

Cyclones and depressions over the north Indian Ocean during 2012*

1. Introduction

During 2012, in all 5 intense low pressure systems formed over the Indian Seas. This includes; two Cyclonic Storms ('Murjan' & 'Nilam') and three Deep Depressions. Out of these systems, three systems formed over the Bay of Bengal and two over the Arabian Sea. All the five systems formed during the post-monsoon season. No intense low pressure system formed during pre-monsoon season, as in the recent past years 1993, 2005 & 2011. Also, no intense low pressure system formed during monsoon season, as in the recent past years 2002 & 2010. Also, this is the first year (as per the available data since 1891), when during a year, only post-monsoon season was cyclogenically active.

The Deep Depression (10-11 October) formed very close to Bangladesh coast. This system was short lived (15 hrs duration). The Cyclonic Storm ('Murjan'; 22-26 October) formed over the Arabian Sea, moved westwards and crossed Somalia coast. It did not affect the Indian coast. The other Cyclonic Storm ('Nilam'; 28 October - 1 November) crossed Tamil Nadu coast and moderately affected the country. The Deep Depression (17-19 November) formed over the Bay of Bengal and dissipated over the sea area without affecting the Indian coast. The fifth system, a Deep Depression (22-25 December) formed over the southwest Arabian Sea, moved westwards and dissipated over the sea area. This system also did not affect the Indian coast.

The track/intensity of these systems is given in Fig. 1. A brief history and monthly distribution are given in Tables 1 & 2. The relevant ship and buoy observations are given in Table 3. Detailed season wise descriptions of these systems are given below:

2. Disturbances formed during the post-monsoon season (October - December)

2.1. Deep Depression over the Bay of Bengal (10 -11 October 2012)

2.1.1. Under the influence of a cyclonic circulation over northwest and adjoining west central Bay of Bengal, a low pressure area formed over the same area on 7 October. It became well marked over northeast Bay of

Bengal off Bangladesh coast on 10 morning. Moving northwards, it subsequently concentrated into a Depression at 1200 UTC of 10 and lay centred near Lat. 21.0° N / Long. 91.0° E, about 350 kms southeast of Kolkata and into a Deep Depression at 1800 UTC and lay centred near Lat. 22.0° N / Long. 91.0° E. It moved northeastwards and crossed Bangladesh coast near Hatia (Bangladesh) between 0000 & 0100 UTC of 11 October and lay centred at 0300 UTC of 11 near Lat. 23.0° N / Long. 91.5° E, about 100 kms south of Agartala over Bangladesh and adjoining areas of Tripura as Depression. It moved northeastwards and weakened into a well marked low pressure area over Mizoram & neighbourhood at 0600 UTC of 11 and further weakened into a low pressure area and lay over Manipur and neighbourhood at 1200 UTC. It became less marked on 12th.

2.1.2. Other features observed

The lowest Estimated Central Pressure (ECP) was 1002 hPa from 1800 UTC of 10 to 0000 UTC of 11. The maximum estimated mean wind speed was 30 kts during the same period. The lowest observed pressure of 1002 hPa was reported by Chittagong at 0000 UTC of 11, when the system was to the west of Chittagong. Bangladesh reported sustained wind of 22 kts over Hatia, 25 kts over Sandip and 32 kts over Chittagong.

The system intensified into a deep depression before landfall, though it was lying very close to coast. The salient features of this deep depression are as follows:

(i) It formed from a remnant of low pressure system from the South China Sea which moved across Vietnam and Myanmar and emerged into the northeast and adjoining east central Bay of Bengal.

(ii) It was short lived with the life period of about 15 hrs.

(iii) It intensified into a deep depression before landfall, though it was lying very close to coast.

2.1.3. Weather and damage caused

System caused extensive damage in Bangladesh taking a toll of 43 human lives.

* Compiled by : Medha Khole, S. Sunitha Devi and Bharati Sabade, Meteorological Office, Pune – 411 005, India.

