 7th, local showers over the region from the North-West Frontier Province to the United Provinces on the 8th and fairly widespread thundershowers in and around the United Provinces on the 9th.

Serial No.	Date.	REMARKS.	Serial No.	Date.	REMARKS.
	<i>April—contd.</i>			<i>October.</i>	
26	9—15 . . .	A few light showers in the northwest frontier on the 10th, local thundershowers along and near the northwest frontier on the 11th, local rain in the northwest frontier and Kashmir with a few dust or thunderstorms in the Punjab, Sind and Rajputana on the 12th and fairly widespread thundershowers over the region from the North-West Frontier Province to the western Himalayas on the 13th and in the extreme north on the next day.	37	16—17 . . .	No precipitation.
27	15—20 . . .	A few dust or thunderstorms in the Punjab and the United Provinces on the 18th and 19th.	38	21—24 . . .	A few falls of rain in the extreme north on the 21st and local rain along and near the western Himalayas on the 22nd with a few light showers on the 23rd and 24th.
28	21—27 . . .	Isolated showers in Kashmir on the 21st, scattered light showers in the northwest frontier and the western Himalayas on the 22nd, local dust or thunderstorms over the region from the northwest frontier to the western Himalayas on the 23rd, widespread thunder-rain in the extreme north with dust or thunderstorms in and near the east Punjab and the United Provinces hills and in north Rajputana on the 24th and 25th and scattered thunderstorms in the extreme north on the 26th.	39	28—29 . . .	Scattered thundershowers along and near the western Himalayas on the 28th.
29	29—30 . . .	A few thunderstorms in the extreme north on the 30th.	40	29—31 . . .	A few falls of light rain in Baluchistan on the 29th and scattered showers in the extreme north on the 30th.
	<i>May.</i>			<i>November.</i>	
30	3—5 . . .	Scattered light showers or duststorms in the northwest frontier and the Punjab on the 3rd, many dust or thunderstorms over the region from the northwest frontier to the western Himalayas and in the United Provinces on the 4th and isolated dust or thunderstorms in the northwest frontier and the western Himalayas on the 5th.	41	1—3 . . .	A few light showers in the North-West Frontier Province and the Punjab hills on the 2nd.
31	7—9 . . .	No precipitation.	42	12—14 . . .	Scattered light rain in the extreme north on the 13th.
32	11—13 . . .	A few dust or thunderstorms in Rajputana and the western Himalayas on the 11th, scattered showers in the western Himalayas on the 12th and many thunderstorms in the extreme north on the 13th.	43	16—19 . . .	A few light falls of rain in the extreme north on the 16th, a few thunderstorms in and near the United Provinces hills on the 17th and local thundershowers in the hills of the Punjab and the United Provinces on the 18th.
33	15—16 . . .	A few thundershowers in the North-West Frontier Province and along and near the Punjab hills on the 15th.	44	19—22 . . .	A few falls of rain in Baluchistan on the 19th and 20th and local rain or snow along and near the western Himalayas on the 20th and 21st.
34	24—25 . . .	Isolated showers in the extreme north on the 24th and 25th.	45	24—25 . . .	No precipitation.
	<i>June.</i>		46	27—29 . . .	A few falls of rain or snow in the extreme north on the 27th and 28th.
35	1—3 . . .	Widespread thunderstorms in northern and Central India on the 1st.		<i>December.</i>	
36	4—5 . . .	A few dust or thunderstorms in the extreme north on the 4th.	47	2—6 . . .	A few light showers in the extreme north from the 3rd to 5th.
	<i>July, August and September.</i>	No well marked western disturbances.	48	7—10 . . .	A few falls of rain in the extreme north on the 7th and fairly widespread rain or snow in Kashmir on the 9th and 10th with a few falls of rain in northwest frontier on the 9th.
			49	12—13 . . .	Feeble disturbance.
			50	15—19 . . .	A few light falls of rain or snow in Kashmir on the 16th, local rain or snow in Kashmir and a few showers in the northwest frontier on the 17th and fairly widespread rain or snow in the extreme north on the 18th.
			51	19—21 . . .	Fairly widespread rain or snow in the northwest frontier, Kashmir, the northern and central Punjab between the 19th and 21st.
			52	22—24 . . .	} Feeble disturbances.
			53	28—29 . . .	
			54	30 . . .	A few light showers in Baluchistan on the 31st.

