

Cyclones and depressions over north Indian Ocean during 2001*

1. Introduction

There were 6 cyclonic disturbances (4 cyclonic storms and 2 depressions) over the north Indian Ocean during 2001. Out of these cyclonic disturbances 3 formed over the Bay of Bengal and 3 over the Arabian Sea. One cyclonic storm (21-28 May 2001) reached the intensity of very severe cyclonic storm. No cyclonic disturbance formed in the winter season.

First cyclonic storm (very severe cyclonic storm) formed during 21-28 May over the Arabian Sea. This storm dissipated in the sea area off Saurashtra-Kutch coast without crossing the coast. The second storm formed over the Arabian Sea during 24-27 September and it also dissipated in the sea area over west-central Arabian Sea. The third storm (cyclonic storm) also formed over the Arabian Sea during 8-10 October. It also dissipated in the sea area over east-central Arabian Sea while moving in a northeasterly direction. The fourth storm (cyclonic storm), formed over the Bay of Bengal during 14-17 October, moved in a westerly direction and crossed south Andhra coast near Nellore. It caused moderate damage and loss of 108 human lives.

Tracks of these systems are given in Fig. 1. The brief history and monthly distribution are given in Tables 1 and 2 respectively. In Table 3, crucial observations of ships are given. Seasonwise description of these systems are given below.

2. Disturbances formed during the Winter season (January and February)

No intense cyclonic disturbance formed during the season.

3. Disturbances formed during the Pre-monsoon season (March-May)

During the season, one cyclonic storm formed over the Arabian Sea. Details are presented below :

3.1. *Very severe cyclonic storm over the Arabian Sea (21-28 May 2001)*

This is the only disturbance which formed during pre-monsoon season.

3.1.1. *Life cycle*

A low pressure area formed over southern parts of central Arabian Sea on 21 May and became well-marked in the same evening over east-central Arabian Sea. It concentrated into a depression at 1200 UTC of 21 near Lat.13.5° N/ Long.69.0° E and into a deep depression in the early morning of 22 and lay near Lat.13.5° N/ Long.70.0° E at 2100 UTC of 21. Moving in a northeasterly direction, it intensified into a cyclonic storm at 0300 UTC of 22 and lay centred near Lat. 14.0° N/ Long. 71.5° E. It remained practically stationary and further intensified into a severe cyclonic storm at 1500 UTC of 22 near Lat. 14.0° N/ Long. 71.5° E and into a very severe cyclonic storm at 2100 UTC of 22 near Lat. 14.5° N / Long. 71.5° E. Moving in a northwesterly direction for some time it weakened into a severe cyclonic storm at 0300 UTC of 26 and lay centred near Lat. 17.5° N / Long 67.5° E. Thereafter, moving in a northerly to northeasterly direction, it weakened into a cyclonic storm at 0300 UTC of 27 and lay centred near Lat. 18.0° N/ Long. 67.5° E. Moving in a northeasterly direction, it further weakened into a deep depression at 1200 UTC of 28 near Lat. 21.0° N/Long. 68.5° E and into a depression at 1800 UTC of 28 near Lat. 21.5° N/ Long. 69.0° E. The system rapidly weakened into a low pressure area close to Saurashtra coast and was seen in synoptic charts of 0300 UTC of 29 as a low pressure area over Saurashtra & Kutch. The cyclone did not cross the coast and dissipated over the sea, thus, no damage was caused over the Indian coast.

3.1.2. *Satellite cloud features and other observations*

The system was tracked mainly on the basis of satellite observations it was reassessed over the ocean. Maximum intensity of the system as given by INSAT cloud imagery (ICI) was T 6.0 (115 kts) from 0900 UTC of 24 to 0000 UTC of 25. ICI reported "EYE" between 0300 UTC of 23 and 1430 UTC of 24.

The estimated lowest central pressure of the system was 942 hPa at 241200 UTC. Maximum estimated wind speed was 115 kts. The system moved initially in a general easterly direction till evening of 22. After that it had a northerly course of movement till 23 morning followed by a northwesterly direction of movement till morning of 25. Then it moved generally in a northerly

