

## Cyclones and depressions over the north Indian Ocean during 2017\*

### 1. Introduction

During 2017, in all 10 intense low pressure systems formed over the Indian Seas. These include; one Very Severe Cyclonic Storm (Ockhi), 1 Severe Cyclonic Storm (Mora), 1 Cyclonic Storm (Maarutha), 3 Deep Depressions and 4 Depressions. Out of these 10 systems, 8 systems formed over the Bay of Bengal and two over Land. One Cyclonic Storm & one Severe Cyclonic Storm formed over the Bay of Bengal in Pre-monsoon season. Monsoon Season witnessed one Deep depression & one depression each over the Bay of Bengal and one land depression.

The details of these systems are summarised in Tables 1, 2 & 3 and the tracks are shown in Fig. 1.

### 2. Details of the systems

#### 2.1. Cyclonic Storm 'MAARUTHA' over the Bay of Bengal (15 - 17 April, 2017)

2.1.1. A trough of low at mean sea level over southeast Bay of Bengal and adjoining Andaman Sea organised into a low pressure area over southeast Bay of Bengal and neighbourhood on 13<sup>th</sup> evening. It became well marked over the same region on 14<sup>th</sup> morning. It then concentrated into a depression and lay centred over southeast Bay of Bengal near Lat. 12.0° N and Long. 88.0° E about 540 kms west-southwest of Mayabandar (Andaman & Nicobar Islands) and 1010 kms south-southwest of Kyaukpyu (Myanmar) at 0000 UTC of 15<sup>th</sup>. It moved north-northeastwards and lay centred over southeast & adjoining eastcentral Bay of Bengal near Lat. 12.5° N and Long. 88.3° E, about 500 kms west-southwest of Maya Bandar and 950 kms south-southwest of Kyaukpyu at 0300 UTC of 15<sup>th</sup>. It moved northeastwards, intensified into a deep Depression and lay centered over eastcentral Bay of Bengal centered near Lat. 13.7° N/ Long. 89.5° E, about 350 kms west-northwest of Maya Bandar and 740 kms south-southwest of Kyaukpyu at 0900 UTC of 15<sup>th</sup>. It moved further northeastwards and lay centered over the same region centered near Lat. 14.3° N/Long. 90.1° E, about 340 kms west-northwest of Maya Bandar and 680 kms south-southwest of Kyaukpyu at 1200 UTC of 15<sup>th</sup>. It moved north-northeastwards and intensified further into a Cyclonic Storm 'Maarutha' and lay centered over east-central Bay

of Bengal near Lat. 15.3° N/ Long. 91.0° E, about 330 kms west-northwest of Maya Bandar and 530 kms south-southwest of Kyaukpyu at 1800 UTC of 15<sup>th</sup>. It further moved northeastwards and lay centered over east-central Bay of Bengal near Lat. 16.7° N/ Long. 92.5° E, about 420 kms nearly north of Maya Bandar and 280 kms southwest of Sandoway (Myanmar) at 0300 UTC of 16<sup>th</sup>. It further moved northeastwards and lay centered over eastcentral Bay of Bengal near Lat. 17.8° N and Long. 93.6° E at 1200 UTC of 16<sup>th</sup>. It further moved northeastwards and crossed Myanmar coast near Sandoway during 1800-2000 UTC of 16<sup>th</sup>. It continued to move northeastwards, weakened into a deep depression and lay centred over Myanmar near Lat. 19.0° N and Long. 95.0° E, about 90 kms northeast of Sandoway at 2100 UTC of 16<sup>th</sup>. It further moved northeastwards and weakened further into a depression and lay centred near Lat. 19.5° N and Long. 95.5° E over Myanmar at 0000 UTC of 17<sup>th</sup>. It then moved east-northeastwards and weakened into a well marked low pressure area over central Myanmar and neighbourhood at 0300 UTC of 17<sup>th</sup>.

#### 2.1.2. Other features observed

The lowest Estimated Central Pressure (ECP) had been 996 hPa. The estimated maximum sustained surface wind speed (MSW) was 40 knots during 2100 UTC of 15<sup>th</sup> to 1800 UTC of 16<sup>th</sup> April. At the time of landfall, the ECP was 996 hPa and MSW was 40 knots. The lowest observed pressure of 984 hPa was reported by Sandoway (Myanmar) at 1200 UTC of 16<sup>th</sup>, when the system was very close to Sandoway along Myanmar coast. Sandoway reported maximum sustained wind (MSW) of 35 knots at the time of landfall.

#### 2.1.3. Weather and damage caused

This system caused heavy to very heavy rainfall in southeast and adjoining eastcentral Bay of Bengal (BoB) on 15<sup>th</sup> and heavy to very heavy rainfall over eastcentral BoB on 16<sup>th</sup>. The rainfall was higher in eastern sector, especially northeast sector. The rainfall decreased significantly at the time of landfall and thereafter.

Three people were killed in Irrawaddy Division. A total of 81 houses were damaged by the storm.

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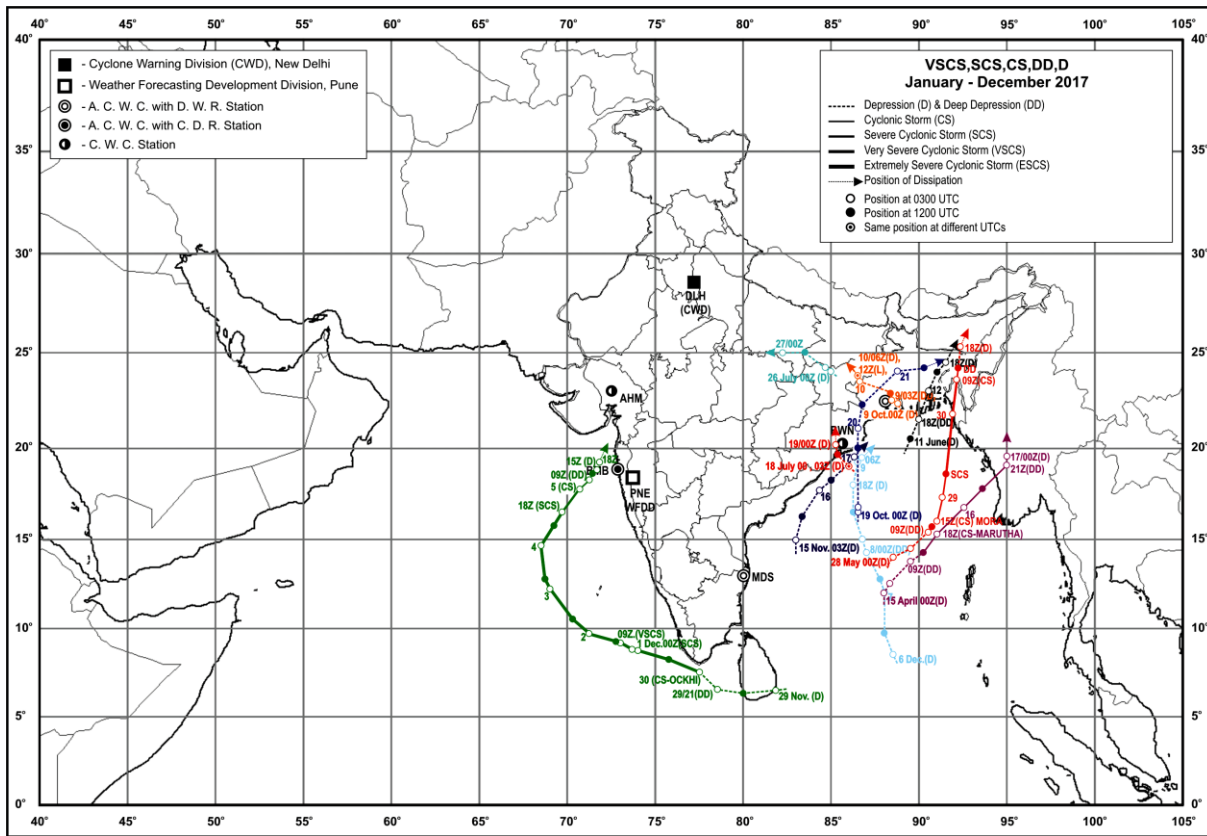


Fig. 1. Tracks of storms and depressions over during the year 2017

Chief amounts of 24 hrs rainfall in cm ( $\geq 1$  cm) ending at 0300 UTC of 15 - 16 April 2017 are given below :

