



## Cyclonic storms & Depressions over the north Indian Ocean during 2023

### 1. Introduction

During 2023, in all 9 intense low pressure systems formed over the Indian Seas. These include; three extremely severe cyclonic storm (MOCHA, BIPERJOY, TEJ), 1 very Severe Cyclonic Storms (HAMOON), 2 Severe Cyclonic Storms (MIDHILI, MICHAUNG), 1 Deep Depressions and 2 Depressions. Out of these 9 systems, 6 systems formed over the Bay of Bengal and 3 over Arabian Sea. One Depression and 1 Extremely Severe Cyclonic Storm formed over Bay of Bengal Pre monsoon season. Monsoon Season witnessed one Deep Depression and 1 Extremely severe cyclonic storm over Arabian sea and One deep depression over Bay of Bengal. One very Severe Cyclonic Storm and 2 Severe Cyclonic Storm formed over Bay of Bengal and 1 Extremely Severe Cyclonic Storm formed over Arabian sea in Post monsoon season.

The details of these systems are summarised in Table 1 and the tracks are shown in Fig. 1 (The tracks and intensities presented here are based on the provisional best track, subject to finalisation by the Track Finalisation committee).

### 2. Details of the systems during 2023

#### 2.1. Depression over southeast and adjoining southwest Bay of Bengal (30<sup>th</sup> January to 2<sup>nd</sup> February 2023)

2.1.1. Under the influence of cyclonic circulation over east equatorial Indian ocean and adjoining southeast Bay of Bengal, a **low pressure area** formed over the same region in the morning of 27<sup>th</sup> Jan. It lay over southeast Bay of Bengal and adjoining east equatorial Indian ocean with the associated cyclonic circulation extending upto mid tropospheric levels. It persisted there on 28<sup>th</sup> Jan. It lay as a **well marked low pressure area** over the same region in the morning of 29<sup>th</sup> Jan. and then persisted over the same region till 29<sup>th</sup> Jan. evening. It moved west-northwestwards and concentrated into a **Depression** and lay centered over southeast and adjoining southwest Bay of Bengal near Lat. 7.7° N / Long. 87.2° E at 0300 hrs UTC of 30<sup>th</sup> Jan. It moved nearly west-northwestwards

and lay centered over southwest and adjoining southeast Bay of Bengal near Lat. 8.0° N / Long. 86.0° E at 1200 hrs UTC of 30<sup>th</sup> Jan. It further moved nearly west-northwestwards and lay centered over southwest Bay of Bengal near Lat. 8.2° N / Long 84.7° E at 0000 hrs UTC of 31<sup>st</sup> Jan. It further moved nearly west-northwestwards and lay centered over the same region near Lat. 8.4° N / Long. 84.3° E at 0300 hrs UTC of 31<sup>st</sup> Jan. It persisted over the same region near Lat. 8.6° N / Long. 83.5° E at 1200 hrs UTC of 31<sup>st</sup> Jan. It moved west-southwestwards and lay centered over the same region near Lat. 8.2° N / Long. 82.6° E at 0300 hrs UTC of 1<sup>st</sup> Feb. It moved slowly westwards and lay centered over the same region near Lat. 8.2°N / Long. 82.3° E at 1200 hrs UTC of 1<sup>st</sup> Feb. It moved west-southwestwards and **crossed Sri Lanka coast between Batticaloa and Trincomalee near Lat. 7.8° N / Long. 81.6° E during 2200 to 2300 UTC of 1<sup>st</sup> Feb. (0330 to 0430 hours IST of the 2<sup>nd</sup>) as a depression.** Thereafter, it continued to move west-southwestwards lay centered over Sri Lanka near Lat. 7.6° N / Long. 81.4° E at 0000 hrs UTC of 2<sup>nd</sup> Feb. It further moved southwestwards and lay centered over south Sri Lanka near Lat. 7.2° N / Long. 81.1° E at 0300 hrs UTC of 2<sup>nd</sup> Feb. It further moved southwestwards and lay centered over the same region near Lat. 6.3° N / Long. 80.3° E at 1200 hrs UTC of 2<sup>nd</sup> Feb. It moved southwestwards and weakened into a well-marked low pressure area over Comorin and adjoining Gulf of Mannar and west coast of Sri Lanka at 1800 hrs UTC of 2<sup>nd</sup> Feb. and then lay over the same region with the associated cyclonic circulation extending upto mid-tropospheric levels. It lay as a low pressure area over Comorin area on 3<sup>rd</sup> Feb evening and then persisted over the same region with the associated cyclonic circulation extending upto 3.1 km above m. s. l. which became less marked at 1200 hrs UTC of 4<sup>th</sup> Feb. However, the associated cyclonic circulation extending upto 3.1 km above m. s. l. became less marked on 5<sup>th</sup>.

#### 2.1.2. Other features observed

The lowest estimated central pressure was 1004 hPa and estimated maximum sustained surface wind speed (MSW) was 25 knots during the depression.

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TABLE 1

Brief Summary of cyclonic storms and depressions over the Indian Seas and neighbourhood during 2023

S. No.	Category	Life Period	Place/Time of landfall	Lowest Estimated central Pressure (hPa)	Max. wind Estimated (kts)	C.I. No..
1	Depression over southeast and adjoining southwest Bay of Bengal	30 <sup>th</sup> Jan.– 2 <sup>nd</sup> Feb.	Crossed Sri Lanka coast between Batticaloa and Trincomalee near latitude 7.8° N and longitude 81.6° E during 2200 to 2300 UTC of 1st Feb (0330 to 0430 hours IST of the 2nd Feb) as a <b>depression</b> .	1004	25	1.5
2	Extremely Severe Cyclonic Storm ‘MOCHA’ over Bay of Bengal	9 <sup>th</sup> - 15 <sup>th</sup> May	Crossed North Myanmar – Southeast Bangladesh coasts between KYAUKPYU (Myanmar) and Cox’s Bazar (Bangladesh) close to North of Sittwe (Myanmar) near latitude 20.3 and longitude 92.8 during 0700 0900 UTC (1230 1430 hrs IST) of 14 <sup>th</sup> May as <b>ESCS</b> .	938	115	6.0
3	Extremely Severe Cyclonic Storm over Arabian Sea ‘BIPARJOY’	6 <sup>th</sup> - 19 <sup>th</sup> June	Crossed Saurashtra & Kutch and adjoining Pakistan coasts between Mandvi (Gujarat) and Karachi (Pakistan) close to Jakhau Port (Gujarat) near latitude 23.28° N and longitude 68.56° E during 1700 hours UTC and 1800 hours UTC. 15 Jun. as <b>VSCS</b> .	958	90	5.0
4	Deep Depression over northeast Bay of Bengal	1 <sup>st</sup> - 3 <sup>rd</sup> Aug	Crossed Bangladesh coast near latitude 21.9° N and longitude 90.3° E close to east of Khepupara, during 1000 to 1100 UTC on 1 <sup>st</sup> Aug. as <b>deep depression</b>	988	30	2.0
5	Depression over eastcentral Arabian Sea	30 <sup>th</sup> Sept. - 1 <sup>st</sup> OCT	Crossed South Konkan coast between Panjim and Ratnagiri during 1500 1700 UTC of 30 <sup>th</sup> Sept. as <b>depression</b>	1000	25	1.5
6	Extremely Severe Cyclonic Storm “TEJ” over the Arabian Sea	20 <sup>th</sup> – 24 <sup>th</sup> October	Crossed Yemen coast close to south of Al Ghaidah between 2100 UTC and 2200 UTC of 24 <sup>th</sup> Oct. near Lat. 15.9 N/ Long 52.2 E) as a <b>Severe Cyclonic Storm</b>	964	95	5.0
7	Very Severe Cyclonic Storm HAMOON” over westcentral Bay of Bengal	21 <sup>st</sup> – 25 <sup>th</sup> October	Crossed Bangladesh coast to the south of Chittagong near Lat. 21.9° N / Long. 91.9° E between 2100 hrs UTC and 2200 hrs UTC of 24 <sup>th</sup> Oct. as a <b>Cyclonic Storm</b>	984	65	4.0
8	Severe Cyclonic Storm “MIDHILI” over Bay of Bengal	15 <sup>th</sup> – 18 <sup>th</sup> November	Crossed Bangladesh coast close to east of Patuakhali near 22.3 deg N/90.5 deg E during 0900 1000 UTC of 17 <sup>th</sup> November as a <b>Severe Cyclonic Storm</b>	996	50	2.5
9	Severe Cyclonic Storm “MICHAUNG” over Bay of Bengal	1 <sup>st</sup> – 6 <sup>th</sup> December	Crossed South Andhra Pradesh coast close to south of Bapatla during 0700 0900 UTC (1230 1430 IST) of 5 <sup>th</sup> December near Lat 15.7 deg. N and Lon 80.3 deg. E as a <b>severe Cyclonic Storm</b>	986	55	3.5

**STORMS & DEPRESSIONS OVER THE NORTH INDIAN OCEAN DURING 2023**

**TABLE 2**

**Storms / Depressions statistics 2023**

Name of the system	Winter	Pre-Monsoon			Monsoon			Post-Monsoon			Total	
	Jan - Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov		Dec
<b>Over the Bay of Bengal</b>												
Depressions/deep depressions	1	-	-	-	-	-	1	-	-	-	-	2
Cyclonic storms	-	-	-	-	-	-	-	-	-	-	-	-
Severe cyclonic storms	-	-	-	-	-	-	-	-	-	1	1	2
Very severe cyclonic storms	-	-	-	-	-	-	-	-	1	-	-	1
Extremely severe cyclonic storms	-	-	-	1	-	-	-	-	-	-	-	1
Super cyclonic storms	-	-	-	-	-	-	-	-	-	-	-	-
<b>Land Depression</b>												
Depressions/deep depressions	-	-	-	-	-	-	-	-	-	-	-	-
<b>Over the Arabian Sea</b>												
Depressions/deep depressions	-	-	-	-	-	-	-	1	-	-	-	1
Cyclonic storms	-	-	-	-	-	-	-	-	-	-	-	-
Severe cyclonic storms	-	-	-	-	-	-	-	-	-	-	-	-
Very severe cyclonic storms	-	-	-	-	-	-	-	-	-	-	-	-
Extremely severe cyclonic storms	-	-	-	-	1	-	-	-	1	-	-	2
Super cyclonic storms	-	-	-	-	-	-	-	-	-	-	-	-
Grand total (Nos.)	1	-	-	1	1	-	1	1	2	1	1	9

**TABLE 3**

**Ships Observations during 1<sup>st</sup> January to 31<sup>st</sup> December, 2023**

Call Sign	Date/ Time (UTC)	Position of the Ship		Wind		Pressure PPPP (hPa)
		Lat. (Deg. N)	Long. (Deg. E)	Dir. (Deg.)	Speed (kts)	
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>(A) Extremely Severe Cyclonic Storm 'MOCHA' over Bay of Bengal - (9<sup>th</sup> May to 15<sup>th</sup> May 2023)</b>						
<b>3FOSS*</b>	090900	5.5	84.3	230	17	1006.8
<b>7KDL*</b>	090900	5.5	87.6	290	18	1005.5
<b>V7A5139*</b>	090900	6.1	93.4	180	16	1009.8
<b>3FOSS*</b>	091800	5.5	80.8	270	20	1009.8
<b>7KDL*</b>	091800	5.5	91.6	230	21	1005.8
<b>7KDL*</b>	100000	5.5	93.0	220	23	1006.3
<b>V7A5139*</b>	100000	5.9	87.3	260	26	1007.3
<b>7KHY*</b>	101800	5.4	84.9	240	26	1007.7
<b>9V6814*</b>	101800	5.3	80.6	270	20	-
<b>7KHY</b>	110000	5.4	86.3	300	33	1007.2
<b>7KHY</b>	110600	5.4	87.6	250	24	1010.7
<b>9V6814</b>	110600	5.5	83.3	230	25	1011.3
<b>9V6814</b>	111200	5.5	84.7	270	37	1010.3
<b>7KHY</b>	111800	5.3	90.2	250	24	1008.1
<b>2EIF7</b>	121800	5.6	82.6	230	20	1015.4
<b>2E2032</b>	121800	5.5	84.3	260	24	1008.9
<b>9V6814</b>	131200	5.5	87.4	270	19	1006.4

