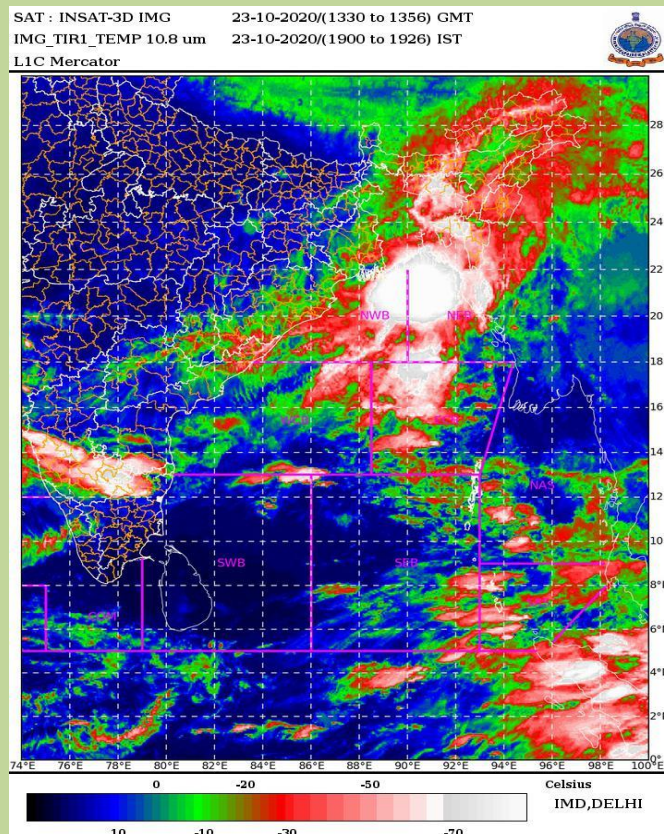




**GOVERNMENT OF INDIA  
MINISTRY OF EARTH SCIENCES  
INDIA METEOROLOGICAL DEPARTMENT**

**Depression over the Bay of Bengal  
(22-24 October, 2020): A Report**



INSAT-3D enhanced Colored IR imagery based on 1330 UTC of 23<sup>rd</sup> October

**Cyclone Warning Division  
India Meteorological Department  
New Delhi  
October, 2020**

# Depression over the Bay of Bengal during 22<sup>nd</sup> – 24<sup>th</sup> October, 2020

## 1. Introduction

- ❖ The Depression originated as a Low Pressure Area over central parts of Bay of Bengal (BoB), in the early morning (0000 UTC) of 20<sup>th</sup> October, 2020 which became a well marked low pressure area over west-central BoB in the morning (0300 UTC) of 21<sup>st</sup> October.
- ❖ Under favourable environmental conditions, it concentrated into a **Depression over northwest & adjoining west-central BoB** in the morning (0300 UTC) of 22<sup>nd</sup> October, 2020.
- ❖ It initially moved northwards for some time and thereafter moved north-northeastwards and crossed West Bengal & adjoining Bangladesh coasts over Sundarbans near latitude 21.8°N and longitude 88.5°E around noon (between 0600 & 0700 UTC) of 23<sup>rd</sup> October 2020 as a Depression with maximum sustained wind speed of 45-55 kmph gusting to 65 kmph.
- ❖ Further moving north-northeastwards, it weakened into a well marked low pressure area over central Bangladesh & neighbourhood in the early morning (0000 UTC) of 24<sup>th</sup> October 2020.
- ❖ The system caused heavy rainfall at isolated places over Telangana, Rayalaseema & Odisha and heavy to very rainfall at few places with extremely heavy falls at isolated places over the northeastern states of India including Assam, Meghalaya, Manipur, Nagaland, Mizoram & Tripura. As a consequence of these heavy rains, Landslides also happened over north-eastern states, affecting normal life.

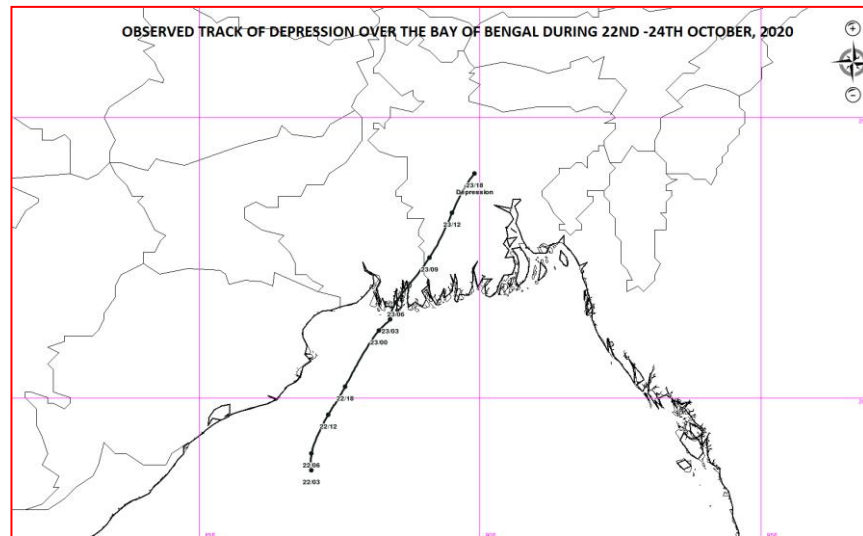
The salient features of the system were as follows:

- (i) It had an initial northward movement followed by north-northeastward moving track.
- (ii) It had a life period of nearly 45 hours.
- (iii) It had a track length of 662 km.
- (iv) Convection and hence the rainfall associated with the system was pronounced over the northeastern Sector and to the left of the track did not experience any heavy rainfall when the system moved inland.

IMD mobilised all its resources to track the system and regular warnings w.r.t. track, intensity, crossing point & time, associated severe weather and adverse impacts & suggested actions 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 with actionable accuracy 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:

The observed track of Depression over west-central BoB is presented in Fig.1. The best track parameters of the system are presented in Table 1.



**Fig.1. Observed track of Depression over the Bay of Bengal (22-24 October, 2020)**

**Table 1: Best track positions and other parameters of the observed track of Depression over the Bay of Bengal (22-24 October, 2020)**

Date	Time (UTC)	Centre lat. <sup>o</sup> N/ long. <sup>o</sup> E	C.I. NO	Estimat ed Central Pressu re (hPa)	Estimated Maximum Sustained Surface Wind (kt)	Estimated Pressure drop at the Centre (hPa)	Grade	
22/10/2020	0300	18.7 87.0	1.5	999	20	3	D	
	0600	19.0 87.0	1.5	998	25	4	D	
	1200	19.7 87.3	1.5	998	25	4	D	
	1800	20.2 87.6	1.5	998	25	4	D	
23/10/2020	0000	21.2 88.2	1.5	998	25	4	D	
	0300	21.4 88.4	1.5	998	25	4	D	
	0600	21.7 88.5	1.5	998	25	4	D	
	Crossed West Bengal & adjoining Bangladesh coasts (near latitude 21.8°N & longitude 88.5° E), between 0600 & 0700 UTC of 23 <sup>rd</sup> October 2020.							
	0900	22.5 89.1	1.5	998	25	4	D	
	1200	23.3 89.5	1.5	1000	20	3	D	
	1800	24.0 89.9	1.5	1000	20	3	D	
24/10/2020	0000	Weakened into well marked low pressure area over Central parts of Bangladesh.						