**15 April, 2017**

**Andaman & Nicobar Islands**

Maya Bandar 4, Port Blair 2

**16 April, 2017**

**Andaman & Nicobar Islands**

Long Island 5, Hut Bay 4, Port Blair 4, Maya Bandar 4, IAF Carnicobar 2

*2.2. Severe Cyclonic storm 'MORA' over Bay of Bengal (28 - 31 May, 2017)*

2.2.1. Under the influence of a cyclonic circulation over southeast Bay of Bengal and neighbourhood, a low pressure area formed over southeast Bay of Bengal and adjoining areas of central Bay of Bengal on 25<sup>th</sup>. It persisted there on 26<sup>th</sup> and became a well marked low

pressure area and lay over east central Bay of Bengal and adjoining areas of southeast and westcentral Bay of Bengal on 27<sup>th</sup>. It concentrated into a Depression and lay centred over central parts of Bay of Bengal centered near Lat. 14.0° N/Long. 88.5° E, about 950 kms south of Kolkata and 980 kms south-southwest of Chittagong (Bangla Desh) at 0000 UTC 28<sup>th</sup>. It moved east-northeastwards and lay over eastcentral Bay of Bengal, centred near Lat. 14.5° N/Long. 89.5° E, about 900 kms nearly south-southeast of Kolkata and 890 kms south-southwest of Chittagong at 0300 UTC of 28<sup>th</sup>. It moved northeastwards, intensified into a Deep Depression and lay centred over eastcentral Bay of Bengal near Lat. 15.4° N/Long. 90.5° E, about 820 kms nearly south-southeast of Kolkata and 770 kms south-southwest of Chittagong at 0900 UTC of 28<sup>th</sup>. It moved further northeastwards and lay centred over eastcentral Bay of Bengal near Lat. 15.7° N/Long. 90.7° E, about 800 kms nearly south-southeast of Kolkata and 740 kms south-southwest of Chittagong at 1200 UTC of 28<sup>th</sup>. Moving northeastwards, It further intensified into Cyclonic Storm 'MORA' over eastcentral Bay of Bengal and lay centred near Lat. 16.0° N/Long. 91.0° E, about 770 kms a. s. l. nearly south-southeast of Kolkata and 700 kms south-southwest of Chittagong at 1500 UTC of 28<sup>th</sup>. It further

TABLE 1

Brief Summary of cyclonic storms and depressions over the Indian Seas and neighbourhood during 2017

| S. No. | Category                           | Life Period             | Place / Time of landfall   | Lowest Estimated central Pressure (hPa) | Max. wind Estimated (kts) | Highest "T" No. |
|--------|------------------------------------|-------------------------|--|---|---------------------------|-----------------|
| 1.     | Cyclonic Storm 'MAARUTHA'          | 15 - 17 April           | Crossed Myanmar coast near Sandoway (Thandwe) during 1800 UTC of 16 <sup>th</sup> and 2000 UTC of 16 <sup>th</sup> . Weakened into a well marked low pressure area over central Myanmar and neighbourhood. during 0300 UTC of 17 <sup>th</sup>                 | 996                                     | 40                        | 2.5             |
| 2.     | Cyclonic Storm 'MORA'              | 28 - 31 May             | Crossed Bangladesh coast near Lat. 21.9° N / Long. 91.9° E between 0200 to 0400 UTC of 30 <sup>th</sup> . Weakened into a well marked low pressure area and lay over Nagaland & neighbourhood at 0000 UTC of 31 <sup>st</sup> May 2017                         | 978                                     | 60                        | 3.5             |
| 3.     | Deep Depression                    | 11 - 13 June            | crossed Bangla Desh coast near Khepupara between 2300 UTC of 11 <sup>th</sup> and 0000 UTC of 12 <sup>th</sup> . Weakened into a well marked low pressure area over east Bangla desh and neighbourhood in the early morning of 13 <sup>th</sup>                | 988                                     | 30                        | 2.0             |
| 4.     | Depression                         | 18 - 19 July            | crossed south Odisha coast close to south of Puri and centred near Lat. 19.8° N / Long. 85.3° E on 1500 UTC of 18 <sup>th</sup> . Weakened into a well marked low pressure area and lay over interior Odisha and neighbourhood at 0300 UTC of 19 <sup>th</sup> | 992                                     | 25                        | 1.5             |
| 5.     | Land Depression                    | 26 - 27 August          | It weakened into a well marked low pressure area 27 <sup>th</sup> morning  | 993                                     | 25                        | -               |
| 6.     | Land Deep Depression               | 9 - 10 October          | weakened into a low pressure area over the same region at 1200 UTC 10 <sup>th</sup>  | 996                                     | 30                        | 1.5             |
| 7.     | Depression                         | 19 - 22 November        | crossed Odisha coast close to Paradip during 1400-1500 UTC on 19 <sup>th</sup> . weakened into a well marked low pressure area over northeast Bangladesh and adjoining Meghalaya and south Assam at 0000 UTC of 22 <sup>nd</sup>                               | 997                                     | 25                        | 1.5             |
| 8.     | Depression                         | 15 - 17 November        | weakened into well marked low pressure area over northwest Bay of Bengal off north Odisha-West Bengal coasts at 0600 UTC of 17 <sup>th</sup>   | 1001                                    | 25                        | 1.5             |
| 9.     | Very Severe Cyclonic Storm 'Ockhi' | 29 November- 5 December | weakened into a well marked low pressure area over eastcentral and adjoining areas of northeast Arabian Sea at 1800 UTC of 5 <sup>th</sup> Dec   | 976                                     | 85                        | 4.5             |
| 10.    | Deep Depression                    | 6 - 9 December          | weakened into a well marked low pressure area over northwest Bay of Bengal at 1200 UTC of 9 <sup>th</sup> Dec  | 1002                                    | 25                        | 2.0             |

moved north-northeastwards and lay over eastcentral Bay of Bengal near Lat. 17.3° N/Long. 91.3° E, about 660 kms south-southeast of Kolkata and 550 kms south-southwest of Chittagong at 0300 UTC of 29<sup>th</sup>. It then moved north-northeastwards, intensified into a Severe Cyclonic Storm and lay centered over northeast and adjoining eastcentral Bay of Bengal near Lat. 18.6° N/Long. 91.5° E, about 550 km south southeast of Kolkata and 410 kms south southwest of Chittagong at 1200 UTC of 29<sup>th</sup>. It moved further north-northeastwards and lay centred over Bangladesh coast near Lat. 21.8° N/Long. 91.9° E, about 50 kms south of Chittagong and close to Kutubdia Island at 0300 UTC of 30<sup>th</sup>. It crossed Bangladesh coast near

Lat. 21.9° N/Long. 91.9° E, about 30 kms south of Chittagong between 0200 and 0400 UTC and lay centred over coastal Bangladesh near Lat. 22.0° N/Long 91.9° E as a severe cyclonic storm at 0400 UTC of 30<sup>th</sup>. It moved north-northeastwards and weakened into a Cyclonic Storm and lay centred over Bangla Desh and adjoining Mizoram & Tripura near Lat. 23.6° N/Long. 92.1° E, about 60 kms west of Aizwal and 140 kms southwest of Silchar at 0900 UTC of 30<sup>th</sup>. It moved further north-northeastwards and weakened into a Deep Depression and lay centred over Tripura and neighbourhood near Lat. 24.2° N/ Long. 92.2° E, about 20 kms east-southeast of Kailashahar and 80 kms southwest of Silchar

**TABLE 2**  
**Storms / Depressions statistics 2017**

| 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   | -   | -   | 1            | 1   | 1   | 5     |
| Cyclonic Storms                  | -      | -   | -           | 1   | -   | -       | -   | -   | -   | -            | -   | -   | 1     |
| Severe Cyclonic Storms           | -      | -   | -           | -   | 1   | -       | -   | -   | -   | -            | -   | -   | 1     |
| Very Severe Cyclonic Storms      | -      | -   | -           | -   | -   | -       | -   | -   | -   | -            | 1   | -   | 1     |
| Super Cyclonic Storms            | -      | -   | -           | -   | -   | -       | -   | -   | -   | -            | -   | -   | -     |
| <b>Total</b>                     | -      | -   | -           | -   | -   | -       | -   | -   | -   | -            | -   | -   | -     |
| <b>Land Depression</b>           |        |     |             |     |     |         |     |     |     |              |     |     |       |
| Depressions/Deep Depressions     | -      | -   | -           | -   | -   | -       | 1   | -   | -   | 1            | -   | -   | 2     |
| <b>Over the Arabian Sea</b>      |        |     |             |     |     |         |     |     |     |              |     |     |       |
| Depressions/Deep Depressions     | -      | -   | -           | -   | -   | -       | -   | -   | -   | -            | -   | -   | -     |
| Cyclonic Storms                  | -      | -   | -           | -   | -   | -       | -   | -   | -   | -            | -   | -   | 0     |
| Severe Cyclonic Storms           | -      | -   | -           | -   | -   | -       | -   | -   | -   | -            | -   | -   | 0     |
| Very Severe Cyclonic Storms      | -      | -   | -           | -   | -   | -       | -   | -   | -   | -            | -   | -   | 0     |
| Extremely Severe Cyclonic Storms | -      | -   | -           | -   | -   | -       | -   | -   | -   | -            | -   | -   | 0     |
| Super Cyclonic Storms            | -      | -   | -           | -   | -   | -       | -   | -   | -   | -            | -   | -   | 0     |
| <b>Grand Total</b>               | -      | -   | -           | 1   | 1   | 1       | 2   | -   | -   | 2            | 2   | 1   | 10    |

at 1200 UTC of 30<sup>th</sup>. It continued to move north-northeastwards and weakened into a Depression and lay centred over south Meghalaya and neighbourhood near Lat. 25.3° N/Long. 92.4° E, about 50 kms north-northwest of Silchar at 1800 UTC of 30<sup>th</sup>. It moved northeastwards and weakened further into a well marked low pressure area and lay over Nagaland & neighbourhood at 0000 UTC of 31<sup>st</sup> May.

#### 2.2.2. Other features observed

The lowest ECP was 978 hPa during 2100 UTC of 29<sup>th</sup> to 0300 UTC of 30<sup>th</sup>. The estimated maximum sustained surface wind speed (MSW) was 60 knots during the same period. The lowest observed pressure of 978 hPa and maximum mean wind speed of 40 kts, was reported by Kutubdia at 0300 UTC of 30<sup>th</sup>, when the system was crossing Bangladesh coast near Lat. 21.9° N/Long. 91.9° E, about 30 kms south of Chittagong between 0200 and 0400 UTC.