TABLE 2 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
DDOR2	131800	5.8	82.3	240	31	1009.5
9V3820	140000	5.7	88.6	260	18	1009.2
9V4V4	140000	5.6	90.8	240	15	1007.4
TBWUK75	141800	5.5	85.0	250	22	1010.2
VRZK9	150000	5.8	86.3	260	15	1011.7
TBWU	151800	5.5	81.5	260	21	1010.2
<b>(B) Extremely Severe Cyclonic Storm 'BIPARJOY' over Arabian Sea (6<sup>th</sup> June to 19<sup>th</sup> June 2023)</b>						
VTTR9*	060000	21.6	61.9	220	25	1005.0
VRQX5	061200	8.6	71.4	220	20	1012.0
AWWB	061200	8.4	76.3	300	31	1005.5
VR9E7	070000	21.5	63.8	260	17	1014.2
VROX5	071800	8.0	68.8	250	20	1013.0
7KIZ	080600	8.0	70.0	230	22	1010.3
VRQX5	080600	6.4	12.0	230	36	1014.0
9HY7	090600	6.4	21.8	220	18	1009.4
9HA5180	091800	9.3	64.9	250	20	1006.9
OYGN2	100600	6.4	13.4	240	35	1006.5
AUTP	101800	15.4	68.8	270	78	1004.0
AUTP	110600	15.2	67.2	230	48	1007.5
V7A5141	110000	13.6	71.2	220	26	1002.5
KAOU	120000	12.1	67.9	240	24	1002.7
TBW4K9	120600	9.7	68.4	240	39	1006.3
IBWUQ96	131200	12.1	60.8	230	30	1000.9
V7TM2	130600	16.4	70.1	220	32	1004.2
9V9926	141200	9.5	60.7	230	35	1007.0
TBWUK33	141800	8.9	60.6	230	23	1014.9
9V5241	150600	10.1	65.1	230	20	1010.0
TBWUK33	151800	14.9	60.6	240	30	1009.8
9V5241	160000	12.0	60.0	220	32	1007.0
TBWUK33	160600	17.8	60.6	230	35	1005.8
9V9450	170000	15.6	73.2	250	17	1007.4
<b>(C) Extremely Severe Cyclonic Storm "TEJ" over the Arabian Sea (20<sup>th</sup> to 24<sup>th</sup> October, 2023)</b>						
VRVI3*	200000	14.5	60.5	50	17	1011.7
VRVI3	210000	18.1	60.5	050	15	1014.7
V7A6073	220600	10.1	65.2	110	09	1016.7
2ICI4	230000	9.3	60.3	140	10	1011.4
VR005	230600	10.5	65.2	030	05	1001.0
3EPU6	240000	11.3	62.7	050	19	1008.
<b>D) Very Severe Cyclonic Storm "HAMOON" over westcentral Bay of Bengal (21<sup>st</sup> to 25<sup>th</sup> October 2023)</b>						
9V7931	211200	14.3	94.3	040	06	1011.0
9V7931	220000	17.1	93.1	140	09	1012.0
<b>E) Severe Cyclonic Storm "MIDHILI" over the Bay of Bengal (15th to 18th November, 2023)</b>						
Nil						
<b>F) Severe Cyclonic Storm "MICHAUNG" over the Bay of Bengal (1<sup>st</sup> to 6<sup>th</sup> December, 2023)</b>						
ONKK	050600	9.3	88.7	230	09	1009.0
ONKK	060600	12.0	84.3	180	10	1011.0

\* Observations during Depression/deep Depression

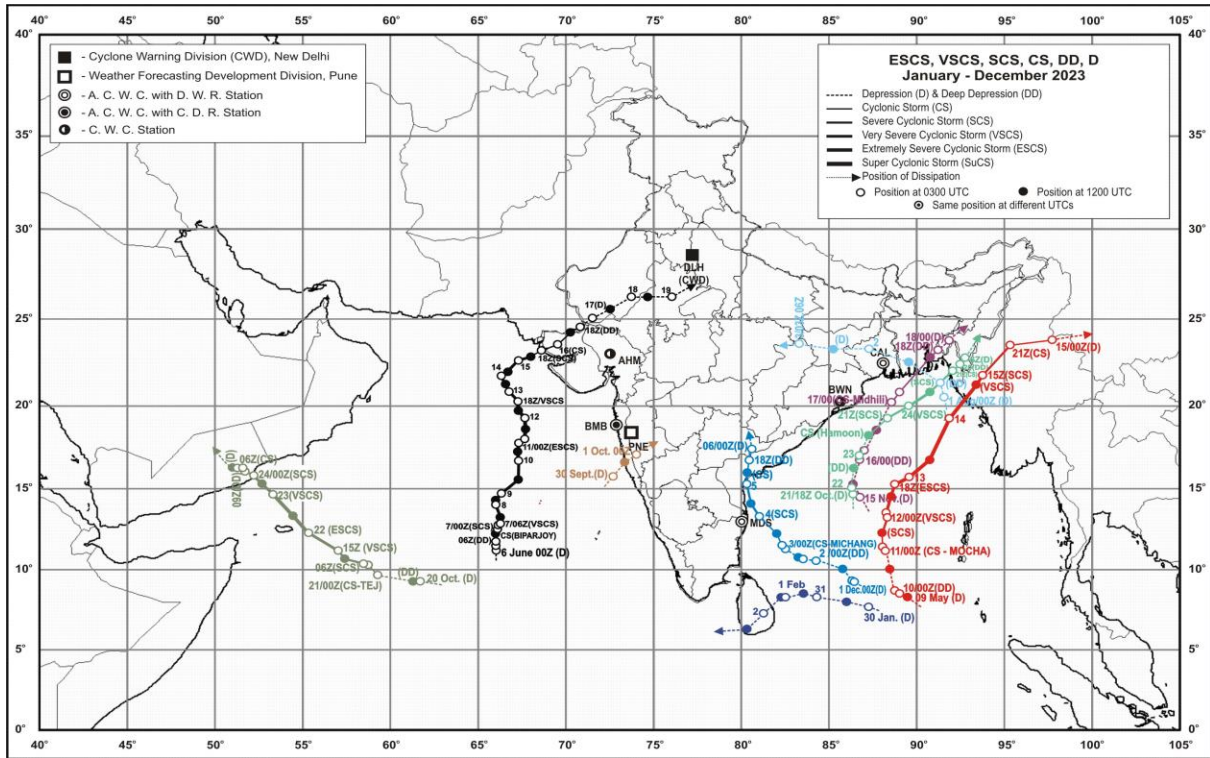


Fig. 1. Tracks of storms and depressions over during the year 2023

Rainfall associated with the depression: Light to moderate rainfall occurred at isolated places & heavy rainfall at isolated places over costal Tamil Nadu on 1<sup>st</sup> February. Light to moderate rainfall at a few places with heavy to very heavy rainfall at isolated places occurred over south Tamil Nadu and adjoining south Kerala on 2<sup>nd</sup> February.

2.1.3. Weather and damage caused

No damage was reported in association with this system over Sri Lanka and Tamil Nadu, India.

Chief amounts of 24 hrs rainfall ( $\geq 7$ cm) ending at 0300 hrs UTC of from 2<sup>nd</sup> - 3<sup>rd</sup> February are given below:

2<sup>nd</sup> February, 2023

**Tamil Nadu** Vedaranyam-7

3<sup>rd</sup> February, 2023

**Tamil Nadu,** Oothu (Dist Tirunelveli) 16, Nalumukku (Dist Tirunelveli) 13, Kakkachi (Dist Tirunelveli) 12, **Puducherry** Velankanni & Needamangalam 10 each, Nannilam, Nagapattinam & Tiruvarur 9 each, Tirupoondi 8 & Thirukuvalai each and **Karikal** Mannargudi, Adirampatnam, Vettikadu, Kodavasal, Neivasal Thenpathi, Ayyampettai, Orthanad & Devakottai 7 each.

2.2. Extremely Severe Cyclonic Storm ‘MOCHA’ over Bay of Bengal (9<sup>th</sup> May to 15<sup>th</sup> May 2023)

2.2.1. Under the influence of cyclonic circulation lay over southeast Bay of Bengal and neighbourhood, a low-pressure area formed over southeast Bay of Bengal and adjoining south Andaman sea with the associated cyclonic circulation extended upto mid tropospheric levels on 8<sup>th</sup> May. It became a well-marked low pressure area over the same region at 0000 hrs. UTC of 9<sup>th</sup> May and then persisted over the same region. It further concentrated into a **Depression** and lay centered over southeast Bay of Bengal near Lat. 8.3° N / Long. 89.5° E at 1200 hrs UTC of 9<sup>th</sup> May. It moved west-northwestward and intensified into a **Deep Depression** and lay centered over the same region near Lat. 8.5°N / Long. 89.0° E at 0000 hrs UTC of 10<sup>th</sup> May. It further moved northwestward and lay centered over the same region near Lat. 8.8° N / Long. 88.9° E at 0300 hrs UTC of 10<sup>th</sup> May. It moved north-northwestwards and lay centered over the same region near Lat. 10.0° N / Long. 88.4° E at 1200 hrs UTC of 10<sup>th</sup> May. It further moved north-northwestwards and intensified into a **Cyclonic Storm “Mocha” pronounced as “Mokha”** and lay centered over the same region near Lat. 11.2° N / Long 88.1° E at 0000 hrs UTC of 11<sup>th</sup> May. It moved north-northwestwards and lay centered over the same region

near Lat. 11.4° N / Long 88.0° E at 0300 hrs UTC of 11<sup>th</sup> May. It further moved northwards and intensified into a **Severe Cyclonic Storm** and lay centered over the same region near Lat 12.2° N / Long. 88.0° E at 1200 hrs UTC of 11<sup>th</sup> May. It moved northwards and intensified into a **Very Severe Cyclonic Storm** and lay centered over central and adjoining southeast Bay of Bengal near Lat. 13.2° N / Long. 88.1° E at 0000 hrs UTC of 12<sup>th</sup> May. It then moved north-northeastwards and lay centered over the same region near Lat. 13.6° N / Long. 88.2° E at 0300 hrs UTC of 12<sup>th</sup> May. It moved north-northeastwards and lay centered over central Bay of Bengal near lat. 14.0° N / Long. 88.3° E at 0600 hrs UTC of 12<sup>th</sup> May. It moved north-northeastwards and lay centered over the same region near Lat. 14.6° N / Long. 88.6° E at 1200 hrs UTC of 12<sup>th</sup> May. It moved nearly north-northeastwards and intensified into a **Extremely Severe Cyclonic Storm** over eastcentral Bay of Bengal and lay centered near Lat. 15.1° N / Long. 88.8° E at 1800 hrs UTC of 12<sup>th</sup> May. It moved nearly northeastwards and lay centered over the same region near Lat. 15.7° N / Long. 89.5° E at 0300 hrs UTC of 13<sup>th</sup> May. It moved nearly northeastwards lay centered over the same region near Lat. 16.4° N / long. 90.3° E at 0900 hrs UTC of 13<sup>th</sup> May. It moved nearly north-northeastwards and lay centered near Lat. 16.9° N / Long. 90.8° E at 1200 hrs UTC of 13<sup>th</sup> May. It further moved nearly north-northeastwards and lay centered over northeast and adjoining eastcentral Bay of Bengal near Lat. 18.7° N / Long. 91.5° E at 0000 hrs UTC of 14<sup>th</sup> May which further moved nearly north-northeastward and lay centered over the same region near Lat. 19.3° N / Long. 91.9° E at 0300 hrs UTC of 14<sup>th</sup> May. It moved north-northeastwards and **crossed north Myanmar-southeast Bangladesh coasts between Kyaukpyu (Myanmar) and Cox's Bazar (Bangladesh) close to north of Sittwe (Myanmar) near Lat 20.25° N / Long. 92.75° E as an Extremely Severe Cyclonic Storm during 0700 to 0900 hrs UTC of 14<sup>th</sup> May.** It lay centered over coastal Myanmar near Lat. 20.5° N / Long. 92.9° E at 0900 hrs UTC of 14<sup>th</sup> May. It moved north-northeastwards and weakened into a **Very Severe Cyclonic Storm** and lay centred over Myanmar near Lat. 21.1° N / Long. 93.3° E at 1200 hrs UTC of 14<sup>th</sup> May. It further moved north-northeastwards and weakened into a **Severe Cyclonic storm** and lay centred over Myanmar near Lat. 21.8° N / Long. 93.8° E at 1500 hrs UTC of 14<sup>th</sup> May which further moved north-northeastwards and weakened into a **Cyclonic Storm** and lay centred over Myanmar near Lat. 23.5° N / Long. 95.3° E at 2100 hrs UTC of 14<sup>th</sup> May. It moved east-northeastwards and rapidly weakened into a **Depression** and lay centred over Myanmar near Lat. 23.9° N / Long. 97.8° E at 0000 hrs UTC of 15<sup>th</sup> May and then moved southeastwards and weakened into a **well-marked low pressure area** which lay centered over northeast

Myanmar at 0300 hrs UTC of 15<sup>th</sup> May. It further weakened into a low pressure area and lay centred over the same area at 0900 hrs UTC of 15<sup>th</sup> May and then became unimportant for Indian region.

