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INDIA WEATHER REVIEW, 1957

ANNUAL SUMMARY

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INDIA WEATHER REVIEW, 1957

ANNUAL SUMMARY

PART-C

STORMS & DEPRESSIONS

I DEPRESSIONS AND CYCLONIC STORMS

During the year two cyclonic storms and two depressions formed in the Bay of Bengal and one cyclonic storm and two depressions in the Arabian Sea. The dates of activity of the storms and the greatest barometric depths observed or estimated near their centres are given in the following table.

TABLE - I

Locality	Month	Date	Greatest observed or estimated barometric depth
Bay of Bengal	August	19th-25th	17 mb (Estimated)
Arabian Sea	November	8th-12th	17 mb (Estimated)
Bay of Bengal	December	24th-27th	10 mb (Estimated)

The detailed description of these storms and depression are followed by an account of western disturbances, the more important local storms and of localities in which winds of force 9 B.F. or more unconnected with cyclonic storms were experienced by ships in the Indian Seas.

1. Depression in the Arabian Sea— —26th to 28th May 1957—

A well-marked trough of low pressure developed in the southeast Arabian Sea over the Comorin-Maldives areas and off the Malabar coast on 18th May. It persisted there on the 19th and then shifted northeastwards. It lay as an upper air trough over south Mysore and neighbourhood between the 20th and 25th becoming more marked on the 25th. The trough then moved northwestwards, emerged into the east central Arabian Sea across coastal Mysore and a shallow depression formed on the 26th morning with centre about 200 kms west of Karwar. The depression moved northnorthwestwards thereafter and was centred about 300 kms west of Bombay at 0830 hrs IST on 27th. By the next morning it weakened into a trough of low pressure which lay off the Gujarat coast. The trough became unimportant by 29th.

The lowest estimated pressure at the centre of the depression was 998 mbs at 1730 hrs IST of 26th when the pressure deficiency was estimated to be of the order of 6 mbs.

In association with this depression, a temporary advance of the monsoon into Kerala and neighbourhood took place, and associated with this advance, widespread and locally heavy rainfall occurred over Kerala, Mysore and some parts of Madras between 22nd and 25th. The noteworthy amounts of rainfall are : Kozhikode 11.6 cm on 21st, Palghat 23.6 cm, Alleppey 16.0 cm, Cochin 13.8 cm on 22nd, Mysore 18.4 cm, Cochin 15.0 cm, Ootacamund 11.3 cm, Bangalore 10.4 cm on 23rd, Kallakurichi 16.6 cm, Mysore 11.5 cm on 24th and Shimoga 8.9 cm on 25th.

2. Cyclonic storm in the Bay of Bengal—
—19th to 25th August 1957—

A low pressure wave was moving westwards across central Burma on the 17th. It moved into the north Bay of Bengal on the morning of 18th and an upper air cyclonic circulation extending to about 3.0 kms a.s.l. developed over the north Bay of Bengal and adjoining land areas. Widespread rain with locally heavy falls was recorded over deltaic Burma, Sandoway recording 16 cm and Bassein 5 cm during the 24 hours ending at 0830 hrs IST on 18th. By the evening of the same day, conditions became unsettled over the northeast and adjoining east central Bay where pressure defects of the order of 5 to 6 mb were reported at 1730 hrs IST. The monsoon also had strengthened over the Bay. Port Blair and Rangoon reported 30 to 40 knots southwesterly winds at the lower tropospheric levels.

By the morning of 19th, the pressure defects over northeast Bay were of the order of 6 to 8 mbs and the conditions became markedly unsettled leading finally to the formation of a depression at the head Bay with associated cyclonic circulation extending upto 6 kms a.s.l. The depression was centred at 0830 hrs IST of 19th near Lat. 19.5°N, Long. 90.5°E. The following observations of 19th are significant in this connection:

Name of the Station.	Time of Obsn. IST	W i n d		R e m a r k s
		Direction	Speed (Knots)	
Sagar Island	0830	NNE	14	
Akyab	0830	SSE	5	
Sandheads	0830	NW	10	
Noakhali	0830	E	2	

The lowest pressure at the centre of the depression as inferred on the morning of 19th was 994 mb with a pressure deficiency of the order of 9 mb.

The depression remained practically stationary till the evening of 19th. On the morning of the next day, increased rainfall was recorded over north Orissa and adjoining West Bengal coast and a decrease along Arakan and East Pakistan coast where the pressure also showed a rising tendency. The upper winds of Calcutta and Gopalpur backed upto 1.5 km a.s.l. Northerly winds of 25 to 30 knots were recorded at Gopalpur and Bhubaneshwar upto 1 km a.s.l., while pressure began to fall rapidly over Orissa coast. The depression which had moved westward was centred at 0830 hrs IST of 20th about 300 km to the east of Puri. The following of 20th are relevant in this connection:

Name of the ship/station	Position		Time of Obsn. IST	W i n d		R e m a r k s
	Lat. °N	Long °E		Direction	Speed (Knots)	
S.S. Jalaparva	19.4	86.3	0530	N	5	
Sandheads			0830	NE	13	
Puri			0830	N	9	Cloudy
Chandbali			0830	NW	2	
Gopalpur			0830	NNW	13	

The lowest pressure estimated at the centre of the depression at 0830 hrs IST was 993 mb with a pressure deficiency of 11 mb.

By the evening of 20th, upper winds at Gopalpur strengthened at higher levels reaching northeasterly 40 knots between 1.5 and 3 kms a.s.l. S.S.Mozaffari (Lat. 17.6°N, and Long. 88.8°E) reported westsouthwesterly wind 25 knots and cloudy sky and Sandheads reported easterly wind 30 knots at 1730 hrs IST of the same day. The depression had moved further westwards and was centred near Lat. 19.5°N, and Long. 88.0°E at 1730 hrs on 20th.

On the night of 20th pressures were falling quickly over the Orissa coast. By 0830 hrs of 21st, pressure departures over the same region reached the order of -12 to -14 mb and fairly widespread rainfall was reported from stations in Orissa and adjoining West Bengal. The cyclonic circulation associated with the depression was extending to 6 kms a.s.l. Calcutta reported easterly winds 30 knots at 0.6 km a.s.l. and Gopalpur reported 45 knots northerly at 0.3 and 0.6 km a.s.l. The depression thus intensified into a deep depression and was centred near Lat. 19.5°N and Long. 87.5°E at 0830 hrs IST on the 21st, as is evident from the following observations of 21st.

Name of the ship/station	Position		Time of Obsn. IST	Wind		Remarks
	Lat. °N	Long. °E		Direction	Speed (Knots)	
S.S.Mozaffari	16.7	88.7	0530	W	37	Cloudy
Puri			0830	NE	18	Cloudy
Gopalpur			0830	NNW	16	Rain during preceding hour
Sandheads			0830	E	20	Drizzle during preceding hour

The estimated pressure departure at the centre of the depression was of the order of -15 mb.

