

Cyclones and depressions over the north Indian Ocean during 2011*

1. Introduction

During 2011, in all 10 intense low pressure systems formed over the Indian seas. These include 1 Very Severe Cyclonic Storm (Thane), 1 Cyclonic Storm (Keila), 4 deep depressions and 4 depressions (including one land depression). Out of these 10 systems, 1 occurred during the winter season, 4 during the monsoon season and 5 during the post-monsoon season. No intense low pressure system formed during the pre-monsoon season, as in recent past years 1993 and 2005. The number of intense low pressure systems that formed over the Bay of Bengal was five and that over the Arabian Sea was four. Five, out of the ten low pressure systems were short-lived (24 to 48 hrs duration).

The depression (2-3 February) formed in the near equatorial latitude and did not affect the country. The Depression over the Arabian Sea (11-12 June) crossed Saurashtra coast. The Deep Depression over the Bay of Bengal (16-22 June) crossed West Bengal-Bangladesh coasts near Lat. 21.8° N / Long. 89.0° E, about 100 kms east of Sagar Islands. Out of the five systems, which formed during post-monsoon season, the Very Severe Cyclonic Storm (VSCS, Thane) crossed Tamil Nadu coast, close to and to the south of Cuddalore. The VSCS (Thane) and the deep depression (26 November - 1 December) were the only system that affected the country.

The track/intensity of these systems is given in Fig. 1. Detailed season wise descriptions of these systems are given below.

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

One depression formed over the southeast Bay of Bengal during the month of February, which was short lived.

2.1. Depression over the Bay of Bengal (2-3 February 2011)

2.1.1. Life cycle

Under the influence of a trough of low at mean sea level, a low pressure area formed over the southwest Bay of Bengal. It concentrated into a Depression at 0900 UTC of 2 and lay centered near Lat. 6.5° North / Long. 82.5° E,

about 550 kms southeast of Kanyakumari. It remained practically stationary and weakened into a well marked low pressure area at 0000 UTC of 3 over southwest Bay of Bengal.

2.1.2. Other features observed

The lowest Estimated Central Pressure (ECP) was 1002 hPa. The maximum estimated mean wind speed was 25 kts. The salient features of the system include, its formation close to equator; short life (about 15 hours) and practically no movement.

2.1.3. Weather and damage caused

As the system was far to the south of the Indian coast and dissipated over the Ocean, it did not affect the weather over India.

2.1.4. Satellite and RADAR observations

The system was tracked with the help of satellite cloud imageries from 0900 UTC of 2 to 0000 UTC of 3. The maximum intensity of the T No. 1.5 was reported from 0900 UTC of 2 to 0000 UTC of 3.

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 T1.0 in the evening of 1st February 2011. The meso-scale convective clusters in association with the system merged gradually along with increase in deep convection. Associated moderate to intense convection was seen over southwest Bay of Bengal, adjoining Sri Lanka, Comorin area, Gulf of Mannar, Palk Strait and coastal Tamil Nadu. The lowest cloud top temperature was -55° C.

3. Disturbances formed during the pre-monsoon Season (March to May)

No intense system formed over the Indian Ocean during the season.

4. Disturbances formed during the monsoon season (June to September)

Four depressions formed during the monsoon season, two over the Bay of Bengal and one each over the Arabian Sea and land.

