

Cyclones and depressions over the North Indian Ocean during 2005*

1. Introduction

During the year, in all 12 tropical disturbances (of which 6 were monsoon systems including a cyclonic storm) with the intensity of depression stage and above, formed over north Indian ocean and adjoining land region. Out of these, 4 reached cyclonic storm intensity. The rest remained as deep depressions (3) and depressions (5). All the 4 cyclonic storms formed over the Bay of Bengal. Out of the 8 depressions/deep depressions, 5 formed over the Bay of Bengal, 2 over the Arabian Sea and the remaining one was a land depression. Hence, while the Arabian Sea was less active and the Bay of Bengal was more active. Though the year had been one of near normal activity over the north Indian Ocean, no storm/depression formed during the pre-monsoon season. Also none intensified beyond the stage of a cyclonic storm.

The first system was a cyclonic storm over southeast Bay and adjoining equatorial Indian Ocean during 13 - 17 January which moved along the equatorial wave and dissipated over the Ocean. Monsoon season was quite active, compared to previous years, in which one cyclonic storm and 5 depressions/deep depressions formed. The first depression formed and lay over the northeast Arabian Sea during 21 - 22 June and weakened *in situ*. The second one was a land Depression (27 June - 5 July). It formed over Gangetic West Bengal and neighbourhood, moved in a westnorthwesterly direction and weakened over west Madhya Pradesh and neighbourhood. The third, a deep depression (29 - 31 July), formed over northwest Bay off Orissa coast. This also moved westnorthwestwards and weakened over central parts of Madhya Pradesh. The fourth, a depression (12 - 16 September), also formed over northwest Bay. It had a westnorthwesterly track initially, which later on became northwesterly and then northerly over central India and weakened over west Uttar Pradesh. The fifth system was a depression (14 - 16 September), formed over east-central and adjoining northeast Arabian Sea. In spite of its initial northnorthwesterly movement, it re-curved northeastwards, crossed Saurashtra coast close to Porbandar and weakened over north Gujarat and adjoining Rajasthan. The last system of the season, a cyclonic storm, formed over north Bay during 17 - 21 September. It drifted

southwestwards initially and crossed north Andhra coast, close to Kalingapatnam. Moving westwards, it gradually weakened into a low pressure area over the Madhya Maharashtra. All the 5 systems formed during the post monsoon season were over the Bay of Bengal. The first system of the season was a deep depression (26-29 October), formed over southwest Bay. It moved in a northwesterly direction and crossed south Andhra coast close to Ongole and weakened over south coastal Andhra Pradesh and neighbourhood. The second depression (20 - 22 November), also formed over southwest Bay. Initially moving northwest and then westwards, it crossed north Sri Lanka coast and weakened over the Gulf of Mannar. The third one was a cyclonic storm (28 November - 2 December), formed over the southeast Bay, Moved northwestwards and weakened over the Ocean off north Tamil Nadu coast. The fourth one, the second cyclone of the season (6 - 10 December), also formed over southeast Bay. Moving westwards, it weakened into a deep depression, crossed south Tamil Nadu coast close to Vedaranniyam and further weakened over south Tamil Nadu and adjoining Kerala. The fifth system, a deep depression (15 - 21 December), formed over southeast Bay moved westwards initially. It then moved northwest, north, then re-curved northeastwards off Tamil Nadu coast and dissipated over the Ocean.

The track / intensity of these systems are given in Fig. 1. The brief history and monthly distribution are given in Tables 1 and 2. The relevant ships and buoy observation are given in Table 3. Season wise description of these systems are given below.

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

During the season, a cyclonic storms formed over the Bay of Bengal. The formation of cyclonic storms in the month of January is very rare. Last such occurrence was in the year 1987 (30 Jan - 4 Feb), over the Bay of Bengal. System forming at a very low latitude is also another significant feature. Though the system attained the cyclonic storm intensity and remained so for about two days, its movement was very sluggish.

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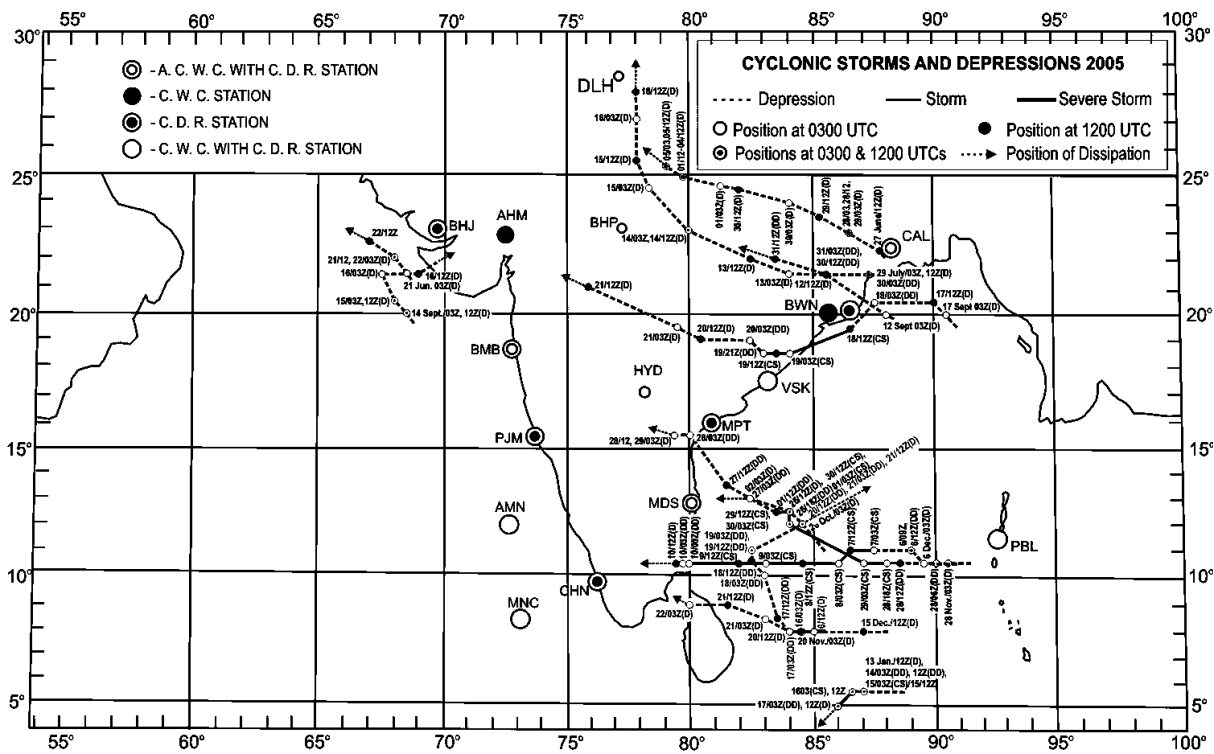


Fig. 1. Tracks of depression/storms during 2005

The details are given below :

2.1. Cyclonic storm 'HIBARU'[†] over southeast Bay and adjoining equatorial Indian Ocean (13 - 17 January 2005)

2.1.1. Life cycle

A trough in the easterlies at sea level over southeast and adjoining southwest Bay organised into a low pressure area over south Bay and adjoining equatorial Indian Ocean on 13 morning. It concentrated into a Depression and lay centred near Lat. 5.5° N / Long. 87.0° E at 1200 UTC of 13. Remaining practically stationary over there, it intensified into a deep depression on 14 morning and further into a cyclonic storm over the same area on 15 morning. Moving slowly westwards, it lay centred near Lat. 5.5° N / Long. 86.5° E at 0300 UTC of 16. Subsequently it drifted southwestwards, weakened into a deep depression and lay centred at 0300 UTC of 17, near Lat. 5.0° N / Long. 86.0° E. It further weakened into a depression over there on 17 evening, into a well-marked

low pressure area on 18 and lay as a low pressure area over there on 19 & 20. It moved westwards, further weakened and became less marked on 27.