#### 2.2.3. Weather and damage caused

Heavy to very heavy rainfall occurred over north-eastern parts of India and over south coastal Bangladesh.

(i) *Damage over India:* No casualties were reported from any Indian state due to SCS Mora. However, rains triggered landslides at many places in Mizoram. It is reported that about 20 houses were damaged in Khawbung village of Champhai district. About 10 houses including a church have been also been damaged in Serchhip district.

(ii) *Damage over Bangla Desh:* As per the preliminary report released by Department of Disaster Management, Govt. of the People's Republic of Bangladesh, 7 people lost their lives and 61 got injured due to 'Cyclone Mora'.

Chief amounts of 24 hrs Rainfall in cm (more than 6 cm) ending at 0300 UTC from 30<sup>th</sup> May to 1<sup>st</sup> June, 2017 are given below:

#### (a) Indian States

##### 31 May, 2017

##### **Arunachal Pradesh**

Passighat AERO & Basar 8 each

TABLE 3

## Ships' Observations during 1 January to 31 December, 2017

| Call Sign<br>(1)   | Date/Time (UTC)<br>(2) | Position of the Ship |                   | Wind            |                    | Pressure          |
|--|------------------------|----------------------|-------------------|-----------------|--------------------|-------------------|
|  |                        | Lat. (°N)<br>(3)     | Long. (°E)<br>(4) | Dir. (°)<br>(5) | Speed (Kts)<br>(6) | PPPP (hPa)<br>(7) |
| <b>(A) Cyclonic Storm 'MAARUTHA' over Bay of Bengal (15-17 April, 2017)</b>                              |                        |                      |                   |                 |                    |                   |
| SHIC*  | 150000                 | 6.1                  | 93.6              | 170             | 10                 | -                 |
| C6SW*3   | 150900                 | 13.1                 | 96.5              | 160             | 21                 | 1007.1            |
| SHJC*  | 151200                 | 6.2                  | 90.2              | 240             | 18                 | 1006.5            |
| C6SW3  | 151800                 | 15.2                 | 96.5              | 100             | 25                 | 1006.2            |
| VWTI   | 160300                 | 11.7                 | 93.5              | 010             | 16                 | 1010.3            |
| VWTI   | 161800                 | 11.6                 | 92.6              | 020             | 02                 | 1011.9            |
| <b>(B) Severe Cyclonic storm 'MORA' over Bay of Bengal (28-31 May, 2017)</b>                             |                        |                      |                   |                 |                    |                   |
| SLKQ*  | 280000                 | 5.8                  | 88.7              | 240             | 24                 | 1000.6            |
| 2HCH5*   | 280000                 | 2.0                  | 88.8              | 180             | 25                 | 1005.2            |
| BATFR28*   | 280300                 | 6.2                  | 87.9              | 240             | 33                 | 1004.8            |
| VRGN7*   | 280300                 | 6.0                  | 95.3              | 210             | 25                 | 1012.0            |
| BATFR28*   | 280900                 | 6.2                  | 87.9              | 350             | 34                 | 1003.6            |
| 3FCJ9*   | 280900                 | 6.1                  | 91.5              | 230             | 19                 | 1008.0            |
| SLKQ*  | 281200                 | 5.9                  | 84.6              | 240             | 24                 | 1001.3            |
| SHIP*  | 281200                 | 5.7                  | 92.4              | 250             | 19                 | 1007.0            |
| VTXB*  | 281500                 | 8.0                  | 93.6              | 250             | 16                 | 1006.7            |
| BATFR28*   | 281500                 | 6.1                  | 87.1              | 240             | 33                 | 1005.1            |
| AUXE   | 290300                 | 11.5                 | 93.0              | 260             | 19                 | 910.8             |
| DFNB2  | 290300                 | 6.1                  | 92.2              | 240             | 17                 | -                 |
| DFNB2  | 290600                 | 6.2                  | 91.7              | 240             | 20                 | 1006.5            |
| SHIP   | 291200                 | 5.3                  | 88.3              | 270             | 26                 | 1006.0            |
| VTXB   | 291200                 | 7.0                  | 93.9              | 210             | 12                 | 1006.3            |
| VTGB   | 300300                 | 11.7                 | 92.6              | 240             | 02                 | 1006.5            |
| DFNB2  | 300900                 | 5.7                  | 84.0              | 250             | 25                 | 1004.9            |
| SHIP*  | 301800                 | 5.6                  | 87.9              | 250             | 33                 | 1009.0            |
| <b>(C) VSCS 'Ockhi' over Lakshadweep area and adjoining southeast Arabian Sea (29 Nov - 5 Dec, 2017)</b> |                        |                      |                   |                 |                    |                   |
| MPMMS*   | 290300                 | 6.5                  | 81.8              | 330             | 30                 | 1007.4            |
| 9HA3490*   | 291200                 | 6.0                  | 87.0              | 070             | 12                 | 1009.1            |
| VRCS2  | 301200                 | 6.7                  | 74.8              | 260             | 35                 | 1006.0            |
| JNNB   | 301200                 | 6.1                  | 79.0              | 180             | 21                 | 1015.3            |
| AUYB   | 010300                 | 10.0                 | 76.0              | 170             | 19                 | 1009.5            |
| D50Y6  | 010900                 | 6.5                  | 74.5              | 240             | 20                 | 1005.9            |
| 9V9373   | 011200                 | 6.5                  | 77.9              | -               | -                  | 1008.5            |
| WN TL  | 021200                 | 19.0                 | 70.6              | 030             | 10                 | 1009.9            |
| ONAH   | 021800                 | 6.7                  | 60.1              | 010             | 14                 | 1011.0            |
| ZDNC2  | 030300                 | 8.3                  | 71.0              | 220             | 38                 | 1005.7            |
| ZDNC2  | 031200                 | 9.3                  | 68.2              | 250             | 42                 | 1004.9            |
| VRMX7  | 041200                 | 17.6                 | 64.7              | 020             | 29                 | 1008.0            |
| AUYK   | 041200                 | 12.4                 | 70.1              | 060             | 14                 | 1010.8            |
| VNTI*  | 050900                 | 10.0                 | 63.4              | 360             | 24                 | 1010.7            |
| VRMX7*   | 051200                 | 13.4                 | 68.8              | 330             | 11                 | 1008.0            |

\* Observation during Depression/deep Depression

**Assam & Meghalaya**

Halflong and B. P. Ghat 11 each, Lumding 10, Shillong C.S.O. 9, Lakhimpur 8, Karimganj, Chauldhowaghat, Matijuri, Barpathar, Jia Bharali N T Xing and N. Lakhimpur/Lilabari 7 each

**Nagaland, Manipur, Mizoram & Tripura**

Lunglei and Serchip (Hydro) 10 each, Kohima 7

**1 June, 2017**

**Arunachal Pradesh**

Roing 11

**Assam & Meghalaya**

Karimganj 9, A. P. Ghat 8, Mawsynram, Cherrapunji (RKM), Cherrapunji & Silchar 7 each

**Manipur, Mizoram & Tripura**

Agartala AERO 13, Kailashahar AERO 10

**(b) Bangladesh**

**30 May, 2017**

Chittagong 17.7, Sandwip 17.3, Sitakunda 13.8, Rangamati 8.7, Hatiya 8.3, Kutubdia 11.5

**31 May, 2017**

Hatia 13.9, Netrokona 9.6

*2.3. Deep Depression over northwest & adjoining northeast Bay of Bengal (11-13 June, 2017)*

2.3.1. Under the influence of the cyclonic circulation over westcentral Bay of Bengal off north Andhra Pradesh-south Odisha coasts, a low pressure area formed over westcentral and adjoining northwest Bay of Bengal off south Odisha-north Andhra Pradesh coasts on 9<sup>th</sup>. It lay over northern parts of central Bay of Bengal and adjoining north Bay of Bengal on 10<sup>th</sup>. It lay as a well marked low pressure area over northwest Bay of Bengal and neighbourhood on 11<sup>th</sup> and concentrated into a Depression and lay centered over northwest and adjoining northeast Bay of Bengal near Lat. 20.5° N/Long. 89.5° E, about 180 kms southsouthwest of Khepupara (Bangla Desh) and 210 kms south-southeast of Canning (West Bengal) at 1200 UTC of 11<sup>th</sup>. It moved north-northeastwards, intensified into a Deep Depression and crossed Bangla Desh coast near Khepupara between 2300 UTC of 11<sup>th</sup>

and 0000 UTC of 12<sup>th</sup>. It lay centered over south Bangla Desh & neighbourhood near Lat. 22.5° N/Long. 90.5° E about 60 km northeast of Khepupara and 170 km south-southwest of Agartala at 0000 UTC of 12<sup>th</sup>. It further moved slightly northeastwards and lay over the same region centered near Lat. 23.0° N/Long. 90.5° E about 130 kms northeast of Khepupara and 100 kms south-southwest of Agartala at 0300 UTC of 12<sup>th</sup>. It moved northwards and lay centred over eastern parts of Bangla Desh and neighbourhood near Lat. 24.0° N/Long. 91.0° E, about 30 kms west-northwest of Agartala at 1200 UTC of 12<sup>th</sup>. It then moved northeast-wards, weakened into a Depression and lay centred over the same region near Lat. 24.5° N/Long. 91.5° E, about 70 kms north-northeast of Agartala at 1800 UTC of 12<sup>th</sup>. It further moved north-northeastwards and weakened into a well marked low pressure area over east Bangla Desh and neighbourhood in the early morning of 13<sup>th</sup>.