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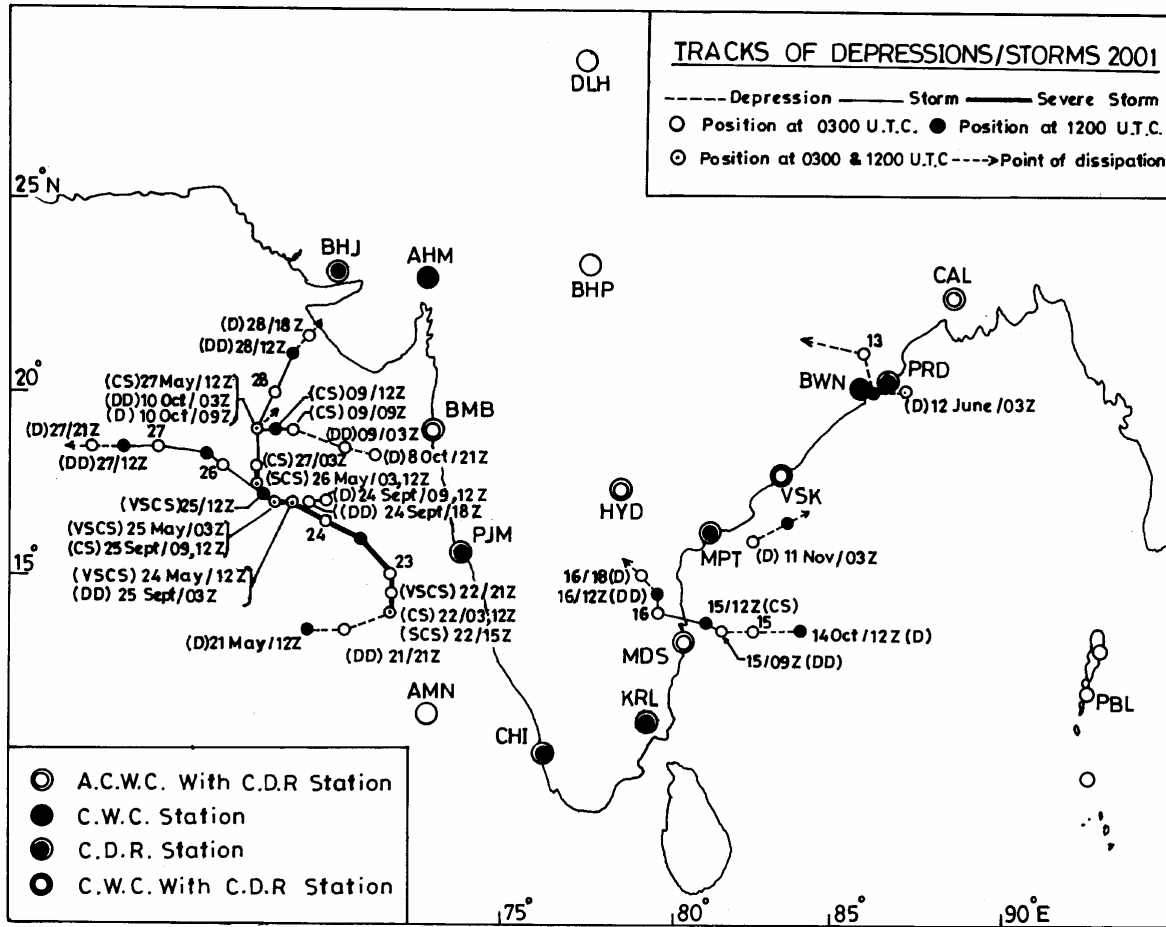


Fig. 1. Tracks of depression/storms during 2001

direction till morning of 28 and recurved towards northeast direction and weakened rapidly near Saurashtra coast and lay as a low pressure area over Saurashtra & Kutch at 0300 UTC of 29. Under the influence of this system monsoon current in southern parts of Arabian Sea was strengthened which helped early onset of monsoon over Kerala on 23, about 8 days earlier than the normal date.

3.1.3. Weather and damages

Fairly widespread to widespread moderate rainfall occurred in south Konkan & Goa on 22, 23, 24 and 25. Isolated to scattered rainfall occurred on 29 and 30 in Gujarat State.

Principal amounts of rainfall (cm) are:

30 May : Rajula (Saurashtra) 6.4, Surat 3.5, Deesa 3.

The system caused no serious damage, only 1 person died on 29 in Jamnagar.

4. Disturbances formed during the Monsoon season (June-September)

During the season, one depressions and one cyclonic storm formed. Details are given below :

4.1. Depression over the Bay of Bengal (12-13 June)

4.1.1. Life cycle

A low pressure area formed over northwest Bay and neighbourhood on 9. It became well-marked on 11 over the same area and concentrated into a depression in the morning of 12 near Lat. 20.0° N/ Long. 87.0° E. Moving in a northwesterly direction, it crossed coast in the afternoon of 12 near Paradip and lay centred about 50 kms southeast of Keonjhar in the morning of 13. It weakened into a well-marked low pressure area on 14 over east Madhya Pradesh & Chattisgarh and neighbourhood and into a low pressure area on 15 over west Madhya Pradesh and neighbourhood.

