

Cyclones and depressions over the Indian seas and neighbourhood during 1992*

1. Chief features

During 1992 there were in all twelve depressions and cyclonic storms over the Bay of Bengal and the Arabian Sea. Out of these, eight formed over the Bay of Bengal and four over the Arabian Sea. Seven of these twelve disturbances were cyclonic storms and five were depressions. Out of the eight systems over the Bay of Bengal, five were cyclonic storms and three were depressions. One cyclonic storm formed over the Bay of Bengal during the pre-monsoon season while the rest of the cyclonic storms in the Bay formed in the post-monsoon season. The cyclonic storm over the Arabian Sea had formed after an interval of six years. Likewise, of the two cyclonic storms in the Arabian Sea one formed during the monsoon season (June) and the other in the post-monsoon season.

Tracks of these cyclones/depressions are given in Fig. 1 and a brief history is given in Table 1. Monthly frequencies are given in Table 2.

2. Pre-monsoon season (March-May)

2.1. Systems in the Bay of Bengal

2.1.1. *Cyclonic storms over the Bay of Bengal (16-19 May)*—A well marked low pressure area formed over the southeast and adjoining southwest Bay on 15 May at 1200 UTC which concentrated into a depression on 16 May at 0300 UTC. Moving initially in a north-northwesterly direction and then in a northerly direction it intensified into a cyclonic storm on 18 at 0300 UTC. Recurving northeastwards, it crossed Arakan coast around the noon of 19 and weakened rapidly. Relevant ship's observations, observations from the coastal stations of Bangladesh and Myanmar and also INSAT positions have been given in Table 3.

INSAT assigned the maximum intensity of T-3.0 in Dvorak's scale for the system while it was crossing the Myanmar coast on 19.

(i) *Pressure*—Sandoway reported the lowest pressure of 993.2 hPa and 24-hour pressure change of 12.0 hPa at 0300 UTC of 19. Estimated central pressure was 992.0 hPa at 0300 and 1200 UTC of 18.

(ii) *Classifications from INSAT imageries*—According to the classifications based on INSAT cloud imageries the intensity of the system was T-2.5 from 0100 UTC of 18, and T-3.0 (peak value) at the time of crossing the coast.

(iii) *Movement of the storm*—The system initially moved slowly in a northnorthwesterly direction with an average speed of 12 kmph from 16 morning to 17 evening under the influence of upper tropospheric easterlies. Subsequently, it recurved and moved north-eastwards with a speed of 25 kmph between 18 morning and noon of 19.

(iv) *Weather and damage caused*—As the system did not cause any weather in India, there was no damage in India due to this system.

2.2. Systems in the Arabian Sea

There were no systems in the Arabian Sea during the pre-monsoon season.

3. Monsoon season (June-September)

3.1. Systems in the Bay of Bengal

3.1.1. *Deep depression over the Bay of Bengal (17-20 June)*—A trough of low pressure lay over the north Bay on 16 and a depression formed over the northwest Bay on 17 June at 0300 UTC. Moving in a westerly direction it intensified into a deep depression by the same evening. Then moving in a westnorthwesterly direction the deep depression crossed Orissa coast near Puri in the early hours of 18 and weakened into a depression on the same evening. It further moved in a westerly direction as a depression till the morning of 20 and weakened into a low pressure area over southwest Madhya Pradesh and neighbourhood by the evening of 20.

(i) *Pressure and wind*—The lowest pressure of 983.0 hPa and maximum wind of northnortheasterly 32 kt were recorded at Paradip on 17 at 1200 UTC.

(ii) *INSAT cloud features*—INSAT gave the peak intensity of T-2.0 from 0900 to 1500 UTC on 17.

*Compiled by : U. S. De, D. S. Desai and M. R. Tikhe, Meteorological Office, Pune.

