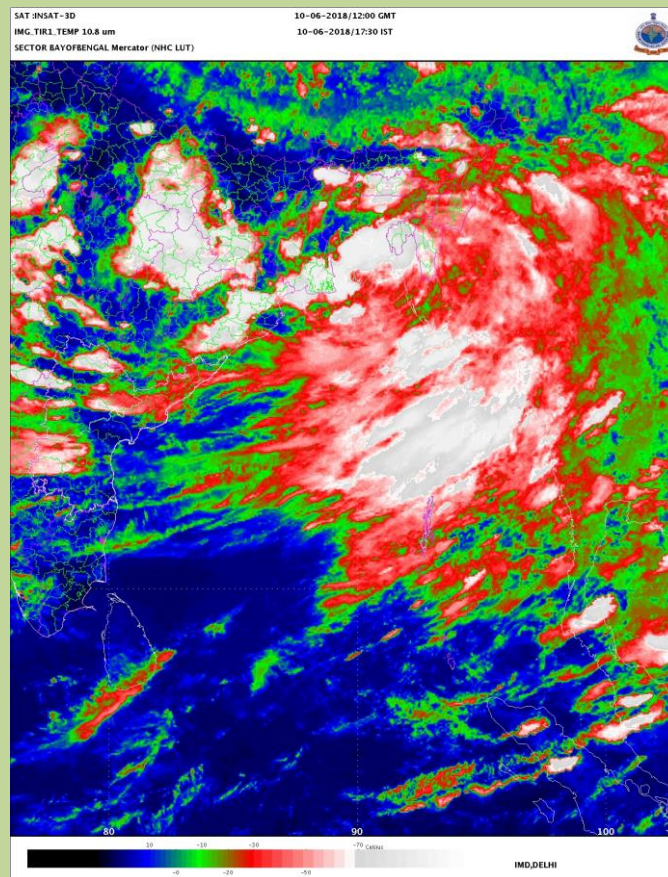




**GOVERNMENT OF INDIA  
MINISTRY OF EARTH SCIENCES  
INDIA METEOROLOGICAL DEPARTMENT**

**Depression over northeast Bay of Bengal  
and adjoining Bangladesh (10-11 June, 2018): A Report**



INSAT-3D enhanced coloured IR imagery based on 1200 UTC of 10<sup>th</sup> June

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

## Depression over northeast Bay of Bengal and adjoining Bangladesh (10-11 June, 2018)

### 1. Introduction

In association with active monsoon conditions, a low pressure area formed over north Bay of Bengal (BoB) and neighbourhood in the evening (1200 UTC) of 8<sup>th</sup> June. It lay as a well marked low pressure area (WML) over northeast BoB and adjoining Bangladesh in the morning (0300 UTC) of 10<sup>th</sup> June. It concentrated into a depression (D) around noon (0600 UTC) of 10<sup>th</sup> June over northeast BoB and adjoining Bangladesh near latitude 22.3°N / longitude 91.5°E. Moving nearly north-northwestwards, it crossed Bangladesh coast near latitude 23.1°N / longitude 91.2°E, south of Feni at night (around 1500 UTC) of 10<sup>th</sup> June and weakened into a WML over Bangladesh and neighbourhood in the early morning (0000 UTC) of 11<sup>th</sup> June. The system caused heavy rainfall at isolated places over Gangetic West Bengal, Odisha and Jharkhand on 9<sup>th</sup>, Gangetic West Bengal & Odisha on 10<sup>th</sup> and over Assam & Meghalaya on 11<sup>th</sup> June. On 12<sup>th</sup>, the system caused heavy to very rainfall at isolated places over Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Odisha and Bihar. On 13<sup>th</sup>, it caused heavy to very rainfall at isolated places over Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura and Odisha. The track of the depression is presented in Fig.1.

