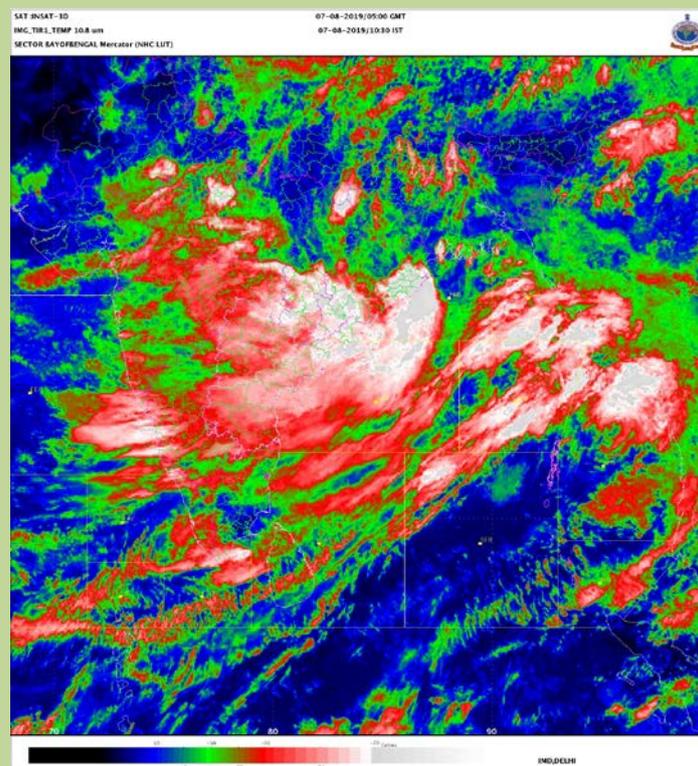




**GOVERNMENT OF INDIA  
MINISTRY OF EARTH SCIENCES  
INDIA METEOROLOGICAL DEPARTMENT**

**Deep Depression over northwest Bay of Bengal and neighborhood  
(06-09 August, 2019): A Report**



**INSAT-3D enhanced Colored IR imagery based on 0500 UTC of 07<sup>th</sup> August**

**Cyclone Warning Division  
India Meteorological Department  
New Delhi  
August 2019**

## **Deep Depression over northwest Bay of Bengal off north Odisha- West Bengal coasts during 6-9 August, 2019**

### **1. Introduction**

A low pressure area formed over north Bay of Bengal (BoB) and adjoining coastal areas of Bangladesh & West Bengal in the morning (0300 UTC) of 5<sup>th</sup> August, 2019. It concentrated into a depression over northwest BoB off north Odisha - West Bengal coasts in the morning (0300 UTC) of 6<sup>th</sup>. It moved northwestwards and intensified into a Deep Depression (DD) over the same region in the early morning (0000 UTC) of 7<sup>th</sup>. Moving northwestwards, it crossed north Odisha-West Bengal coasts close to north of Balasore in the same afternoon (during 0800 - 0900 UTC) of 7<sup>th</sup>. Thereafter, it moved west-northwestwards from the evening (1200 UTC) of 7<sup>th</sup> and weakened into a depression over northeast Chhattisgarh & neighbourhood in the early morning (0000 UTC) of 8<sup>th</sup> August. It moved northwestwards and weakened into a well-marked low pressure area over southeast Rajasthan & neighbourhood in the evening (1200 UTC) of 9<sup>th</sup> August, 2019. Thereafter, it moved nearly west-southwestwards during next 3 days and weakened into a low pressure area over northwest Arabian Sea and neighbourhood in the evening (1200 UTC) of 12<sup>th</sup>.

The salient features of the system were as follows:

- (i) It had a near westward moving track.
- (ii) It had a life period of 81 hours.
- (iii) It had a track length of 1284 km.
- (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, Gangetic West Bengal, Chattisgarh, Jharkhand, Bihar, Madhya Pradesh, Vidarbha, Rajasthan and Gujarat. Extremely heavy rainfall occurred over Odisha on 7<sup>th</sup>, Chhattisgarh on 8<sup>th</sup>, Gujarat region on 9<sup>th</sup> & 10<sup>th</sup> and Saurashtra & Kutch on 10<sup>th</sup> & 11<sup>th</sup>.

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:**

On 5<sup>th</sup> August, the Madden Julian Oscillation (MJO) index lay in phase 4 with amplitude more than 1. It was expected to continue in same phase with amplitude greater than 1 for next 5 days. Hence, MJO was favouring enhancement of convective activity over BoB. Also southwest monsoon was in its active phase with the monsoon trough extending over the north BoB and strong cross equatorial flow

was prevailing over the BoB. Considering the environmental conditions, the sea surface temperature (SST) was 28-30°C over northwest and adjoining westcentral BoB. The tropical cyclone heat potential was around 80-90 KJ/cm<sup>2</sup> over the system area. The lower level positive vorticity was about 80 x10<sup>-6</sup>sec<sup>-1</sup> over central parts of BoB with east-west oriented positive vorticity zone extending from Myanmar to parts of central India. The low level convergence was about 20 x10<sup>-5</sup>sec<sup>-1</sup> over westcentral BoB. The upper level divergence was about 5-10 x10<sup>-5</sup>sec<sup>-1</sup> over westcentral BoB. Vertical wind shear was high (30-40 knots) over the north BoB becoming 10-20 over extreme north BoB. The cyclonic circulation associated with the system was extending upto 200 hPa level and was tilting southwestwards with height. Under these favourable environmental conditions, a Low Pressure Area formed over north BoB and adjoining coastal areas of Bangladesh & West Bengal in the morning (0830 hrs IST/0300 UTC) of 5<sup>th</sup> August, 2019 along the axis of monsoon trough.

On 6<sup>th</sup> August, the MJO continued in same phase and was supporting enhancement of convective activity over BoB and central India during next 5 days. Similar thermal conditions prevailed. As regards dynamical features, the lower level positive vorticity increased significantly and was about 150 x10<sup>-6</sup>sec<sup>-1</sup> over central parts of north BoB and adjoining central BoB. The low level convergence was about 20 x10<sup>-5</sup>sec<sup>-1</sup>. The upper level divergence was about 5-10 x10<sup>-5</sup>sec<sup>-1</sup>. Vertical wind shear was moderate (10-15 knots) over northwest BoB around the system centre. The cyclonic circulation associated with the system was extending upto 200 hPa level. The presence of strong easterly winds in the upper tropospheric levels and the extension of monsoon trough across the plains of north India indicated nearly westward movement of the system. Under these conditions depression formed over the northwest BoB and adjoining areas by 0830 hrs IST /0300 UTC of 6<sup>th</sup>.

At 0530 hrs IST/0000 UTC of 7<sup>th</sup>, the positive vorticity zone at 850 hPa level increased and was about 170 x10<sup>-6</sup>sec<sup>-1</sup> over northwest BoB off West Bengal-Odisha coasts. The vertical wind shear was moderate (15-20 knots) over northwest BoB around the system centre. It showed a decreasing trend in the northwest direction over the central and western parts of Indian region. The low level convergence increased and was about 40 x10<sup>-5</sup>sec<sup>-1</sup> over coastal Odisha to the southwest of system centre. The upper level divergence also increased and was about 40 x10<sup>-5</sup> sec<sup>-1</sup> to the southwest of the system. The cyclonic circulation associated with the system extended upto 200 hPa level and was tilting south-westwards with height. Similar thermal conditions prevailed. Under these conditions, the system further intensified into a DD by 0000 UTC of 7<sup>th</sup> over northwest BoB off north Odisha-West Bengal coasts. The same steering flow persisted and the system moved northwestwards and crossed north Odisha-West Bengal coasts close to north of Balasore during 1330-1430 hrs IST (0800-0900 UTC) of 7<sup>th</sup>.

The system maintained the intensity of DD for next 10 hrs even after crossing the coast because of continuous moisture influx and low wind shear over central India. Gradually, due to land interactions and decrease in low level vorticity (100 x 10<sup>-6</sup>sec<sup>-1</sup>), low level convergence (10 x10<sup>-5</sup>sec<sup>-1</sup>) and upper level divergence (20 x 10<sup>-5</sup>sec<sup>-1</sup>) over central India, the system weakened into a depression over northeast Chhattisgarh & neighbourhood at 0530 hrs IST/0000 UTC of 8<sup>th</sup> and into a WML over southeast Rajasthan & neighbourhood in the evening (1200 UTC) of 9<sup>th</sup> August, 2019. The observed track of Deep depression over northwest BoB is presented in Fig.1.

The best track parameters of the system are presented in Table 1. The typical satellite imageries are presented in Fig. 2.

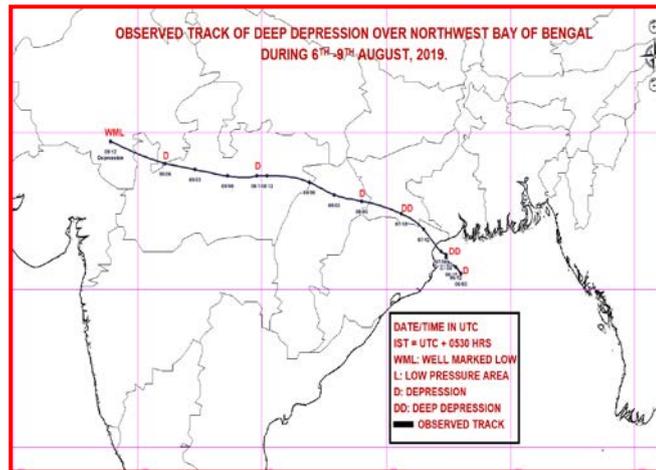


Fig.1. Observed track of Depression over northwest Bay of Bengal and neighborhood (06-09 August, 2019)

Table 1: Best track positions and other parameters of the Deep Depression over northwest Bay of Bengal off north Odisha – West Bengal coasts during 06-09 August, 2019

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	
06/08/2019	0300	20.5	88.0	1.5	990	25	3	D	
	0600	20.5	88.0	1.5	990	25	3	D	
	1200	20.7	87.8	1.5	990	25	3	D	
	1800	20.8	87.6	1.5	990	25	3	D	
07/08/2019	0000	21.0	87.4	2.0	988	30	5	DD	
	0300	21.1	87.4	2.0	988	30	5	DD	
	0600	21.2	87.2	2.0	988	30	5	DD	
	Crossed north Odisha-West Bengal coasts close to north of Balasore in the during 0800-0900 UTC								
	1200	21.9	86.5	-	988	30	5	DD	
	1800	22.4	85.6	-	988	30	5	DD	
08/08/2019	0000	22.8	84.0	-	999	25	4	D	
	0300	23.0	82.9	-	999	25	4	D	
	0600	23.4	81.9	-	999	25	4	D	
	1200	23.6	80.2	-	999	25	4	D	
	1800	23.6	79.8	-	1000	25	3	D	
09/08/2019	0000	23.6	78.6	-	1000	25	3	D	
	0300	23.8	77.3	-	1000	25	3	D	
	0600	24.0	76.1	-	1000	25	3	D	
	1200	<b>Weakened into a well-marked low pressure area over southeast Rajasthan &amp; neighborhood by 1200 UTC of 9<sup>th</sup> August 2019</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-7 and microwave & SCAT Sat imageries were also considered. Typical INSAT-3D IR, visible, enhanced colored and cloud top brightness temperature imageries are presented in Fig. 2.