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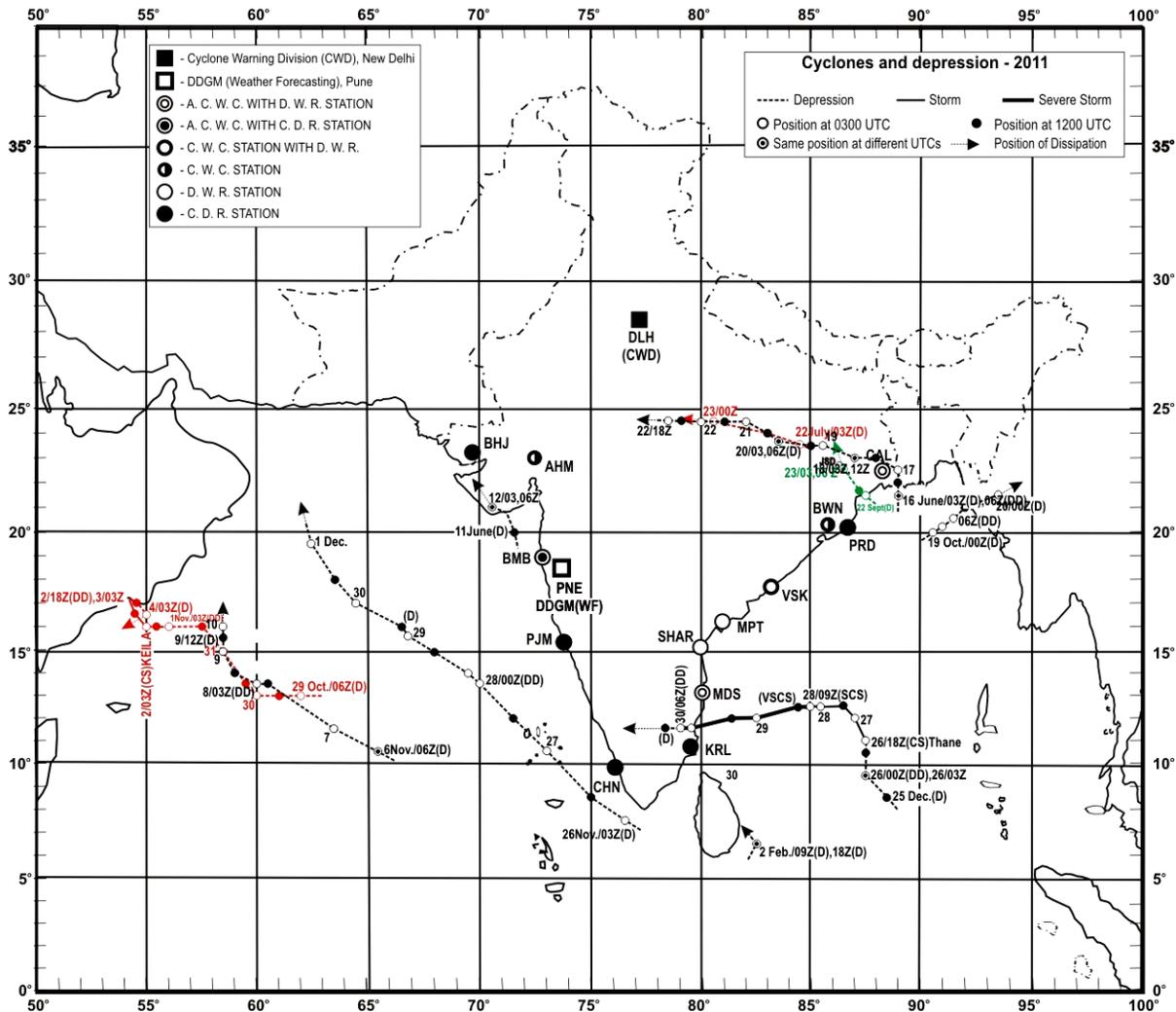


Fig. 1. Tracks of cyclones and depression over the Indian Ocean during the year 2011

4.1. Depression over the Arabian Sea (11 – 12 June 2011)

4.1.1. Life cycle

A low pressure area formed over the east central Arabian Sea off north Maharashtra coast on 6. It persisted there on 7 and lay as a well marked low pressure area over the east central Arabian Sea and neighbourhood from 8 to 10 and over the east central Arabian Sea off north Maharashtra-south Gujarat coasts on 11 morning. Subsequently, it concentrated into a Depression and lay centered over the northeast Arabian Sea off Maharashtra-Gujarat coasts at 1200 UTC of 11, near Lat. 20.0° N / Long. 71.5° E, about 180 km northwest of Mumbai. It moved north-northwestwards and crossed Saurashtra

(Gujarat) coast near Lat. 20.8° N / Long. 71.2° E, about 25 km to the east of Diu around 2200 UTC of 11 and lay centered at 0300 UTC of 12 over Saurashtra and neighbourhood, about 70 km south southwest of Amreli, near Lat. 21.0° N / Long. 70.5° E and remained practically stationary over the same area till 0600 UTC. Gradually moving northwestwards, it weakened into a well marked low pressure area over Saurashtra and adjoining northeast Arabian Sea by 1200 UTC of 12. It further weakened into a low pressure area over the same region on 13 and became less marked on 14.

4.1.2. Other features observed

The lowest Estimated Central Pressure (ECP) was 996 hPa from 1200 UTC of 11 to 0200 UTC of 12. The

maximum estimated mean wind speed was 25 kts. Maximum sustained wind of 40-50 kmph was reported along Saurashtra and Diu coasts. The system moved initially north northwestwards before crossing and then northwestwards, over land.

4.1.3. *Weather and damage caused*

No damage was reported due to this system. However, under the influence of the system, widespread rainfall with heavy to very heavy falls at isolated places occurred over Saurashtra & Kutch and Diu. A trough extended along and off the west coast from the centre of this system, which also caused significant weather over the coast.