LOCAL STORMS.

Of the local storms reported in newspapers, the following are noteworthy :—

January 7th.—A severe hailstorm passed over Dibrugarh at night and considerable damage was caused to crops in the adjoining villages.

January 9th.—A constable on patrol duty, attached to the Sandeshkhali Police Station, Sunderbans, was drowned when a boat carrying a special police party capsized during a severe thunderstorm.

January 11th.—As a result of a violent hailstorm much damage was caused to crops and property at Chousala, Taluka Daryapur in Berar and Kodgaon Village in Ramtek Tahsil in Nagpur district.

January 31st.—A severe gale lasting over an hour accompanied by torrential rain and hail swept over Jubbulpore in the evening causing much damage to the standing crops. It also caused considerable panic to thousands of pilgrims attending the Somavati Amvashya fair at the Gwarighat banks of the Nerbudda River.

January 31st.—A shepherd, a buffalo and a cow were killed by lightning in Rampur Tingraha (Gonda, U. P.) during a thunderstorm.

February 14th.—A severe hailstorm passed over Nainital. Hails as large as walnuts fell at Haldwani. Crops all over the district were badly damaged.

March 7th.—Dibrugarh experienced a severe hailstorm which lasted for about half an hour. Much damage was done to the betel leaf and chilli plantations as well as to other crops.

March 7th.—Several lives were reported lost and many persons injured in a violent gale, which passed over Tipling in Mauza Tingkhong, 45 miles from Dibrugarh. Many houses were levelled down and several big trees uprooted.

Almost simultaneously a gale also swept over Sibsagar sub-division. The gale, the fury of which lasted barely three minutes, blew away the roofs of many houses, uprooted trees and levelled down huts. House collapses and fall of trees were responsible for a couple of deaths and injuries to several.

March 10th.—Hailstones as big as potatoes fell in several parts of the Palampur Valley (Kangra), resulting in injuries to several persons and to a large number of cattle. Wheat and potato crops were also damaged at Paprola.

March 12th.—Twentyfive persons were killed and about one hundred and fifty injured as a result of a terrific tornado that passed over six villages in Narayanganj sub-division. About 2,000 huts were either blown away or severely damaged, rendering many homeless and destitute.

March 15th.—In the evening a severe gale blew over Chandshi in the Gournadi Thana, Bakurganj (East Bengal) and did considerable damage.

March 21st.—A severe hailstorm passed over Jaykuchi and several other adjoining villages in Patidurang Mauza (Gauhati) causing considerable damage to the Masur, Sugarcane and Mango crops. Twigs and branches of trees were strewn all over the fields and roads.

March 22nd.—A disastrous nor'wester passed over three villages, Jhautala, Karnalapur and KaJamichar in Comilla District. About 60 persons were reported to have been killed and several injured. Huts and trees in the affected areas were completely destroyed.

March 26th.—A severe thunderstorm passed over Nasik in the evening. The huge shamianas erected in connection with the opening of the Bhonsle Military School crumbled down pinning underneath several people. A number of trees were uprooted and the tiles of the newly erected school building were blown off injuring many persons, a boy and a man seriously. Owing to the storm there was a widespread dislocation of telegraphic communications.

April 14th.—A severe hailstorm swept over Satkhira (southwest Bengal) and its neighbourhood and caused serious damage to property and crops.

April 20th.—A nor'wester passed over Nowgong (Assam) causing severe damage to many houses and granaries, uprooting trees and blowing away corrugated iron roofing in the southern part of the district. The loss to property was estimated at nearly one lakh of rupees and thousands of people were reported to have been rendered homeless.

April 20th.—A violent storm swept over the sub-division of Tangail (east Bengal) in the afternoon. A boy aged 10 years died and his mother was injured due to the fall of a tree over their house. Many trees were uprooted, houses damaged and telegraph lines snapped. The roof of the local cinema house was blown away.

April 20th.—Kushtia (Bengal) experienced at about 3-20 P.M. a nor'wester accompanied by a smart shower of rain, as a result of which a large number of trees, both big and small, were uprooted and the streets were strewn with innumerable broken branches. A large number of huts were razed to the ground and roofs of many tin-sheds were blown off. The storm lasted for about six or seven minutes.