TABLE 1

Brief history of cyclonic storms and depressions over the Indian seas and neighbourhood during 2001

S. No.	Type of system	Life period	Point of crossing the coast	Lowest estimated central pressure (hPa)	Recorded max. wind	Highest "T" No. (estimated)
1.	VSCS	21-28 May	Dissipated over sea. No landfall	932	-	6.0
2.	D	12-13 June	Near Paradip (Orissa)	-	-	-
3.	CS	24-27 September	Dissipated over sea. No landfall	998	-	2.5
4.	CS	8-10 October	Dissipated over sea. No landfall	998	-	2.5
5.	CS	14-17 October	Near Nellore	996	-	2.5
6.	D	11 November	Dissipated over sea. No landfall	-	-	-

D- Depression, DD-Deep depression, CS – Cyclonic storm, SCS - Severe cyclonic storm, VSCS – Very severe cyclonic storm, Super CS – Super cyclonic storm

TABLE 2

Storms/depressions statistics 2001

Name of the system	Winter		Pre-monsoon			Monsoon				Post-monsoon			Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Over Bay of Bengal													
Depressions/Deep depressions						1						1	2
Cyclonic storms										1			1
Severe cyclonic storms													
Very severe cyclonic storms													
Super cyclonic storm													
Total													3
Land depression													
Deep depression													
Over Arabian Sea													
Depressions/Deep depressions													
Cyclonic storms									1	1			2
Severe cyclonic storms													
Very severe cyclonic storms					1								1
Super cyclonic storm													
Grand Total					1	1			1	2	1		6

4.1.2. *Satellite cloud features and other observations*

INSAT cloud imagery did not assign any 'T' number to this system.

4.1.3. *Weather and damages*

The system produced heavy rain over Orissa, Madhya Pradesh & Chattisgarh, Vidarbha and Gujarat.

Principal amounts of rainfall (cm) are:

13 June Orissa : Kotraguda 19,
Bhubaneswar 18,
Nimapada 14

14 June Vidarbha : Armor 35,
Bhiwapur 30,
Gadchiroli 27, Kuhu 26

TABLE 3

Crucial observations during the storm periods

Call Sign	Date/Time (UTC)	Lat. (°N)	Long. (°E)	Dir. (°)	Speed (kts)	PPPP (hPa)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Very severe cyclonic storm over the Arabian Sea (21-28 May 2001)						
DQVK	230600	9.6	64.9	270	14	1011.9
ATJW	240000	13.2	73.8	240	18	1005.5
DADD	260600	9.0	66.8	240	30	1007.0
ELXX3	260600	11.5	55.0	230	40	-
ELY4Z	270600	9.6	63.5	320	30	1006.5
ELXZ6	271200	8.2	71.7	250	18	1007.3
ELXA7	271200	9.0	65.7	230	26	1006.0
Depression over the Bay of Bengal (12-13 June)						
Nil						
Cyclonic storm over the Arabian Sea (24-27 September)						
SHIP	250000	16.3	67.9	290	28	1004.2
DNHS	250000	10.8	58.3	190	16	1010.0
ELYJ3	260000	17.1	66.8	280	35	1002.0
CBZ4	260000	21.2	62.4	300	25	-
ELYJ3	260600	18.5	65.1	200	26	1005.0
3FJY	260600	13.3	66.7	250	15	1010.0
VZPQ	270000	23.2	64.9	180	05	1005.8
ATQP	270600	24.2	58.7	000	02	1012.1
Cyclonic storm over the Arabian Sea (8-10 October 2001)						
DHDN	090000	10.7	63.7	310	24	1010.9
ELZD9	090000	12.5	64.2	280	16	1008.0
DGWM	090600	15.7	57.9	320	14	-
ELZD9	091200	14.3	60.4	270	10	1008.5
Cyclonic storm over the Bay of Bengal (14-17 October 2001)						
WHG	140600	12.8	84.5	260	24	1008.1
PFEI	150000	10.3	87.0	210	15	1007.0
Depression over the Bay of Bengal (11 November 2001)						
Nil						

15 June Vidarbha : Moregaon 18, Kalam 17, Karanja 16, Washim 15

16 June West Madhya Pradesh : Sagar 11
Gujarat Region : Navasari 24, Palsana, Mahuwa 23
Saurashtra & Kutch : Khambalia 31, Keshod 24, Bhanitad, Ranawab 23, Kalyanpur 21