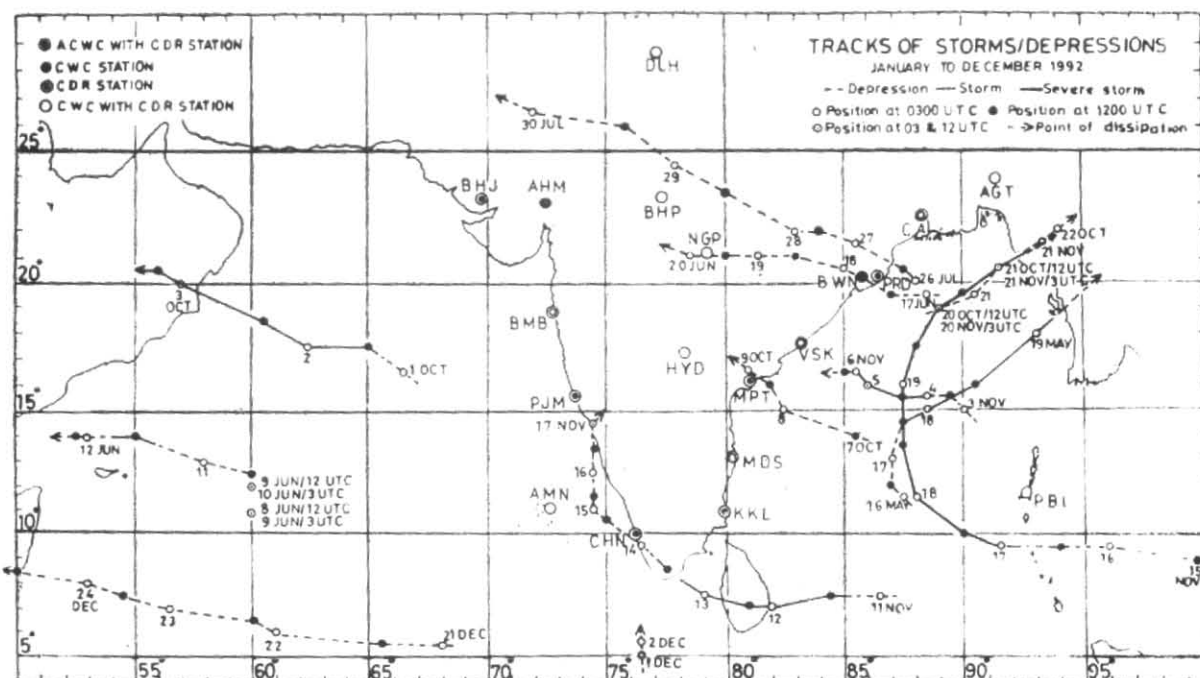


Fig. 1. Tracks of storms/depressions for the year 1992

TABLE I

Brief history of depressions and cyclonic storms over Indian seas and neighbourhood during 1992

S. No.	Type of system	Life period	Point of crossing the coast	Recorded lowest pressure/ central pressure (hPa)	Recorded maximum wind	Highest T-No. recorded
1	CS	16-19 May	Myanmar coast around the noon of 19th near Lat. 19°N	993.2 hPa at Sandoway (Myanmar) at 0300 UTC of 19th	250/35 by ship <i>ATCR</i> (9.2°N, 90.4°E) at 1200 UTC of 16th	3.0
2	Do.	8-12 Jun	—	—	—	3.0
3	DD	17-20 Jun	Crossed Orissa coast near Puri in the early hours of 18th	983.0 hPa at Paradip at 1200 UTC of 17th	32 kt at Paradip at 1200 UTC of 17th	2.0
4	Do.	26-30 Jul	Orissa coast near Chandbali in the mid-night of 26th	982.7 hPa at Chandbali at 1200 UTC of 26th	30 kt at Sandheads at 1200 UTC of 26th	2.0
5	CS	1-3 Oct	Oman coast at early morning of 3rd	—	—	3.0
6	DD	7-9 Oct	Andhra coast between Machilipatnam and Kakinada near Machilipatnam on 9th morning	999.5 hPa at Machilipatnam at 1200 UTC of 8th	25 kt by ship (11.9°N, 82.1°E) at 0600 UTC 8th	1.5
7	CS	20-22 Oct	Bangladesh coast near Cox's Bazar on 21 night	Estimated central pressure 998.0 hPa at 1200 UTC of 21 October	—	2.5
8	Do.	3-6 Nov	Dissipated over the ocean	Estimated central pressure 998.0 hPa at 0300 UTC of 4 November	—	3.5
9	SCS	11-17 Nov	(i) Sri Lanka coast in the noon of 12th (ii) South Tamil Nadu coast near Tuticorin around 1100 UTC of 13th (iii) Karnataka coast near Honavar on 17th evening	995.6 at 1610 IST on 13th at Tuticorin Port Trust	113 kmph at 1608 IST at Tuticorin Trust on 13th	4.0
10	SCS(H)	15-21 Nov	Myanmar-Bangladesh coast close to Teknoff in the afternoon of 21st	Estimated central pressure 952.0 hPa at 1200 UTC of 19 November	By ship <i>VWVY</i> (20.1°N, 88.4°E) 020/28 at 0000 UTC of 20 November	5.5
11	D	1-2 Dec	—	—	—	2.0
12	DD	21-24 Dec	—	—	330/25 by ship <i>VJNU</i> (7.2°N, 58.6°E) at 1200 UTC of 22 November	2.0