April 23rd.—Two students died on the spot and two others were seriously injured as a result of being struck by lightning in a village near Hubli.

April 24th.—At about 5-30 P.M. the 49 up passenger train from Mailani to Lucknow, while passing between Jharekpur and Sitapore was caught in a terrific gale and two carriages were derailed. One passenger received a fractured thigh and three others minor injuries.

April 24th.—A severe hailstorm swept over Gauhati at about 9-30 P.M. Hailstones as big as tennis balls fell for ten minutes. Electric lights failed and the town was plunged in darkness. The damage to fruit trees was considerable. A number of thatched houses was also damaged.

April 25th.—After a prolonged drought lasting over two months Habiganj (Assam) experienced a severe thunderstorm which lasted for about an hour. The intensity of the storm was so great that the roof of the local G. K. Institution Office building was blown away completely to a distance of about 100 feet. Several trees were also uprooted and houses razed to the ground.

April 26th.—Great havoc was wrought by a thunderstorm that swept the southern part of Nowgong (Assam) district. Nearly a hundred persons were reported to have been injured. Many people were rendered homeless.

April 26th.—Salem experienced a severe hailstorm at night. Many trees were uprooted and a cinema tent was damaged.

April 27th.—A violent thunderstorm passed over Karimganj town (Assam). Thirteen houses were blown down and several big trees were uprooted. Telegraphic communications were also interrupted.

April 28th.—A severe hailstorm accompanied by a light shower swept over Nilphamari (Bengal) sub-division at night. The storm lasted for about 20 minutes. A large number of houses were blown away and many big trees and bamboo clumps were uprooted. A girl, aged about 10, was killed when a house collapsed on her.

April 28th.—As the result of a severe gale one man was killed, several were injured and a large number of houses were blown away at the village of Mutuail, a few miles from Dacca. The storm also caused some damage in the town of Dacca.

April 29th.—A severe nor'wester passed over Brahmanbaria (east Bengal) in the evening, causing heavy damage. The Brahmanbaria M. E. School and the Anandamoyee Girls School were the worst affected. Five hundred huts were blown away. Several houses were also considerably damaged. Many trees were uprooted and also a number of telegraph posts.

April 29th.—A severe storm passed over Baradi (Dacca) and the high school building was badly damaged.

April 30th.—A severe thunderstorm passed over Kushtia (Bengal) at about 5 P.M. causing damage to property. At Amlapara several corrugated iron sheds as well as canister tin roofings of several houses were blown off and the sugar-crushing mill suffered considerable damage. No loss of life, is, however, reported.

April 30th.—Nine persons were killed at Nariagadai in Pabna by the fall of a big banyan tree on a tin shed during a thunderstorm.

May 1st.—A severe hailstorm, attended with a heavy shower, swept over Lohajong and many other villages of Vikrampur (east Bengal). A large number of houses, shops and jute godowns were blown away and big trees and bamboo clumps were uprooted. Telegraph communication was also disturbed in some places.

May 2nd.—Vehicles were overturned and occupants were hurt, pedestrians injured, lights failed stopping cinema shows, telephone communications were interrupted and mango and lichi crops were damaged extensively by a hailstorm which passed over Muzaffarpur (Bihar) at night. The storm was believed to have been the worst experienced this year over that place, some hailstones being bigger than tennis balls.

May 2nd.—Two Muslims and a Hindu milkman were struck dead by lightning at Kandi (Murshidabad) during a thunderstorm.

May 3rd.—A nor'wester broke over Calcutta at about 5-30 P.M. and for nearly half an hour the city was swept by a gale. As a result of the storm the temperature dropped by about 14°F.

May 5th.—A severe thunderstorm of great intensity accompanied by a heavy shower of rain passed over Manikganj (east Bengal). The storm lasted for an hour. Many trees were uprooted and corrugated tin houses were blown away. No loss of life was, however, reported.

May 6th.—A severe hailstorm accompanied by a heavy shower, swept over Natore (Bengal) and its outskirts at night at 12. The storm continued for about an hour, causing much damage to mango crops and uprooting many trees.

May 7th.—Many people were injured and hundreds of huts were damaged as a result of a severe hail and thunderstorm which swept over fifteen villages in Rajshahi. Several were injured being struck by hailstones.

