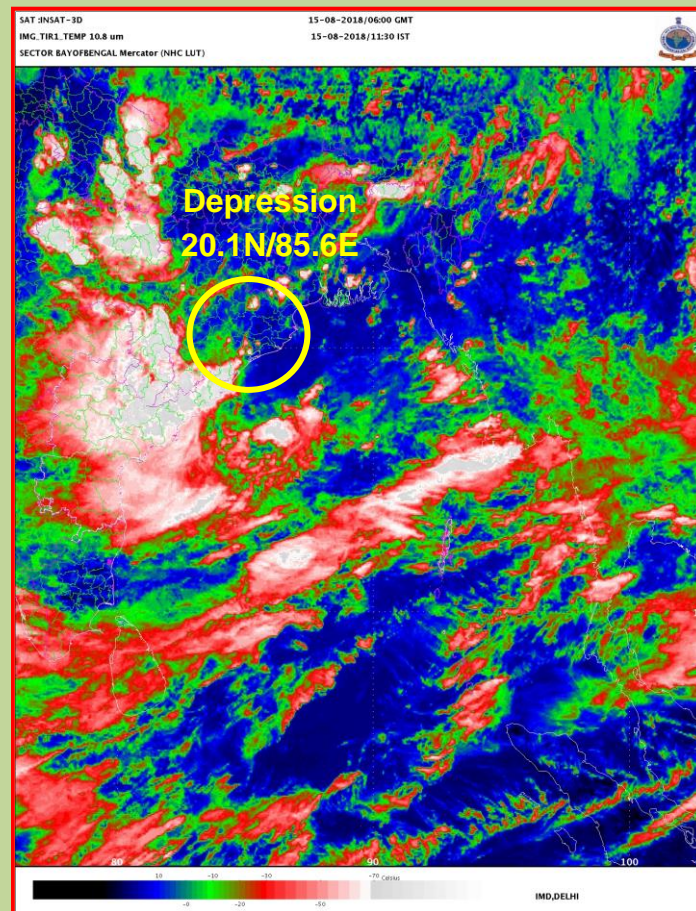




**GOVERNMENT OF INDIA  
MINISTRY OF EARTH SCIENCES  
INDIA METEOROLOGICAL DEPARTMENT**

**Depression over coastal Odisha  
(15-17 August, 2018): A Report**



INSAT-3D enhanced coloured IR imagery based on 0600 UTC of 15<sup>th</sup> August

**Cyclone Warning Division  
India Meteorological Department  
New Delhi  
August 2018**

## **Depression over coastal Odisha (15-17 August, 2018)**

### **1. Introduction**

Under the influence of a cyclonic circulation over northwest Bay of Bengal (BoB) off West Bengal coast, a low pressure area (LPA) formed over the same region in the morning (0300 UTC) of 13<sup>th</sup>. It lay as a well marked low pressure area (WML) over northwest BoB off West Bengal-north Odisha coasts in the afternoon (0900 UTC) of 14<sup>th</sup>. It concentrated into a depression over coastal Odisha in the morning (0300 UTC) of 15<sup>th</sup>. It moved west-northwestwards and weakened gradually into a WML over southwest Madhya Pradesh and neighbourhood in the morning (0300 UTC) of 17<sup>th</sup> and LPA in the same evening (0900 UTC). The system became less marked over east Rajasthan and neighbourhood in the morning (0300 UTC) of 18<sup>th</sup> August.

The salient features of the system were as follows:

- (i) It had a straight moving track and moved west-northwestwards throughout its life period.
- (ii) It had a life period of 48 hours (depression to depression).
- (iii) It had a track length (depression to depression) of 1145 km and moved with an average speed of 25 kmph.
- (iv) Under the influence of this system and its remnant low pressure area widespread and intense rainfall activity was observed over the northern and central parts of the country extending from Odisha, Chattisgarh, Vidarbha, Telangana, Madhya Pradesh, Marathwada, Konkan & Goa, Gujarat and East Rajasthan. Extremely heavy rainfall occurred over Chattisgarh on 16<sup>th</sup> and west Madhya Pradesh on 17<sup>th</sup>.
- (v) Under its influence, the lower level westerly/southwesterly winds over the Arabian Sea along & off Kerala coast strengthened. The interaction of the stronger westerly/southwesterly winds with the Western Ghats resulted in heavy to extremely heavy rainfall activity over Kerala during this period.

IMD mobilised all its resources to track the system and regular warnings w.r.t. track, intensity, landfall and associated adverse weather were issued to concerned central and state disaster management agencies, print & electronic media and general public. Regular advisories were also issued to WMO/ESCAP Panel member countries including Bangladesh. Its genesis, movement and associated adverse weather could be predicted well by IMD

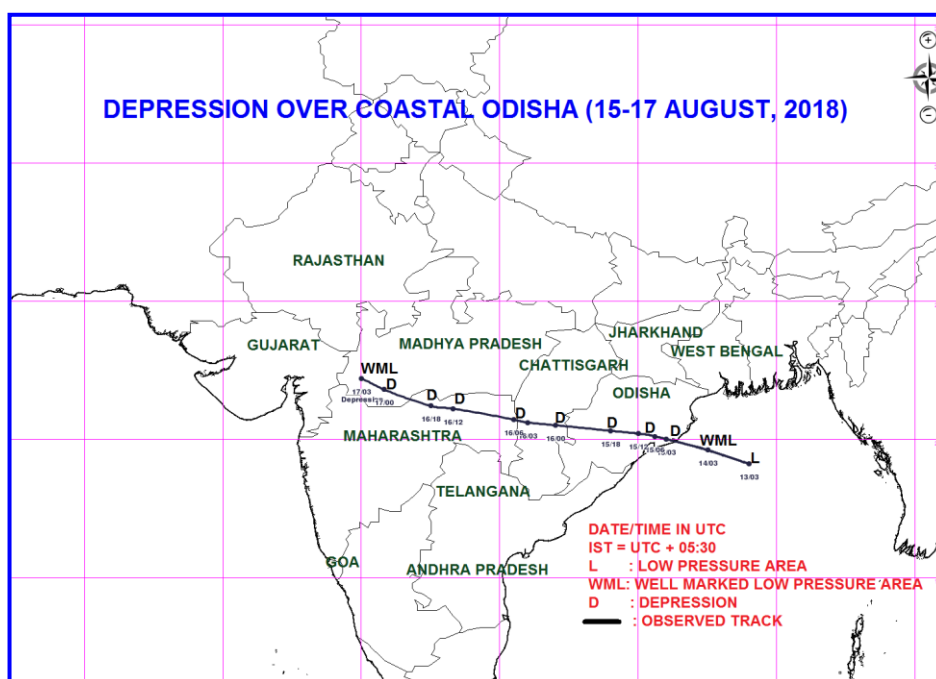
The brief life history, associated weather and forecast performance of IMD/RSMC, New Delhi are presented in following sections.

### **2. Brief life history**

A cyclonic circulation lay over westcentral BoB & adjoining south coastal Andhra Pradesh at 7.6 km above mean sea level on 9<sup>th</sup>. It persisted over the same region and was seen at 5.8 km above mean sea level on 10<sup>th</sup>. It lay over south Odisha - north Andhra Pradesh coasts between 3.1 km & 5.8 km above mean sea level, tilting southwestwards with height on 11<sup>th</sup>. It lay over north coastal Odisha & neighbourhood extending upto 7.6 km above mean sea level and tilting south-southwestwards with height on 12<sup>th</sup>. Under its influence, a low pressure area formed over northwest BoB off West Bengal coast with the associated cyclonic circulation extending upto 7.6 km above mean sea level tilting southwestwards with height on 13<sup>th</sup>. It lay as a WML over northwest BoB off West Bengal-north Odisha coasts with the associated cyclonic circulation extending upto 7.6 km above mean sea level, tilting southwestwards with height on 14<sup>th</sup>.