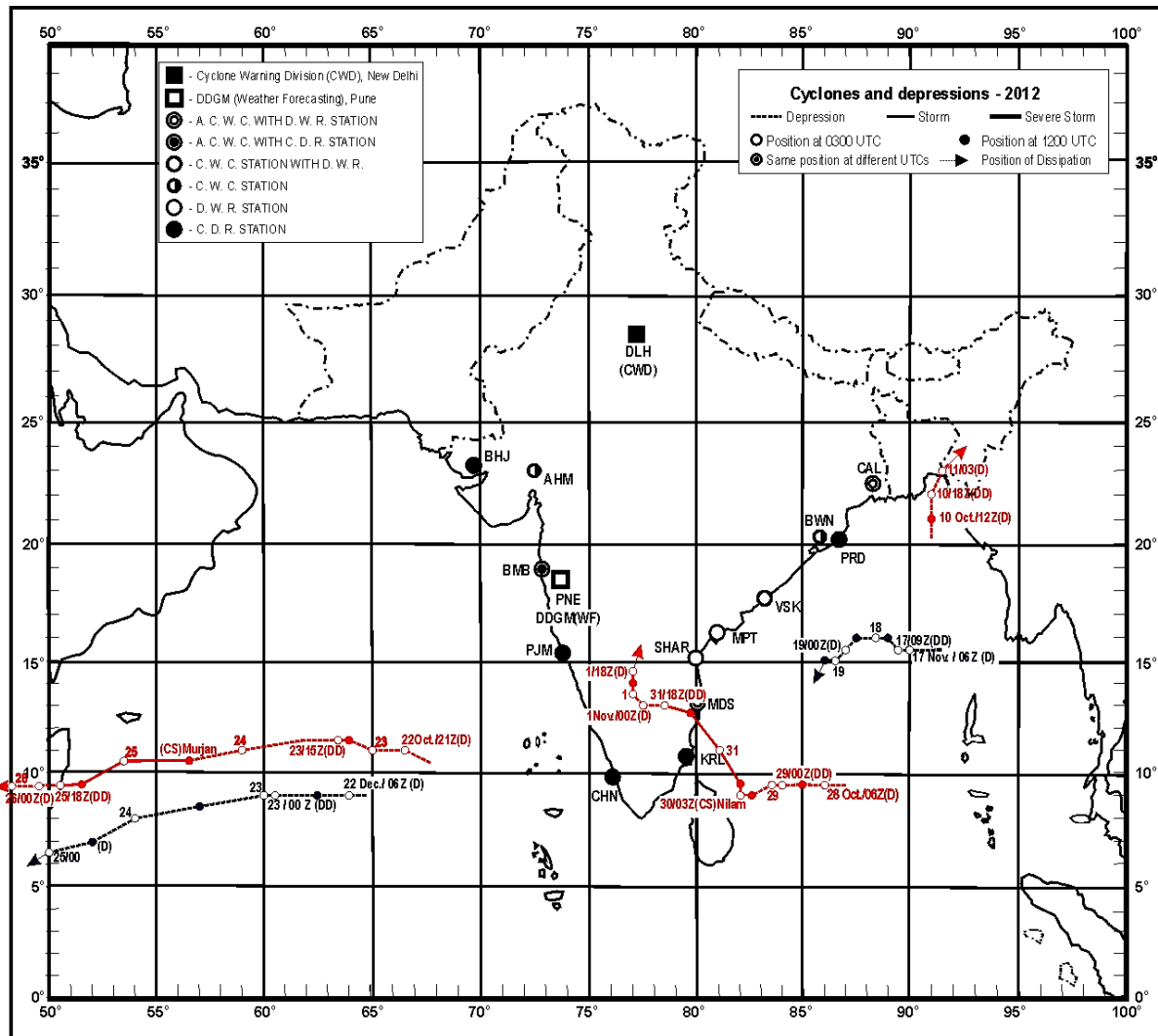


Fig. 1. Tracks of Cyclones and Depressions over North Indian Ocean during the year 2012

TABLE 1
Brief summary of cyclonic storms and depressions over the Indian seas and neighbourhood during 2012

S. No.	Category	Life period	Place / Time of landfall	Lowest estimated central pressure (hPa)	Max. wind (Estimated/observed) (kts)	Highest "T" No.
1.	Deep Depression	10 - 11 Oct	Bangladesh coast near Hatia between 0000 & 0100 UTC of 11 October	1002	32	2.0
2.	Cyclonic Storm (Murjan)	22 - 26 Oct	Somalia coast between 1700 & 1800 UTC of 25 October	998	40	2.5
3.	Cyclonic Storm (Nilam)	28 Oct - 1 Nov	North Tamil Nadu coast near 12.5° N/ 80.2° E, south of Chennai, near Mahabalipuram between 1030 & 1130 UTC of 31 October	986	45	3.0
4.	Deep Depression	17 - 19 Nov	Dissipated over sea	1002	31	2.0
5.	Deep Depression	22 - 25 Dec	Dissipated over sea	1002	30	2.0