2.1.2. Satellite cloud features and other observations

Maximum intensity of the system as given by Kalpana I imagery was T 2.5 from 0000 UTC of 14 to 0600 UTC of 16.

The system was not tracked by RADAR as it was far away from the coast. However, the system centers were fixed using satellite observations.

2.1.3. Other features observed

The lowest estimated central pressure was 1000 hPa. The maximum estimated wind speed was 35 kts. The system initially moved in a northwesterly direction and then drifted southwestwards and dissipated over the Sea area.

[†] As per the recommendation of WMO/ESCAP Panel, RSMC New Delhi started naming the Tropical cyclones over the north Indian Ocean, with effect from the post monsoon season of 2004. ACR-2006 held at Chennai, recommended to follow this practice at National level as well.

TABLE 1

Brief history of cyclonic storms and depressions over the north Indian ocean and neighbourhood during 2005

S. No.	Type of system	Life period	Point of crossing the coast	Lowest estimated central pressure (hPa)	Max. wind (Estimated/observed)	Highest "T" No. (estimated)
1.	CS 'HIBARU'	13 – 17 Jan	Dissipated over the equatorial Indian Ocean	1000	35 kts	2.5
2.	D	21 – 22 Jun	Dissipated over northeast Arabian Sea	–	25 kts	1.5
3.	D	27 Jun – 5 Jul	Land depression	990	25 kts	–
4.	DD	29 – 31 Jul	Orissa coast near Balasore	–	30 kts	2.0
5.	D	12 – 16 Sep	Orissa coast near Paradeep	–	25 kts	1.5
6.	D	14 – 16 Sep	Saurashtra coast close to Porbandar	–	25 kts	1.5
7.	CS 'PYARR'	17 – 21 Sep	Andhra coast close to Kalingapatnam	988	35 kts	2.5
8.	DD	26 – 29 Oct	South Andhra coast near Ongole	–	45 kts	3.0
9.	D	22 – 22 Nov	North Sri Lanka coast	–	25 kts	1.5
10.	CS 'BAAZ'	28 Nov – 2 Dec	Dissipated over west–central Bay	998	45 kts	3.0
11.	CS 'FANOOS'	6 – 10 Dec	South Tamil Nadu coast near Vedaranyam	–	55 kts	3.5
12.	DD	15 – 21 Dec	Dissipated over southwest Bay	–	30 kts	2.0

D- Depression, DD-Deep depression and CS - Cyclonic Storm

TABLE 2

Storms/depressions statistics 2005

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	1	1	1	5	
Cyclonic storms	1							1		1	1	4	
Severe cyclonic storms													
Very severe cyclonic storms													
Super cyclonic storm													
Total												9	
Land depression													
Deep depressions					1							1	
Over Arabian Sea													
Depressions/Deep depressions					1			1				2	
Cyclonic storms													
Severe cyclonic storms													
Very severe cyclonic storms													
Super cyclonic storm													
Grand total	1				2	1		3	1	2	2	12	

TABLE 3

Crucial ship/buoy observations during the storm/depression periods 2005

Call Sign	Date/Time (UTC)	Lat. (°N)	Long. (°E)	Dir. (Deg.)	Speed (kts)	PPPP (hPa)
(A) Cyclonic storm 'HIBARU' over southeast Bay and adjoining equatorial Indian Ocean (13-17 January)						
DPKZ	131200	6.0	86.1	030	30	–
ABFN3	140000	6.3	91.2	200	15	1006.5
2CBZ4	141200	6.0	84.2	000	20	1007.5
DMRJ	150000	5.9	84.9	000	20	1009.0
MZIM8	151200	6.0	88.3	300	25	1006.6
CLUP2	160000	6.1	88.0	090	20	–
SHIP	161200	6.0	87.8	135	15	–
HZDD	161200	5.4	84.8	045	30	–
(B) Deep depression over southwest Bay (26 – 29 October)						
Buoy	260300	12.5	85.0	090	10	1003.4
Buoy	261200	12.5	84.7	170	10	1001.9
Buoy	261200	14.0	83.3	030	15	1002.3
(C) Cyclonic storm 'BAAZ' over southeast Bay (28 November – 2 December)						
Buoy	010300	12.5	84.8	130	10	–
Buoy	010300	13.8	83.2	060	10	–
Buoy	010300	11.5	81.5	310	10	–
(D) Cyclonic storm 'FANOOS' over southeast Bay (6 – 10 December)						
Ship	060000	6.0	88.0	270	10	1007.0
Ship	061200	6.0	88.0	310	20	–
Buoy	080300	12.5	84.7	045	15	–
Buoy	080300	6.0	86.0	270	10	–
Buoy	081200	12.5	84.7	045	05	1004.3
Buoy	081200	6.0	87.3	210	10	–

2.1.4. *Weather and damage*

The system did not affect the weather in India.

Bengal. Apart from this 2 depressions over the Arabian Sea and one land depression also formed. The details of which are given below :

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

No storm/depression formed during the pre-monsoon season, unlike the past 11 years. Most of the years during 1994-2004 witnessed at least one severe storm during the month of May.

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

During the season, one cyclonic storm, one deep depression and a depression formed over the Bay of

4.1. *Depression over the Arabian Sea (21–22 June 2005)*

4.1.1. *Life cycle*

Under the influence of an upper air cyclonic circulation which moved northwards very slowly along the off-shore trough during 5 - 20 June, a depression formed over northeast Arabian Sea and adjoining Saurashtra & Kutch and lay centred close to Porbandar at 0300 UTC of 21. Moving westnorthwestwards, it lay over northeast Arabian Sea, centred near Lat. 22.0° N / Long. 68.0° E at 1200 UTC of 21 and at 0300 UTC of 22 and

near Lat. 22.5° N / Long. 67.0° E at 1200 UTC of 22. It weakened into a well-marked low pressure area over there on 23 and became less marked on 24.

4.1.2. *Satellite cloud features and other observations*

The system was tracked by Satellite. Maximum intensity of T 1.5 was reported by Kalpana 1 imagery from 0600 UTC of 21 to 0000 UTC of 23.

4.1.3. *Other features observed*

The maximum estimated wind speed was 25 kts. The system initially moved in a northwesterly direction and then in a westnorthwesterly direction and dissipated over the sea area.

4.1.4. *Weather and damage*

The system did not cross the Indian coast and hence no damage was reported. However, fairly widespread rainfall activity with isolated heavy falls was realised on 22 June in Saurashtra & Kutch.