At 0300 UTC of 14<sup>th</sup>, Madden Julian oscillation Index currently lay in phase 6 with amplitude greater than 1. The low level relative vorticity is about  $100 \times 10^{-5} \text{sec}^{-1}$  over westcentral BoB and was oriented along northeast to southwest. The lower level convergence is about  $20 \times 10^{-5} \text{sec}^{-1}$  over westcentral & adjoining northwest BoB to the

southwest of system centre. The upper level divergence was about  $40 \times 10^{-5} \text{sec}^{-1}$  over west central BoB to the southeast of system centre. The vertical wind shear was moderate (10-20 knots) around system centre and along the expected direction of movement of depression. Under these conditions, the system lay as a WML over northwest BoB off West Bengal-north Odisha coasts. The upper tropospheric ridge lay far to the north of the system centre in association with the Tibetan High. There were east-southeasterly winds over the region. All these conditions supported further intensification of WML into a depression at 0300 UTC of 15<sup>th</sup> August and its west-northwestward movement. With the similar environmental conditions, the system maintained its intensity of depression till morning of 17<sup>th</sup> August and moved west-northwestwards with a faster speed (25 kmph). It weakened into a WML over southwest Madhya Pradesh and neighbourhood at 0300 UTC and an LPA at 0900 UTC of 17<sup>th</sup>. It became less marked over east Rajasthan and neighbourhood at 0300 UTC of 18<sup>th</sup>. The observed track and best track parameters of depression over coastal Odisha are presented in Fig.1 and Table 1.



**Fig.1. Observed track of Depression over northwest Bay of Bengal and neighborhood (15-17 August, 2018)**

**Table 1: Best track positions and other parameters of the Depression over coastal Odisha during 15-17 August, 2018**

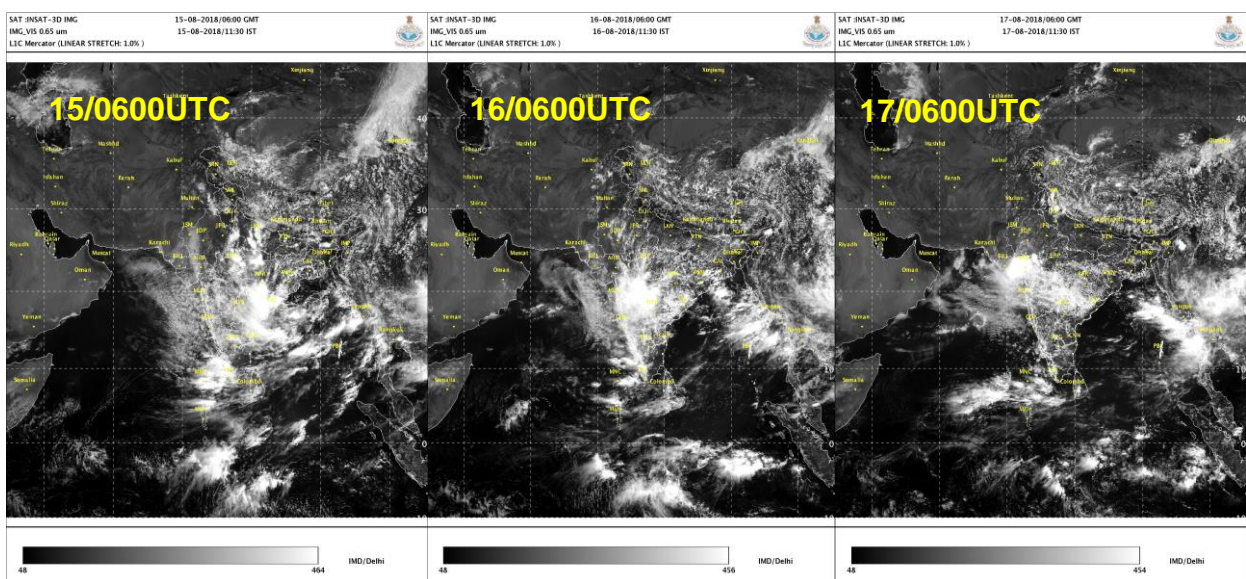
Date	Time (UTC)	Centre lat. <sup>o</sup> N/ long. <sup>o</sup> E		C.I. NO.	Estimated Central Pressure (hPa)	Estimated Maximum Sustained Surface Wind (kt)	Estimated Pressure drop at the Centre (hPa)	Grade
15/08/2018	0300	20.0	86.0	-	993	25	4	D
	0600	20.1	85.6	-	993	25	4	D
	1200	20.2	85.0	-	993	25	4	D
	1800	20.3	84.0	-	993	25	4	D
16/08/2018	0000	20.5	82.0	-	994	25	3	D
	0300	20.6	81.0	-	994	20	3	D
	0600	20.7	80.5	-	994	20	3	D



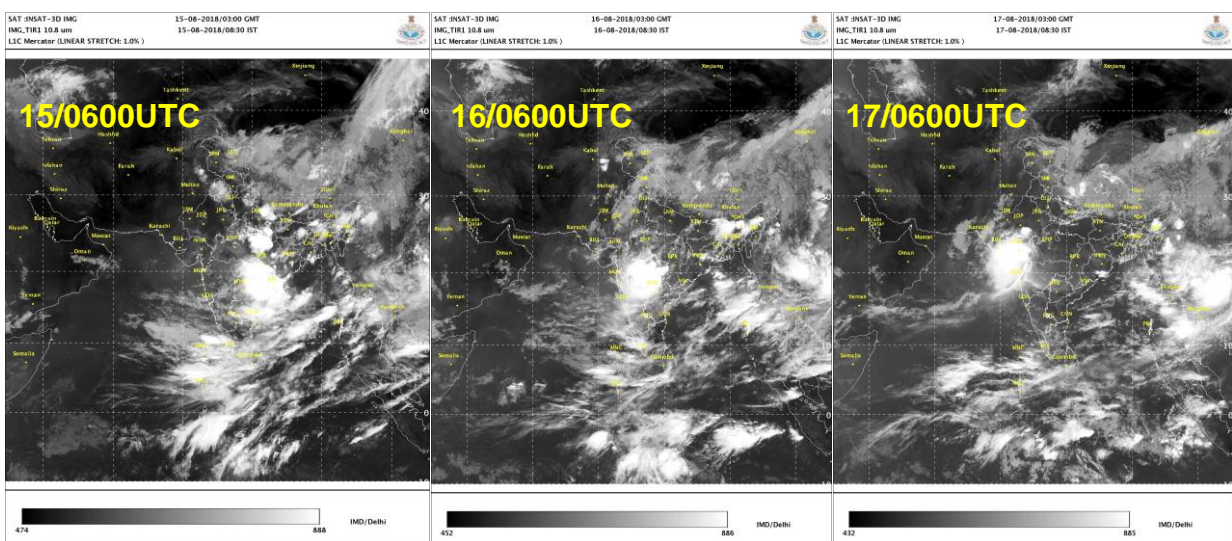
	1200	21.1	78.3	-	994	20	3	D
	1800	21.2	77.5	-	994	20	3	D
17/08/2018	0000	21.8	75.8	-	994	20	3	D
	0300	<b>Weakened into a well-marked low pressure area over southwest Madhya Pradesh and adjoining Gujarat &amp; north Madhya Maharashtra</b>						

**3. Feature observed through Satellites and Radar:**

Satellite monitoring of the system was mainly done by using half hourly INSAT-3D imageries. Satellite imageries of international geostationary satellites Meteosat-8 imageries were also considered. Typical INSAT-3D IR, visible, enhanced colored and cloud top brightness temperature imageries are presented in Fig. 2. The imageries indicate the shear pattern of clouds associated with the depression. The convective clouds were sheared to the southwest of system centre.