*2.3.2. Other features observed*

The lowest ECP was 988 hPa during 1800 UTC of 11<sup>th</sup> to 0000 UTC of 12<sup>th</sup>. The estimated maximum sustained surface wind speed (MSW) was 30 knots during 0000 UTC to 1200 UTC of 12<sup>th</sup>. The lowest observed pressure of 989.1 hPa was reported by Hatia at 0000 UTC of 12<sup>th</sup>. The maximum mean wind speed of 30 kts was reported by Cox Bazar at 0000 UTC of 12<sup>th</sup>.

*2.3.3. Realized weather*

The deep depression caused heavy rainfall over northeastern states and Bangla Desh.

Chief amounts of 24 hrs rainfall in cm ( $\geq 7$  cm) ending at 0300 UTC of 12-14 June, 2017 are given below:

**12 June, 2017**

**Assam & Meghalaya**

N. Lakhimpur and Kampur 7 each

**Nagaland-Manipur-Mizoram-Tripura**

Bishalgarh 9, Arundhutinagar 7

**13 June, 2017**

**Assam & Meghalaya**

Cherrapunji (Rkm) 33, Cherrapunji 32, Mawsynram 19, Shillong 11, Williamnagar, Karimganj and Panbari 10 each, Goalpara CWC, Barpeta and Barapani 8 each, Beky Rly. Bridge and Shella 7 each

**Nagaland-Manipur-Mizoram-Tripura**

Serchip (Hydro) 24, Aizawal 18, Lunglei and Bishalgarh 10 each, Agartala AP and Sabroom 9 each, Khowai 8, Arundhutinagar and Kailashahar 7 each

**14 June, 2017**

**Arunachal Pradesh**

Itanagar and Naharlagun 7 each

**Assam & Meghalaya**

Jia Bharali N T Xing, Puthimari and Guwahati AP 11 each, Mawsynram 10, Tezpur, Majbhat and Karimganj 9 each, Goibargaon, Dhekiajuli and Badatighat 8 each, Nalbari / Pagladia 7

*2.4. Depression over northwest & adjoining westcentral Bay of Bengal and coastal areas of Odisha (18 - 19 July, 2017)*

2.4.1. Under the influence of a cyclonic circulation over northwest Bay of Bengal and neighbourhood, a low pressure area formed over northwest Bay of Bengal off north Odisha & Gangetic West Bengal coasts on 15<sup>th</sup>. It lay over northwest Bay of Bengal and adjoining coastal areas of Gangetic West Bengal & Odisha on 16<sup>th</sup>. It intensified into a well marked low pressure area over northwest Bay of Bengal & adjoining westcentral Bay of Bengal & coastal areas of Odisha and north Andhra Pradesh on 17<sup>th</sup>. It concentrated into a depression and lay centered over northwest and adjoining westcentral Bay of Bengal and coastal areas of Odisha near Lat. 19.0° N and Long. 86.0° E, about 120 kms east-southeast of Gopalpur and 80 kms south-southeast of Puri at 0000 UTC of 18<sup>th</sup>. The system remained practically stationary over the same region at 0300 UTC of 18<sup>th</sup>. It lay over northwest Bay of Bengal and adjoining areas of coastal Odisha & north Andhra Pradesh at 0900 UTC of 18<sup>th</sup> and remained practically stationary near Lat. 19.9° N/Long. 85.3° E, about 70 kms east-northeast of Gopalpur and 50 kms southwest of Puri at 1200 UTC of 18<sup>th</sup>. It moved nearly north-westwards and crossed south Odisha coast close to south of Puri & centred near Lat. 19.8° N/Long. 85.3° E, over coastal Odisha and neighbourhood about 50 kms west of Puri and 70 kms southwest of Bhubaneswar around 1500 UTC of 18<sup>th</sup>. It moved nearly west-northwestwards and weakened into a well marked low pressure area and lay over interior Odisha and neighbourhood at 0300 UTC of 19<sup>th</sup>.

2.4.2. *Other features observed*

According to satellite imageries, the intensity of the system was CI 1.5 at the time of formation of depression. The estimated central pressure was 992 hPa and maximum sustained wind speed was 25 knots gusting to 35 knots. The lowest observed Pressure of 992.7 hPa, recorded by Gopalpur between 0000 and 1200 UTC of 18<sup>th</sup> July, when the centre of system was very close to it. Wind speed of 41 kts was recorded by Ship (YJUP4) (at Lat. 15.7° N/ Long. 83.4° E).

2.4.3. *Realized weather*

Under the influence of the Depression, rainfall at most places with heavy to very heavy rainfall at a few places and isolated extremely heavy rainfall occurred over Chhattisgarh on 17 and over Vidarbha on 18 July. Rainfall at most places with heavy to very heavy rainfall at isolated places occurred over Odisha, Vidarbha, coastal Andhra Pradesh and Telangana on 17, over Odisha, West Madhya Pradesh, Chhattisgarh and coastal Andhra Pradesh on 18, over Vidarbha & Chhattisgarh on 19 & over West Madhya Pradesh, East Madhya Pradesh & Chhattisgarh on 20 July.

Chief amounts of 24 hrs rainfall in cm ( $\geq 6$  cm) ending at 0300 UTC from 18-21 July, 2017 is given below:

**18 July, 2017****Odisha**

Kosagumda 17, Tentulikhunti ARG 14, Dabugan ARG and Banki ARG 13 each, Jeypore 12, Koraput, Binjharpur ARG and Mundali 11 each, Dharmagarh ARG, Jhorigam ARG, Similiguda AWS and Jaipatna 9 each, Junagarh, Umarkote, Kaptipada ARG and Raighar ARG 8 each, Bhavani P., Bari ARG, Hindol and Pottangi 7 each, Nawarangpur, Pattamundai, Gunupur, Lanjigarh, Kashipur, Naraj and Daitari 6 each

**Vidarbha**

Nagpur AP 13, Kamptee 12, Amgaon and Korchi 11 each, Armori and Mauda 10 each, Salekasa 9, Kurkheda 8, Bhamragad, Pauni, Gondia and Gondia AP 7 each, Gadchiroli, Nagbhir, Dhanora, Hingna & Perseoni 6 each

**Chhattisgarh**

Dondilohara 27, Kanker 16, Balod 14, Ambagarh Chowki and Jagdalpur 12 each, Dhamtari 10, Bhanupratappur 9, Kondagaon, Simga & Konta 8 each, Dongargarh, Gandai, Katghora, Deobhag and Gariabund 7 each, Bijapur 6

**Coastal Andhra Pradesh**

Kalingapatnam and Gudivada 9 each, Chintur, Bondapalle and Paleru Bridge 8 each, Gajapathinagaram and Vijaywada AP 7 each, Ichchapuram, Sompeta, Merakamudidam, Vararamachandrapur, Palakonda, Salur, Cheepurupalle and Tekkali 6 each

**19 July, 2017**

**Odisha**

Dabugan ARG 20, Jhorigam ARG 19, Chandahandi ARG 16, Kosagumda and Jaipatna 15 each, Dharmagarh ARG 14, Raighar ARG and Tentulikhunti ARG 13 each, Junagarh and Umarkote 11 each, Gudari, Mohana, Jeypore and Nawarangpur 10 each, Bhavani P. and Kashipur 9 each, Koraput and Malkangiri 8 each, Narla ARG, Nawana, Belpada ARG and Odagaon ARG 7 each, Khaprakhol ARG and Gunupur 6 each

**West Madhya Pradesh**

Pachmarhi 12, Khandwa and Khandwa AWS 9 each, Bhainsdehi 7

**Vidarbha**

Bhamragad 34, Chamorshi 26, Bramhapuri 21, Sindewahi 19, Mul 17, Etapalli, Pauni, Pombhurna and Ahiri 13 each, Gadchiroli, Mulchera and Warora each 12, Hinganghat 11, Bhadravati, Samudrapur, Chandrapur and Saoli 10 each, Gondpipri, Lakhandur, Armori, Ballarpur and Ramtek 9 each, Dhanora, Chandur Rlwy, Bhiwapur, Nagbhir and Rajura 8 each, Wani, Warud, Deoli, Mauda, Arjuni Morgaon, Narkheda, Saoner, Wardha, Babulgaon and Pandherikawara 7 each

**Chhattisgarh**

Jagdapur 19, Dantewara 14, Deobhog 13, Sukma 11, Kanker and Dondilohara 9 each, Bijapur and Narayanpur 8 each, Kondagaon 7

**Coastal Andhra Pradesh**

Gudivada 9, Vijaywada AP and Vararamachandrapur 7 each

**20 July, 2017**

**Vidarbha**

Risod 15, Gondia and Gondia AP 11 each, Ramtek 10, Mohadi 9, Dharni and Chamorshi 6 each

**21 July, 2017**

**West Madhya Pradesh**

Khategaon 11, Nusrulgunj Arg 10, Thandla, Bhopal and Bhopal AWS Arg 9 each, Petlawad, Ashta -Arg, Pichhore and Ichhwar 8 each, Sehore - AWS & Depalpur 7 each, Jawad 6