### 3. Features observed through Satellites and Radar:

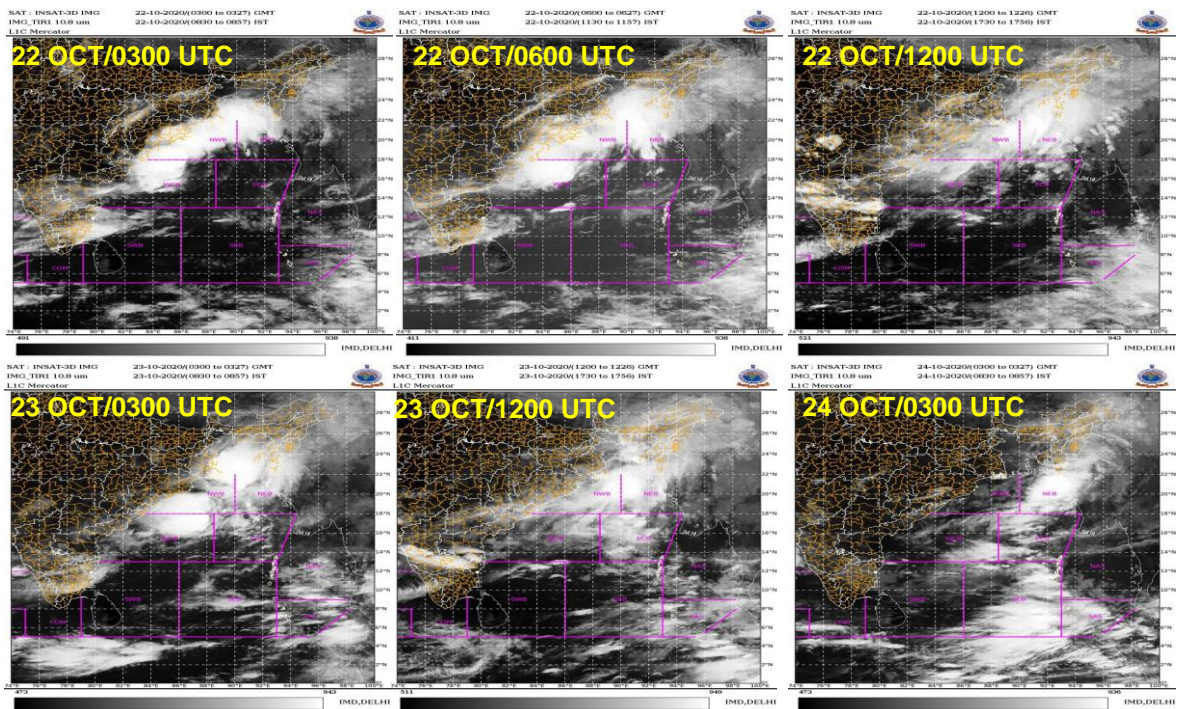
India Meteorological Department (IMD) maintained round the clock watch over the north Indian Ocean and the development of the system was monitored since 14<sup>th</sup> October, about 8 days prior to the formation of depression over northwest BoB and adjoining westcentral BoB on 22<sup>nd</sup> October. The **Depression** was monitored with the help of available satellite observations from INSAT 3D and 3DR, SCAT SAT, polar orbiting satellites and available ships & buoy observations in the region. The system was also monitored by Doppler Weather RADARs (DWRs) Paradip, Kolkata and Agartala. Various numerical weather prediction models run by the Ministry of Earth Sciences (MoES) institutions, models run by other Global centres and dynamical-statistical models were utilized to predict the genesis, track, landfall and intensity of the Depression. A digitized forecasting system of IMD was utilized for analysis and comparison of various models' guidance, decision making process and warning products generation. The heavy rainfall and wind warning at district and meteorological subdivision level along with expected impact, suggested actions and fishermen warnings were issued by IMD well in advance to all concerned states, media and stakeholders.

All through the system period, the convection was organized in a shear pattern and the minimum Cloud Top Temperature reported had been minus 93°C. Intensity of the system remained to be T 1.5 over the Sea.

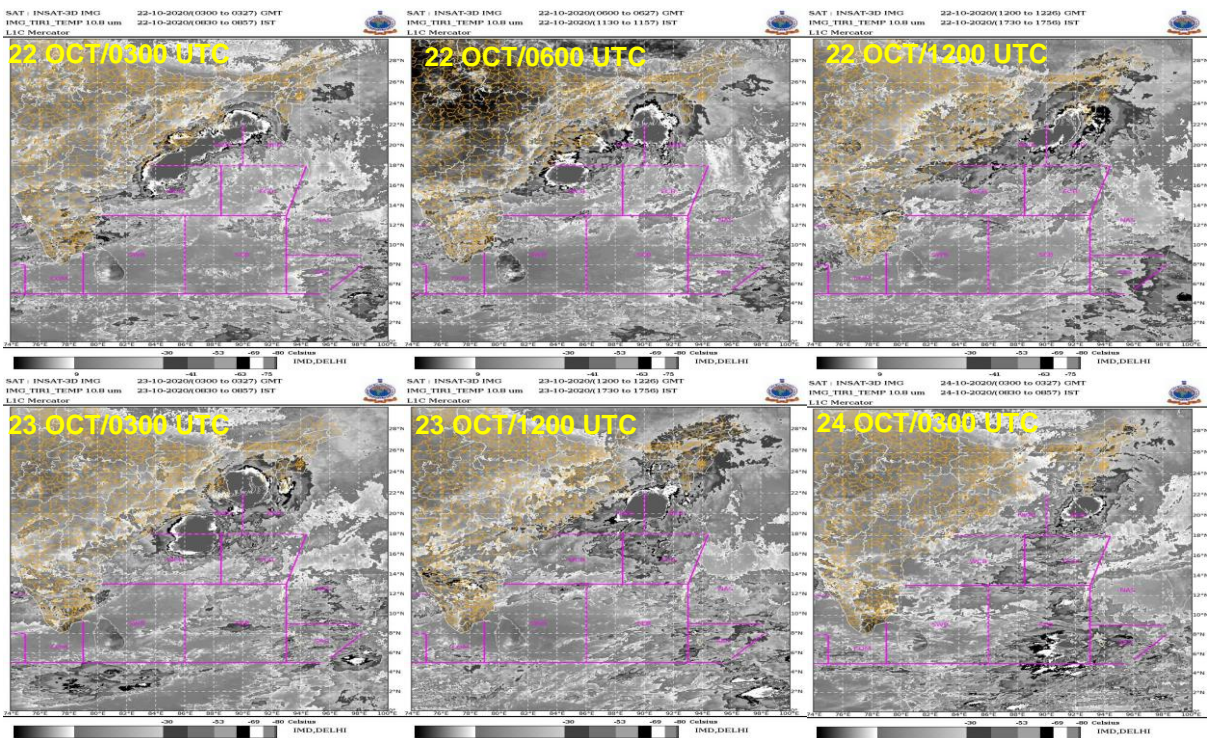
As per satellite imagery based on 0300 UTC of 22<sup>nd</sup> October, the convective clouds were sheared to the northwest of the system center. Scattered low and medium clouds with embedded intense to very intense convection lay over northwest and adjoining west-central BoB and neighbourhood. As per satellite imagery based on 0000 UTC of 23<sup>rd</sup> October, the convective clouds became sheared to the northeast of the system center, mainly under the influence of upper level westerlies. Scattered low and medium clouds with embedded intense to very intense convection lay over north BoB, coastal west Bengal and Bangladesh in association with the system. As per satellite imagery based on 1200 UTC of 23<sup>rd</sup> October, the system lay over coastal areas of south-west Bangladesh and neighborhood. Center was not clearly defined in IR/visible imageries. Broken low/medium clouds with embedded intense to very intense convection lay over north BoB, coastal west Bengal and Bangladesh, Meghalaya, south Assam, Mizoram & Tripura in association with the system.

**Fig.2 a-d** depicts the INSAT based cloud imageries. The radar imageries from DWR Paradip, Kolkata and Agartala are presented in **Fig.3a to Fig 3c**.