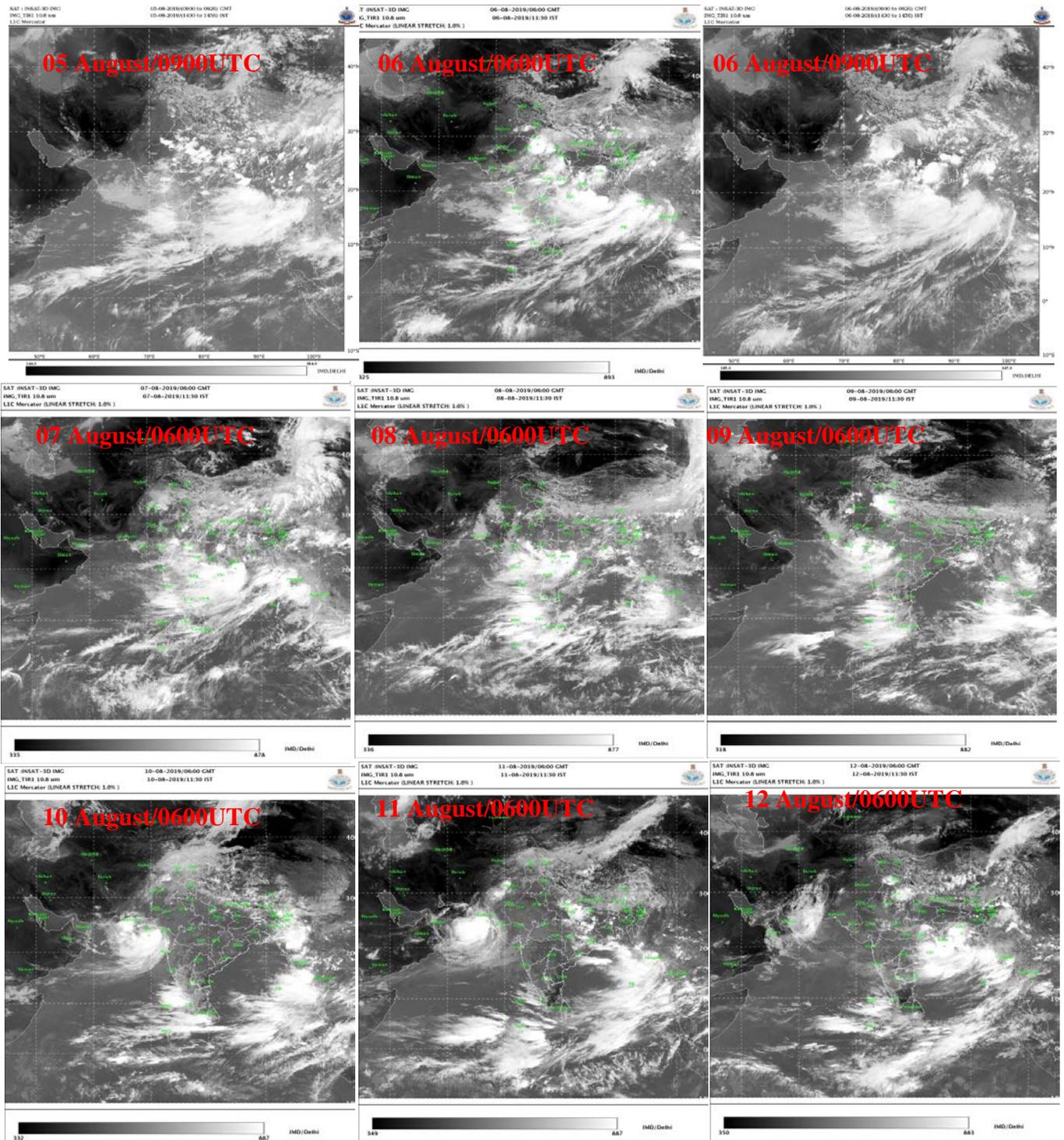
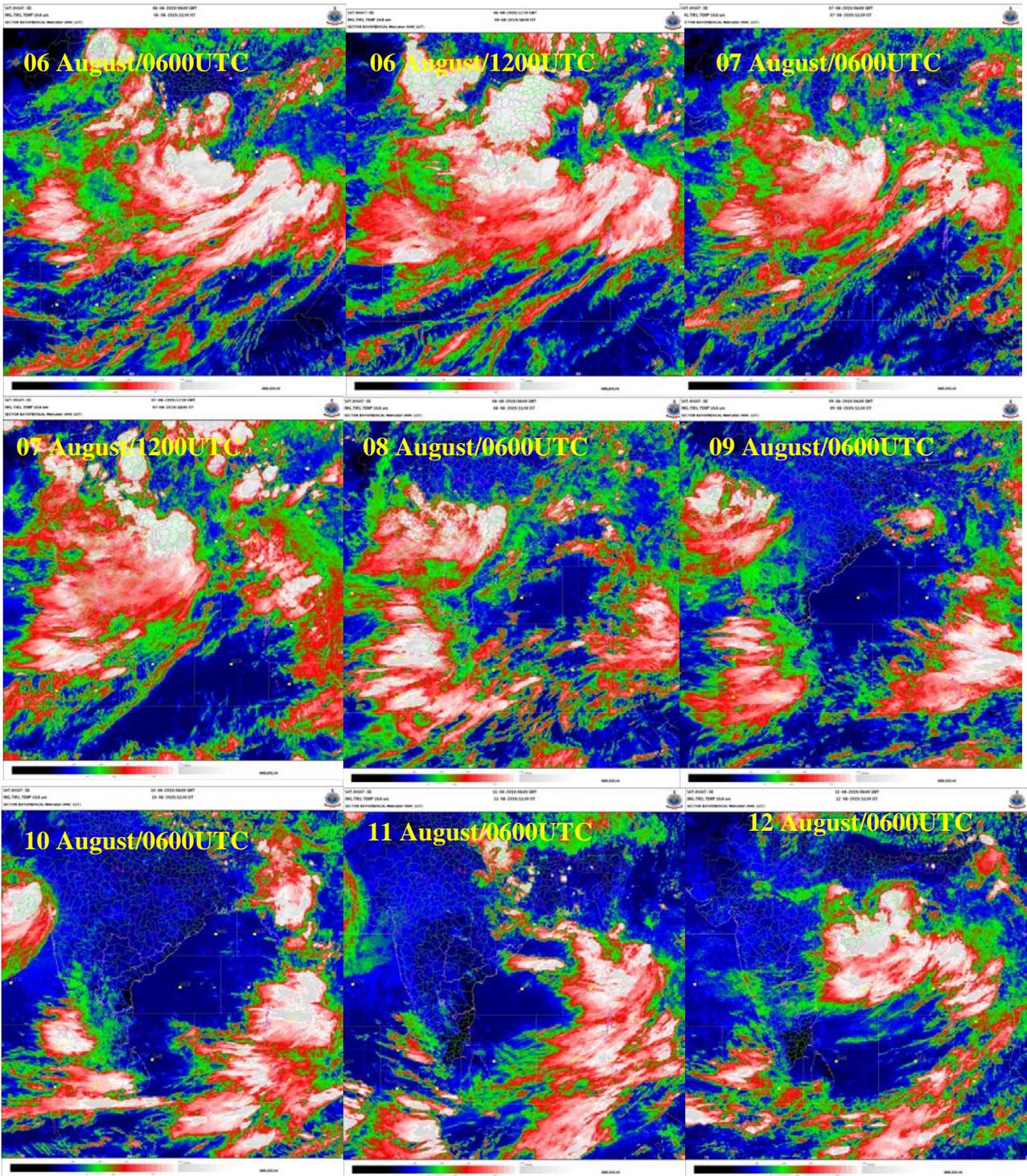


Fig. 2(i): INSAT-3D IR imageries during 05-12 August, 2019



**Fig. 2(ii): INSAT-3D enhanced colored imageries during 06-12 August, 2019**

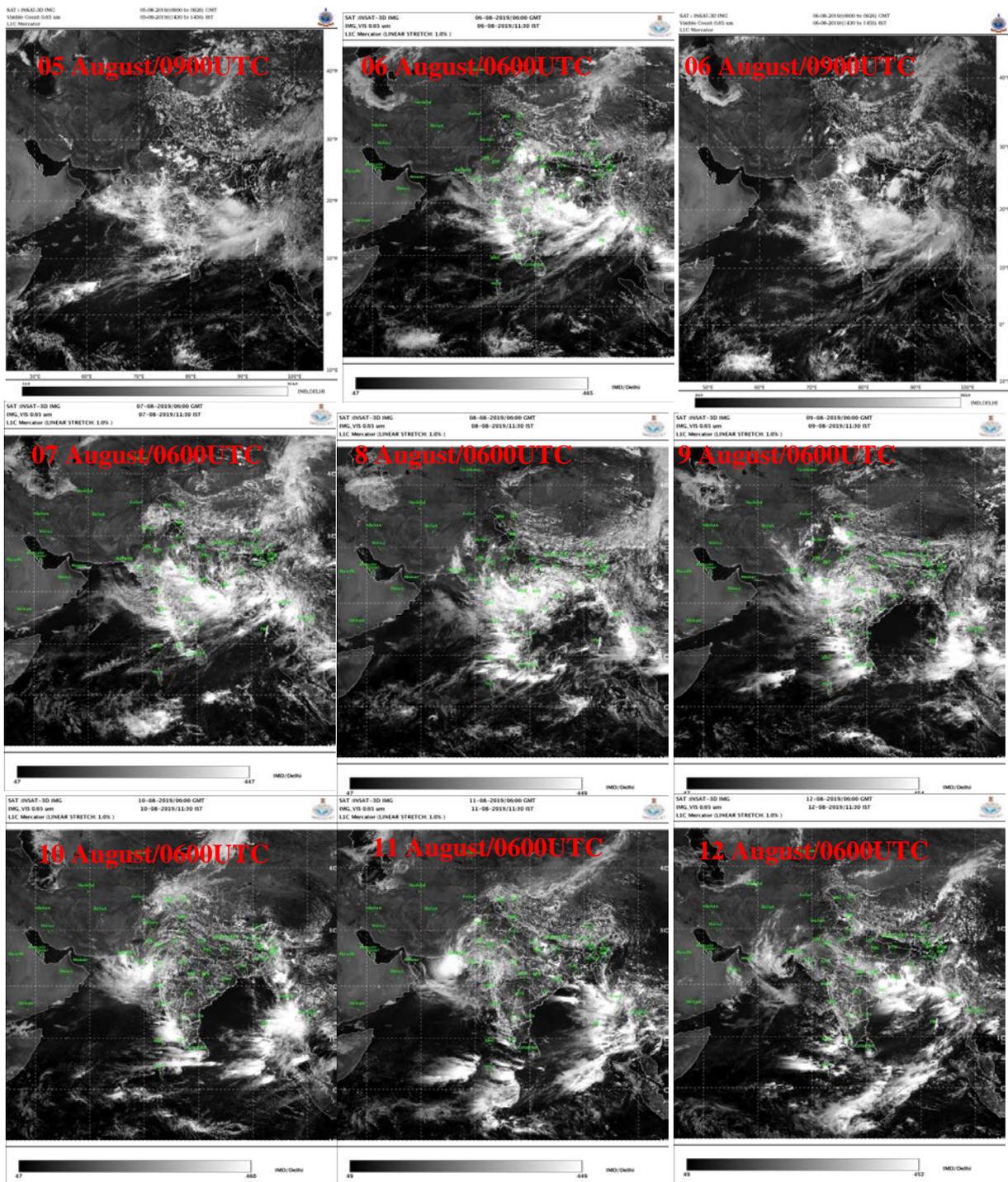
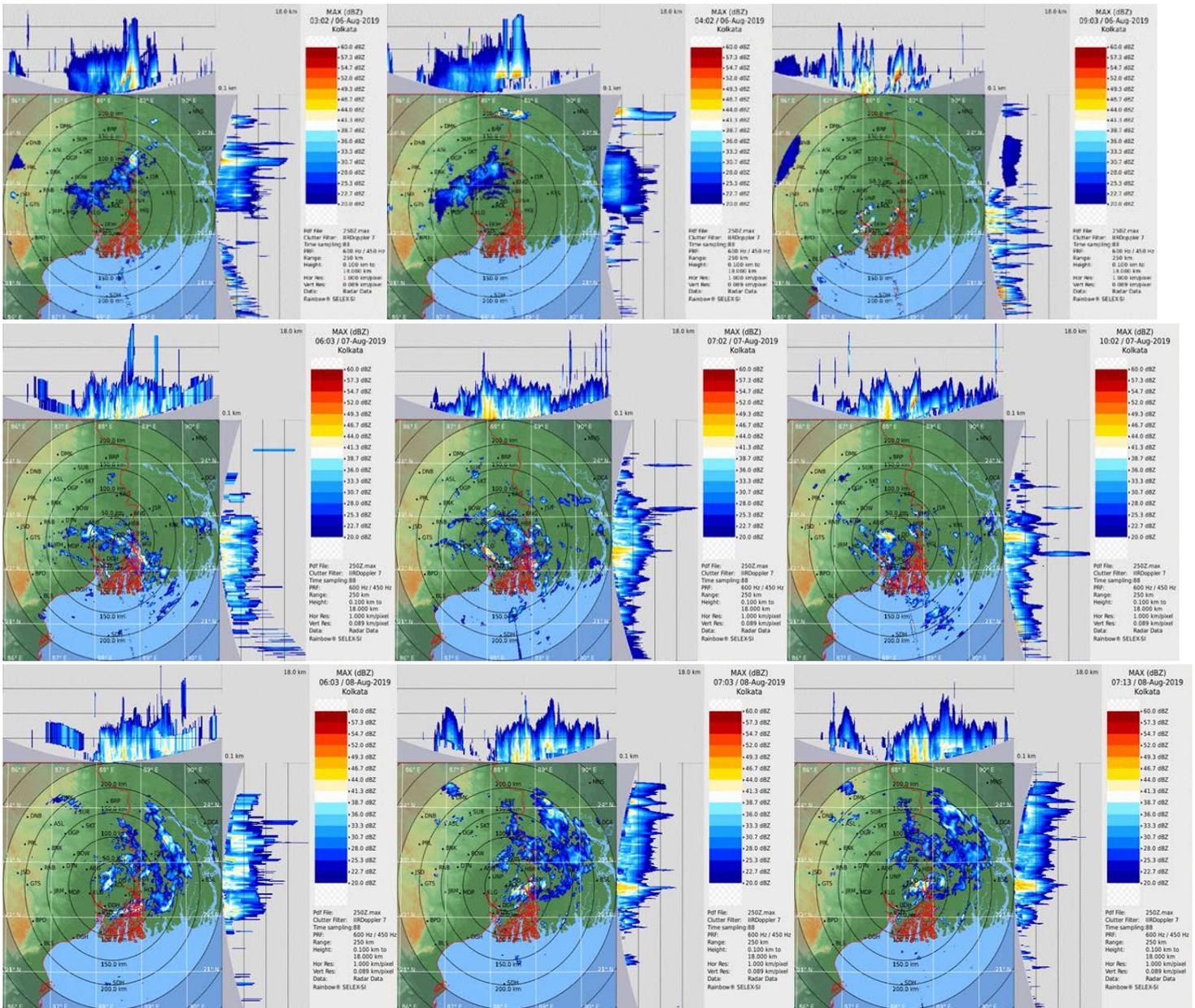