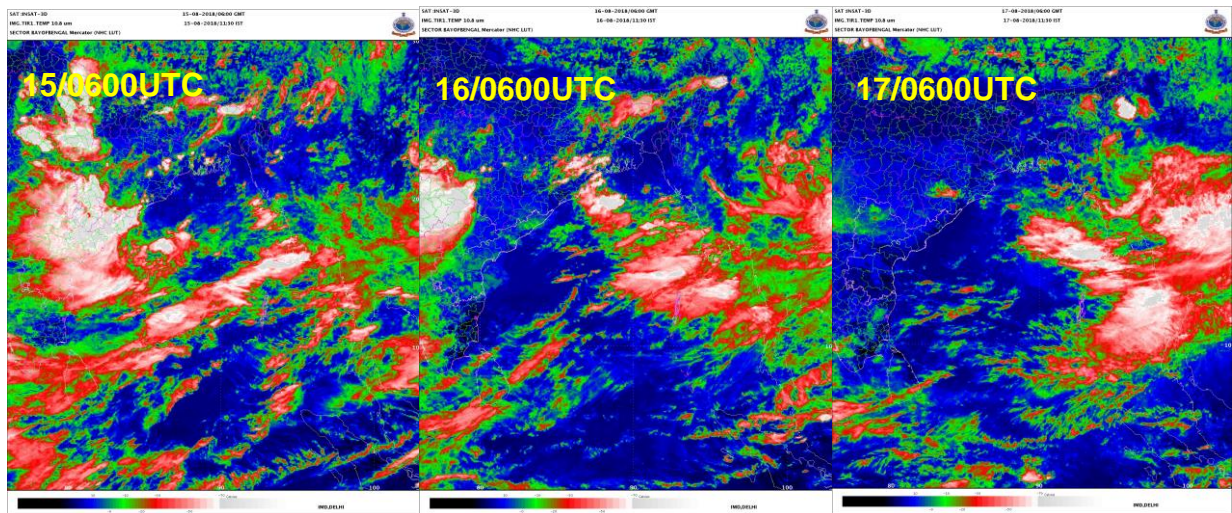


**Fig. 2(i): INSAT-3D visible imageries during 15-17 August, 2018**

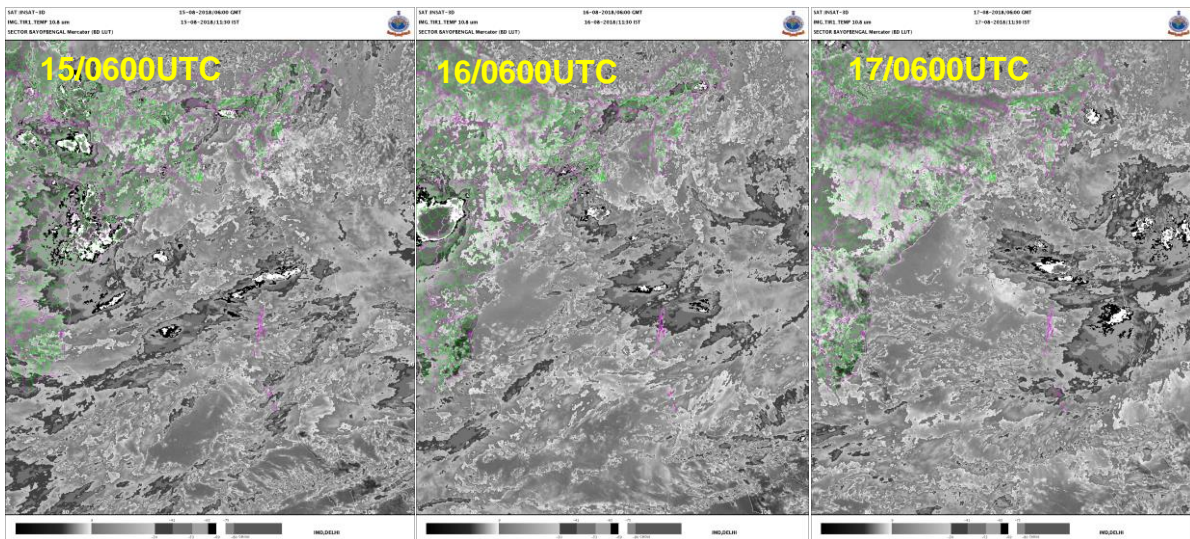


**Fig. 2(ii): INSAT-3D enhanced colored imageries during 15-17 August, 2018**





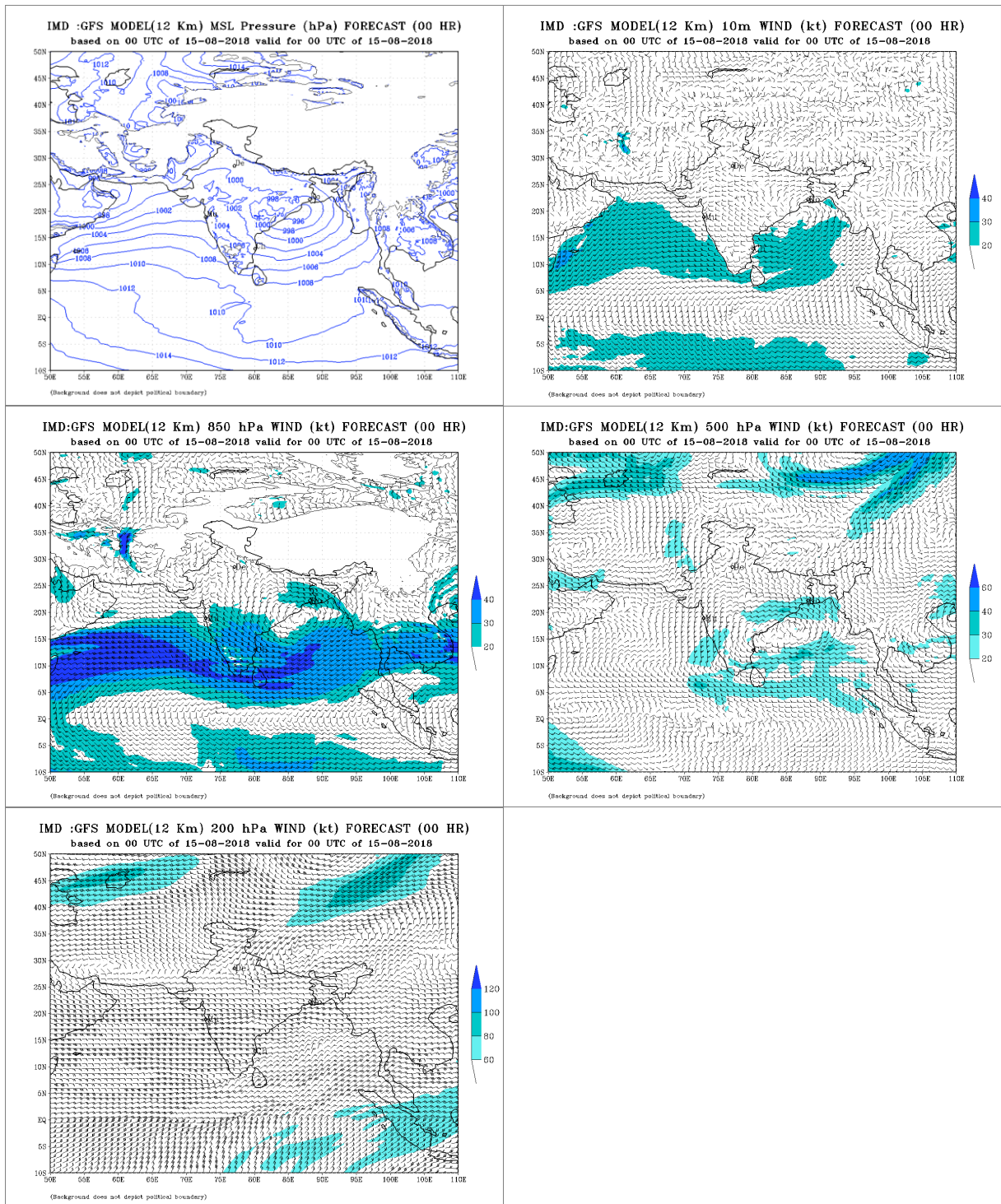
**Fig. 2(iii): INSAT-3D enhanced colored imageries during 15-17 August, 2018**