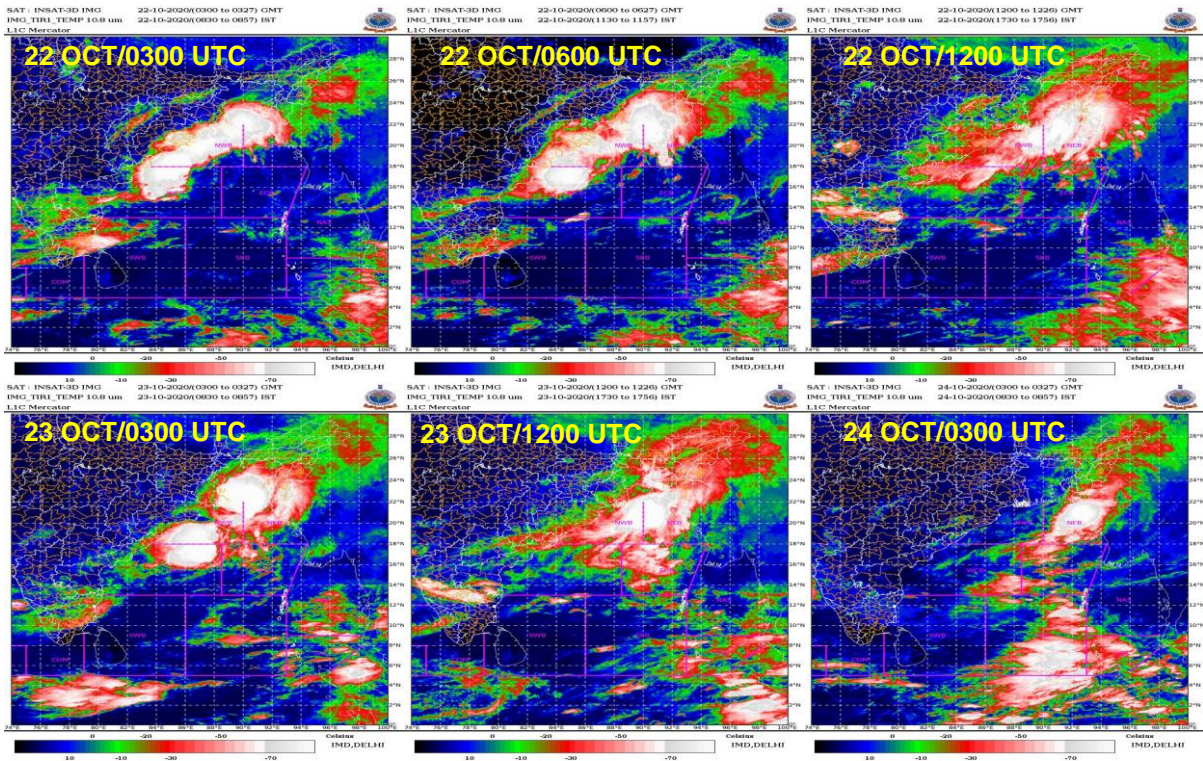


**Fig. 2a:** INSAT-3D IR imageries during life cycle of Depression (22-24 October, 2020)

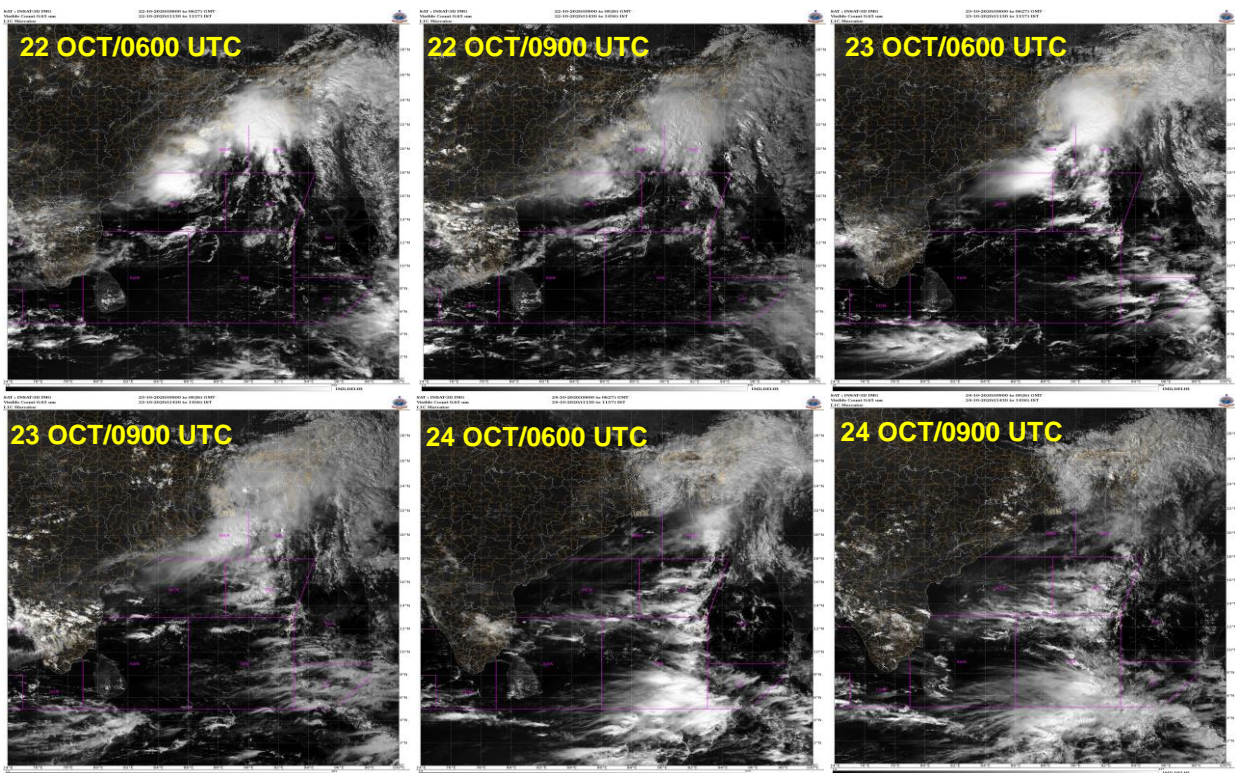


**Fig. 2b:** INSAT-3D cloud top brightness imageries during life cycle of Depression (22-24 October, 2020)



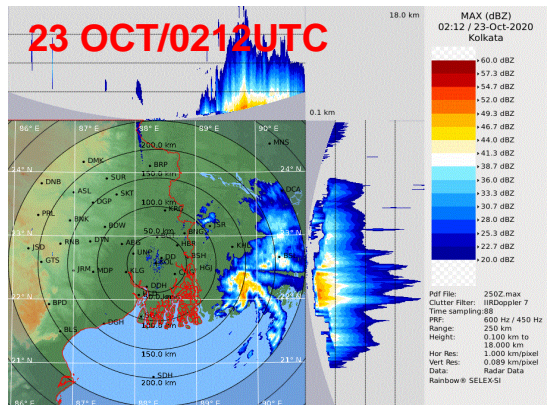


**Fig. 2c: INSAT-3D enhanced colored imageries during life cycle of Depression (22-24 October, 2020)**

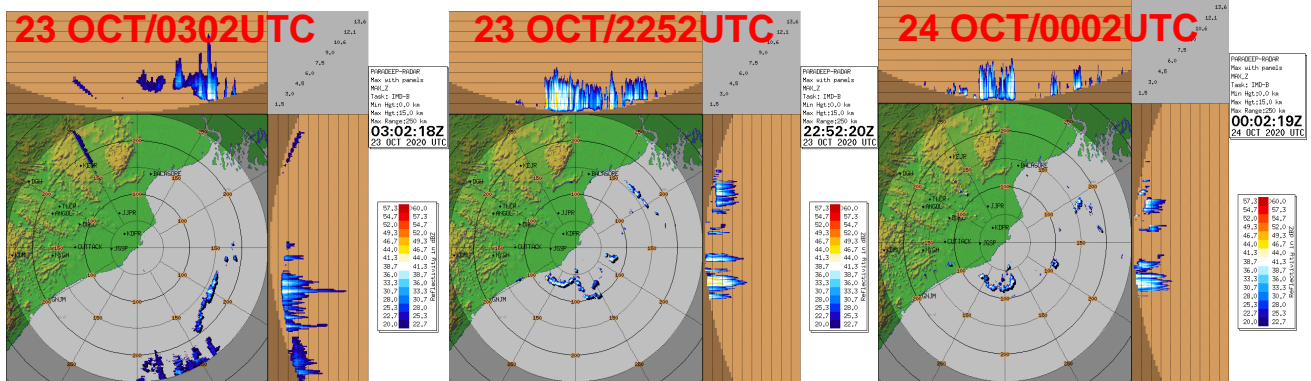


**Fig. 2d: INSAT-3D visible imageries during life cycle of Depression (22-24 October, 2020)**

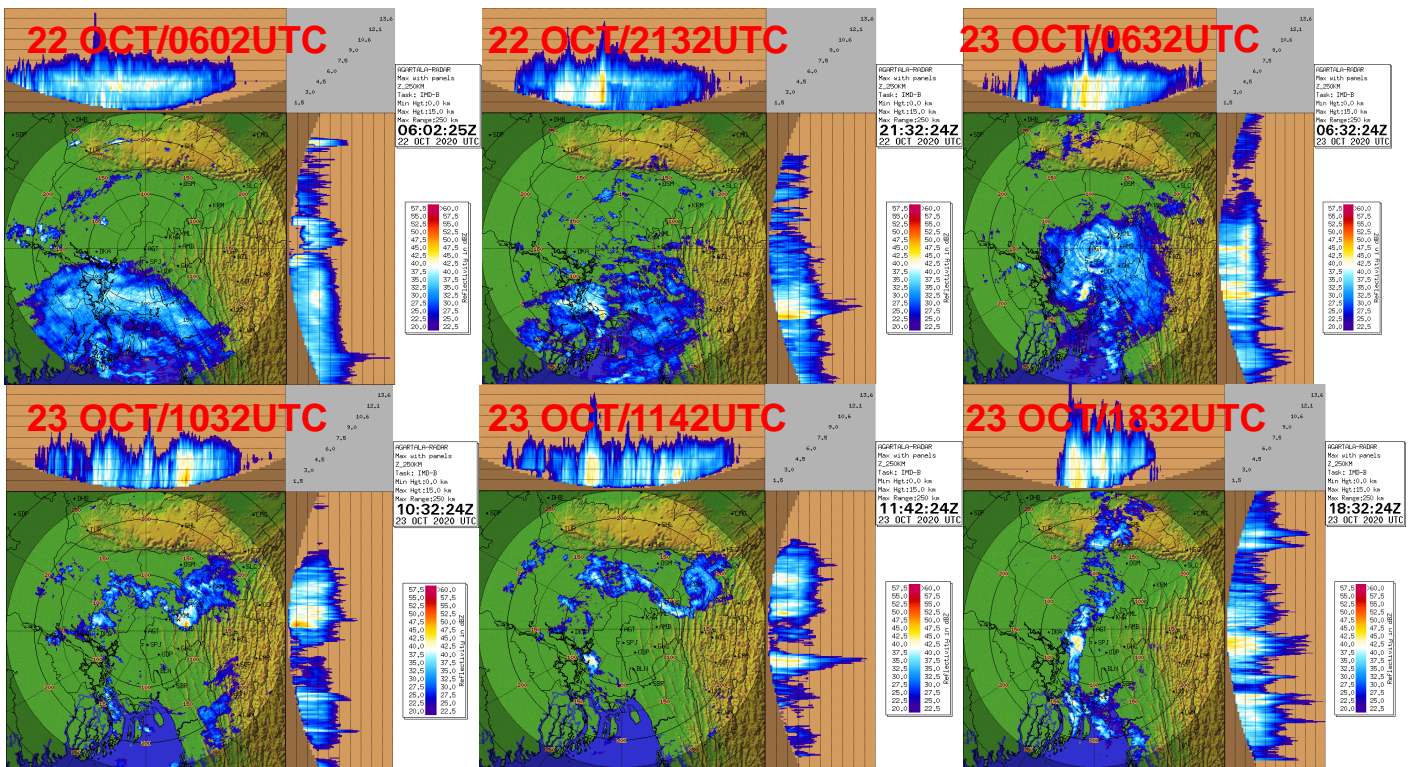




**Fig 3a:** Typical Max Z Radar imageries of DWR KOLKOTA during 23 October, 2020



**Fig 3b:** Typical Max Z Radar imageries of DWR PARADIP during 22-24 October, 2020



**Fig 3c:** Typical Max Z Radar imageries of DWR AGARTALA during 22-24 October, 2020

#### 4. 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 (a) – 5(d).