Fig. 2(iii): INSAT-3D Visible imageries during 05-12 August, 2019



**Fig. 3: Typical Radar imageries of DWR Kolkata during during 06-08 August, 2019**

### 3. Dynamical features

IMD GFS (T1534) analysis fields of mean sea level pressure (MSLP), winds at 10 m, 850, 500 and 200 hPa levels are presented in Fig.4. At 0000 UTC of 6<sup>th</sup> August, it indicated a low pressure area over northwest BoB. The circulation was seen extending upto 500 hPa level tilting southeastwards with height. At 200 hPa level strong easterly flow is seen. On 6<sup>th</sup>, IMD GFS underestimated the intensity of the system.

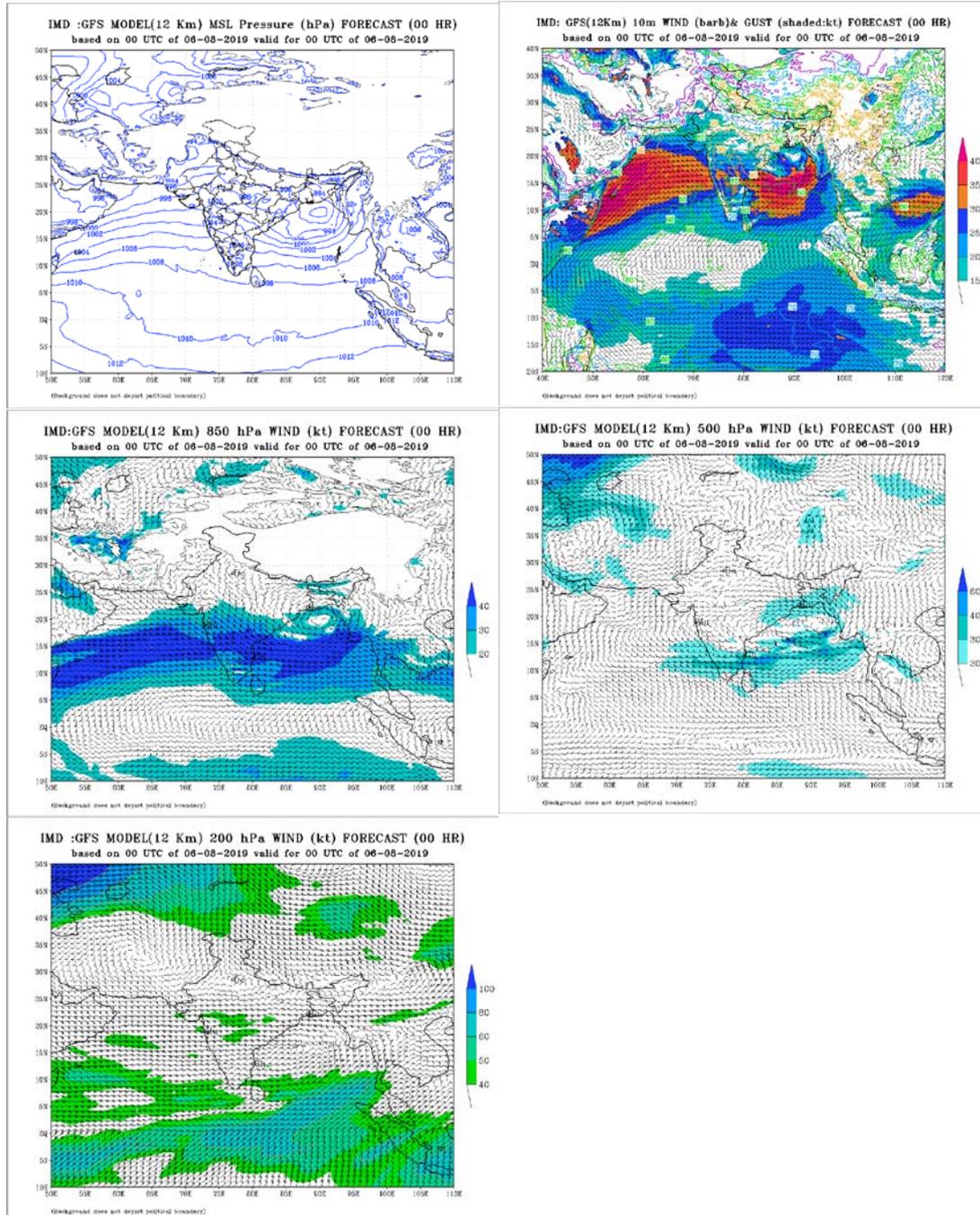
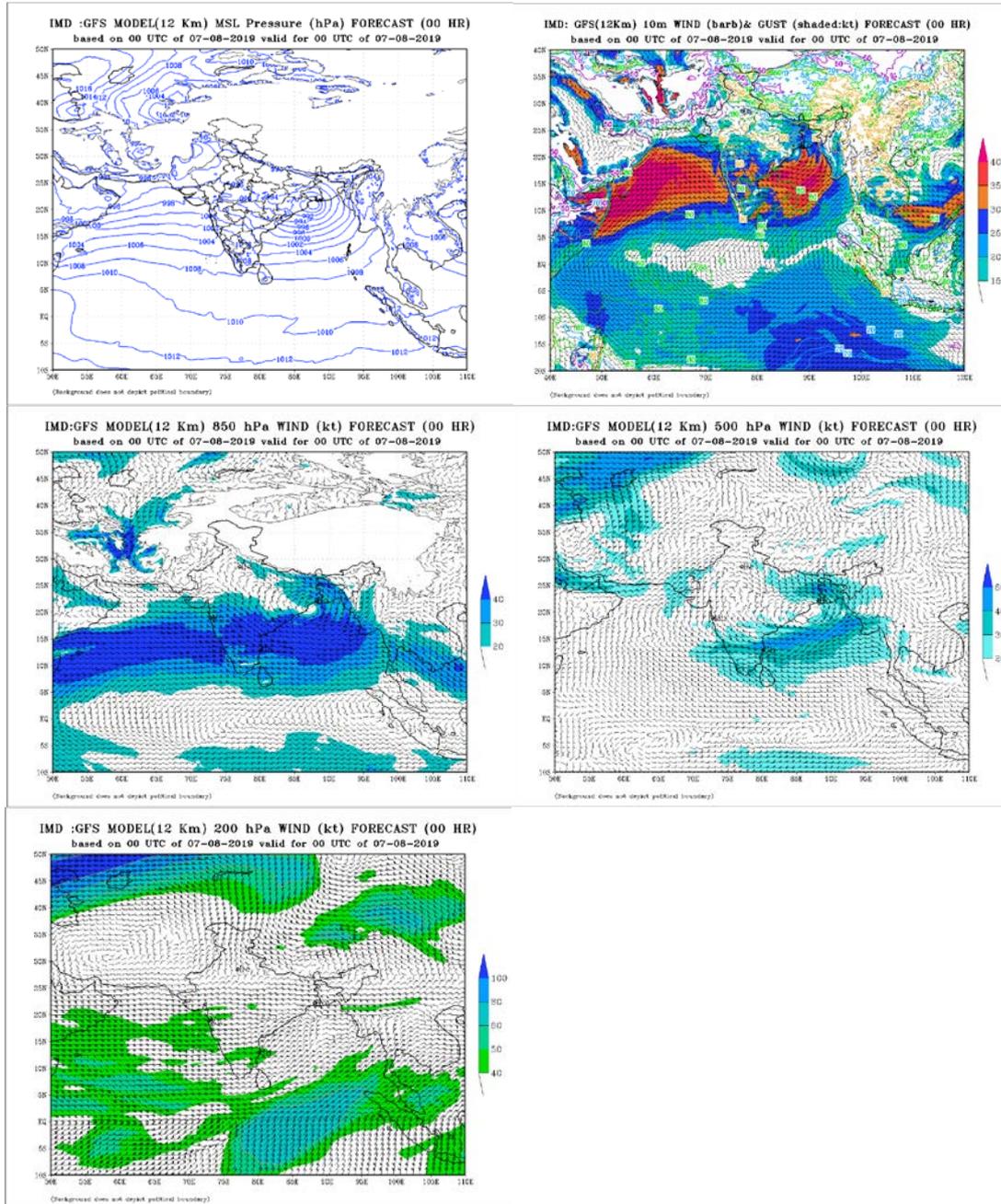