### 2.2.2. Other features observed

The estimated maximum sustained surface wind speed (MSW) was 115 knots at 1800 UTC of 13<sup>th</sup> May and maintained its peak intensity till 0000 UTC of 14<sup>th</sup> May. The estimated central pressure during this period was 938 hPa with pressure drop of about 66 hPa.

### 2.2.3. Weather and damage caused

As per media reports from Myanmar (Associated Press Television News, 19<sup>th</sup> May), the ESCS MOCHA caused 145 deaths in Myanmar. It caused widespread flash floods and power outages, extensive damage to buildings, cell phone towers, trees etc. in Myanmar. The adjoining areas of southeast Bangladesh also received the impact of "MOCHA". Many houses were damaged and trees fell because of strong winds and heavy rainfall. However, no death was reported from Bangladesh. In India, No damage has been reported from Andaman & Nicobar Islands. However, Mizoram state received the burnt from "ESCS MOCHA". Three deaths were reported from Mizoram due to landslides caused by heavy rain and strong winds over Mizoram.

## 2.3. Extremely Severe Cyclonic Storm 'BIPARJOY' over Arabian Sea (6<sup>th</sup> June to 19<sup>th</sup> June 2023)

2.3.1. Under the influence of cyclonic circulation lay over southeast Arabian sea, a **low-pressure area** formed over the same region with the associated cyclonic circulation extended upto mid-tropospheric levels on 5<sup>th</sup> June evening. It concentrated into a **Depression** over the same region and lay centered near Lat. 11.3° N / Long. 66.0° E at 0000 hrs UTC of 6<sup>th</sup> June. It then lay centered near Lat. 11.5° N / Long. 66.0° E over the same region at 0300 hrs UTC of 6<sup>th</sup> June. It moved nearly northwards and further intensified into a **Deep Depression** and lay centered over southeast and adjoining eastcentral Arabian sea near Lat. 11.9° N / Long. 66.0° E at 0600 hrs UTC of 6<sup>th</sup> June. It continued to move nearly northwards and intensified into a **Cyclonic Storm "Biparjoy" (pronounced as "Biporjoy")** and lay centered over eastcentral and adjoining southeast Arabian sea near Lat. 12.1° N / Long. 66.0° E at 1200 hrs UTC of 6<sup>th</sup> June. It further moved nearly northwards and intensified into a **Severe Cyclonic Storm** and lay centered over the same region near Lat. 12.6° N / Long. 66.1° E at 0000 hrs UTC of 7<sup>th</sup> June. It moved nearly north-northeastwards and lay centered over the same region near Lat. 12.7° N / Long.

66.2° E at 0300 hrs UTC of 7<sup>th</sup> June. It further moved nearly north-northeastwards and intensified into a **Very Severe Cyclonic Storm** and lay centered over the same region near Lat. 12.8° N / Long. 66.3° E at 0600 hrs UTC of 7<sup>th</sup> June. It moved nearly northwards and lay centered over the same region near Lat. 13.3° N / Long. 66.2° E at 1200 hrs UTC of 7<sup>th</sup> June. It further moved nearly northwards and lay centered over the same region near Lat. 14.0° N / Long. 66.0° E at 0300 hrs UTC of 8<sup>th</sup> June. It further moved nearly northwards and lay centered over the same region near Lat. 14.4° N / Long. 66.0° E at 1200 hrs UTC of 8<sup>th</sup> June. It moved slowly north-northeastwards and lay centered over the same region near Lat. 14.8° N / Long. 66.4° E at 0300 hrs UTC of 9<sup>th</sup> June. It moved northeastwards and lay centered over the same region near Lat. 15.5° N / Long. 67.1° E at 1200 hrs UTC of 9<sup>th</sup> June. It moved nearly northwards and lay centered over the same region near Lat. 16.5° N / Long. 67.4° E at 0000 hrs UTC of 10<sup>th</sup> June. It further moved nearly northwards and lay centered over the same region near Lat. 16.7° N / Long. 67.4° E at 0300 hrs UTC of 10<sup>th</sup> June. It again moved nearly northwards and lay centered over the same region near Lat. 17.1° N / Long. 67.3° E at 1200 hrs UTC of 10<sup>th</sup> June. It moved north-northeastwards and intensified into an **Extremely Severe Cyclonic Storm** and lay centered over the same region near Lat. 17.9° N / Long. 67.4° E at 0000 hrs UTC of 11<sup>th</sup> June. It moved north-northeastwards and lay centered over the same region near Lat. 18.0° N / Long. 67.6° E at 0300 hrs UTC of 11<sup>th</sup> June and moved nearly northwards and lay centered over the same region near Lat. 18.6° N / Long. 67.7° E at 1200 hrs UTC of 11<sup>th</sup> June. It moved northwards and lay centered over the eastcentral and adjoining northeast Arabian sea near Lat. 19.2° N / Long. 67.7° E at 0000 hrs UTC of 12<sup>th</sup> June. It further moved northwards and lay centered over the same region near Lat. 19.4° N / Long. 67.7° E at 0300 hrs UTC of 12<sup>th</sup> June. It moved nearly northwestwards and lay centered over the same region near Lat. 19.9° N / Long. 67.3° E at 1200 hrs UTC of 12<sup>th</sup> June. It weakened into a **Very Severe Cyclonic Storm “Biparjoy” (pronounced as “Biporjoy”)** over northeast and adjoining eastcentral Arabian sea near Lat. 20.1° N / Long. 67.2° E at 1800 hrs UTC of 12<sup>th</sup> June. It moved north-northwestwards and lay centered over the same region near Lat. 20.6° N / Long. 67.0° E at 0000 hrs UTC of 13<sup>th</sup> June. It further moved nearly north-northwestwards and lay centered over the same region near Lat. 20.9° N / Long. 66.9° E at 0300 hrs UTC of 13<sup>th</sup> June. It moved nearly northwestwards and lay centered over northeast Arabian sea near Lat. 21.0° N / Long. 66.7° E at 0600 hrs UTC of 13<sup>th</sup> June. It moved nearly north-northwestwards and lay centered over the same region near Lat. 21.3° N / Long. 66.5° E at 1200 hrs UTC of 13<sup>th</sup> June. It moved nearly northwards and lay centered over the same region near Lat. 21.9° N / Long.

66.3° E at 0000 hrs UTC of 14<sup>th</sup> June. It moved slowly northwards and lay centered over the same region near Lat. 21.9° N / Long. 66.3° E at 0300 hrs UTC of 14<sup>th</sup> June. It moved nearly northeastwards and lay centered over the same region near Lat. 21.9° N / Long. 66.5° E at 0900 hrs UTC of 14<sup>th</sup> June. It moved east-northeastwards and lay centered over the same region near Lat. 22.0° N / Long. 66.7° E at 1200 hrs UTC of 14<sup>th</sup> June. It moved north-northeastwards and lay centered over the same region near Lat. 22.5° N / Long. 67.0° E at 0000 hrs UTC of 15<sup>th</sup> June. It further moved north-northeastwards and lay centered over the same region near Lat. 22.6° N / Long. 67.1° E at 0300 hrs UTC of 15<sup>th</sup> June. It moved east-northeastwards and lay centered over the same region near Lat. 22.8° N / Long. 67.6° E at 0900 hrs UTC of 15<sup>th</sup> June. It moved nearly eastwards and lay centered over the same region near Lat. 22.9° N / Long. 68.0° E at 1200 hrs UTC of 15<sup>th</sup> June. It moved northeastwards and **crossed Saurashtra, Kutch and adjoining PakUTCan coasts between Mandvi (Gujarat) and Karachi (PakUTCan) close to Jakhau Port (Gujarat) between 1700 to 1800 hrs UTC of 15<sup>th</sup> June** and weakened into a **Severe Cyclonic Storm** over Saurashtra and Kutch at 1800 hrs UTC of 15<sup>th</sup> June. Continuing to move northeastwards, it lay centered over Saurashtra and Kutch near Lat. 23.6° N / Long. 69.2° E at 0000 hrs UTC of 16<sup>th</sup> June. It moved east-northeastwards and further weakened into a **Cyclonic Storm** and lay centered over the same region near Lat. 23.4° N / Long. 69.5° E at 0300 hrs UTC of 16<sup>th</sup> June. It moved nearly northeastwards and lay centered over the same region near Lat. 23.9° N / Long. 70.0° E at 0900 hrs UTC of 16<sup>th</sup> June. It moved nearly northeastwards and lay centered over Kutch and adjoining PakUTCan near Lat. 24.2° N / Long. 70.3° E at 1200 hrs UTC of 16<sup>th</sup> June. It moved northeastwards and lay centered over southeast PakUTCan, adjoining southwest Rajasthan and Kutch near Lat. 24.5° N / Long. 70.7° E at 1500 hrs UTC of 16<sup>th</sup> June. It moved nearly northeastwards and weakened into a **Deep Depression** and lay centered over the same region near Lat. 24.6° N / Long. 70.9° E at 1800 hrs UTC of 16<sup>th</sup> June. It moved east-northeastwards and lay centered over southwest Rajasthan, adjoining Gujarat and southeast PakUTCan near Lat. 24.7° N / Long. 71.2° E at 0000 hrs UTC of 17<sup>th</sup> June. It moved northeastwards and lay centered over the same region near Lat. 25.0° N / Long. 71.5° E at 0300 hrs UTC of 17<sup>th</sup> June. It moved northeastwards and lay centered over southwest Rajasthan and adjoining Gujarat near Lat. 25.3° N / Long. 71.9° E at 0600 hrs UTC of 17<sup>th</sup> June. It moved east-northeastwards and weakened into a **Depression** and lay centered over south Rajasthan and adjoining north Gujarat near Lat. 25.6° N / Long. 72.5° E at 1200 hrs UTC of 17<sup>th</sup> June. It moved east-northeastwards and lay centered over central parts of south Rajasthan and neighbourhood near Lat. 25.8° N / Long. 72.8° E at 1800 hrs UTC 17<sup>th</sup> June. It

moved east-northeastwards and lay centered over the same region near Lat. 26.2° N / Long. 73.8° E at 0300 hrs UTC of 18<sup>th</sup> June. It moved nearly eastwards and lay centered over central parts of east Rajasthan near Lat. 26.3° N / Long. 74.7° E. at 1200 hrs UTC of 18<sup>th</sup> June It moved nearly eastwards and weakened and lay centered as a **well marked low pressure area** over central parts of northeast Rajasthan and neighbourhood at 0300 hrs UTC of 19<sup>th</sup> June. It lay over northeast Rajasthan, adjoining areas of northwest Madhya Pradesh and southwest Uttar Pradesh on 19<sup>th</sup> evening. It further weakened into a **low pressure area** which lay over northwest Madhya Pradesh, adjoining areas of northeast Rajasthan and southwest Uttar Pradesh and then lay over southwest Uttar Pradesh, adjoining areas of northwest Madhya Pradesh and northeast Rajasthan with the associated cyclonic circulation extending upto middle tropospheric levels on 20<sup>th</sup> morning. It lay over central Uttar Pradesh with the associated cyclonic circulation extended upto middle tropospheric levels on 20<sup>th</sup> evening and then persisted over the same region.