D — Depression, CS — Cyclonic storm, DD — Deep depression, SCS — Severe cyclonic storm, SCS(H) — Severe cyclonic storm with a core of hurricane winds.

(iii) *Rainfall* — Under its influence widespread rainfall with scattered heavy to very heavy falls occurred in Orissa and isolated heavy falls in Gangetic West Bengal on 18, 19 and 20. Widespread rainfall with isolated heavy falls also occurred in Vidarbha and Telangana on 19 and 20.

(iv) *Damage* — Media reports heavy rainfall in Orissa caused the death of 7 people.

3.1.2. *Deep depression over the Bay of Bengal (26-30 July)* — A low pressure area formed over the northwest Bay under the influence of an upper air cyclonic circulation on 25 morning which later concentrated into a depression on 26 at 0300 UTC. Moving in a westnorthwesterly direction it intensified into a deep depression on 26 evening and crossed the Orissa coast, near Chandbali at mid-night of 26. It weakened into a depression by the morning of 27, moved in a northwesterly direction and lay as a depression over east Rajasthan on 29 evening. Moving westwards it weakened further and merged with the seasonal low over west Rajasthan on 30.

(i) *Pressure and wind* — Lowest pressure of 982.7 hPa was recorded at Chandbali at 1200 UTC of 26 and maximum wind eastsoutheasterly 30 kt was reported at Sandheads at 1200 UTC of 26.

(ii) *INSAT cloud features* — INSAT recorded the peak intensity of T-2.0 from 0900 to 2000 UTC on 26.

(iii) *Rainfall* — Under its influence widespread rain with scattered heavy to very heavy falls occurred over Orissa from 25 to 28. Widespread rain with isolated heavy falls also occurred over coastal Andhra Pradesh on 26 and 27, over Gangetic West Bengal on 27 and 28 over east Madhya Pradesh and Vidarbha from 27 to 29 and over Gujarat and Rajasthan on 30 and 31.

(iv) *Damage* — There were no reports of damage in association with the system.

3.2. Systems in the Arabian Sea

3.2.1. *Cyclonic storm over the Arabian Sea (8-12 June)* — A low pressure area formed over Lakshadweep area and neighbourhood on 3. It moved slowly in a westerly direction and concentrated into a depression over the southwest Arabian Sea at 1200 UTC on 8. Moving initially in a northerly direction and later in a northwesterly direction it intensified into a cyclonic storm at 0900 UTC on 11. Thereafter moving in a westerly direction the cyclonic storm weakened into a depression on 12 morning and further into a low pressure area by 13.

(i) *INSAT cloud features* — INSAT gave a peak intensity of T-3.0 from 0900 to 1300 UTC on 11. The system was mainly tracked with the help of satellite imageries.

(ii) *Rainfall and damage* — There were no ship's observations from the vicinity of the storm. The storm did not cause any weather or damage over India.

4. Post-monsoon season (October-December)

4.1. Systems in the Bay of Bengal

4.1.1. *Deep depression over the Bay of Bengal (7-9 October)* — A well marked low pressure area formed over

the southeast and adjoining parts of the central Bay on 7 morning which rapidly concentrated into a depression over the west central Bay on 7 at 1200 UTC. Moving in a northwesterly direction it intensified into a deep depression on 8 evening and crossed the south Andhra coast between Machilipatnam and Kakinada in the early hours of 9. It weakened into a depression on 9 morning and into a low pressure area over Andhra Pradesh on the same evening.