TABLE 2
Storms / depressions statistics 2012

Name of the system	Winter	Pre-monsoon			Monsoon				Post-monsoon			Total
	Jan - Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Over the Bay of Bengal												
Depressions/Deep Depressions	-	-	-	-	-	-	-	-	1	1	-	2
Cyclonic Storms	-	-	-	-	-	-	-	-	1	-	-	1
Severe Cyclonic Storms	-	-	-	-	-	-	-	-	-	-	-	-
Very Severe Cyclonic Storms	-	-	-	-	-	-	-	-	-	-	-	-
Super Cyclonic Storms	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	2	1	-	3
Land Depression												
Depressions	-	-	-	-	-	-	-	-	-	-	-	-
Over the Arabian Sea												
Depressions/Deep Depressions	-	-	-	-	-	-	-	-	-	-	1	1
Cyclonic Storms	-	-	-	-	-	-	-	-	1	-	-	1
Severe Cyclonic Storms	-	-	-	-	-	-	-	-	-	-	-	-
Very Severe Cyclonic Storms	-	-	-	-	-	-	-	-	-	-	-	-
Super Cyclonic Storms	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	1	-	1	2
Grand Total	-	-	-	-	-	-	-	-	3	1	1	5

TABLE 3
Ships' Observations during 1st January to 31st December 2012

S. No.	Name of the Ship	Call Sign	Country to which belong	Date and time of observation	Position of Ship Lat. ° N / Long. ° E
I. Cyclonic Storm (Murjan, 23-26 October 2012) over the Arabian Sea					
1.	Maersk Karlskrona	A8PW8	Liberia	1200 UTC of 23 Oct 2012	11.4/68.2
2.	Zim Jamaica	A8OY7	Liberia	0300 UTC of 24 Oct 2012	12.4/58.9
3.		2FUB4		1200 UTC of 24 Oct 2012	13.5/56.6
4.	Budapest Expression	DGWE2	Germany	1200 UTC of 25 Oct 2012	13.9/52.0
5.	Msc Vega	D5BE4	Liberia	1200 UTC of 25 Oct 2012	14.5/55.0
6.		2FUB4		1200 UTC of 25 Oct 2012	8.5/60.0
II. Cyclonic Storm (Nilam, 28 October – 1 November 2012) over the Bay of Bengal					
7.	Swarnakamal	AUYN	India	1200 UTC of 28 Oct 2012	11.5/88.0
8.	Desh Vishal	AUTP	India	0300 UTC of 29 Oct 2012	5.9/84.3
9.	Msc Renee	A8YN5	Liberia	1200 UTC of 29 Oct 2012	6.3/86.5
10.	Oocal Jakarta	VRGO7	Hong Kong	1200 UTC of 29 Oct 2012	6.0/77.7
11.	Maersk Salalah	OZDM2	Denmark	1200 UTC of 29 Oct 2012	11.8/77.7
12.	Oocal Jakarta	VRGO7	Hong Kong	1200 UTC of 30 Oct 2012	6.0/85.0

Fairly widespread rainfall with isolated heavy falls occurred over Arunachal Pradesh, Assam & Meghalaya and Nagaland-Manipur-Mizoram-Tripura on 10 & 11. The significant amounts of rainfall in cms (≥ 7 cm) are given below:

11 October 2012

Tripura : Belonia 9, Bagafa 7.

12 October 2012

Mizoram : Lengpui 9.

Assam : Matizuri 9, Kajalgaon (AWS) 7.

2.1.4. Satellite and RADAR observations

The system was tracked with the help of satellite (Kalpana-1) cloud imageries from 1200 UTC of 10 to 0600 UTC of 11. The maximum intensity of T No 2.0 was reported from 1500 UTC of 10 to 2000 UTC of 10.

The satellite imageries showed a developing low level circulation centre associated with increasing deep convection over the region. It was seen as a vortex with T No. 1.0 from 0300 to 0800 UTC of 10. The T number of 1.5 was assigned at 0900 UTC and T No. 2.0 at 1500 UTC on the same day. The lowest Cloud Top Temperature (CTT) was about -80°C recorded during night of 10.

The system was also tracked by DWRs Khepupara, Cox's Bazar (Bangladesh) and Agartala. The DWR imageries from Agartala indicated that the wind speed was higher in the southern quadrant of the deep depression at the time of landfall. The radial wind of about 25-30 meter per second (48-58 kts) was reported. It indicates that Agartala experienced 15-20 knots wind at the surface level during 0100-0300 UTC.