### 2.3.2. Other features observed

**Maximum sustained wind speed and estimated central pressure:** The system reached its peak intensity of 90 knots at 0000 UTC of 11<sup>th</sup> June and maintained its peak intensity till 1500 UTC of 12<sup>th</sup> June. The estimated central pressure during this period was 958 hPa with pressure drop of about 40 hPa at the centre.

**Realised wind at different stations of Saurashtra and Kutch during landfall:** Dwarka reported 130 kmph, Kandla 115 kmph, Sikka 111 kmph and Mundra Port 102 kmph.

The system caused heavy to extremely heavy rainfall over Gujarat region and Saurashtra and Kutch on 13<sup>th</sup> and during 15<sup>th</sup> to 18<sup>th</sup> June, over Rajasthan during 16<sup>th</sup> to 20<sup>th</sup> June and heavy to very heavy rainfall over Madhya Pradesh during on 19<sup>th</sup> to 21<sup>st</sup> June

### 2.3.3. Weather and damage caused

As per available reports, no death was reported from Gujarat, 7 deaths were reported from Rajasthan due to heavy rain related incidents associated with Biparjyo cyclone.

Chief amounts of 24 hrs rainfall ( $\geq 7$ cm) ending at 0830 hours UTC of date the 13<sup>th</sup> - 20<sup>th</sup> June:

#### 13<sup>th</sup> June:

**Saura-shtra** Sutrapada (dUTC Gir Somnath) 21, Veraval (dUTC Gir Somnath) 20, Keshod (dUTC

**& Kutch** Junagadh) 20, Mendarda (dUTC Junagadh) 19, Malia (dUTC Junagadh) 18, Mangrol(j) (dUTC Junagadh) 14, Talala (dUTC Gir Somnath) 13, Vanthali (dUTC Junagadh) 12, Manavadar (dUTC Junagadh) 11, Junagarh\_aws (dUTC Junagadh) 10, Junagadh (dUTC Junagadh) 8, Porbandar (dUTC Porbandar) 8, Upleta (dUTC Rajkot) 8, Visavadar (dUTC Junagadh) 7, Bhanvad (dUTC Devbhoomi Dwarka) 7, Kutiana (dUTC Porbandar) 7.

#### 14<sup>th</sup> June:

**Saura-shtra** Khambhalia (dUTC Devbhoomi Dwarka) 12, Okha (dUTC Devbhoomi Dwarka) 11, **& Kutch** Kalyanpur (dUTC Devbhoomi Dwarka) 7, Dwarka (dUTC Devbhoomi Dwarka) 7, Upleta (dUTC Rajkot) 7, Jamjodhpur (dUTC Jamnagar) 7.

#### 15<sup>th</sup> June: Nil

#### 16<sup>th</sup> June:

**Gujarat Region** Wav (dUTC Banaskantha) 8,

Gandhidham (dUTC Kutch) 20, Kandla Airport (dUTC Kutch) 16, Dwarka (dUTC Devbhoomi Dwarka) 15, Anjar (dUTC Kutch), Bhuj (dUTC Kutch) & Mundra (dUTC Kutch) 13 each, Okha (dUTC Devbhoomi Dwarka) 11, Kandla New (dUTC Kutch) & Khambhalia (dUTC Devbhoomi Dwarka) 10 each, Jamjodhpur (dUTC Jamnagar) 9, Kalyanpur (dUTC Devbhoomi Dwarka) 8, Jamnagar (dUTC Jamnagar), Naliya (dUTC Kutch) & Kalavad (dUTC Jamnagar) 7 each. 13

#### 17<sup>th</sup> June

Okha (dUTC Devbhoomi Dwarka) 23, Anjar (dUTC Kutch) 22, Mandvi(k) (dUTC Kutch) 22, Bhachau (dUTC Kutch) 21, Mundra (dUTC Kutch) 19, Rapar (dUTC Kutch) 19, Nakhatrana (dUTC Kutch) 17, Kandla New (dUTC Kutch) 17, Jamnagar (dUTC Jamnagar) 16, Gandhidham (dUTC Kutch) 15, **& Kutch** Khambhalia (dUTC Devbhoomi Dwarka) 13, Bhuj (dUTC Kutch) 13, Kandla Airport (dUTC Kutch) 12, Ladhika (dUTC Rajkot) 11, Lakhpat (dUTC Kutch) 10, Kalavad (dUTC Jamnagar) 10, Chuda (dUTC Surendranagar) 10, Wankaner (dUTC Morbi) 9, Jodia (dUTC



Jamnagar) 9, Rajkot (dUTC Rajkot) 9, Tankara (dUTCMorbi) 8, Morbi (dUTC Morbi) 8, Dhrol (dUTC Jamnagar) 7, Abdasa (dUTC Kutch) 7, Targhadia (dUTC Rajkot) 7, Chotila (dUTC Surendranagar) 7, Halvad (dUTC Morbi) 7, Jamnagar (dUTC Jamnagar) 7.

**Gujarat Region**

Vadgam 11, Dhanera 11, Dantiwada 10, Deodar 9, Radhanpur 9, Vadali 9, Harij 9, Santalpur 8, Poshina 8, Bhabhar 8, Visnagar 8, Deesa 8, Suigam 8, Khedbrahma 8, Sami 7, Satlasana 7, Dantewadaaws 7, Dharoi Colony 7, Palanpur 7,

**West Rajasthan**

Mt. Abu (Sirohi) 21, Sedwa (Barmer) 14, Mounntabu Tehsil (Sirohi) 13, Raniwada (Jalore) 11, Bidasra (Churu) 8 and Reodar (Sirohi) 7.

**East Rajasthan**

Mounntabu Tehsil 13, Reodar 7.

**18<sup>th</sup> June:**

**Gujarat Region**

Amirgadh (dUTC Banaskantha) 21, Danta (dUTC Banaskantha) 17, Dhanera (dUTC Banaskantha) 16, Dantiwada (dUTC Banaskantha) 15, Poshina (dUTC Sabarkantha) 15, Palanpur (dUTC Banaskantha) 14, Santalpur (dUTC Patan) 13, Deesa (dUTC Banaskantha) 13

**Rajasthan**

Mounntabu (Sirohi) 36, Chitalwana (Jalore) 34, Raniwada (Jalore) 32, Jalore (Jalore) 32, Sheoganj (Sirohi) 31, Sanchore (Jalore) 30, Jaswantpur (Jalore), 29, Sumerpur (Pali) 27, Chotan (Barmer) 27, Dhorimanna (Barmer) 26, Rani (Pali) 25, Reodar (Sirohi) 24, Bali (Pali) 24, Siwana (Barmer) 24, Bagoda (Jalore) 23, Jawai Dam (Pali) 23, Abu Road (Sirohi) 20, Pali (Pali) 20, Samdari (Barmer) 20, Sedwa (Barmer) 19, Dhanau (Barmer) 18, Balotra (Barmer) 18, Desuri (Pali) 18, Pindwara (Sirohi) 18, Bhinmal (Jalore) 17, Deogarh (Rajsamand) 15, Guddamalan (Barmer) 14, Marwar (Pali) 13, Junction Pachbhadra (Barmer) 13, Sirohi (Sirohi) 13, Kubhalgarh (Rajsamand) 12, Gadhbor (Rajsamand) 12, Gogunda (Udaipur) 12, Bhadrajun (Jalore) 11, Ahore (Jalore) 10, Kotda (Udaipur) 10, Nokda (Barmer) 9, Jodhpur (Jodhpur) 9, Luni (Jodhpur) 9, Kalyanpur (Barmer) 9, Sindhari (Barmer) 9, Jodhpur (Jodhpur) 9, Rohat (Pali) 9, Baitu (Barmer) 8, Sayla (Jalore) 8, Sojat (Pali) 8, Amet (Rajsamand) 7, Ramsar (Barmer) 7, Todgarh (Ajmer) 7

**19<sup>th</sup> June:**

**Gujarat Region**

Danta (dUTC Banaskantha) 13, Amirgadh (dUTC Banaskantha) 9, Khedbrahma (dUTC Sabarkantha) 8, Vijaynagar (dUTC Sabarkantha) 7,

**East Rajasthan**

Sheoganj (dUTC Sirohi) 35, Nagrafort (dUTC Tonk) 31, Deogarh (dUTC Rajsamand) 27, Kumbhalgarh (dUTC Rajsamand) 25, Amet (dUTC Rajsamand) 24, Rajsamand (dUTC Rajsamand) 22, Ajmer Tehsil (dUTC Ajmer) 16, Reodar (dUTC Sirohi) 15, Srinagar (dUTC Ajmer) 15, Pushkar (dUTC Ajmer) 15, Deoli (dUTC Tonk) 15, Nainwa (dUTC Bundi) 14, Mandal (dUTC Bhilwara) 13, Ajmer (dUTC Ajmer) 13, Tonk Tehsil (dUTC Tonk) 13, Piplu (dUTC Tonk) 13, Kekri (dUTC Ajmer) 12, Nasirabad (dUTC Ajmer) 11, Railmagra (dUTC Rajsamand) 11, Pindwara (dUTC Sirohi) 11, Abu Road (dUTC Sirohi) 11, Gegal (dUTC Ajmer) 11, Jawaja (dUTC Ajmer) 11, Tatgarh (dUTC Ajmer) 10, Bhinay (dUTC Ajmer) 9, Bhim (dUTC Rajsamand) 9, Kishangarh (dUTC Ajmer) 9, Niwai (dUTC Tonk) 9, Jahazpur (dUTC Bhilwara) 9, Nathdwara (dUTC Rajsamand) 9, Sahada (dUTC Bhilwara) 9, Raipur (dUTC Bhilwara) 9, Uniara / Aligarh (dUTC Tonk) 8, Asind (dUTC Bhilwara) 8, Gogunda (dUTC Udaipur) 8, Arai (dUTC Ajmer) 8, Todaraisingh (dUTC Tonk) 8, Sirohi (dUTC Sirohi) 8, Geola (dUTC Ajmer) 8, Sarwar (dUTC Ajmer) 8, Mangliawas (dUTC Ajmer) 7, Rashmi (dUTC Chittorgarh) 7, Pisagan (dUTC Ajmer) 7, Hurda (dUTC Bhilwara) 7, Kotda (dUTC Udaipur) 7, Tonk Vanasthali (dUTC Tonk) 7, Malpura (dUTC Tonk) 7, Hindoli (dUTC Bundi) 7, Vijaynagar (dUTC Ajmer) 7.

**West Rajasthan**

Desuri (dUTC Pali) 38, Sumerpur (dUTC Pali) 28, Erinpura/jawai Dam (dUTC Pali) 24, Bali (dUTC Pali) 19, Ahore Sr (dUTC Jalore) 17, Marwar Junction (dUTC Pali) 14, Jalore (dUTC Jalore) 9, Jaswantpura (dUTC Jalore) 8, Merta City (dUTC Nagaur) 8, Bilara (dUTC Jodhpur) 7, Pali (dUTC Pali) 7.