At 0000 UTC of 21<sup>st</sup> October, it indicated a Depression over northern parts of west-central BoB. The circulation was seen extending upto 500 hPa level. At 200 hPa level, an anti-cyclone prevailed to the northeast of the system centre, indicating the likely northeastward movement of the system. In general, the model simulated the system quite well, with slight shift in the observed location.

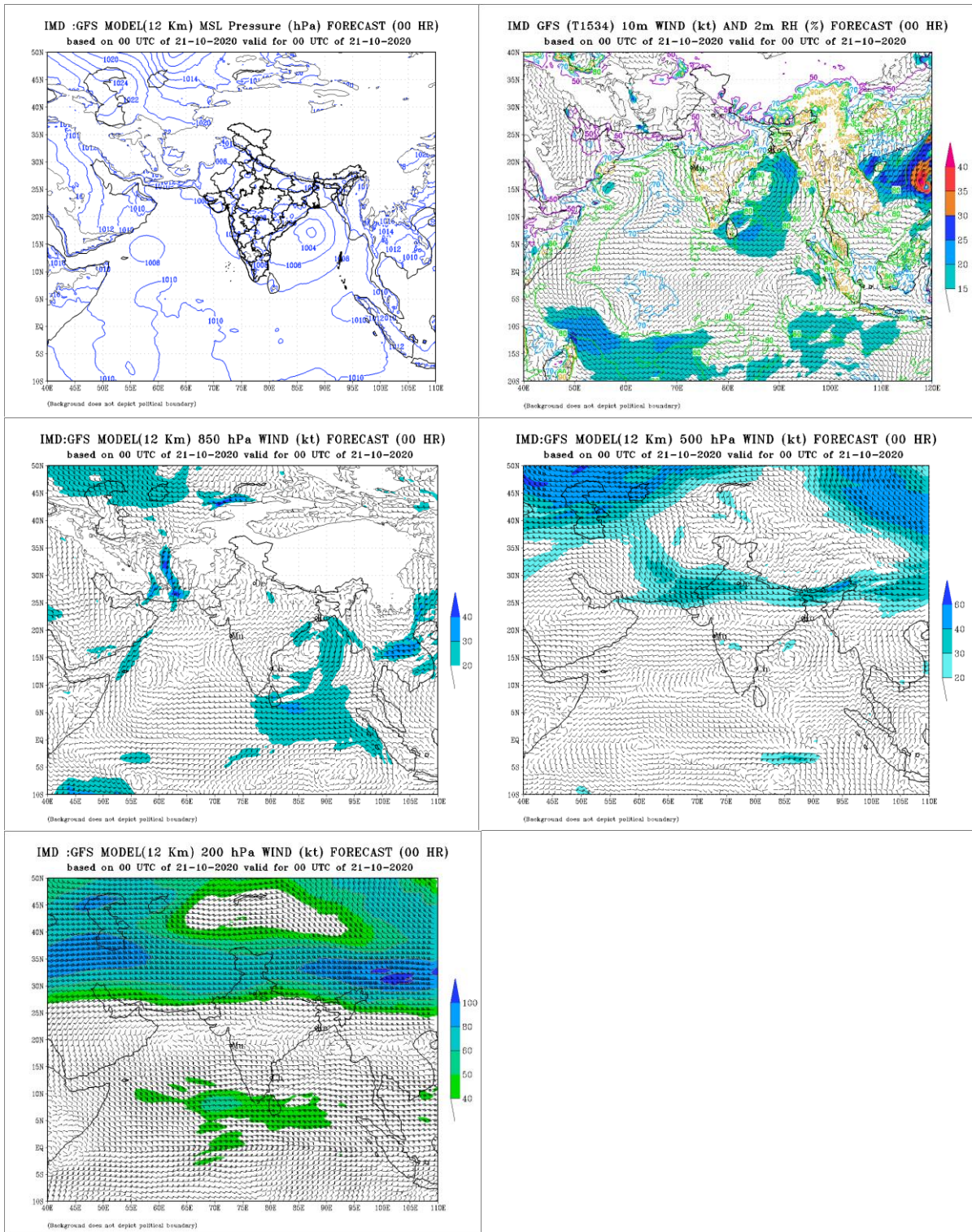
At 0000 UTC of 22<sup>nd</sup> October, it indicated a Depression lying over northwest BoB. The circulation was seen extending upto 500 hPa level, but with slight southward tilt. Also a trough in mid-latitude westerlies was shown to be present to the west of the system, over northwest India at 500 hPa. At 200 hPa level the anti-cyclone was located overhead the system centre, providing upper level divergence. The system intensity at 0000 UTC remained that of a Depression. Also the location was aptly simulated by the model.