2.2. Cyclonic Storm (Murjan) over the Arabian Sea (22 - 26 October 2012)

2.2.1. A trough of low at mean sea level extended from southeast Arabian Sea to south Maharashtra coast on 20 and from Lakshadweep area to south Gujarat Region on 21. It organized into a low pressure area over southeast Arabian Sea and neighbourhood on 22. It lay as a well marked low pressure area over the same region in the evening of 22. It concentrated into a Depression and lay centred near Lat. 11.0°N / Long. 66.5°E at 2100 UTC of 22. Moving westwards, it lay centred near Lat. 11.0°N / Long. 65.0°E , 800 kms east of Amini Divi at 0300 UTC of 23 October and near Lat. 11.5°N / Long. 64.0°E at

1200 UTC. It further moved westwards and intensified into a Deep Depression and lay over southwest and adjoining west central Arabian Sea centred near Lat. 11.5°N / Long. 63.5°E at 1500 UTC of 23. Moving slightly west-southwestwards, it lay over southwest and adjoining west central Arabian Sea and centred near Lat. 11.0°N / Long. 59.0°E at 0300 UTC of 24. Moving west-southwestwards, it further intensified into a Cyclonic Storm (Murjan) and lay centred near Lat. 10.5°N / Long. 56.5°E , about 1750 kms west-southwest of Amini Divi at 1200 UTC of 24 October. Then, it moved westwards and lay at 0300 UTC of 25 October near Lat. 10.5°N / Long. 53.5°E , about 2100 kms west-southwest of Amini Divi and near Lat. 9.5°N / Long. 51.5°E , about 2300 kms west-southwest of Amini Divi at 1200 UTC. It further moved westwards and crossed Somalia coast near Lat. 9.5°N / Long. 50.8°E between 1700 & 1800 UTC and further weakened into a Deep Depression and lay centred near Lat. 9.5°N / Long. 50.5°E at 1800 UTC of 25. Moving further westwards, it weakened into a Depression and lay centred at 0000 UTC 26 October over Somalia near Lat. 9.5°N / Long. 49.5°E and lay centred at 0300 UTC of 26 October near Lat. 9.5°N / Long. 48.5°E . It further weakened into a low pressure area over Somalia and adjoining Ethiopia and became unimportant in the evening of 26 October.

2.2.2. Other features observed

The lowest Estimated Central Pressure (ECP) was 998 hPa and estimated maximum sustained surface wind of 40 kts at 1800 UTC of 24. A ship with call sign 2FUB4 (13.5/56.6) reported wind $070^{\circ}/35$ kts at 1200 UTC of 24. There was no meteorological observation available from Somalia. The system generally moved in a westerly direction.

2.2.3. Weather and damage caused

As the system moved away from the Indian coast, no damage was reported due to this system. However, under its influence, widespread/fairly widespread rainfall with isolated heavy falls occurred over Lakshadweep area from 21 to 23, when the system lay as a low pressure area in its vicinity.

2.2.4. Satellite and RADAR observations

According to INSAT imagery, a vortex formed over southeast Arabian Sea with T No.1.0 and lay centered at 1200 UTC of 22 October near Lat. 10.0°N / 68.0°E . Wind shear was 10-20 kt at 1200 UTC of 23rd indicating further intensification of the system. The system intensified further with intensity T No. 2.0 at 1700 UTC of 23 at centre 11.3°N / 63.3°E . Moving in the westerly

direction it intensified again into a cyclonic storm with intensity T No. 2.5 and centre 10.5° N / 56.5° E.

System moved rapidly after 0900 UTC of 25 with a speed nearly 30 km/hr and crossed the coast at 1600 UTC of 25 October 2012 at 9.5° N / 50.6° E.

The system was of shear pattern till 0600 UTC of 23rd. Then it changed into curved band pattern till its landfall.

The maximum intensity of the system according to Dvorak's classification was T 2.5 from 1200 of 24 to 1500 UTC of 25 October 2012.