(i) *Pressure and wind* — Lowest pressure of 999.5 hPa was recorded at Machilipatnam at 1200 UTC of 8. Wind observations recorded by ship VTXS (11.9° N, 82.1° E) was 310°/25 kt at 0600 UTC of 8.

(ii) *INSAT cloud features* — INSAT gave the peak intensity of T-1.5 from 1200 UTC of 7 to 0600 UTC of 8.

(iii) *Rainfall* — Under its influence widespread rainfall with isolated heavy falls occurred over coastal Andhra Pradesh from 8 to 10 and over Telangana, Rayalaseema and Tamil Nadu on 8 and 9.

(iv) *Damage* — There were no reports of damage caused by the system.

4.1.2. *Cyclonic storm over the Bay of Bengal (20-22 October)* — A low pressure area formed on 20 over the central and adjoining north Bay under the influence of upper air cyclonic circulation. It quickly concentrated into a depression in the evening of 20 over north Bay and neighbourhood. Moving in a northeasterly direction it intensified into a deep depression in the morning of 21 and into a cyclonic storm in the same evening. Continuing its northeasterly movement the cyclonic storm crossed the Bangladesh coast near Cox's Bazar on 21 night and weakened into a depression over Myanmar on 22 morning. It further moved in a northeasterly direction and weakened into a low pressure area.

(i) *Pressure* — Estimated central pressure was 998.0 hPa at 1200 UTC of 21.

(ii) *INSAT cloud features* — INSAT gave a peak intensity of T-2.0 from 0600 to 1300 UTC on 21.

(iii) *Movement of the storm* — The system being to the north of the upper tropospheric ridge line, it moved in a northeasterly direction.

(iv) *Rainfall and damage* — The system did not cause any rainfall or damage in India.

4.1.3. *Cyclonic storm over the Bay of Bengal (3-6 November)* — The remnant of typhoon Angela emerged into the east central Bay as a low pressure area on 2 November. It concentrated into a depression on third morning. Moving slowly in a westnorthwesterly direction it intensified into a cyclonic storm over the east central Bay on 4 morning. Thereafter the cyclonic storm rapidly weakened into a depression and then into a low pressure area over the central Bay. It became inconspicuous by 7 evening over the same region.

(i) *Pressure* — Estimated central pressure was 998.0 hPa at 0300 UTC of 4 November. A ship LALZ (17.2° N, 90.8° E) reported wind 160°/24 kt at 0600 UTC of 3.

TABLE 2

Storms/depressions statistics

Name of the system	Winter		Pre-monsoon		Monsoon				Post-monsoon			Total
	Jan-Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Over Bay of Bengal												
Depression	—	—	—	1	1	—	—	1	—	—	3	
CS	—	—	1	—	—	—	—	1	1	—	3	
SCS	—	—	—	—	—	—	—	—	1	—	1	
SCS(H)	—	—	—	—	—	—	—	—	1	—	1	
Total	—	—	1	1	1	—	—	2	3	—	8	
Over Land												
Depression	—	—	—	—	—	—	—	—	—	—	—	
Over Arabian Sea												
Depression	—	—	—	—	—	—	—	—	—	2	2	
CS	—	—	—	1	—	—	—	1	—	—	2	
SCS	—	—	—	—	—	—	—	—	—	—	—	
SCS(H)	—	—	—	—	—	—	—	—	—	—	—	
Total	—	—	1	2	1	—	—	3	3	2	12	

TABLE 3

Ship observations (16-19 May 1992)

S. No.	Call sign	Date & time (UTC)	Position		Wind		Cloud	PPPP.P (hPa)
			Lat. (°N)	Long. (°E)	Dir (deg)	Speed (kt)		
1	ATCR	160600	8.3	90.4	200	28	7/8	1009.4
2	ATCR	161200	9.2	90.4	250	35	7/8	1007.8
3	ATCR	170000	10.5	91.2	230	30	—	1006.4
4	ATCR	170300	10.5	91.0	210	27	4/8	1007.1
5	ATCR	170600	11.2	91.2	210	30	7/8	1006.9
6	ATCR	170900	11.8	91.2	210	30	Overcast	1003.6
7	ATJX	170300	11.9	84.2	230	20	Overcast	1004.3
8	VBNV	170600	12.1	82.5	210	05	6/8	—
9	ATJY	170600	14.3	83.0	250	22	Overcast	0998.5
10	ATKI	171200	15.9	83.2	220	07	7/8	0997.4