**Fig. 2(iii): INSAT-3D cloud top brightness temperature imageries during 15-17 August, 2018**

**Dynamical features**

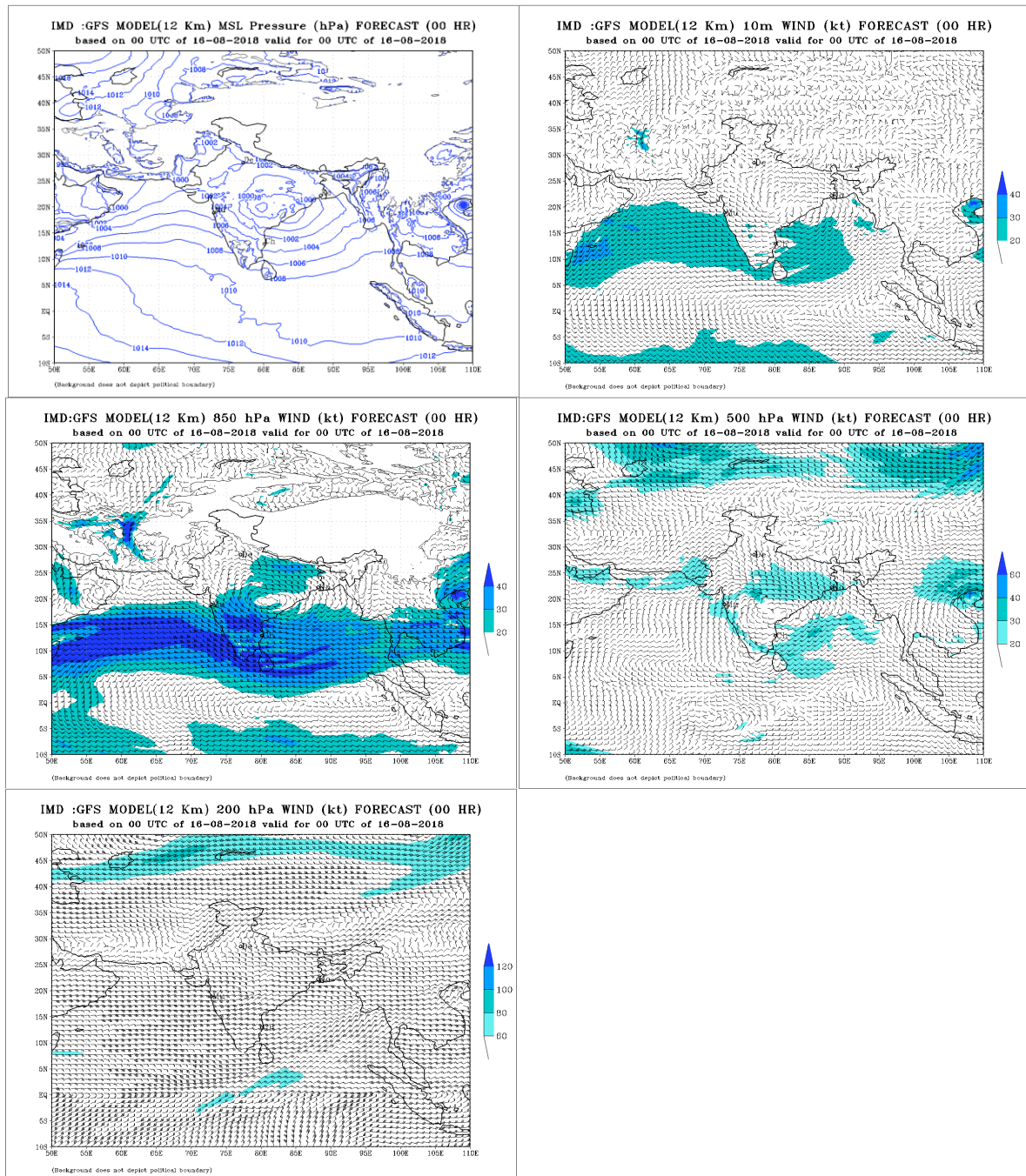
IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10 m, 850, 500 and 200 hPa levels are presented in Fig.4. At 0000 UTC of 15<sup>th</sup> August, it indicated a low pressure area over northwest BoB off Odisha coast. The circulation was seen upto 500 hPa level tilting southwestwards with height. The ridge at 200 hPa level was far to the north in association with anticyclonic circulation near 31<sup>o</sup>N/86<sup>o</sup>E. The winds over the depression at 200 hPa level were nearly easterly. At 0300 UTC of 15<sup>th</sup>, the system lay as a depression over coastal Odisha.