4.2. Cyclonic storm over the Arabian Sea (24-27 September)

4.2.1. Life cycle

Under the influence of an upper air cyclonic circulation, a low pressure area formed over east-central

Arabian Sea on 24 morning. It concentrated into a depression at 0900 UTC of 24 over east-central Arabian Sea and lay centred near Lat. 17.0° N/ Long. 69.5° E and became deep depression at 1800 UTC of 24 and lay centred near Lat. 17.0° N/Long. 69.0° E. Remaining practically stationary for some time and then moving in a westerly to northwesterly direction, it intensified into a cyclonic storm at 0900 UTC of 25 and lay centred near Lat. 17.0° N/ Long. 68.0° E. It moved in a northwesterly to westerly direction and weakened into a deep depression at 1200 UTC of 27 and lay centred near Lat. 18.5° N/ Long. 63.5° E. It further weakened into a depression at 2100 UTC of 27 and lay centred near Lat. 18.5° N/Long. 62.5° E. Thereafter, the system weakened into a low pressure area at 0300 UTC of 28 over west-central Arabian Sea. It became less marked on 29 morning over the same area.

4.2.2. *Satellite cloud features and other observations*

The maximum 'T' number reported by INSAT was T 2.5 (35 kts) from 0600 UTC of 25 to 0000 UTC of 27. The lowest estimated central pressure was 998 hPa at 0300 UTC and 1200 UTC of 26. The estimated maximum wind speed was 35 kts. System moved in a westerly to northwesterly direction. The system did not cross the Indian coast.

4.2.3. *Weather and damages*

As the system did not cross coast, it did not cause any damage. However, isolated rainfall occurred over south Gujarat Region and Saurashtra on 26 and 27. Principal amounts of rainfall (cm) are:

26 September : Junagarh 7, Jetpur (Rajkot), Dhoraji (Rajkot) 6 each, Gondal (Rajkot) 4

27 September : Visavadar (Saurashtra) 11, Junagarh 6

5. **Disturbance formed during the Post-monsoon season (October-December)**

During this season, two cyclonic storms (one each in the Arabian Sea and the Bay of Bengal) and one depression formed over the Bay of Bengal. Details are presented below :

5.1. *Cyclonic storm over the Arabian Sea (8-10 October 2001)*

5.1.1. *Life cycle*

A well-marked low pressure area formed over south Madhya Maharashtra, south Konkan & Goa and adjoining coastal Karnataka and east-central Arabian Sea. It concentrated into a depression at 21 UTC of 8 near Lat. 18.3° N/ Long. 71.0° E and moving in a northwesterly direction, rapidly intensified into a deep depression at 0300 UTC of 9 near Lat. 18.5° N/ Long. 70.0° E. Then, it moved in a northwesterly direction and further rapidly intensified into a cyclonic storm at 0900 UTC of 9 near Lat. 19.0° N/ Long. 68.5° E. Moving in a westerly direction, it weakened into a deep depression at 0300 UTC of 10 near Lat. 19.0° N/ Long. 67.5° E and into a depression at 0900 UTC of 10 near Lat. 19.0° N/ Long. 67.5° E. It moved in a northeasterly direction and further weakened into a low pressure area over east-central Arabian Sea.

5.1.2. *Satellite cloud features and Radar observations*

The Maximum 'T' number was T 2.5 (35 kts) from 0600 UTC to 2300 UTC of 9. The lowest estimated central pressure was 998 hPa at 1800 UTC of 9. Maximum estimated wind speed was 35 kts at 1800 UTC of 9. System initially moved in a westnorthwesterly to northwesterly direction and then recurved to northeasterly direction. The system dissipated over the sea area.

5.1.3. *Weather and damages*

As the system did not cross coast, it did not cause any serious damage. However, widespread rainfall occurred in Madhya Maharashtra on 7 and 8; in Konkan & Goa from 7 to 9 and in Gujarat on 10. Principal amounts of rainfall (cm) are :