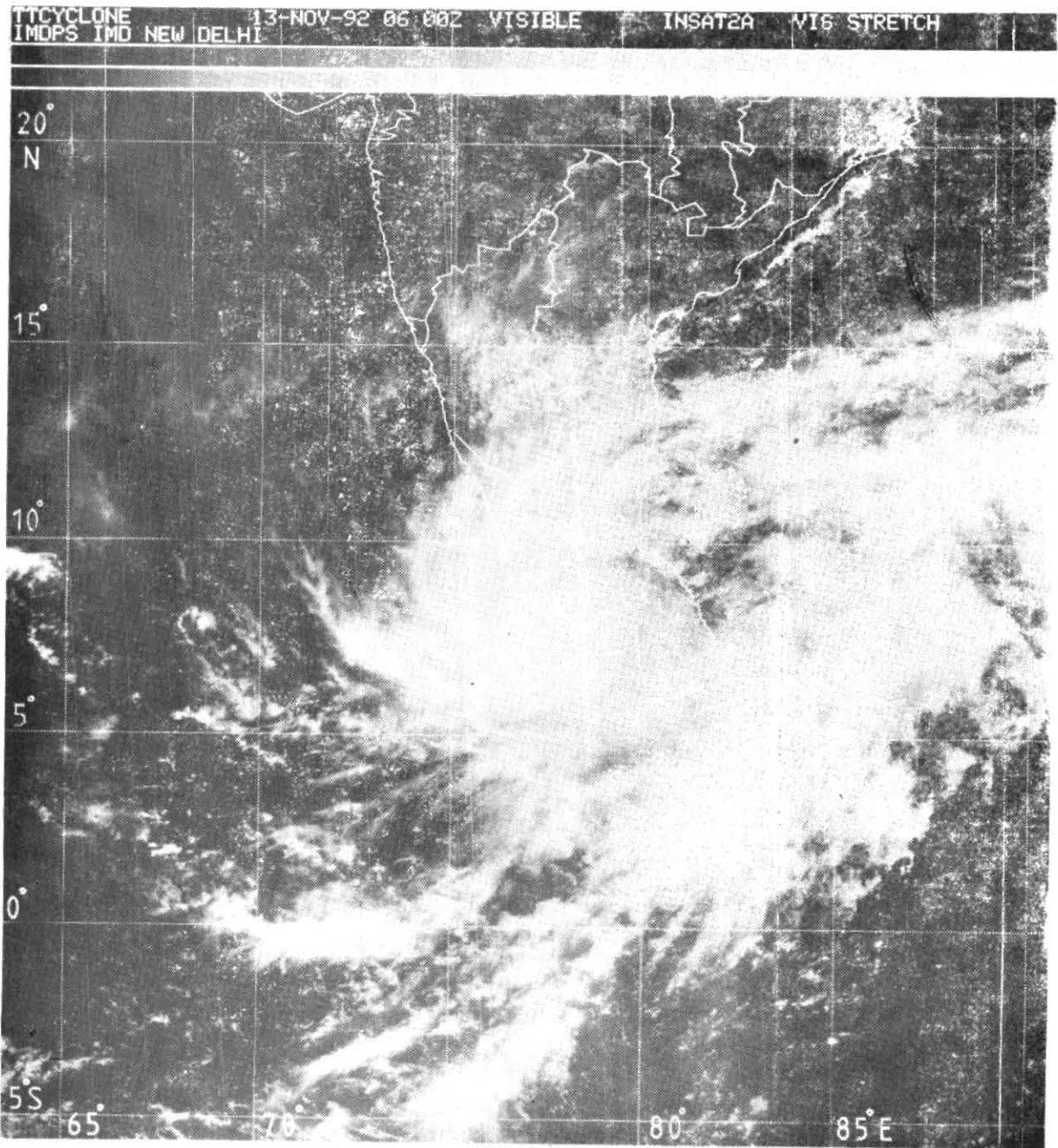


Fig. 2(a). INSAT-2A cloud picture of 13 November 1992 at 0600 UTC

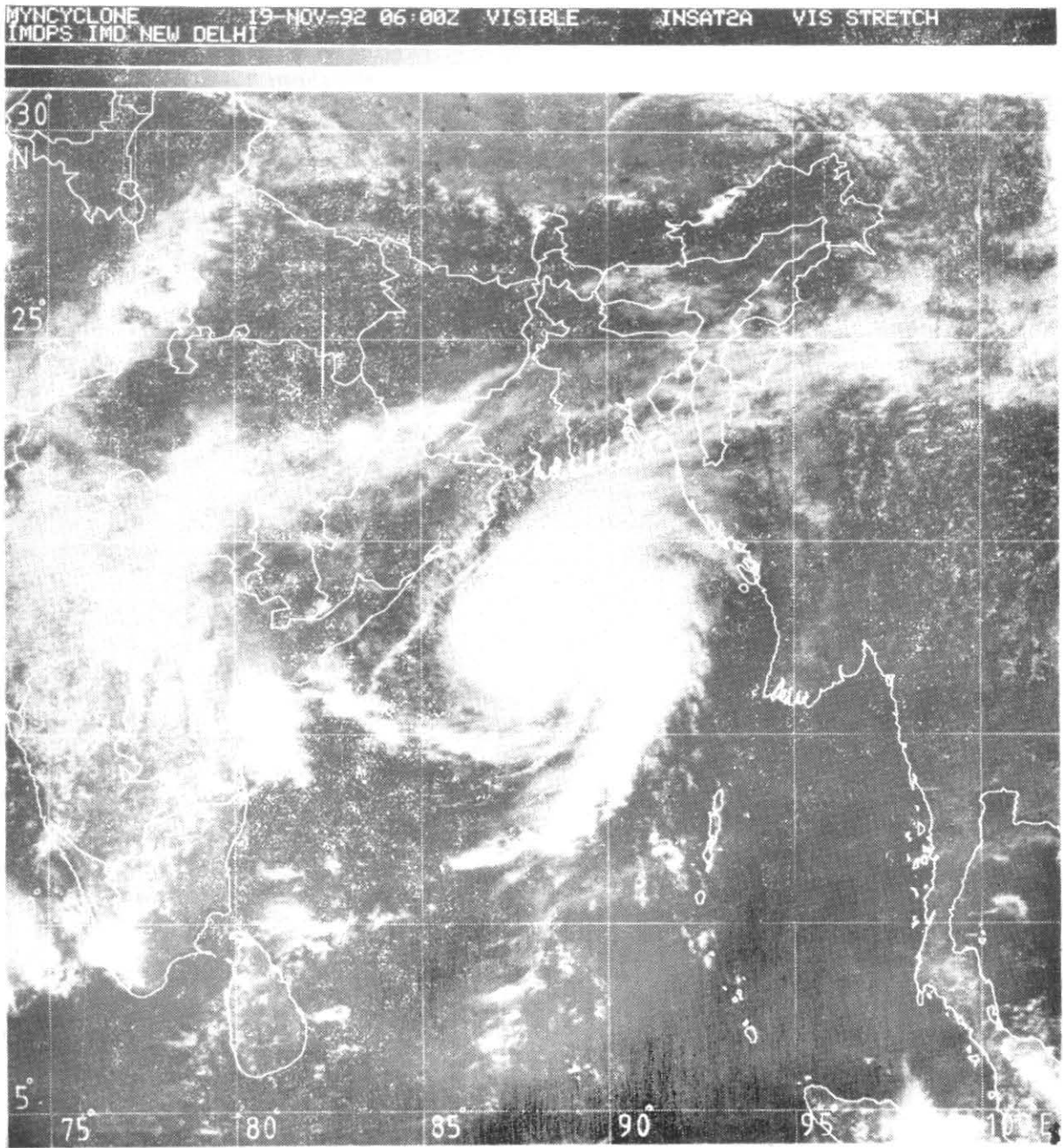


Fig. 2(b). INSAT-2A cloud picture of 19 November 1992 at 0600 UTC

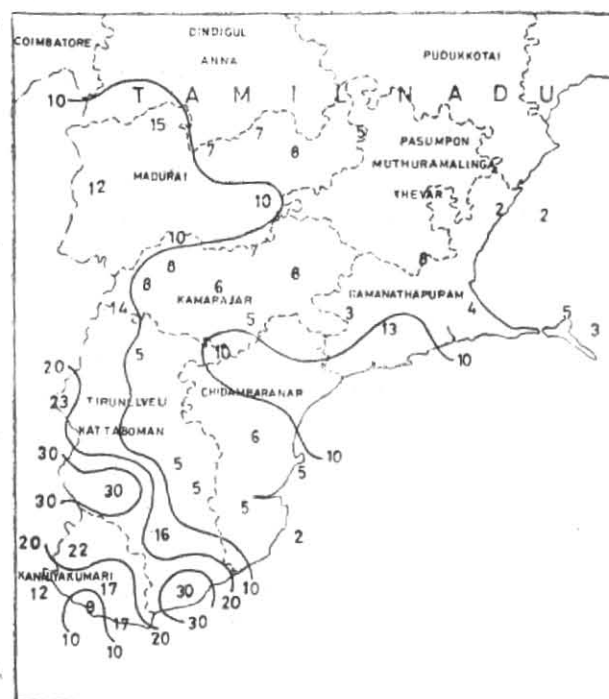


Fig. 3. Isohyetal map of Tuticorin cyclone, 14 November 1992

(ii) *INSAT cloud features* — INSAT gave the peak intensity of the system T-3.5 at 0100 and 0200 UTC of 6.

(iii) *Rainfall and damage* — As the system dissipated over the ocean it did not cause any rainfall or damage in India.

4.1.4. *Severe cyclonic storm over the Bay of Bengal (11-17 November)* — A well marked low pressure area formed over the southeast Bay and neighbourhood on 10, under the influence of an upper air trough in the lower levels. It concentrated rapidly into a deep depression at 0300 UTC on 11 and into a cyclonic storm at 0900 UTC of the same day. Moving in a westerly direction across Sri Lanka the system emerged into