**West Madhya Pradesh**

Ratlam 7

**20<sup>th</sup> June:**

**East Rajasthan**

Dholpur Tehsil (dUTC Dholpur) 19, Ajmer (dUTC Ajmer) 15, Banera (dUTC Bhilwara) 12, Kishangarh (dUTC Ajmer) 11, Ajmer Tehsil (dUTC Ajmer) 11, Nasirabad (dUTC

Ajmer) 11

**West Madhya Pradesh** Ater (dUTC Bhind) 14, Morena (dUTC Morena) 13, Gormi (dUTC Bhind) 12, Ambah (dUTC Morena) 12, Badoda (dUTC Sheopur) 10,

**West Uttar Pradesh** Khairagar 13.

#### 2.4. *Deep Depression over northeast Bay of Bengal (1<sup>st</sup> Aug to 3<sup>rd</sup> Aug 2023)*

2.4.1. Under the influence cyclonic circulation westcentral and adjoining northwest Bay of Bengal off north Andhra Pradesh-south Odisha coasts, a **low pressure area** formed over the same region on 24<sup>th</sup> Jul. evening. It intensified into a **well marked low pressure area** over the same region on 25<sup>th</sup> Jul. morning and then persisted over the same region with the associated cyclonic circulation extending upto 7.6 km above m. s. l. on 25<sup>th</sup> Aug. It persisted there on 26<sup>th</sup> Jul. It lay over south Odisha, adjoining north coastal Andhra Pradesh and neighbourhood on 27<sup>th</sup> Jul. morning and then weakened into a low pressure area over the same region with the associated cyclonic circulation extended upto 7.6 km above m.s. l. on 27<sup>th</sup> Jul. It lay over interior Odisha and adjoining Chhattisgarh on 27<sup>th</sup> Jul. evening and lay over north Odisha and neighbourhood on 28<sup>th</sup> Jul. morning which then became less marked. However, the associated cyclonic circulation lay over north Odisha, adjoining areas of Gangetic West Bengal and Jharkhand which extended upto 5.8 km above m. s. l. tilting southwards with height on 28<sup>th</sup> Jul. It lay over Gangetic West Bengal and adjoining north Odisha on 29<sup>th</sup> Jul. morning. Under its influence, a low pressure area formed over north Odisha and adjoining south Gangetic West Bengal coast with the associated cyclonic circulation extending upto 5.8 km above m. s. l. tilting southwestwards with height on 29<sup>th</sup> Jul. It lay over northwest Bay of Bengal and adjoining north Odisha and West Bengal coasts with the associated cyclonic circulation extended upto 7.6 km above m. s. l. tilting southwestwards with height on 30<sup>th</sup> Jul. It lay as a well marked low pressure area over central parts of north Bay of Bengal on 31<sup>st</sup> Jul morning and then persisted with the associated cyclonic circulation extending upto 9.5 km above m. s. l on 31<sup>st</sup> July. It then concentrated into a **Depression** and lay centered over northeast Bay of Bengal near Lat. 20.5° N / Long. 91.5° E at 0000 hrs UTC of 1<sup>st</sup> Aug. It moved north-northwestwards and intensified into a **Deep Depression** and lay centred over the northeast Bay of Bengal off Bangladesh coast near Lat. 21.2° N / Long. 91.2° E at 0300 hrs UTC of 1<sup>st</sup> Aug. It moved west-northwestwards and **crossed Bangladesh coast near Lat.**

**21.9° N / long. 90.3° E close to east of Khepupara during 1000 to 1100 hrs UTC as a deep depression of 1<sup>st</sup> Aug.** Continuing to move west-northwestwards, it lay centred over coastal Bangladesh and neighbourhood near Lat. 22.5° N / Long. 89.5° E at 1200 hrs UTC of 1<sup>st</sup> Aug. It further moved west-northwestwards and lay centred over Gangetic West Bengal near Lat. 23.1° N/Long. 87.2° E, close to Bankura (West Bengal) at 0000 hrs UTC of 2<sup>nd</sup> Aug. It continued to move west-northwestwards and lay centred over the same region near Lat. 23.2° N / Long. 87.1° E, close to Bankura (West Bengal), about 70 km east-southeast of Purulia (West Bengal) at 0300 hrs UTC of 2<sup>nd</sup> Aug. It moved west-northwestwards and lay centred over Gangetic West Bengal and adjoining Jharkhand near Lat. 23.3° N / Long. 86.3° E at 0600 hrs UTC of 2<sup>nd</sup> Aug. It moved westwards and weakened into a **Depression** over Jharkhand and lay centred near Lat. 23.3° N / Long. 85.1° E at 1200 hrs UTC of 2<sup>nd</sup> Aug. It moved westwards and lay centred over Jharkhand and adjoining north Chhattisgarh near Lat. 23.3° N / Long. 84.1° E at 1800 hrs UTC of 2<sup>nd</sup> Aug. It moved west-northwestwards and lay centred over north Chhattisgarh and neighbourhood near Lat. 23.4° N / Long. 83.4° E at 0000 hrs UTC of 3<sup>rd</sup> Aug. It moved west-northwestwards and lay centred over the same region near Lat.23.5° N / Long. 83.1° E at 0300 hrs UTC of 3<sup>rd</sup> Aug. It remained practically stationary and weakened into a **well marked low pressure area** over the same region at 1200 hrs UTC of 3<sup>rd</sup> Aug. It lay over north Chhattisgarh, adjoining northeast Madhya Pradesh-southeast Uttar Pradesh at 0000 hrs UTC of 4<sup>th</sup> Aug. and then weakened into a **low pressure area** over northeast Madhya Pradesh and neighbourhood with the associated cyclonic circulation extending upto 7.6 km above m. s. l. on 4<sup>th</sup> Aug. It persisted there on 5<sup>th</sup> which became less marked on 6<sup>th</sup>.

#### 2.4.2. *Other features observed*

The estimated central pressure was 988 hPa during 0300 UTC of 1<sup>st</sup> Aug. to 0600 UTC of 2<sup>nd</sup> Aug. and maximum sustained wind speed was 30 knots during 0300 UTC of 1<sup>st</sup> Aug. to 0300 UTC of 2<sup>nd</sup> Aug.

It is seen that light to moderate rainfall occurred at isolated places & heavy to very heavy rainfall at isolated places over costal Odisha, costal Andhra Pradesh & West Bengal on 1<sup>st</sup> August. Light to moderate rainfall at a few places with heavy to very heavy rainfall at isolated places occurred over Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh and Odisha on 2<sup>nd</sup> August.

#### 2.4.3. *Weather and damage caused*

No damage was reported in association with this system.

Chief amounts of 24 hrs rainfall ( $\geq 7$ cm) ending at 0830 hours UTC of date the 1<sup>st</sup> Aug. to 3<sup>rd</sup> Aug.:

**1<sup>st</sup> August** Bhubaneswar 26, Satyabadi 11, Kantapada 10, Tihidi 10, Bhuban 10, Bhandaripokhari 9, Puri 9, Chandbali 9, Pipili 9, Jatni 9, Cuttack 8, Rairangpur 8, Rajkanika 8, Barpalli 7, Lahunipara 7, Banki 7, Udala 7, Gop 7, Tigiria 7

Boudhgarh 39, Jujumura 36, Rairakhol 35, Karanjia 30, Sharpada 28, Birmaharajpur 27, Thakurmunda 26, Ullunda 26, Athmalik 23, Rajkishorenagar 23, Binika 23, Agalpur 22, Phiringia 22, Khairamal 22, Joshipur 22, Sonepur 21, Dunguripalli 21, Raruana 21, Baliguda 21, Sukruli 21, K Nuagaon 21, Phulbani 21, Salebhatta 20, Madanpur Rampur 19, Kirmira 19, Kolabira 19, Kusumi 19, Telkoi 19, Jamda 19, Bijepur 19, Khaira 19, Tensa 17, Bolangir 17, Swam Patna 17, Gaisilet 17, Ambadola 17, Kantamal 16, Oupada 16, Pallahara 16, Bangamunda 16, Laikera 16, Tarva 16, Belgaon 15, Keonjargarh 15, Angul 15, Kaptipada 15, Barpalli 15, Daitari 15, Chakapad 15, Talcher 15, Banspal 15, Bhawanipatna 15, Bhuban 15, Bahalda 15, Soro 14, Harabhanga 14, Naktideul 14, Komna 14, Balasore 14,

**2<sup>nd</sup> August** Kotagarh 14, Bhograi 13, Khajuripada 13, Chendipada 13, Nh5 Gobindpur 13, Sohela 13, Tikabali 13, Hindol 13, Rajghat 13, Gudvela 13, Kantapada 12, Loisingha 12, Narla 12, Ghatagaon 12, Padmapur 12, Basudevapur 12, Padampur 12, Raikia 12, Danagadi 12, Joda 12, Lanjigarh 12, Hatadihi 11, Rengali 11, Bijatala 11, Rasagovindapur 11, Jamankira 11, Champua 11, Udala 11, Remuna 11, Jenapur 11, Ghasipura 11, Kalinga 11, Deogaon (District: Bolangir) 11, Rairangpur 10, Parjang 10, Jhumpura 10, Turekela 10, Bahanga 10, Nawana 10, Jharbandh 10, Sukinda 10, Anandpur 10, Realmal 10, Tikarpara 9, Muruda 9, Golamunda 9, Paikmal 9, Bargarh 9, Bonth 9, Nilgiri 9, Karlamunda 9, Kesinga 9, Harichandanpur 9, Kankadahad 9, Altuma 9, Kamakhyanagar 9, Batagaon 9, Gop 9, Titlagarh 9, Gondia 8, Tiring 8, Banarpal 8, Patnagarh 8, Jajpur 8, Daringibadi 8, Chandikhol 8, Jajpur Pto 8, Korei 8, Bari 8, Dharmagarh 8, Nawapara 8, Bangiriposi 8, Ambabhona 7, Sinapali 7, Th Rampur 7, Saintala 7, G Udayagiri 7, Barmul 7, Barkote 7, Banaigarh 7, Gania 7, Khariar 7, Betanati

7, Bhandaripokhari 7, Junagarh 7, Banki 7, Lahunipara 7, Boden 7, Akhuapada 7, Kotraguda 7, Belpada 7, Bhadrak 7, Atabira 7, Jaipur 7, Samakhunta 7, Balipatna 7

**3<sup>rd</sup> August** Kutra 20, Panposh 19, Rourkela 18, Mandiradam 17, Rajgangapur 16, Baragaon 15, Binika 14, Nawana 13, Lephripara 12, Dharakote 12, Karlamunda 11, Birmaharajpur 10, Narsinghpur 10, Kantamal 10, Rampur 10, Kirmara 10, Bamra 10, Balishankara 10, Dhankauda 9, Hemgiri 9, Lakhampur 9, Gania 9, Deogaon 9, Barmul 9, Athamalik 9, Lamataput 9, Kanhia 9, Padampur 9, Padmapur 9, Tangarpali 9, K. Nuagaon 9, Nandapur 9, Sundergarh 8, Jharsuguda 8, Komna 8, Lathkata 8, Sambalpur 8, R.K.Nagar 8, Bhapur 8, Harabhanga 7, Naktideul 7, Jharbandh 7, Banarpal 7, Patnagarh 7, Nuagaon 7, Gudvela 7, Banspal 7, Titilagarh 7, Talcher 7 Burla 7, Batagaon 7.

## 2.5. Depression over eastcentral Arabian Sea (30<sup>th</sup> Sept. to 1<sup>st</sup> Oct. 2023)

2.5.1. Under the influence of cyclonic circulation over north coastal Karnataka and neighbourhood, a **low pressure area** formed over eastcentral Arabian sea off south Konkan-Goa coasts on 29<sup>th</sup> Sept. morning and then persisted over the same region with the associated cyclonic circulation extending upto 7.6 km above m.s. l. on 29<sup>th</sup> Sept. It lay as a **well marked low pressure area** over the same region on 30<sup>th</sup> Sept. morning and intensified into a **Depression** over the same region and lay centred near Lat. 15.9° N / Long. 72.8° E at 0300 hrs UTC of 30<sup>th</sup> Sept. It moved north-northeastwards and lay centered over eastcentral Arabian sea close to south Konkan coast, near Lat. 16.6° N / Long. 73.2° E at 1200 hrs UTC of 30<sup>th</sup> Sept. It moved nearly northeastwards and **crossed south Konkan coast between Panjim (Goa) and Ratnagiri (Maharashtra) during 1500-1700 hrs UTC of 30<sup>th</sup> Sept.** It moved east-northeastwards and lay centered over south Konkan near Lat. 17.0° N / Long. 74.0° E at 0000 hrs UTC of 1<sup>st</sup> Oct. It moved northeastwards and weakened into a **well-marked low pressure area** over south Madhya Maharashtra and neighbourhood at 0300 hrs UTC of 1<sup>st</sup> Oct. It lay as a **low pressure area** over the same region on 2<sup>nd</sup> Oct. morning and then became less marked. However, the remnant associated cyclonic circulation lay over central parts of Madhya Maharashtra extending between 4.5 and 7.6 km above m.s. l. on 2<sup>nd</sup> Oct. which became less marked on 3<sup>rd</sup> Oct.