During the course of the day, surface winds at stations over coastal Orissa strengthened considerably. Cuttack reported 29 knots northeasterly winds at 1730 hrs IST. Pressure departures over coastal Orissa were of the order of -14 mb while those over northwest and west central Bay were of the order of -9 to -10 mb. The upper winds over Calcutta veered and strengthened by the evening, being eastsoutheasterly 35-40 knots between 0.6 and 3.0 km a.s.l. The deep depression concentrated into a cyclonic storm and was centred at 1730 hrs IST of 21st near Lat. 19.5°N, and Long. 86.0°E. The following observations of 21st are relevant in this connection.

Name of the station.	Time of Obsn. IST	Wind		Remarks
		Direction	Speed (Knots)	
Gopalpur	1730	W	18	Slight continuous rain.
Puri	1730	NE	20	Slight intermittent drizzle.
Chandbali	1730	NE	5	

The pressure at the centre of the storm was estimated to be 983 mb and pressure departure was estimated to be -17 mb.

Moving in a westnorthwesterly direction, the cyclonic storm lay at 2130 hrs IST of the same day close to south Orissa coast near Long. 85.0°E. It crossed coast between Gopalpur and Puri on the morning of 22nd and then weakened into a deep depression centred near Phulbani. Fairly widespread rain had occurred during the 24 hours ending at 0830 hrs IST. Moving initially northwestwards and later

westnorthwestwards, the deep depression lay over west Madhya Pradesh centred at 0830 hrs IST of 23rd between Indore and Bhopal, Thereafter, it weakened and moved slowly northwestwards and lay at 0830 hrs IST of 24th over south Rajasthan between Kankroli and Jhalwar. Moving northwards thereafter, the depression which had already become shallow lay about 50 km to the southwest of Sri Ganganagar. It broke up over Kashmir Himalayas on the morning of 26th.

In association with the depression monsoon was vigorous over Orissa, Madhya Pradesh, Konkan, coastal Andhra Pradesh, Saurashtra and Kutch, Vidarbha, Rajasthan, Punjab(I) and Jammu and Kashmir and active over coastal Mysore and Telegana. According to press reports, the Kashmir valley from Anantnag to Sapore a 75 miles stretch was completely under water except for Srinagar and some villages. Godavari near Bhadrachalam and the Narmada in Indore were reported to be in high spate as a result of heavy rain, dislocating rail and road traffic. River Ravi was also reported to be in spate threatening the city of Amritsar.

A statement showing district averages of rainfall and particularly heavy rainfall amounts is given below :

State and district.	District averages on								Particularly heavy falls (cm)
	18	19	20	21	22	23	24	25	
<u>ORISSA</u>									
Balasore	On 22nd - Sere 13.0
Kalahandi	..	4.1	4.1	10.7	..	..	..	..	On 18th - Midnapur Rampur 16.3
Mayurbhang	3.0	..	..	..	..	On 22nd - Malkangiri
Koraput	..	4.2	4.8	7.5	6.8	..	..	..	13.7, Koraput 14.5, Padwa 13.0 On 23rd - Jeypore 24.0
<u>MADHYA PRADESH</u>									
Durg	4.3	..	..	..	On 22nd - Rajnandgaon 16.3, Kawardha 18.8
Bastar	3.3	..	7.5	..	..	..	On 22nd - Sukma 13.2, Kankar 16.3
Damoh	5.4	..	..	..	..	..	..	..	On 23rd - Hoshangabad 17.8, Seoni 19.8, Shaharpur 15.5
Hoshangabad	10.9	..	..	On 23rd - Mohapani and Gotitora 19.1.
Narsinhapur	4.4	7.2	..	On 24th - Powarkheda 18.5
Nimar	13.2	..	..	..	On 22nd - Khandwa 20.3 Harsud 18.0, Mandhata 14.5.
Betul	6.8	..	..	On 23rd - Chincholi 14.0
Seoni	..	3.0	..	..	..	3.4	..	..
Bhind	..	3.9	..	..	..	..	..	..

Some of the other noteworthy rainfall amounts (in cms) associated with this depression are:

On 18th - Chanda 15.7; On 19th - Mahabaleshwar 11.0; On 20th - Bombay (Santacruz) 14.3; On 21st - Mahabaleshwar 26.9; Harnai 12.1; On 22nd - Jagdalpur 13.6, Ven-
gurla 13.3, Vishakhapatnam 12.1, Mahabaleshwar 10.5, Bombay (Santacruz) 10.3,
Calingapatnam 10.2; On 23rd - Hoshangabad 17.8, Mahabaleshwar 17.3, Ratlam 15.5,
Pachmarhi 11.8, Indore 10.6, Bhopal 10.2, Veraval 10.0, Barwani 14.6, Khargaon
16.9, Jorhat 23.2, Maheswar 16.5; On 24th - Erinpura Road 15.7, Siliguri 12.1,
Neemuch 11.0, Udaipur 10.6, Pindwara 21.3, Deogarh 24.0, Sirohi 19.3; On 25th -
Mount Abu 17.0, Dras 10.0, Sonemarg 9.0, Khargaon 17.2; On 26th - Jammu 15.0,

3. Depression in the Bay of Bengal—
—9th to 15th September 1957—

On the 5th September a trough of low pressure developed over the west central and adjoining northwest Bay of Bengal. By the morning of 7th, it became well marked and the cyclonic circulation associated with this trough of low pressure was extending upto 3 km a.s.l. The westerlies over Ceylon, at the lower tropospheric levels were gradually strengthening and were of the 30 knots on 8th morning. Westerlies over south Bay of Bengal also strengthened to 15 to 20 knots and fairly widespread rainfall was reported from the Bay Islands and the Burma coast.

The well marked trough of low pressure concentrated into a depression on the morning of 9th with centre near Lat. 13.0°N and Long. 85.0°E. The following observations of 9th were relevant in this connection.

Name of the ship.	Position		Time of Obsn. IST	Wind		Remarks
	Lat. °N	Long. °E		Dir.	Speed (Knots)	
S.S. Greworles	11.5	84.5	0530	W	30	Slight continuous rain
S.S. Rajput	13.7	91.4	0530	SW	10	Overcast
S.S. Rewpong	14.7	85.0	0530	NE	5	Rain/showers
S.S. Jalaputra	15.1	85.0	1130	ENE	15	Rain/showers

The lowest pressure inferred at the centre of the depression was 998 mb.

By the evening of 9th, the depression had moved in a northerly direction and was near Lat. 14.5°N and Long. 85.5°E. Increased cloudiness was reported over coastal stations of Andhra Pradesh were some stations reported drizzle. By the morning of 10th, the depression had moved northnorthwestwards and was centred at 0830 hrs IST near Lat. 16.0°N and Long. 86.0°E. At 0530 hrs IST of the same day, S.S. Jalaputra (Lat. 17.6°N, and Long. 86.0°E) had reported northnortheasterly wind 15 knots and rain showers while at 1130 hrs IST (Lat. 18.3°N and Long. 86.3°E) of the same reported eastnortheasterly winds 25 knots.

