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Cyclones and depressions of 1972—Bay of Bengal and Arabian Sea

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1. Introduction

Seven cyclonic storms and nine depressions formed in the Bay of Bengal and the Arabian Sea during the year 1972. Two depressions also developed over land areas, one over Gangetic West Bengal and the other over Bihar Plateau. Of the seven cyclonic storms, six formed in the Bay of Bengal (five of them of severe intensity) and one of severe intensity in the Arabian Sea. Of the nine depressions, six developed during the monsoon season. The tracks of these storms and depressions are shown in Fig. 1 and their monthly distribution in Table 1.

The main features of this year's cyclonic disturbances were :

(*i*) No cyclonic storm struck the west coast of India.

(*ii*) South Orissa and Tamil Nadu were the main targets of cyclones. The two severe cyclones which hit south Orissa and adjoining north Andhra in September, and the severe cyclone which hit Tamil Nadu in December, caused considerable damage to property. But the loss to life was negligible as warnings were issued well in time and timely precautionary measures were taken by the State Governments. Storm surges varying from 1 to 3 metres high were reported along Orissa coast in association with the severe Baruva cyclone of 10 September.

(*iii*) The depressions and low pressure areas which moved across the plains of north India during the monsoon did not cause any serious floods this year.

A brief history of the cyclones and depressions, together with important features associated with them, is enumerated in the following paragraphs in chronological order.

2. Bay of Bengal

2.1. *Severe cyclonic storm of 7-11 April*

A low pressure area developed over south Andaman Sea and adjoining southeast Bay on the 6th. It concentrated into a depression on the morning of the 7th near 9°N, 91°E. Moving northwest, it intensified into a cyclonic storm of narrow core the same evening near 9.5° N, 90.5° E. Then moving practically northwards, it became severe on the evening of 8th with its centre near 11.5°N, 90.0°E. Continuing to move northwards, it weakened into a depression on the morning of 11th near 17°N, 91°E and dissipated the same evening over east central and adjoining northeast Bay. The weakening of the storm was probably due to the storm having moved into a region of lower sea surface temperature. Some ships reported sea surface temperatures between 28°C to 31°C in the south Bay, while a ship in north and adjoining east central Bay reported sea surface temperature of 27°C. Advection of cold air from south of the westerly jet maximum above 200 mb, could have also contributed to the cooling of the storm at top levels.

This system caused widespread rain in the Bay Islands from 7th to 10th, with scattered heavy falls on the 8th and 9th. Car Nicobar reported a heavy fall of 10 cm of rain on the 8th ; while on the 9th, Maya Bandar reported 9 cm, Long Island 8 cm and Port Blair 7 cm. No damage was caused by this cyclone.

This system could not be detected on the synoptic charts with available data. It was detected and tracked only with the aid of satellite pictures and aircraft reconnaissance reports.

The U.S. Air Force reconnaissance aircraft SWAN 01 which flew into the storm on the 9th gave the centre of the storm at 1300 GMT as

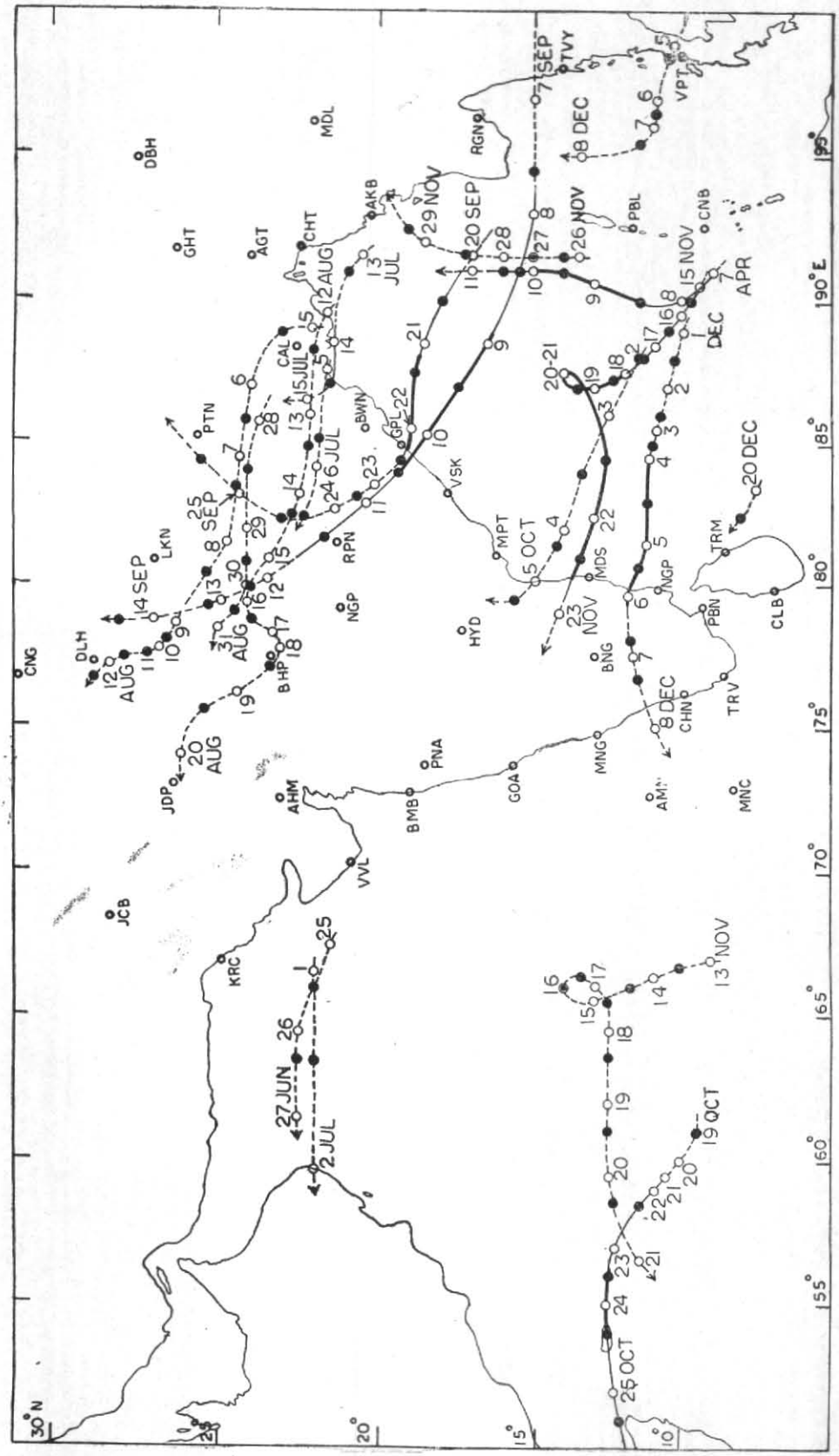

Fig. 1
Tracks of storms and depressions during January to December 1972

TABLE 1

Monthly distribution of cyclones and depressions in the Bay of Bengal and Arabian Sea 1972

	Jan—Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec		Annual total	
	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C	D	C
Bay of Bengal			1	(1)					1	1	1		2	(2)	1		1	(1)	2	1	(1)	6	6	(5)
Arabian Sea							1		1							1	(1)	1				3	1	(1)
Land Depression											2											2		
Total			1	(1)			1		2	1	3		2	(2)	1	1	(1)	2	1	2	1	(1)	11	7	(6)

D=Depression C=Cyclonic storm Figures in bracket-indicate the cyclonic storm which had become severe

13°53 'N, 91°13'E and the maximum wind as 80 kt. It reported a closed eye wall 8 n. miles thick and lightning in all quadrants of the storm. Another reconnaissance aircraft report at 1300 GMT of 10th gave the 700 mb circulation centre at 15.2°N, 90.5°E and a 35-knot maximum sustained wind near the centre. Dropsonde report from reconnaissance aircraft SWAN 02 received on the 10th is reproduced below:

AIR FORCE SWAN 02XXTC 1972 OB 10 DROP

97779 71717 UUAA 1041/ 99160 10908 06360 99004 25818 00036 25618 85463 21830 70134 14057 50587 051/ / 88999 77999 UUBB 1041/ 99160 10908 06360 00004 25818 11986 25018 22981 25014 33947 23405 44939 23805 55924 23810 66896 22408 77869 22425 88817 20442 99803 20642 11730 15148 22724 16058 33655 09642 44624 07856 55576 03436 66496 051// 51515 10168 05750 =

The satellite weather bulletin received from Washington mentioned that the system was in Stage X, Cat-3, DIA 2, with possible eye visible at 0801 GMT of 9th. The centre was given as 14°N, 91°E. The satellite picture of the cyclone on the morning of 9th is reproduced in Fig. 2. From the maximum wind of 80 kt reported by reconnaissance aircraft on the 9th, the estimated pressure at the centre of the storm was 983 mb.

A few reports received from ships and from Port Blair near the storm field are given in Table 2.

TABLE 2

Time (GMT)	Ship/ Station	Location		Wind (Dir/Speed in kt)	Pressure (mb)
		Lat. (°N)	Long. (°E)		
		9 April 1972			
0000	ATAE	10·6	91·4	S/20	1009·7
0000	Port Blair			S/25*	
0000	Port Blair			S/30-45**	
0600	ATAE	11·5	90·5	SW/16	1010·2
1200	VWDG	15·1	91·3	SE/24	1007·5

* Upto 0·9 km **1·5 to 3·1 km

2. 2. *Depression of 5-6 July*

A low pressure area developed over the Head Bay of Bengal on the morning of 4th and concentrated into a depression on the morning of 5th with its centre about 50 km east of Balasore. Moving practically westwards, it weakened into a low over north Madhya Pradesh on the 7th and merged with the monsoon trough by the next day over northwest Madhya Pradesh and adjoining east Rajasthan.