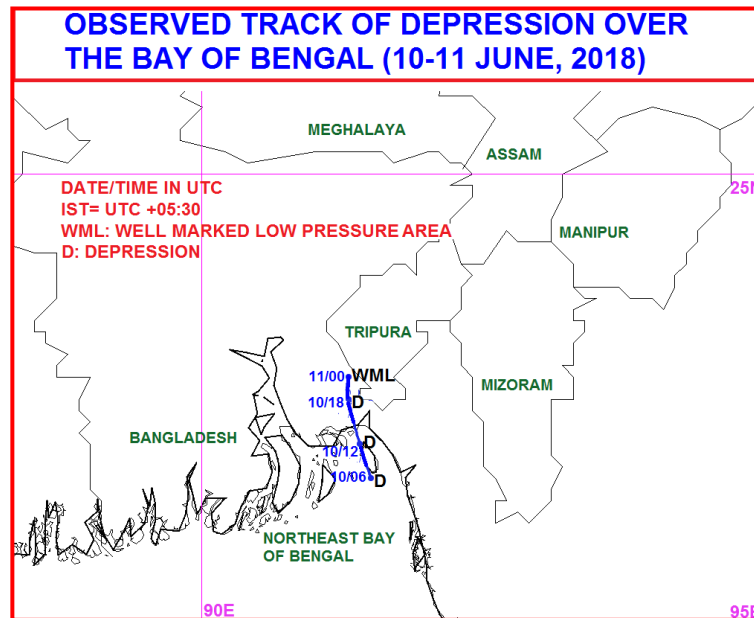


Fig.1. Observed track of Depression over northeast Bay of Bengal and adjoining Bangladesh (10-11 June, 2018)

### 2. Brief life history

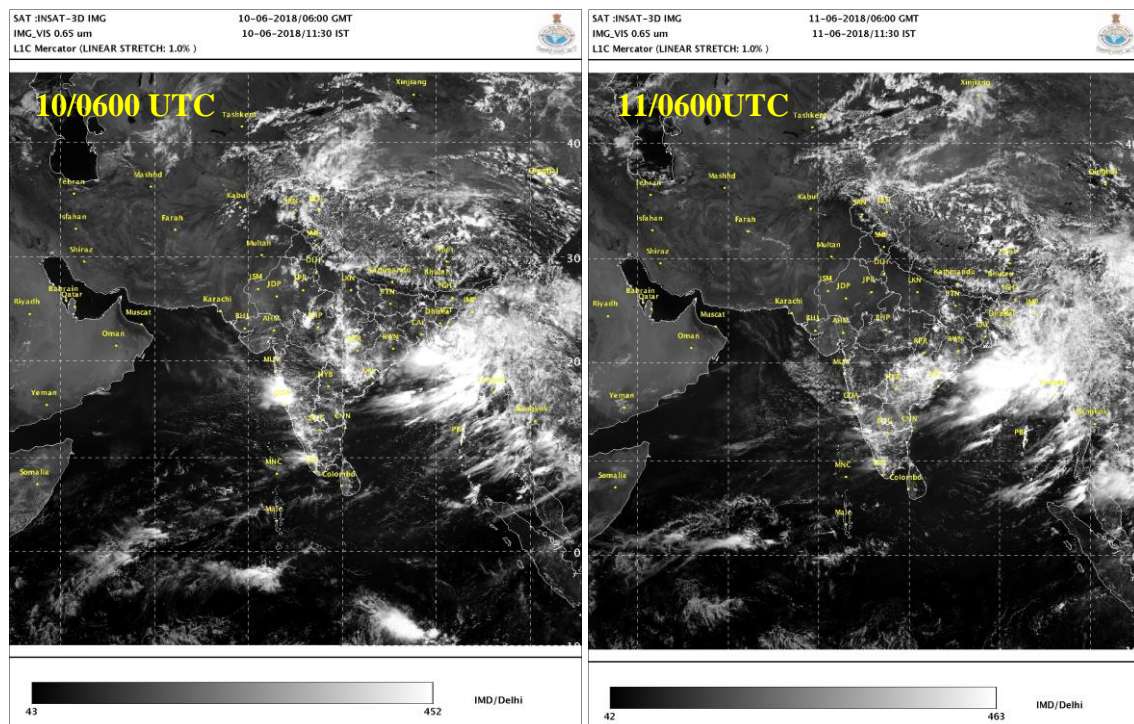
Under the influence of cyclonic circulation over north BoB & neighbourhood extending between 1.5 km & 7.6 km above mean sea level on 8<sup>th</sup> June, a low pressure area formed over north BoB and neighbourhood at 1200 UTC of 9<sup>th</sup>. At 1200 UTC of 9<sup>th</sup>, environmental conditions were supporting intensification of system. The sea surface temperature (SST) was 30-31°C over northeast BoB. The tropical cyclone heat potential was less than 50 KJ/ cm<sup>2</sup> over north BoB. The low level relative vorticity was about  $100 \times 10^{-6} \text{ s}^{-1}$  over northeast & adjoining eastcentral BoB. The vertical wind shear was low (5-10 knots) over northeast BoB. The lower level convergence was about  $20 \times 10^{-5} \text{ s}^{-1}$  and the upper level divergence was about  $20 \times 10^{-5} \text{ s}^{-1}$  northeast and adjoining eastcentral BoB off Myanmar coast. At 0600 UTC of 10<sup>th</sup>, similar sea conditions prevailed over north BoB and the environmental conditions further improved leading to formation of Depression over northeast BoB and adjoining Bangladesh. The low level relative vorticity was about  $100 \times 10^{-6} \text{ s}^{-1}$  to the northeast of the system centre. The lower level convergence was about  $40 \times 10^{-5} \text{ s}^{-1}$  to the northeast of the system centre. The upper level divergence was about  $30 \times 10^{-5} \text{ s}^{-1}$  to the