The chief amounts of rainfall in cms are :

21 June 2005 : Naliya 3,

22 June 2005 : Veraval 7, Porbandar 5.

4.2. *Depression over the land (Gangetic West Bengal) (27 June–5 July 2005)*

4.2.1. *Life cycle*

Under the influence of an upper air cyclonic circulation over northwest Bay, a low pressure area formed over there on 27 morning, which rapidly moved inland and concentrated into a depression over Gangetic West Bengal and adjoining northwest Bay, close to Kolkata at 1200 UTC of 27. Moving westwards, it lay centred near Jamshedpur (over Jharkhand) till 0300 UTC of 29. Subsequently moving in a westnorthwesterly direction, it lay close to Ranchi at 1200 UTC of 29. It lay close to: Daltonganj at 0300 UTC of 30; Siddhi at 1200 UTC of 30 June; Rewa at 0300 UTC of 1 July; Khajuraho from 1200 UTC of 1 to 4 and near Nowgong on 5. It weakened into a well marked low pressure area over northwest Madhya Pradesh and adjoining areas of west Uttar Pradesh and east Rajasthan on 6 morning. It moved over to west Uttar Pradesh and adjoining areas on 7, weakened into a low pressure area over west Rajasthan and neighbourhood on 8 and became less marked on 9.

4.2.2. *Satellite cloud features and other observations*

System was tracked by Kalpana 1, However, the system was over land, no T number was assigned.

4.2.3. *Other features observed*

The estimated lowest pressure was 990 hPa and maximum sustained surface wind was 25 kts throughout its course. Initially, it moved in a westerly direction, then westnorthwesterly and finally northwesterly.

4.2.4. *Weather and damage*

Widespread rainfall activity was realised on 28 & 29 in Gangetic West Bengal (with isolated heavy falls), on 30 June and 1 July in Jharkhand, 2 - 6 July in east Madhya Pradesh (with heavy falls at a few places). Fairly widespread rainfall activity was also realised on 7 July in east Madhya Pradesh and east Rajasthan.

The chief amounts of rainfall in cms are :

Gangetic West Bengal

28 June 2005 : Bagati (Magra) 11, Kolkata AP 8, Digha & Diamond Harbour 7 each.

29 June 2005 : Sriniketan & Krishnanagar 5 each.

Jharkhand

30 June 2005 : Daltonganj 6.

East Madhya Pradesh

2 July 2005 : Satna 19, Jabalpur 7.

3 July 2005 : Satna 19, Sagar 12, Nowgong & Khajuraho 7 each.

4 July 2005 : Sagar 48, Jabalpur 17.

5 July 2005 : Jabalpur 8.

The system caused flooding all along its track, especially over Madhya Pradesh.

West Madhya Pradesh

- 4 July 2005 : Chachauha & Guna 7 each.
 5 July 2005 : Bhopal & Hoshangabad 9 each,
 6 July 2005 : Bhora 10, Chechora & Chanderi 9 each, Vidisha 7.

Rajasthan

- 4 July 2005 : Mount Abu 13.
 5 July 2005 : Ansawar 19, Aklera & Sangod 17 each, Khanpur 16, Jhalarapatan 13, Jhalawar 11, Bakni 9, Manohar, Thana, Jayal & Malsi 7 each.
 6 July 2005 : Chipaboard 13, Arnod 12, Malernandgaon & Nagpur 11 each, Chabra 10, Aklera & Sikar 9 each, Khanpur, Manohar, Thana & Paota 8 each, Bhratpur & Sambhar 7 each.
 7 July 2005 : Bahadurgarh 15, Govindgarh 14, Ramgarh 13, Kishangarhwas & Mandawar 12 each, Laxmangarh 11, Nadwai & Tizara 9 each, Anta, Chabra, Kathumar, Mahuva & Nimrana 8 each, Bari, Deeg, Dhaulpaur & Nagaur 7 each.

4.3. *Deep depression over northwest Bay off Orissa coast (29 - 31 July 2005)*

4.3.1. *Life cycle*

A low pressure area formed over northwest Bay and adjoining coastal areas of Gangetic West Bengal and Orissa on 28. It concentrated into a depression on 29 and lay centred close to Balasore till 30 morning when it intensified into a deep depression over there. Moving westwards, it lay over north Orissa, close to Keonjhar at 1200 UTC of 30 and 0300 UTC of 31. It lay over Chattisgarh and neighbourhood close to Champa at 1200 UTC of 31. Further moving westnorthwestwards, it rapidly weakened into a well marked low pressure area over central parts of Madhya Pradesh on 1 August and into a low pressure area over west Madhya Pradesh and adjoining southeast Rajasthan on 2. It moved over to southeast Rajasthan and neighbourhood and subsequently merged into the seasonal heat low on 3.

4.3.2. *Satellite cloud features and other observations*

The maximum intensity based on satellite imagery was T 2.0 at 0900 UTC of 30 with centre at Lat. 21.5° N / Long. 87.0° E. As per the storm account, the system crossed Orissa coast between 0900 UTC and 1200 UTC of 30 July.

4.3.3. *Other features observed*

The maximum estimated wind speed was 30 kts. The system moved in a westerly/westnorthwesterly direction and crossed Orissa coast near Balasore, around the noon of 30.

4.3.4. *Weather and damage*

Widespread rainfall activity with isolated heavy to very heavy falls were realised on 29 to 31 in Orissa and on 31 in Chattisgarh.

The chief amounts of rainfall in cms are:

Orissa

- 29 July 2005 : Chandbali 25, Thakumunda 23, Rajkanika 19, Anandpur 9, Pallahara 9, Swampatna, Kendrapara & Paradip 8 each.
 30 July 2005 : Tikarapada & Rairakhhol 31 each, Athagarh & Khandapada 29 each, Hindol 26, Akhuapada 25, Chandbali, Niraj & Athamalik 24 each, Mundali, Rajkanika, Rajkishorenagar & Dhenkanal 22 each, Cuttack & Jamnkira 21 each, Pallahara, Rengali & Talcher 20 each, Angul 19, Jenapur, Kendrapara & Binika 18 each, Narsinghpur, Bargarh & Sambalpur 17 each, K-Nagar, Bijepur & Nimpada 16 each, Phulbani & Bhubaneswar 15 each, Khiramal, Kuchinda, Nayagarh & Kantamal 14 each, Alipingal & Dunguripalli 13 each, Jajpur, Jhumpura, Hirakund, Pipli, Tikabali & Harbhanga 12 each, Kakatpur 11, Joshipur, Sohella & Sonapur 10 each, Bolangir, Puri & Baliguda 9 each, Jharsuguda 8, Soro, Bonth, Paradip, Keonjhar, Baripada Rairangpur & Naktideul 7 each.

31 July 2005 : Ambabhona 31, Pallahara 26, Baragarh 21, Bijepur 20, Nakatideul, Khairamal & Rengali 19 each, Phulbani 15, Rairakhhol 14, Sambalpur, Kuchinda, Jamankira & Athamalik 12 each, Kantamalik 11, Padampur & Rajkishore Nagar 10 each, Deogarh, Belgaon & Harabhanga 9 each, Hirakund & Athagarh 8 each, Tikarpada 7.

Chattisgarh

31 July 2005 : Katghora 19, Raipur 18, Arang 16, Rajim & Bilaspur 15 each, Mana AP, Gariaband & Sarangarh 14 each, Mahasamund 11, Dhamtarai & Raigarh 10 each, Mungeli, Gandai & Saraipali 8 each, Pali & Champa 7 each.