In association with this system, the monsoon was active over Bihar Plateau on 5th, in Orissa on 5th and 6th, in Vidarbha from 5th to 7th, in Madhya Pradesh from 5th to 8th, in Telangana on 6th and 7th and in Madhya Maharashtra and Gujarat Region on the 7th. Scattered heavy to very heavy falls occurred in Madhya Pradesh and Orissa. The flooded *Narmada* submerged the Bombay-Agra National Highway near Indore, disrupting vehicular traffic. The flood waters of the *Godavari* entered Bhadrachalam town. Some parts of Jalgaon were also flooded causing some damage to crops and some loss of cattle. The notable rainfall amounts reported by

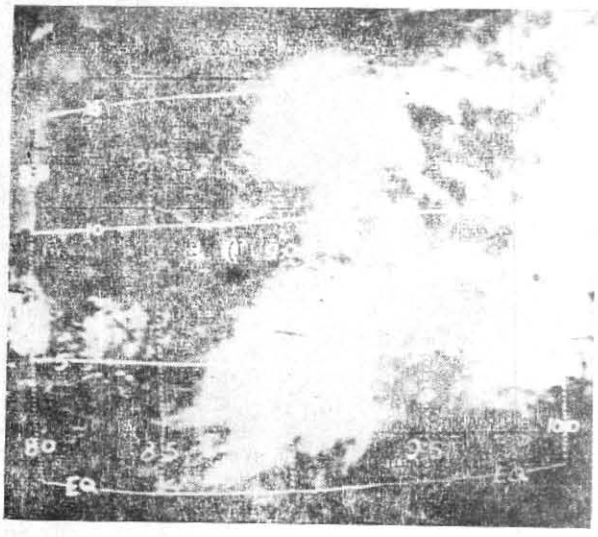

Fig. 2
ESSA-8 view of cyclone at 0830 IST on 9 Apr 1972

observatories and State raingauge stations were (13 cm or more) :

Date	*Station*	*Rainfall* (cm)	*Date*	*Station*	*Rainfall* (cm)
5	Phulbani	14	7	Bhira	14
	Pushparajgarh	13		Kanker	13
	Bagra Tawa	13		Deori	13
	Niwas	13	8	Mahabaleshwar	27
6	Bolangir	14		Narsinghpur	22
	Titlagarh	14		Shajapur	17
7	Mahabaleshwar	20		Bhira	14

The highest pressure defect reported near the centre of the system was 6 to 7 mb on 5th.

2. 3. *Cyclonic storm of 13 -15 July*

A low lay over Bangla Desh and adjoining northeast Bay on the 12th. Under the influence of a low pressure wave moving westwards across Burma, a deep depression formed over northeast Bay on the morning of 13th. Moving westnorthwest it intensified into a cyclonic storm on the morning of 14th, when it was centred about 50 km eastsoutheast of Sagar Island. It crossed coast near Balasore on the afternoon of 14th and moving northwestwards, weakened rapidly into a low over Bihar Plateau by the evening of 15th. It merged with the monsoon trough by the 17th.

This storm caused active to vigorous monsoon conditions in Orissa from 13th to 15th, in Gangetic West Bengal on the 14th, and active monsoon conditions in east Madhya Pradesh on 15th and 16th and in Bihar Plateau between 15th and 18th. The rivers in north Orissa rose in spate and flooded large areas in Cuttack, Balasore, Dhenkanal and Keonjhar districts, resulting in damage to railway tracks, irrigation works, houses and crops in these areas. Train services in this section of Southeastern Railway were dislocated for some days. No tidal waves were associated with this cyclone. The maximum estimated winds were 35-45 knots in Orissa and there was no damage due to winds. The notable rainfall amounts (13 cm or more) were :

Date	*Station*	*Rainfall* (cm)	*Date*	*Station*	*Rainfall* (cm)
14	Sandheads	37	15	Jajpur	21
	Talchar	24		Anandpur	21
	Kendrapara	22		Chandbali	17
	Athgarh	17		Athgarh	15
15	Bhadrak	27		Sidhi	14
				Sambalpur	13

Some useful reports available from observatories in the storm field are given in Table 3.

Akyab reported a pressure defect of 13 mb at 0300 GMT of 13th. Sandheads and Sagar Island also reported a pressure defect of 13 mb each near the centre of the storm at 0300 GMT of 14th, and Contai 12 mb. Balasore had a pressured defect of 12 mb at 1200 GMT of 14th when the centre of the storm was close to it. The lowest pressure of 984.7 mb was reported at Balasore near the centre of the storm at 1200 GMT of 14th.

On the 11th and 12th, the monsoon trough lay close to the foot of the Himalayas causing break monsoon conditions over the country with relatively warmer westerlies blowing across the plains of north India. The Head Bay warmed up in the lower levels between the 11th and 13th as seen from the rise in the temperatures at Bhubaneshwar and Calcutta. This warming could have led to the intensification of the depression in the north Bay into a cyclonic storm by the 14th.

2. 4. *Deep depression of 12-20 August*

A low pressure area which lay over north Bay on the 10th and 11th concentrated into a depression on the morning of 12th over the Head Bay with its centre near 21.5°N, 89.5°E. Moving practically westwards, it became deep on the

TABLE 3

Time (GMT)	Station	Wind (Dir/Speed in kt)	Pressure (mb)
	13 July 1972		
0000	Akyab	E/20	990·8
0300	Do	S/30]	991·0
1800	Agartala	ESE/50*	
	14 July 1972		
0000	Sandheads	W/45	986·6
0300	Do	WSW/55	986·9
0600	Do	SSW/45	991·8
1200	Do	SW/40	989·8
0000	Sagar Island	NNW/25	986·4
0300	Do	NNE/17	986·8
0700	Do	SSE/16	985·3
0900	Do	SSE/28	986·9
1200	Do	SSE/22	988·4
0000	Calcutta	ENE/40*	
0000	Bhubaneshwar	WNW/40*	

* 0·9 km

morning of 14th but again weakened into a depression by the next day. Then moving slowly westnorthwestwards upto 16th, and then southwestwards upto 18th it lay as a deep depression on the morning of 18th near Bhopal. Subsequently moving northwestwards, it weakened into a low over south Rajasthan by 20th evening, and merged with the monsoon trough by the 23rd.

Under its influence, the monsoon was active in Gangetic West Bengal, Bihar Plateau and Orissa from 12th to 14th, in Madhya Maharashtra from 17th to 19th, in Gujarat State between 17th and 22nd and in west Rajasthan between 20th and 22nd. It was active to vigorous in Madhya Pradesh from 13th to 19th and in Vidarbha from 16th to 18th. Scattered or isolated heavy to very heavy rain occurred in Orissa, Gangetic West Bengal, Bihar State, Madhya Pradesh, east Rajasthan and Gujarat State on some days during the above period. The strong low level easterlies associated with the depression extended into west Uttar Pradesh, Haryana and the Punjab decreasing in speed down-stream and causing isolated heavy falls in these areas on the 17th and 18th. An interesting feature in the rainfall distribution associated with this depression was that there was also widespread rain with heavy falls in the rear of the depression on the 14th. According to press reports, some districts in west Madhya Pradesh and Broach and Baroda districts in Gujarat State were affected by floods, which disrupted vehicular traffic and caused some damage to crops, roads and bridges in these areas. The notable rainfall amounts (13 cm or more) were :

Date	*Station*	*Rainfall* (cm)	*Date*	*Station*	*Rainfall* (cm)
13	Baripada	24	17	Nagar Nigam (MP)	14
14	Gotitoria (MP)	32		Bagra Tawa (MP)	13
	Jharsuguda	13		Pachmarhi	13
	Narayanganj (MP)	13	18	Harsod (MP)	26
15	Gotitoria (MP)	54		Bikangaon (MP)	23
	Jabalpur	23		Sihora (MP)	23
	Hatod (MP)	18		Khandwa	21
	Baihar	17		Betul	19
	Mandla	16		Dungarpur	17
	Niwas (MP)	16		Mandhata (MP)	16
	Pachmarhi	13		Barhanpur (MP)	16
16	Pachmarhi	24		Kannod	15
	Raisen	13		Pachmarhi	13
	Bagra Tawa (MP)	13		Khargone	13
17	Kannod	20		Mhow (MP)	13
	Mandhata (MP)	18		Khachord (MP)	13
	Bhopal	15		Rajpur (MP)	13
	Betul	15			
	Gangdhar (Raj)	15	20	Patan (MP)	25

Sandheads reported surface winds NW 30 kt at 00 GMT of 12th and W 25 kt at 03 and 12 GMT of that day. The easterlies at 0.9 and 1.5 km about 400 km to the north of the depression centre, were 40 to 50 kt at 00 GMT of 14th. At 0.6 and 0.9 km Jabalpur reported S/SE 30-35 kt winds and Nagpur SSW 25-35 kt at 00 GMT of 18th and Jodhpur N/NNE 20-25 kt at 00 GMT of 20th. The largest pressure defect reported near the centre of the system was 8 mb.

2. 5. *Severe cyclonic storm of 7-14 September*

Typhoon ELSIE which lay over south China Sea on 1 September, crossed Viet Nam coast by the 3rd and weakened into a depression on the 4th. Moving westwards across Indo-China, it emerged into the Andaman Sea as a deep depression on the morning of 7th, when it was centred about 250 km southsoutheast of Rangoon. Continuing to move westwards, it intensified again into a cyclonic storm on the morning of 8th, with its centre near 15°N, 93°E. Subsequently moving northwestwards, it became severe on the mornin

of 9th, when it was centred near 16.5°N, 88.5°E. It crossed the extreme north Andhra coast near Baruva on the afternoon of 10th. Continuing its northwestward movement across south Orissa and southeast Madhya Pradesh, it gradually weakened into a cyclone on the 11th and into a depression on the 12th when it was centred near Jabalpur. Then it moved northnorthwest across west Uttar Pradesh, weakened into a low on 15th and broke up over the hills of west Uttar Pradesh.