At 1730 hrs IST of the same day, fairly widespread rain or thundershowers were reported from stations in Gangetic West Bengal. Also pressures in that region showed a falling tendency. Upper winds over Orissa and Gangetic West Bengal strengthened, Calcutta reporting southeasterly to easterly winds 25 to 30 knots between 0.9 and 4.5 km a.s.l. and Jamshedpur and Jharsuguda mainly easterly winds between 25 and 40 knots upto 2.1 km a.s.l. The depression moved northnorthwestwards and was centred at 1730 hrs IST near Lat. 17.5°N and Long. 85.0°E. The following observations of 10th are relevant in this connection:

Name of the ship.	Position		Time of Obsn. IST	Wind		Remarks
	Lat. °N	Long. °E		Dir.	Speed Knots	
S.S. Jalaputra	19.8	86.8	1730	ESE	25	Violent rain showers
S.S. Bharatmitra	13.4	84.8	1730	WSW	18	—

By the morning of 11th the upper winds at Bhubaneswar and neighbouring stations had veered and became southeasterly while those at Vishakhapatnam backed and became northerly to northwesterly. The pressure departures over north Andhra Pradesh - south Orissa coast were of the order of -5 mb. Gopalpur and Calingapatnam reported southeasterly winds 5 knots slight intermittent rain and westnorthwesterly winds 5 knots slight continuous drizzle respectively at 0530 hrs IST on 11th when the depression which had moved rapidly in a northwesterly direction lay close to the coast near Lat. 18.5°N.

Widespread rain with scattered heavy falls were reported from stations in Orissa, Balasore and Gopalpur recording 9 cm and 6 cm of rain respectively

during the 24 hours ending at 0830 hrs IST of 11th. The surface winds over the northwest Bay and adjoining coastal stations were also strong. Saugar Island reported southsoutheasterly winds 25 knots, Sandheads eastsoutheasterly 20 knots, Puri southeasterly 20 knots at 0830 hrs IST. S.S.Jalaputra (Lat. 20.8°N and Long. 87.8°E) at 0530 hrs IST reported southeasterly winds 30 knots. The depression crossed the coast near Lat. 18.5°N (between Gopalpur and Calingapatam) and moving in a westnorthwesterly direction it lay at 0830 hrs IST of the same day over south Orissa with centre about 50 km to the north of Koraput.

The depression then moved northwestwards and lay near Kakker in east Madhya Pradesh at 1730 hrs IST of 11th. Moving westnorthwestwards thereafter, it was over Vidarbha on the morning of 12th with centre about 50 kms to the southeast of Nagpur. Moving later in a northwesterly direction, it lay over Madhya Pradesh with its centre near Betul on the morning of 13th.

Under the influence of an upper air trough in the westerlies which was moving across the northern parts of the country, the depression moved northwards thereafter across northwest Madhya Pradesh and west Uttar Pradesh and was weakening at the same time. It finally broke over east Himachal Pradesh and Kumaon hills by the 15th. Under the influence of this depression the monsoon was active over Gangetic West Bengal and adjoining Bihar Plateau and Orissa where widespread rain with scattered heavy falls occurred during the 24 hours ending at 0830 hrs IST of 12th, Contai and Baripada recording 10 cm each, Midnapore and Jamshedpur 9 cm each and Balasore 6 cm. The depression was also responsible for a temporary revival of monsoon over Madhya Pradesh, southeast Rajasthan, west Uttar Pradesh and the eastern districts of Punjab(I). Widespread and locally heavy rain occurred over a belt extending from Telangana and east Maharashtra to west Uttar Pradesh and east Himachal Pradesh. Very heavy rain was reported from the Kumaon hills and neighbourhood on the 14th and 15th.

According to press reports forty-two persons in west Uttar Pradesh lost their lives as a result of floods due to excessive rains. Several thousand houses in Moradabad and Meerut districts of west Uttar Pradesh were reported to have been damaged and railway communications in some parts of west Uttar Pradesh dislocated. The level of the river Jamuna near Delhi was also reported to have risen above the danger mark and several villages by the side of the banks partly submerged.

A statement giving district averages and noteworthy amounts of rainfall during the period 10th to 15th September 1957 is given below:

State and district.	District averages on						Particularly heavy falls (cms)
	10	11	12	13	14	15	
BIHAR							
Singhbhum	4.3	..	..	..
UTTAR PRADESH							
Saharanpur	2.8	16.4	On 15th - Deobund 24.4, Nayashahr 14.2, Kalsia 16.8, Salimpur 15.2
Aligarh	11.3	3.5	On 14th - Aligarh 14.5, Atrauli 16.0, Hathras 12.7, Balanpur 22.9
Moradabad	12.3	15.2	On 14th - Moradabad 15.5, Thakurwara 15.2.
Muzaffarpur	On 15th - Amrona 36.3.
Meerut	On 15th - Muzaffarnagar 20.1;
Bulandshahr	On 16th - Jeoli Janasath 23.6
Mainpuri	On 14th - Dasna 27.4
							On 14th - Bulandshahr 27.9, Dgyananthpur 25.4
							On 14th - Mustafabad 19.3, Shikohabad 14.0, Gopalpur 22.1

State and district.	District averages on						Particularly heavy falls (cms)
	10	11	12	13	14	15	
Etah	On 14th - Etah 14.5
Bareilly	On 15th - Kundhra 14.0
Nainital	On 14th - Kaladhungi 13.2, Ramnagar 15.2. On 15th - Kaladhungi 20.6, Tanakpur 22.7, Nainital 31.5, Haldvani 19.6, Nainital Obsy. 31.2.
PUNJAB							
Gurgaon	5.5	..	
Karnal	4.6	
Ambala	11.0	On 15th - Ambala 15.5, Naraingarh 17.0, Dadupur 18.5.
Hoshiarpur	11.0	..	
Patiala	7.7	On 15th - Rajpura 13.0.
Sirhind	
Sub-Divn.	7.6	On 15th - Rajpura 13.0.
Sangrur Divn.	On 15th - Barthala 13.0.
Kandaghat	
Sub-Divn.	3.9	8.1	On 15th - Rohati 14.2.
MADHYA PRADESH							
Gwalior	2.3	2.5	
Shivpuri	2.3	2.0	On 13th - Kolaras 6.0
Guna	5.8	4.1	On 13th - Mungaoli 6.7 On 14th - Mungaoli 7.2, Guna 6.7
Bhilsa	2.3	1.5	
Rajgarh	2.4	3.6	3.2	On 12th - Biaora 5.4
Shajapur	3.1	..	On 13th - Shujalpur 6.5
Dewas	2.5	
Indore	2.6	
Dhar	2.2	2.3	..	
Raesen	3.8	On 14th - Bareilly 9.1, Salwani 6.4
Satna	1.6	1.9	..	..	..	..	On 10th - Sohawal 5.3
Shadhol	..	2.7	..	2.1	..	..
Chhatarpur	3.2	..	..	..	On 11th - Chhatarpur 15.7. On 14th - Bijwar 10.2. On 15th - Chhatarpur 8.4.
Durg	On 10th - Khamaria 11.4.
Bastar	3.1	2.3	..	..
Sagar	2.5	2.5	On 13th - Chandia Nalla 8.8. On 14th - Banda 8.9.
Damoh	3.6	4.6	On 14th - Damoh 8.1. On 15th - Damoh 8.0.
Hoshangabad	3.1	2.3	4.3	..	On 12th - Shogapur 9.5 On 14th - Pachmarhi 13.8, Sohagpur 9.5, Seoni and Malwala 9.4.
Narsimhapur	3.8	1.8	7.4	..	On 14th - Gadarpur 12.1, Narsimhapur 8.1, Tendukhera 8.0
Nimar	3.6	..	..
Betul	4.7	7.1	..	On 13th - Atnar 8.9. On 14th - Bhainsdehi 12.7, Atnar 12.7, Multai 10.5
Chhindwara	1.8	3.3	2.3	..	
Bhind	3.8	3.8	On 14th - Mehagaon 6.7
Morena	4.8	..	1.8	On 13th - Sabalgarh 8.1.