4.1.4. *Satellite and RADAR observations*

According to INSAT imagery, a vortex formed over east central Arabian Sea with T1.0 and lay centered at 0000 UTC of 8 June near Lat. 17.0° N / 70.0° E and near Lat. 19.0° N / 71.0° E at 0300 UTC of 11 June. The broken intense convection in association with the system became organized gradually.

Maximum intensity of the system according to Dvorak's classification was T1.5 from 1200 to 2100 UTC of 11 June 2011. Associated broken intense to very intense convection (with cloud top temperature of -77° C) lay over Arabian Sea between Lat. 16.5° N & 21.0° N and to the east of Long. 65.5° E.

4.2. *Deep Depression over the Bay of Bengal (16 – 23 June 2011)*

4.2.1. *Life cycle*

A low pressure area formed over the northwest Bay of Bengal and neighbourhood on 14. It lay as a well marked low pressure area over the same region on 15. It concentrated into a Depression and lay centered at 0300 UTC of 16 over the northwest Bay of Bengal, near Lat. 21.5° N / Long. 89.0° E, about 150 kms southeast of Kolkata and further intensified into a Deep Depression at 0600 UTC of 16 over the same region. It further moved north northwestwards and crossed West Bengal-Bangla Desh coasts, near Lat. 21.8° N / Long. 89.0° E, about 100 km to the east of Sagar Islands, between 1100 & 1200 UTC of 16 and lay over Gangetic West Bengal and adjoining Bangla Desh, near Lat. 22.0° N / Long. 89.0° E, about 100 kms southeast of Kolkata at 1200 UTC of 16. Moving slightly northwards, it lay centered near Lat. 22.5° N / Long. 89.0° E, about 80 km east of Kolkata at 0300 UTC of 17. Subsequently, moving westwards, it lay

over Gangetic West Bengal, near Lat. 23.0° N / Long. 88.0° E, close to Burdwan at 1200 UTC of 17. Further moving westwards, it lay over Gangetic West Bengal and adjoining areas of Jharkhand, centered near Lat. 23.0° N / Long. 87.0° E, about 25 km south of Bankura at 0300 UTC of 18. It remained practically stationary over the same region at 1200 UTC of 18. Thereafter, it further moved northwards and lay over Jharkhand and adjoining Gangetic West Bengal, centered near Lat. 23.5° N / Long. 85.5° E, about 50 km southeast of Ranchi at 0300 UTC of 19. Moving slightly westwards, it lay centered near Lat. 23.5° N / Long. 85.0° E, about 25 km northnorthwest of Ranchi at 1200 UTC of 19. It further moved west northwestwards and lay over Chhattisgarh and adjoining areas of Jharkhand, about 50 km northeast of Ambikapur (Lat. 23.7° N / Long. 83.5° E) at 0300 UTC of 20 and further weakened into a Depression over the same area at 0600 UTC of 20. Moving slightly northwestwards, it lay centered at 1200 UTC of 20 over southeast Uttar Pradesh and neighbourhood, about 150 km south of Varanasi (Lat. 24.0° N / Long. 83.0° E). Subsequently moving west northwestwards, it lay centered at 0300 UTC of 21, over east Madhya Pradesh and adjoining south Uttar Pradesh, about 100 km east of Rewa (Lat. 24.5° N / Long. 82.0° E). Then it moved westwards and lay centered at 1200 UTC of 21, over the same area close to Satna (Lat. 24.5° N / Long. 81.0° E). Continuing the westward movement, it lay centered at 0300 UTC of 22, over east Madhya Pradesh, close to and to the west of Panna (Lat. 24.5° N / Long. 80.5° E) and over the central parts of Madhya Pradesh and adjoining south Uttar Pradesh, about 50 km northeast of Sagar (Lat. 24.5° N / Long. 79.1° E) at 1200 UTC of 22 and at 1800 UTC near Lat. 24.5° N / Long. 78.5° E. It moved further northwestwards and weakened into a well marked low pressure area over west Madhya Pradesh and neighbourhood in the early morning of 23.

4.2.2. *Other features observed*

The lowest ECP was 978 hPa at 0600 UTC of 17. The lowest observed pressure was 983.4 hPa at 1200 UTC of 18 at Bankura. The maximum estimated mean wind speed was 35 knots. The maximum sustained surface wind was reported as 35 knots by an AWS to the northeast of Kolkata around 0600 UTC of 17 June.