This system, when it was lying over the Andaman Sea, caused widespread rain in the Bay Islands with isolated heavy falls on the 7th and 8th. Long Island reported 8 cm of rain on 7th and Port Blair 8 cm on 8th. Coco Island to the north of Bay Islands recorded 14 cm on 8th. As the storm crossed coast and moved across the country, it caused widespread rain with scattered heavy to very heavy falls in Orissa from 9th to 12th, in Bihar and West Bengal on the 12th, in Madhya Pradesh on 12th and 13th and in Uttar Pradesh from 13th to 15th. Widespread rain with isolated heavy falls also occurred in Srikakulam and Visakhapatnam districts of Andhra Pradesh on the 11th. Good rainfall was also reported from Maharashtra State from 9th to 12th and from Himachal Pradesh on 15th and 16th. This cyclone was of large extent (about 1000 km in diameter) and affected the coastal districts extending from Srikakulam in Andhra Pradesh to Balasore in Orissa. Heavy damage to crops and other property was reported from Ganjam, Puri and Cuttack districts, the worst affected being Ganjam district. Some damage was also reported from Balasore, Mayurbhanj, Keonjhar, Dhenkanal Phulbani, Kalahandi and Bolangir districts. The crops affected were paddy, sugarcane, vegetables, banana, coconut and betel vines. The damage was caused by gales, heavy rain and floods in these districts, while in the coastal areas saline water inundation due to tidal waves was also responsible for such damages. In all, about 14 lakh acres of cropped land and 45 lakh people were affected. About 2 lakh houses and buildings were damaged. 8,000 heads of cattle died. About 100 persons lost their lives, mostly in Chilka lake area, reportedly due to their unwillingness to move to safer place. There was extensive dislocation of telecommunications. Rail traffic and power supply were disrupted for some days (during and after cyclone) in the coastal districts. In Andhra Pradesh, the entire Srikakulam district was affected by the cyclone. The northren parts, particulary, had very heavy rain and winds of hurricane force (100-125 kmph). Heavy damage was caused to coconut groves and banana plantations in the coastal areas. Vast areas of cropped land were submerged due to heavy rain and floods, the worst affected talukas being Sompeta and Ichapuram. A number of catamarans and several houses of fishermen in the coastal areas were damaged. Road and rail communications and power supply were disrupted over many parts of the district. There was saline water inundation over the coastal belt extending from Tekkali to Ichapuram. There was practically no loss of human lives but few hundreds of cattle were lost in this district. The notable rainfall amounts (13 cm or more) were :

Date	*Station*	*Rainfall* (cm)	*Date*	*Station*	*Rainfall* (cm)
9	Athgarh (Orissa)	27	12	Bhira	18
	Berhampur (Orissa)	17		Pendra	16
				Bilaspur	13
10	Berhampur	43		Pachmarhi	13
	Nayagarh	24	13	Datia	17
	Athgarh	19		Ambikapur	13
	Chikiti	15		Khajuraho	13
	Bhanjnagar (Orissa)	14			
	Kendrapara (Orissa)	13	14	Ramsanehighat (U.P.)	27
				Kehri	19
11	Parlakhemandi (Orissa)	23		Pilibhit	16
				Dataganj	16
	Pathapatnam (A.P.)	23		Gonda	15
	Kalingapatam	21		Sitapur	15
	Tekkali (Andhra)	21		Shajhahanpur	15
	Kodala (Orissa)	20		Bisauli	15
	Palakonda (A.P.)	19		Lucknow	13
	Jagatsinghpur (Orissa)	18		Budaun	13
				Nainital	13
	Nayagarh (orissa)	16	15	Champawat (U.P.)	33
	Parvathipuram (A.P.)	16		Nainital	27
	Berhampur	14		Najibabad	15
	Bhanjnagar (Orissa)	14		Mukteshwar	15
	Sompeta (A.P.)	14		Pilibhit	14
	Bobili (A.P.)	13		Roorkee	13

Rangoon reported winds at 0·6 and 0·9 km a.s.l. as NE/40-50 kt at 00 GMT of 7th and E/40-50 kt at 1200 GMT of the same day. At these levels, Port Blair recorded W/30-35 kt winds at 00 and 12 GMT of 8th. Gopalpur recorded maximum surface wind of 75 kt (140 kmph) in gusts at 0400 GMT of 10th. Puri recorded a maximum wind speed of 94 kt (175 kmph) and Paradeep 65 kt (120 kmph) on the same morning. The maximum wind speed was estimated at 100-150 kmph in other parts of Puri and Cuttack districts and about 60 to 70 kmph at Chandbali in Balasore

district. The maximum wind speed was also estimated to be 125 kmph in the northern parts of Srikakulam district in coastal Andhra Pradesh. Gopalpur recorded the lowest pressure of about 969 mb at 0600 GMT of 10th and a pressure defect of 26 mb at 03 GMT of 10th. The 24-hour pressure fall at Gopalpur ending 03 GMT of 10th was 25 mb. The hourly values of pressure and wind recorded at Gopalpur from the midnight of 9th to the midnight of 10th, are depicted in Fig. 3. Titlagarh recorded a pressure defect of 15 mb at 03 GMT of 11th. Other available reports from ships and observatories in and near the storm field are given in Table 4.

Tidal waves in association with this cyclone affected practically the entire coast of Orissa and the extreme northern parts of Srikakulam district in coastal Andhra Pradesh. According to the report by Shri P. B. Bhattacharya, Meteorologist, who visited the cyclone effected areas, a storm surge of 1 metre above high tide level was recorded by the tide-gauge ot Paradeep port. At other coastal stations between Chandbali and Baruva, storm surges were estimated to be between 1 to 3 metres by the port authorities. The coastal areas of Puri and Cuttack districts were the worst affected by inundation. Saline water inundation extended 20 to 30 km. inland in these coastal districts. A diagram showing the estimated storm surge and the estimated or observed wind speeds associated with the cyclone is given in Fig. 4. The tidal waves in the open sea off Puri and Gopalpur were estimated to be 5 to 6 metres.

A reconnaissance aircraft of the USA, stationed at Guam, flew into this storm on the evening of 9th and located the centre of the storm near 17·4°N, 87·2°E, which agreed very well with the centre located by the satellite, the same evening. The centre as given in the Washington Satellite Bulletin that evening was 17·8° N, 87·3°E. The aircraft estimated the surface wind speed associated with this cyclone at that time as 65 kt (120 kmph). This cyclone came into the range of the Cyclone Warning Radar at Dolphin's Nose, Visakhapatnam, from the morning of 10th September and was tracked by the radar upto 11th morning. The path of the cyclone as tracked by this radar, close to coast is given in Fig. 5.

The APT satellite pictures received in India showed that this system was in stage X, category 2 on the 9th, stage X, category 4 on the 10th; and stage X, category 2 on the 11th. The APT picture of 9th forenoon (Fig. 6) shows the eye of the storm near 17·5°N, 87·5°E. The maximum wind estimated from the satellite picture was 110 kt

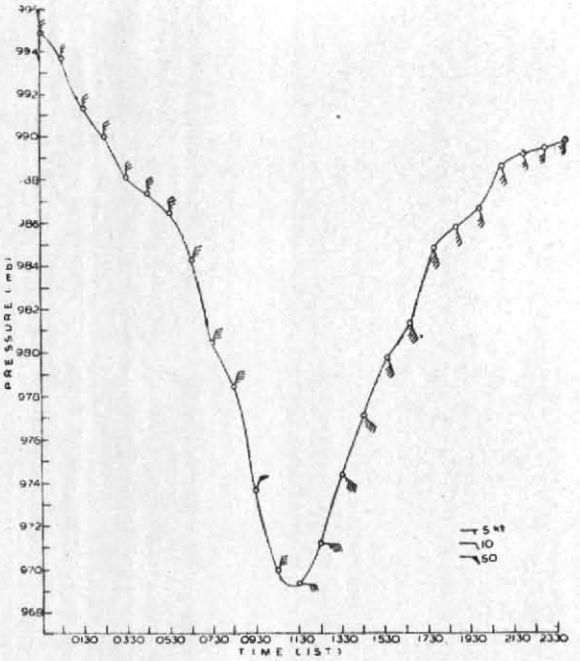

Fig. 3

Hourly observations of wind and pressure at Gopalpur

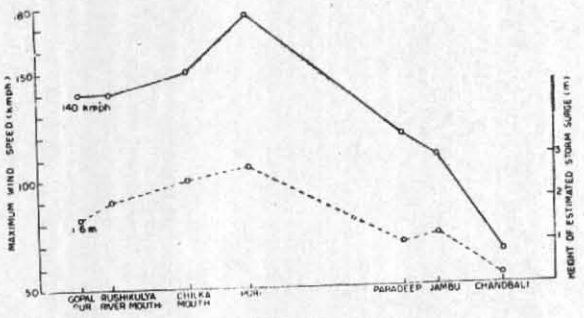

Fig. 4

Maximum on-shore winds and storm surges on Orissa coast on 10 Sep 1972

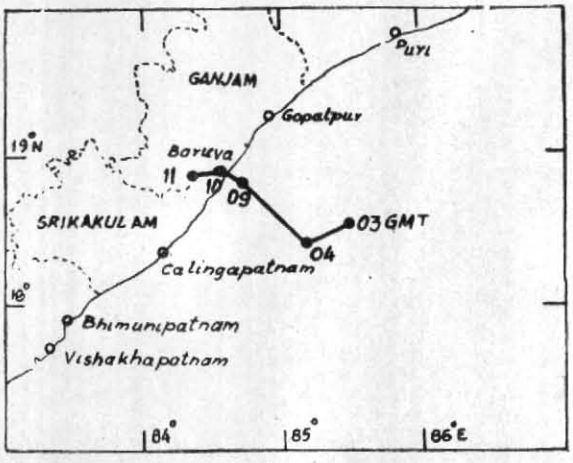

Fig. 5

Radar track of Baruva Cyclone of 10 Sep 1972

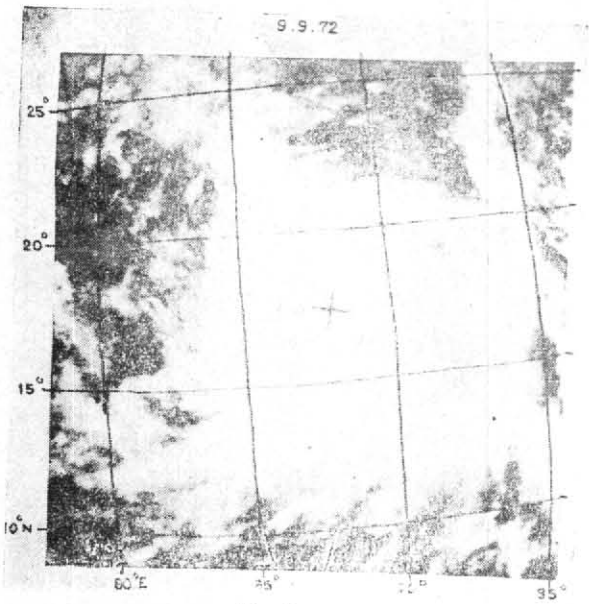

Fig. 6

ESSA-18 view of Baruva cyclone at about 1000 IST on 9 Sep 1972 showing the "eye"

and this gave an estimated pressure of 957 mb at the centre of the storm.