4. Depression in the Bay of Bengal—
—23rd to 27th September 1957—

The monsoon westerlies were showing strengthening in the southeast Bay of Bengal and north Andaman Sea between 18th and 20th. On the evening of 20th, Port Blair reported 40 - 50 knots westsouthwesterly winds between 0.3 and 2 kms a.s.l. A low pressure wave was moving westwards across central Burma on that day. It moved into northeast and adjoining east central Bay on the morning of 21st and a well marked low pressure area developed over north and adjoining central Bay on 22nd. The associated circulation was extending upto 5 kms a.s.l. Pressure departures over Arakan and adjoining northeast and east central Bay were of the order of -6 mbs. The well marked low concentrated into a depression the next morning and was centred at 0830 hrs IST near Lat. 19.0°N and Long. 89.5°E. The following observations recorded on the morning of 23rd were relevant.

Name of the ship/station	Position		Time of Obsn. IST	Wind		Remarks
	Lat. °N	Long °E		Dir.	Speed Knots	
Sandheads			0830	N	18	Slight continuous rain
Cox's Bazar			0830	SE	3	Cloudy
S.S.Jalaprakash	19.7	87.2	0530	N	18	Showers of rain during the preceding hour.
S.S.Jalaprabha	18.3	86.8	0530	WNW	10	Cloudy

The estimated pressure at the centre of the depression was of the order of 998 mb at 0830 hrs IST.

Moving in a northwesterly direction, the depression was centred near Lat. 19.5°N and Long. 88.5°E at 1730 hrs IST of the same day.

During the course of the night, pressure rose along Orissa and West Bengal coasts. The pressure departures over northeast Bay was of the order of -5 mb on the morning of 24th. The depression moved northwards and was centred near Lat. 20.0°N and Long. 88.0°E at 0830 hrs IST of 24th. The following observations recorded on the 24th were significant.

Name of the ship/station	Position		Time of Obsn. IST	Wind		Remarks
	Lat. °N	Long °E		Dir.	Speed	
S.S.Bharatratna	18.7	86.0	0530	NW	5	Cloudy
S.S.State of Kutch	19.2	89.4	0530	S	15	Cloudy
Sandheads			0830	E	9	Overcast

On the 24th night the upper winds along the West Bengal coast backed to northerlies while those over the Arakana and Chittagong coasts veered becoming southerlies to southsouthwesterlies. The depression recurved and moving in a northnortheasterly direction it was centred at 0830 hrs IST of 25th close to coast about 100 kms to the southwest of Calcutta. The following observations of 25th morning are relevant in this connection.

Name of the station	Time of Obsn. IST	Wind		Remarks
		Dir.	Speed (Knots)	
Sandheads	0830	W	11	Cloudy
Chittagong	0830	ESE	9	Cloudy
Sagar Island	0830	NNW	9	—
Calcutta	0830	NNW	2	
Cox's Bazar	0830	SSE	7	Moderate continuous rain

During the course of the day, the depression crossed the coast and weakened further and by the morning of 26th, it lay as a trough of low pressure over East Pakistan and adjoining parts of Assam. It became unimportant the next day.

The depression caused widespread rain with locally heavy falls in coastal West Bengal on 24th and Assam on 26th and 27th. The following table gives the district averages and noteworthy rainfall associated with the depression.

State and district.	District averages on						Particularly heavy falls (cms.)
	22	23	24	25	26	27	
ASSAM							
Lakhimpur	6.1	..	On 26th - Harmati 17.4
Garo Hills	5.5	5.1	..	..
Khasi & Jaintia hills	7.0	13.8	5.5	On 25th - Mawsynram 31.2 On 26th - Mawsynram 36.7 Cherrapunji 18.3 On 27th - Cherrapunji 16.5
WEST BENGAL							
24 Parganas	3.1	..	..	..
West Dinajpur	2.9	..	..
Nadia	2.7	..	..	..

5. Deep depression in the Arabian Sea— —20th to 26th October 1957—

Under the influence of a low pressure wave from the east, a diffuse low pressure area formed over north Andaman Sea on the 11th of October 1957. The associated cyclonic circulation could be clearly inferred from the winds over Port Blair (northwesterly 15 knots), Tavoy (southwesterly 22 knots), Victoria Point (westerly 22 knots) and Rangoon (easterly 22 knots) at 0.9 km a.s.l. This moved gradually westwards and was near south Madras coast on the 15th morning. Cloudiness over the coastal stations south of Madras increased on the 14th morning itself and on the 15th morning coastal stations round Madras reported rain. The low pressure area crossed extreme south Peninsula and was emerging into the Arabian Sea on the 18th and was over the Comorin - Maldives area on that day. The circulation extended upto 4.5 kms as indicated by the 1730 hrs IST charts of 18th. On the morning of 19th, Minicoy wind at the surface and upto 4 kms showed that it was northwesterly which indicated that the low pressure area was east of it. Under its influence, good rainfall was recorded in the extreme southwest Peninsula on the morning of 20th. By the evening of the same day, the disturbance had moved west of Minicoy where the winds strengthened to southwesterly 20 knots at the lower tropospheric levels. Moving northwards thereafter and intensifying at the same time, it was northwest of Amini Divi on the morning of 21st where it lay as a depression centred near Lat. 11.5°N. and Long. 70.5°E at 0830 hrs IST of the same day. The following observations reported on the morning of 21st are relevant.