**East Madhya Pradesh**

Jabalpur 12, Lakhnadon 10, Dindori AWS 8, Katni - AWS, Ghansore, Malanjkhanda, Umariya and Umariya - AWS 7 each, Hatta 6

*2.5. Land Depression over northwest Jharkhand and neighbourhood (26-27 July, 2017)*

2.5.1. Under the influence of a cyclonic circulation over Gangetic West Bengal and neighbourhood, a low pressure area formed over Gangetic West Bengal and adjoining areas of Jharkhand on 23<sup>rd</sup> evening. It lay as a well marked low pressure area over the same region on 24<sup>th</sup> & 25<sup>th</sup>. It concentrated into a Depression over northwest Jharkhand and neighbourhood, centered close to Daltonganj near Lat. 24° N/Long. 85° E at 0000 UTC of 26<sup>th</sup>. It moved northwestwards and lay centered over southwest Bihar and neighbourhood near Lat. 25.0° N/Long. 83.5° E, about 80 kms northwest of Daltonganj (Jharkhand) and 170 kms east of Siddhi (East Madhya Pradesh) at 1200 UTC of 26<sup>th</sup>. It further moved northwestwards and lay centred over southeast Uttar Pradesh and neighbourhood near Lat. 25° N/Long. 82.5° E about 60 kms southwest of Varanasi (east Uttar Pradesh) and 120 kms northeast of Siddhi (East Madhya Pradesh) at 0000 UTC of 27<sup>th</sup>. It weakened into a well marked low pressure area 27<sup>th</sup> morning and lay over northeast Madhya Pradesh and neighbourhood.

*2.5.2. Other features observed*

The lowest observed pressure of 994.5 hPa was reported by Daltonganj at 0300 UTC 26<sup>th</sup>. The maximum sustained wind speed of 8 kts was reported by Gaya at 0300 & 1200 UTC of 26<sup>th</sup>.

*2.5.3. Realized weather*

Under the influence of this depression, rainfall at most places with heavy to very heavy rainfall at a few places and isolated extremely heavy rainfall occurred over Jharkhand on 25<sup>th</sup> and over west Madhya Pradesh on 27<sup>th</sup>. Rainfall at most places with isolated heavy to very heavy rainfall occurred over Chhattisgarh and east Uttar Pradesh on 25<sup>th</sup>, Chhattisgarh, east and west Uttar Pradesh, east



and west Madhya Pradesh on 26<sup>th</sup> and over west Uttar Pradesh, east and west Madhya Pradesh on 27<sup>th</sup>.

Chief amounts of 24 hrs rainfall in cm ( $\geq 7$  cm) ending at 0300 UTC from 26-29 July, 2017 are given below:

**26 July, 2017**

#### **Jharkhand**

Latehar 27, Mandar 25, Hindgir & Ranchi 21 each, Kuru 19, Lohardaga 17, Gomia & Maheshpur 14 each, Ramgarh & Daltonganj 13 each, Jamshedpur 12, Pupunki, Dhanbad & Koner 10 each, Putki 9, Panchet, Tenughat, Maithon, Topchanchi, Jaridih & Palkot 8 each, Raidih, Nandadih, Giridih, Dumri, Bokaro, Torpa, Barhi, Barkisuraya & Gumla 7 each

#### **Chhattisgarh**

Ramanujganj 9

#### **East Uttar Pradesh**

Ghorawal 9

**27 July, 2017**

#### **Jharkhand**

Daltonganj 10, Lohardaga, Kurdeg & Ramgarh 9 each

#### **Chhattisgarh**

Ambikapur 13, Pathalgaon 11, Surajpur and Jashpurnagar 9 each

#### **East Uttar Pradesh**

Dudhi 10

#### **West Uttar Pradesh**

Deoband 7

#### **East Madhya Pradesh**

Singrauli AWS 8

#### **West Madhya Pradesh**

Khandwa 9

**28 July, 2017**

#### **West Uttar Pradesh**

Lalitpur 9, Mahroni 7

#### **East Madhya Pradesh**

Panna AWS 8, Tendukheda 7

#### **West Madhya Pradesh**

Narsingarh 23, Raisen and Raisen AWS 21 each, Bareilly and Agar 12 each, Suvasara 11, Guna and Guna AWS 10 each, Khilchipur and Ashoknagar AWS 9 each, Bhaora, Chanderi and Isagarh 8 each, Manasa, Vidisha AWS, Sarangpur, Udaipura and Tarana 7 each

**29 July, 2017**

#### **West Madhya Pradesh**

Agar and Neemuch AWS 11 each, Jawad 10, Mandasaur AWS 9, Bhanpura 7

#### **East Rajasthan**

Pratapgarh 24, Rashmi 16, Nimbahera and Bakani 15 each, Chhotisadri, Dug, Kapasan, Chittorgarh, Asnawar and Pachpahar 13 each, Jhalarapatan, Pindwara and Mangliawas 12 each, Dungla, Badesar, Kotda, Bari - Sadri and Chambal / R. B. Dam 11 each, Banera, Mount Abu, Mount Abu Tehsil, Khanpur and Arnod 10 each, Bhainsroadgarh, Begu, Bhopalsagar, Nasirabad and Sheoganj 9 each, Gangdhar and Ramganjmandi 8 each, Sirohi, Mandal, Nayanagar/Beawar, Aklera, Gangrar, Bhilwara, Bhilwara Tehsil and Salumber 7 each

#### *2.6. Land Deep Depression over Gangetic West Bengal (9-10 October, 2017)*

2.6.1. Under the influence of a cyclonic circulation over north Bay of Bengal & neighbourhood, a low pressure area formed over north Bay of Bengal and adjoining south Bangladesh on 8<sup>th</sup> morning. It lay as a well marked low pressure area over north Bay of Bengal and adjoining coastal Bangladesh and coastal West Bengal 8<sup>th</sup> evening. It concentrated into a depression and lay centered over Gangetic West Bengal and adjoining north Bay of Bengal near Lat. 22.4° N/Long. 88.4° E, about 50 km southeast of Kolkata at 0000 UTC of 9<sup>th</sup>. It moved west-northwestwards and intensified into a deep depression and lay centered over Gangetic West Bengal near Lat. 22.5° N/Long. 88.4° E close to Kolkata at 0300 UTC of 9<sup>th</sup>. It then moved north-northwestwards and lay centered near Lat. 22.9° N/Long. 88.1° E about 50 km north-northwest of Kolkata and 90 km south-southeast of

Shantiniketan at 1200 UTC of 9<sup>th</sup>. It moved west-northwestwards and lay centred over Gangetic West Bengal near Lat. 23.2° N/Long. 87.1° E close to Bankura (Gangetic West Bengal) at 0000 UTC of 10<sup>th</sup>. It further moved west-northwestwards and lay centred over Gangetic West Bengal and adjoining Jharkhand & Bihar near Lat. 23.5° N/Long. 86.7° E close to Purulia (Gangetic West Bengal) at 0300 UTC of 10<sup>th</sup>. Moving northwestwards, it weakened into a **Depression** over Jharkhand and adjoining west Bengal near Lat. 23.8° N/Long. 86.6° E about 20 kms east of Dhanbad (Jharkhand) and at 0600 UTC of 10<sup>th</sup>. It further weakened into a low pressure area over the same region at 1200 UTC 10<sup>th</sup>.

#### 2.6.2. Other features observed

The ECP was 996 hPa at 0000 to 0600 UTC of 9<sup>th</sup>. The estimated wind speed was 30 kts from 0300 UTC of 9<sup>th</sup> to 0300 UTC of 10<sup>th</sup>.

#### 2.6.3. Realized weather

The system caused heavy to very heavy rainfall at isolated places over Gangetic West Bengal and heavy rainfall at isolated places over Bihar on 10 October and heavy rainfall at isolated places over Gangetic West Bengal, Jharkhand and Bihar on 11 October, 2017.

Chief amounts of 24 hrs rainfall in cm ( $\geq 7$  cm) ending at 0300 UTC from 9<sup>th</sup> to 11<sup>th</sup> October, 2017 are given below:

#### 9 October, 2017

##### Gangetic West Bengal

Canning 14, Baruipur and Manmothnagar 12 each, Diamond Harbour 7

##### Odisha

Talcher 9

#### 10 October, 2017

##### Gangetic West Bengal

Durgapur 19, Burdwan (State Raingauge) 17, Panagarh and Asansol 16 each, Gheropara 14, Bolpur 13 each, Sri Niketan 12, Narayanpur and Kanksa 11 each, Barrackpur 10, Uluberia 9, Bagati, Chinsura Mangalkote and Bongaon 8 each, Hetampur, Uluberia, Dum Dum, Alipore, Amta and Bankura 7 each

##### Odisha

Niali 7

##### Jharkhand

Dumka and Maithon 11 each, Gobindpur 8, Mohanpur 7

##### Chhattisgarh

Sukma 8, Rajim 7

#### 11 October, 2017

##### Gangetic West Bengal

Asansol 9, Narayanpur 7

##### Odisha

Bhograi 7

##### Jharkhand

Jamtara 14, Giridih 10, Pathargama and Moharo 9 each, Madhupur and Dumka 8 each

##### Bihar

Jamui 19, Sono 18, Suryagadha 17, Bhagalpur 15, Jhajha 14, Parbatta 13, Lakhisara I, Banka and Bihpur 11 each, Monghyr and Sabour 10 each, Puri and Katoria 8 each, Gogri 7