2.6. *Severe cyclonic storm of 20-25 September*

Typhoon FLOSSIE which formed in the south China Sea on 12 September 1972, moved westwards into Viet Nam by the 16th and weakened into a depression. Subsequently, it emerged into the north Andaman Sea as a well marked low pressure area on the 19th. Moving westnorthwest, it concentrated into a depression by the morning of 20th and intensified into a cyclonic storm by noon, when it was centred about 550 km west of Rangoon. Continuing to move westnorthwest, it became severe by the afternoon of 21st and was centred at 1200 GMT near 19°N, 87·5°E. It crossed extreme south Orissa coast near Gopalpur on the afternoon of 22nd and weakened into a depression by the morning of the 23rd. Thereafter, moving northwestwards across southeast Madhya Pradesh and later recurving northeastwards across northeast Madhya Pradesh, Bihar and adjoining east Uttar Pradesh, it weakened into a low pressure area over extreme north Bihar by the 26th.

As the disturbance moved from Andaman Sea to east central Bay, it caused widespread rain with isolated heavy falls over the Bay Islands *from 19th* to 21st. Maya Bandar recorded 7 cm of rain on the 19th, 7 cm on the 20th and 8 cm on the 21st. Kondul recorded 9 cm on 20th. As the storm crossed Orissa coast and moved across the interior parts of the country towards Bihar,

TABLE 4

Time (GMT)	Ship/ Station	Location Lat. (°N)	Location Long. (°E)	Wind (Dir/Speed in kt)	Pressure (mb)
		8 September 1972			
0300	Coco Island			SW/25	1001·7
		9 September 1972			
1200	VWSF	15·5	85·2	WSW/33	995·0
		10 September 1972			
0000	VWWK	18·5	88·6	SSE/39	992·0
0300	Bhubaneshwar			ENE/40	992·9

it causesd widespread rain with scattered or isolated heavy falls in Orissa, east Madhya Pradesh, east Uttar Pradesh, Bihar, north Bengal and also in Srikakulam district of coastal Andhra Pradesh on some days between the 22nd and 26th. This cyclone was not so severe or as large in radial extent as the previous cyclone which hit Orissa and the adjoining parts of Andhra Pradesh 12 days earlier, *i.e.*, on 10 September. Heavy rain and gales in association with this cyclone lashed Puri, Ganjam, Koraput and some parts of Srikakulam districts. Due to heavy rain and floods in *Vamsadhara*, many villages in Srikakulam and Koraput districts were inundated resulting in considerable damage to crops and houses. Sompeta and Ichchapuram talukas in Srikakulam district were badly hit. Telecommunications and power supply were cut off in these districts. No loss of life was reported on account of this cyclone. According to press reports, there was tidal inundation in Astarang block of Puri district; no other tidal inundation was reported in association with this cyclone. The notable amounts of heavy rainfall (13 cm or more) were :

Date	*Station*	*Rainfall* (cm)	*Date*	*Station*	*Rainfall* (cm)
22	Berhampur (Orissa)	27	26	Jalpaiguri	23
	Chandbali	17		Darbhanga	23
23	Sompeta (A.P.)	29		Baghdogra	15
	Bhubaneshwar	16		Cooch Behar	15
	Bhawanipatna	16		Darjeeling	15
	Mainpur (MP)	13		Kalimpong	14

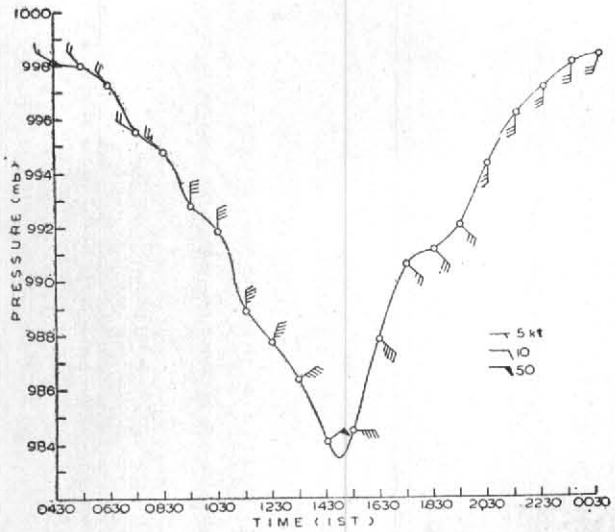

Fig. 7

Hourly observations of wind and pressure at Gopalpur on 22 Sep 1972

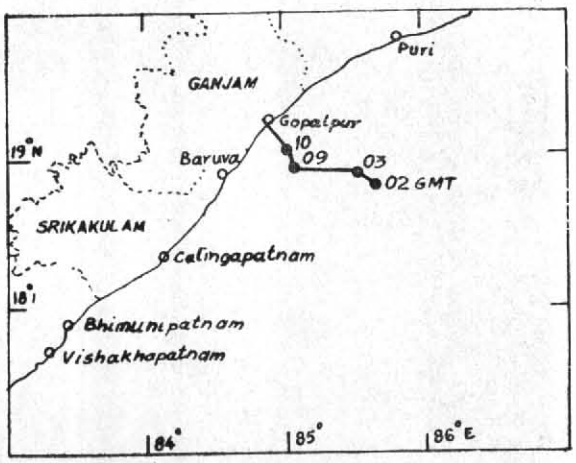

Fig. 8

Radar track of Gopalpur cyclone of 22 Sep 1972.

Gopalpur reported surface winds of 75 to 90 kmph (40-50 kt) from 0400 to 1100 GMT on 22nd. The highest wind speed recorded in gust was 136 kmph (73 kt) at Gopalpur at about 0740 GMT on 22nd. The lowest pressure recorded at Gopalpur was 983·4 mb at about 0930 GMT on that day. The hourly values of pressure and wind recorded at Gopalpur from 00 to 18 GMT on 22nd are depicted in Fig. 7. Baruva in Srikakulam district reported westerly winds of 40 to 50 kt on 22nd night. Ship ATBE reported the lowest pressure of 975 mb and an eastely surface wind of about 50 knots in the storm field, close to the centre of the storm at 1730 GMT of 21st. The message received from the ship is reproduced below :

"ATBE (Deshalok) Position at 1730 hrs GMT approx. 19° 22′N, 87° 15′E, Bar Pressure 975 mb. In last three hours tendency falling 9 mb. Wind direction 080 true, force 10, swell 060, height 10 metres. Continuous drizzle, poor visibility, experiencing disastrous weather being near the centre of the storm. Since engine tube oil pump not keeping suction, unable to use main engine and move away from storm centre."

At 0300 GMT of 22nd, Gopalpur recorded a pressure defect of about 13 mb and a 24 hr pressure fall of about 11 mb. Some reports from ships and observatories in and near the storm field are given in Table 5.

This cyclone came within the range of the Cyclone Warning Radar at Dolphin's Nose, Visakhapatnam, on the morning of 22nd. The path of the cyclone as tracked by this radar is given in Fig. 8.

The U.S. Air Force reconnaissance aircraft from Guam, which flew into the storm at 0730 GMT of 20th gave the centre of the storm near 17·6°N, 90·9° E, and reported the lowest pressure as 994 mb and maximum wind as 45 knots. Two other reconnaissance missions into the storm at 0830 and 1100 GMT on the 21st reported the lowest pressure as 978 mb and 982 mb with maximum winds of 65 and 100 knots respectively. The centre was located near 18·5° N, 87·5° E.

The satellite pictures showed that this system was in stage C on the 20th and in stage X-2 on 21st and 22nd. On the 23rd morning also when the system was over land as a deep depression, the APT picture showed the system in stage X-1. The satellite picture of this storm on 21 September 1972 is reproduced in Fig. 9. The estimated pressure at the centre of the storm corresponding to a maximum wind of 100 kt reported by aircraft was 963 mb which agreed fairly well with the pressures reported by ships.

2. 7. *Deep depression of 2 to 5 October*

A low pressure area developed over Andaman Sea on 1st. Moving westwards, it concentrated into a depression on the evening of 2nd near

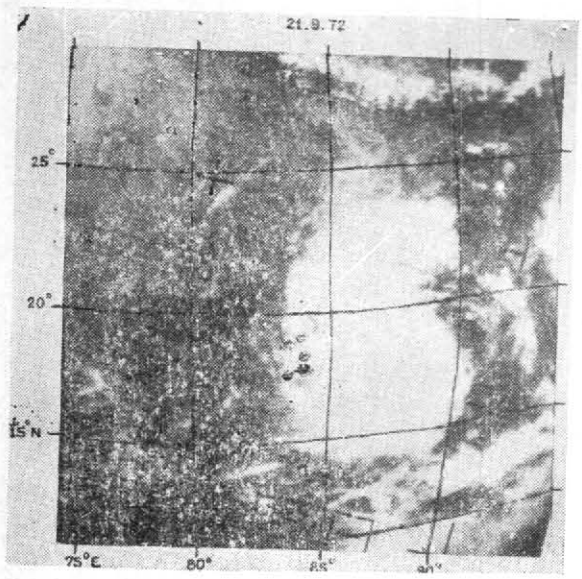

Fig. 9

APT picture of Gopalpur cyclone at about 1030 IST on 21 Sep 1972

11·5°N, 88°E. Then moving northwestwards it became deep on the morning of 3rd, crossed south Andhra coast near Ongole on the morning of 5th and weakened into a low over Telangana on the 6th.