At 0000 UTC of 23<sup>rd</sup> October, the model indicated the system as a Depression (with slight intensification, as compared to the previous day) over northwest BoB, close to south Bangladesh coast. The circulation was seen extending only upto 600 hPa level (Figure not shown). The westerly trough at 500 hPa had moved further eastwards & was seen over eastern India, to the west of the system. The anti-cyclone at 200 hPa level remained to be overhead the system, though its vertical extension had diminished. The system as a Depression lay close to Bangladesh coast.

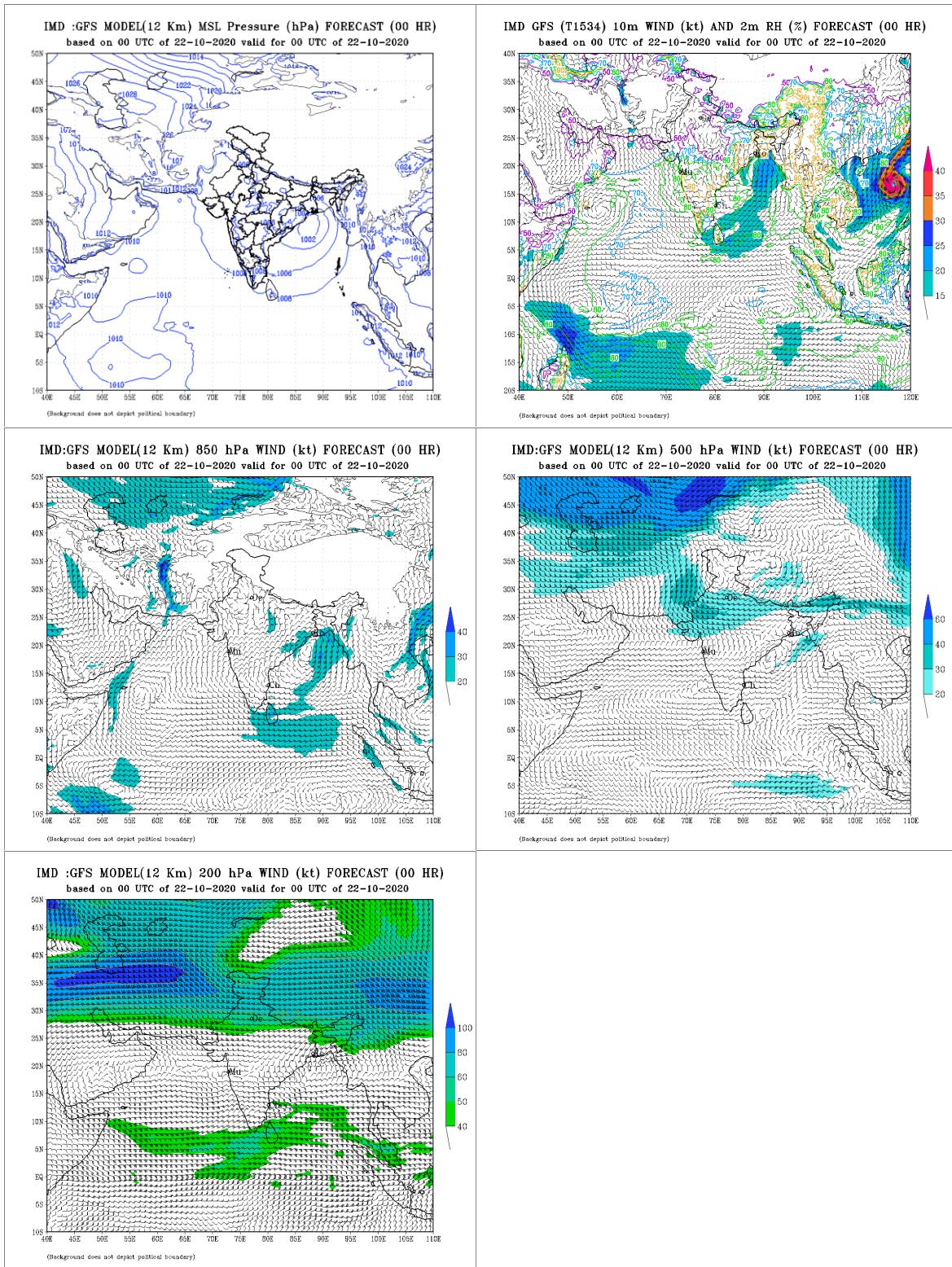
At 0000 UTC of 24<sup>th</sup> October, the model located the system as a Low Pressure Area centered over Bangladesh and adjoining Assam & Meghalaya. The circulation was seen extending upto 850 hPa level. The westerly trough was seen over the system area at 500 hPa level. In reality, the system had crossed West Bengal & adjoining Bangladesh coasts (near latitude 21.8°N & longitude 88.5° E), between 0600 & 0700 UTC of 23<sup>rd</sup> October 2020. It maintained the intensity of Depression till the mid-night of 23<sup>rd</sup> October and subsequently weakened into well marked low pressure area over Central parts of Bangladesh by 0000 UTC of 24<sup>th</sup> October.

Thus IMD GFS provided reliable guidance in forecasting the intensity & movement of the system all through its life period.