#### 2.7. Depression over westcentral Bay of Bengal and neighbourhood (19-22 October, 2017)

2.7.1. Under the influence of a cyclonic circulation over southwest Bay of Bengal and neighbourhood and the east-west shear zone roughly along Lat. 12° N, a low pressure area formed over central Bay of Bengal and neighbourhood on 15<sup>th</sup>. It persisted there on 16<sup>th</sup>. It lay as a well marked low pressure area over central and adjoining south Bay of Bengal on 17<sup>th</sup>. It lay over westcentral and adjoining southwest Bay of Bengal on 17<sup>th</sup> evening and over westcentral Bay of Bengal and neighbourhood on 18<sup>th</sup>. It then concentrated into a **Depression** and lay centred over westcentral Bay of Bengal & neighbourhood near Lat. 16.5° N/Long. 86.5° E, about 370 kms south-southeast of Puri and 470 kms south of Chandbali (Odisha) at 0000 UTC of 19<sup>th</sup>. It moved northwards and lay centred over the same region near Lat. 16.8° N/Long. 86.5° E, about 440 kms south of Chandbali (Odisha) and 340 kms south-southeast of Puri at 0300 UTC of 19<sup>th</sup>. It moved northwards and lay over

North West Bay of Bengal near Lat. 20.0° N/ Long. 86.5° E, about 40 kms south-southwest of Paradip (Odisha) and 90 kms south-southwest of Chandbali at 1200 UTC of 19<sup>th</sup>. It further moved northwestwards and crossed Odisha coast close to Paradip during 1400-1500 UTC and lay centered over coastal Odisha near Lat. 20.2° N/Long. 86.5° E, close to west of Paradip (Odisha) at 1500 UTC of 19<sup>th</sup>. It moved further northwards and lay over coastal Odisha near Lat. 21.0° N/Long. 86.5° E, about 35 kms north-northwest of Chandbali (Odisha) at 0300 UTC of 20<sup>th</sup>. Subsequently, it moved north-northeastwards and lay centered over north Odisha and adjoining Jharkhand near Lat. 22.0° N/Long. 86.6° E at 0900 UTC of 20<sup>th</sup>. It further moved north-northeastwards and lay centered over southeast Jharkhand and adjoining north Odisha and Gangetic West Bengal and neighbourhood near Lat. 22.2° N/Long. 86.7° E, about 85 kms southeast of Jamshedpur (Jharkhand) and 65 kms southwest of Midnapore (West Bengal) at 1200 UTC of 20<sup>th</sup>. It further moved north-northeastwards and lay centered over Bangla Desh and adjoining West Bengal, near Lat. 24.0° N/Long. 88.7° E, about 35 kms west-northwest of Ishurdi (Bangla Desh) and 45 kms east-southeast of Behrampur (West Bengal) at 0300 UTC of 21<sup>st</sup>. It lay centred over Bangladesh, near Lat. 24.2° N/ Long. 90.2° E, about 50 kms northwest of Dhaka (Bangla Desh) at 1200 UTC of 21<sup>st</sup>. It moved east-northeastwards and weakened into a well marked low pressure area over northeast Bangladesh and adjoining Meghalaya and south Assam at 0000 UTC of 22<sup>nd</sup>.

### 2.7.2. Other features observed

The lowest observed pressure of 999.7 hPa was reported by Chandbali on 20 October at 0900 UTC. The maximum sustained wind speed of 27 kts was reported by Buoy 23091 (17.7/89.1) on 19 October at 1200 UTC.

### 2.7.3. Realized weather

Under its influence, isolated heavy rainfall occurred over Odisha on 18<sup>th</sup>. It caused isolated heavy rainfall over Gangetic West Bengal and scattered heavy with isolated very heavy rainfall over Odisha on 19<sup>th</sup>. On 20<sup>th</sup>, Assam and Meghalaya experienced isolated heavy to very heavy rainfall, Gangetic West Bengal experienced scattered heavy and isolated very heavy to extremely heavy rainfall. The system caused isolated heavy to very heavy rainfall with extremely heavy falls over Assam and Meghalaya & widespread heavy to very heavy rainfall over Nagaland, Manipur, Mizoram and Tripura on 21<sup>st</sup> October.

Chief amounts of 24 hrs rainfall in cm ( $\geq 7$  cm) ending at 0300 UTC from 18 - 21 October, 2017 are given below:

## 19 October, 2017

### Tripura

Kamalpur 7

### Odisha

Derabis 8, Balikuda, Pattamundai, Nimpara and Tirtol 7 each

## 20 October, 2017

### Mizoram

Serchip (Hydro) 8

### Gangetic West Bengal

Contai 10, Kalaikunda (IAF) 8, Canning 7

### Odisha

Balimundali 22, Tikarpara 21, Jaipur and Tirtol 20 each, Gop 19, Tangi 18, Remuna, Pipili & Brahmagiri 17 each, Chandikhol, Puri 16 each, Jajpur, Balasore & Soro 15 each, Banpur, Ranpur, Nilgiri, Kakatpur & Nawana 14 each, Bolagarh & Nimpara 13 each, Krishnaprasad, Alipingal, Satyabadi, Chandbali, Bonth, Chandanpur & Bari 12 each, NH5 Gobindpur, Daitari, Rajkanika, Binjharpur, Udala, Nuagada, Balikuda, Jagatsinghpur & Kantapada 11 each, Mohana & Hindol 10 each, Kujanga, Betanati, Astaranga, Dhamnagar, Rajghat, Anandpur, Balipatna, Niali, Karanjia, Kaptipada, Phulbani, Chhatrapur, Sukinda, R.Udaigiri, Banki, Bhadrak & Bhogra 9 each, Jenapur, Marsaghai, Bhubaneswar Aero, Mundali, Mahanga, Danagadi, Lanjigarh, Daringibadi, Berhampur, Mahendragarh, Odagaon, Jaleswar, Nayagarh, Kotagarh, Akhuapada, Samakhunta & Baliguda 8 each, Ambadola, Athgarh, Bhuban, Baripada, Garadapur, Harichandanpur, Keonjhar, Purushottampur, Khandapara, Jamsolaghat, Muniguda, Tihidi, Bangiriposi, Gopalpur and Naraj 7 each.

## 21 October, 2017

### Arunachal Pradesh

Namsai 18, Miao 11

### Assam & Meghalaya

Manash Nh Xing 14, Kokrajhar 13, Aie Nh Xing 9, Williamnagar 8, Panbari & Beky Railway Bridge 7 each

**Nagaland, Manipur, Mizoram & Tripura**

Sonamura 11

**Sub - Himalayan West Bengal & Sikkim**

Cooch Behar 7

**Gangetic West Bengal**

Bankura 28, Bankura 21, Kalaikunda 20, Narayanpur 18, Phulberia & Kansabati Dam 12 each, Suri 11, Tusuma, Panagarh, D. P. Ghat & Sri Niketan 10 each, Gheropara, Tilpara Barrage, Hetampur & Salar 9 each, Midnapore, Bagati, Amtala & Midnapore 8 each, Debagram, Purulia & Burdwan 7 each

**Odisha**

Nawana 12, Basudevpur 10, Birmaharajpur 9, Banki, Barmul, Mohana, Rairangpur & Ullunda 7 each

**Jharkhand**

Ghatsila 7

**22 October, 2017****Assam & Meghalaya**

Cherrapunji (Ramakrishna Maath ) 31, Cherrapunji 28, Halflong 14, Margherita & Karimganj 13 each, Williamnagar 11, A. P. Ghat & Silchar 8 each, B. P. Ghat, Lakhipur & Bokajan 7 each

**Nagaland, Manipur, Mizoram & Tripura**

Amarpur 18, Belonia 17, Kamalpur 15, Sabroom, Dharmanagar & Panisagar 13 each, Chhamonu & Agartala Aero 11 each, Kailashahar Aero, Khowai & Sonamura 10 each, Arundhutinagar & Udaipur 9 each, Imphal T Aero 8

*2.8. Depression over westcentral Bay of Bengal off Andhra Pradesh coast (15-17 November, 2017)*

2.8.1. A low pressure area lay over Malay peninsula and neighbourhood on 5<sup>th</sup> & 6<sup>th</sup>; over Malay peninsula and adjoining Andaman Sea on 7<sup>th</sup>; over south Andaman Sea and adjoining Malay peninsula on 8<sup>th</sup>; over southeast Bay of Bengal and neighbourhood on 9<sup>th</sup>; over southwest Bay of Bengal and neighbourhood on 10<sup>th</sup> & 11<sup>th</sup> and over southwest Bay of Bengal and adjoining Sri-Lanka and neighbourhood on 12<sup>th</sup>. It lay as a well marked low pressure area over southwest

Bay of Bengal and neighbourhood on 13<sup>th</sup> and over westcentral and adjoining southwest Bay of Bengal on 14<sup>th</sup>. It concentrated into a depression over westcentral Bay of Bengal off Andhra Pradesh coast and lay centred near Lat. 15.0° N and Long. 83.0° E, about 230 kms southeast of Machilipatnam, 300 kms south of Visakhapatnam and 510 kms south-southwest of Gopalpur on 15<sup>th</sup> at 0300 UTC of 15<sup>th</sup>. It moved north-northeastwards and lay centred near Lat. 16.2° N/Long. 83.3° E at 1200 UTC of 15<sup>th</sup>. It further moved northeastwards and lay centred near Lat. 17.7° N/Long. 84.3° E over westcentral and adjoining northwest Bay of Bengal off north Andhra Pradesh-south Odisha coasts about 110 kms east of Visakhapatnam and 185 kms south-southwest of Gopalpur at 0300 UTC of 16<sup>th</sup>. It moved northeastwards and lay centered over northwest and adjoining westcentral Bay of Bengal off south Odisha coast near Lat. 18.1° N/Long. 85.0° E about 270 kms south - southwest of Paradip, 200 kms east-northeast of Visakhapatnam and 120 kms south of Gopalpur at 1200 UTC of 16<sup>th</sup>. It further moved northeastwards and lay centred over northwest Bay of Bengal off Odisha coast near Lat. 19.5° N/Long. 86.3° E about 70 kms south of Paradip, 180 kms east - northeast of Gopalpur and 250 kms south - southwest of Digha on at 0300 UTC of 17<sup>th</sup>. It moved northeastwards and weakened into a well marked low pressure area over northwest Bay of Bengal off north Odisha - West Bengal coasts at 0600 UTC of 17<sup>th</sup>.