This system caused fairly widespread rain in the Bay Islands from 1st to 3rd, in south Peninsula including Andhra Pradesh from 4th to 7th and in Orissa from 5th to 7th. Scattered heavy to very heavy rain which occurred in Andhra Pradesh between the 4th and 7th was reported to have caused breaches in some places between Vijayawada and Waltair, disrupting train services in South Central Railway. Many parts of East Godavari district were flooded resulting in damage to standing crops and rendering about 10,000 people homeless. The notable amounts of rainfall (13 cm or more) were :

Date (Oct)	*Station*	*Rainfall* (cm)	*Date*	*Station*	*Rainfall* (cm)
4	Razole (A.P.)	14	6	Tuni (A.P.)	16
	Amalapuram (A.P.)	14		Bhimavaram (A.P.)	15
	Kummidivaram (A.P.)	13		Alamuru (A.P.)	15
5	Penukonda	17		Eluru (A.P.)	13
	Kakinada	14		Kottapeta (A.P.)	13
	Sulurpet	13			
6	Tanuku (A.P.)	17	7	Nidadavolu	13

TABLE 5

Time (GMT)	Ship/ Station	Location Lat. (°N)	Location Long. (°E)	Wind (Dir/Speed in kt)	Pressure (mb)
		21 September 1972			
1200	ATAY	18·9	86·0	NW/38	1000·0
1200	SPTX	18·7	86·8	NNW/35	998·9
1730	ATBE	19.4	87.2	E/52	975.0
1800	SPHY	18.5	87.2	W/50	999.7
		22 September 1972			
0300	Puri			SE/39	997.6
0300	Paradeep			SE/35	1002·0

The largest pressure defect reported near the centre of the system was 6 mb and the lowest pressure 1000·2 mb. The winds at 0·6 and 0·9 km a.s.l. at Visakhapatnam and Madras at 0600 GMT of 4th were E/30-35 kt (55-65 kmph) and WNW/30 kt (56 kmph) respectively while Gannavaram reported ENE/E-30 kt wind (56 kmph) at 0·3 and 0·6 km a.s.l. at 00 GMT of 5th. Ship ATAF at 15·5°N, 86°E reported NE/25 kt wind at 00 GMT of 3rd at Ship VWWK at 14·6°N, 81·4°E reported S/21 kt wind at 06 GMT of 5th.

The satellite pictures (not reproduced) showed that the system was in stage B or C on 3rd and 4th. The cloudiness extended towards northnortheast as much as 5 to 7° in latitude from the centre of the depression between 4th and 6th.

2. 8. *Severe cyclonic storm of 15-23 November*

A low pressure area formed in the south Andaman Sea on the 13 November 1972. It became well marked on the 14th and moving westnorthwest into southeast Bay of Bengal, it concentrated into a depression, probably deep, on the morning of 15th, when it was centred near 9·5°N, 90·5° E. Subsequently moving northwest, it intensified into a cyclonic storm by the evening of 16th and into a severe cyclonic storm by the morning of 18th, when it was centred near 12°N, 87·5°E. Then it moved northnorthwest and executed a clockwise

loop in its track between the 19th and 21st. After 21st morning, it moved fast, initially west-southwest and later westnorthwest, and crossed extreme south Andhra coast near Sriharikota Island during the early part of the night on 22nd. Continuing to move westnorthwest, it weakened into a depression on the morning of 23rd over Rayalaseema and into a low pressure area on the 24th over Interior Mysore.

The isallobaric gradient was towards the northwest or north of the storm centre from 18th to 20th and the storm was moving in a northwesterly direction. By 20th evening pressures started falling over Andhra-north Tamil Nadu coasts and rising over Orissa-West Bengal coasts and over the Bay Islands. By 21st evening the pressure fall was highest over Tamil Nadu coast and the storm also had moved westwards towards Tamil Nadu coast by 21st evening. The isallobaric gradient from the storm centre thus indicated the initial northwestward movement and the final westward movement of the storm. While changing from a northerly course to a westerly course, the storm made a loop possibly because it had moved into the 'Col' region between two upper tropospheric anticyclones — one over north Andhra Pradesh and the other over Indo-China. However, this could not be confirmed for want of Port Blair observations during this period.

As the disturbance moved from Andaman Sea to the central Bay of Bengal, it caused widespread rain in the Bay Islands from the 13th to 20th, with scattered heavy falls between the 15th and 18th. As the cyclone hit Sriharikota and weakened over interior Andhra and adjoining Interior Mysore, it caused fairly widespread rain in coastal Andhra Pradesh and Rayalaseema and scattered rain in Tamil Nadu and Mysore State between the 23rd and 25th. The rainfall was, however, widespread in south Interior Mysore on the 24th. Isolated heavy to very heavy falls occurred in Ongole, Nellore and Chingleput districts between the 23rd and 25th. No loss of life was reported on account of this cyclone. However, this cyclone was reported to have uprooted a large number of trees all along the road from Gummidipundi to Sulurpet. Considerable damage was done to *casuarina* and *eucalyptus* plantations. The road from Pulicat lake to Sriharikota Island was damaged at many places due to choppy waves in Pulicat lake. In Sriharikota Island and neighbourhood a large number of electric poles and telephone posts were bent in different directions and severely damaged. No tidal waves were reported in association with this cyclone. The notable rainfall amounts (13 cm or more) were :

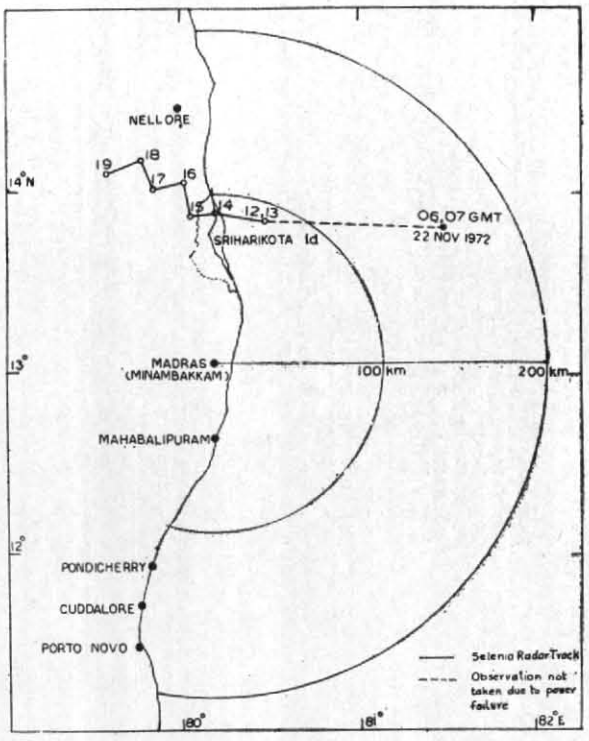

Fig. 10

Radar track of Sriharikota cyclone

Date (Nov)	*Station*	*Rainfall* (cm)	*Date* (Nov)	*Station*	*Rainfall* (cm)
15	Hut Bay	19	23	Sulurpet (A.P.)	13
23	Venkatagiri (A.P.)	15	25	Rapur (A.P.)	13

Many ships' reports were received from the storm field. The lowest pressure reported near the centre of the storm was 983 mb and the maximum wind 60 kt gusting to 90 kt, by ship ATAF. Madras reported westerly winds of 40 to 50 kt at 0·3 and 0·6 km a.s.l. at 1200 GMT of 22nd. The largest pressure defect on the morning of 23rd when the system had weakened into a depression, was 6 mb. Reports from ships in the storm field are given in Table 6.

This cyclone was seen in the Selenia X-band radar at Madras airport on the 22nd noon when it was about 160 km eastnortheast of Madras. Subsequently, it could be tracked almost from hour to hour from 1200 GMT till it crossed coast. The observations taken by this radar showed that the cyclone crossed coast near Sriharikota Island at about 1430 GMT on 22nd. The path of the cyclone as tracked by this radar is given in Fig. 10.

The satellite pictures showed that this system

TABLE 6

Time (GMT)	Ship/ Station	Location Lat. (°N)	Location Long. (°E)	Wind (Dir/Speed in kt)	Pressure (mb)
		17 November 1972			
0300	Ship	13·0	88·7	ENE/35	1009·0
1200	JEEO	12·0	89·8	ESE/32	1002·2
		20 November 1972			
0500	SWIQ	15·1	86·2	NNE/35	1007·0
0500	SVIV	15·0	87·3	NE/45	1004·0
1000	ATBE	14·2	85·7	N/45	997·0
		21 November 1972			
0300	VWPV	14·4	88·9	SSE/28	1007·6
0400	ATAF	15·2	85·0	NNE/35	1008·0
0800	Do.	14·1	84·5	NNE/40	1002·0
1200	Do.	13·6	84·1	NE/50	993·8
1530	Do.	12·7	84·2	SE/90 (gusty)	983·0
1200	Madras			SWS/W 40-50*	

* at 0·3 and 0·6 km

was in stage X, category 2 and 3 between 18th and 22nd. The satellite pictures of this storm on the 18th and 22nd are reproduced in the Figs. 11 and 12. The maximum wind speed estimated from the satellite picture was about 80 kt which gave an estimated pressure of 985 mb at the centre of the storm. This agreed well with the pressure of 983 mb reported by the ship ATAF.

2. 9. *Deep depression of 27 to 29 November*

A trough of low which lay over Andaman Sea on the 23rd developed into a well-marked low over south Andaman Sea on the 24th. Moving northnorthwestwards, it concentrated into a depression on the morning of 26th near 13·5°N, 91·5°E. Then moving north slowly, it became deep on the next day near 15°N, 91·5° E and recurved northeastwards towards Arakan coast on the 29th and weakened into a low near Akyab late on that evening.