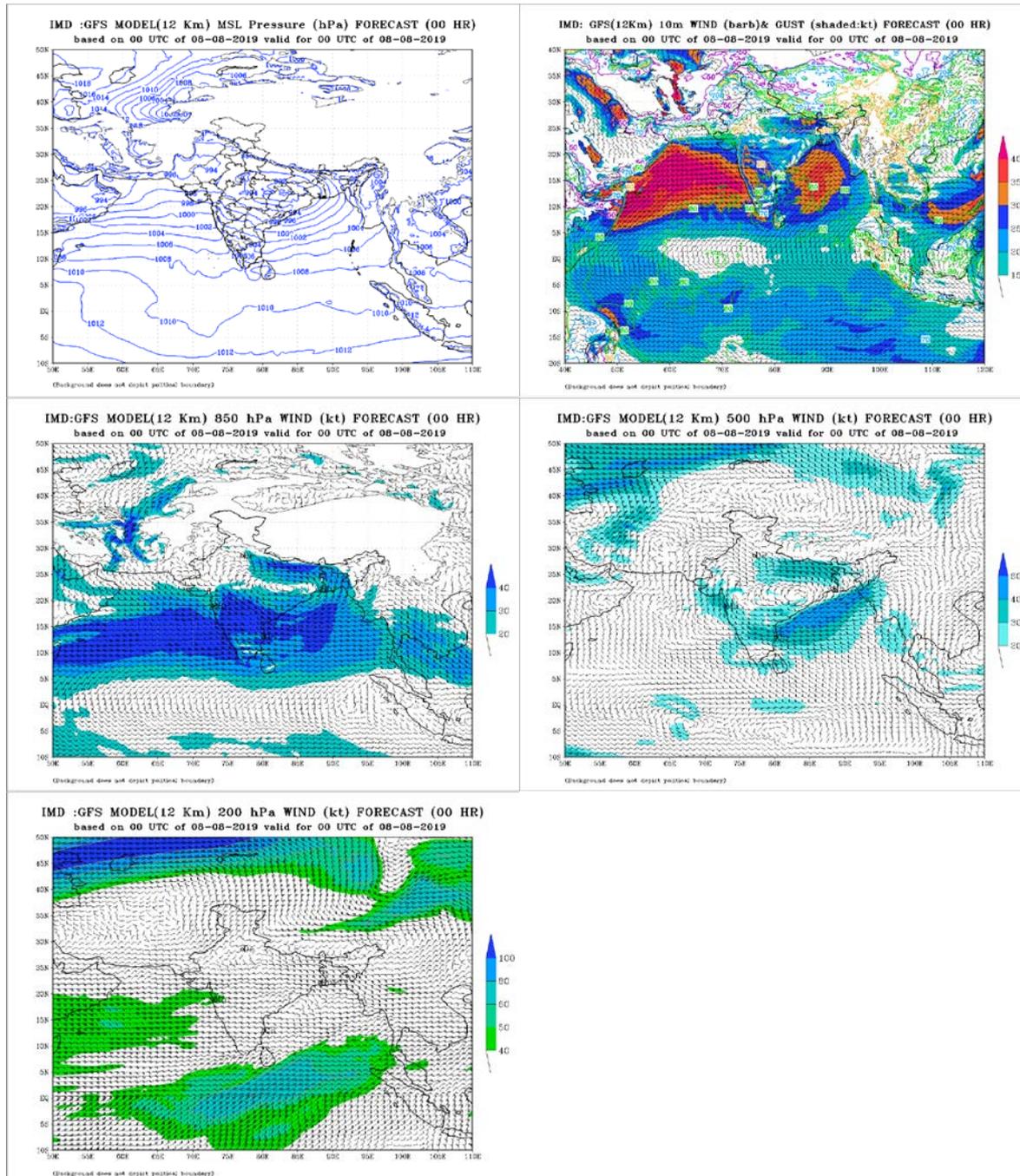
Fig4 (i): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 6<sup>th</sup> August 2019

At 0000 UTC of 7<sup>th</sup> August, IMD GFS indicated a deep depression over northwest BoB off north Odisha-West Bengal coasts. The circulation was seen extending upto 500 hPa level tilting southeastwards with height. At 200 hPa level strong easterly flow is seen. On 7<sup>th</sup>, the intensity of the system was correctly picked up.



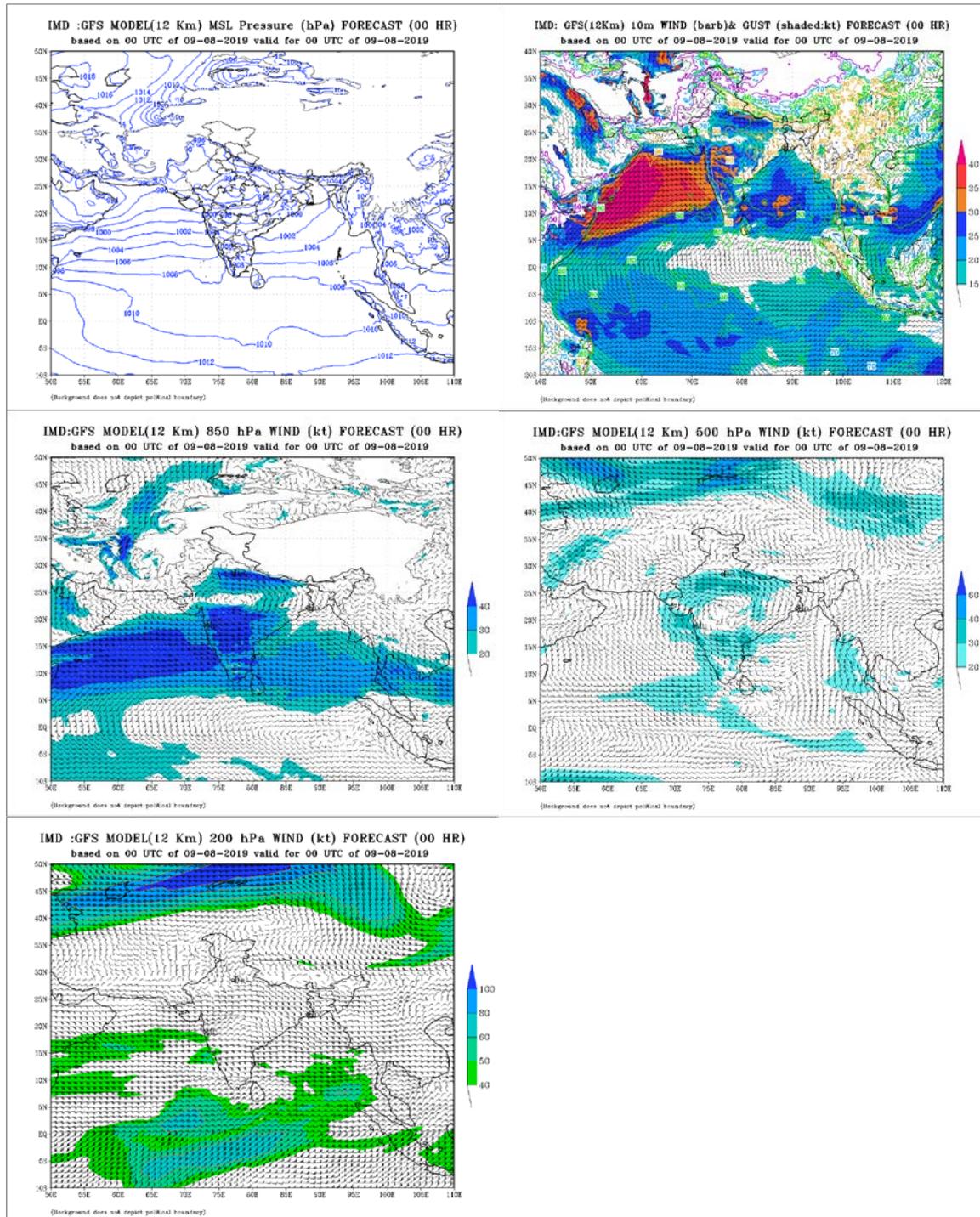
**Fig4 (ii): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 7<sup>th</sup> August 2019**

At 0000 UTC of 8<sup>th</sup> August, IMD GFS indicated a depression over north Chattisgarh. The circulation was seen extending upto 500 hPa level tilting southeastwards with height. The intensity of the system and movement was correctly picked.



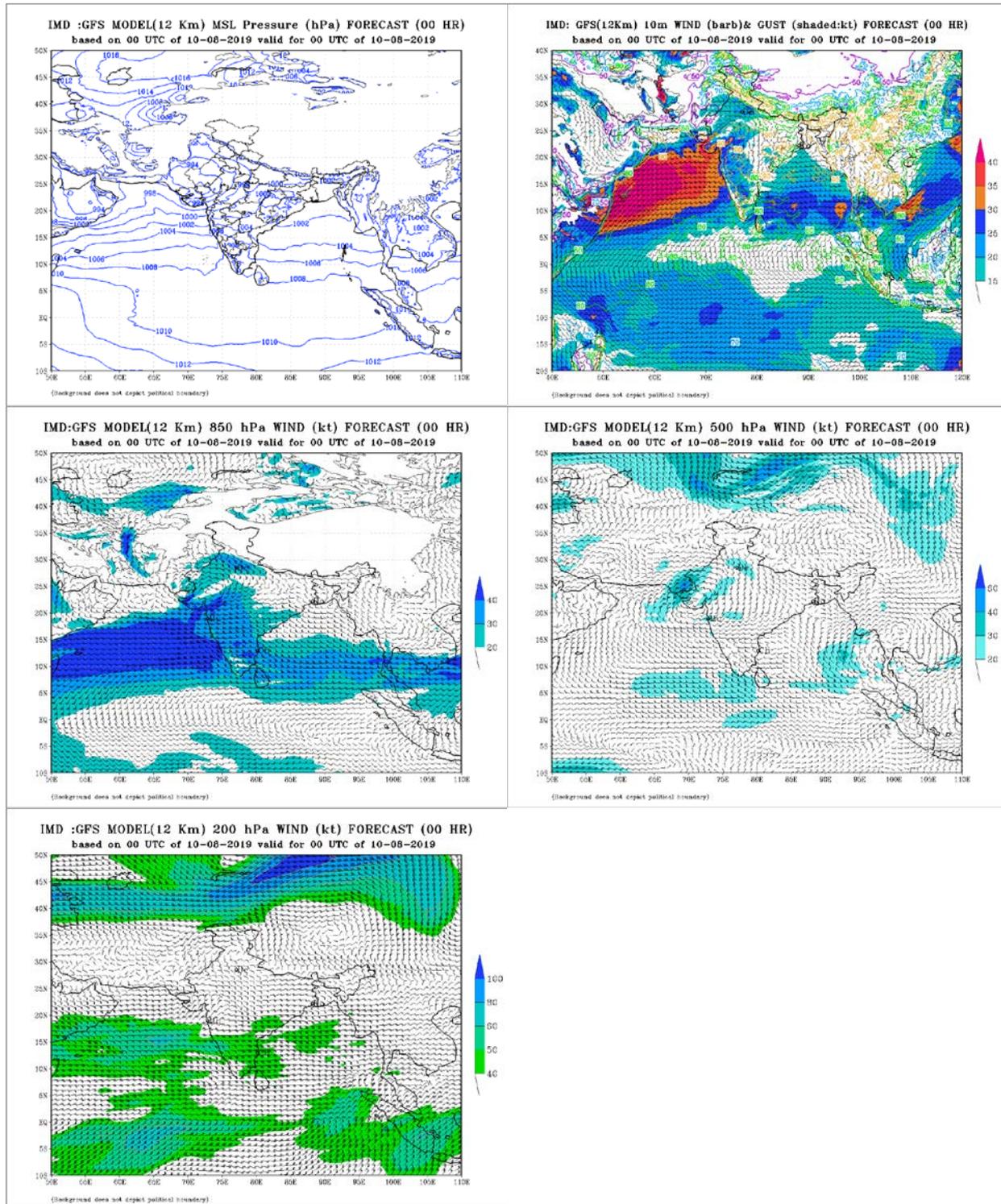
**Fig4 (iii): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 8<sup>th</sup> August 2019**

At 0000 UTC of 9<sup>th</sup> August, IMD GFS indicated depression over east Madhya Pradesh. The circulation was seen extending upto 500 hPa level. Even on 9<sup>th</sup>, moisture influx is seen into the core of the system. The intensity of the system and movement was correctly picked.