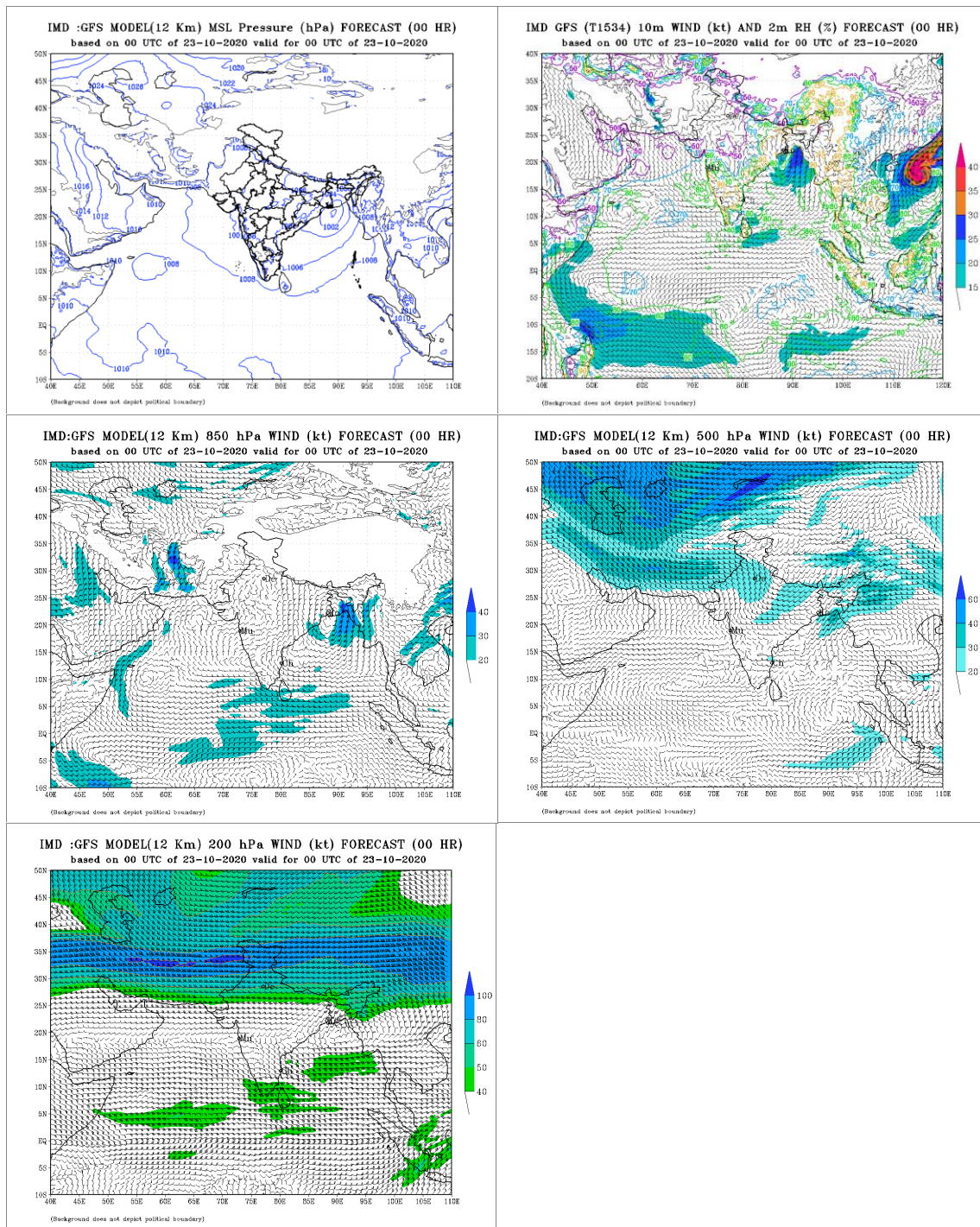


**Fig.4 (a):** IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 21<sup>st</sup> October 2020

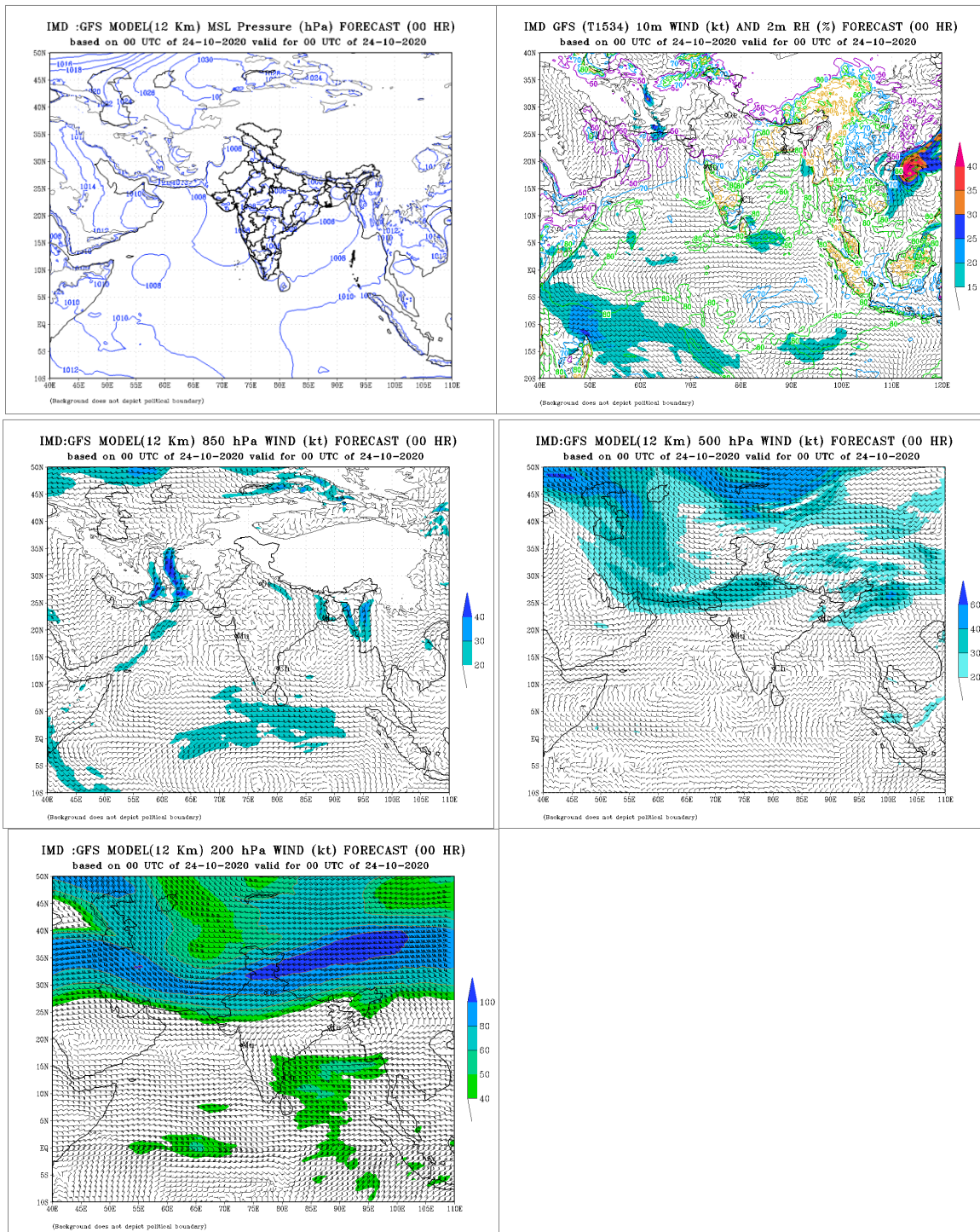


**Fig.4 (b): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 22<sup>nd</sup> October 2020**





**Fig.4 (c): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 23<sup>rd</sup> October 2020**

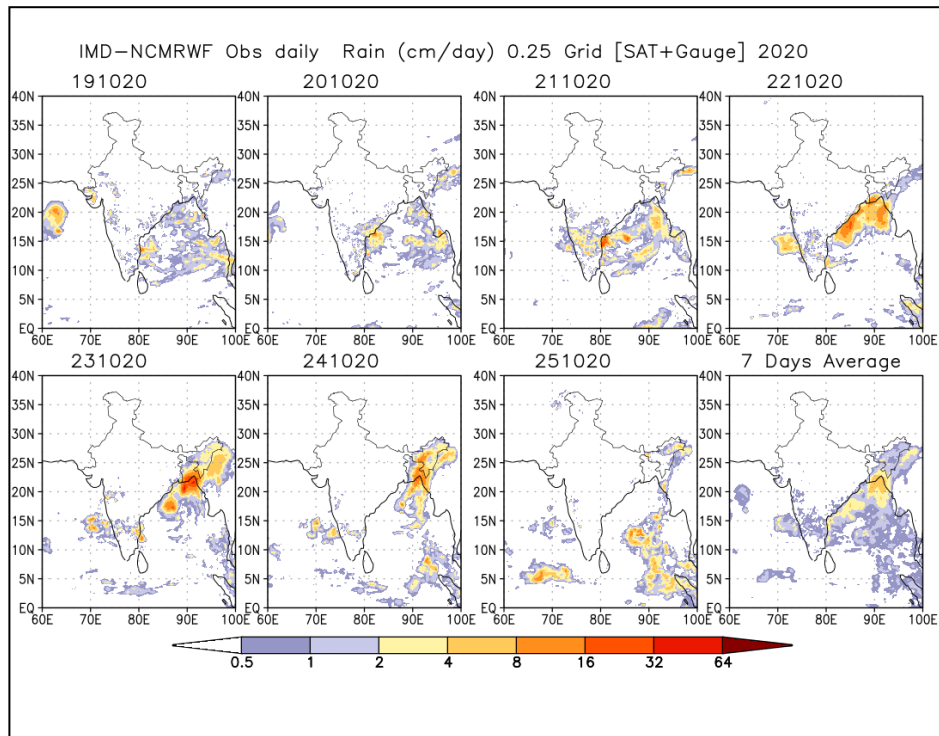


**Fig.4 (d): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 24<sup>th</sup> October 2020**



## 5. Realized Weather:

Realised rainfall in association with the system based on IMD-NCMRWF GPM merged gauge rainfall data is depicted in Fig 5. It may be noted that the system caused heavy rainfall at few places over coastal Odisha on 22<sup>nd</sup>, heavy to very heavy rainfall with extremely heavy rainfall at a few places over coastal Bangladesh on 23<sup>rd</sup> and over Assam & Meghalaya on 24<sup>th</sup>.



**Fig.5: Daily rainfall distribution based on merged gridded rainfall data of IMD/ NCMRWF during 19-25 October, 2020**

Realized 24 hrs accumulated rainfall ( $\geq 7$ cm) ending at 0830 hrs IST of date during the life cycle of the system is presented below:

(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).