This system caused fairly widespread rain in the Bay Islands from 25th to 28th. Long Island recorded 9 cm of rain and Port Blair 4 cm on 26th. Ship ATGY near 16·5°N, 92·3°E reported surface wind ESE/20 kt and pressure 1004·8 mb at 00 GMT of 28th. The same ship reported near 15·2°N, 93·2°E, surface wind S/25kt and pressure 1006·1 mb at 0600 GMT of 28th. Akyab reported an easterly wind of 30 kt at 0·9 km at 00 GMT of 29th.

A reconnaissance aircraft of the U.S. Air Force which flew into this disturbance at 0640 GMT of 28th, gave the centre of the depression as 16·5°N, 92·0°E and the sea level pressure near the depression centre as 1004 mb. The maximum wind was 25 kt in the east quadrant. From the satellite picture, this system could be classified under stage C generally between 27th and 29th. The satellite picture of this system as on 27th morning is reproduced in Fig. 13.

2. 10. *Severe cyclonic storm of 1-8 December*

A low pressure area moving westwards from south Andaman Sea concentrated into a depression on the morning of 1 December 1972 near 10°N, 89°E. Moving westnorthwest, it intensified into a cyclonic storm on the morning of 3rd, near 11°N, 85·5°E and into a severe cyclonic storm on the morning of 4th, when it was centred about 500 km east of Cuddalore. Later, moving westwards, it developed a narrow inner core of hurricane force winds on the 5th around its centre. Subsequently moving westnorthwest, it crossed Tamil Nadu coast close to and north of Cuddalore at about 2330 GMT on 5th December and was centred within 50 km westnorthwest of Cuddalore at 0300 GMT on the 6th. Later, it weakened into a depression and moving westsouthwestwards across the south Peninsula, it emerged into the Arabian Sea off Mysore-Kerala coasts on the 8th. It weakened further into a low pressure area over Laccadives on the 9th and moved away westwards after 10th.

This system caused fairly widespread rain with isolated heavy to very heavy falls in the Bay Islands from 1 to 3 December. As the storm hit Tamil Nadu coast and moved across the south Peninsula into the Arabian Sea, it caused fairly widespread rain in Tamil Nadu from 5th to 10th, in Rayalaseema, south Interior Mysore and Kerala from 7th to 10th, with scattered heavy to very heavy falls in Tamil Nadu and Kerala. Fairly widespread rain with isolated heavy to very heavy falls also occurred in coastal Andhra Pradesh on the 6th and 7th.

This cyclone caused considerable damage to crops and other property in Chingleput, North and South Arcot, Salem, Dharmapuri, Coimbatore, Nilgiris, Thanjavur and Tiruchchirappalli districts and in Pondicherry, mainly due to heavy

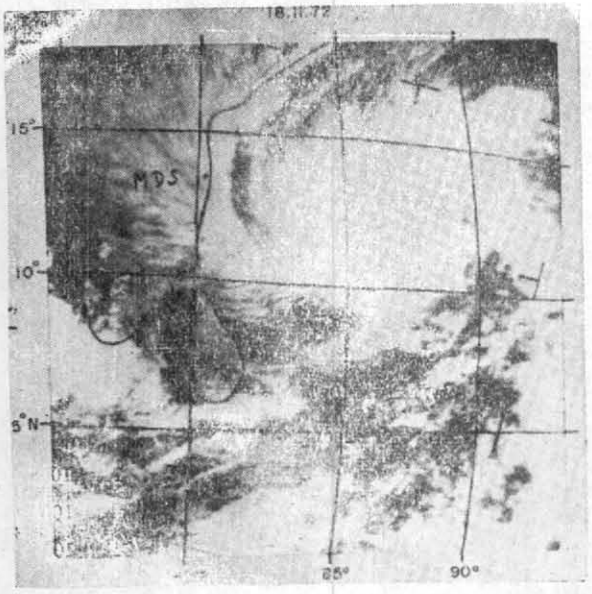

Fig. 11. At about 1015 IST on 18 Nov 1972

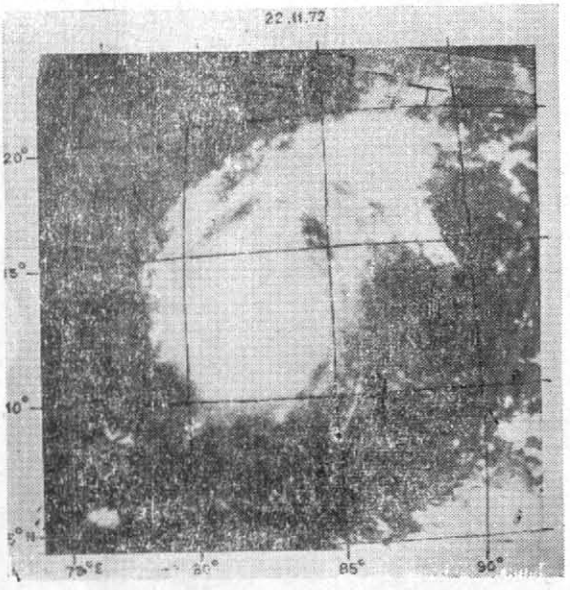

Fig. 12. At about 0945 IST on 22 Nov 1972
APT picture of Sriharikota cyclone

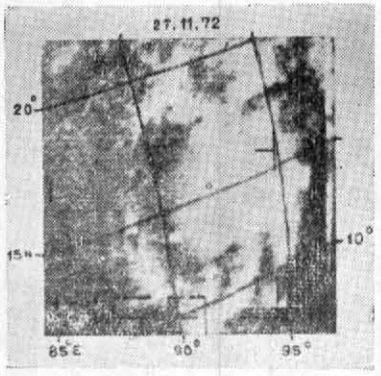

Fig. 13

ESSA-8 view of deep depression at about 0920 IST on 27 Nov 1972

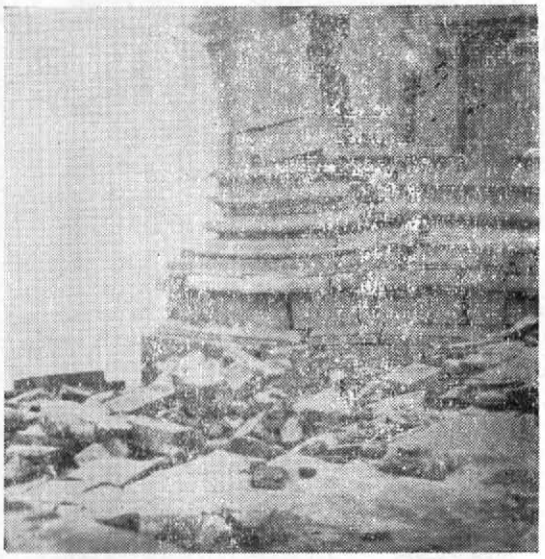

Fig. 14

Shiva temple on sea shore at Tranquebar damaged by strong winds & sea water during Cuddalore cyclone

rain and floods. South Arcot was the worst affected district. About 80 persons were reported to have lost their lives and several thousands of people rendered homeless in these districts. Many thousands of houses were damaged. Neyveli mines were flooded. Damage to telecommunications was also caused by gales in the coastal areas. Many trees were uprooted. The *Kalasam* on the Gopuram of the famous temple at Chidambaram was knocked down. Fig. 14 shows the Shiva temple damaged by strong winds and flooding by sea water at Tranquebar. In Madras City, low lying areas were flooded rendering about 30,000 people homeless. Road and rail communications in the coastal districts of Tamil Nadu remained disrupted for some days. Some damage to crops and other property

was also reported from the southern districts of Interior Mysore, due to heavy rain and floods. According to press reports, the total damage caused by this cyclone in Tamil Nadu has been assessed by the State Government at over Rs. 40 crores, including Rs. 7 crores worth of standing crops washed away in the above mentioned districts. No tidal waves were reported in association with this cyclone. The notable amounts of rainfall (13 cm or more) were :

Date (Nov)	*Station*	*Rainfall* (cm)	*Date* (Nov)	*Station*	*Rainfall* (cm)
3	Maya Bandar	15	7	Mannargudi	14
6	Cuddalore	18		Woolapalem	13
	Kanchipuram	17	8	Kodangallur (Kerala)	22
	Mayuram	15		Gopichettipalayam	18
	Madras	14		Fort Cochin	14
	Nagapattinam	14		Mannargudi	13
7	Atirampattinam	22	9	Coimbatore City	18
	Kavali	16	10	Satyamangalam	19
	Pondicherry	16		Gopichettipalayam	18
	Kanchipuram	16			

Cuddalore recorded surface winds of 60 to 80 kt between 2230 GMT of 5th and 0230 GMT of 6th and the lowest pressure of about 984 mb at 2300 GMT of 5th. Madras reported NNE/40-45 kt winds at 0·6 and 0·9 km a.s.l. at 00 GMT of 5th and NE/45 kt between 0·3 and 0·9 kt at 1200 GMT of the same day. It reported E/40-50 kt at 00 GMT of 6th at those levels. Along the east coast, Cuddalore recorded the highest 24-hour pressure fall and the lowest pressure defect at 03 and 12 GMT of 5th. This could be suggestive of the expected movement of the cyclone. The cyclone did cross coast near Cuddalore on the 6th early morning. The highest pressure defect reported by Cuddalore was 17 mb at 03 GMT of 6th. The hourly values of wind and pressure recorded at Cuddalore are depicted in Fig. 15. Some reports from ships in and near the storm field are given in Table 7.