Name of the ship/ station.	Position		Time of Obsn. IST	Wind		Remarks
	Lat. °N	Long °E		Dir.	Speed Knots	
Minicoy			0530	W	5	
S.S. Suez Maru	13.0	70.5	0530	WSW	10	Overcast
S.S. Jalaprabha	15.6	72.6	1130	SSE	10	Slight intermittent drizzle.
S.S. Ryhomaru	14.3	71.7	1130	SE	12	Slight continuous rain
S.S. City of Durham	16.6	70.4	1130	SE	3	Cloudy
S.S. Kohomaru	16.4	68.0	1130	NNE	20	Cloudy

Moving eastnortheastwards, the depression was centred near Lat. 12.0°N and Long. 72.0°E at 0830 hrs IST of 22nd. The circulation associated with the depression extended upto 3 kms a.s.l. Moving northwards thereafter, it intensified into a deep depression and was centred near Lat. 13.0°N and Long. 72.0°E on the morning of next day. The upper winds over Mangalore upto 1.5 km a.s.l. were about 30 knots at this time. It moved in a northwesterly direction and was centred near Lat. 14.5°N and Long. 70.5°E at 0830 hrs IST of 24th. S.S.Palankottah (Lat. 15.5°N and Long. 70.0°E) at 1530 hrs IST of 24th which lay close to the centre of the depression reported sudden increase of wind speed to B.F.8 which lasted for nearly three hours. The ship estimated the depression apparently small in area, centred at 1500 hrs GMT about Lat. 15.45°N and Long. 70.15°E with steep barometric gradient near the centre.

Continuing its northwesterly course, the deep depression lay with its centre near Lat. 16.0°N and Long. 70.0°E on the morning of 25th.

A western disturbance was moving across Kashmir on 24th, In the rear of the disturbance there was a rush of cold dry air into the Arabian Sea across northwest India. Apparently as a result of this, the deep depression weakened rapidly into a trough of low pressure and became unimportant by the 26th.

The lowest estimated pressure at the centre of the depression was 1003 mb at 12 hrs. GMT of the 23rd with a probable departure of -5 mb.

In association with this depression, fairly widespread or local thunder-showers occurred on a number of days in the Peninsula particularly in the coastal districts. District averages of the rainfall and particularly heavy rainfalls during this period are given below:

State and district.	District averages on							Particularly heavy falls (cms.)
	20	21	22	23	24	25	26	
MADRAS								
South Arcot	..	..	..	..	..	2.8	..	On 20th - Kottamyllore 12.5
Tanjore	..	..	..	..	..	..	..	On 22nd - Vallam 10.7
Madurai	2.6	..	..	..	..	..	..	On 20th - Natham 8.4, Usilampatti 8.6
Tirunelveli	..	..	..	..	..	..	..	On 22nd - Usilampatti 8.8
								On 23rd - Kadayanallur 12.7
								On 25th - Radhapuram 7.8
								On 26th - Srivaikuntam 8.0
Salem	..	..	..	..	..	..	..	On 20th - Dharmapuri 11.7
Coimbatore	..	..	..	..	..	2.8	..	On 21st - Pariyanayakam-palayam 10.0, Coimbatore 8.2
								On 25th - Satyamangalam 10.7, Avanashi 10.5, Mettupalayam 8.7.
The Niligiris	..	..	..	..	2.5	2.3	..	On 24th - Kodanad 7.5, Coonoor 7.3.
								On 25th - Kotagiri 9.3.
Kanyakumari	..	..	..	..	..	2.7	2.1	On 22nd - Balamore 10.7.
								On 25th - Nagercoil 12.6.
MYSORE								
Shimoga	..	..	4.8	..	..	..	..	On 22nd - Honnali 9.3, Shikapur 9.9, Anandapuram 8.1.
Chitaldurg	..	..	3.9	1.7	..	..	..	On 22nd - Chitaldurg 7.4,
								On 23rd - Jagalur 7.0.
Bidar	..	3.0	..	2.1	5.8	..	..	On 24th - Bidar 9.1, Santhpur 12.7.

State and district.	District averages on						Particularly heavy falls (cms.)	
	20	21	22	23	24	25		26
Gulbarga	..	..	..	5.6	4.4	..	..	On 23rd - Shahpur 12.7, Jewargi 7.2 On 24th - Seram 6.6
Raichur	..	..	..	2.9	..	..	..	On 23rd - Deodurga 7.0
South Kanara	2.4	..	3.0	..	..	..	..	On 20th - Karkala 5.7, Coondapur 4.9
Coorg	3.1	3.0	..	..	..	..	..	On 21st - Titimatti 9.8
Bijapur	..	..	..	3.2	2.9	2.6	..	On 23rd - Bilgi 10.7 On 24th - Jamkhandi 5.8
Belgaum	..	..	..	3.0	..	2.1	..	On 23rd - Hukeri 5.6 On 25th - Athani 7.7
KERALA								
Quilon	..	..	..	..	..	..	..	On 22nd - Aryankavu 7.5
Kottayam	..	2.0	2.2	..	..	3.3	..	On 22nd - Peermade (Residency, 19.1, Peermade (Taluka) 8.2 On 21st - Kanjirappalli 9.4 On 25th - Malayattur 9.3, Parur 8.3, Vaikom 8.4
Trichur	..	..	..	..	1.6	4.2	..	On 24th - Thalappally 7.7 On 25th - Trichur 8.9, Cochin 7.4
Palghat	2.1	1.8	..	..	..	..	..	On 20th - Perinthalamanna 8.9 On 21st - Palghat 8.5
Kozhikode	2.7	2.7	2.2	..	..	2.2	..	On 21st - Manjeri 8.9 On 22nd - Vythiri 5.8 On 23rd - Vythiri 5.8
Cannanore	..	2.9	..	..	..	..	..

Some of the other noteworthy amounts of rainfall are - On 17th - Nagapattinam 14 cm; On 18th - Pambam 11.7 cm; On 24th - Sholapur 13 cm; On 25th - Hanamkonda 13.6 cm; Sironcha 11.5.

6. Severe cyclonic storm in the Arabian Sea—
—8th to 12th November 1957—

In association with the movement of a low pressure wave from east a low pressure area developed over the Comorin Maldiva area on the evening of 3rd November. Moving slowly westwards, it lay on the evening of 7th with central the region near Lat. 9.0°N and Long. 68.0°E. It intensified into a depression the next day and was centred at 1730 hrs IST near Lat. 12.5°N and Long. 67.5°E. The upper winds of Minicoy had strengthened by this time to 25 knots at 0.3 and 0.6 km a.s.l. The following observations of 8th evening are relevant in this connection.

Name of the ship/ station.	Position		Time of Obsn. IST	Wind		Remarks
	Lat. °N	Long °E		Dir.	Speed (Knots)	
S.S.Clan Davidson	9.8	63.5	1730	N	5	Cloudy
S.S.Indian Renown	9.0	67.9	1730	WSW	11	Cloudy
S.S.British Tenacity	14.1	70.5	1730	ESE	16	Rain during preceding hour

Name of the ship/ station	Position		Time of Obsn. IST	Wind		R e m a r k s
	Lat. °N	Long °E		Dir.	Speed (Knots)	
S.S.Nikomaru	14.7	71.7	1730	SE	20	Moderate continuous rain
S.S.Korcimaru	7.2	75.9	1730	SW	9	Showers during the preceding hour
Minicoy			1730	S	13	Rain during the past hour
Mangalore			1730	S	13	Thundershowers

Moving slowly northnorthwestwards, the depression was centred near Lat. 13.5°N and Long. 67.0°E at 0830 hrs IST of 9th. Ships' observations from the central region were meagre but a number of ships at about 500 kms or more from the centre reported winds of the order of 20 - 25 knots suggesting that the depression had probably deepened during the day.