**Fig4 (i): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 15<sup>th</sup> August**

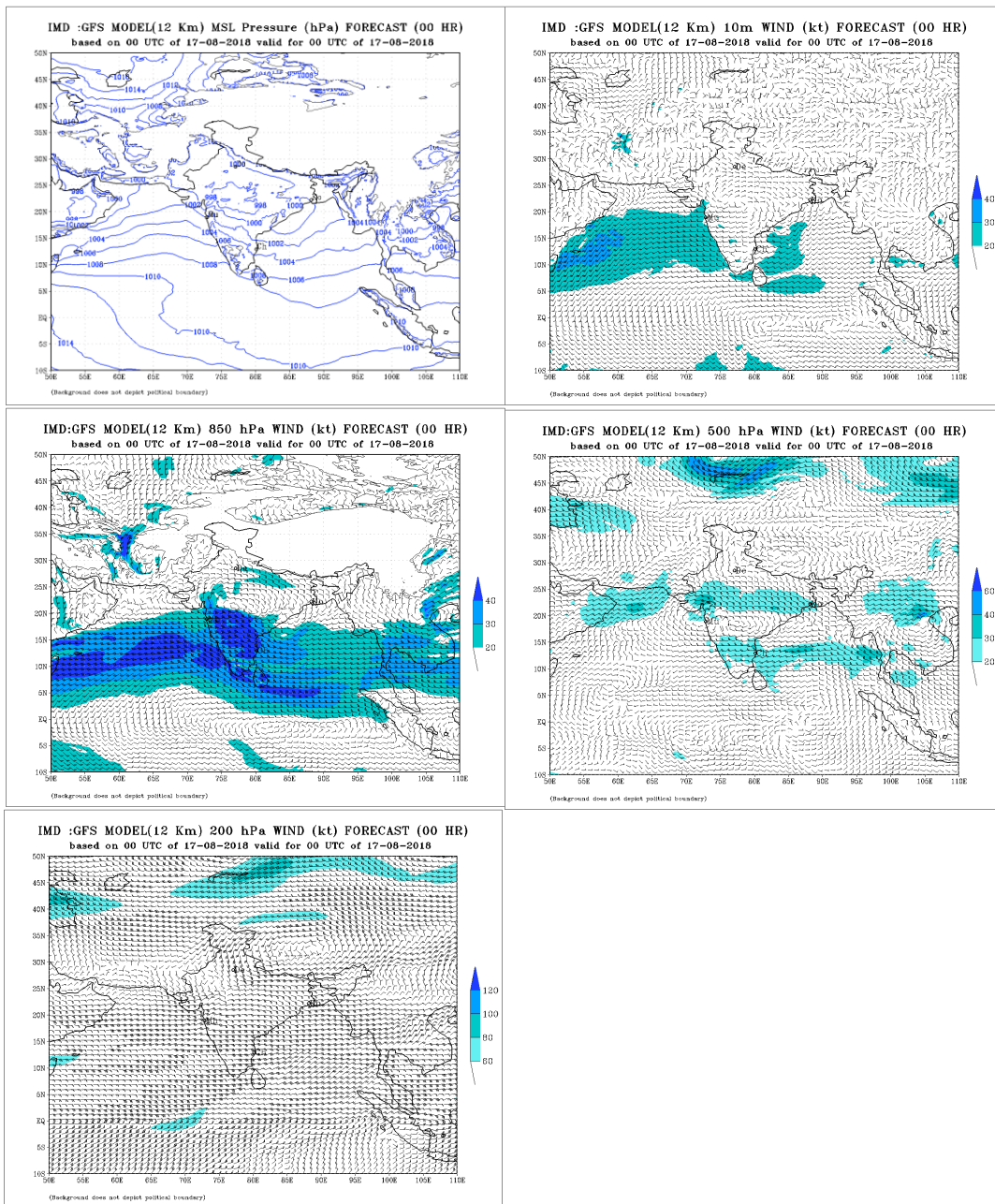


At 0000 UTC of 16<sup>th</sup> August, it indicated a low pressure area over east Vidarbha. The circulation was seen upto 500 hPa level tilting southwestwards with height. Ridge was seen to the far north in association with anticyclonic circulation near 31°N/86°E. The winds over the depression at 200 hPa level were nearly easterly. At 0300 UTC of 16<sup>th</sup>, the system lay as a depression over Chattisgarh.



**Fig.4 (ii): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 16th August**

The initial conditions based on 0000 UTC of 17<sup>th</sup> indicated an extended low over south Madhya Pradesh and adjoining Maharashtra. At 0300 UTC of 17<sup>th</sup>, the system weakened into a WML over southwest Madhya Pradesh and neighbourhood.



**Fig3 (ii): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 17<sup>th</sup> August**

Thus IMD GFS underestimated the genesis and intensification, as it predicted only a low pressure area. Also the area of occurrence was low was also misplaced on 15<sup>th</sup> and 16<sup>th</sup> August. However, it could pick up the near westward movement of system correctly.

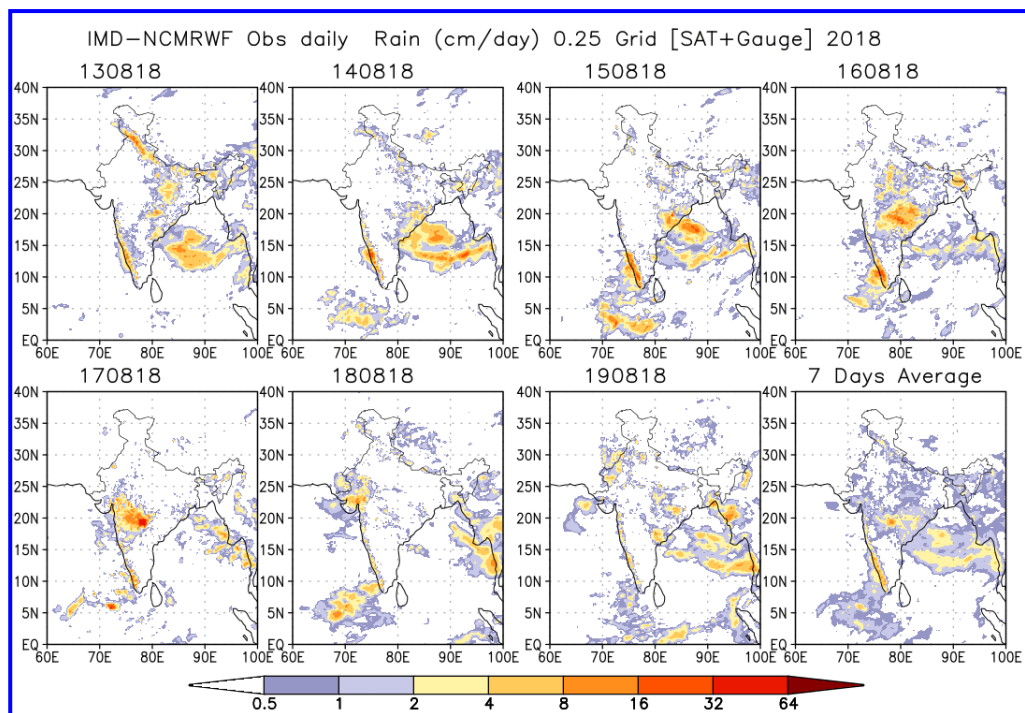


#### 4. Realized Weather:

##### 4.1 Rainfall:

Under the influence of depression, on 14<sup>th</sup>, heavy to very heavy rainfall occurred at a few places over Odisha and coastal Andhra Pradesh with extremely heavy falls at isolated places over Odisha. On 15<sup>th</sup> August, heavy rainfall occurred at a few places over Odisha, Vidarbha, Chattisgarh, Telangana and at isolated places over Madhya Pradesh, Madhya Maharashtra and Marathwada with very heavy rainfall at isolated places over Odisha, Vidarbha, Telangana & Chattisgarh and extremely heavy rainfall at isolated over Chattisgarh. On 16<sup>th</sup>, the system caused heavy to very heavy rainfall at many places over Vidarbha, Marathwada, Madhya Maharashtra, Gujarat, west Madhya Pradesh & Goa and at isolated places over Telangana with extremely heavy rainfall at isolated places over & west Madhya Pradesh. On 17<sup>th</sup>, it caused heavy to very rainfall at isolated places over Gujarat, Saurashtra & Kutch, Vidarbha, Madhya Maharashtra and Marathwada. On 18<sup>th</sup>, it caused, heavy rainfall at isolated places over Gujarat, Saurashtra & Kutch, Madhya Maharashtra, Konkan & Goa and at many places over Telangana with very heavy falls at isolated places. On 19<sup>th</sup>, it caused heavy rainfall at isolated places over Gujarat, Saurashtra & Kutch, Vidarbha, Konkan & Goa, Marathwada and east Rajasthan.

The daily rainfall distribution ending at 0300 UTC of each date during 17-23 July, 2018 based on merged gridded rainfall data of IMD/NCMRWF is shown in Fig.4.



**Fig.4: Daily rainfall distribution based on merged gridded rainfall data of IMD/NCMRWF during 13-19 August, 2018**

(Heavy rainfall distribution: Isolated places: upto 25%, A few places: 26-50%, Many places: 51-75%, Most places: 76-100% of total stations in the region;  
Heavy rainfall: 64.5 – 115.5 mm, Very heavy rainfall: 115.6 – 204.4 mm, Extremely heavy rainfall: 204.5 mm or more).