The cyclone came into the range of the Cyclone Warning Radar at Madras, by 1600 GMT of 4th, when the cyclone was about 300 km away from the coast. Thereafter, the cyclone was tracked from hour to hour precisely with the help of this radar, till it crossed coast near Cuddalore in the early morning of 6th. The smooth track of the cyclone based on the hourly radar observations

TABLE 7

Time (GMT)	Ship/ Station	Location Lat. (°N)	Location Long. (°E)	Wind (Dir/Speed in kt)	Pressure (mb)
		1 December 1972			
0000	VWWN	9·6	92·8	S/19	1010·8
		2 December 1972			
1200	PFGX	13·0	84·6	NE/24	1007·4
1200	VWWN	10·7	87·5	S/25	1006·3
		3 December 1972			
0000	Do.	11·6	85·3	NNE/14	1003·4
0300	Do.	12·0	83·9	N/30	100[illegible]
1200	Jayalakshmi	9·9	83·5	NW/24	1004·0
		4 December 1972			
0300	VWKR	11·8	84·5	ESE/35	997·0
0430	Do.	11·5	84·3	NNE/35	987·0
0600	JCAY	11·4	82·8	NNE/32	1004·2
1800	DEAX	13·6	83·3	ENE/47	1005·8
		5 December 1972			
0600	Madras			NE/55*	
1200	Do.			NE/45**	
0600	YTEL	11·9	82·0	SSE/31	1004·5

* at 0·9 km

** 0·3 to 0·9 km

is shown in Fig. 16. The radar picture of the cyclone at 1200 hrs GMT of 5 December is given in Fig. 17.

The satellite pictures showed that the system was in stage X, category 2 to 3, diameter about 3° between 4th and 6th. The satellite view of the cyclone on the 4th and 6th are given in Figs. 18 and 19. The maximum wind estimated from the satellite picture is about 70 kt, which agrees well with the maximum wind of 75 kt reported by Cuddalore. For a maximum wind of 75 kt, the estimated pressure at the centre of the storm was 984 mb which agreed well with the lowest pressure reported by Cuddalore.

2. 11. *Depression of 5-8 December*

Typhoon SALLY moving westwards across the Gulf of Siam weakened and crossed Tennasserim coast as a depression and emerged into Andaman Sea on the morning of 6th when it was centred near 11°N, 97°E. Moving westnorthwest initially

and later northwards it weakened into a well marked low over extreme north Andaman Sea by the 9th.

It caused scattered or isolated light to moderate rainfall in the Bay Islands on the 6th and 7th.

No ships' reports were available in the depression field.

2. 12. *Depression of 20 December*

A depression formed in southwest Bay of Bengal near 7·5°N, 83·5°E on the morning of 20th. It moved northwestwards towards east Sri Lanka coast and weakened into a low on the next morning and into a trough off Sri Lanka-Tamil Nadu coast on the 22nd.

It caused isolated light to moderate rain in Tamil Nadu from 21st to 23rd.

Ship ULZD near 9·5°N, 82·5°E reported NE/25 kt wind at 0600 GMT of 20th and N/20 kt at 1200 GMT of 20th near 8°N, 82·2°E. Ship PCYP near 6°N, 83°E reported W/20 kt wind at 0600 GMT of 20th. Trincomalee reported NNW/25 kt at 0·3 km and Colombo N/25 kt at 0·6 and 0·9 km a.s.l. at 1200 GMT of 20th.

3. Arabian Sea

3. 1. *Depression of 25-27 June*

In the well-marked trough that lay off Gujarat-Maharashtra coasts on 22nd and 23rd, a low developed off west Saurashtra coast on the 24th. Moving northwest it concentrated into a depression at 03 GMT of 25th, with its centre near 21·5°N, 67·5°E. Subsequently moving practically westwards, it weakened near Oman coast by the 28th. This system facilitated the advance of the monsoon into the eastern parts of northwest India. It caused scattered light to moderate rain or thundershowers in Gujarat State during the above period.

Some reports from ships in and near the depression field are given in Table 8.

The pressure defect in Saurashtra coast was generally 4 to 5 mb at 12 GMT of 24th and 03 GMT of 25th. The largest pressure defect of 5·8 mb was reported by Dwarka at 03 GMT of 25th.

3. 2. *Depression of 1-2 July*

A well marked low which lay in northeast Arabian Sea off Saurashtra coast on 30 June, concentrated into a depression near 22°N, 66·5°E, on the morning of 1 July. Moving rather fast west-

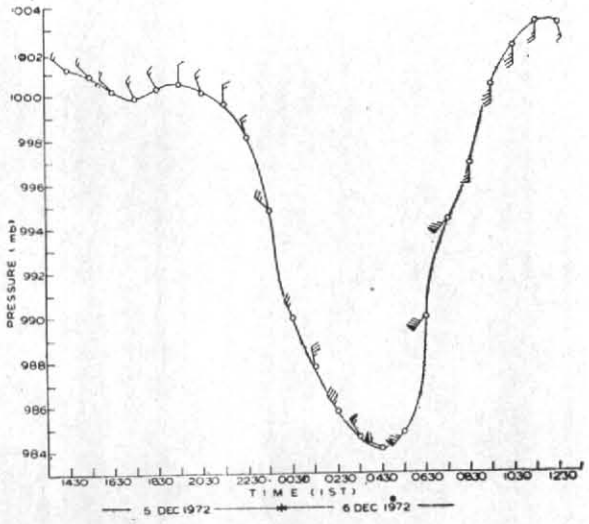

Fig. 15

Hourly observations of wind and pressure of Cuddalore cyclone of Dec 1972

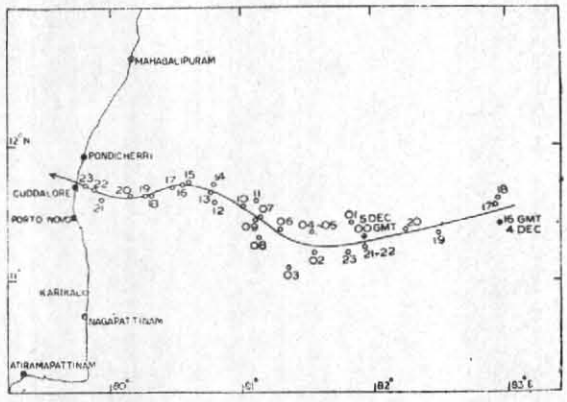

Fig. 16

Radar track of Cuddalore cyclone of 4-6 Dec 1972

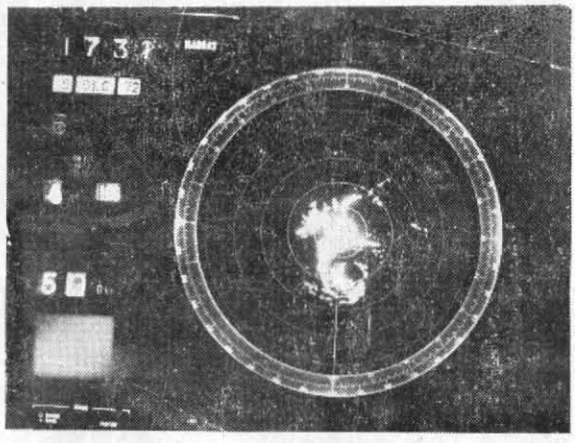

Fig. 17

Radar picture of Cuddalore cyclone at 1731 IST on 5 Dec 1972 (Taken from 10 cm Radar at Madras)

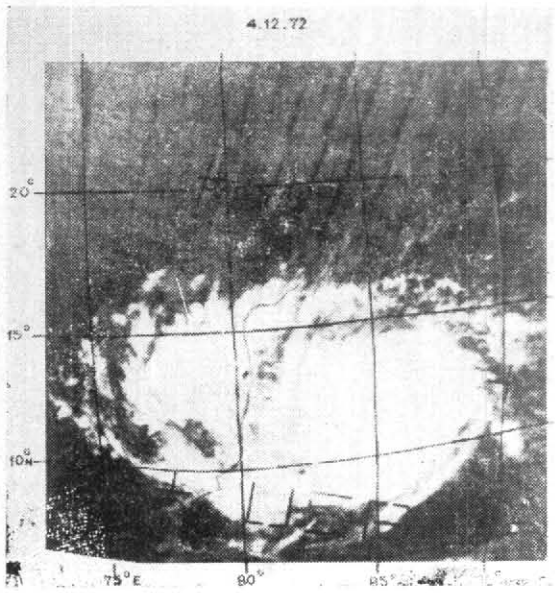

Fig. 18. At about 1030 IST on 4 Dec 1972

Fig. 19. At about 1015 IST on 6 Dec 1972

ESSA-8 views of Cuddalore cyclone of December 1972

TABLE 8

Time (GMT)	Ship/ Station	Location Lat. (°N)	Location Long. (°E)	Wind (Dir/Speed in kt)	Pressure (mb)
		25 June 1972			
1200	PIWA	19·1	66·2	WSW/39	995·1
1200	PJKL	20·3	64·4	Vari/7	995·0
		26 June 1972			
0000	PIWA	21·3	63·5	W/14	992·9
0600	Do.	22·0	62·5	NNE/05	995.5
0600	PIEK	20·3	63·2	SW/20	996·4
1200	Masirah			NW/30*	
		27 June 1972			
0000	Jiwani			E/25**	

* at 1·5 km

** at 0·6 and 0·9 km

wards, it crossed Oman coast near 22°N on the morning of 2nd and weakened inland.

This system caused active monsoon conditions in Saurashtra and Kutch on 1 July.

Ship GBQU at 21·2°N, 63·2°E, reported surface wind SW/30 kt and a pressure of 992·1 mb at 12 GMT of 1st. Jiwani reported E/20-25 kt upto 0·9 km and NE/30-40 kt at 1·5 and 2·1 km a.s.l. at 12 GMT of 1st. The upper winds at Karachi the same day were E/20-30 kt upto 0·9 km a.s.l. Masirah reported WNW/35 kt at 1·5 km a.s.l. at 00 GMT of 2nd.

The APT cloud pictures showed that this system was in stage B on the 1st and 2nd.

3.3. *Severe cyclonic storm of 19-25 October*

A low pressure area with associated cyclonic circulation extending to the middle troposphere, which lay over southeast Arabian Sea on the 18th, moved westwards and concentrated into a depression over southwest Arabian Sea on 19th evening near 9·5°N, 61·0°E. Subsequently moving northwest, it intensified into a cyclonic storm on the morning of 21st near 10·5°N, 59·5°E and into a severe cyclonic storm on the evening of 23rd near 12·5°N, 56°E. Later moving practically westwards, it weakened into a cyclonic storm by 24th evening and moved away towards Gulf of Aden by the 26th.