2.5.2. *Other features observed*

The estimated central pressure was 1002 hPa and maximum sustained wind speed was 25 knots during the system.

The spatial distribution of rainfall during 28<sup>th</sup> Sep to 04<sup>th</sup> Oct clearly showed the rainfall belts over Goa, Kerala, Maharashtra & Kerala region due to the depression. It also indicates higher rainfall activity in the southwest sector of the system.

2.5.3. *Weather and damage caused*

No damage was reported in association with this system.

*Chief amounts of 24 hrs rainfall ( $\geq 7$ cm) ending at 0300 hrs UTC of from 30<sup>th</sup> Sept.-2<sup>nd</sup> Oct.:*

**Konkan & Goa**

<b>28 Sep</b>	Lanja 13; Kudal and Canacona 9; Sangameshwar Devrukh 7;
<b>29 Sep</b>	Dabolim N.a.s. Navy 12; Margao 11; Mormugao Pmo IMD 10; Panjim 8; Ponda and Mapusa 7;
<b>30 Sep</b>	Mapusa 13; Margao 11; Ponda, Pernem, Canacona and Quepem 10 each; Panjim, Dodamarg, Dabolim N.a.s. Navy and Sanguem 9 each; Sawantwadi 8; Kudal and Mormugao Pmo IMD 7.
<b>1 Oct</b>	Ratnagiri 13; Roha & Sudhagad Pali 12; Sawantwadi 9; Mapusa, Pernem and Murud 8; Tala, Dodamarg and Sanguem 7;
<b>2 Oct</b>	Sangameshwar Devrukh 16; Wakwali ARG 13; Poladpur & Mandangad 12; Khed 11; Ratnagiri 10; Shriwardhan & Dapoli ARG 9; Harnai IMD 8; Chiplun, Guhagarh & Lanja 7;

2.6. *Extremely Severe Cyclonic Storm “TEJ” over the Arabian Sea (20<sup>th</sup> to 24<sup>th</sup> October, 2023)*

2.6.1. The **low pressure area** over southeast and adjoining eastcentral Arabian sea moved nearly westwards and lay over southeast and adjoining southwest Arabian sea at 0300 hrs UTC of 19<sup>th</sup> Oct. It persisted over the same region on 19<sup>th</sup> Oct. evening. It moved nearly westwards and lay as a **well marked low pressure area** over southwest Arabian Sea at 1800 hrs UTC of 19<sup>th</sup> Oct. It then concentrated into a **Depression** and lay centered over southwest Arabian sea near Lat. 9.3° N / Long. 61.7° E at 0300 hrs UTC of 20<sup>th</sup> Oct. It moved west northwestwards

and intensified into **Deep Depression** and lay centered over the same region near Lat. 9.4° N / Long. 61.3° E at 1200 hrs UTC of 20<sup>th</sup> Oct. It moved west northwestwards and intensified into a **Cyclonic Storm “Tej” (pronounced as Tej)** and lay centered over the same region near Lat 9.9° N / Long. 59.4° E. at 0000 hrs UTC of 21<sup>st</sup> Oct. It moved west northwestwards and lay centered over the same region near Lat. 10.1° N / Long. 58.8° E at 0300 hrs UTC of 21<sup>st</sup> Oct. It moved west northwestwards and intensified into a **Severe Cyclonic Storm** and lay centered over the same region near Lat. 10.2° N / Long. 58.3° E at 0600 hrs UTC of 21<sup>st</sup> Oct. It moved northwestwards and intensified into a **Very severe Cyclonic Storm** and lay centered over the same region near Lat. 11.1° N / Long. 57.0° E at 1500 hrs UTC of 21<sup>st</sup> Oct. It further moved northwestwards and lay centered over the westcentral and adjoining southwest Arabian Sea near Lat. 12.0° N / Long. 56.0° E at 0000 hrs UTC of 22<sup>nd</sup> Oct. It further intensified into an **Extremely Severe Cyclonic Storm**; moved northwestwards and lay centered over the same region near Lat. 12.3° N / Long. 55.4° E at 0300 hrs UTC of 22<sup>nd</sup> Oct. It moved northwestwards and lay centered over the same region near Lat. 12.6° N / Long. 55.1° E at 0600 hrs UTC of 22<sup>nd</sup> Oct. It moved northwestwards and lay centered over westcentral Arabian sea near Lat. 13.3° N / Long. 54.4° E at 1200 hrs UTC of 22<sup>nd</sup> Oct. It continued to move northwestwards and weakened into a **Very Severe Cyclonic Storm** and lay centered over westcentral Arabian sea near Lat. 14.6° N / Long. 53.2° E about 230 km north northwest of Socotra (Yemen). at 0300 hrs UTC of 23<sup>rd</sup> Oct. It moved north northwestwards and lay centered over the westcentral Arabian sea very close to Yemen coast near Lat. 15.8°N / Long. 52.3° E at 1800 hrs UTC of 23<sup>rd</sup>. Oct. It **crossed Yemen coast near Lat. 15.9° N / Long. 52.2° E close to south of Al Ghaidah between 2100 hrs UTC and 2200 hrs UTC of 24<sup>th</sup> Oct. as a Very Severe Cyclonic Storm** with maximum sustained wind speed reaching 125-135 kmph gusting to 150 kmph. It then continued to move north westward and weakened into a **Severe Cyclonic Storm** and lay centered over coastal Yemen near Lat. 15.9° N / longitude 52.1° E at 0000 hrs UTC of 24<sup>th</sup> Oct. It moved west northwestward and lay centered at 0830 hrs UTC of 24<sup>th</sup> over the same region near Lat. 16.0° N / Long. 51.8° E. It moved west northwestward and weakened into a **Cyclonic Storm** and lay centered over Yemen, near Lat. 16.1° N / Long. 51.5° E at 0600 hrs UTC of 24<sup>th</sup> Oct. It moved west northwestwards and weakened into a **Deep Depression** and lay centered over Yemen near Lat. 16.1° N / Long. 51.3° E at 0900 hrs UTC of 24<sup>th</sup> Oct. It moved west northwestward and weakened into a **Depression** and lay centered over Yemen near Lat. 16.2° N / Long. 51.0° E at 1200 hrs UTC of 24<sup>th</sup> Oct. It moved west northwestward and weakened into a **well marked low pressure area** over the same region at 1500

hrs UTC of 24<sup>th</sup> Oct. It further moved west northwestwards and weakened into a **low pressure area** over the same region at 0000 hrs UTC of 25<sup>th</sup> Oct. with the associated cyclonic circulation extending upto mid tropospheric levels and then became unimportant.

#### 2.6.2. Other features observed

Estimated Central Pressure (hPa) was 964 hPa with pressure drop of about 44 hPa during 0300 to 1800 hrs UTC of 22<sup>th</sup> Oct. The estimated maximum sustained surface wind speed was 95 kts during during 0300 to 1800 hrs UTC of 22<sup>th</sup> Oct. Estimated the MSW of 120 130 kmph gusting to 145 kmph (65 knots gusting to 75 knots) were observed during landfall.

#### 2.6.3. Weather and damage caused

As per media reports from Yemen, ESCS TEJ caused 2 deaths in Yemen. It caused widespread floods and power outages, extensive damage to buildings, cell phone towers, trees *etc.* in Yemen.

### 2.7. Very Severe Cyclonic Storm "HAMOON" over westcentral Bay of Bengal (21<sup>st</sup> to 25<sup>th</sup> October 2023)

2.7.1. Under the influence of cyclonic circulation in lower tropospheric levels over southeast Bay of Bengal, a **low pressure area** formed over southwest and adjoining southeast Bay of Bengal on 20<sup>th</sup> morning. It then persisted over the same region till 20<sup>th</sup> Oct. evening with the associated cyclonic circulation extending upto mid tropospheric levels. It lay over southeast and adjoining eastcentral Bay of Bengal at 0000 hours UTC of 21<sup>st</sup> Oct. It moved northwestwards and lay as a **well marked low pressure area** over southeast and adjoining central Bay of Bengal at 0300 hrs UTC of 21<sup>st</sup> Oct. It moved slowly northwestwards and lay over westcentral and adjoining south Bay of Bengal at 0900 hours UTC of 21<sup>st</sup>. It further moved slowly northwestwards and concentrated into a **Depression** and lay centered over westcentral Bay of Bengal near Lat. 14.7°N / Long. 86.4°E at 1800 hrs UTC of 21<sup>st</sup> Oct. It moved west northwestwards and lay centered at 0830 hrs UTC of 22<sup>nd</sup> Oct. over the same region near Lat. 15.0° N / Long. 86.2° E. It moved nearly northwards and lay centered at 1130 hrs UTC of 22<sup>nd</sup> over the same region near Lat. 15.3° N / Long. 86.2° E. It moved nearly northwards and intensified into a **Deep Depression** and lay centered over the same region near Lat. 16.2° N / Long. 86.4° E at 1200 hrs UTC of 22<sup>nd</sup> Oct. It moved northeastwards and lay centered over westcentral Bay of Bengal near Lat. 16.7° N / Long. 86.7° E at 0000 hrs UTC of 23<sup>rd</sup> Oct. It moved northeastwards and lay centered over the same region near Lat. 17.0° N / Long.

86.8° E at 0300 hrs UTC of 23<sup>rd</sup> Oct. It moved north northeastwards and intensified into a **Cyclonic Storm "Hamoon" (pronounced as Hamoon)** and lay centered over the same region near Lat. 18.3° N / Long. 87.3° E at 1200 hrs UTC of 23<sup>rd</sup> Oct. It moved north northeastwards and lay centered over northwest and adjoining westcentral Bay of Bengal near Lat. 18.7° N / Long. 87.6° E at 1500 hrs UTC of 23<sup>rd</sup> Oct. It further moved northeastwards and intensified into a **Severe Cyclonic Storm** and lay centered over northwest Bay of Bengal near Lat. 19.3° N / Long. 88.4° E at 2100 hrs UTC of 23<sup>rd</sup> Oct. It moved east northeastwards and intensified into a **Very Severe Cyclonic Storm** and lay centered over northwest and adjoining northeast Bay of Bengal near Lat. 20.0° N / Long. 89.5° E at 0300 hrs UTC of 24<sup>th</sup> Oct. It moved east northeastwards and lay centered over the northeast and adjoining northwest Bay of Bengal near Lat. 20.6° N / Long. 90.2° E at 0900 hrs UTC of 24<sup>th</sup> Oct. It moved northeastwards and weakened into a **Severe Cyclonic Storm** and lay centered over northeast Bay of Bengal near Lat. 20.9° N / Long. 90.8° E at 1200 hrs UTC of 24<sup>th</sup> Oct. It moved northeastwards and weakened into a **Cyclonic Storm** and **crossed Bangladesh coast to the south of Chittagong near Lat. 21.9° N / Long. 91.9° E between 2100 hrs UTC and 2200 hrs UTC of 24<sup>th</sup> Oct. as a Cyclonic Storm** with wind speed of 75 85 kmph gusting to 95 kmph and then lay centered over coastal Bangladesh near Lat. 22.2° N / Long. 92.2° E at 0000 hrs UTC of 25<sup>th</sup> Oct. It moved nearly northeastwards and weakened into a **Deep Depression** and lay centered over southeast Bangladesh and adjoining Mizoram near Lat 22.4° N / Long. 92.4° E at 0300 hrs UTC of 25<sup>th</sup> Oct. It moved nearly north northeastwards and weakened into a **Depression** and lay centered over Mizoram near Lat. 22.7° N / Long. 92.7° E at 0600 hrs UTC of 25<sup>th</sup> Oct. It moved nearly north northeastwards and weakened into a **well marked low pressure area** and lay centered over north Mizoram and adjoining Manipur & Myanmar at 1200 hrs UTC of 25<sup>th</sup> Oct. which became less marked on 26<sup>th</sup> morning. However, the associated cyclonic circulation over north Myanmar and neighbourhood extending upto 3.1 km above m. s. l. persisted on 26<sup>th</sup> Oct. which became less marked on 27<sup>th</sup>.