As per the DWR Kolkata observations, the maximum radial wind as observed from PPI (V) was 25 mps at a height of 0.5 km above ground level at 1806 UTC of 17 June at a distance 60-65 km west-southwest of DWR Kolkata. The maximum horizontal wind estimated from VVP_2 product is 40 knots at height 1.2, 2.4, 2.7 & 3.0 km within 50 km radius of Kolkata at 1836 UTC of 17 June 2011.

An important feature of the system was the abnormal pressure drop at the centre of the system (max. 12 hPa) over the land, even though the maximum surface wind speed was reported as 30-35 knots over Gangetic West Bengal.

The system moved initially in a northerly direction and crossed West Bengal-Bangladesh coast. It continued to move in northerly direction for some more time after crossing and then moved west-northwestwards across Gangetic West Bengal, Jharkhand, north Chhattisgarh and west Madhya Pradesh during 17-23 June.

4.2.3. *Weather and damage caused*

Heavy rainfall and landslides took a toll of 9 persons in West Bengal and 3 in Chattisgarh. In west Midnapore 200 mud walled houses totally collapsed due to heavy rain. Many villages were inundated due to collapsing of the river-embankment in North 24 Parganas and Kansabati Area. In Jharkhand, trees were uprooted, power supply disrupted and heavy damages were caused to houses and crops.

Under the influence of the system, widespread rainfall with heavy to very heavy falls at isolated places occurred over Orissa, Gangetic West Bengal Jharkhand, Chattisgarh, Madhya Pradesh, Bihar and Uttar Pradesh.

4.2.4. *Satellite and RADAR observations*

Doppler Weather Radar (DWR), Kolkata, tracked the system since 0300 UTC of 15 June 2011 at every 10 minutes interval. As per the observations, the front part of the system hit the coast at about 1106 UTC of 16 June at 108 km SSE of Kolkata. The system got better organised with two spiral bands by 1206 UTC of 16 June. It intensified further at 0558 UTC of 17 June.

The maximum radial wind as observed from PPI(V) was 25 mps at a height of 0.5 km above ground level at 1806 UTC of 17 June at a distance 60-65 km WSW of DWR Kolkata.

4.3. *Land Depression over Jharkhand (22 – 23 July 2011)*

4.3.1. *Life cycle*

The low pressure area over Gangetic West Bengal and neighbourhood, concentrated into a Depression which lay over northwest Jharkhand and neighbourhood, about 50 km southeast of Daltonganj (Lat. 23.5° N / Long. 84.5° E) at 0300 UTC of 22. Moving in a west northwesterly direction, it lay over southeast Uttar

Pradesh and neighbourhood, about 100 km east of Sidhi (Lat. 24.0° N / Long. 83.0° E) at 1200 of 22. Thereafter, it moved westwards and lay centered over east Madhya Pradesh, about 100 km northeast of Sagar (Lat. 24.5° N / Long. 80.5° E) at 0000 UTC of 23. Continuing the westward movement, it weakened into a well marked low pressure area and lay over north Madhya Pradesh and neighbourhood on 23 morning and became less marked on 24.

4.3.2. *Other features observed*

The lowest ECP was 990 hPa from 0300 to 1200 UTC of 22. The maximum estimated mean wind speed was 20 knots. The maximum sustained surface wind was reported as 30 knots by Umaria at 0300 UTC of 22 July. The lowest central pressure of 989.4 hPa was reported by an Automatic Weather Station (AWS) at Singrouli in east Madhya Pradesh.

The depression moved west-northwestwards along the monsoon trough and lay centered at 0000 UTC of 23 July 2011 over east Madhya Pradesh, about 100 km northeast of Sagar. It further moved west-northwestwards and weakened into a well marked low pressure area over north Madhya Pradesh and neighbourhood at 0300 UTC of 23 July 2011.

4.3.3. *Weather and damage caused*

No damage was reported due to this system. Widespread rainfall with heavy to very heavy falls at isolated places occurred over Madhya Pradesh, Madhya Maharashtra, Konkan & Goa and Rajasthan.

4.4. *Depression over the Bay of Bengal (22 – 23 September 2011)*

4.4.1. *Life cycle*

A low pressure area formed over the northwest Bay of Bengal and adjoining coastal areas of West Bengal on 20. It lay as a well marked low pressure area over the northwest Bay of Bengal and adjoining West Bengal-Orissa coasts on 21. Subsequently, it concentrated into a Depression over the northwest Bay of Bengal off north Orissa-West Bengal coasts and lay centered at 0300 UTC of 22 near Lat. 21.5° N / Long. 87.5° E, about 50 km east southeast of Balasore. It moved slightly westwards and lay centered near Lat. 21.7° N / Long. 87.2° E at 1200 UTC and then moving west northwestwards, crossed north Orissa coast, close to Balasore between 1700 & 1800 UTC of 22. Subsequently moving northwestwards, it lay over Jharkhand and neighbourhood, centered close to Jamshedpur (Lat. 22.5° N / Long. 86.5° E) at 0300 UTC

of 23. It remained practically stationary over the region, close to Jamshedpur till 0600 UTC and weakened into a low pressure area by 0900 UTC.