These heavy rainfall caused flooding in these regions.

4.4. Depression over northwest Bay (12–16 September 2005)

4.4.1. Life cycle

Under the influence of an upper air cyclonic circulation over west central Bay and adjoining areas of coastal Andhra Pradesh–south Orissa, a low pressure area formed over west–central and adjoining northwest Bay off north Andhra–south Orissa coasts on 10. It persisted there on 11, rapidly concentrated into a depression and lay centred at 0300 UTC of 12 near Lat. 20.0° N / Long. 88.0° E. It crossed Orissa coast near Paradip by 0900 UTC of 12 and lay close to Keonjhar on 1200 UTC of 12. Moving in a westnorthwesterly direction, it lay close to Jharsuguda and Champa respectively at 0300 & 1200 UTC of 13. Further moving northwestwards, it lay close to Jabalpur at 0300 & 1200 UTC of 14 and about 100 km north of Sagar at 0300 UTC of 15. It subsequently moved northwards and lay close to Gwalior at 1200 UTC of 15; Agra at 0300 UTC of 16 and about 100 km southeast of Delhi at 1200 UTC of 16. Further moving northwards, it rapidly weakened into a low pressure area over west Uttar Pradesh and neighbourhood on 17 morning and became less marked on 18. However, the associated upper air cyclonic circulation extending upto 1.5 km a.s.l. lay over west Uttar Pradesh and adjoining Uttaranchal on 18 and became less marked on 19.

4.4.2. Satellite cloud features and other observations

The maximum intensity based on satellite imageries was T 1.5 reported from 0600 UTC of 12 to 1200 UTC of 12 and again from 2100 UTC of 16 to 0600 UTC of 17. Satellite positions were relocated by 0.5° on delayed mode.

4.4.3. Other features observed

The maximum estimated wind speed was 25 kts. The system moved in a northwesterly direction and crossed Paradip coast at 0900 UTC of 12. After crossing, it moved initially in a westnorthwesterly direction and then in a northerly direction.

4.4.4. Weather and damage

Widespread to fairly widespread rainfall activity were realised from 12 to 15 September in Orissa (with heavy to very heavy falls at a few places); from 12 to 14 September in Chattisgarh (with isolated heavy to very heavy falls); on 14 & 15 September in Madhya Pradesh (with isolated heavy to very heavy falls). As a low pressure area it also gave fairly widespread rainfall with isolated heavy to very heavy falls in east Uttar Pradesh on 16 & 17 September and widespread rainfall activity in Uttar Pradesh and Uttaranchal on 17 & 18 September and fairly widespread with isolated heavy to very heavy falls in south Rajasthan from 14 to 16 September.

The chief amounts of rainfall in cms are:

Orissa

12 Sep 2005 : Nowrangpur 30, Jeypore 17, Mohana 16, Bhavanipatna 14, Udala & Tikabali 10 each, Dhenkanal, Malkangiri & Baliguda 9 each, Nilgiri, Hindol, Mandanpur Rampur & Phulbani 8 each, Soro, Athagarh, Angul, Mahendragarh, Udaigiri, Junagarh & Lajigarh, Puri 7 each.

13 Sep 2005 : Bhavanipatna 27, Hindol 23, Narsigpur 22, Junagarh, Nayagarh & Phulbani 21 each, Nawarangpur & Baliguda 17 each, Khariar 16, Madnanpur & Rampur 15 each, Jaipatna 14, Komna, Jeypore, Belgaon & Kotraguda 13 each,

Paradip, Barmul & Dashpalla 12 each, Tikarapada, Paikmal, Bhanjanagar, Boudhgarh, Kantamal, Umerkote, Khandapada, Bolangir & Titlagarh 11 each, Rajghat, Chandbali, Madhabarida & Ranpur 10 each, Rajkanika, Mohana, Surada & Koraput 9 each, Nilgiri, Akhuapada, Athamalil & Nawapara 8 each, Bhograi, Soro, Khairamal, Padampur & Baripada 7 each.

14 Sep 2005 : Rajghat 27, Bhograi 22, Bangiriposh 15, Hemgiri 13, Paikmal 12, Ambabhona, Nawapara & Balasore 8 each, Swampatna, Bijepur, Padampur, Baripada & Pantnagar 7 each.

15 Sep 2005 : Bhograi 16, Thakurmunda 9, Paradip 8.

Chattisgarh

12 Sep 2005 : Devbhog 11, Durg 9, Raipur & Narayanpur 8 each.

13 Sep 2005 : Gariaband 14, Kondagaon & Balod 13 each, Narayanpur & Mahasamund 12 each, Dongargarh 11, Jagdalpur & Kanker 10 each, Ambagarh & Chowki 9 each, Rajnandgaon & Dongargaon 8 each, Raipur 7.

14 Sep 2005 : Dongargarh 23, Dondilohara 20, Narayanpur 18, Dongargaon 12, Ambagarh, Chowki & Champa 11 each, Durg, Rajnandgaon & Gandai 9 each, Raipur & Janjgir 8 each, Arang, Gariaband & Bemitara 7 each.

Madhya Pradesh

14 Sep 2005 : Seoni 21, Betul 8, Khandwa 7.

15 Sep 2005 : Mandia 18, Sailana 16, Jabalpur 15, Seoni 14, Chhindwara, Amarwara & Chansore 13 each, Multai & Keolari 11 each, Balaghat & Umariya 10 each, Bhasdehi, Bhopal, Harda & Indore 9 each, Jaora, Pachmari, Betul & Narsigpur 8 each. Mhow, Depalpur & Maihar 7 each.

Rajasthan

14 Sep 2005 : Pushkar 8, Hanumangarh & Sangaria 7 each.

15 Sep 2005 : Danpur 19, Kesarpura 18, Banwara 11, Bhuugra 10, Ghatol 9, Dhambola, Galiakot & Shergarh 8 each, Athuna 7.

16 Sep 2005 : Anta 20, Baran 16, Begu 14, Pindwara 13, Deeg 12, Bali 9, Gudamalani & Jalor 8 each, Ahore, Bagoda, Telhara & Veja 7 each.

Uttar Pradesh

16 Sep 2005 : Kanpur 15, Dalmau & Lucknow 13 each, Raebareilly & Hanumansetu 12 each, Bhatpurwaghat, Chillaghat, Auria & Ankinghat 11 each, Ayodhya & Neemsar 10 each, Banda, Elginbridge, Fatehpur & Bareilly 9 each, Mainpuri 8, Kalpi 7.

17 Sep 2005 : Bareilly 27, Bhinga 18, Kakardharighat, Bansi & Bahraich 12 each, Ayodhya 11, Kakrahi & Katerniaghat 10 each, Balrampur 9, Paliakalan 8, Ragoli & Narora 7 each.

Uttaranchal

17 Sep 2005 : Santipuri 24, Nainital 20, Kalagarh & Pantnagar 17 each, Pati 11, Marora 9, Karanprayag & Hardwar 7 each.

18 Sep 2005 : Kalagarh 13, Pantnagar 10, Haridwar 8, Tehri & Marora 7 each.

As per press reports, 6 persons died and many low lying villages were flooded due to heavy rains in Madhya Pradesh. According to the Director of Agriculture, Government of Orissa, 75,343 hectares of cropped area were submerged after heavy down pour during 12 - 13 September.