7 October : Pune (PSN) 3.9, Mumbai (SCZ) 2.4

8 October : Pune (LHG) 4.9, Alibag 4.8, Solapur 4.6, Silvasa 4.4, Veraval 2.5, Umbergaon 2.7

9 October : Khamba 10.5, Dharampur 3.8, Bansda 3.5, Madhuban 3.3, Silvasa 3.0

5.2. *Cyclonic storm over the Bay of Bengal (14-17 October 2001)*

5.2.1. *Life cycle*

A low pressure area formed over west-central and adjoining southwest Bay off north Tamil Nadu-south Andhra coast on 14 morning. It concentrated into a depression at 1200 UTC of 14 near Lat. 13.5° N/ Long. 84.0° E. Moving in a westerly direction, it rapidly intensified into a deep depression at 0900 UTC of 15 near Lat. 13.5° N/ Long. 81.5° E. Then, moving in a northwesterly direction, it further rapidly intensified into a cyclonic storm at 1200 UTC of 15 near Lat. 13.7° N/ Long. 81.0° E. It moved in a northwesterly direction and made a landfall near Nellore around 0000 UTC of 16 and lay centred as a cyclonic storm at 0300 UTC of 16 near Lat. 14.0° N/ Long. 79.5° E. It moved in a northerly to northwesterly direction and weakened into a deep depression at 1200 UTC of 16 near Lat. 14.5° N/ Long. 79.5° E and into a depression at 1800 UTC of 16 near Lat. 15.0° N/ Long. 79.0° E. The system further weakened into a well-marked low pressure area over Rayalaseema on 17 morning without any appreciable movement.

5.2.2. *Satellite cloud features, radar and other observations*

The maximum 'T' number of the system was T 2.5 (35 kts) from 1800 UTC to 2000 UTC of 15. The lowest estimated central pressure was 996 hPa at 0000 UTC of 16. The estimated maximum wind speed was 35 kts from 1200 UTC of 15 to 0300 UTC of 16. No significant storm surge occurred in the coastal belt. System moved in a westerly to northwesterly direction.

5.2.3. *Weather and damages*

The system produced exceptionally heavy rainfall in Nellore, Srikakulam, East Godavari and Chittoor districts of coastal Andhra Pradesh and heavy rainfall in Tamil Nadu. Principal amounts of rainfall (cm) are :

15 October : Vandhalai (Tiruvannamalai Distt.) 7.2 and Arakonam (Vellore Distt.) 7.6.

16 October : Sulturpet (Nellore Distt.) 26.1, Nellore 24.9, Red Hills (Lake area Tamil Nadu), 13.5, Thamarapakkam (Lake area, Tamil Nadu) 12.2, Puttur (Chittoor Distt.) 10.6, Amlapuram (East Godavari) 10.5, Tiruvallur 10.2 and Rapur (Nellore Distt.), Chennai, Poondi (Lake area) 10.0 each.

17 October : Gudur (Nellore Distt.) 15.2, Thambalapalle (Chittoor Distt.) 13.1, Sitaramapuram (Nellore Distt.) 11.4, Tekkali (Srikakulam Distt.) 7.2 and Peddapuram (East Godavari Distt.) 6.8.

The system caused some damage due to very heavy rainfall in coastal Andhra Pradesh as given below :

Number of deaths	: 108 (Mainly due to heavy rains)
Number of persons missing	: 21
Districts affected	: Nellore, Chittoor and Cuddapah
Number of tanks breached	: 1,635
Damage to crop	: 1,25,000 hectares (Paddy, Groundnut, pulses etc.)

Number of cattle killed : 1000 approx.

Number of houses damaged : 55,747

Estimated loss (in crores) : Rs. 500/-

Roads damaged : NHS and R & H roads in Nellore & Chittoor districts

The system did not produce any reportable damage in Tamil Nadu.

5.3. *Depression over the Bay of Bengal (11 November 2001)*

5.3.1. *Life cycle*

A well-marked low pressure area over southwest Bay and adjoining west-central Bay off north Tamil Nadu-south Andhra coasts concentrated into a depression at 0300 UTC of 11 near Lat. 16.0° N/ Long. 82.5° E. Moving in a northeasterly direction, it weakened into a well-marked low pressure area over west-central and adjoining northwest Bay on 12.

5.3.2. *Satellite cloud features, radar and other observations*

Maximum intensity of T 1.5 was reported by INSAT cloud imageries from 2100 UTC of 10 to 0000 UTC of 12.

5.3.3. *Weather and damages*

As the system dissipated over the sea area, no damage was reported. However, widespread to fairly widespread rainfall occurred over coastal Andhra Pradesh and Orissa during the period. Significant amounts of rainfall (cms) are:

10 November : Gopalpur 6, Kalingapatnam 5, Paradip 3

11 November : Visakhapatnam 8, Paradip 6, Waltair 5, Kakinada, Kalingapatnam & Tuni 2 each, Bhubaneswar, Puri, Gopalpur & Balasore 1 each

12 November : Puri & Kalingapatnam 7 each, Gopalpur, Paradip & Waltair 6 each, Bhubaneswar 3, Cuttack 1