4.4.2. *Other features observed*

The lowest ECP was 995 hPa at 1200 UTC of 22. The maximum estimated mean wind speed was 25 knots. The lowest central pressure of 995.7 hPa was reported by Balasore at 0900 UTC of 22 which was very close to the estimated value.

The depression moved westwards when it was over the sea area and then northwestwards, along the monsoon trough after crossing the coast. After weakening into a well marked low pressure area, it moved northeastwards across Jharkhand, Bihar and Sub-Himalayan West Bengal & Sikkim.

4.4.3. *Weather and damage caused*

Heavy rains associated with the system over the upper catchment areas caused floods over Orissa and Bihar.

Under the influence of the system, widespread/fairly widespread rainfall with heavy to very heavy falls at isolated places occurred over Orissa, Gangetic West Bengal, Jharkhand and Bihar during 22-24 September. The system, even as a low pressure area, gave widespread/fairly widespread rainfall with heavy to very heavy falls at isolated places during 25-27 September over Sub-Himalayan West Bengal & Sikkim and Bihar.

5. **Disturbances formed during the post-monsoon season (October to December)**

5.1. *Deep Depression over the Bay of Bengal (19 – 20 October 2011)*

5.1.1. *Life cycle*

Under the influence of a cyclonic circulation, a low pressure area formed over southeast & adjoining southwest Bay of Bengal on 17 morning. It lay as a well marked low pressure area over east central & adjoining northwest and west central Bay of Bengal on 18. It lay over north and adjoining east central Bay of Bengal in the evening and subsequently concentrated into a Depression at 0000 UTC of 19 near Lat. 20.0° N / Long. 90.5° E, about 350 kms east-southeast of Digha. It further moved northeastwards and lay centered at 0300 UTC of 19 near Lat. 20.2° N / Long. 91.0° E and intensified into a Deep Depression at 0600 UTC near Lat. 20.5° N / Long. 91.5° E. It lay over northeast Bay of Bengal, near Lat.

21.0° N / Long. 92.0° E, very close to Bangladesh coast at 1200 UTC of 19. It crossed Bangladesh coast, close to south of Cox's Bazar around 1300 UTC and subsequently, weakened into a Depression at 0000 UTC of 20 and lay centered near Lat. 21.5° N / Long. 93.5° E. It further weakened into a low pressure area and lay over Myanmar and adjoining Bangladesh and Mizoram and northeast Bay of Bengal on 20 and became less marked on 21.

5.1.2. *Other features observed*

The maximum estimated mean wind speed was 30 knots. The lowest central pressure of 1001.5 hPa was reported by Cox's Bazar (Bangla Desh) at 1200 UTC of 19.

5.1.3. *Weather and damage caused*

As the system was far away from the Indian coast, no adverse weather/damage was reported.

5.1.4. *Satellite observations*

The maximum intensity of the T No 2.0 was reported from 0600 UTC to 1800 UTC of 19.

5.2. *Cyclonic Storm 'Keila' over the Arabian Sea (29 October – 4 November 2011)*

5.2.1. *Life Cycle*

A trough of low from south Arabian Sea to south Gujarat coast on 27, organised into a low pressure area over the central parts of south Arabian Sea and adjoining central Arabian Sea on 28. It lay as a well marked low pressure area over the central and adjoining south Arabian Sea on 29. It concentrated into a Depression over the west central and adjoining southwest Arabian Sea and lay centred at 0600 UTC of 29, near Lat. 13.0° N / Long. 62.0° E, about 1400 kms west of Mangalore. Moving westwards, it lay centred at 1200 UTC of 29 near Lat. 13.0° N / Long. 61.0° E and at 0300 UTC of 30 near Lat. 13.0°N / Long. 60.0° E. Subsequently moving northwestwards, it lay centred near Lat. 13.5° N / Long. 59.5° E at 1200 UTC of 30; near Lat. 15.0° N / Long. 58.5° E at 0300 UTC of 31 October and near Lat. 16.0°N / Long. 57.5° E at 1200 UTC of 31 October. Moving westwards, it intensified into a Deep Depression and lay centered near Lat. 16.0° N / Long. 56.0° E at 0300 UTC of 1 November and near Lat. 16.0° N / Long. 55.5° E at 1200 UTC. Continuing the westward movement, it further intensified into Cyclonic Storm 'Keila' and lay centered at 0300 UTC of 2, near Lat. 16.0° N / Long. 55.0° E. Subsequently, it moved north northwestwards and lay centered near Lat. 16.5° N / Long. 54.5° E, about 30 kms