The 24 hour cumulative rainfall ( $\geq 7$  cm) ending at 0830 hours IST of date during 15-20<sup>th</sup> August is presented below:

**15th August:**

**Odisha:** Lanjigarh-28, Madanpur Rampur-25, Ambadola 7 Narla-24 each, Bhawanipatna-22, Kashipur-19, Koraput, Nuagada, Jaipatna & Tentulikhunti-15 each, nawarangpur-13, Kashinagar, R. Udaigiri & Jeypore-12 each, Kesinga & Junagarh-10 each, Similiguda 7 Pottangi-9 each, Muniguda, Raghunathpur, Paralakhemundi & Dabugan-8 each and Niali, Chandanpur & Banki-7 each

**Coastal Andhra Pradesh:** Palakonda-13, Ranastalam-11, Vepada & Kalingapatnam-10 each, Mandasa-9, Garividi, Pathapatnam & Cheepurupalle-8 each and Gantayada & Palasa-7 each

**16th August:**

**Odisha:** Malkangiri & Sinapali – 15 each, Junagarh, Boden, & Patnagarh – 12 each, Nawapara -11, Narla, Raigarh & Dharmagarh – 10 each, Bhawanipatna, Saintala & Jharbandh – 9 each, Ambadola, Dabugan, Hindol, Nischintakoili, & Similiguda, Lanjigarh & Jeypore – 8 each and Khaprakhol, Kesinga, Paikmal & Chandahandi- 7 each

**West Madhya Pradesh:** Gwalior, Sonkatch & Isagarh – 8 each and Kolaras - 7

**East Madhya Pradesh:** Dindori- 8 and Tendukheda - 7

**Vidarbha:** Lakhandur – 13, Bhadravati & Ahiri – 12 each, Korpana 11, Mohadi & Sadakarjuni -10 each, Bramhapuri, Chandrapur & Bhandara – 9 each, Ballarpur, Lakhani, Gondia, Nagbhir & Mulchera - 8 each and Chimur, Deori, Umrer, Mul, Tumsar, Arjuni, Morgaon, Warora, Sindewahi & Desaiganj 7

**Chhattisgarh:** Bhopalpatnam – 40, Bijapur 14, Kanker 11, Gariabund & Jagdalpur 9, Rajim, Mahasamund, Mana-Raipur & Simga 8 each and Arang & Deobhog – 7 each

**Telangana:** Perur - 19, Sirpur – 17, Asifabad – 13, Kaleswaram, Utnur & Chennur – 11 each, Manthani, Ibrahimpatnam & Adilabad – 9 each, Ramgundam, Venkatapuram, Metpalle, Bhupalpalle & Mudhole – 8 each and Sarangapur, Eturnagaram, Bhiknur, Boath & Julapalle – 7 each

**Madhya Maharashtra:** Mahabaleshwar- 14

**Marathwada:** Mahur, Tuljapur, Bhum & Kinwat – 7 each

**17<sup>th</sup> August:**

**Vidarbha:** Barshitakli -16, Digras, Karanjlad & Arni-13 each, Manora & Buldana – 12 each, Deolgaon Raja & Pusad – 11 each, Patur, Malkapur & Sindkhed Raja – 10 each, Murtajapur, Darwha, Jalgaon Jamod, Motala, Mangrulpir, Joiti & Umerkhed - 9, Mahagaon, Malegaon, Lonar, Chikhli, Akola & Dharni-8 each and Washim, Mehkar, Korpana & Risod-7 each

**Marathwada:** Kinwat & Mahur – 19 each, Kannad-17, Aurangabad-16, Phulambri & Jalna-15 each, Pathri, Jafrabad & Selu – 14 each, Mantha, Manvat, Partur & Ghansawangi-13 each, Ardhapur-12, Himayatnagar, Badnapur, Vaijapur & Aundha Nagnath – 11 each, Purna, Jintur, Nanded, Sillod, Hadgaon & Bhokardan -10 each, Sonpeth, Paithan, Manjlegaon, Kallamnuri & Osmanabad – 9 each, Ambad & Parbhani – 8 each and Kandhar, Vasmat, Soegaon, Gangapur, Kaij, Georai, Mudkhed & Hingoli – 7 each

**Madhya Maharashtra:** Mahabaleshwar - 16, Raver, Navapur & Jamner-14 each, Jalgaon - - 13, Lonavala -12, Dhadgaon/Akrani -10, Peth, Dhule, Parola & Erandol -10 each, Shirpur, Bodwad, Pachora, Surgana & Chalisingaon – 9 each and Gidhade, Yaval, Dahigaon, Shirampur, Girnadam & Igatpuri – 7 each



**Konkan & Goa:** Valpoi-14, Bhira & Matheran – 9 each and Dodamarg-8

**Gujarat Region:** Chhota Udepur-14, Tilakwada-13, Ukai, Quant & Valod-12, Godhra & Wanakbori -10 each, V.Vidyanagar-9, Vyara, Subir & Vadodara-8 each and Nizer, Vansda, Garudeshwar, Dhanpur, Garbada, Bodeli, Sagbara & Uchchhal -7 each

**North Interior Karnataka:** Londa-8

**Telangana:** Boath - 19, Adilabad-10 and Sarangapur-7

**West Madhya Pradesh:** Bhikangaon - 23, Shegaon - 21, Khandwa & Burhanpur - 17 each, Khargone, Thikri & Sendhwa - 13 each, Badwani – 12, Jhabua – 11, Manawar, Pandhana, Nepanagar, Sardarpur & Kasarwad – 10 each, Maheshwar & Gandhwani – 9 each and Kukshi, Khaknar & Barwaha – 8 each

### **18<sup>th</sup> August:**

**Gujarat Region:** Kapadvanj-15, Godhra-13 and Matar-12

**Saurashtra & Kutch:** Kandla New & Sayla-11 each, Muli & Chotila-9 each and Wadhvan, Dhrangadhra, Surendranagar & Limbdi – 7 each.

**Vidarbha:** Chandur Bazar-7

**Madhya Maharashtra:** Radhanagari-10 and Mahabaleshwar-8

**Marathwada:** Jalna-16 and Vasmat-7

### **19<sup>th</sup> August:**

**Gujarat Region:** Kaprada-8

**Saurashtra & Kutch:** Anjar & Gandhidham-10 each and Kandla Airport- 9

**Madhya Maharashtra:** Mahabaleshwar- 9 and Radhanagari & Shahuwadi-7 each

**Konkan & Goa:** Karjat & Sangameshwar Devrukh-7 each

### **20<sup>th</sup> August:**

**Gujarat Region:** Tarapur-7,

**Saurashtra & Kutch:** Kotdasangani-7,

**Konkan & Goa:** Bhira -8 and Alibag-7

**East Rajasthan:** Lalsot-10 and Amer & Nagar-7 each

## **5. Bulletins issued by IMD**

IMD issued regular bulletins to WMO/ESCAP Panel member countries including Bangladesh and Myanmar, National & State Disaster Management Agencies of Andhra Pradesh, Odisha, Chattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Telangana, Uttar Pradesh and Rajasthan, general public and media. Regular Bulletins every six hourly were issued since formation of depression over northwest BoB. In addition, RSMC New Delhi also issued Press Release and SMS to registered users.

### **5.1.: Bulletins issued by Cyclone Warning Division, New Delhi**

Bulletins issued by Cyclone Warning Division of IMD in association with the system are given in Table 2

**Table 2(a): Bulletins issued by Cyclone Warning Division, IMD, New Delhi**

S. No.	Bulletins	No. of Bulletins	Issued to
1	National Bulletin	11	1. IMD's website 2. FAX and e-mail to Control Room NDM, Ministry of Home affairs, Control Room NDMA, Cabinet Secretariat, Minister of Sc. & Tech, Secretary MoES, DST, HQ Integrated Defence Staff, DG Doordarshan, All India Radio, DG-NDRF, Director Indian Railways, Indian Navy, IAF, Chief Secretary: Andhra Pradesh, West Bengal, Odisha, Chattisgarh, Jharkhand, Maharashtra, Madhya Pradesh, Maharashtra, Telangana, Karnataka, Rajasthan and Gujarat
2	RSMC Bulletin	2	1. IMD's website 2. All WMO/ESCAP member countries through GTS and E-mail. 3. Indian Navy, IAF by E-mail
3	Press Release	3	1. Disaster Managers, Media persons by email and uploaded on website
4	Facebook /Twitter	6 times	Highlights uploaded on facebook/twitter since formation of depression.
5	SMS	843	Twice daily