#### 2.7.2. Other features observed

Estimated lowest Central Pressure (hPa) was 985 hPa and estimated maximum sustained surface wind speed was 65 kts on 24<sup>th</sup> Oct.

#### 2.7.3. Weather and damage caused

As per media reports from Bangladesh, VSCS Hamoon caused 3 deaths in Bangladesh. It caused widespread floods and power outages, extensive damage to buildings, cell phone towers, trees *etc.* in Bangladesh.

2.8. *Severe Cyclonic Storm “MIDHILI” over the Bay of Bengal (15<sup>th</sup> to 18<sup>th</sup> November, 2023)*

2.8.1. Under the influence of cyclonic circulation over Andaman Nicobar Islands and adjoining areas of Andaman and southeast Bay of Bengal extending upto upper tropospheric levels, a **low pressure area** formed over southeast Bay of Bengal and adjoining Andaman Nicobar Islands on 14<sup>th</sup> Nov. at 0000 hrs UTC. It persisted over the same region. It moved west northwestwards with the associated cyclonic circulation extending upto upper tropospheric levels. It lay as a **well marked low pressure area** over southeast and adjoining central Bay of Bengal at 1200 hrs UTC of 14<sup>th</sup> Nov. and then it lay over westcentral and adjoining areas of eastcentral and south Bay of Bengal at 0000 hrs UTC of 15<sup>th</sup> Nov. with the associated cyclonic circulation extending upto upper tropospheric levels. It further moved west northwestwards and concentrated into a **Depression** and lay centred over westcentral Bay of Bengal near Lat. 14.5° N / Long. 86.8° E at 0830 hrs UTC of 15<sup>th</sup> Nov. It moved northwestwards and lay centred over the same region near Lat 14.7° N / Long 86.5° E at 0600 hrs UTC on 15<sup>th</sup> Nov. and then moved north northwestwards and lay centred over the same region near Lat 15.3° N / Long 86.4° E at 1200 hrs UTC on 15<sup>th</sup> Nov. It further moved north northeastwards and intensified into a **Deep Depression** and lay centred over westcentral Bay of Bengal near Lat 16.9° N / Long 86.8° E at 0000 hrs UTC on 17<sup>th</sup> Nov. It further moved north northeastwards and lay centred over westcentral Bay of Bengal near Lat. 17.4° N / Long. 87.0° E at 0300 hrs UTC on 16<sup>th</sup> Nov. It further moved north northeastwards and lay centred over westcentral Bay of Bengal near Lat. 17.9° N / Long. 87.3° E at 0600 hrs UTC on 16<sup>th</sup> Nov. and then moved north northeastward and lay centred over northwest and adjoining westcentral Bay of Bengal near Lat. 18.6° N / Long. 87.7° E at 1200 hrs UTC on 16<sup>th</sup> Nov. It further moved north northeastwards and lay centred at over northwest Bay of Bengal near Lat. 19.1° N / Long. 88.0° E 1800 hrs UTC on 16<sup>th</sup> Nov. It moved north northeastwards and intensified into a **Cyclonic storm “Midhili” (pronounced as “Midhili”)** and lay centered over northwest Bay of Bengal near Lat. 20.1° N / Long. 88.5° E at 0000 hrs UTC on 17<sup>th</sup> Nov. It further moved north northeastwards and lay centered over northwest and adjoining northeast Bay of Bengal near Lat. 20.8° N / Long. 89.0° E at 0300 hrs UTC on 17<sup>th</sup> Nov. It moved north northeastwards and concentrated as **severe cyclonic storm** and lay centered over northeast and adjoining northwest Bay of Bengal close to Bangladesh coast near Lat. 21.8° N / Long. 90.0° E at 0900 hrs UTC on 17<sup>th</sup> Nov. It moved north northeastwards and **crossed Bangladesh coast near Khepupara during 0900 to 1000 hrs UTC of 17<sup>th</sup> Nov. It then continued to move north northeastwards across the islands of Bangladesh**

**weakened as a Cyclonic Storm** and lay centered over coastal Bangladesh near Lat. 22.8° N / Long. 90.8° E at 1200 hrs UTC on the 17<sup>th</sup> Nov. Further it moved north northeastwards and weakened into a **Deep Depression** and lay centered over Tripura and adjoining Bangladesh near Lat. 23.3° N / Long. 91.3° E at 1800 hrs UTC on 17<sup>th</sup> Nov. It moved northeastwards, weakened into a **Depression** and lay centered over Tripura and adjoining Bangladesh and Mizoram near Lat. 23.7° N / Long. 91.7° E at 0000 hrs UTC on 18<sup>th</sup> Nov. It moved northeastwards and weakened into a **low pressure area** over north Tripura and neighbourhood at 0300 hrs UTC on the 18<sup>th</sup> Nov. which became less marked on the evening of 18<sup>th</sup>.

2.8.2. *Other features observed*

Estimated lowest Central Pressure (hPa) was 986 hPa and estimated maximum sustained surface wind speed was 50 kts at 0900 UTC of 17<sup>th</sup> Nov.

2.8.3. *Realized Weather*

According to an official report in Tripura, the storm fully damaged 12 houses, severely damaged 72 houses and partly damaged 255 houses. The cyclone accompanied by rainfall also damaged crops in various parts of the state but luckily there was no report of any loss of life. The total loss occurred by the cyclonic storm could not be ascertained till the last information came in. Sources said, Sadar is one among the 23 sub divisions to receive the highest rainfall on Friday 17 Nov. All the rivers were flowing below the expected flood level till Saturday evening. Meanwhile, moderate to dense fog occurred at isolated pockets over all districts of Tripura till morning of November 19.

As per media reports from Bangladesh, Cyclone Midhili wreaked havoc across the coastal districts of Chattogram, Cox's Bazar, Noakhali, Feni, and Lakshmipur, damaging crops, primarily affecting Aman paddy and winter vegetables. It caused widespread floods and power outages, extensive damage to buildings, cell phone towers, trees etc. in Bangladesh.

Chief amounts of 24 hrs rainfall ( $\geq 7$ cm) ending at 0300 hrs UTC for 18 Nov.

**18 Nov:**

Kvk South 15; Amarpur 14; Kanchanpur 13; Lengpui, Kvk Dhalai, Gokulpur AWS and Agartala AP 11; Lawngtlai ARG, Sonamura, Arundhutinagar and Lembuchhera10; Kolasib ARG and Dharmanagar/Panisagar 9; Udaipur and Khowai 8; Kamalpur, Serchip (hydro),

Saiha ARG, Bishalgarh and Kailashahar AP 7.

2.9. *Severe Cyclonic Storm “MICHAUNG” over the Bay of Bengal (1<sup>st</sup> to 6<sup>th</sup> December, 2023)*

2.9.1. Under the influence cyclonic circulation south Andaman sea and adjoining Thailand, a **low pressure area** formed over south Andaman sea and adjoining Malacca strait on 27<sup>th</sup> Nov. It moved westwards and lay over south Andaman sea on 28<sup>th</sup> Nov. and lay over south Andaman sea and adjoining southeast Bay of Bengal on evening of 28<sup>th</sup> Nov. and then lay as a **well marked low pressure area** over the same region. It lay over southeast Bay of Bengal and adjoining south Andaman sea on the morning of 29<sup>th</sup> Nov. and then persisted over the same region on 29<sup>th</sup> Nov. It moved west northwestwards and lay over southeast Bay of Bengal at 0300 hrs UTC of 30<sup>th</sup> Nov. It moved west northwestwards and concentrated into a **Depression** and lay centered over southeast and adjoining southwest Bay of Bengal near Lat. 9.1° N / Long. 86.4° E at 0000 hrs UTC on 1<sup>st</sup> Dec. It moved northwestwards and lay centered over the same region near Lat. 9.3° N / Long. 86.2° E at 0300 hrs UTC of 1<sup>st</sup> Dec. It moved west northwestwards and lay centered over southwest Bay of Bengal near Lat. 10.0° N / Long. 85.7° E at 1200 hrs UTC on 1<sup>st</sup> Dec. It further moved west northwestwards and intensified into a **Deep Depression** and lay centered over the same region near Lat. 10.5° N / Long. 84.1° E at 0000 hrs UTC on 2<sup>nd</sup> Dec. It moved west northwestwards and lay centered over the same region near Lat. 10.6° N / Long. 83.6° E at 0300 hrs UTC on 2<sup>nd</sup> Dec. It moved west northwestwards and lay centered over the same region near Lat. 10.7° N / Long. 83.2° E at 0600 hrs UTC on 2<sup>nd</sup> Dec. It moved west northwestwards and lay centered over the same region near Lat. 10.9° N / Long. 83.1° E at 1200 hrs UTC on 2<sup>nd</sup> Dec. It further moved northwestwards and intensified into a **Cyclonic Storm “MICHAUNG” (pronounced as MIGJAUM)** and lay centered over the same region near Lat. 11.4° N / Long. 82.5° E at 0000 hrs UTC on 3<sup>rd</sup> Dec. It moved northwestwards and lay centered over the same region near Lat. 11.5° N / Long. 82.4° E at 0300 hrs UTC on 3<sup>rd</sup> Dec. It moved northwestwards and lay centered over the same region near Lat. 11.8° N / Long. 82.2° E at 0600 hrs UTC on 3<sup>rd</sup> Dec. It moved north northwestwards and lay centered over the same region near Lat. 12.4° N / Long. 81.9° E at 1500 hrs UTC on 3<sup>rd</sup> Dec. It moved north northwestwards and lay centered over the southwest and adjoining westcentral Bay of Bengal near Lat. 13.0° N / Long. 81.4° E at 2100 hrs UTC on 3<sup>rd</sup> Dec. It moved northwestwards and lay centered over westcentral and adjoining southwest Bay of Bengal off south Andhra Pradesh and adjoining north Tamil Nadu coast near Lat. 13.2° N / Long. 81.2° E at 0000 hrs UTC on 4<sup>th</sup> Dec. It

moved northwestwards and further intensified into a **Severe Cyclonic Storm** and lay centered over the same region near Lat. 13.3° N / Long. 81.0° E at 0300 hrs UTC on 4<sup>th</sup> Dec. It moved northwestwards and lay centered over westcentral Bay of Bengal off south Andhra Pradesh coast near Lat. 14.0° N / Long. 80.5° E at 1200 hrs UTC on 4<sup>th</sup> Dec. It moved northwards and lay centered over westcentral Bay of Bengal off south Andhra Pradesh coast near Lat. 14.9° N / Long. 80.2° E at 0000 hrs UTC on 5<sup>th</sup> Dec. It moved northwards and lay centered over the same region near Lat. 15.2° N / Long. 80.25° E at 0300 hrs UTC on 5<sup>th</sup> Dec. It moved northwards and **crossed south Andhra Pradesh coast close to south of Bapatla during 0700 to 0900 hrs UTC on 5<sup>th</sup> Dec as a Severe Cyclonic Storm with maximum sustained wind speed of 90 100 kmph.** It lay centered over south coastal Andhra Pradesh near Lat. 15.8° N / Long. 80.3° E at 0900 hrs UTC on 5<sup>th</sup> Dec. It moved nearly northwards and weakened into a **Cyclonic Storm** at 1000 hrs UTC and lay centered over south Coastal Andhra Pradesh near Lat. 16.0° N / Long. 80.3° E at 1200 hrs UTC on 5<sup>th</sup> Dec. It moved northwards and lay centered over central coastal Andhra Pradesh near Lat. 16.4° N / Long. 80.4° E at 1500 hrs UTC on 5<sup>th</sup> Dec. It moved nearly northwards and weakened into a **Deep Depression** over central Coastal Andhra Pradesh and lay centered over central coastal Andhra Pradesh near Lat. 16.8° N / Long. 80.4° E at 1800 hrs UTC on 5<sup>th</sup> Dec. It moved nearly northwards and weakened into a **Depression** and lay centered near Lat. 17.4° N / Long. 80.5° E over northeast Telangana and adjoining south Chhattisgarh south interior Odisha Coastal Andhra Pradesh at 0000 hrs UTC on 6<sup>th</sup> Dec. It further weakened into a **well marked low pressure area** over the same region and the associated cyclonic circulation extended upto 5.8 km above m. s. l. on 6<sup>th</sup> Dec.