### **22<sup>nd</sup> October**

**Odisha:** Paradip -7, Tihidi-7.

### **23<sup>rd</sup> October**

**Assam & Meghalaya:** Mawsynram-13, Sohra-12, Sohra (RKM) -11, Bakulia-8

**Nagaland- Manipur – Mizoram – Tripura:** Sabroom-8, Lawngtlai-7

**Odisha:** Kendrapara-7

### **24<sup>th</sup> October**

**Assam & Meghalaya:** Mawsynram-35, Sohra (RKM) – 30, Sohra -29, Shillong C.S.O.-17, Nongstein-16, Shillong AWS-15, Barapani-13, Dharamtul-10, Kampur-10, Williamnagar-7, Numaligarh-7, Bhaghmara-7.

**Nagaland- Manipur – Mizoram – Tripura:** Kailashahar Aero-9, Gandecheerra-7, Dharmanagar/ Panisagar-7, Sonamura-7, Udaipur-7.

## 6. Bulletins issued by IMD

IMD issued regular bulletins to National & State Disaster Management Agencies of Odisha, Andhra Pradesh, Tamil Nadu, Andaman & Nicobar Islands, West Bengal, Nagaland, Manipur, Mizoram, Tripura, Assam, Meghalaya, general public and media and WMO/ESCAP Panel member countries including Bangladesh and Myanmar. Regular Bulletins every six hourly were issued since formation of depression over northwest BoB. In addition, CWD New Delhi also issued Press Release and SMS to registered users.

In view of the depression over Bangladesh special bulletins & district wise Impact Based Forecasts were also issued for the States of Assam, Meghalaya, Manipur, Mizoram and Tripura in addition to regular forecast and warnings. These forecasts and warnings were disseminated to state govts, state disaster management authorities, NDRF, media etc. These bulletins were also disseminated through social media platforms like Facebook, Twitter, Whatsapp & YouTube Videos were uploaded in various languages like Hindi, English, Assamese, Bengali and local dialect of Manipur.

### 6.1: 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.	Bulletin type	No. Of Bulletins	Issued to
1	Bulletin from DGM IMD	3	Cabinet Secretary, Principal Secretary to Prime Minister, Secretary Ministry of Home Affairs, Defense, Agriculture, Information & Broadcasting, Department of Sc. & Technology, NDMA, and Shipping & Surface Transport, Control Room Home Affairs, Director Indian Railways, Director General Doordarshan & All India Radio, Director General National Disaster Response Force and Chief Secretary- Government of Odisha, Andhra Pradesh, Tamil Nadu, Andaman & Nicobar Islands, West Bengal, Nagaland, Manipur, Mizoram, Tripura, Assam, Meghalaya.
2	National Bulletin+ Informatory Message	11 + 2	1. IMD's website, RSMC New Delhi website 2. FAX and e-mail to Control Room Ministry of Home Affairs & National Disaster Management Authority, Cabinet Secretariat, Minister of Science & Technology, Secretary MOES, Headquarter Integrated Defense Staff, Director General Doordarshan, All India Radio, PIB MOES, UNI, DG National Disaster Response Force, Director,



			Punctuality, INDIAN RAILWAYS, Chief Secretary: Government of Odisha, Andhra Pradesh, Tamil Nadu, Andaman & Nicobar Islands, West Bengal, Nagaland, Manipur, Mizoram, Tripura, Assam, Meghalaya.
6	RSMC Bulletin	08	1. IMD's website 2. WMO/ESCAP member countries through GTS and E-mail.
7	Warnings through SMS	Frequently	SMS to disaster managers at national level and concerned states (every time when there was change in track, intensity and landfall characteristics) (i) 1412 to General Public by IMD Headquarters (ii) 98 to disaster managers by IMD Headquarters (ii) 332143 SMS to fishermen by INCOIS (iii) 11 Total bulletins sent through NAVIC (INCOIS) (iv) 224617 to farmers by Kisaan Portal
8	Warnings through Social Media	Daily	Cyclone Warnings were uploaded on Social networking sites (Facebook and Tweeter) since inception to weakening of system (every time when there was change in track, intensity and landfall characteristics).
9	Press Release	5	Disaster Managers, Media persons by email and uploaded on website
10	Video Capsule	1	Video capsule by DGM IMD about the system

**Table 2(b): Bulletins issued by Area Cyclone Warning Centre (ACWC) Kolkata, Meteorological Centre (MC) Shillong, Meteorological Centre (MC) Agartala, Chennai, Cyclone Warning Centre Bhubaneswar**

S.No.	Type of Bulletin Number	No. of Bulletins issued			
		ACWC Kolkata	MC Shillong	MC Agartala	CWC Bhubaneswar
1.	Sea Area Bulletins	05	NIL	NIL	NIL
2.	Coastal Weather Bulletins	04	NIL	NIL	16
3.	Fishermen Warnings issued	04	NIL	NIL	32
4.	Port Warnings	08	NIL	NIL	21
5.	Heavy Rainfall Warning	02	05	05	06
6.	Gale Wind Warning	NIL	NIL	NIL	NIL ( Wind Warning for Odisha Coast issued ) 04
7.	Storm surge Warning	NIL	NIL	NIL	NIL
8.	Information & Warning	06	17	02	11

	issued to State Government and other Agencies				( In addition to regular Bulletins )
9.	SMS	NIL	NIL	NIL	NIL
10.	No. of Press releases	06	03	02	02
11.	No. of impact based warnings for a. District  b. City	03(For six districts) 01(for Kolkata)	02 03	02 02	03 01
12.	No. of whatsapp messages	3032	42	49 (Disaster Management Group 28, Media Group 21)	7348
13.	No. of updates on facebook	05	05	15	63
14.	No. of updates on tweeter	05	05	15	100
15	No. of warning video released	03	01	01	08

## 7. Operational Forecast Performance

### 7.1 Genesis:

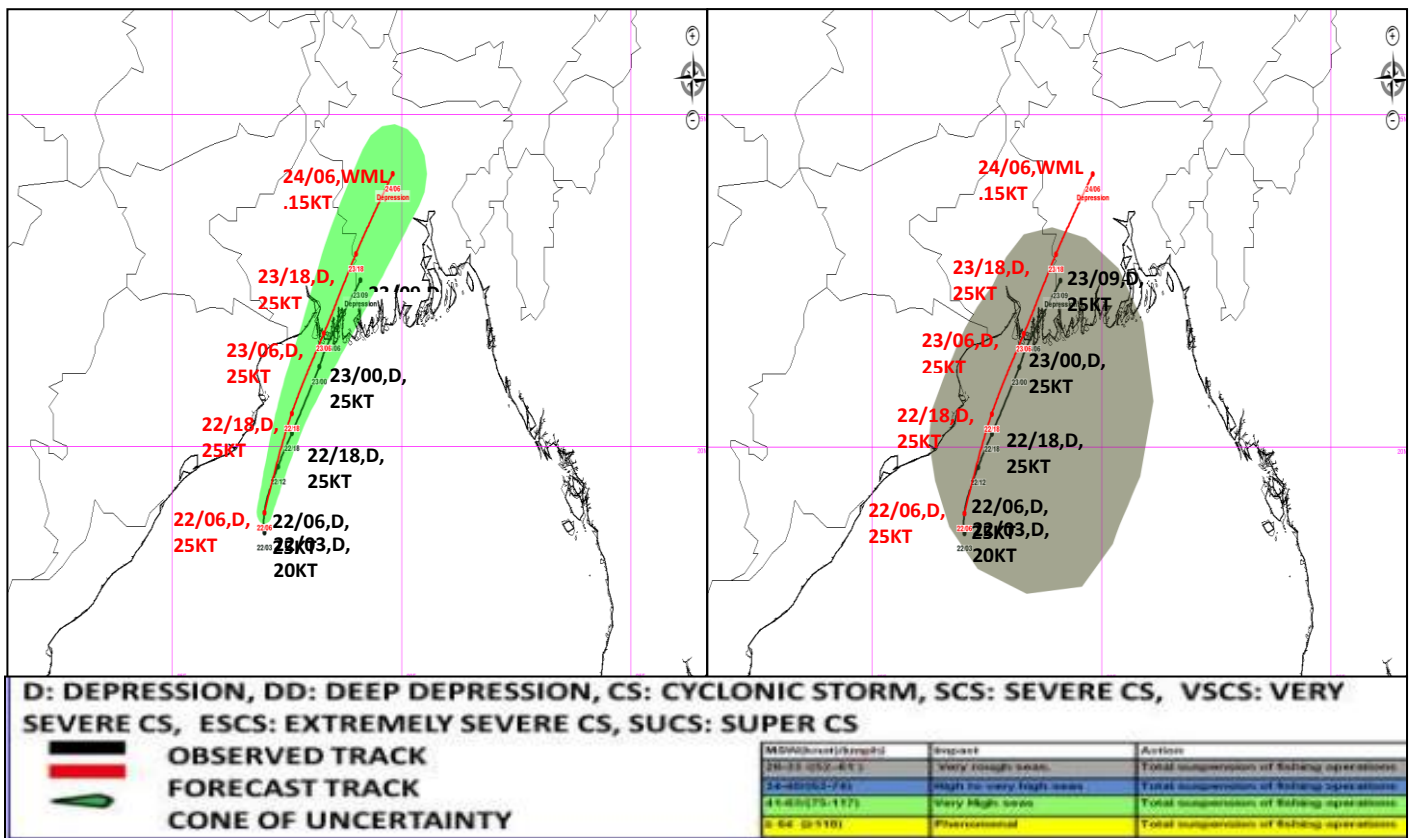
- ❖ The tropical weather outlook issued on 14<sup>th</sup> indicated that an LPA would form over central BoB around 19<sup>th</sup> October.
- ❖ The extended range outlook issued on 15<sup>th</sup> October indicated low probability (1-33%) of cyclogenesis over central Bay of Bengal during 20<sup>th</sup>-22<sup>nd</sup> October (about 7 days prior to formation of depression over BoB on 22<sup>nd</sup>). An LPA formed over central parts of BoB on 20<sup>th</sup> morning. It intensified into a depression over northwest BoB on 22<sup>nd</sup> morning.