northeast of the system centre. The vertical wind shear was moderate (10-20 knots) over the system area. The system moved nearly northwards, as it lay close to south of the ridge in association with an anticyclonic circulation in upper & middle tropospheric levels to the east of system centre. The depression crossed Bangladesh coast close to south of Feni at night (1500 UTC) of 10<sup>th</sup>. Thereafter, due to land interactions, cut off in moisture supply and increased vertical wind shear, it weakened into a WML in the morning (0000 UTC) of 11<sup>th</sup> June.

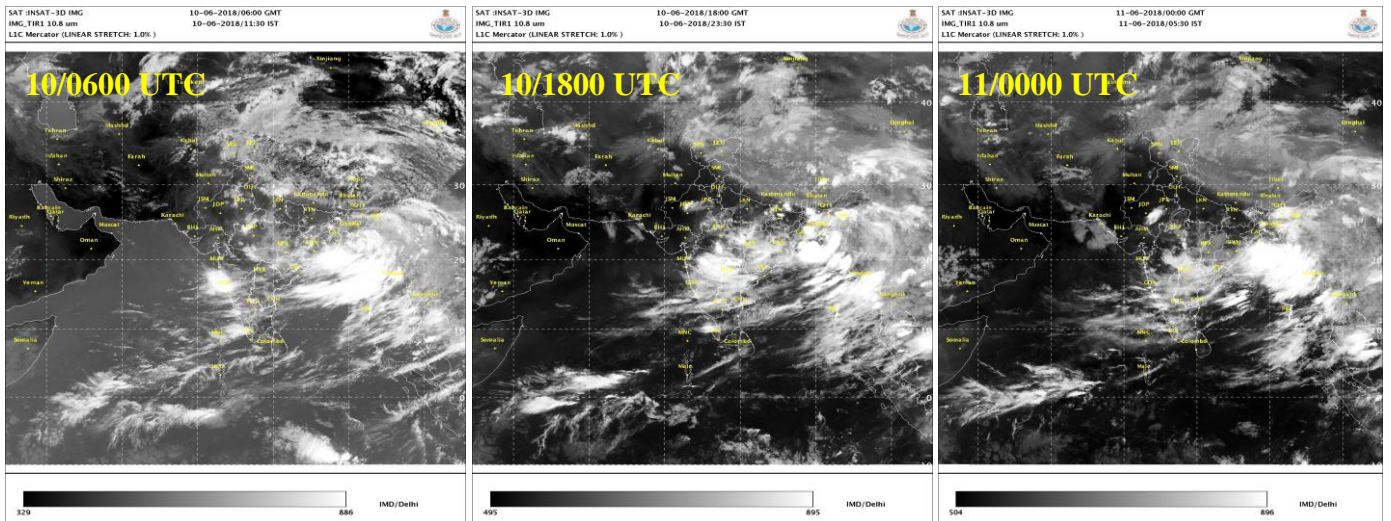
The best track parameters of the system are presented in Table 1. The typical satellite imageries are presented in Fig. 2.