2.9.2. *Other features observed*

Estimated lowest Central Pressure (hPa) was 986 hPa and estimated maximum sustained surface wind speed was 55 kts during 1200 to 1500 UTC of 4<sup>th</sup> Dec.

Realised wind reported at different stations of Andhra Pradesh :

(i) Krishnapatnam Port reported 103 kmph gusting to 115 kmph on 4<sup>th</sup> December, 2023.

(ii) MO Bapatla reported 1400/38kt (75 kmph) at 1430 hours IST on 5<sup>th</sup> December 2023.

(iii) Kavali High Wind Speed Recorder reported 2700/36kts (70 kmph) at 1644 hours IST of 04<sup>th</sup> December 2023.

Realised wind reported at different stations of Tamil Nadu :

(i) High Wind Speed Recorder at Chennai (NBK) recorded wind speed of about 75 kmph (40-45 knots) in gusts during early hours to noon of 04th December 2023.

(ii) NBK Anemograph recorded wind speed of 60-70 kmph in gusts during this period.

(iii) MBK recorded wind speed of 80-90 kmph in gusts during this period.

(iv) NBK AWS 30 kt (56 kmph) on 04th / 14:15 IST.

(v) MBK AWS 37 kt (68 kmph) on 04th / 10:30 IST.

(vi) Ennore AWS recorded 43 knots (80 kmph) on 04th / 19:45 IST (75 kmph) in gusts

### 2.9.3. Weather and damage caused

As per media reports, 17 persons were killed in various incidents associated with “Michaung” in Tamil Nadu and two in Andhra Pradesh. More than 41,000 people were evacuated and temporarily relocated, including 32,158 in Tamil Nadu and 9,500 in Andhra Pradesh. Schools and offices were closed due to heavy rains and flooding in Chennai. In Andhra Pradesh, crop damage and losses were reported due to the flooding of fields.

Chief amounts of 24 hrs rainfall ( $\geq 7$ cm) ending at 0830 hours UTC of date the 27<sup>th</sup> Nov. - 20<sup>th</sup> June 13<sup>th</sup> June: Saurashtra & Kutch:

It caused heavy rainfall over Nicobar Islands, Tamil Nadu, Andhra Pradesh, Odisha, Jharkhand, Gangetic West Bengal, Telangana and Mizoram

### 27<sup>th</sup> Nov. 2023

**Andaman & Nicobar Islands** Car Nicobar 8

### 3<sup>rd</sup> Dec. 2023

**Tamil Nadu & Puducherry** Pallipattu 15; Uthukottai 13; Thenkasi 11; Zone 12 Alandhur & Ponneri 10 each; Tiruttani, Avadi & Wallajah 9 each; Meenambakkam, Anna University, Zone 12, Meenambakkam, Alandur, Chennai(AP), Zone 14, Perungudi, Oothu, Shencottah, Tiruvallur, Anna University, Zone 12 D156

Mugalivakkam & Thamaraiykkam 8 each; Zone 11 Valasaravakkam, Gundar Dam, Zone 10 Kodambakkam, Zone 14 U41 Perungudi, Nalumukku, Cholavaram, Tambaram, Zone 13 U39 Adyar, Zone 09 Ice House, Papanasam, VIT\_Chennai, MGR Nagar, Zone 09 Teynampet & Kakkachi 7 each;

**Rayalaseema** Thottambedu 15, Srikalahasti 14, Tirupati Aero 13, Satyavedu 10, Nagari & Tada 9 each, Sullurpeta, Gudur 8 each;

**Coastal Andhra Pradesh** Nellore 7

### 4<sup>th</sup> Dec, 2023

**Rayalaseema** Sullurpeta 20; Tada 19; Gudur 14; Srikalahasti, Thottambedu & Satyavedu 13 each; Nagari 12, Tirupati Aero 7;

**Coastal Andhra Pradesh** Nellore 19;

Zone 14 Perungudi 29; Avadi 28; Alandur & Chennai (AP) 25 each; Zone 13 Adyar, Meenambakkam AWS, Zone 12 Meenambakkam, Chennai (N), Puzhal & Cholavaram 23 each; Mahabalipuram, MGR Nagar, Zone 10 Kodambakkam & CD Hospital Tondiarpet 22 each; Zone 11 Valasaravakkam, Zone 15 Sholinganallur, DGP Office, Pallikaranai, Chennai (N), Anna University & Ponneri 21 each; Zone 03 Puzhal, Perambur, Zone 09 Ice House & Red Hills 20 each; Ayanavaram Taluk Office, Taramani, Satyabama Uty, Anna Nagar & VIT\_Chennai 19 each, Chennai Collector Office, Sholinganallur), Zone 09 Teynampet, Zone 08 Malar Colony, Ambattur, Anna University, Valasaravakkam, Good Will School Villivakkam, YMCA Nandnam, KVK Kattukuppam, Thamaraiykkam & Kodambakkam 18 each; Gummidipoondi, Tambaram, Ambathur 2 & Kelambakkam 17 each; Zone 06 T.V.K Nagar, Zone 04 Tondiarpet, Chembarappakkam, Teynampet, Tiruvallur, Zone 01 Kathivakkam, ThiruViKa Nagar & Zone 03 Madhavaram 16 each & Uthukottai, Zone 08 Anna Nagar, Sholinganallur, Tirur KVK, Zone 06 Kolathur, Tondiarpet, Zone 14 Perungudi & Ennore 15 each, Zone 07 Ambattur, Zone 13 Adyar Eco Park, Zone 05 GCC, Poonamallee,

**Tamil Nadu, Puducherry & Karaikal**



Thirukalukundram, Zone 12 Alandhur & Koratur 14 each; Sriperumbudur, Thirupporur, Zone 02 Manali, Zone U39 Adyar & Chembarabakkam 13 each; Mugalivakkam, Kundrathur, Chengalpattu, Zone 15 Uthandi, Royapuram & Zone 07 U18 D81 Vanagaram 12 each; Zone 05 Royapuram & Zone U32 Maduravoyal 11 each; Poondi & Tiruttani 10 each; Thiruvottiyur, Maduranthagam, Thiruvallangadu, Kancheepuram, Uthiramerur & Cheyyur 9 each; Walajabad, Minnal, Arakonam & Marakkanam 8 each; Thiruvottiyur 7

**5<sup>th</sup> Dec, 2023**

**Tamil Nadu**

Poonamallee 34; Avadi 28; KVK Kattukuppam 27; Chennai (N), Chennai(N) AWS & Tambaram 24 each & Mahabalipuram & Zone 09 Ice House 22 each; Royapuram, Zone 13 Adyar, ThiruViKa Nagar, Zone 05 GCC, Zone 10 Kodambakkam & Chembarapakkam\_Rev 21 each; Zone 15 Sholinganallur, Taramani, Meenambakkam, Chennai (AP), Kundrathur, Thamaraipakkam, Kodambakkam & Tiru KVK 19 each, Teynampet, Valasaravakkam, Tiruvallur, Anna University & Zone 11 Valasaravakkam 18 each, Uthukottai, NIOT\_Pallikaranai, Ponneri, Sriperumbudur & Koratur 17 each; Kelambakkam 16; Cholavaram 15; Thiruvallangadu, Poondi, Alandur & Thirupporur 14 each; Red Hills 13; Zone Alandhur, Tiruttani, Gummidipoondi & Chembarabakkam\_CMWSSB 12 each; Thirukalukundram, Pechiparai & Zone 05 Royapuram 11 each; Minnal & Zone 04 Tondiarpet 10 each; Chengalpattu, Zone 12 D156 Mugalivakkam, Wallajah, Perunchani Dam & Tiruttani PTO 9 each; Zone 03 Puzhal, Puthan Dam, Panapakkam 12 & Zone 09 Teynampet 8 each, R.K.Pet, Walajabad, Pallipattu, Vembakkam, Sholingur & Kuzhithurai 7 each;

**Coastal Andhra Pradesh**

Bapatla 22; Nellore 22; Rapur 21; Atmakur 19; Amalapuram, Addanki & Karamchedu 17 each; Masulipatnam Cdr 16; Kavali 15; Avanigada & Vinjamur 14 each, Udayagiri 13; Ongole 12; Repalle & Kandukur 11 each; Konakanamitla, Gudivada, Santhamaguluru 9 each; Tenali, Kakinada & Yanam 8 each, Marrisudi, Veligandla,

Mundlamuru, Guntur, Seetharamapuram, Tanuku, Vijayawada & Peddapuram 7 each;

**Rayalseema**

Gudur 28; Srikalahasti 24 & Kodur 24 each; Thottambedu, Sullurpeta & Penagaluru 23 each; Tadapati 20; Venkatagiri 18; Satyavedu 14; Nagari & Tirupati Aero 13 each; Rajampet 12; Atlur 9; Badvel 8; Gurramkonda, Kalakada, Sambepalle, Royachoti, Pakala, Pullampeta, Chinnamandem & Cuddapah 7 each

**6<sup>th</sup> Dec, 2023**

**Telangana**

Aswaraopeta 34; Palawancha 25; Chandrugonda 23; Kothagudem 22; Julurpad & Mulakalapalle 20 each, Aswapuram 19; Burgampadu 18 & Bhadrachalam 18 each; Sathupalle 16; Tekulapalle 15; Madhira & Enkuru 14 each; Bonakal 13; Manuguru & Wyra Kvk 12 each; Pinapaka & Thollada 10 each; Konijerla 9; Gundala 8; Venkatapur, Chinthakam & Yellandu 7 each;

**Coastal Andhra Pradesh**

Bhimadole 24; Kukunoor 22; Narsapuram 21 & Chintalapudi 21; Narsipatnam, Bheemavaram & Koyyalagudem 20 each; Amalapuram, Anakapalle, Kunavaram & Yelamanchili 19 each; Sattenapalle & Palakoderu 18 each; Tanuku 17; Kaikalur, Prathipadu, Santhamaguluru & Polavaram 16 each; Chodavaram, Visakhapatnam, Denkada & Chintur 15 each; Tadepalligudem, Darsi & Kakinada 14 each; Anakapalle, Velairpad, Srungavarapukota & Tiruvuru 13 each; Tuni, Chintapalle, Mentada, Paderu & Nuzvid 12 each; Nandigama, Eluru, Vararamachandrapur, Guntur, Bondapalle, Gajapathinagaram, Vepada & Amaravati 11 each; Vizianagaram, Bheemuniapatnam, Mangalagiri, Piduguralla, Araku Valley & Yanam 10 each; Pusapatirega, Peddapuram, Addanki, Gantyada, Mundlamuru & Lam 9 each; Podili, Atchampet, Vijayawada, Garividi & Ranastalam 8 each; Nellimarla, Jangamaheswarapuram, Cheepurupalle, Visakhapatnam & Gudivada 7 each;

**Tamil Nadu** Virudunagar, Ponnamaravathi, Natham, Singampunari, Sathiar, Arimalam 7 each;

**Odisha** Pottangi 11; Similiguda 9; Koraput 7.

**7<sup>th</sup> Dec.**

Coastal Yelamanchili (dist Anakapalli) 7,

**Andhra Pradesh** Chodavaram (dist Anakapalli) 7, Araku Valley (dist Alluri Sitharamaraju) 7

**8<sup>th</sup> Dec.**

**Gangetic west Bengal** Phulberia 7, Jharkhand: Kharsema 7

**Mizoram** Champhai 8, Lengpui 8, Serchip 7, Lenglui 7

**Gangetic West Bengal** Burdwan 7