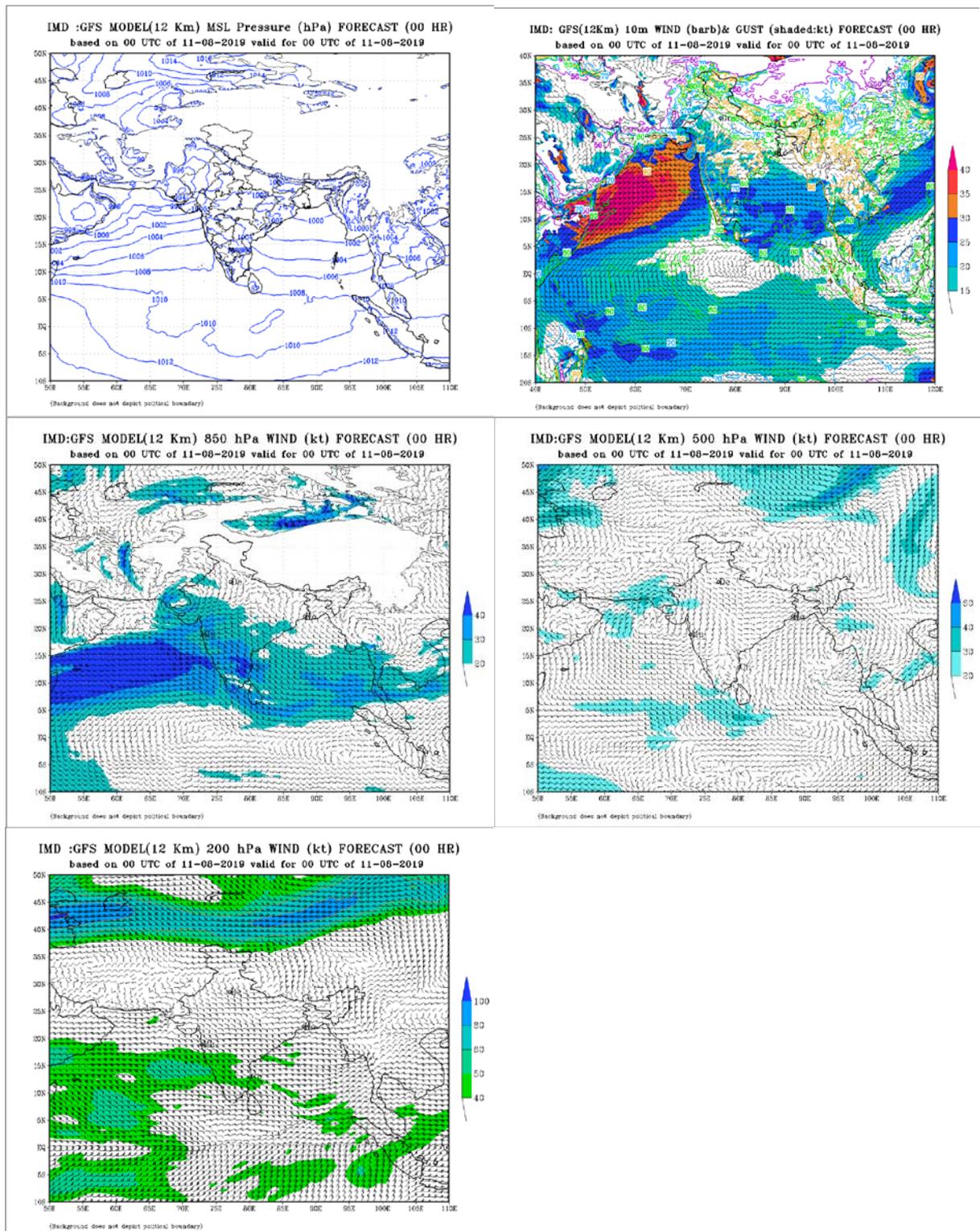
**Fig4 (iv): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 9<sup>th</sup> August 2019**

At 0000 UTC of 10<sup>th</sup> August, IMD GFS indicated a well marked low pressure area over west Madhya Pradesh. The circulation was seen extending upto 500 hPa level. Even on 10<sup>th</sup>, moisture influx is seen into the core of the system. The weakening of the system and movement was correctly picked.



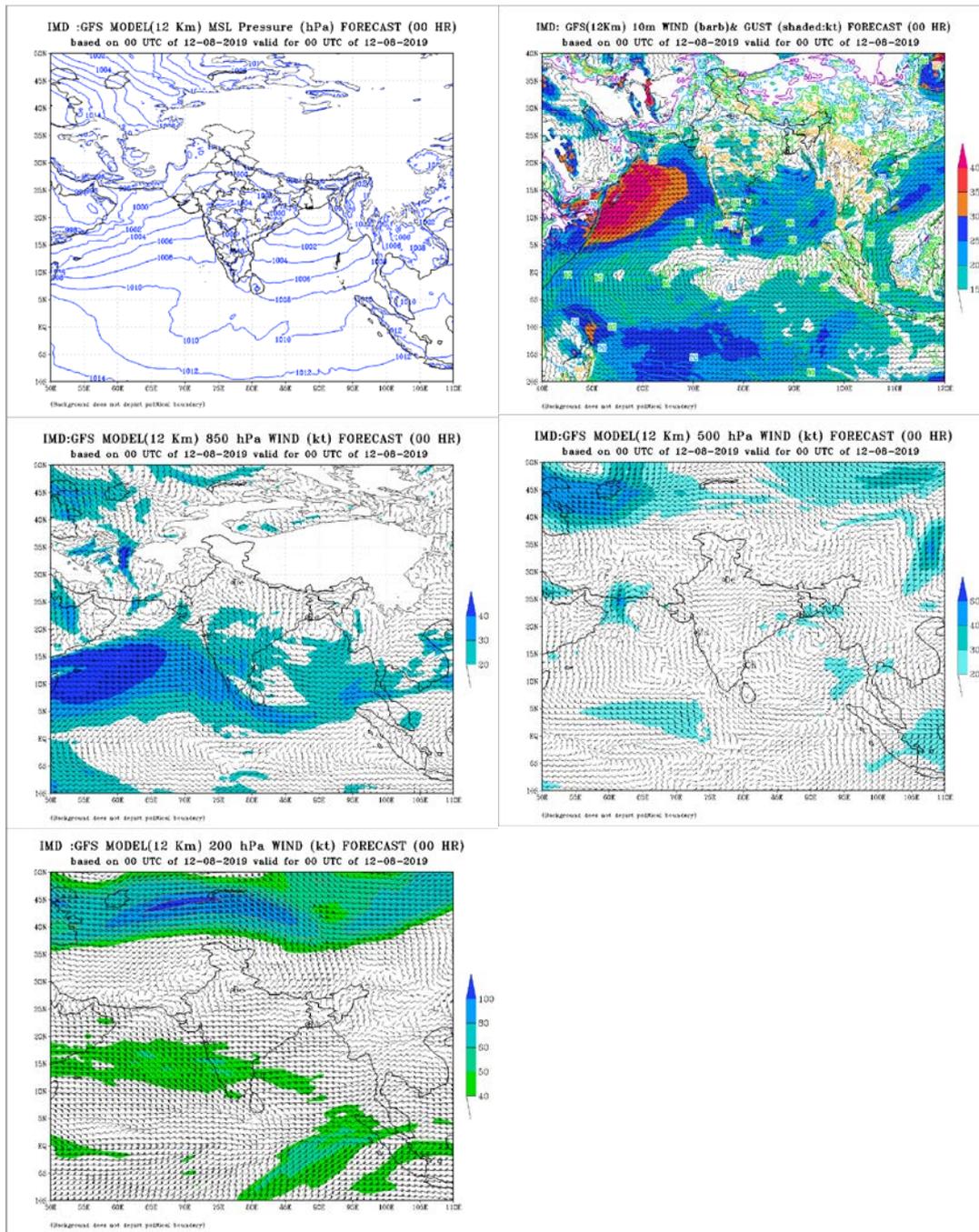
**Fig4 (v): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 10<sup>th</sup> August 2019**

At 0000 UTC of 11<sup>th</sup> August, IMD GFS indicated a well marked low pressure area over east Pakistan.



**Fig4 (vi): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 11<sup>th</sup> August 2019**

At 0000 UTC of 12<sup>th</sup> August, circulation is seen over northeast Arabian Sea.



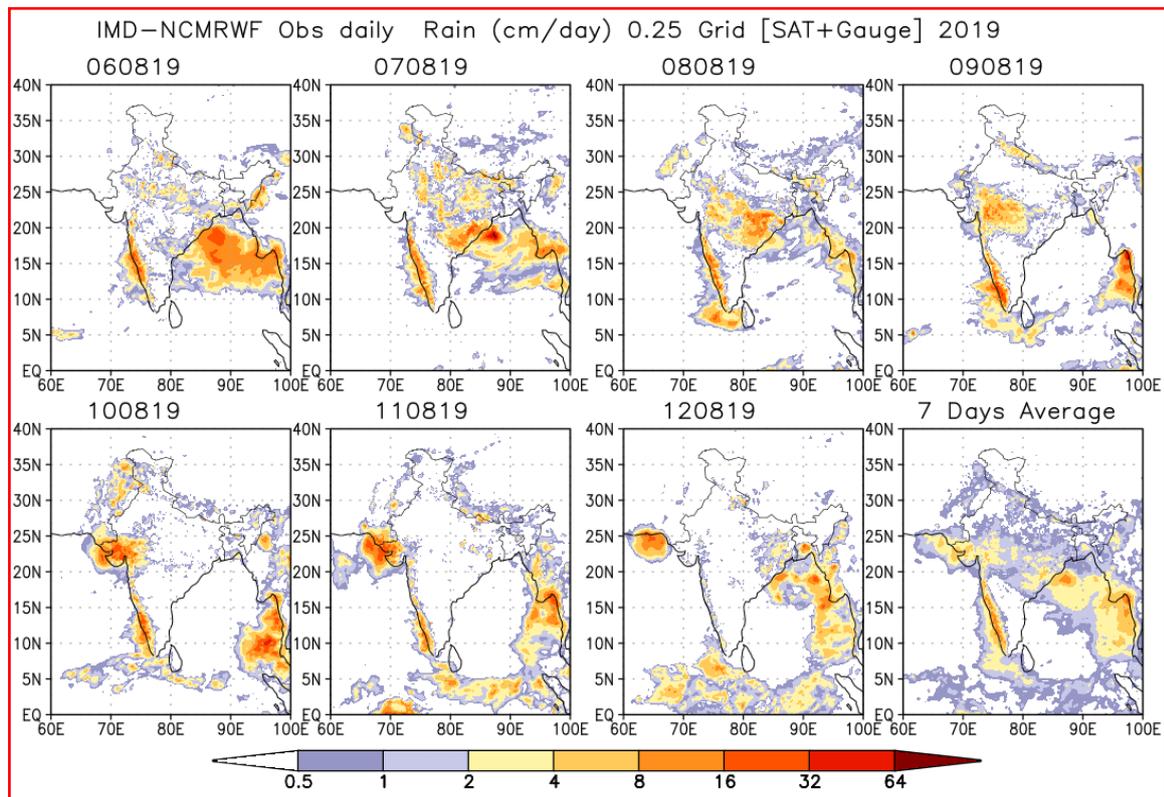
**Fig4 (vii): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 12<sup>th</sup> August**

Thus, IMD GFS initially underestimated the intensity of the system and couldn't pick up the genesis of the system on 6<sup>th</sup>. However subsequently movement and intensity of the system could be captured well.