south southeast of Salalah (Oman) at 1200 UTC of 2. It further moved northwestwards and crossed Oman coast, close to north of Salalah (17.1/54.3) between 1600 – 1700 UTC and weakened into a Deep Depression and lay centered at 1800 UTC of 2, over coastal Oman, close to Salalah (17.1/54.2). It remained practically stationary over the same area at 0300 UTC of 3. Moving eastwards, it lay at 1200 UTC of 3, over Oman coast centered near Lat. 17.0° N / Long. 54.5° E. It meandered over the same region and then moving slightly southwestwards, weakened into a Depression and lay centered at 0300 UTC of 4 near Lat. 16.5° N / Long. 55.0° E. It subsequently weakened into a low pressure area at 0600 UTC of 4 and became less marked in the evening.

5.2.2. *Other features observed*

The ECP was 996 hPa from 0600 UTC of 2 November till the time the system crossed the coast. The maximum estimated mean wind speed was 35 knots. Around the time of landfall, Salalah reported maximum wind of 23 knots at 1500 UTC and 6 knots at 1800 UTC of 2 November 2011. It indicates that the system weakened just after the landfall.

The system initially moved westwards, then northwestwards and again in westward direction. It moved further in northwestward direction before crossing the coast. After crossing, the system re-emerged into the Arabian Sea on 3rd November. At last the system moved eastwards and then southwards over the west central Arabian Sea and weakened gradually. It weakened into a low pressure area on 4th November 2011 over west central Arabian Sea off Oman coast.

5.2.3. *Weather and damage caused*

As the system was far away from the west coast of India, it did not cause any adverse weather/damage.

5.2.4. *Satellite observations*

As per the satellite observation, the maximum intensity of T 2.5 was reported from 0300 to 1500 UTC of 2. It meandered over the Oman coast and re-emerged into the Arabian Sea at 0300 UTC of 4 November as Depression and weakened into low pressure area.

5.3. *Deep Depression over the Arabian Sea (6 - 10 November 2011)*

5.3.1. *Life Cycle*

A low pressure area formed over the southeast and adjoining east central Arabian Sea on 2. It lay as a well

marked low pressure area over the central parts of Arabian Sea on 6 morning and concentrated into a Depression at 0600 UTC of 6, over the central and adjoining southeast Arabian Sea, near Lat. 10.5° N / Long. 65.5° E (about 1050 kms west southwest of Mangalore) and near Lat. 10.6° N / Long. 65.5° E at 1200 UTC of 6. Further moving west northwestwards, it lay at 0300 UTC of 7, near Lat. 11.5° N / Long. 63.5° E and at 1200 UTC, near Lat. 13.5° N / Long. 60.5° E. Moving westwards, it intensified into a Deep Depression and lay centered at 0300 UTC of 8, over the west central Arabian Sea, near Lat. 13.5° N / Long. 60.0° E. Thereafter, it moved west northwestwards and lay centred at 1200 UTC of 8, near Lat. 14.0° N / Long. 59.0° E. Further moving north northwestwards, it lay centred at 0300 UTC of 9, near Lat. 15.0° N / Long. 58.5° E. Thereafter it moved northwards, weakened into a Depression and lay centered at 1200 UTC of 9, near Lat. 15.5° N / Long. 58.5° E. It moved northwards and lay centered at 0300 UTC of 10, near Lat. 16.0° N / Long. 58.5° E. It then weakened into a well marked low pressure area and lay over the west central Arabian Sea off Oman coast in the evening of 10. It further weakened and became unimportant by the morning of 11.

5.3.2. *Other features observed*

The lowest ECP was 1000 hPa from 0300 UTC of 8 to 0600 UTC of 9. The maximum estimated mean wind speed was 30 knots. A ship SKWI (Lat. 14.9° N / Long. 58.8° E.) reported highest mean wind speed of 50 kts and PPPP 1001.2 hPa at 0300 UTC of 9.

The system moved in a northwesterly direction from 0600 UTC of 6 to 1200 UTC of 9 and then it moved in a northerly direction for sometime before dissipating over the Sea area.

5.3.3. *Weather and damage caused*

As the system was far away from the Indian coast, no adverse weather/damage occurred.