4.5. *Depression over east central and adjoining northeast Arabian Sea (14-16 September 2005)*

4.5.1. *Life cycle*

Under the influence of the remnant of a low pressure area, a well marked low pressure area formed over

northeast Arabian Sea and adjoining north Konkan - Saurashtra coasts on 11. It lay over south Gujarat region, adjoining north Konkan and northeast Arabian Sea on 12 and over Saurashtra and neighbourhood on 13. Subsequently, it concentrated into a depression over east central and adjoining northeast Arabian Sea and lay centred near Lat. 20.0° N/ Long. 68.5° E at 0300 & 1200 UTC of 14. It lay over northeast Arabian Sea near Lat. 20.5° N / Long. 68.0° E at 0300 & 1200 UTC of 15. Moving northnorthwestwards, it lay near Lat. 21.5° N / Long. 67.5° E at 0300 UTC of 16. Then it recurved eastwards and lay centred near Lat. 21.5° N / Long. 69.0° E (about 50 km west of Porbandar) at 1200 UTC of 16. It crossed coast close to Porbandar during the night of 16. Subsequently moving northwards, it rapidly weakened into a low pressure area over northern parts of Gujarat and adjoining Rajasthan on 17 morning. Though it became less marked on 18, the associated upper air cyclonic circulation extending upto 4.5 km a.s.l. lay over north Gujarat and adjoining areas of south Rajasthan and west Madhya Pradesh on 18; south Gujarat and neighbourhood on 19 & 20 and became less marked on 21.

4.5.2. *Satellite cloud features and other observations*

The maximum intensity of T 1.5 was reported from 0000 UTC of 14 to 0000 UTC of 16 based on satellite imageries.

4.5.3. *Other features observed*

The maximum estimated wind speed was 25 kts. The system moved initially in a northwesterly direction, then in an easterly direction and finally moving in a northeasterly direction, it crossed Saurashtra coast near Porbandar on 16 night.

4.5.4. *Weather and damage*

Strong gale force winds caused destruction in Gujarat on 16 night.

Under the influence of the system, fairly widespread rainfall with isolated heavy falls occurred over Gujarat on 15 September. The chief amounts of rainfall in cms are :

Gujarat

15 Sep 2005 : Palanpur 9, Meghraj & Dharoi 8 each, Vyara 7.

According to press reports, 13 people died in Gujarat due to heavy rain.

4.6. *Cyclonic storm 'PYARR' over the Bay of Bengal (17–21 September 2005)*

4.6.1. *Life cycle*

A trough of low at sea level over north Andaman Sea organised into a feeble low pressure area over north Andaman Sea and adjoining Arakan coast on 15 and became a low pressure area over east-central Bay and adjoining Arakan coast on 16. It concentrated into a depression and lay centred near Lat. 20.0° N / Long. 90.5° E at 0300 UTC of 17 and near Lat. 20.5° N / Long. 90.0° E at 1200 UTC of 17. It intensified into a deep depression near Lat. 20.5° N / Long. 87.5° E at 0300 UTC of 18 and further into a cyclonic storm near Lat. 19.5° N / Long. 86.5° E at 1200 UTC of 18. It crossed north Andhra coast, close to Kalingapatnam around 0230 UTC of 19 and lay centred near Lat. 18.5° N / Long. 84.0° E over Kalingapatnam at 0300 UTC of 19 and near Lat. 18.5° N / Long. 83.5° E at 1200 UTC of 19. Moving westwards, it weakened into a deep depression at 2100 UTC of 19 and lay centred near Lat. 18.5° N / Long. 83.0° E and near Jagdalpur at 0300 UTC of 20. It further weakened into a depression and lay centred close to Ramagundam (Lat. 19.0° N / Long. 80.5° E) at 1200 UTC of 20; near Chandrapur (Lat. 19.5° N / Long. 79.5° E) at 0300 UTC of 21 and near Jalgaon (Lat. 21.0° N / Long. 76.0° E) at 1200 UTC of 21. It subsequently weakened into a well marked low pressure area over north Madhya Maharashtra and adjoining south Gujarat and southwest Madhya Pradesh on 22 morning and lay over west Madhya Pradesh and adjoining southeast Rajasthan and Gujarat region on 23. Moving northnortheastwards, it further weakened into a low pressure area over southwest Uttar Pradesh and adjoining northeast Rajasthan on 24. It lay over west Uttar Pradesh and adjoining Uttaranchal on 25 and became less marked on 26.

4.6.2. *Satellite cloud features and other observations*

The maximum intensity as reported by Satellite was T-2.5 from 1200 UTC of 18 to 0600 UTC of 19. As per the storm account, the system crossed north coastal Andhra Pradesh between 0300 & 0400 UTC of 19 September. Position of the vortex at 0300 UTC of 19 was Lat. 18.4° N / Long. 83.8° E.

CDR Visakhapatnam reported no spiral/ organised bands in any of the observation.

DWR Machilipatnam reported a spiral band like feeder, which appeared in the southern sector at about 250 km, but the intensity was less than 23 dBz. Except this, no organisation of clouds such as spiral bands could be seen

at any time and hence the centre of the storm could not be fixed. They also reported wind speeds as high as 16 kts between 1 & 2 km heights from westerly direction.

4.6.3. *Other features observed*

The lowest estimated central pressure was 988 hPa. The maximum estimated wind speed was 35 kts. At 0200 UTC of 19, Kalingapatnam reported southerly 10 kts surface wind and the satellite inferred centre at 0300 UTC of 19, Lat. 18.4° N / Long. 83.8° E with intensity T 2.5. The system crossed north Andhra coast near Kalingapatnam at 0230 UTC of 19 September. As per the post cyclone survey report the system crossed between Kalingapatnam and Gopalpur at the mouth of Bahuda river, 70 kms northeast of Kalingapatnam (Srikakulam district). Strong winds started around 22 hours (IST) of 18 and lasted till 0800 hrs (IST) of 19.

4.6.4. *Weather and damage*

Widespread rainfall activity with isolated heavy to very heavy falls was realised in coastal Andhra Pradesh and Orissa.

The chief amounts of rainfall in cms are:

Andhra Pradesh

19 Sep 2005 : Kalingapatnam 35, Tekkali 14, Visakhapatnam, Veeraghattam & S.Kota 12 each, Visakhapatnam AP 11, Saluru 10, Bobbili 9, Anakapalle 8, Gajapatnagar 7.

20 Sep 2005 : Kunnavaram 49, Koida 48, Kakinada 28, Khammam 24, Dowlaiswaram 21, Rajahmundry 20, Eluru & Visakhapatnam 19 each, Narsapur 18, Tuni & Sattanapalle 17 each, Gannavaram 16, Choddavaram & Kaikalur 15 each, Machilipatnam 14, Yellemanchili, Prakasam Barrage, Anakapalle & Dolphin's nose 13 each, Repalle 11, Piduguralla 10, Bapla 9.

As per the information collected from the collectors office, the following damage were reported.

Number of deaths - 64,

Number of fishermen missing - 15,

Number of livestock died - 291,

Total loss estimated by Government - Rs 1809 crores

Damage was mainly due to inundation of the low lying areas and flash floods submerging the crops due to heavy rains.