2.3. Cyclonic Storm (Nilam) over the Bay of Bengal (28 October - 01 November 2012)

2.3.1. A low pressure area over southeast Bay of Bengal and neighbourhood concentrated into a Depression over the same area and lay centred at 0600 UTC of 28 near Lat. 9.5° N/Long. 86.0° E, about 730 kms southeast of Chennai. Moving westwards, it lay centred at 1200 UTC of 28 over southwest Bay of Bengal near Lat. 9.5° N / Long. 85.0° E, about 650 kms southeast of Chennai. It continued to move westwards and intensified into a Deep Depression and lay centred at 0000 UTC of 29 over southwest Bay of Bengal near Lat. 9.5° N / Long. 84.0° E, about 550 kms southeast of Chennai. Continuing the westward movement, it lay centred at 0300 UTC over southwest Bay of Bengal near Lat. 9.5° N / Long. 83.5° E, about 530 kms southeast of Chennai and at 1200 UTC of 29 near Lat. 9.0° N / Long. 82.5° E, about 500 kms south-southeast of Chennai. It further intensified into a Cyclonic Storm (Nilam) and lay centred at 0300 UTC of 30 over southwest Bay of Bengal near Lat. 9.0° N / Long. 82.0° E, about 500 kms south-southeast of Chennai. Further, it moved northwards and lay centred at 1200 UTC of 30 near Lat. 9.5° N / Long. 82.0° E, about 450 kms south-southeast of Chennai. It moved northwestwards and lay centred at 0300 UTC of 31 over southwest Bay of Bengal near Lat. 11.0° N / Long. 81.0° E, about 260 kms south-southeast of Chennai. Moving north-northwestwards, it crossed north Tamil Nadu coast near Lat. 12.5° N / Long. 80.2° E, south of Chennai, near Mahabalipuram between 1030 and 1130 UTC of 31 and lay centred at 1200 UTC of 31 near Lat. 12.7° N / Long. 79.8° E, about 50 kms south-southwest of Chennai. It moved northwestwards and weakened into a Deep Depression over north Tamil Nadu and adjoining areas of Rayalaseema and interior Karnataka and lay centred at 1800 UTC of 31 October, near Lat. 13.0° N / Long. 78.5° E, about 180 kms west-northwest of Chennai. It further moved northwestwards and weakened into a Depression over Rayalaseema and adjoining areas of south interior Karnataka and lay centred at 0000 UTC of 1 November 2012 near Lat.

13.0° N / Long. 77.5° E, about 75 kms, south of Anantpur and at 0300 UTC over south Interior Karnataka, near Lat. 13.5° N / Long. 77.0° E, close to Chitradurga. It remained practically stationary at 1200 UTC near Lat. 14.0° N / Long. 77.0° E, near Chitradurga. Moving slightly northwards it lay centred at 1800 UTC of 1 November 2012 near Lat. 14.5° N / Long. 77.0° E. It further weakened into a well marked low pressure area over Rayalaseema and neighbourhood in the morning of 2.

2.3.2. Other features observed

The lowest Estimated Central Pressure (ECP) was 986 hPa (post cyclone survey report). The lowest observed pressure was 987.8 hPa at 1040 UTC of 31 October at Kalpakkam (ISRO-AWS, located south of Chennai, (Post Cyclone Survey report). The maximum estimated mean wind speed was 45 knots. Maximum sustained wind speed of 74 kmph (40 kts) was reported over Chennai (NBK) at 1110 UTC of 31. The HWSR at Karaikal reported maximum wind speed of westerly/37 kts on 31st October.

The salient features of this storm are as follows.

(i) The cyclone followed a unique track with many rapid changes in direction of movement. It initially moved westwards, remained practically stationary for quite some time near Sri Lanka coast and then moved north-northwestwards till landfall. It moved west-northwestwards initially over land upto south interior Karnataka and then moved northwestwards and northwards. The remnant low pressure area moved northeastwards.

(ii) It moved very fast on the day of landfall, *i.e.*, 31st October, 2012.

(iii) Over the land surface, the cloud mass was significantly sheared to the northeast of system centre during its dissipation stage leading to rainfall activity over entire Andhra Pradesh and adjoining Odisha.

(iv) Maximum rainfall occurred over southwest sector of the system centre and heavy to very heavy rainfall extended upto 300 km.