**Table-2(b): Bulletins issued by Cyclone Warning Centre (CWC) Bhubaneswar/ Meteorological Centre (MC) Raipur**

S. N.	Type of Bulletin	Number of Bulletins	
		ACWC Kolkata	MC Raipur
1.	Sea Area Bulletins	NIL	NIL
2.	Coastal Weather Bulletins	12	NIL
3.	Fishermen Warnings issued	21	NIL
4.	Port Warnings	13	NIL
5.	Heavy Rainfall Warning	05	04
6.	Gale Wind Warning	NIL	NIL
7.	Storm surge warning	NIL	NIL
8.	Information & Warning issued to State Government and other Agencies	07	04
9.	SMS/ Whatsapp (message in group)/email	1850	0/20+/30+
10.	Press Release	04	



## 6. Operational Forecast Performance

- The first information regarding formation of low pressure area over northwest BoB and neighbourhood around 13<sup>th</sup> was issued at 0630 UTC of 8<sup>th</sup> August (about 120 hours in advance). The low pressure area formed over northwest BoB and neighbourhood at 0300 UTC of 13<sup>th</sup> August.
- First information regarding formation of depression over northwest BoB off West Bengal & Odisha coasts during 15<sup>th</sup> to 16<sup>th</sup> August with moderate probability (51-75%) was issued in Tropical Weather Outlook issued at 0600 UTC of 14<sup>th</sup> August (about 24 hours in advance). And depression formed over coastal Odisha at 0300 UTC of 15<sup>th</sup> August.
- In the first bulletin issued in the morning (0300 UTC) of 15<sup>th</sup> August, it was predicted that depression would move west-northwestwards with no further intensification during next 24 hours. The warning was further updated in the morning (0300 UTC) of 16<sup>th</sup> August that the system would move further west-northwestwards and weaken gradually during next 24 hours. The system moved west-northwestwards throughout its life period and weakened into WML over southwest Madhya Pradesh & neighbourhood at 0300 UTC of 17<sup>th</sup>.

IMD issued regular warning bulletins to the concerned central and state disaster management authorities and press & media. The verification of heavy rainfall warnings issued by IMD for the depression during 15<sup>th</sup> -17<sup>th</sup>.August is presented in Table 3. It can be found that the occurrence of heavy rainfall in association with the system could be predicted well in advance.

**Table 3 : Verification of heavy rainfall warning issued by IMD for Depression over coastal Odisha (15<sup>th</sup> – 17<sup>th</sup> August, 2018)**

Date/ Base Time (UTC)	Forecast Issued	Realised Rainfall
15/0300	<ul style="list-style-type: none"> <li>•Heavy to very heavy rain at a few places and extremely heavy falls at isolated places is very likely over south Odisha, south Chhattisgarh &amp; north Telangana and heavy to very rain at isolated places over north coastal Andhra Pradesh during next 24 hrs and isolated heavy to very falls over these regions during subsequent 24 hrs.</li> <li>•Gujarat region is likely to receive heavy to very heavy rain at a few places</li> </ul>	<p><b>15th August:</b>  <b>Odisha:</b> Lanjigarh-28, Madanpur Rampur-25, Ambadola 7 Narla-24 each, Bhawanipatna-22, Kashipur-19, Koraput, Nuagada, Jaipatna &amp; Tentulikhunti-15 each, nawarangpur-13, Kashinagar, R. Udaigiri &amp; Jeypore-12 each, Kesinga &amp; Junagarh-10 each, Similiguda 7 Pottangi-9 each, Muniguda, Raghunathpur, Paralakhemundi &amp; Dabugan-8 each and Niali, Chandanpur &amp; Banki-7 each  <b>Coastal Andhra Pradesh:</b> Palakonda-13, Ranastalam-11, Vepada &amp; Kalingapatnam-10 each, Mandasa-9, Garividi, Pathapatnam &amp; Cheepurupalle-8 each and Gantiyada &amp; Palasa-7 each</p> <p><b>16th August:</b>  <b>Odisha:</b> Malkangiri &amp; Sinapali – 15 each, Junagarh, Boden, &amp; Patnagarh – 12 each,</p>

	<p>and extremely heavy falls at isolated places on 17<sup>th</sup> and heavy rain at a few places with very heavy rain at isolated places on 18<sup>th</sup> August.</p> <ul style="list-style-type: none"> <li>•Saurashtra and Kutch is likely to receive heavy to very heavy rain at isolated places on 17<sup>th</sup> and 18<sup>th</sup>.</li> <li>•Heavy to very heavy rainfall at isolated places likely over east Vidarbha and east Madhya Pradesh during next 24 hrs.</li> <li>•Heavy to very heavy rainfall at a few places is likely over Vidarbha and isolated heavy to very heavy rainfall likely over south Madhya Pradesh, north Madhya Maharashtra and north Konkan during subsequent 24 hrs.</li> </ul>	<p>Nawapara -11, Narla, Raigarh &amp; Dharmagarh – 10 each, Bhawanipatna, Saintala &amp; Jharbandh – 9 each, Ambadola, Dabugan, Hindol, Nischintakoili, &amp; Similiguda, Lanjigarh &amp; Jeypore – 8 each and Khaprakhol, Kesinga, Paikmal &amp; Chandahandi- 7 each</p> <p><b>West Madhya Pradesh:</b> Gwalior,&amp; Sonkatch &amp; Isagarh – 8 each and Kolaras - 7</p> <p><b>East Madhya Pradesh:</b> Dindori- 8 and Tendukheda - 7</p> <p><b>Vidarbha:</b> Lakhandur – 13, Bhadravati &amp; Ahiri – 12 each, Korpana 11, Mohadi &amp; Sadakarjuni -10 each, Bramhapuri, Chandrapur &amp; Bhandara – 9 each, Ballarpur, Lakhani, Gondia, Nagbhir &amp; Mulchera - 8 each and Chimur, Deori, Umrer, Mul, Tumsar, Arjuni, Morgaon, Warora, Sindewahi &amp; Desaiganj 7</p> <p><b>Chhattisgarh:</b> Bhopalpatnam – 40, Bijapur 14, Kanker 11, Gariabund &amp; Jagdalpur 9, Rajim, Mahasamund, Mana-Raipur &amp; Simga 8 each and Arang &amp; Deobhog – 7 each</p> <p><b>Telangana:</b> Perur - 19, Sirpur – 17, Asifabad – 13, Kaleswaram, Utnur &amp; Chennur – 11 each, Manthani, Ibrahimpatnam &amp; Adilabad – 9 each, Ramgundam, Venkatapuram, Metpalle, Bhupalpalle &amp; Mudhole – 8 each and Sarangapur, Eturnagaram, Bhiknur , Boath &amp; Julapalle – 7 each</p> <p><b>Madhya Maharashtra:</b> Mahabaleshwar- 14</p> <p><b>Marathwada:</b> Mahur, Tuljapur, Bhum &amp; Kinwat – 7 each</p>
16/0300	<p>○ Heavy to very heavy rainfall at a few places with <b>extremely heavy falls</b> at isolated places is very likely over Vidarbha &amp; Marathwada during next 24 hours and heavy rainfall at isolated places over West Vidarbha &amp; Marathwada during subsequent 24 hours.</p> <p>○ Isolated heavy to very heavy rainfall and <b>extremely heavy falls</b> very likely over Madhya Maharashtra and</p>	<p><b>17<sup>th</sup> August:</b></p> <p><b>Vidarbha:</b> Barshitakli -16, Digras, Karanjlad &amp; Arni-13 each, Manora &amp; Buldana – 12 each, Deolgaon Raja &amp; Pusad – 11 each, Patur, Malkapur &amp; Sindkhed Raja – 10 each, Murtajapur, Darwha, Jalgaon Jamod, Motala, Mangrulpur, Joiti &amp; Umerkhed - 9, Mahagaon, Malegaon, Lonar, Chikhli, Akola &amp; Dharni-8 each and Washim, Mehkar, Korpana &amp; Risod-7 each</p> <p><b>Marathwada:</b> Kinwat &amp; Mahur – 19 each, Kannad-17, Aurangabad-16, Phulambri &amp; Jalna- 15 each, Pathri, Jafrabad &amp; Selu – 14 each, Mantha, Manvat, Partur &amp; Ghansawangi-13 each, Ardhapur-12, Himayatnagar, Badnapur, Vaijapur &amp; Aundha Nagnath – 11 each, Purna,</p>