the Gulf of Mannar on 13 morning. It further intensified into a severe cyclonic storm, moved in a northwesterly direction and crossed south Tamil Nadu coast near Tuticorin on 13 evening. Moving further in a northwesterly direction it weakened into a depression over land and emerged into the southeast Arabian Sea as a depression on the 14 evening. It intensified again into a deep depression at 0300 UTC on 15. Thereafter the system moved in a northerly direction and crossed the Karnataka coast near Honavar (14.5° N, 74.5° E) and weakened into a low pressure area over north interior Karnataka by 18.

(i) *Pressure* — The lowest pressure of 995.6 hPa and peak wind of 113 kmph (61kt) was recorded at 1610 IST on 13 at Tuticorin.

(ii) *INSAT cloud features* — INSAT gave a peak intensity of T-4.0 at 0900 UTC and 1000 UTC of 13. A satellite cloud picture of this cyclone at 0600 UTC of 13 is shown in Fig. 2 (a). However in view of actual observations available from the cyclone field at that time, it was not declared as a severe cyclonic storm with a core of hurricane.

(iii) *Movement of the storm* — The system initially moved in a westerly direction from 0900 UTC of 11 to 0300 UTC of 13 (16 kmph) as it was embedded in the seasonal trough. From 13 morning to 15 morning the system moved in a northwesterly direction (13 kmph) as it came under the influence of the southeasterly winds of the mid-tropospheric anticyclone.

(iv) *Rainfall* — Under the influence of the system widespread rainfall with scattered heavy to very heavy falls occurred over south Tamil Nadu and south Kerala from 13 to 15. Widespread rain with isolated heavy falls also occurred over Karnataka and Lakshadweep area from 16 to 18. Isohyetal map for 14 November 1992 is given in Fig. 3.

(v) *Damage* — Media reports about 175 people were killed due to heavy rainfall, landslides and floods and about 160 were reported missing in Tamil Nadu and Kerala.