#### 4. Realized Weather:

##### 4.1 Rainfall:

Under the influence of this system, heavy to very heavy rainfall over Odisha at isolated places, heavy rainfall at isolated places over Jharkhand, Bihar & east Madhya Pradesh (MP) and very heavy rainfall at isolated places over west MP on 6<sup>th</sup> August. On 7<sup>th</sup>, it caused heavy rainfall at isolated places over Gangetic West Bengal, Bihar and east MP, extremely heavy rainfall at isolated places with heavy to very heavy falls at many places over Odisha, heavy to very heavy falls at isolated places over Jharkhand, west MP, Vidarbha & Chattisgarh. On 8<sup>th</sup>, it caused extremely heavy falls at isolated places over Chattisgarh, heavy to very falls at isolated places over Vidarbha and few places over east & west MP and east Rajasthan. On 9<sup>th</sup>, it caused heavy to very heavy rainfall at few places east MP, Vidarbha, isolated extremely heavy rainfall with heavy to very heavy falls at many places over west MP & few places over east Rajasthan, heavy falls at isolated places over west Rajasthan and isolated extremely heavy falls with heavy to very heavy falls at few places over Gujarat region. On 10<sup>th</sup>, it caused heavy to very falls at few places over west MP & east Rajasthan, extremely heavy falls at isolated few places with heavy to very heavy falls at many places over Gujarat region and Saurashtra & Kutch. On 11<sup>th</sup>, it caused heavy to very heavy rainfall at few places over Gujarat region and extremely heavy falls with heavy to very heavy falls at few places over Saurashtra & Kutch. The daily rainfall distribution ending at 0300 UTC of each date during 06-12 August, 2019 based on merged gridded rainfall data of IMD/NCMRWF is shown in Fig.5.



**Fig.5: Daily rainfall distribution based on merged gridded rainfall data of IMD/NCMRWF during 06-12 August, 2019**

(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 06-11<sup>th</sup> August is presented below:

### **6<sup>th</sup> August**

**Odisha:** Krishnaprasad-13, Brahmagiri & Thakurmunda -11 each, Puri-9, Karanjia-8 and Gopalpur, Jamsolaghat & Swam-Patna-7 each

**Jharkhand:** Simdega-7

**Bihar:** Rafiganj 8 and Daudnagar 7

**West Madhya Pradesh:** Garoth-17

**East Madhya Pradesh:** Nowgong-10 and Jabalpur & Tikamgarh-8 each

### **7<sup>th</sup> August**

**Gangetic West Bengal:** Purihansa 7

**Odisha:** Lanjigarh 38; Kashipur 32; Kotagarh 31; Phiringia 29; Kotraguda 26; Tarva 24; Muniguda 23; Kalinga 21; Gudari 19; Tikabali 18; Raikia, Kantamal, Madanpur & Rampur-17 each; G Udayagiri & R.Udaigiri-16 each; Baliguda, Similiguda, Daringibadi & Jeypore-15 each; Koraput & Phulbani-14 each; Nayagarh, Jaipatna, Bissem-Cuttack, Niali & Berhampur-13 each; Gopalpur, Digapahandi, Hindol, Krishnaprasad, Alipingal & Mohana-12 each; Kantapada, Nuagada, Odagaon, Narla, Purushottampur, Bhuban, Rayagada, Aska, Belaguntha & Puri-11 each; K Nuagaon, Malkangiri, Gop, Gunupur, Banki & Chhatrapur-10 each; Nimpara, Jagannath Prasad, Tentulikhunti, Bhanjnagar, Sorada, Danagadi & Korei -9 each; Bhawanipatna, Khandapara, Kakatpur, Satyabadi, Astaranga & Banpur-8 each and Raghunathpur, Balipatna, Jagatsinghpur, Pottangi, Madhabarida, Joshipur, Khairamal & Narsinghpur-7 each.

**Jharkhand:** Manatu 9, Chandil & Latehar-7 each

**Bihar:** Galgalia 7

**West Madhya Pradesh:** Salwani/Silvani, Pachmarhi & Multai-10 each; Suvasara-8 and Biaora, Neemuch & Udaipura-7 each.

**East Madhya Pradesh:** Katangi 7.

**Vidarbha:** Katol-13, Narkheda-9, Sironcha-7.

**Chhattisgarh:** Rajpur-17; Konta-14; Bhairamgarh & Usoor-13 each; Chhindgarh & Bijapur-12 each; Katekalyan & Korba-11 each; Sukma & Bhopalpatnam-10 each; Kuakonda-9; Darbha-8 and Lohandiguda, Jagdalpur & Dantewara-7 each.

**Coastal A.P. & Yanam:** Chintur-21; Koida-14; Vararamachandrapur, Velairpad & Kunavaram-13 each; Paderu-12; Narsipatnam & Kukunoor-10 each; Chintapalle & Sompeta-8 each and Mandasa-7.

**Telangana:** Venkatapuram-17; Eturnagaram-14; Mudhole, Perur & Aswapuram-12 each; Dummugudem, Bhupalpalle & Burgampadu-11 each; Manthani, Gundala, Pinapaka, Venkatapur & Armur-10 each; Gudurwrgl, Nandipet, Velpur & Palawanacha-9 each; Mortad, Bhadrachalam, Kothaguda, Govindaraopet, Makloor, Mulakalapalle, Tekulapalle, Yellandu & Metpalle-8 each and Kothagudem, Kammar Palle, Luxettipet, Navipet, Balkonda, Manuguru, Ramgundam & Kaleswaram-7 each.

### **8<sup>th</sup> August**

**East Rajasthan:** Hindoli-11; Kotri-10; Mandalgarh-9 and Sapotra & Dug-8 each.

**West Madhya Pradesh:** Ashoknagar-19; Sonkatch, Khandwa & Sardarpur-14 each; Tarana 13; Guna, Petlawad, Khaknar, Khargone & Mungaoli-11 each; Thikri & Pachmarhi-10 each; Chanderi, Dhar, Neapanagar & Ashta-Arg-9 each; Shegaon, Tonkhurd & Burhanpur-8 each and Suvasara, Nalchha & Gandhwani-7 each.

**East Madhya Pradesh:** Malanjkhanda-14; Jabalpur & Rehli-11; Chindwara & Waraseoni-10 each; Khurai & Deori-9 each; Garhakota, Singrauli & Mandla-8 each and Lanji, Patan, Paraswad & Balaghat-7 each.

**Gujarat Region:** Quant-26 and Chhota Udepur-7

**Vidarbha:** Dharni-13; Dhanora-8 and Gondia-7

**Chhattisgarh:** Deobhog-30; Lohandiguda-27; Mana-Raipur-23; Raipur, Pusaur & Jagdalpur-18 each; Orcha, Bastanar, Abhanpur, Bhairamgarh & Thankhamariya-17 each; Sahaspurlohara-16; Bilaspur-15; Rajim, Kharsiya & Patan-13 each; Bakavand, Mahasamund, Kawardha, Kurud, Arang, Bastar, Chhura, Tokapal & Katekalyan-12 each; Bhatapara, Magarlod, Bemetara, Makadi, Raigarh, Simga, Narayanpur & Saja-11 each; Gidam, Pithora, Gandai & Basana-10 each; Chhindgarh, Kashdol, Pakhanjur, Masturi, Darbha, Pallari/Palari & Tamnar-9 each; Berla, Durg, Lailunga, Bijapur, Dantewara, Sukma, Bagbahara & Gharghoda-8 each and Gariabund, Kuakonda, Saraipali, Baderajpur, Tilda, Baloda Bazar, Manpur, Dhamdha, Khairagarh, Dhabhara, Sakti, Pharasgaon, Jaijapur & Champa-7 each.

### 9<sup>th</sup> August

**West Rajasthan:** Desuri & Shergarh-7 each

**East Rajasthan:** Mount Abu, Mounntabu Tehsil, Khushalgarh, Girva & Pindwara-13 each; Gangdhar-12; Udaipur/D-Aero & Mavli-11 each; Vallabhnagar & Arnod -10 each; Garhi, Ganeshpur & Aspur-9 each; Pachpahar Sr, Sahada Sr, Sallopat Sr, Danpur, Sarara, Gogunda, Sagwara & Bari-Sadri-8 each and Arthuna, Pirawa, Galiakot, Railmagra, Nithuwa, Jahazpur, Sajjangarh, Shergarh & Jhadol-7 each.

**West Madhya Pradesh:** Tarana 21; Maheshwar, Kasarwad & Bhikangaon-19 each; Jhabua-18; Thandla & Shajapur-17; Thikri, Bhainsdehi & Dhar-16 each; Raisen-15; Sardarpur & Neapanagar-14 each; Khandwa-, Manawar, Khaknar & Shegaon-13 each; Sendhwa, Depalpur, Gandhwani, Nalchha, Salwani & Silvani-12 each; Alirajpur, Suvasara & Khargone & Sonkatch-11 each; Burhanpur, Khategaon, Agar, Bhopal & Badwani-10 each; Petlawad, Jaora, Ujjain, Tonkhurd, Jabot, Begumganj, Ichhawar, Mandsaur, Mhow, Kannod & Bagli-9; Manasa, Gautampura, Udaipura, Pandhana, Bhabhra & Indore-8 each and Harda, Sarangpur, Multai, Nusrulgunj-Arg, Bhanpura, Mahidpur, Garoth, Kukshi, Sehore-, Pachmarhi, Badnawar, Khachrod & Ashta-7each.

**East Madhya Pradesh:** ; Tendukheda & Kareli-15 each; Narsinghpur-12; Mandla & Nainpur-9 each; Gadarpura-8 and Deori, Keolari & Ghansore-7 each.

**Gujarat Region:** Chhota Udepur-34; Quant-28; Jetpur Pavi & Nizer-17 each; Naswadi-16; Dhanpur-12; Godhra; Bodeli; Dahod & Sanjeli 11 each; Devgad Baria, Umerpada, Limkheda, Jambughoda, Vijaynagar, Dediapada, Fatepura, Sagbara & Subir 9 each; Dabhoi; Rajpipala; Shahera; Garbada & Ukai 8 each; Uchchhal; Vadodara; Kadana; Halol & Morva Hadaf 7 each

**Vidarbha:** ; Mauda 12; Chikhaldia 11; Dharni, Nagpur & Akot 9 each; Chandur Bazar; Bhandara; Hingna & Arvi 8 each; Mohadi; Tumsar; Ashti; Wardha & Morsi 7 each.

### 10<sup>th</sup> August

**East Rajasthan:** Pratapgarh-15; Kherwara & Salumber - 12; Sarara - 11; Jagpura, Aspur, Devel, Ghatol, Dungarpur Tehsil, Loharia & Bhungra - 8 each and Ganeshpur, Pipalkhunt, Arnod, Nithuwa, Reodar, Kesarpura & Arthuna - 7 each

**West Madhya Pradesh:** Bhabhra 19; Sardarpur & Manawar 9 each; Alirajpur, Nalchha & Mandsaur 8 each and Jabot & Sendhwa 7 each

**Gujarat Region:** Mahudha 34, Dhandhuka 32, Kadi 30, Galteshwar 26, Dholera 24, Kalol 23, Jotana 21, Nadiad & Chhota Udepur 20 each, Bodeli & Dediapada 19 each; Godhra, Sanand, Mahesana, Kathalal & Anand 18 each, Desar, Thasra & Dholka 17 each, Umerpada, Bayad, Petlad & Vijapur 16 each, Amod, V.Vidyanagar, Umreth, Jetpur Pavi & Matar 15 each, Jambughoda, Mahemdavad, Khambhat, Saraswati, Borsad & Dhansura 14 each, Subir, Halol, Karjan, Sojitra, Sami & Tarapur 13 each, Savli 12, Kapadvanj, Ghoghamba, Vaso, Abad City, Kheda, Dabhoi, Mansa, Netrang & Wanakbori 11 each, Patan, Anklav, Songadh, Prantij, Sagbara, Garudeshwar, Gandhinagar, Vijaynagar, Waghaj, Vagra, Dhanpur, Himatanagar, Tilakwada, Shankheshvar, Nandod, Bavla, Shahera, Sankheda, Vadodara, Idar & Kalol 9 each, Nizer, Khanpur, Becharaji, Dahegam, Vansda, Detroj, Bhabhar, Bhiloda, Dantiwada, Naswadi & Jambuser 8 each and Harij, Talod, Vyara, Radhanpur & Quant 7 each.