The system after crossing caused heavy rainfall over Orissa as well.

The chief amounts of rainfall in cms are:

Orissa

18 Sep 2005 : Tikabali 15, Kotagarh 13, Daringibadi 11, Phulbani 10, Alipingal, Joshipur, Mohana & Udaigiri 9 each, Kalinga, Paradip, Kakatpur & Gudari 8 each.

19 Sep 2005 : Jeypore 20, Koraput & Pottangi 17 each, R. Udaigiri 15, Mahendragarh 13, Mohana 11, Hindol, Kotagarh, Tikabali, Gudari & Gunpur 10 each, Khandapada, Nowrangapur & Rayagada 9 each.

No damage was reported in Orissa.

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

During the season, two cyclonic storms, three depressions (including two deep depressions) formed over the Bay of Bengal. No Storm/depression developed over the Arabian Sea during the season. The details are given below :

5.1. *Deep depression over southwest Bay (26–29 October 2005)*

5.1.1. *Life cycle*

A low pressure area formed over southwest and adjoining west - central Bay on 25. It concentrated into a depression and lay centred near Lat. 12.0° N / Long. 84.5° E at 0300 UTC of 26 and near Lat. 12.5° N / Long. 84.0° E at 1200 UTC of 26. It subsequently intensified into a deep depression over the same area at 1800 UTC of 26. Moving in a northwesterly direction it lay centred near Lat. 13.0° N / Long. 82.5° E at 0300 UTC and near Lat. 13.5° N / Long. 81.5° E at 1200 UTC of 27. Subsequently moving in a northnorthwesterly direction, it lay centred

near Lat. 15.5° N / Long. 80.0° E, about 50 km east of Ongole at 0300 UTC of 28. It crossed south Andhra coast close to Ongole by 0800 UTC of 28, weakened into a depression and lay centred about 50 km west of Ongole at 1200 UTC of 28. It remained practically stationary over there on 29 morning and weakened into a well marked low pressure area over south coastal Andhra Pradesh and neighbourhood in the evening. It further weakened into a low pressure area over the same region on 30, lay as a trough of low extending from south coastal Andhra Pradesh to south Tamil Nadu on 31 October and became less marked on 1 November.

5.1.2. *Satellite cloud features and other observations*

Maximum intensity of T 3.0 was reported based on the satellite imagery at 0600 UTC of 28 with centre near Lat. 15.2° N / Long. 79.9° E. As per the storm account, the system crossed coast near Ongole between 0500 & 0600 UTC of 28 October.

The system was tracked by Doppler Weather RADARs at Chennai, Sriharikota and Machilipatnam, details of which are given below :

DWR Chennai - It was in continuous operation during the course of the system. The products were disseminated through e-mail to all forecasters. From 0600 to 0900 UTC of 27, the vortex centre was estimated with fair/ good degree of confidence. Vortex signature in the form of doughnut in the radial velocity field served as a confirmatory tool for fixing the centre. As per their report, the deep depression had not further intensified into cyclonic storm at any stage.

DWR SHAR - The RADAR observations indicated a closed vortex at 0600 UTC of 27, but lacked the required properties of a cyclone eye (inadequate cloud heights and low reflectivity in the eye wall region). Such vortex like cloud arrangements were seen at different locations as the storm progressed in a northnorthwest direction.

Confidence of fixing the centres were poor except around 0600 UTC of 27.

DWR Machilipatnam - The organisation of clouds such as hook/spiral bands were seen from 0200 UTC to 0400 UTC of 28 October and hence the centre of the storm could be fixed at Lat. 15.2° N / Long. 80.1° E near Kavali using spiral of 20° crossing angle with fair confidence. On 28, wind speeds as high as 50 kts were observed between 0.6 km and 3 km heights from the easterly direction.

5.1.3. *Other features observed*

Based on the number of closed isobars and the satellite derived T No. of 3.0, this could even be considered as the case of a marginal cyclone, during a short period before crossing.

The maximum estimated wind speed was 45 kts based on the surface observations of Ongole the system moved in a northnorthwesterly direction and crossed the coast close to Ongole at 0800 UTC of 28.

5.1.4. *Weather and damage*

Widespread rainfall activity with heavy to very heavy falls at a few places in coastal Andhra Pradesh and at isolated places in Tamil Nadu were realised on 28 & 29 October.

The chief amounts of rainfall in cms are :

Coastal Andhra Pradesh

28 Oct 2005 : Kavali 35, Nellore 26, Sompetta 14, Mandasi 11.

29 Oct 2005 : Kavali 8, Visakhapatnam AP 7.

According to press reports, most of the damage were due to heavy rain causing floods, breaching of tanks and damage to railway tracks in Andhra Pradesh.

The districts affected are Nellore, Prakasam, Guntur and Krishna in coastal Andhra Pradesh and Chittoor, Cuddapah, Kurnool in Rayalaseema and Nalgonda in Telangana.

- | | |
|--|---|
| (i) No. of deaths | : 18 (Nellore 13 and other 5). |
| (ii) No. of houses collapsed | : Nellore – 1000 and
Prakasam – 45. |
| (iii) No. of tanks breached | : 44 (Nellore). |
| (iv) No. of acres of Paddy submerged | : 44,423 hectares in
Prakasam district,
50,000 hectares in Kurnool
district and
1,00,000 hectares in Nellore
district. |
| (v) No. of acres of Fish ponds submerged | : 2200 hectares in Prakasam
district. |

Rail tracks were breached at many places in the above districts.

Tamil Nadu

28 Oct 2005 : Tiruvallur 27, Redhills 24, Ponneri 20, Chennai 16, Tambaram 13.

29 Oct 2005 : Kalwakurthy 27, Porumammala & Cumbum 13 each.

As per media reports about 60 deaths were reported in Tamil Nadu due to heavy rain, floods, wall collapse, electrocution and lightning. Many low lying areas, roads/highways were inundated and breached. Nearly 600 huts in the low lying areas off the Cauvery delta region were inundated and damaged.

5.2. *Depression over southwest Bay (20–22 November 2005)*

5.2.1. *Life cycle*

A trough of low at sea level lay over southeast Bay and adjoining south Andaman Sea on 14. It organised into a low pressure area over there on 15 and lay over southeast Bay on 16 & 17, southeast and adjoining southwest Bay on 18 and over southwest Bay on 19. Subsequently it concentrated into a depression and lay centred near Lat. 8.0° N / Long. 84.5° E at 0300 UTC on 20 and near Lat. 8.0° N / Long. 84.0° E at 1200 UTC of 20. Moving in a northwesterly direction, it lay near Lat. 8.5° N / Long. 83.0° E at 0300 UTC of 21 and near Lat. 9.0° N / Long. 81.5° E at 1200 UTC of 21. Then it moved westwards, crossed north Sri Lanka coast in the early morning and lay centred near Lat. 9.0° N / Long 80.0° E at 0300 UTC of 22. It weakened into a well marked low pressure area over Gulf of Mannar and neighbourhood on 22 evening and persisted there on 23. It weakened into a low pressure area while moving across south Tamil Nadu and lay over southeast Arabian Sea and adjoining Lakshadweep area on 24; southeast Arabian Sea on 25 and over southeast and adjoining east central Arabian Sea during 26 November to 1 December. It became less marked on 2.