2.3.3. Weather and damage caused

Rainfall at most places with scattered heavy to very heavy rainfall occurred over north coastal Tamil Nadu. Rainfall at most places with isolated heavy to very heavy rainfall also occurred over north interior Tamil Nadu. Also, remnant of the system as a depression and subsequently as a low pressure area caused heavy to very heavy rainfall over Karnataka, Andhra Pradesh and Odisha. Six persons died in Andhra Pradesh. Two houses

were fully damaged and 32 houses were severely damaged in Guntur district of Andhra Pradesh. Also, crops in 250 acres each of Agricultural and Horticultural land were inundated due to heavy rains. Chief amounts of 24 hrs rainfall in cms (7 cm or more) ending at 0300 UTC are given below:

31 October 2012

Tamil Nadu : Vedaranniyam and Mahabalipuram 13 & each, Trangambadi 10, Ennore AWS, Puducherry Chennai (Nungambakkam), Nagapattinam, Kalpakkam and Tiruvarur 9 each, Madavaram AWS, Thiruthuraiipoondi, Nannilam, Kelambakkam, Chennai Airport, Karaikal and Anna University 8 each, Tambaram, Sirkali, Mayiladuthurai, Kodavasal, Muthupet, Marakkanam, Vanur, Chengalpattu, Cholavaram and Puducherry 7 each.

Andhra Pradesh : Srikalahasthi 11, Tirumalla 8, Chittoor 7.

01 November 2012

Tamil Nadu : Yercaud 24, Alangayam 20, Vandavasi 19, & Tirukoilur 14, Vanur and Tindivanam 13 Puducherry each, Gingee, Villupuram, Mylam AWS, Ambur, Tirupattur and Valangaiman 11 each, Sirkali, Kodavasal, Polur, Sethiathope, Tozhudur, Thali, Melalathur and Naduvattam 10 each, Parangipettai, Trangambadi, Kolli dam, Penucondapuram, Needamangalam and Arani 9 each, Chengam, Tiruvannamalai, Mayiladuthurai, Mannargudi, Kolachel, Chidambaram, Cuddalore, Pallipattu and Tirukattupalli 8 each, Aravakurichi, Barur, Hosur, Denkanikottai, Krishnagiri, Uthangarai, Pochampalli, Kattumannarkoil, Chidambaram AWS, Neyveli AWS, Thanjavur, Thiruvidadimaruthur, Kumbakonam, Madukkur, Vallam, Aduthurai AWS, Grand Anaicut, Sankarapuram, Nannilam, Thiruthuraiipoondi, Vaniyambadi, Puducherry, Pappireddipatti, Dharmapuri, Thuvakudi, Pullambadi, Eraniel and Kothagiri 7 each.

Andhra Pradesh : Vinjamur 16, Tirumalla and Ongole 15 each, Darsi 14, Addanki, Darsi and Kaveli 13 each, Rapur, Bhimuniapatnam and Podili 12 each, Venkatagirikota, Kaveli (a) and Venkatagiri Town 11 each, Udayagiri and

Avanigadda 10 each, Rajampet and Chittoor 9 each, Thambalapalli and Arogyavaram, Madakasira, Atmakur, Gudur and Nellore 8 each, Srikalahasthi, Punganur, Puttur, Amarapuram, Penukonda, Kadiri, Seetharampuram and Kakinada 7 each.

Karnataka : Bagepalli 14, Koratagere 11, Kolar, Rayalpadu, GKVK and Hoskote 10 each, Srinivaspura, Doddaballapura, Nayakanahatti, CN Halli, Madhugiri, Thondebhavi and Gudibande 9 each, MM Hills, Mulbagal, Bangarpet, Bengaluru City, Bengaluru HAL AP, Nelamangala, Hiriyur, Kibbanahalli, Kunigal, Bargur, Chintamani and Gowribidanur 8 each, Jagalur, Hosanagara, Chitradurga, Gubbi, Sira, Sidlaghatta, Magadi, Channapatna, Kanakapura and Ramanagara 7 each, Panchanahalli, Kadur, Arasikere, Bandipura, Maddur, Malur, TG Halli and Devanahalli, 6 each.

02 November 2012

Andhra Pradesh : Sattenapalle and Salur 14 each, Vijayawada 13, Prathipadu, Nandigama and Nuzivid 11 each, Atchampeta, Bobbili, Koderu and Gudivada 10 each, Vizianagaram, Vuyyur, Gajapathinagaram, Addanki, Darsi, S. Kota and Tuni 9 each, Kakinada, Ongole, Tiruvur, Chintapalle, Palasa, Bapatla, Araku, Tanuku, Avanigadda and Cheepurupalle 8 each, Guntur, Kaikalur, Bapatla, Mancherail, Podili, Yelamanchili, Tenali and Eluru 7 each.