*2.8.2. Other features observed*

The lowest ECP was 1001 hPa at 1200 UTC of 15<sup>th</sup> November. The estimated maximum sustained wind speed was 25 kts.

*2.8.3. Realized weather*

Under its influence, isolated heavy rainfall occurred over Odisha & isolated heavy to very rainfall over Andhra Pradesh occurred on 15<sup>th</sup>. On 17<sup>th</sup>, heavy rainfall occurred at isolated places over Odisha and Andhra Pradesh.

Chief amounts of 24 hrs rainfall in cm ( $\geq 7$  cm) ending at 0300 UTC from 15<sup>th</sup> & 18<sup>th</sup> November are given below:

**15 November, 2017****Puducherry**

Thanjavur 7

**16 November, 2017**

**Odisha**

GOP & Astaranga 9 each, Puri, Paradeep, Digapahandi, Paralakhemundi, Mahendragarh, Tirtol, B alikuda, Kujanga & Nischintakoili 7 each

**Coastal Andhra Pradesh**

Sompeta 18, Ichchapuram 17, Mandasa 14, Palasa and Kalingapatnam 11, Tekkali 9, Pathapatnam 7

**17 November, 2017**

**Odisha**

Tirtol 8, Rajkanika and Binjharpur 7 each

**Coastal Andhra Pradesh**

Vijayawada A.P. 9

*2.9. Very Severe Cyclonic Storm 'Ockhi' over Lakshadweep area and adjoining southeast Arabian Sea (29 November-5 December, 2017)*

2.9.1. A low pressure area formed over southwest Bay of Bengal & adjoining areas of south Sri Lanka and equatorial Indian Ocean on 28<sup>th</sup>. It became a well marked low pressure area at 0000 UTC of 29<sup>th</sup> November. It concentrated into a depression over southwest Bay of Bengal & adjoining areas of south Sri Lanka & Lakshadweep and equatorial Indian Ocean near Lat. 6.5° N/Long. 81.8° E about 80 kms to the east-southeast of Hambantota and 500 kms east-southeast of Kanyakumari at 0300 UTC of 29<sup>th</sup>. It moved west-southwestwards and lay centred near Lat. 6.2° N/Long. 80.0° E about 30 kms northwest of Galle (Sri Lanka) and 340 kms southeast of Kanyakumari at 1200 UTC of 29<sup>th</sup> November. It intensified into a Deep Depression over Comorin area and neighbourhood near Lat. 6.5° N/Long. 78.6° E about 240 kms west-northwest of Galle (Sri-Lanka) and 170 kms of southeast of Kanyakumari (Tamil Nadu) at 2100 UTC of 29<sup>th</sup>. It moved west-northwestwards and intensified into a Cyclonic Storm (Ockhi) and lay centred over the same area near Lat. 7.5° N/Long. 77.5° E about 340 kms west-northwest of Galle (Sri-Lanka), 60 kms of south of Kanyakumari (Tamil Nadu), 120 kms southwest of Thiruvananthapuram and 480 kms of east-southeast of Minicoy on at 0300 UTC 30<sup>th</sup> November. It moved westwards and lay centred over southeast Arabian Sea near Latitude 8.2° N and Longitude 75.8° E, about 130 kms west-southwest of Thiruvananthapuram and 290 kms east-southeast of Minicoy at 1200 UTC of 30<sup>th</sup> November. It further moved westwards, intensified into a

**Severe Cyclonic Storm** at 0000 UTC of 1<sup>st</sup> December near Lat. 8.8° N/Long. 74.0° E. It continued to move west-northwestwards and lay centred over Lakshadweep area and adjoining southeast Arabian Sea near Lat. 8.9° N and Long. 73.8° E, about 90 kms northeast of Minicoy and 270 kms south-southeast of Amini-divi of 0300 UTC of 1<sup>st</sup> December. It continued to move west-northwestwards and intensified further into a **Very Severe Cyclonic Storm 'Ockhi'** over the same area near Lat. 9.1° N and Long. 73.0° E, about 90 kms north of Minicoy and 220 kms south-southeast of Amini Divi at 0900 UTC of 1<sup>st</sup> December. It further moved west-northwestwards and lay centred over the same area near Lat. 9.2° N/Long. 72.8° E, about 100 kms north-northwest of Minicoy and 210 kms south of Amini Divi at 1200 UTC of 1<sup>st</sup> December. It moved further west-northwestwards and lay centred over Lakshadweep area and adjoining southeast Arabian Sea near Lat. 9.7° N/Long. 71.2° E, about 260 kms west-northwest of Minicoy and 230 kms southwest of Amini Divi at 0300 UTC of 2<sup>nd</sup>. Further moving northwestwards it and lay centred over southeast Arabian Sea & adjoining Lakshadweep area near Lat. 10.2° N/Long. 70.6° E, about 250 kms west-southwest of Amini Divi at 0900 UTC of 2<sup>nd</sup> December. It further moved northwestwards and lay centred over southeast Arabian Sea near Lat. 10.5° N/Long. 70.3° E, about 275 kms west-southwest of Amini Divi at 1200 UTC of 2<sup>nd</sup>. It continued to move northwestwards and lay centred over southeast Arabian Sea near Lat. 11.1° N/Long. 69.7° E, about 330 kms west of Amini Divi at 1800 UTC of 2<sup>nd</sup> December and lay centred over southeast and adjoining eastcentral Arabian Sea near Lat. 11.7° N/Long. 69.2° E, about 390 kms west-southwest of Amini Divi, 910 kms south-southwest of Mumbai and 1120 kms south-southwest of Surat at 0000 UTC of 3<sup>rd</sup> December. It further moved north-northwestwards and lay centred over eastcentral and adjoining southeast Arabian Sea near Lat. 12.1° N/Long. 69.0° E, about 420 kms west-northwest of Amini Divi, 880 kms south-southwest of Mumbai and 1090 kms south-southwest of Surat at 0300 UTC of 3<sup>rd</sup>. It moved north-northwestwards and lay over eastcentral and adjoining southeast Arabian Sea near Lat. 12.9° N and Long. 68.7° E, about 480 km west-northwest of Amini Divi, 820 km south-southwest of Mumbai and 1020 km south-southwest of Surat at 1200 UTC of 3<sup>rd</sup> December. It then moved northwards and lay centred over eastcentral Arabian Sea near Lat. 14.7° N and Long. 68.5° E, about 600 kms north-northwest of Amini Divi, 670 kms south-southwest of Mumbai and 850 kms south-southwest of Surat at 0300 UTC of 4<sup>th</sup> December. It moved north-northeastwards and lay centred over eastcentral Arabian Sea near Lat. 15.2° N/Long. 69.0° E, about 590 kms southwest of Mumbai and 770 kms south-southwest of Surat at 0900 UTC of 4<sup>th</sup> December. It further moved

north-northeastwards and weakened into a **Severe Cyclonic Storm** lay centred over eastcentral Arabian Sea near Lat. 16.5° N/Long. 69.8° E, about 540 kms southwest of Mumbai and 720 kms south - southwest of Surat at 1800 UTC of 4<sup>th</sup> December. It further moved north - northeastwards and weakened into a Cyclonic Storm and lay centered over eastcentral Arabian Sea near Lat. 17.7° N/Long. 70.7° E, about 390 kms south - southwest of Surat and 230 kms west - southwest of Mumbai at 0300 UTC of 5<sup>th</sup> December. Moving north-northeastwards, it further weakened into a Deep Depression and lay centred over eastcentral Arabian Sea near Lat. 18.3° N/Long. 71.2° E, about 290 kms south - southwest of Surat and 160 kms west of Mumbai at 0900 UTC of 5<sup>th</sup> December. It moved north-northeastwards and lay centered over eastcentral Arabian Sea near Lat. 18.5° N/Long. 71.4° E, about 240 kms south-southwest of Surat and 150 kms west-northwest of Mumbai at 1200 UTC of 5<sup>th</sup> December. It further moved north-northeastwards and weakened into a Depression and lay over eastcentral and adjoining northeast Arabian Sea centred near Lat. 18.8° N/Long. 71.6° E, about 160 kms south - southwest of Surat and 130 kms northwest of Mumbai at 1500 UTC of 5<sup>th</sup> December. It further moved north-northeastwards and weakened into a well marked low pressure area over eastcentral and adjoining areas of northeast Arabian Sea at 2100 UTC of 5<sup>th</sup> December.