**Table 1: Best track positions and other parameters of the Depression over northeast BoB during 10-11 June, 2018**

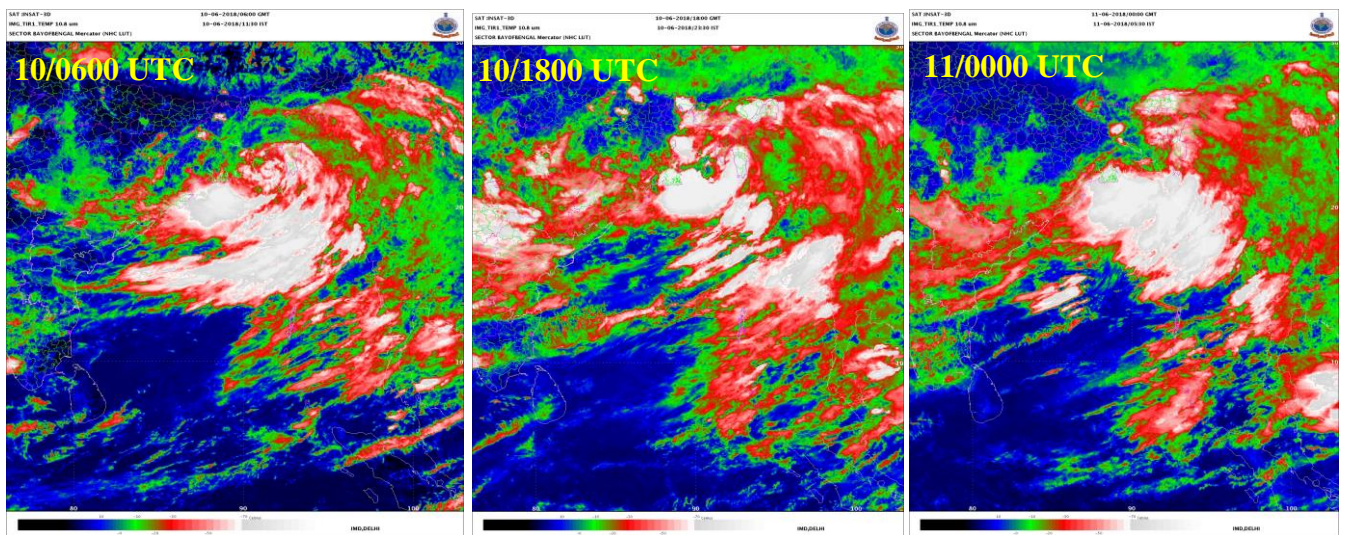
Date	Time (UTC)	Centre lat. <sup>o</sup> N/ long. <sup>o</sup> E	C.I. NO.	Estimated Central Pressure (hPa)	Estimated Maximum Sustained Surface Wind (kt)	Estimated Pressure drop at the Centre (hPa)	Grade	
10.06.2018	0600	22.3/91.5	1.5	990	25	3	D	
	1200	22.7/91.4	1.5	988	25	4	D	
	1500	Crossed Bangladesh coast near latitude 23.1°N/longitude 91.2°E south of Feni						
	1800		-	990	20	3	D	
11.06.2018	0000	Weakened into a well marked low pressure area over Bangladesh and neighbourhood						



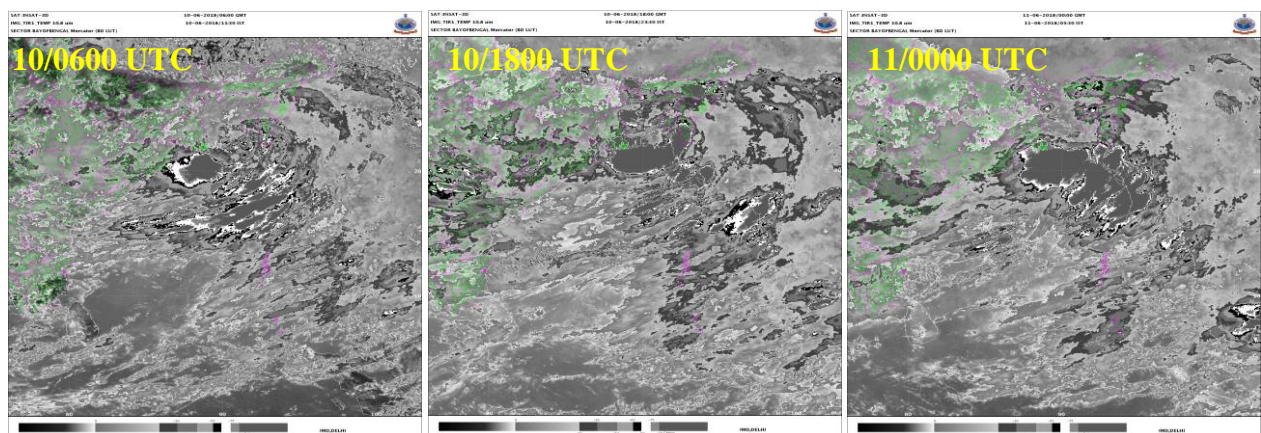
**Fig. 2(i): INSAT-3D visible imageries at 0600 UTC of 11<sup>th</sup> June, 2018**