2.3.4. Satellite and RADAR observations

The system was monitored mainly with satellite supported by meteorological buoys, coastal and island observations. It was also monitored by Doppler Weather RADAR (DWR), Chennai and CDR Karaikal.

The maximum intensity of the system according to Dvorak's classification was T No. 3.0 from 0000 to 1100 UTC of 31 October. The system was of curved band pattern till 1800 UTC of 30 October, then it changed into CDO pattern. It further intensified (T 3.0) at 0000 UTC of 31st and continued to move in the same direction to cross the north Tamil Nadu coast around 1200 UTC of 31 October, 2012 near 12.5° E / 80.0° E.

DWR Chennai monitored the system from the night of 29 October, when the cyclonic storm was about 500 km

southeast of Chennai. Prominent features of Eye could not be seen persistently. RADAR-echoes in some parts of spiral bands were stronger than the eye-wall echoes on many occasions. Maximum observed reflectivity was around 55 dBZ. The wind field was less symmetric to the eye. Maximum velocity of about 30 mps observed in the cyclone field was associated with the spiral band.

Coastal surface observations were recorded on hourly basis, the half hourly INSAT/ Kalpana imageries and every 10 minutes DWR imageries and products were used for monitoring of cyclonic storm.

CDR Karaikal monitored the system from 27th October. No overlays were fitted for fixing centre of the cyclone. Observations were not recorded from 0000 UTC of 31 due to technical problem.

2.3.5. Performance of RADAR/Telecommunications Channels

DWR Chennai : The DWR performance during the cyclone surveillance period had been very good with optimum power output, sensitivity and stability without any trouble except during the period from 0615 to 0710 UTC - Radome door inter lock switch opened due to strong wind.

Performance of all telecommunication facilities, viz., VPN connectivity, broadband internet connectivity, telephone, and tele-fax was good.

CDR Karaikal : RADAR worked satisfactorily during the storm period 26th to 30th October. The performance of all communication systems and standby generator was good.

2.4. Deep Depression over the Bay of Bengal (17-19 November 2012)

2.4.1. The well marked low pressure area over east central and adjoining southeast and west central Bay of Bengal concentrated into a *Depression* over the same area and lay over east central Bay of Bengal at 0600 UTC of 17, centered near Lat. 15.5° N / Long. 90.0° E. It moved slightly northwestwards and intensified further into a *Deep Depression* over the same region at 0900 UTC and lay centered near Lat. 15.5° N / Long. 89.5° E and near Lat. 16.0° N / Long. 89.0° E at 1200 UTC of 17, about 1000 kms east-northeast of Chennai. It remained practically stationary and lay centred at 0300 UTC of 18 near Lat. 16.0° N / Long. 88.5° E, about 950 kms east-northeast of Chennai. Moving westwards, it lay centred at 1200 UTC of 18 over west central Bay of Bengal near Lat. 16.0° N / Long. 87.5° E, about 800 kms east-

northeast of Chennai. It moved southwestwards and weakened into a *Depression* and lay centred at 0000 UTC of 19 near Lat. 15.5° N / Long. 87.0° E, about 750 kms east-northeast of Chennai and near Lat. 15.0° N / Long. 86.5° E, about 700 kms east-northeast of Chennai at 0300 UTC. It moved slightly westwards and lay centred at 1200 UTC of 19 near Lat. 15.0° N / Long. 86.0° E, about 650 kms east-northeast of Chennai. It further weakened into a well marked low pressure area over the west central Bay of Bengal at 1500 UTC of 19.

2.4.2. Other features observed

It formed from the remnant of low pressure system of south China Sea, which emerged into Bay of Bengal across Thailand. The lowest Estimated Central Pressure (ECP) was 1002 hPa from 1200 UTC of 17 to 1800 UTC of 18. The maximum estimated mean wind speed was 30 knots during the same period. The Maximum Sustained Wind (MSW) was reported as 31 knots by Buoy (23093, 16.5/88.0) at 0900 UTC of 18. The lowest central pressure of 1002.3 hPa was reported by the same Buoy at the same period.

The salient features of this storm are as follows:

- (i) The system moved westwards initially and then west-southwestwards under the influence of the middle tropospheric steering ridge.
- (ii) The system weakened over the sea due to entrainment of cold and dry air from Indian main land in middle tropospheric levels and gradual increase in the vertical wind shear resulting in the northeastward shearing of convection from the low level circulation centre.
- (iii) There existed a well defined low level circulation centre with banding features though the convection was significantly sheared to northeast under the influence of high wind shear on 18th and 19th November.