5.2.2. *Satellite cloud features and other observations*

The maximum intensity of T 1.5 was reported based of satellite imageries from 1200 UTC of 19 to 0000 UTC of 23.

5.2.3. *Other features observed*

The maximum estimated wind speed was 25 kts. The system moved in a northwesterly direction, then westerly direction and finally in a westnorthwesterly direction. Moving westwards, it crossed Sri Lanka coast at 0000 UTC of 22.

5.2.4. *Weather and damage*

The system gave rise to heavy to very heavy rainfall over Tamil Nadu and Rayalaseema during 22 to 24 November. Widespread to fairly widespread rainfall activity was realised in the above sub-divisions.

The chief amounts of rainfall in cms are :

Rayalaseema

22 Nov 2005 : Tirupathi 8.

23 Nov 2005 : Tirupathi 21, Gudur 13, Puttur 9, Atmakur & Pakala 8 each.

Tamil Nadu

21 Nov 2005 : Vedaranniyam 9.

22 Nov 2005 : Panruti & Parangipettai 22 each, Chidambaram 13, Cheyyar 11, Vedaranniyam 10, Mayiladuthurai, Tirumayam, Cuddalore & Pondicherry 9 each, Srimushnam, K. Koil, Thanjavur, Chennai AP & Chembarapakkam 7 each.

23 Nov 2005 : Toludur 17, Panruti & Ulundurpet 15 each, Kallakurichi, Dindigul, Srimusham & Virudhachalam 14 each, Thirukoilur, Melur & Chittampatti 11 each, Chidambaram & Peppireddypatti 10 each, Palani, Harur & Chatrapatti 9 each, Nilkottai 8, Vallam, K. Koil, Viralimalai, Vembavur, Kodavasam & Kodaikanal 7 each.

24 Nov 2005 : Panruti 32, Kallakurichi 31, Palani 27, Dindigul 26, Vallam 25, Toludur 24, Mayanur 23, Vembaver & Pullambadi 22 each, Natham 21, Viralimalai, Thirukattupalli, Mussuri & Lalgudi 20 each, Aravakurichi 19, Udumalpet, Thirukoilur, Nilkottai, Erode & K. Paramathi 17 each,

K. Koil, Chattrapatti 16, Srimushnam, Thiruvavarur, Mayiladuthurai, Ramanathapuram, & Thanjavur 15 each, Kulithalai 14, Melur, Peppireddypatti & Sirkali 13 each, Virudhachalam, Kodaikanal & Dharapuram 12 each, Parangipettai & Chittampatti 11 each, Chidambaram & Vedsandur 10 each, Kumbakonam 9, Harur, Tirumayam & Sriperumbathur 8 each, Cholavaram 7.

5.3. Cyclonic storm 'BAAZ' over southeast Bay (28 November – 2 December 2005)

5.3.1. Life cycle

Under the influence of an upper air cyclonic circulation a low pressure area formed and persisted over south Andaman Sea and adjoining Tenasserim coast on 25 & 26. It lay over south Andaman Sea and adjoining southeast Bay on 27 morning and became well marked in the evening. Subsequently, it concentrated into a depression and lay centred at 0300 UTC of 28, near Lat. 10.5° N / Long. 90.5° E. Intensifying into a deep depression, it lay centred near Lat. 10.5° N / Long. 90.0° E at 0600 UTC and near Lat. 10.5° N / Long. 88.5° E at 1200 UTC of 28. Continuing its westward movement, it further intensified into a cyclonic storm and lay centred near Lat. 10.5° N / Long. 88.0° E at 1800 UTC of 28 and near Lat. 10.5° N / Long. 87.0° E at 0300 UTC of 29. Then it moved northwestwards and lay centred near Lat. 12.0° N / Long. 84.0° E at 1200 UTC of 29 & at 0300 UTC of 30 and near Lat. 12.5° N / Long. 84.0° E at 1200 UTC of 30 November & 0300 UTC of 1 December. Moving slowly westwards, it weakened into a deep depression and lay centred near Lat. 12.5° N / Long. 83.5° E at 1200 UTC of 1 December and further into a depression, centred near Lat. 13.0° N / Long. 82.5° E at 0300 UTC of 2. Subsequently, it weakened into a well marked low over southwest and adjoining west central Bay off north Tamil Nadu - south Andhra coasts on 2 evening and lay over southwest Bay and adjoining north Tamil Nadu on 3 morning. It further weakened into a low pressure area over north Tamil Nadu and adjoining coastal Andhra Pradesh on 3 evening and became less marked on 4.

5.3.2. Satellite cloud features and other observations

The maximum intensity of the system based on satellite imageries was T 3.0 from 0300 UTC of 29 to 0400 UTC of 30.

The system was followed by DWR Chennai & SHAR.

DWR Chennai – It was in continuous operation during the period. No well defined band was seen consistently and hence centre could not be fixed from the RADAR images.

5.3.3. Other features observed

The lowest estimated central pressure was 998 hPa. The maximum estimated wind speed was 45 kts. The system moved in a westnorthwest to northwesterly direction and dissipated over the sea.

5.3.4. Weather and damage

Isolated rainfall activity occurred with heavy to very heavy falls in Andhra Pradesh on 3 & 4 December.

Widespread to fairly widespread rainfall activity was also realised with heavy to very heavy rainfall at a few places and at isolated places on 4, 5 & 6 in Tamil Nadu and Andaman & Nicobar islands respectively.

The chief amounts of rainfall in cms are:

Andaman & Nicobar islands

04 Dec 2005 : Nancowry 9.

05 Dec 2005 : Port Blair 7.

06 Dec 2005 : Port Blair 10.

Andhra Pradesh

03 Dec 2005 : Tada 18, Nellore 8, Tirupathi 7.

04 Dec 2005 : Rapur 28, Nellore 8.

Tamil Nadu

03 Dec 2005 : Tambaram 31, Chennai AP 28, Thiruvallur & Chennai city 23 each, Arakonam 21, Sri Perumbuthur 18, Chengalpattu & Red Hills 15 each, Tiruttani 14, Poondi 13, Ponneri 11.

04 Dec 2005 : Pullambadi 18, Papnasam 17, Parangipettai, Tindivanam, Vandavasi & Vallam 13 each, Sri Perumbuthur 12, Thiruvallur 7.

05 Dec 2005 : Vallam 13, Erode 9, Tuticorin 8.

According to press reports :

Heavy rains caused floods in Nellore, Chittoor and Cuddapah districts of Andhra Pradesh.

Number of : 11 (Nellore 7, Chittoor 3,
deaths Cuddapah 1).

Number of tanks : 27 (Nellore district).
breached

Many villages were reported to be marooned in the above districts.

Even after the weakening into a well-marked low pressure area on 2, it caused widespread rain with scattered heavy to very heavy rain on subsequent 4 days causing inundation of low lying areas in Tamil Nadu. As per the press reports, 10 deaths were reported and 3.29 lakh hectares of standing crops were damaged in Nagapattinam, Tiruchirapalli, Sivaganga, Cuddalore and Tiruvarur districts.