May 7th.—As a result of a thunderstorm which swept over Noakhali (east Bengal) at night three cargo boats sank in the river near the Mahindakhal. Two other cargo boats were also reported to have been capsized in the Noakhali khal.

May 9th.—A man was killed, many thatched houses collapsed and the roads were littered with uprooted trees as the result of a severe duststorm which blew over village Kharagpur in Monghyr district (Bihar). A woman and a child taking shelter under a shed were killed by the roof of the shed collapsing.

May 13th.—A thunderstorm of great severity swept over Rawalpindi. It caused considerable damage to property in the city and suburbs. The storm lasted for several hours. Three men were reported to have been killed by lightning in the village of Chur.

May 16th.—Two persons were killed by lightning at Abdullapur in the Mymensingh district. It was reported that a hut was also set ablaze in a neighbouring village.

May 17th.—Two deaths from lightning were reported in Tangail (east Bengal). One man was killed and several houses were razed to the ground at Kakuachar when a thunderstorm passed over the village. The second tragedy occurred at Habla where a young man of 17 was struck dead by lightning.

May 31st.—Two persons, husband and wife, were struck by lightning and killed instantaneously in the village Tetri in Ranchi during a thunderstorm.

June 3rd.—A hailstorm lasting about two hours caused great damage to life and property in the interior of Almora district.

June 6th.—Two persons were killed, six injured and two tongas smashed to pieces during a thunderstorm in Ajmer.

June 27th.—Two persons, father and son, were killed and two others were badly burnt by lightning at Meherpur. Several houses were also damaged by the thunderstorm in Nadia district.

July 9th.—A severe gale passed over Narayanganj at about 6 A.M. causing serious damage to the jute godowns of several Marwari firms. Portions of the roofs of the godowns and branches of several trees were blown away. The loss of property was estimated at Rs. 5,000.

September 18th.—A severe tornado passed over the village Bainat Ashuli in Munshiganj sub-division east Bengal, at about 4 P.M. The tornado was reported to have originated from the Padma River and passed over the village with terrific speed sweeping away every thing in its track. About sixty houses and a large number of trees were blown down.

October 19th.—A hailstorm of severe intensity swept over about ten villages of Malla-Nagpur (Lucknow), considerably damaging standing paddy crop.

WINDS OF FORCE NINE OR MORE IN INDIAN SEAS.

Excluding dates of storms and depressions, a description of which has been given above, winds of force nine or more

were recorded on ships in the Indian seas during the year 1938 on the following occasions :—

Date.	Name of Ship.	APPROXIMATE POSITION.	
		Lat. N.	Long. E
		°	°
10th June . . .	<i>S. S. British Duchess</i> . . .	14	57
11th July . . .	<i>S. S. British Architect</i> . . .	11	59
18th July . . .	<i>S. S. Maloja</i>	18-17	62-59
24th and 25th July	<i>S. S. Lahore</i>	13-11	53-60



Reg. No. 1454 E 37.1,500-1,100'38-1,100'39

ENGRAVED HELIO. S. I. O. CALCUTTA.

CIRCLE INDICATES POSITION OF DEPRESSION AT 8 AM.

DOT " " " " " OTHER THAN 8 AM.

PUBLICATIONS OF THE INDIA METEOROLOGICAL DEPARTMENT.

(Complete list, including those publications which are now out of print.)