2.4.3. Weather and damage caused

There was no damage due to the deep depression, as it weakened over the sea.

Heavy rainfall occurred over Andhra Pradesh, Puducherry and Tamil Nadu due the remnant low pressure area of this depression. The chief amount of 24 hrs cumulative rainfall in cms (5 cm or more) ending at 0300 UTC of date are given below:

22 November 2012

Tamil Nadu : Sathanur Dam 10, Padalur 6,
& Sankarapuram 5.
Puducherry

23 November 2012

Coastal : Tada 7.
Andhra
Pradesh

Rayalaseema : Tirupati (AP) 14, Perumallapalli and
Puttur 7 each, Tirupati and Rajampet
6 each, Pakala 5.

Tamil Nadu : Pallipattu 6.
&
Puducherry

24 November 2012

Tamil Nadu : Chengalpattu 14, Watrap and
& Tuticorin 10 each, Usilampatti,
Puducherry Bodinaickanur and Virudachalam 7
each, Coonoor 6, Viralimalai,
Maduranthagam, Kothagiri,
Ulundurpet, Vellore, Sirkali and
Keeranur 5 each.

25 November 2012

Tamil Nadu : Manimutharu 14, Thenkasi 12,
& Shencottah and Maniyachi 6 each,
Puducherry Illuppur 5.

2.4.4. Satellite and RADAR observations

The maximum intensity of the system according to Dvorak's classification was T No.2.0 from 0900 of 17 November to 0800 UTC of 18th November. The cyclogenesis technique based on Oceansat-2 winds of 15 November showed that the system would develop into a cyclone.

The system was away from DWR Chennai range all through its life period.

2.5. Deep Depression over the Arabian Sea (22-25 December 2012)

2.5.1. The trough of low at mean sea level over southwest Bay of Bengal off Sri Lanka coast lay over Maldives area and adjoining southeast Arabian Sea on 20 and over southeast Arabian Sea and neighbourhood on 21. It organized into a low pressure area and lay over

southeast and adjoining southwest Arabian Sea on 22 morning. It rapidly concentrated into a Depression and lay centered at 0600 UTC of 22 over central parts of south Arabian Sea near Lat. 9.0° N and Long. 64.0° E. It moved westwards and lay over southwest Arabian Sea near Lat. 9.0° N and Long. 62.5° E at 1200 UTC of 22. Further moving westwards, it intensified into a Deep Depression and lay over southwest Arabian Sea near Lat 9.0° N and Long. 60.5° E, about 1400 kms west-southwest of Amini Divi (Lakshadweep) at 0000 UTC of 23 and near Lat 9.0° N and Long. 60.0° E, about 1450 kms west-southwest of Amini Divi (Lakshadweep) at 0300 UTC. Moving west-southwestwards, it lay centered at 1200 UTC of 23 near Lat 8.5° N and Long. 57.0° E about 1700 kms west-southwest of Amini Divi (Lakshadweep). Then, it moved westwards and lay centered at 0300 UTC of 24 near Lat 8.0° N and Long. 54.0° E. Further, it moved west-southwestwards and weakened into a Depression and lay centred near Lat 7.0° N and Long. 52.0° E at 1200 UTC of 24 and near Lat 6.5° N and Long. 50.0° E at 0000 UTC of 25. Further moving west-southwestwards, it weakened into a well marked low pressure area over southwest Arabian Sea off Somalia coast on 25 morning and subsequently became unimportant.

2.5.2. Other features observed

The lowest Estimated Central Pressure (ECP) was 1002 hPa from 0000 UTC of 23 to 1100 UTC of 24. The maximum estimated mean wind speed was 30 knots. The Maximum Sustained Wind (MSW) was reported as 23 knots by ships A8KX4 at 0600 UTC of 22 and by A8ZE4 at 1200 UTC of 24. The lowest central pressure of 1007.2 hPa was reported by the ship 2FUB2 (0.4/58.7), Buoy 23494 (8.4/73.0) and Amini Divi at 1200 UTC of 22.

2.5.3. Weather and damage caused

No damage was reported due to this system.

2.5.4. Satellite and RADAR observations

The maximum intensity of the system according to Dvorak's classification was T No. 2.0 from 0000 of 23rd December to 1200 UTC of 24th December. The cyclogenesis technique based on Oceansat-2 winds did not show any sign of formation of cyclone.