	<p>north Konkan during next 48 hours.</p> <ul style="list-style-type: none"> <li>○ Gujarat region is very likely to receive isolated heavy to very heavy rainfall during next 24 hours and isolated heavy to very heavy rain with <b>extremely heavy falls</b> for subsequent 24 hours.</li> <li>○ Saurashtra and Kutch is also very likely to receive heavy to very heavy rainfall at isolated places on 17<sup>th</sup> and 18<sup>th</sup>.</li> <li>○ Isolated heavy to very heavy rainfall over North Interior Karnataka and isolated heavy rainfall over Telangana during next 24 hours.</li> <li>○ Isolated heavy rainfall over southwest Madhya Pradesh during next 48 hours.</li> </ul>	<p>Jintur, Nanded, Sillod, Hadgaon &amp; Bhokardan - 10 each, Sonpeth, Paithan, Manjlegaon, Kallamnuri &amp; Osmanabad – 9 each, Ambad &amp; Parbhani – 8 each and Kandhar, Vasmat, Soegaon, Gangapur, Kaij, Georai, Mudkhed &amp; Hingoli – 7 each</p> <p><b>Madhya Maharashtra:</b> Mahabaleshwar - 16, Raver, Navapur &amp; Jamner-14 each, Jalgaon - - 13, Lonavala -12, Dhadgaon/Akrani -10, Peth, Dhule, Parola &amp; Erandol -10 each, Shirpur, Bodwad, Pachora, Surgana &amp; Chalisgaon – 9 each and Gidhade, Yaval, Dahigaon, Shirampur, Girnamad &amp; Igatpuri – 7 each</p> <p><b>Konkan &amp; Goa:</b> Valpoi-14, Bhira &amp; Matheran – 9 each and Dodamarg-8</p> <p><b>Gujarat Region:</b> Chhota Udepur-14, Tilakwada-13, Ukai, Quant &amp; Valod-12, Godhra &amp; Wanakbori -10 each, V.Vidyanagar-9, Vyara, Subir &amp; Vadodara-8 each and Nizer, Vansda, Garudeshwar, Dhanpur, Garbada, Bodeli, Sagbara &amp; Uchchhal -7 each</p> <p><b>North Interior Karnataka:</b> Londa-8,</p> <p><b>Telangana:</b> Boath - 19, Adilabad-10 and Sarangapur-7</p> <p><b>West Madhya Pradesh:</b> Bhikangaon - 23, Shegaon - 21, Khandwa &amp; Burhanpur - 17 each, Khargone, Thikri &amp; Sendhwa - 13 each, Badwani – 12, Jhabua – 11, Manawar, Pandhana, Neapanagar, Sardarpur &amp; Kasarwad – 10 each, Maheshwar &amp; Gandhwani – 9 each and Kukshi, Khaknar &amp; Barwaha – 8 each</p>
17/0300	<ul style="list-style-type: none"> <li>○ Isolated heavy to very heavy rainfall and <b>extremely heavy falls</b> very likely over north Konkan, Isolated heavy to very heavy rainfall over north Madhya Maharashtra and isolated heavy over south Konkan during next 24 hours. Isolated heavy rainfall over Konkan &amp; Goa for subsequent 24 hours.</li> <li>○ Heavy to very heavy rainfall at a few places and <b>extremely heavy</b></li> </ul>	<p><b>18<sup>th</sup> August:</b></p> <p><b>Gujarat Region:</b> Kapadvanj-15 , Godhra-13 and Matar-12</p> <p><b>Saurashtra &amp; Kutch:</b> Kandla New &amp; Sayla-11 each , Muli &amp; Chotila-9 each and Wadhvan , Dhrangadhra, Surendranagar &amp; Limbdi – 7 each.</p> <p><b>Vidarbha:</b> Chandur Bazar-7</p> <p><b>Madhya Maharashtra:</b> Radhanagari-10 and Mahabaleshwar-8</p> <p><b>Marathwada:</b> Jalna-16 and Vasmat-7</p> <p><b>19<sup>th</sup> August:</b></p> <p><b>Gujarat Region:</b> Kaprada-8</p> <p><b>Saurashtra &amp; Kutch:</b> Anjar &amp; Gandhidham-10 each and Kandla Airport- 9</p> <p><b>Madhya Maharashtra:</b> Mahabaleshwar- 9 and</p>

	<p><b>falls</b> at isolated places very likely over Gujarat region and Saurashtra &amp; Kutch during next 24 hours. Heavy to very heavy rainfall at isolated places is very likely over these regions for subsequent 24 hours.</p> <ul style="list-style-type: none"> <li>○ Heavy rainfall very likely over southeast Rajasthan and southwest Madhya Pradesh during next 24 hours.</li> </ul>	<p>Radhanagari &amp; Shahuwadi-7 each  <b>Konkan &amp; Goa:</b> Karjat &amp; Sangameshwar Devrukh-7 each  <u><b>20<sup>th</sup> August:</b></u>  <b>Gujarat Region:</b> Tarapur-7,  <b>Saurashtra &amp; Kutch:</b> Kotdasangani-7,  <b>Konkan &amp; Goa:</b> Bhira -8 and Alibag-7  <b>Marathwada:</b> Mudkhed, Umari and Dharmabad &amp; Ardhapur-7 each  <b>East Rajasthan:</b> Lalsot-10 and Amer &amp; Nagar-7 each</p>
--	---	---

## 7. Summary and Conclusions:

A depression formed over coastal Odisha in the morning (0300 UTC) of 15th. It moved west-northwestwards and weakened gradually into a WML over southwest Madhya Pradesh and neighbourhood in the morning (0300 UTC) of 17th and LPA in the same evening (0900 UTC). The system became less marked over east Rajasthan and neighbourhood in the morning (0300 UTC) of 18<sup>th</sup> August.

Under the influence of this system and its remnant low pressure area widespread and intense rainfall activity was observed over the northern and central parts of the country extending from Odisha, Chattisgarh, Vidarbha, Telangana, Madhya Pradesh, Marathwada, Konkan & Goa, Gujarat and East Rajasthan. Extremely heavy rainfall occurred over Chattisgarh on 16<sup>th</sup> and west Madhya Pradesh on 17<sup>th</sup>.

Under its influence, the lower level westerly/southwesterly winds over the Arabian Sea along & off Kerala coast strengthened. The interaction of the stronger westerly/southwesterly winds with the Western Ghats resulted in heavy to extremely heavy rainfall activity over Kerala during this period.

## 8. Acknowledgements:

India Meteorological Department (IMD) duly acknowledges the contribution from all the stake holders who contributed to the successful monitoring, prediction and early warning service of the system. We specifically acknowledge the contribution from Indian Space Research Organisation (ISRO) and all sister organizations of Ministry of Earth Sciences including National Centre for Medium Range Weather Forecasting Centre (NCMRWF) NOIDA, National Institute of Technology (NIOT) Chennai & Indian National Centre for Ocean Information Services (INCOIS), Hyderabad. The support from various Divisions/Sections of IMD including Area Cyclone Warning Centre Kolkata, Regional Meteorological Centre Nagpur, Cyclone Warning Centre Bhubaneswar, Ahmedabad, Meteorological Centre Raipur, Ranchi, Jaipur, Numerical Weather Prediction (NWP) Division, Information System & Services Division (ISSD) and Satellite and Radar Division at IMD HQ New Delhi is also duly acknowledged for monitoring and predicting the system.