### 7.2 Intensification, landfall and movement:

- ❖ The tropical weather outlook issued on 20<sup>th</sup> indicated that the LPA over central parts of BoB would become more marked and move initially northwestwards and then north-northeastwards. Actually, the system intensified into depression on 22<sup>nd</sup> morning and it moved initially northwestwards and then north-northeastwards.
- ❖ The tropical weather outlook issued on 21<sup>st</sup> indicated that the system would move towards West Bengal-Bangladesh coasts.
- ❖ In the first national bulletin issued at 1245 hrs IST of 22<sup>nd</sup> (about 24 hours prior to landfall) it was indicated that the system would cross West Bengal-

Bangladesh coasts between Sagar Islands and Khepupara over Sundarbans in the afternoon of 23<sup>rd</sup>.

- ❖ Actually, the system moved northwestwards for some time & thereafter north-northeastwards and crossed West Bengal & adjoining Bangladesh coasts over Sundarbans near latitude 21.8°N and longitude 88.5°E around noon (between 1130 & 1230 hrs IST) of 23rd October 2020 as a depression with maximum sustained wind speed of 45-55 kmph gusting to 65 kmph.



**Fig 6: Observed and forecast track along with cone of uncertainty and quadrant wind distribution based on 06 UTC of 22nd October 2020**

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 22<sup>nd</sup> - 24<sup>th</sup> October 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 the Bay of Bengal (22-24 October, 2020)**

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
22/10/2020 0300 UTC	<p>❖ 22nd October 2020: Heavy to very heavy falls (115.6-204.4 mm/day) at a few places and extremely heavy falls (&gt;204.4 mm/day) at isolated places very likely over Nagaland, Manipur, Mizoram &amp; Tripura and Light to moderate rainfall at most places with heavy to very heavy falls at isolated places over coastal &amp; adjoining districts of Odisha, Gangetic West Bengal and Assam &amp; Meghalaya.</p> <p>❖ 23rd October 2020: Heavy to very heavy falls (115.6-204.4 mm/day) at a few places and extremely heavy falls at isolated places very likely over Nagaland, Manipur, Mizoram &amp; Tripura &amp; Assam &amp; Meghalaya &amp; heavy to very heavy falls isolated places over coastal districts of Gangetic West Bengal and isolated heavy falls over extreme northern districts of Odisha.</p> <p>❖ 24th October 2020: Isolated heavy falls likely over Tripura &amp; Mizoram and Assam &amp; Meghalaya, Nagaland, Manipur, Mizoram &amp; Tripura</p>	<p><b>22<sup>nd</sup> October</b></p> <p><b>Odisha:</b> Paradip -7, Tihidi-7.</p> <p><b>23<sup>rd</sup> October</b></p> <p><b>Assam &amp; Meghalaya:</b> Mawsynram-13, Sohra-12, Sohra (RKM) -11, Bakulia-8</p> <p><b>Nagaland- Manipur – Mizoram - Tripura:</b> Sabroom-8, Lawngtlai-7</p> <p><b>Odisha:</b> Kendrapara-7</p> <p><b>24<sup>th</sup> October</b></p> <p><b>Assam &amp; Meghalaya:</b> Mawsynram-35, Sohra (RKM) - 30, Sohra -29, Shillong C.S.O.-17, Nongstein-16, Shillong AWS-15, Barapani-13, Dharamtul-10, Kampur-10, Williamnagar-7, Numaligarh-7, Bhaghmara-7.</p> <p><b>Nagaland- Manipur – Mizoram - Tripura:</b> Kailashahar Aero-9, Gandecherra-7, Dharmanagar/ Panisagar-7, Sonamura-7, Udaipur-7.</p>
23/10/2020 0300 UTC	<p>❖ 23rd October 2020: Light to moderate rainfall at most places with heavy to very heavy falls (115.6-204.4 mm/day) at a few places and extremely heavy falls (&gt;200 mm / Day) at isolated places very likely over Tripura, heavy to very heavy falls at a few places Nagaland, Manipur, Mizoram, south Assam &amp; Meghalaya. Light to moderate rainfall at many places with heavy rainfall at isolated places likely over remaining districts of Assam.</p> <p>❖ 24th October 2020: Light to moderate rainfall at many places with Isolated heavy falls likely over Assam , Meghalaya, Nagaland, Manipur, Mizoram &amp; Tripura</p>	<p><b>Nagaland- Manipur – Mizoram - Tripura:</b> Kailashahar Aero-9, Gandecherra-7, Dharmanagar/ Panisagar-7, Sonamura-7, Udaipur-7.</p>

## 8. Summary and Conclusions:

Under the influence of a cyclonic circulation over central parts of Bay of Bengal (BoB), a low pressure area formed over the same region in the early morning (0530 hrs IST) of 20<sup>th</sup> October, 2020. It lay as a well marked low pressure area over west-central BoB in the morning (0830 hrs IST) of 21<sup>st</sup> October. Under favourable environmental conditions, it concentrated into a **Depression over northwest & adjoining westcentral BoB** in the morning (0830 hrs IST) of 22<sup>nd</sup> October, 2020. It

initially moved northwards for some time and thereafter moved north-northeastwards and crossed West Bengal & adjoining Bangladesh coasts over Sundarbans near latitude 21.8°N and longitude 88.5°E around noon (between 1130 & 1230 hrs IST) of 23<sup>rd</sup> October 2020 as a Depression with maximum sustained wind speed of 45-55 kmph gusting to 65 kmph. Further moving north-northeastwards, it weakened into a well marked low pressure area over central Bangladesh & neighbourhood in the early morning (0530 hrs IST) of 24<sup>th</sup> October 2020. The system caused heavy rainfall at isolated places over Telangana, Rayalaseema & Odisha and heavy to very rainfall at few places with extremely heavy falls at isolated places over the northeastern states of India including Assam, Meghalaya, Manipur, Nagaland, Mizoram & Tripura

IMD monitored and predicted the genesis, movement and weather associated with the system accurately and timely bulletins were disseminated to the user agencies.

### **9. 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 Indian Institute of Tropical Meteorology (IITM), Pune, 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 Centres Chennai & Kolkata, Cyclone Warning Centres Vishakhapatnam & Bhubaneswar, Meteorological Centres Guwahati and Agartala, Numerical Weather Prediction (NWP) Division, Information System & Services Division (ISSD) and Satellite, Agrometeorological Division and Radar Division at IMD HQ New Delhi is also duly acknowledged for monitoring and predicting the system.

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