**Saurashtra & Kutch:** Barvala 38, Gadhdha & Botad 29 each, Ranpur 26, Chuda 24, Kandla New, Dhrangadhra, Surendranagar & Vallabhipur 21 each, Rajkot 20, Rapar, Thangadh & Wadhvan 19 each, Gandhidham & Umralla 18 each, Bhachau, Halvad & Vichhiya 17 each, Chotila, Morbi, Kandla Airport, Tankara & Dhrol 16 each, Kotdasangani & Lalpur 15 each, Jodia, Kharaghoda, Amreli & Gondal 14 each, Dasada, Sayla, Lakhtar, Muli, Limbdi, Lodhika & Kalyanpur 13 each, Babra, Shihor, Lathi & Porbandar 12 each, Vadia, Paddhari, Jamnagar & Bhavnagar 11 each, Naliya, Jasdan, Maliamiana & Anjar 10 each, Okha, Wankaner, Kalavad & Abdasa 9 each, Visavadar & Dwarka 8 each, Bhanvad, Nakhatrana, Jamkandorna, Mundra, Bhesan & Mandvi 7 each

### **11<sup>th</sup> August**

**Gujarat Region:** Radhanpur 18, Suigam 13, Gandevi 9, Chikhli, Valod & Vyara -8 each and Jalalpor 7,

**Saurashtra & Kutch:** Nakhatrana 32, Naliya & Tankara 27 each, Morbi 26, Abdasa 25, Rapar, Dhrangadhra & Lakhpatt 21 each, Kalavad & Malia & Miana 20 each, Lodhika 18, Paddhari, Okha & Jodia 16 each, Rajkot 15, Anjar & Bhesan 13 each, Visavadar, Vanthali, Khambhalia, Mendarda & Jamnagar 12 each, Kandla New, Bhachau & Dasada 11 each, Dwarka & Junagadh 10 each, Kalyanpur, Gandhidham, Dhrol, Kandla Airport, Wankaner, Halvad, Ranavav, Mandvi, Jamkandorna & Malia 9 each, Kotdasangani & Bhuj- 8 each and Gondal, Bhanvad, Kutiana, Jamjodhpur, Lalpur, Thangadh, Kharaghoda & Bagasra- 7 each

## **4. 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	18	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: Odisha, Chattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Telangana, Rajasthan, West Bengal, Gujarat and Telengna
2	RSMC Bulletin	6	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	5	1. Disaster Managers, Media persons by email and uploaded on website
4	Facebook /Twitter	4 times a day	Highlights uploaded on facebook/twitter since formation of depression.
5	SMS	4 times a day	To disaster managers of central and state level and general public registered with RSMC website.

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

S. N.	Type of Bulletin	Number of Bulletins issued by CWC Bhubaneswar
1.	Sea Area Bulletins	NIL
2.	Coastal Weather Bulletins	19
3.	Fishermen Warnings issued	41
4.	Port Warnings	24
5.	Heavy Rainfall Warning	07
6.	Gale Wind Warning	NIL
7.	Storm surge warning	NIL
8.	Information & Warning issued to State Government and other Agencies	11
9.	SMS/ Whatsapp (message in group)	650

## 6. Operational Forecast Performance

- First information about likely formation of an LPA over northeast BoB and neighbourhood around 4<sup>th</sup> August was given in the Tropical Weather Outlook (TWO) issued at 0600 UTC of 1<sup>st</sup> August. It was also indicated that the system would intensify further and expected cyclogenesis was predicted around 5<sup>th</sup> August with fair confidence (51-75%).
- In the TWO bulletin issued at 0600 UTC of 2<sup>nd</sup> August, cyclogenesis was predicted around 6<sup>th</sup> with fair confidence (51-75%).
- Actually LPA formed over north BoB and adjoining areas at 0300 UTC of 5<sup>th</sup> and depression formed northwest BoB & adjoining areas at 0300 UTC of 6<sup>th</sup>. Thus formation of LPA could be predicted about 5 days in advance and cyclogenesis could be correctly predicted about 4 days in advance.
- In the first bulletin issued at 1030 hrs IST (0500 UTC) of 6<sup>th</sup> August, it was predicted that the system would intensify into a deep depression by 7<sup>th</sup>. It was also predicted that the system would move west-northwestwards across Odisha - West Bengal coasts during next 48 hours.
- Actually, the system intensified into a DD on 7th. It also moved west-northwestwards across Odisha-West Bengal coasts.
- In the bulletin issued at 1930 hrs IST (1400 UTC) of 6th, it was predicted that the system would move west northwestwards and cross north Odisha - West Bengal coasts near Balasore by noon of 7th August 2019. Actually, the system crossed north Odisha-West Bengal coasts close to north of Balasore during 0800-0900 UTC of 7<sup>th</sup>. Thus landfall point could be predicted about 19 hrs in advance.

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 deep depression during 7<sup>th</sup> - 9<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 Deep Depression over northwest Bay of Bengal and neighborhood (06-11 August, 2019)**

Date/Base Time of observation (UTC)	24 hr Heavy rainfall warning ending at 0830 hrs IST of next day	Realised 24-hour heavy rainfall ending at 0300 UTC of date
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06/08/2019 0300 UTC	<p><b>6<sup>th</sup> August</b></p> <ul style="list-style-type: none"> <li>• Heavy to very heavy rainfall at a few places and isolated <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) very likely over Odisha.</li> <li>• Isolated heavy to very heavy and extremely heavy falls very likely over south Chhattisgarh.</li> <li>• Isolated heavy to very heavy falls are also very likely over Gangetic West Bengal and Jharkhand.</li> <li>• Heavy to very heavy falls at isolated places very likely over Madhya Pradesh on 6<sup>th</sup> August</li> </ul> <p><b>7<sup>th</sup> August</b></p> <ul style="list-style-type: none"> <li>• Heavy to very heavy rainfall at a few places and isolated <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) very likely over Odisha.</li> <li>• Isolated heavy to very heavy and extremely heavy falls very likely over south Chhattisgarh.</li> <li>• Isolated heavy to very heavy falls are also very likely over Gangetic West Bengal and Jharkhand.</li> <li>• Heavy to very heavy falls with isolated <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) very likely over Madhya Pradesh.</li> </ul> <p><b>8<sup>th</sup> August</b></p> <ul style="list-style-type: none"> <li>• Heavy to very heavy falls with isolated <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) very likely over Madhya Pradesh on 7<sup>th</sup> and 8<sup>th</sup> August.</li> </ul>	<p><b>6<sup>th</sup> August</b></p> <p><b>Odisha:</b> Krishnaprasad-13, Brahmagiri &amp; Thakurmunda -11each, Puri-9, Karanja-8 and Gopalpur, Jamsolaghat &amp; Swam-Patna-7 each</p> <p><b>Jharkhand:</b> Simdega-7</p> <p><b>Bihar:</b> Rafiganj 8 and Daudnagar 7</p> <p><b>West Madhya Pradesh:</b> Garoth-17</p> <p><b>East Madhya Pradesh:</b> Nowgong-10 and Jabalpur &amp; Tikamgarh-8 each</p> <p><b>7<sup>th</sup> August</b></p> <p><b>Gangetic West Bengal:</b> Purihansa 7</p> <p><b>Odisha:</b> Lanjigarh 38; Kashipur 32; Kotagarh 31; Phiringia 29; Kotraguda 26; Tarva 24; Muniguda 23; Kalinga 21; Gudari 19; Tikabali 18; Raikia, Kantamal, Madanpur &amp; Rampur-17 each; G Udayagiri &amp; R.Udaigiri-16 each; Baliguda, Similiguda, Daringibadi &amp; Jeypore-15 each; Koraput &amp; Phulbani-14 each; Nayagarh, Jaipatna, Bissem-Cuttack, Niali &amp; Berhampur-13 each; Gopalpur, Digapahandi, Hindol, Krishnaprasad, Alipingal &amp; Mohana-12 each; Kantapada, Nuagada, Odagaon, Narla, Purushottampur, Bhuban, Rayagada, Aska, Belaguntha &amp; Puri-11 each; K Nuagaon, Malkangiri, Gop, Gunupur, Banki &amp; Chhatrapur-10 each; Nimpara, Jagannath Prasad, Tentulikhunti, Bhanjnagar, Sorada, Danagadi &amp; Korei -9 each; Bhawanipatna, Khandapara, Kakatpur, Satyabadi, Astaranga &amp; Banpur-8 each and Raghunathpur, Balipatna, Jagatsinghpur, Pottangi, Madhabarida, Joshipur, Khairamal &amp; Narsinghpur-7 each.</p> <p><b>Jharkhand:</b> Manatu 9, Chandil &amp; Latehar-7 each</p> <p><b>Bihar:</b> Galgalia 7</p> <p><b>West Madhya Pradesh:</b> Salwani/Silvani, Pachmarhi &amp; Multai-10 each; Suvasara-8 and Biaora, Neemuch &amp; Udaipura-7 each.</p> <p><b>East Madhya Pradesh:</b> Katangi 7.</p> <p><b>Vidarbha:</b> Katol-13, Narkheda-9, Sironcha-7.</p> <p><b>Chhattisgarh:</b> Rajpur-17; Konta-14; Bhairamgarh &amp; Usoor-13 each; Chhindgarh &amp; Bijapur-12 each; Katekalyan &amp; Korba-11 each; Sukma &amp; Bhopalpatnam-10 each; Kuakonda-9; Darbha-8 and Lohandiguda, Jagdalpur &amp; Dantewara-7 each.</p> <p><b>Coastal A.P. &amp; Yanam:</b> Chintur-21; Koida-14; Vararamachandrapur, Velairpad &amp; Kunavaram-13</p>
07/08/2019 0300 UTC	<p><b>7<sup>th</sup> August</b></p> <ul style="list-style-type: none"> <li>• Heavy to very heavy rainfall at a few places and isolated <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) very likely over Odisha and Chhattisgarh.</li> <li>• <b>Heavy to very heavy &amp;</b></li> </ul>	

	<p><b>extremely heavy falls</b> very likely over east Madhya Pradesh.</p> <ul style="list-style-type: none"> <li>Isolated heavy falls are also very likely over Gangetic West Bengal, Bihar and Jharkhand.</li> <li>Heavy to very heavy falls at a few places very likely over north Andhra Pradesh and Telangana during next 24 hours, over Chhattisgarh during the subsequent 24 hours and over Vidarbha during next 48 hours.</li> </ul> <p><b>8<sup>th</sup> August</b></p> <ul style="list-style-type: none"> <li>Heavy to very heavy falls and isolated <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) over west Madhya Pradesh and east Rajasthan.</li> </ul> <p><b>9<sup>th</sup> August</b></p> <ul style="list-style-type: none"> <li>Heavy to very heavy rainfall at isolated places is likely to continue over west Madhya Pradesh and east.</li> <li>Heavy to very heavy rainfall at a few places and isolated <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) very likely over Gujarat.</li> </ul>	<p>each; Paderu-12; Narsipatnam &amp; Kukunoor-10 each; Chintapalle &amp; Sompeta-8 each and Mandasa-7.</p> <p><b>Telangana:</b> Venkatapuram-17; Eturnagaram-14; Mudhole, Perur &amp; Aswapuram-12 each; Dummugudem, Bhupalpalle &amp; Burgampadu-11 each; Manthani, Gundala, Pinapaka, Venkatapur &amp; Armur-10 each; Gudurwrgl, Nandipet, Velpur &amp; Palawancha-9 each; Mortad, Bhadrachalam, Kothaguda, Govindaraopet, Makloor, Mulakalapalle, Tekulapalle, Yellandu &amp; Metpalle-8 each and Kothagudem, Kammar Palle, Luxettipet, Navipet, Balkonda, Manuguru, Ramgundam &amp; Kaleswaram-7 each.</p> <p><b>8<sup>th</sup> August</b></p> <p><b>East Rajasthan:</b> Hindoli-11; Kotri-10; Mandalgarh-9 and Sapotra &amp; Dug-8 each.</p> <p><b>West Madhya Pradesh:</b> Ashoknagar-19; Sonkatch, Khandwa &amp; Sardarpur-14 each; Tarana 13; Guna, Petlawad, Khaknar, Khargone &amp; Mungaoli-11 each; Thikri &amp; Pachmarhi-10 each; Chanderi, Dhar, Neapanagar &amp; Ashta-Arg-9 each; Shegaon, Tonkhurd &amp; Burhanpur-8 each and Suvasara, Nalchha &amp; Gandhwani-7 each.</p> <p><b>East Madhya Pradesh:</b> Malanjhand-14; Jabalpur &amp; Rehli-11; Chindwara &amp; Waraseoni-10 each; Khurai &amp; Deori-9 each; Garhakota, Singrauli &amp; Mandla-8 each and Lanji, Patan, Paraswad &amp; Balaghat-7 each.</p> <p><b>Gujarat Region:</b> Quant-26 and Chhota Udepur-7</p> <p><b>Vidarbha:</b> Dharni-13; Dhanora-8 and Gondia-7</p> <p><b>Chhattisgarh:</b> Deobhog-30; Lohandiguda-27; Mana-Raipur-23; Raipur, Pusaur &amp; Jagdalpur-18 each; Orcha, Bastanar, Abhanpur, Bhairamgarh &amp; Thankhamariya-17 each; Sahaspurlohara-16; Bilaspur-15; Rajim, Kharsiya &amp; Patan-13 each; Bakavand, Mahasamund, Kawardha, Kurud, Arang, Bastar, Chhura, Tokapal &amp; Katekalyan-12 each; Bhatapara, Magarlod, Bemetara, Makadi, Raigarh, Simga, Narayanpur &amp; Saja-11 each; Gidam, Pithora, Gandai &amp; Basana-10 each; Chhindgarh, Kashdol, Pakhanjur, Masturi, Darbha, Pallari/Palari &amp; Tamnar-9 each; Berla, Durg, Lailunga, Bijapur, Dantewara, Sukma, Bagbahara &amp; Gharghoda-8 each and Gariabund, Kuakonda, Saraipali, Baderajpur, Tilda, Baloda Bazar, Manpur, Dhamdha, Khairagarh, Dhabhara, Sakti, Pharasgaon, Jaijaipur &amp; Champa-7 each.</p>
08/08/2019 0300 UTC	<p><b>08<sup>th</sup> August</b></p> <ul style="list-style-type: none"> <li>Heavy to very heavy rainfall at a few places with isolated <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) very likely over Vidarbha and heavy to very heavy rainfall with <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) at isolated places over Chhattisgarh, Madhya Pradesh and Gujarat Region</li> </ul>	