4.1.5. *Severe cyclonic storm with a core of hurricane winds over the Bay of Bengal (15-21 November)* — Remnants of the typhoon "Forrest" emerged in the Andaman Sea and concentrated into a depression at 1200 UTC of 15. Moving in a westerly direction it intensified into a cyclonic storm on 17 morning. Then moving in a northwesterly direction it intensified into a severe cyclonic storm with a core of hurricane winds at 0300 UTC on 18. It moved further northwards up to 19 morning and then recurved towards northeast and crossed the Bangladesh-Myanmar coast in the afternoon of 21 as cyclonic storm. It later weakened rapidly into a deep depression over Myanmar by 22 and further into a low pressure area by 23.

(i) *Pressure* — Estimated central pressure was 952.0 hPa at 1200 UTC of 19 when the cyclone was at its peak intensity (T-5.5).

(ii) *INSAT cloud features* — INSAT recorded the peak intensity of T-5.5 from 0200 UTC of 19 to 0400 UTC of 20. INSAT imagery at 0400 UTC of 17 recorded that 'eye' was forming and the intensity was T-3.0. It became an elongated eye at 1200 UTC on 18 when intensity was T-4.5. Eye was again reported by INSAT continuously from 2000 UTC of 18 to 0400 UTC of 20 when the intensity of the system was T-5.5. A satellite cloud picture of this cyclone at 0600 UTC of 19 is shown in Fig. 2 (b).

(iii) *Movement of the storm* — From 1200 UTC of 15 to 0300 UTC of 17 the system moved in a westerly direction as a depression. From 0300 UTC of 17 to 0300 UTC of 18 the system moved in a northwesterly direction as a severe cyclonic storm with a core of hurricane winds. From 0300 UTC of 18 to 0300 UTC of 19 the system moved in a northerly direction and thereafter in a northeasterly direction till it crossed coast. System moved with an almost uniform speed of 18 to 19 kmph and did not show faster movement after its recurvature.

(iv) *Rainfall and damage* — As the system crossed Bangladesh - Myanmar coast it did not cause any rainfall or damage in India.

5. Post-monsoon season (October-December)

5.1. Systems in the Arabian Sea

5.1.1. *Cyclonic storm over the Arabian Sea (1-3 October)* — A deep depression formed over the east central and adjoining west central Arabian Sea at 0300

UTC of 1. It moved in a westnorthwesterly direction and intensified into a cyclonic storm on the evening of 1. Continuing its westnorthwesterly movement the cyclonic storm crossed the Oman coast on 3 morning and weakened rapidly into a low pressure area over Saudi Arabia by the morning of 5.

(i) *Wind* — Massirah (in Oman) wind eastsoutheasterly 25 kt at 0300 UTC on 3.

(ii) *INSAT cloud features* — INSAT gave the peak intensity of T-3.0 at 0300 and 0600 UTC of 2 and 0000 and 0300 UTC on 3.

(iii) *Rainfall and damage*—The system did not cause any rainfall or damage in India.

5.1.2. *Depression over the Arabian Sea (1 & 2 December)* — A low pressure area formed over the north Indian Ocean and the adjoining Comorin Sea area on 1. It concentrated into a depression over the Comorin Sea area at 1200 UTC on 1. It remained stationary as a depression till 2 morning. It then moved northwards and weakened into a low pressure area over Lakshadweep area by evening of 2.

(i) *INSAT cloud features* — INSAT gave a peak intensity as T-2.0 from 1200 UTC of 1 to 0000 UTC of 2.

(ii) *Rainfall and damage*—Under its influence widespread rainfall with isolated heavy falls occurred over coastal parts of south Tamil Nadu on 3. The system did not cause any damage.

5.1.3. *Deep depression over the Arabian Sea (21-24 December)* — A depression formed over the southeast Arabian Sea in the active ITCZ at 0300 UTC on 21. Moving westwards it intensified into a deep depression at 1200 UTC on 21. Then moving in a west-northwesterly direction it dissipated off Somalia coast by the evening of 24.

(i) *Wind* — Ship *VJNU* (7.2°N, 58.6°E) recorded wind 330°/25 kt at 1200 UTC on 22.

(ii) *INSAT cloud features* — INSAT gave a peak intensity of T-2.5 from 0600 UTC of 23.

(iii) *Rainfall and damage* — The system did not cause any rainfall or damage in India.