### 2.9.2. Other features observed

There was rapid intensification of Ockhi during its genesis stage, as it intensified into a Cyclonic Storm at 0300 UTC of 30 November, after its genesis as a depression at 0300 UTC of 29<sup>th</sup> (within 24 hrs). It intensified from deep depression into a cyclonic storm over Comorin area within six hours. While moving west - northwestwards, Ockhi further intensified into a Severe Cyclonic Storm (SCS) over Lakshadweep area in the early morning (0530 IST) of 1<sup>st</sup> December and Very Severe Cyclonic Storm (VSCS) over southeast (SE) Arabian Sea to the west of Lakshadweep in the afternoon (1430 IST) of 1<sup>st</sup> December. It then moved northwestwards and reached its peak intensity of 150 - 160 kmph gusting to 180 kmph in the afternoon (1430 IST) of 2<sup>nd</sup> December with lowest central pressure of 976 hecta Pascal (hPa). It moved north - northwestwards for some time and then north - northeastwards and maintained its intensity till early morning of 3<sup>rd</sup> December. It then continued to move north - northeastwards and weakened gradually. It crossed south Gujarat coast between Surat and Dahanu as a well marked low around early morning (0530 IST) of 6<sup>th</sup> December. Thus Ockhi had a clockwise recurving track. The track length of the cyclone was 2538 km. The life period of cyclone was 162 hours (6 days & 18 hours) against long

period average of 4.7 days for very severe cyclonic storm over north Indian Ocean.

### 2.9.3. Realized weather

It caused isolated heavy rainfall over south Tamil Nadu on 28<sup>th</sup> and 29<sup>th</sup> and scattered heavy to very heavy rainfall and isolated extremely heavy rainfall over south Tamil Nadu on 30<sup>th</sup> November and 1<sup>st</sup> and 2<sup>nd</sup> December. It caused isolated heavy rainfall over south Kerala on 29<sup>th</sup> November and 1<sup>st</sup> December and heavy to very heavy rainfall on 30<sup>th</sup> November. It caused heavy to very heavy rainfall over Lakshadweep on 1<sup>st</sup> and 2<sup>nd</sup> December. There was heavy rainfall over north coastal Maharashtra and adjoining south coastal Gujarat on 5<sup>th</sup> December.

Chief amounts of 24 hrs rainfall in cm ( $\geq 7$ cm) ending at 0300 UTC from 28 November - 5 December are given below:

#### 28 November, 2017

##### Tamil Nadu

Anaikaranchatram (Kollid) 6, K. M. Koil, Sirkali, Jayamkondam, Pullambadi & Manimutharu 5 each

#### 29 November, 2017

##### Tamil Nadu

Nannilam 7, Rameswaram 6, Trangambadi 5

#### 30 November, 2017

##### Tamil Nadu

Thuckalay 7, Jayamkondam, Chennai AP, Puducherry, Kanyakumari 6 each, Mylaudy, Thanjavur, Mayiladuthurai, Radhapuram & Taramani Arg 5 each

#### 1 December, 2017

##### Tamil Nadu

Manimutharu 38, Mylaudy 19, Thenkasi 17, Thuckalay, Pechiparai, Gudalur and Bhoothapandy 16 each, Watrap 15, Maniyachi, Eraniel and Colachel 14 each

##### Kerala

Aryankavu 26, Myladumparaagri 12, Punalur 9, Thiruvananthapuram AP 8

##### Lakshadweep

Minicoy 19

## 2 December, 2017

### Tamil Nadu

Sathanur Dam 23, Sirkali 19, Chidambaram & Anaikaranchatram (Kollid) 18, Chidambaram Aws 17, Virudachalam and Chengam 15 each

### Lakshadweep

Minicoy 14, Car Nicobar IAF 8.9

#### 2.10. *Deep Depression over central Bay of Bengal (6-9 December, 2017)*

2.10.1. A trough of low at mean sea level over Malay Peninsula and neighbourhood organised into a low pressure area over Malay peninsula and adjoining south Andaman Sea on 30<sup>th</sup> November. It lay over south Andaman Sea and adjoining Malay peninsula on same evening and became a well marked low pressure area over south Andaman Sea and adjoining strait of Malacca on 1<sup>st</sup> December. It lay over north Sumatra coast and adjoining south Andaman Sea on 2<sup>nd</sup>; over southeast Bay of Bengal and adjoining south Andaman Sea and equatorial Indian Ocean on 3<sup>rd</sup> and 4<sup>th</sup>. and over southeast Bay of Bengal and neighbourhood on 5<sup>th</sup>. It concentrated into a **Depression** over southeast Bay of Bengal and neighbourhood and lay centred near Lat. 8.5° N/ Long. 88.5° E about 1160 kms to the southeast of Machilipatnam and 1250 kms south - southeast of Gopalpur at 0300 UTC of 6<sup>th</sup>. It moved north-northwestwards and lay centered near Lat. 9.8° N/ Long. 88.0° E, about 1020 kms to the east-southeast of Machhlipatnam and 1100 kms south-southeast of Gopalpur at 1200 UTC of 6<sup>th</sup>. It moved northwestwards and lay centered near Lat. 11.1° N/Long. 88.0° E, about 930 kms east-southeast of Machhlipatnam and 970 kms south-southeast of Gopalpur at 0000 UTC of 7<sup>th</sup>. It further moved northwards and lay centered near Lat. 12.0° N/ Long. 88.0° E, about 870 kms southeast of Gopalpur and 875 kms east-southeast of Machhlipatnam at 0300 UTC of 7<sup>th</sup>. It moved north-northwestwards and lay centered over southeast and adjoining central Bay of Bengal near Lat. 12.8° N/Long. 87.7° E, about 770 kms south-southeast of Gopalpur and 800 kms east-southeast of Machhlipatnam at 1200 UTC of 7<sup>th</sup>. It continued to move north-northwestwards and intensified into a **Deep Depression** over central Bay of Bengal near Lat. 14.3° N/ Long. 87.0° E, about 590 kms south-southeast of Gopalpur and 660 kms east-southeast of Machhlipatnam at 0000 UTC of 8<sup>th</sup>. It further moved north-

northwestwards and lay centered over westcentral Bay of Bengal near Lat. 15.0° N/Long. 86.8° E, about 510 kms south - southeast of Gopalpur and 610 kms east-southeast of Machilipatnam at 0300 UTC of 8<sup>th</sup>. It moved north - northwestwards and lay centered over west central Bay of Bengal near Lat. 16.5° N/Long. 86.3° E, about 330 kms southeast of Gopalpur and 550 kms east-northeast of Machhlipatnam at 1200 UTC of 8<sup>th</sup>. It weakened into a **Depression** and lay centred over westcentral and adjoining northwest Bay of Bengal near Lat. 18.0° N/ Long. 86.2° E, about 190 kms southeast of Gopalpur and 250 kms south-southwest of Paradip at 1800 UTC of 8<sup>th</sup>. It moved north-northeastwards and lay centered over northwest Bay of Bengal near Lat. 19.2° N/Long. 86.5° E, about 170 kms east of Gopalpur and 120 kms south - southwest of Paradip and 320 kms south - southwest of Digha at 0300 UTC of 9<sup>th</sup>. It moved north-northeastwards and lay centered near Lat. 19.5° N/Long. 86.7° E, about 170 kms east of Gopalpur and 90 kms south of Paradip and 280 kms south-southwest of Digha at 0600 UTC of 9<sup>th</sup>. It further moved north-northeastwards and weakened into a well marked low pressure area over northwest Bay of Bengal at 1200 UTC of 9<sup>th</sup> December, 2017.

#### 2.10.2. *Other features observed*

The lowest estimated pressure of 1002 hPa was during 0000-1200 UTC of 8<sup>th</sup> December. Maximum estimated sustained wind was 30 kts.

#### 2.10.3. *Realized weather*

The system caused light to moderate rainfall at a few places with isolated heavy falls over Tamilnadu and Puducherry on 6-7 December. Light to moderate rainfall at many places with isolated heavy falls occurred over coastal Odisha and adjoining districts of interior Odisha on 8<sup>th</sup>. Light to moderate rainfall also occurred at many places over coastal districts of West Bengal, south Assam, Meghalaya, Mizo ram and Tripura with isolated heavy falls over Tripura on 9<sup>th</sup>.

Chief amounts of 24 hrs rainfall in cm ( $\geq 7$  cm) ending at 0300 UTC from 7-10 December are given below:

## 7 December, 2017

### Tamilnadu & Puducherry

Virudunagar AWS 11, Sivagiri 6, Sivakasi 5

## 8 December, 2017

### Tamilnadu & Puducherry

Gobichettipalayam 8, Rajapalayam 7, Srivilliputhur 6, Kovilpatti 5

**8 December, 2017****Odisha**

Kakatpur 12, Gop 11, Paradeep, Puri and Astaranga 10 each, Balikuda and Kujanga 9 each, Niali 8, Satyabadi and Tirtol 7 each, Alipingal, Krishnaprasad, Nimpara and Jagatsinghpur 6 each, Marsaghai, Derabis, Raghunathpur and Pipili 5 each

**10 December, 2017****Assam**

Karimganj and Amraghat 5 each

**Mizoram**

Serchip 6

**Tripura**

Kailashahar 7, Arundhutinagar and Gokulpur 5 each

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