	<ul style="list-style-type: none"> <li>• <b>Heavy to very heavy rainfall at a few places</b> over East Rajasthan, heavy to very heavy rainfall at isolated places over Saurashtra &amp; Kutch and heavy rainfall at isolated places over West</li> </ul> <p><b>09<sup>th</sup> August</b></p> <ul style="list-style-type: none"> <li>• Heavy to very heavy rainfall at a few places with isolated <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) very likely over Gujarat Region and Saurashtra &amp; Kutch and heavy to very heavy rainfall with isolated <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) over West Madhya Pradesh and East Rajasthan.</li> <li>• Heavy rainfall at isolated places over West Rajasthan, Vidarbha and East Madhya Pradesh.</li> </ul> <p><b>10<sup>th</sup> August</b></p> <ul style="list-style-type: none"> <li>• Heavy to very heavy rainfall at isolated places over Gujarat Region and Saurashtra &amp; Kutch and Light to moderate rainfall at a few places with heavy rainfall at isolated places over West Madhya Pradesh and Rajasthan.</li> </ul>	<p><b>9<sup>th</sup> August</b></p> <p><b>West Rajasthan:</b> Desuri &amp; Shergarh-7 each</p> <p><b>East Rajasthan:</b> Mount Abu, Mounntabu Tehsil, Khushalgarh, Girva &amp; Pindwara-13 each; Gangdhar-12; Udaipur/D-Aero &amp; Mavli-11 each; Vallabhnagar &amp; Arnod -10 each; Garhi, Ganeshpur &amp; Aspur-9 each; Pachpahar Sr, Sahada Sr, Sallopat Sr, Danpur, Sarara, Gogunda, Sagwara &amp; Bari-Sadri-8 each and Arthuna, Pirawa, Galiakot, Railmagra, Nithuwa, Jahazpur, Sajjanganrh, Shergarh &amp; Jhadol-7 each.</p> <p><b>West Madhya Pradesh:</b> Tarana 21; Maheshwar, Kasarwad &amp; Bhikangaon-19 each; Jhabua-18; Thandla &amp; Shajapur-17; Thikri, Bhainsdehi &amp; Dhar-16 each; Raisen-15; Sardarpur &amp; Neapanagar-14 each; Khandwa-, Manawar, Khaknar &amp; Shegaon-13 each; Sendhwa(Med), Depalpur, Gandhwani, Nalchha, Salwani &amp; Silvani-12 each; Alirajpur, Suvasara &amp; Khargone &amp; Sonkatch-11 each; Burhanpur, Khategaon, Agar, Bhopal &amp; Badwani-10 each; Petlawad, Jaora, Ujjain, Tonkhurd, Jabot, Begumganj, Ichhawar, Mandsaur, Mhow, Kannod &amp; Bagli-9; Manasa, Gautampura, Udaipura, Pandhana, Bhabhra &amp; Indore-8 each and Harda, Sarangpur, Multai, Nusrulgunj-Arg, Bhanpura, Mahidpur, Garoth, Kukshi, Sehore-, Pachmarhi, Badnawar, Khachrod &amp; Ashta-7each.</p> <p><b>East Madhya Pradesh: ;</b> Tendukheda &amp; Kareli-15 each; Narsinghpur-12; Mandla &amp; Nainpur-9 each; Gadarwara-8 and Deori, Keolari &amp; Ghansore-7 each.</p> <p><b>Gujarat Region:</b> Chhota Udepur-34; Quant-28; Jetpur Pavi &amp; Nizer-17 each; Naswadi-16; Dhanpur-12; Godhra; Bodeli; Dahod &amp; Sanjeli 11 each; Devgadhi Baria, Umerpada, Limkheda, Jambughoda, Vijaynagar, Dediapada, Fatepura, Sagbara &amp; Subir 9 each; Dabhoi; Rajpipala; Shahera; Garbada &amp; Ukai 8 each; Uchchhal; Vadodara; Kadana; Halol &amp; Morva Hadaf 7 each</p> <p><b>Vidarbha: ;</b> Mauda 12; Chikhalda 11; Dharni, Nagpur &amp; Akot 9 each; Chandur Bazar; Bhandara; Hingna &amp; Arvi 8 each; Mohadi; Tumsar; Ashti; Wardha &amp; Morsi 7 each.</p>
09/08/2019 0300 UTC	<p><b>9<sup>th</sup> August.</b></p> <ul style="list-style-type: none"> <li>• Heavy to very heavy rainfall at a few places with isolated <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) very likely over Gujarat Region, Saurashtra &amp; Kutch, southeast Rajasthan and southwest Madhya Pradesh on</li> </ul>	<p><b>10<sup>th</sup> August</b></p> <p><b>East Rajasthan:</b> Pratapgarh-15; Kherwara &amp; Salumber - 12; Sarara - 11; Jagpura, Aspura, Devel, Ghatol, Dungarpur Tehsil, Loharia &amp;</p>

	<p><b>10<sup>th</sup> August</b></p> <ul style="list-style-type: none"> <li>Heavy to very heavy rainfall at a few places with isolated <b>extremely heavy falls</b> (<math>\geq 20\text{cm}</math>) very likely over Saurashtra &amp; Kutch; <b>Heavy to very heavy rainfall</b> at isolated places over Gujarat region and <b>Heavy rainfall</b> at isolated places over south Rajasthan</li> </ul>	<p>Bhungra - 8 each and Ganeshpur, Pipalkhunt, Arnod, Nithuwa, Reodar, Kesarpura &amp; Arthuna - 7 each</p> <p><b>West Madhya Pradesh:</b> Bhabhra 19; Sardarpur &amp; Manawar 9 each; Alirajpur, Nalchha &amp; Mandsaur 8 each and Jabot &amp; Sendhwa 7 each</p> <p><b>Gujarat Region:</b> Mahudha 34, Dhandhuka 32, Kadi 30, Galteshwar 26, Dholera 24, Kalol 23, Jotana 21, Nadiad &amp; Chhota Udepur 20 each, Bodeli &amp; Dediapada 19 each; Godhra, Sanand, Mahesana, Kathalal &amp; Anand 18 each, Desar, Thasra &amp; Dholka 17 each, Umerpada, Bayad, Petlad &amp; Vijapur 16 each, Amod, V.Vidyanagar, Umreth, Jetpur Pavi &amp; Matar 15 each, Jambughoda, Mahemdavad, Khambhat, Saraswati, Borsad &amp; Dhansura 14 each, Subir, Halol, Karjan, Sojitra, Sami &amp; Tarapur 13 each, Savli 12, Kapadvanj, Ghoghamba, Vaso, Abad City, Kheda, Dabhoi, Mansa, Netrang &amp; Wanakbori 11 each, Patan, Anklav, Songadh, Prantij, Sagbara, Garudeshwar, Gandhinagar, Vijaynagar, Waghai, Vagra, Dhanpur, Himatanagar, Tilakwada, Shankheshvar, Nandod, Bavla, Shahera, Sankheda, Vadodara, Idar &amp; Kalol 9 each, Nizer, Khanpur, Becharaji, Dahegam, Vansda, Detroj, Bhabhar, Bhiloda, Dantiwada, Naswadi &amp; Jambuser 8 each and Harij, Talod, Vyara, Radhanpur &amp; Quant 7 each.</p> <p><b>Saurashtra &amp; Kutch:</b> Barvala 38, Gadhda &amp; Botad 29 each, Ranpur 26, Chuda 24, Kandla New, Dhrangadhra, Surendranagar &amp; Vallabhipur 21 each, Rajkot 20, Rapar, Thangadh &amp; Wadhvan 19 each, Gandhidham &amp; Umralla 18 each, Bhachau, Halvad &amp; Vichhiya 17 each, Chotila, Morbi, Kandla Airport, Tankara &amp; Dhrol 16 each, Kotdasangani &amp; Lalpur 15 each, Jodia, Kharaghoda, Amreli &amp; Gondal 14 each, Dasada, Sayla, Lakhtar, Muli, Limbdi, Lodhika &amp; Kalyanpur 13 each, Babra, Shihor, Lathi &amp; Porbandar 12 each, Vadia, Paddhari, Jamnagar &amp; Bhavnagar 11 each, Naliya, Jasdan, Maliamiana &amp; Anjar 10 each, Okha, Wankaner, Kalavad &amp; Abdasa 9 each, Visavadar &amp; Dwarka 8 each, Bhanvad, Nakhatrana, Jamkandorna, Mundra, Bhesan &amp; Mandvi 7 each</p> <p><b>11<sup>th</sup> August</b></p> <p><b>Gujarat Region:</b> Radhanpur 18, Suigam 13, Gandeви 9, Chikhli, Valod &amp; Vyara 8 each and Jalalpor 7,</p>
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## 7. Summary and Conclusions:

A low pressure area formed over north Bay of Bengal (BoB) and neighbourhood in the on 5<sup>th</sup> August, 2019. It concentrated into a depression over northwest BoB off north Odisha - West Bengal coasts in the morning (0830 hrs IST) of 6<sup>th</sup> and into a DD on 7<sup>th</sup>. Moving northwestwards, it crossed north Odisha-West Bengal coasts close to north of Balasore during (1330-1430 hrs IST) of 7<sup>th</sup>. Thereafter, it moved west-northwestwards and weakened into a depression on 8<sup>th</sup> August, into a well-marked low pressure area over southeast Rajasthan & neighbourhood on 9<sup>th</sup>. Thereafter, it moved nearly west-southwestwards during next 3 days and weakened into an LPA over northeast Arabian Sea and neighbourhood on 12<sup>th</sup>.

## 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). The support from various Divisions/Sections of IMD including Area Cyclone Warning Centre Kolkata, Regional Meteorological Centre Nagpur, Cyclone Warning Centre Bhubaneswar, 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.