5.4. Cyclonic storm 'FANOOS' over southeast Bay (6–10 December 2005)

5.4.1. Life cycle

Under the influence of an upper air cyclonic circulation, a low pressure area formed over south Andaman Sea and neighbourhood on 4. It lay over southeast Bay and adjoining south Andaman Sea on 5 morning and became well marked over southeast Bay in the evening. Subsequently, it concentrated into a depression and lay centred near Lat. 10.5° N / Long. 89.5° E at 0300 UTC of 6. Intensifying into a deep depression, it lay centred near Lat. 11.0° N / Long. 89.0° E at 0900 UTC & 1200 UTC of 6. Moving westwards, it further intensified into a cyclonic storm and lay centred at 0300 UTC of 7 near Lat. 11.0° N / Long. 87.5° E and at 1200 UTC near Lat. 11.0° N / Long. 86.5° E. Then it drifted slightly southwestwards and lay centred at 0300 UTC of 8, near Lat. 10.5° N / Long. 86.0° E. Further moving westwards, it lay centred at 1200 UTC of 8, near Lat. 10.5° N / Long. 84.5° E; at 0300 UTC of 9, near Lat. 10.5° N / Long. 83.0° E and at 1200 UTC of 9, near Lat. 10.5° N / Long. 82.0° E. Continuing the westward movement, it weakened into a deep depression, which lay

centred near Lat. 10.5° N / Long. 80.0° E at 0000 UTC of 10 and crossed south Tamil Nadu coast close to Vedaranniyam at 0530 UTC of 10. It weakened into a depression and remained practically stationary, close to Vedaranniyam, at 1200 UTC of 10. Moving westwards, it further weakened into a low pressure area and lay over south Tamil Nadu, adjoining Kerala and neighbourhood on 11 morning and became less marked in the evening.

5.4.2. Satellite cloud features and other observations

The maximum intensity based on satellite imageries was T 3.5 from 0200 UTC of 8 to 0300 UTC of 10. "EYE" was observed in visible imagery at 0900 and 1000 UTC of 9 but CCC covered the eye, therefore its intensity was not upgraded. As per the storm account, the system crossed the south Tamil Nadu coast between 1300 UTC and 1400 UTC on 10.

The system was tracked by CDR Karaikal and DWR Chennai.

DWR Chennai – It observed some features of storm from 0000 UTC to 1743 UTC of 9 which were not consistent owing to the distance and intensity variations. The system features were marginally sufficient to estimate the vortex centre with fair/ poor degree of confidence. The only centre fixed by RADAR at 1741 UTC of 9 at Lat. 10.38° N / Long. 81.28° E was with fair confidence. The DWR products were disseminated by e-mail to IMD websites. The DWR was in continuous operation till 1743 UTC of 9.

CDR Karaikal – Continuous RADAR watch was maintained through the storm period. The observations indicated ill defined vortex except at two observations at 1600 and 1700 UTC of 9, when "open eye" was seen and the centre was fixed at Lat. 10.4° N / Long. 81.4° E and Lat. 10.4° N / Long. 81.3° E respectively with "Fair" confidence. Spiral bands were seen in most of the RADAR observations. RADAR pictures were transmitted using dial up INTERNET access. Many times due to slow access, image could not be transmitted on time.

5.4.3. Other features observed

The maximum estimated wind speed was 55 kts. The system moved in a westerly direction and crossed Tamil

Nadu coast near Vedaranniyam around 0600 UTC of 10. Maximum wind speed of 32 kts was observed at Karaikal.

5.4.4. *Weather and damage*

Northeast monsoon rainfall activity was significantly enhanced by this system and Tamil Nadu received widespread rainfall with scattered heavy to very heavy falls on 11 & 12 December. Rainfall activity was also realised in Andaman & Nicobar islands with isolated heavy falls on 27 & 28 November, during the formative stage of the system.

The chief amounts of rainfall in cms are :

Andaman & Nicobar islands

27 Nov 2005 : Hut Bay 9, Maya Bandar 5.

28 Nov 2005 : Port Blair 10, Hut Bay 6, Maya Bandar & Long islands 3 each.

Fairly widespread with isolated heavy rainfall occurred in north coastal Tamil Nadu and Andhra Pradesh on 3 and 4 December. Significant amounts of rainfall (cm) are given below :

Tamil Nadu

11 Dec 2005 : Ramanathpuram 35, Panruti 14, Senkottai 13, Pamban, Kamudhi & Madhukar 12 each, Kadaladi 11, Ambasamudram 10, Palayamkottai 7.

12 Dec 2005 : Ambasamudram 17, Senkottai 13, Paramakudi 12.

5.5. *Deep depression over southeast Bay (15 - 21 December 2005)*

5.5.1. *Life cycle*

A trough of low at sea level organised into a low pressure area over southeast Bay and adjoining south

Andaman Sea on 13. It moved over to southeast Bay on 14 morning and became well marked over there in the evening. It persisted over southeast Bay and neighbourhood on 15 morning and subsequently concentrated into a depression which lay centred near Lat. 8.0° N / Long. 87.0° E at 1200 UTC of 15. Moving westwards, it lay centred near Lat. 8.0° N / Long. 85.0° E at 0300 UTC of 16 and near Lat. 8.0° N / Long. 84.5° E at 1200 UTC of 16. Continuing its westward movement, it further intensified into a deep depression and lay centred at 0300 UTC of 17, near Lat. 8.0° N / Long. 84.0° E. Then it moved westnorthwestwards and lay centred near Lat. 8.5° N / Long. 83.5° E at 1200 UTC of 17. Thereafter, moving northwestwards it lay centred near Lat. 10.0° N / Long. 83.0° E at 0300 UTC of 18; near Lat. 10.5° N / Long. 82.5° E at 1200 UTC of 18 and near Lat. 11.0° N / Long. 82.5° E at 0300 and 1200 UTC of 19. It then started re-curving northeastwards and lay centred at Lat. 11.5° N / Long. 83.5° E at 0300 UTC of 20. Further moving northeastwards, it weakened into a depression and lay centred near Lat. 12.0° N / Long. 84.5° E during 1200 UTC of 20 to 1200 UTC of 21. It further weakened into a well-marked low pressure area over southwest Bay and adjoining westcentral Bay on 22 morning.

5.5.2. *Satellite cloud features and other observations*

The maximum intensity based on satellite imagery was T 2.0 from 0300 UTC of 16 to 0900 UTC of 20. The system was followed by CDR Karaikal and DWR Chennai.

From 0400 UTC to 0900 UTC on 19, the system features seen by the RADAR were prominent in the DWR at Chennai. Apparent vortex centres were reported on 19, 0600 & 0900 UTC as given below :

- (i) 190600 : Lat. 11.6° N/ Long. 82.5° E at Az 123°/ range 291 km.
- (ii) 190900 : Lat. 11.5° N/ Long. 82.5° E at Az 125°/ range 300 km.

5.5.3. *Other features observed*

The maximum estimated wind speed was 30 kts. The system moved initially in an easterly direction, then in a northnorthwesterly direction and finally re-curved northeastwards.

5.5.4. *Weather and damage*

The system did not cause significant damage to the Indian coast. Scattered rainfall was realised on 18 & 19 in Tamil Nadu.

The chief amounts of rainfall in cms are :

18 Dec 2005 : Chennai AP 6.

19 Dec 2005 : Chennai city 6.