S.S.British Birch (Lat. 14.6°N and Long. 69.6°E) reported southerly winds of 30 knots and heavy continuous rain at 0530 hrs IST of 10th. The coastal upper winds had come into the grip of the cyclonic circulation upto 4 km a.s.l. The microseisms recorded at Colaba showed slight increase in amplitude. These indicated that the deep depression had intensified into a cyclonic storm. It was centred near Lat. 15.0°N and Long. 67.5°E at 0830 hrs IST of 10th.

The cyclonic storm continued to move eastnortheastwards intensifying at the same time. Stations along the Konkan coast showed fall of pressure. Weather along and off the Konkan coast deteriorated considerably. S.S.British Birch (Lat. 14.8°N and Long. 70.6°E) reported southerly winds of 37 knots and rain in sight at 1730 hrs IST of 10th. Further increase in the amplitude of the microseisms was recorded at Colaba and were definitely of the storm type since 2030 hrs IST of 10th.

On the morning of 11th there were hardly any observations from the inner area of the storm. The available observations, however, indicated that the cyclonic storm probably became severe in the course of the night and was centred near Lat. 15.5°N and Long. 69.5°E at 0830 hrs IST of 11th.

The severe cyclonic storm moved thereafter in a northerly direction and gradually weakened. It lay as a cyclonic storm of moderate intensity with centre near Lat. 17.0°N and Long. 70.0°E at 0830 hrs of 12th and as a deep depression near Lat. 18.0°N and Long. 70.0°E at 1730 hrs of the same day. The subsequent movement of the depression was difficult to follow due to extreme paucity of observations in the field of the depression. It would appear that the depression moved northnorthwestwards and rapidly weakened into a low pressure area off the Konkan Gujarat coasts the next day.

Some of the interesting observations recorded by S.S.British Birch, S.S.Aronda and S.S.Indian Pioneer, which were in the storm field are given below:

Name of the S h i p	Date	Time of Obsn. IST	Position		Wind		Weather Remarks
			Lat. °N	Long °E	Dir.	Speed Knots	
S.S.British Birch	10.10	0530	14.6	69.6	S	30	Heavy continuous rain
		1130	14.6	70.0	S	30	
		1430	14.3	70.6	S	30	Moderate intermittent rain
		1730	14.8	70.6	S	37	Rain in sight
		2030	13.6	71.1	S	30	Overcast

Name of the S h i p	Date	Time of Obsn. IST	Position		Wind		Weather Remarks
			Lat. °N	Long °E	Dir.	Speed Knots	
S.S. Aronda	10.10	2230	18.6	70.6	E	25	Light rain, Sea rough, swell moderate to heav
	11.10	0230	18.0	71.3	E/N	30	Gusts, Squalls Heavy sea and swell continu-
		0430	17.7	71.5	ENE	25	ous rain Occasional rain, mode-
		0730	17.1	71.5	E/N	30	rate to heavy sea, swe Gusts. Rough confused
		1030	16.9	71.9	SE/E	30	sea, swell. Severe thunderstorm. Very heavy rain
S.S. Indian Pioneer 12.10	1130	16.5	71.5	ESE	30	Rough seas, heavy swel from southeast. Conti	
	1530	18.6	69.1	NE	30	uous heavy rain, Squal gale during past 4 hou	
	1730	18.7	69.8	NE	30	Continuous heavy rain Slight continuous rain Slight, intermittent rain	

Under the influence of the cyclonic storm fairly widespread or local rainfall occurred in the south Peninsula and the Konkan between 7th and 15th and in Gujarat and Saurashtra and Kutch between 13th and 15th. The following table gives the district averages and particularly heavy amounts of rainfall associated with the storm.

State and district.	8th	9th	10th	11th	12th	Particularly heavy falls.
MADRAS						
Tanjore	..	..	..	3.1	3.2	
Coimbatore	..	5.1	..	..	..
Nilgiris	3.9	..	..	..	..
MYSORE						
Hassan	..	2.8	..	..	..
Shimoga	3.6	..	..	..	..
South Kanara	7.0	3.2	..	..	..
Coorg	3.4	2.6	..	..	..
North Kanara	4.0	3.3	..	..	..
Belgaum	2.5	..	..	..	..
KERALA						
Triwandrur	..	..	2.8	..	2.7	
Palghat	3.2	..	..	..	..
Cannanore	4.0	3.1	..	..	..

7. Cyclonic storm in the Bay of Bengal—
—25th to 27th December 1957—

On the morning of 23rd December a general fall of pressure was observed over south Bay Islands. Nancowrie and Kondul reported rainfall of 3 cm and 1 cm respectively. These indicated that a low pressure wave from the east was moving westwards over that region. By the evening the existence of a low pressure area in the extreme south Bay could be inferred from the following ships' observations at 1730 hrs IST on that day.

Name of the S h i p	Position		Time of Obsn. IST	Wind		R e m a r k s
	Lat. °N	Long °E		Dir.	Speed (Knots)	
State of Madras	7.0	92.5	1730	ENE	9	Cloudy
S.S.Tjinrgara	1.0	89.4	1730	W	15	Cloudy
S.S.Bander	7.8	82.5	1730	N	15	Overcast

During the night of 23rd pressures began rising over the Bay Islands while they were falling along the Coromandel coast and Ceylon. The disturbance became well marked on the morning of 24th with its central region near Lat. 5.5°N and Long. 84.5°E as could be evident from the following observations of 24th.

Name of the ship/ station	Position		Time of Obsn. IST	Wind		R e m a r k s
	Lat. °N	Long °E		Dir.	Speed Knots	
S.S.Eihomaru	5.9	85.0	0830	SE	15	Slight intermittent rain
Trincomalee			0830	NE	5	Light drizzle
S.S.Lagganga	9.6	83.5	0830	NE	25	Cloudy

It concentrated into a depression and was centred near Lat. 7.0°N and Long. 83.0°E at 1730 hrs IST of the same day. The following observations made at 1730 hrs IST on 24th are significant.

Name of the ship/ station	Position		Time of Obsn. IST	Wind		R e m a r k s
	Lat. °N	Long °E		Dir.	Speed Knots	
S.S.City of Liver- pool	8.5	82.6	1730	NE	20	Moderate intermittent drizzle
Trincomalee			1730	N	20	Showers during preceding hours
Colombo			1730	W	6	Slight continuous drizzle
S.S.Eihomaru	5.9	82.1	1730	W	20	Heavy continuous rain
Galle			1730	NW	10	Slight continuous rain

The winds over Ceylon stations at the lower tropospheric levels were considerably strong at 1730 hrs IST of 24th and were of the order of 30 to 40 knots northerly to northeasterlies.

Moving in a northwesterly direction the depression intensified into a deep depression and was centred near Lat. 7.5°N and Long. 82.5°E at 0830 hrs IST of 25th. The following observations of 25th are relevant in this connection.