5.3.4. *Satellite observations*

The maximum intensity of the T No. 2.0 was reported from 0000 UTC of 8 to 0600 UTC of 9.

5.4. *Deep Depression over the Arabian Sea (26 November - 1 December 2011)*

5.4.1. *Life Cycle*

A well marked low pressure area formed over Comorin area and neighbourhood, under the influence of a

cyclonic circulation over the area on 25. It concentrated into a Depression and lay at 0300 UTC of 26 centered near Lat. 7.5° N / Long. 76.5° E, about 120 kms south southwest of Thiruvananthapuram. It moved northwestwards and lay at 1200 UTC over Lakshadweep area and adjoining Maldives and Comorin area, centered near Lat. 8.5° N / Long. 75.0° E. It further moved northwestwards and lay at 0300 UTC of 27 over Lakshadweep area and neighbourhood centered near Lat. 10.5° N / Long. 73.0° E, about 70 km southeast of Amini Divi. It continued to move northwestwards and lay at 1200 UTC over southeast and adjoining east central Arabian Sea centered near Lat. 12.0° N / Long. 71.5° E. Maintaining its northwesterly course, it intensified into a Deep Depression and lay at 0000 UTC of 28 over east central Arabian Sea centered near Lat. 13.5° N / Long. 70.0° E and Lat. 14.0° N / Long. 69.5° E, about 450 km northwest of Amini Divi (Lakshadweep Island) at 0300 UTC. Thereafter, it took a west-northwesterly course and lay at 1200 UTC of 28 over east central Arabian Sea centered near Lat. 15.0° N / Long. 68.0° E and at 0300 UTC of 29 and near Lat. 15.7° N / Long. 66.8° E, about 750 kms southwest of Mumbai. It remained practically stationary and weakened into a Depression and lay centered near Lat. 16.0° N / Long. 66.5° E at 1200 UTC of 29. Further moving northwestwards, it lay over the east central and adjoining west central Arabian Sea, near Lat. 17.0° N / Long. 64.5° E at 0300 UTC of 30 and near Lat. 18.0° N / Long. 63.5° E at 1200 UTC. Moving further northwestwards, it lay centered at 0300 UTC of 1 December near Lat. 19.5° N / Long. 62.5° E, about 1100 kms west of Mumbai. It weakened into a well marked low pressure area at 0600 UTC of the same day over the same area and lay as a low pressure area over west central Arabian Sea in the evening. The system became less marked on 2 morning.

5.4.2. Other features observed

The lowest ECP was 998 hPa from 0000 UTC of 28 to 0600 UTC of 29. The maximum estimated mean wind speed was 30 knots. Amini Divi reported lowest pressure of 996.3 hPa at 0300 UTC of 27 November when the system was 70 kms southeast of Amini Divi.

The system moved generally in a northwesterly direction, before dissipating over the Sea area.

5.4.3. Weather and damage caused

As the system was far away from the Indian coast, it did not cause any damage.

However, heavy to very heavy rainfall at isolated places occurred over Kerala on 27 November and

Lakshadweep during 27 - 28 November in association with the system. Though the system moved into Arabian Sea, it drew moisture from the Bay of Bengal across Tamil Nadu. As such, all the sub-divisions covered by the Northeast monsoon regime received excess weekly rainfall during the week ending 30 November 2011.

5.4.4. Satellite observations

The maximum intensity of the T No 2.0 was reported from 2100 UTC of 27 to 0300 UTC of 29.