This system did not affect the weather over India.

This system was tracked mainly with the help of satellite pictures as no ships' reports were available in and near the storm field except on the 24th when ship ATIR gave valuable observations close to the storm centre. It reported a surface wind of 35 kt from SSW and surface pressure of 995·7 mb

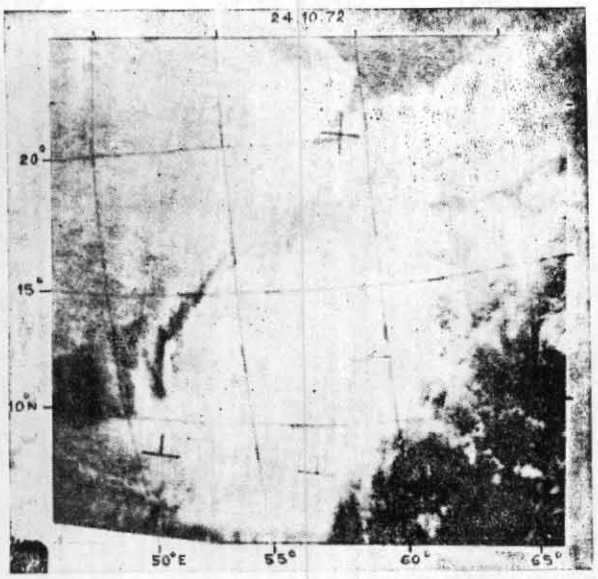

Fig. 20

APT picture of Arabian Sea cyclone at about 1100 IST on 24 Oct 1972

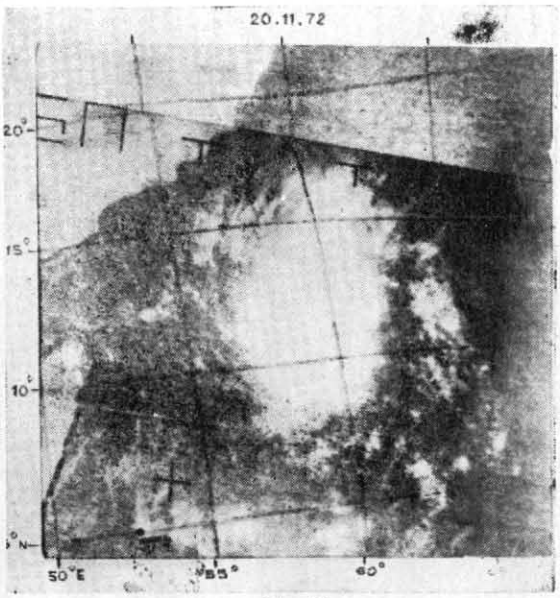

Fig. 21

ESSA-8 view of Arabian Sea depression at about 1100 IST on 20 Nov 1972

near 12·0°N, 55·2°E at 00 GMT of 24th and a surface wind of 50 knots from SE and surface pressure of 996·0 mb near 12·5°N, 55·3°E at 03 GMT of 24th.

From the satellite pictures this system could be classified as stage B on 19th and 20th, stage X, category 1 on 21st, stage X, category 2 to 3 from 22nd to 24th and stage C+ on 25th and 26th. The satellite picture of the storm on the 24th is reproduced in Fig. 20. The maximum wind estimated from the satellite picture was 65 kt which gave an estimated pressure of 991 mb at the centre of the storm.

3.4. *Deep depression of 13-21 November*

A depression formed over southeast Arabian Sea on the morning of 13th with its centre near 9°N, 67°E. Moving northnorthwestwards, it became deep on the 14th. Continuing its northnorthwestward movement it weakened into a depression on 16th and making a clockwise loop in its track upto 17th evening, it was centred near 12·5°N, 64·5°E on the morning of 18th. Subsequently moving westwards upto 20th and later southwestwards, it weakened into a low by the evening of 21st and moved away towards Somalia coast.

This system did not affect the weather over India.

This system was also tracked only with the help of satellite pictures. It could be classified under stage C on 14th and 15th and in stage B on the other days. A satellite view of this depression on 20th is reproduced in Fig. 21.

4. Land Depressions

4.1. *Deep depression of 5-12 August*

A low pressure area which lay over north and adjoining east central Bay on 1 August, moved slowly northnorthwestwards to Bangla Desh and adjoining Gangetic West Bengal by the morning of 5th when it concentrated into a depression about 100 km southeast of Calcutta. Moving northnorthwest initially and later practically westwards, it became deep on the morning of 8th, when it was centred close to Sidhi. Then moving in a northwesterly direction, it weakened into a low over Haryana and adjoining east Rajasthan on the 13th.

This system caused fairly widespread rain with scattered or isolated heavy to very heavy falls in Gangetic West Bengal, Orissa, Bihar State, Madhya Pradesh, Uttar Pradesh, east Rajasthan and Haryana on some days during the above period. A large number of State raingauge stations in Sawai Madhopur, Alwar, Jaipur and Bharatpur districts in Rajasthan reported very heavy rain between 10th and 12th. The monsoon was active in Orissa on 5th, in Gangetic West Bengal on 7th, in Bihar State on 6th and 7th, in east Uttar Pradesh from 6th to 9th, in Madhya Pradesh from 8th to 10th, in east Rajasthan and plains of west

Uttar Pradesh from 9th to 11th and in Haryana from 10th to 12th. According to press reports, heavy rain in Rajasthan caused breaches in dams and floods in some rivers there, leading to inundation of many villages in Bharatpur and Sawai Madhopur districts. About 5,000 heads of cattle were lost and several thousands of houses were damaged. Road traffic on Agra-Bharatpur section and rail traffic on Bayana-Gangapur section were disrupted. Some areas in Agra district were also flooded. The notable amounts of rainfall (13 cm or more) were :

Date (Aug)	*Station*	*Rainfall* (cm)	*Date*	*Station*	*Rainfall* (cm)
7	Hazaribagh	14	11	Karauli (Raj)	36
	Devendranagar (MP)	13		Nadoti (Raj)	36
8	Sidhi	18		Sarmathuro (Raj)	32
	Janta	16		Sikrai (Raj)	29
	Ajaigarh	15		Gangapur (Raj)	26
	Panna	14		Hindaun (Raj)	19
	Devendranagar	14		Sapotra (Raj)	19
	Satna	21		Iglas (West U.P.)	18
	Nowgong	19		Rajgarh (Raj)	17
	Datia	18		Bayana (Raj)	16
	Karera	17		Baswa (Raj)	16
	Khajuraho	17		Sabalgarh (M.P.)	15
	Panna	14		Bari (Raj)	14
	Ajaigarh	14		Bawal (Haryana)	14
	Lalsot (Raj)	14		Kotkasim (Raj)	13
10	Bari (Raj)	25		Thanagazi (Raj)	13
	Nadoti (Raj)	25	12	Behrod (Raj)	27
	Sikrai (Raj)	24		Narnaul (Haryana)	25
	Sapotra (Raj)	22		Pawta (Raj)	23
	Sabalgarh (MP)	22		Neemrana (Raj)	20
	Karauli (Raj)	21		Bansur (Raj)	15
	Gangapur (Raj)	20		Mundawar (Raj)	15
	Mahuva (Raj)	18		Mahendragarh (Haryana)	15
	Sheopur	16		Kotputli (Raj)	14
	Gwalior	14		Thanagazi (Raj)	14

The following observatories reported strong winds at 0·6 and 0·9 km a.s.l. in the depression field.

Allahabad S/45-50 kt at 12 GMT of 8th

Lucknow E/30-50 kt at 12 GMT of 8th

Bareilly E/40-55 kt at 00 GMT of 9th

Delhi ENE /30 kt at 06 GMT of 9th

Gwalior N/NW/30 kt at 00 GMT of 9th

Gwalior WSW /40-45 kt at 12 of GMT of 9th

Bareilly E/40 kt at 12 GMT of 10th

Bareilly SE/30-35 kt at 12 GMT of 11th

Allahabad reported gusty surface winds of 25 kt from ENE at 03 GMT of 8th. The lowest pressure reported near the centre of this system was 989 mb and the largest pressure defect was 11 mb.

4. 2. *Depression of 28-31 August*

A low pressure area formed over head Bay of Bengal on the 26th. It moved northwestwards to Gangetic West Bengal on the 27th and concentrated in to a depression on the morning of 28th over Bihar Plateau and adjoining Gangetic West Bengal. Subsequently moving practically westwards, it weakened into a well marked low by the evening of 31st over northwest Madhya Pradesh and adjoining east Rajasthan. The depression was probably deep from 29th morning to 30th morning.

Under the influence of this system, the monsoon was active to vigorous in Gangetic West Bengal from 26th to 29th and active in Bihar Plateau on 27th and 28th and in Madhya Pradesh from 27th to 30th. Due to heavy rain, the south Bengal rivers rose in spate. Low lying areas in Midnapore and Kharaghpur towns were flooded affecting about 1,000 families. Floods were also reported from some parts of Madhya Pradesh and Broach district, causing damage to cotton crops. The notable amounts of rainfall (13 cm or more) were :

Date (Aug)	*Station*	*Rainfall* (cm)	*Date* (Aug)	*Station*	*Rainfall* (cm)
27	Sagar Island	20	30	Jabalpur	26
	Ajaigarh (MP)	16		Narsingpur	22
	Sagar (MP)	15		Pachmarhi	22
	Sandheads	14		Deori (MP)	17
28	Tikamgarh	32		Sangod (Raj)	14
	Burdwan	22		Patan (MP)	13
	Purulia	15		Ghansore (MP)	13

The easterlies upto 0·9 km a.s.l. about 200 to 300 km from the depression centre were generally about 30 kt on 28th and 29th. Allahabad reported gusty surface winds of 25 kt from E at 12 GMT of 29th. The reported pressure defect near the centre of the depression was about 6 mb.