<p>The Indian Meteorologist's Vade Mecum— Part I, 2nd Edition (1883). Rs. 3* Part II (1877). Rs. 5*</p> <p>Instructions to Observers of the Indian Meteorological Department, 2nd Edition (1902). Rs. 3*</p> <p>Instructions to Observers at the 2nd and 3rd class Observatories, 2nd Edition (1934). Rs. 1-4 or 2s. 3d.</p> <p>Cloud Atlas, 2nd and revised edition (1937). Rs. 2-2 or 4s. Supplement to ditto (1938). As. 12 or 1s.</p> <p>Tables for the Reduction of Meteorological Observations in India, 3rd Edition (1925). Rs. 5-8.</p> <p>Relative Humidity Tables, new revised edition (1937) As. 7 or 9d.</p> <p>Handbook of Cyclonic Storms in the Bay of Bengal for use of Sailors— Vol. I, Text, 2nd Edition (1900). Rs. 4.* Vol. II, Plates, 2nd Edition (1901). Rs. 1-8.*</p> <p>CYCLONE MEMOIRS— Part I. Bay of Bengal Cyclone of May 20th to 28th, 1887. (1888). Re. 1.* Part II. Bay of Bengal Cyclone of August 21st to 28th, 1888. (1890). Rs. 3. Part III. Bay of Bengal Cyclones of September 13th to 20th and October 27th to 31st, 1888, and Arabian Sea Cyclone of November 6th to 9th, 1888. (1890). Rs. 5. Part IV. An enquiry into the nature and course of storms in the Arabian Sea and a catalogue and brief history of all recorded storms in the Arabian Sea from 1848—1889. (1891). Rs. 3. Part V. Account of three cyclones in the Bay of Bengal and Arabian Sea during November, 1891. (1893). Rs. 3.*</p> <p>Report of the Midnapore and Burdwan Cyclone of the 15th and 16th of October, 1874. (1875). Rs. 3.*</p> <p>Report of the Vizagapatam and Backergunge Cyclones of October, 1876. (1877). Rs. 3.*</p> <p>Report on the Madras Cyclone of May, 1877. (1879). Rs. 3.*</p> <p>Monthly weather charts of the Bay of Bengal and adjacent sea north of the equator, showing mean pressure, winds and currents. (1886). Rs. 5.*</p> <p>Monthly weather charts of the Arabian Sea and the adjacent portion of the North Indian Ocean, showing mean pressure, winds and currents. (1888). Rs. 5.</p> <p>Charts of the Bay of Bengal and adjacent sea north of the equator, showing the specific gravity, temperature and currents of the sea surface. (1887). Rs. 1-8.</p> <p>Climatological Atlas of India. (1906). Rs. 27* .</p> <p>Meteorological Atlas of the Indian seas and the North Indian Ocean. (1908). Rs. 13.*</p> <p>Daily weather reports and charts of the Indian monsoon area for the years 1893 to 1899, each month, Re. 1.*</p> <p>Normal weather or pilot charts of the Indian monsoon area for 8 a.m. for each month, November 1900 to August 1908, each month, As. 4.*</p> <p>Reports on the Meteorology of India for the years 1875—1890 (16 volumes). Each Rs. 10.†</p> <p>Meteorology of the Bombay Presidency, 1878 . . .</p> <p>Storm tracks in the Bay of Bengal (1925). Rs. 3-6 or 5s. 9d.</p> <p>Storm tracks in the Arabian Sea. (1926). Rs. 3-8 or 6s.</p> <p>Rainfall Organisation (1929). As. 2 .</p> <p>Meteorology of the Persian Gulf and Mekran. (1931) Rs. 3 or 5s. 3d.</p> <p>Five-day Normals of Maximum and Minimum Temperatures and Accumulated Rainfall. (1931). Rs. 4 or 6s. 6d.</p> <p>Winds, Weather and Currents on the Coasts of India and the Laws of Storms. (1931). Rs. 2-6 or 4s. 3d.</p>	<p>H. F. Blanford.</p> <p>Sir John Eliot.</p> <p>Departmental.</p> <p>Do.</p> <p>Do.</p> <p>Do.</p> <p>Sir John Eliot.</p> <p>Do.</p> <p>Do.</p> <p>Do.</p> <p>W. L. Dallas.</p> <p>Sir John Eliot.</p> <p>W. G. Wilson.</p> <p>Sir John Eliot.</p> <p>Do.</p> <p>H. F. Blanford.</p> <p>Sir John Eliot.</p> <p>W. L. Dallas.</p> <p>Sir John Eliot.</p> <p>W. L. Dallas.</p> <p>Departmental.</p> <p>Do.</p> <p>Do.</p> <p>C. Chambers.</p> <p>C. W. B. Normand.</p> <p>Do.</p> <p>Departmental.</p> <p>B. N. Banerji.</p> <p>Departmental.</p> <p>Do.</p>	<p>Meteorological Conditions affecting Aviation over the North West Frontier (1934). Rs. 1-8 or 2s. 6d.</p> <p>Meteorology for Airmen in India— Part I. General Meteorological Features (1936). Rs. 4-12 or 8s. 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