5.5. Very Severe Cyclonic Storm (Thane) over the Bay of Bengal (25 – 31 December 2011)

5.5.1. Life Cycle

A trough of low at mean sea level organized into a low pressure area over the southeast Bay of Bengal and neighbourhood in the forenoon of 24. It became well marked over the same area by 24 evening and persisted there on 25 morning. It concentrated into a Depression and lay at 1200 UTC of 25 centred near Lat. 8.5° N and / Long. 88.5° E, about 1000 kms south east of Chennai. It moved northwestwards and intensified into a Deep Depression at 0000 UTC of 26 over southeast Bay of Bengal and lay centred near Lat. 9.5° N / Long. 87.5° E. It remained practically stationary during next 3 hours and lay centred at 0300 UTC of 26 near Lat. 9.5° N / Long. 87.5° E, about 900 kms southeast of Chennai. It moved further northwards and lay centred at 1200 UTC of 26 over the southeast Bay of Bengal, near Lat. 10.5° N / Long. 87.5° E. Further moving northwards, it intensified into Cyclonic Storm (Thane) and lay centred at 1800 UTC of 26 over the southeast Bay of Bengal, near Lat. 11.0° N / Long. 87.5° E. It then moved northwestwards and lay centred at 0300 UTC of 27 over the southeast Bay of Bengal, near Lat. 12.0° N / Long. 87.0° E, about 750 kms eastsoutheast of Chennai and near Lat. 12.5° N / Long. 86.5° E at 1200 UTC. It then moved westwards and lay centred at 0300 UTC of 28 over the southwest & adjoining southeast Bay of Bengal near Lat. 12.5° N / Long. 85.5° E, about 550 kms eastsoutheast of Chennai. Continuing its westward movement, it intensified into a Severe Cyclonic Storm at 0900 UTC, near Lat. 12.5° N / Long. 85.0° E and further intensified into a Very Severe Cyclonic Storm at 1200 UTC of the same day and lay centered near Lat. 12.5° N / Long. 84.5° E. It further moved westsouthwestwards and lay centred at 0300 UTC of 29, near Lat. 12.0° N / Long. 82.5° E, about 270 kms east of Puducherry and at 1200 UTC near Lat. 12.0° N / Long. 81.3° E. It further moved westwards and crossed north Tamil Nadu coast close to and to the south of Cuddalore between 0100 - 0200 UTC of 30. It continued

to move westwards and weakened into a Severe Cyclonic Storm and lay centred at 0300 UTC of 30, near Lat. 11.6° N / Long. 79.5° E, about 30 kms west of Cuddalore and 35 kms southwest of Puducherry. Moving further westwards, the system weakened rapidly into a Deep Depression at 0600 UTC, near Lat. 11.6° N / Long. 79.0° E, about 100 kms west of Cuddalore. It moved westsouthwestwards and further weakened into a Depression and lay centred at 1200 UTC, over north Tamil Nadu close to Salem (Lat. 11.6° N / Long. 78.2° E). Moving westwards, it further weakened into a well marked low pressure area over north Kerala and neighbourhood at 0000 UTC of 31.

5.5.2. Other features observed

As per the post cyclone survey conducted by IMD, the lowest observed mean sea level pressure was 969 hPa was recorded at Cuddalore. The maximum estimated wind speed was 75 kts. Puducherry reported maximum wind of 68 knots (125 kmph) and Cuddalore reported maximum wind of 76 knots (140 kmph) at the time of landfall. Gale wind speed reaching 120-140 kmph prevailed along and off north Tamil Nadu and Puducherry coast.

Storm surge

As per post-cyclone survey conducted by IMD, a storm surge of about 1 metre height inundated the low lying coastal areas of Cuddalore, Puducherry and Villuparam districts at the time of landfall of the Very Severe Cyclonic Storm (Thane).

The system moved initially in a northwesterly direction and then in a northerly direction. It again moved in a northwesterly direction and further moved in a westerly direction. After attaining the intensity of Very Severe Cyclonic Storm, it moved generally in a west to west southwesterly direction and crossed north Tamil Nadu coast between Cuddalore (43329) and Puducherry (43331) during 0100 UTC to 0200 UTC of 30 December.

5.5.3. Weather and damage caused

Incidents related to heavy rains claimed 35 lives in Tamil Nadu, 7 in Puducherry and 4 in Kerala. About 73292 thatched houses were fully and 94633 houses were partially damaged by winds and rains in various districts of Tamil Nadu. Six thousand people were sent to relief camps. Standing crops of Sugarcane, Tapioca, betel nuts, banana and coconut over thousands of hectares were affected. The storm uprooted trees and electric posts, disrupted power supply and transport services and standing crops. The district of Cuddalore was the worst-hit with roads severely damaged. Also, hundreds of boats were damaged in the cyclone affected coastal areas. The estimated damage was 1300 to 1500 crore of rupees.

Under the influence of the system, widespread/fairly widespread rainfall occurred over Andaman & Nicobar Islands from 25-27 December and over coastal Andhra Pradesh, Rayalaseema, Tamil Nadu and Kerala during 31 December 2011-1 January 2012.

Heavy to Very heavy rainfall occurred at isolated places over Andaman & Nicobar Islands on 24 and from 26 - 27 December and at a few places over Tamil Nadu and Kerala during 30 - 31 December and 31 December respectively.

5.5.4. Satellite and RADAR Observation

The maximum intensity of T 4.5 was reported from 0300 UTC of 29 to 0000 UTC of 30. EYE was reported during this period.

DWR Chennai issued the serially numbered RADAR bulletins from 1200 UTC of 28, till 0600 UTC of 30 and then the hourly RADAR based bulletins were discontinued as the system had weakened beyond reasonable estimation of features.

CDR Karaikal also tracked the system from 1800 UTC of 28 till the time of landfall.