Name of the ship/ station	Position		Time of Obsn. IST	Wind		R e m a r k s
	Lat. °N	Long °E		Dir.	Speed Knots	
S.S.Nagasaki	4.5	88.2	0530	S	11	Cloudy
S.S.Jagganga	11.0	83.9	0530	NNE	20	Overcast
S.S.Senzanmaru	11.7	84.7	0530	ENE	20	Rain
S.S.Leicestershire	6.6	82.5	0530	WSW	20	Cloudy
S.S.Tarushimaru	6.0	85.7	0530	SSW	15	Overcast
S.S.Bandoran	5.7	83.0	0530	WSW	20	Cloudy
S.S.City of Liverpool	6.0	81.4	0530	W	25	Cloudy
S.S.Makala	8.0	82.6	1130	E	30	Moderate drizzle/rain
S.S.Leicestershire	7.3	83.4	1130	SW	15	Cloudy
Colombo			0830	NNW	6	Showers
Mannar			0830	N	10	Moderate continuous rain

S.S.Makala (Lat. 9.1°N and Long. 82.9°E) reported southeasterly wind 25 knots and overcast sky and City of Ottawa (Lat. 11.4°N and Long. 83.7°E) reported easterly 20 knots and heavy continuous rain at 1730 hrs IST of the same day. This indicated that the deep depression was intensifying into a cyclonic storm, which was centred near Lat. 8.5°N and Long. 82.0°E at 0830 hrs IST of 26th. The following observations recorded on the morning of the same day were as follows:

Name of the ship/ station	Position		Time of Obsn. IST	Wind		R e m a r k s
	Lat. °N	Long °E		Dir.	Speed Knots	
S.S.Leicestershire	10.1	82.5	0530	SE	13	Slight continuous rain
S.S.City of Ottawa	8.7	82.7	0530	SW	20	—
S.S.Rajula	11.1	84.6	0530	E	9	Overcast
Trincomalee			0830	N	25	Slight intermittent rain
S.S.Vily	12.3	82.5	0830	NE	25	Heavy rain

Hambantota recorded 35-45 knots westerly between 0.3 and 0.9 kms at 0530 hrs IST. The cyclonic storm moved in a northwesterly direction but weakened into a deep depression with centre near Lat. 9.5°N and Long. 81.5°E at 1730 hrs IST of the same day. It weakened into a depression by the next morning and did not show any appreciable movement. By the evening of the same day, it weakened further and lay as a well marked low pressure area over Ceylon. It moved slowly westwards affecting extreme south Peninsula and emerged over Comorin - Maldiva area by 29th. Later it became unimportant.

Under the influence of the cyclonic storm a good spell of rain occurred in the extreme south Peninsula causing disruption of railway communication. Some of the noteworthy amounts of heavy rainfall are : Nagapattinam 9 cm on 27th and 14 cm on 28th and Pamban 9 cm on 26th. However, Ceylon was the country more affected by the storm experiencing very heavy floods during the past fifty years. According to press reports, all the rivers in Ceylon were in spate and the banks of four major irrigation tanks had burst submerging a number of villages and fields. According to press reports, more than 200 persons were killed and over 2,50,000 people rendered homeless by the floods. Road and rail traffic were also completely dislocated on account of the floods.

II ACCOUNT OF WESTERN DISTURBANCES DURING 1957

The year was marked by a number of western disturbances which caused little or no rain. However, during the month of October and November when the western disturbance activity is not much pronounced, many disturbances moved across the northern parts of the country. From the middle of March there was practically no active western disturbance with the result that the rainfall in Jammu and Kashmir, Punjab and Himachal Pradesh was generally in deficit during this period. During the second week of July, a western disturbance caused the inflow of monsoon air into Punjab and Kashmir.

A list of 99 western disturbances that affected the country classified according to the nature of precipitation caused by them is given in the following table. Description of the more active ones is added.

Nature of precipitation.	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jly.	Aug.	Sep.	Oct.	Nov.	Dec.
Widespread rain	2	-	-	1	-	1	4	-	1	2	1	1
Local rain	3	-	2	-	5	1	2	2	2	-	-	1
Little or no rain	8	7	7	10	2	6	2	4	3	5	6	8
No. of western disturbances in each month.	13	7	9	11	7	8	8	6	6	7	7	10

1. Western depression during the period—
—7th to 10th January 1957—

A western disturbance moved into Baluchistan from the west on the 7th morning with associated upper air trough extending at least upto 3 km. As the main disturbance was moving away eastwards across Punjab and Kashmir, the next day, a secondary low moved over to north Rajasthan with a trough of low pressure extending into Arabian Sea through lower Sind. On the 9th the low moved over to Punjab and intensified into a deep depression with associated trough extending upto 7 km. The pressure departure at Lahore was -18 mb on the 9th morning. On the next day it moved away eastnortheastwards and weakened. Under the influence of the depression widespread rainfall was reported over Punjab and west Uttar Pradesh on the 9th and 10th. Locally heavy falls of rain were reported from Kumaon hills on the 10th. Fairly widespread snow also occurred in Jammu & Kashmir and Himachal Pradesh on 8th and 9th. Some of the significant rainfall amounts are Ajmer 7 cm, Agra and Hardoi 5 cm each on 9th and Sabour 9 cm, Naya Dumka 8 cm and Nainital and Malda 7 cm each on 10th.

2. Western disturbance during the period—
—10th to 12th December 1957—

A western disturbance moved into west Baluchistan on 9th December. Moving in an eastnortheasterly direction, it concentrated into a depression on the 11th morning when it lay over north Rajasthan and the adjoining areas of the Punjab. The pressure departure near the centre was about -10 mb. The depression was associated with strong upper winds. It weakened and moved away across the Western Himalayas by 12th after inducing a low over south Uttar Pradesh and adjoining north Madhya Pradesh. The induced low moved away across Assam by 13th.

In association with the western depression fairly widespread rain or snow occurred in Jammu and Kashmir, Himachal Pradesh and Punjab on 11th and 12th and in west Uttar Pradesh on 12th. Locally heavy to very heavy rain occurred in the Kumaon hills on 12th when Nainital reported 15 cm, Mussoorie 11 cm and Mukteswar 9 cm.

III LOCAL STORMS 1957

S.No.	Place	Date and Time	Classification of storm	Loss of human life	Remarks
1	2	3	4	5	6
1.	Nadia, Hazaribagh and parts of West Bengal	12th January	Severe storm and hailstorm	4	About 16,000 people rendered homeless as a result of the severe storm. 2000 huts spread over 43 villages collapsed and other 1000 were partially damaged. The number of cattle perished is estimated at 400.
2.	Begumpet	11th March - Afternoon	Severe hail-storm	..	Hail stones, the size of which was about 2½" in diameter (the largest) hit the area. Maximum wind speed in the squall was about 89 mph. Several cattle, poultry and birds died due to the fall of hail. Many trees were uprooted. Girders were bent. Considerable section of roof of one of the hangars in the airport was

Sr. No.	Place	Date & Time	Classification of storm	Loss of human life	Remarks
1	2	3	4	5	6
3.	Delhi	Reported on 22nd March	Hailstorm	..	Heavy thundershowers accompanied by 75 mph (120 kmph) hailstorm struck Delhi disrupting civil and air services. The roofs of old buildings blown off.
4.	Jabalpur	26th March - Evening	Hailstorm	..	Hail-stones of egg size hit the city accompanied by a heavy shower.
5.	Bhopal	Reported on 6th April	Hailstorm	..	Heavy damage was caused to wheat and gram crops in over 20,000 villages in the central, southern and northern parts of Madhya Pradesh.
6.	Moga (District: Ferozepure)	Reported on 8th April	Hailstorm	..	Hailstorm caused damage to crops over an area of about 55,000 acres in 122 villages of Ferozepore District.
7.	Kurnool	Reported on 22nd April - Evening	Severe storm with showers	2	Two persons were killed and two injured during high winds and a very heavy downpour. 300 tents were blown away injuring 13 persons.
8.	Howrah	Reported on 13th May	Nor'wester	5	The 36 mph (57 kmph) wind swept the area blowing off a number of tin-sheds and thatched and tile roofs of several houses in its trail. The northern and eastern areas of Calcutta were hit by hailstorm accompanied by rain.
9.	Dibrugarh	14th May - night	Severe storm	8	Eight persons were killed in a severe storm that hit Dibrugarh and adjoining villages. 2624 families in the different 60 villages were affected as a result of the floods.
10.	Ahmedabad	27th May - evening	Squall and duststorm	1	Squall with a wind speed of 42 mph (67.2 kmph) hit the city killing one person. Lashing winds uprooted trees and flung roof tops of improvised huts. Duststorm greatly reduced the visibility and dislocated traffic.
11.	Allahabad	1st June - evening	Duststorm	..	A severe duststorm with a velocity of 47 mph (75.2 kmph) accompanied by a heavy shower swept over Allahabad uprooting trees, dislocating road and rail traffic and electric and telephone connection.
12.	Kasganj	Reported on 4th June - Night	Rain and storm	..	A storm associated with heavy rain damaged standing crops and uprooted number of mango trees.
13.	Delhi	13th June - Afternoon	Thunderstorm	..	A severe thunderstorm accompanied by a series of squalls hit Delhi from westsouthwest with the wind speed of 86 mph (146 kmph).

Sr. No.	Place	Date & Time	Classification of storm	Loss of human life.	Remarks
1	2	3	4	5	6
14.	Ratnagiri	28th June	Gale and rain	..	A strong gale with heavy showers uprooted trees and disorganised transport services.
15.	Bareilly	6th August - Evening	Severe storm	..	Over 19 persons including six women were injured and several houses damaged when a severe storm hit Bareilly and adjoining area. Storm approached from north, burst over the city with considerable velocity uprooting hundreds of trees.

IV WINDS OF FORCE NINE OR MORE IN THE INDIAN SEAS

Excluding dates of storms and depressions a description of which has been given above, no reports of winds of force 9 or more by ships in the Indian seas were received during 1957.

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TRACKS OF STORMS AND DEPRESSIONS (IN THE INDIAN SEAS)

1957

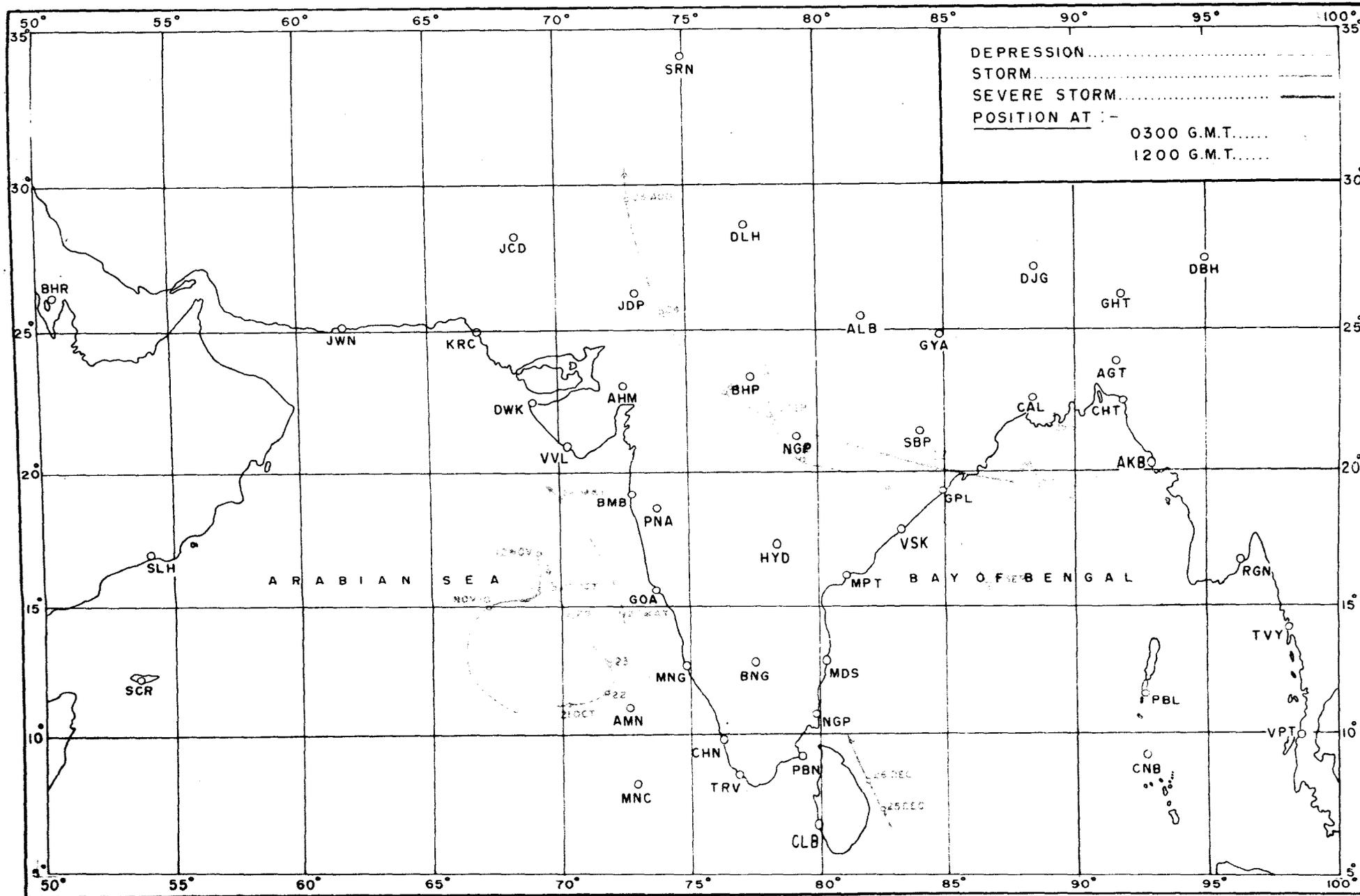


FIG. 1