**Fig. 2(ii): INSAT-3D IR imageries of Depression at 0600 and 1800 UTC of 10<sup>th</sup> and 0600 UTC of 11<sup>th</sup> June, 2018**



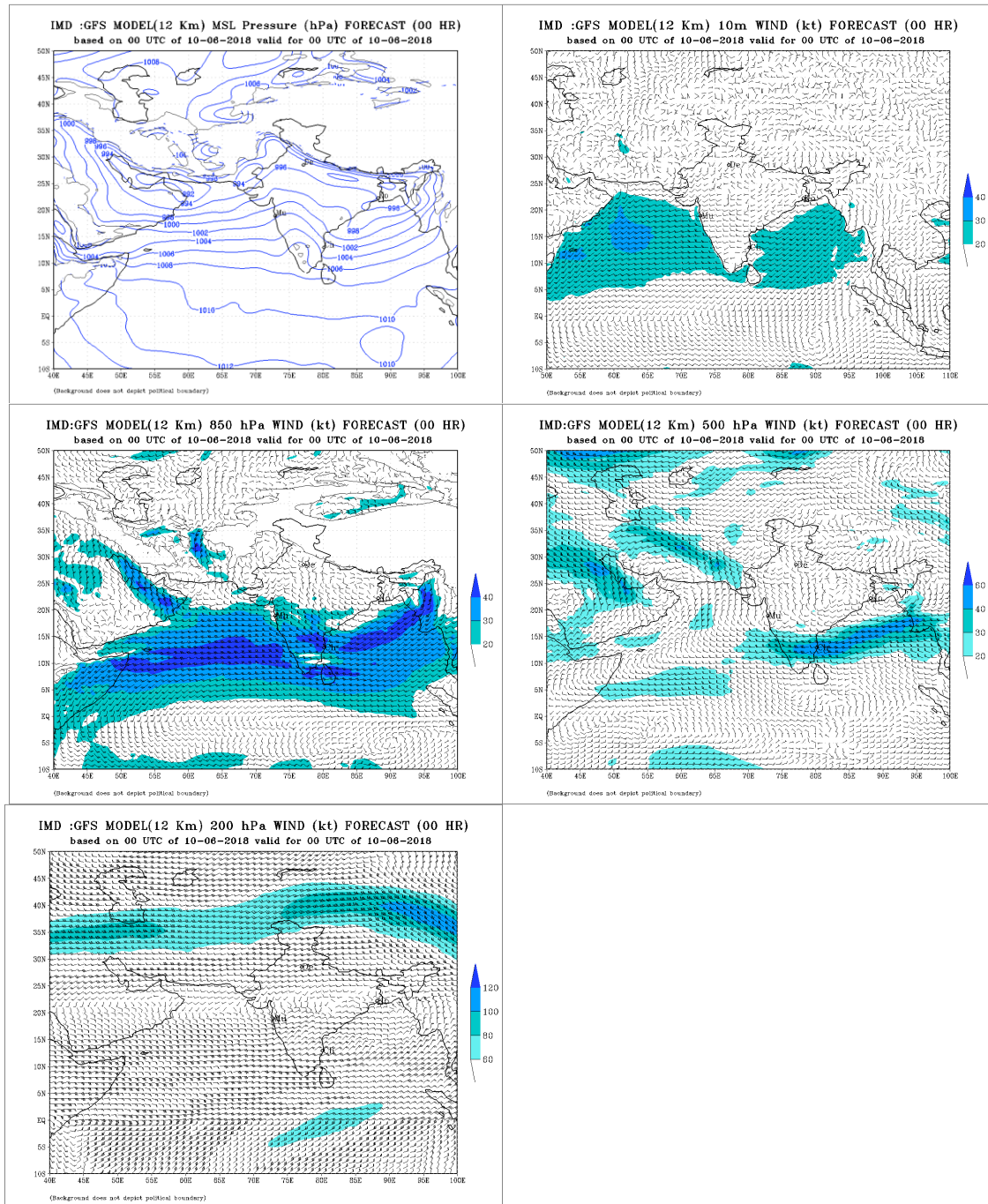
**Fig. 2(iii): INSAT-3D enhanced coloured imageries at 0600 and 1800 UTC of 10<sup>th</sup> and 0600 UTC of 11<sup>th</sup> June, 2018**



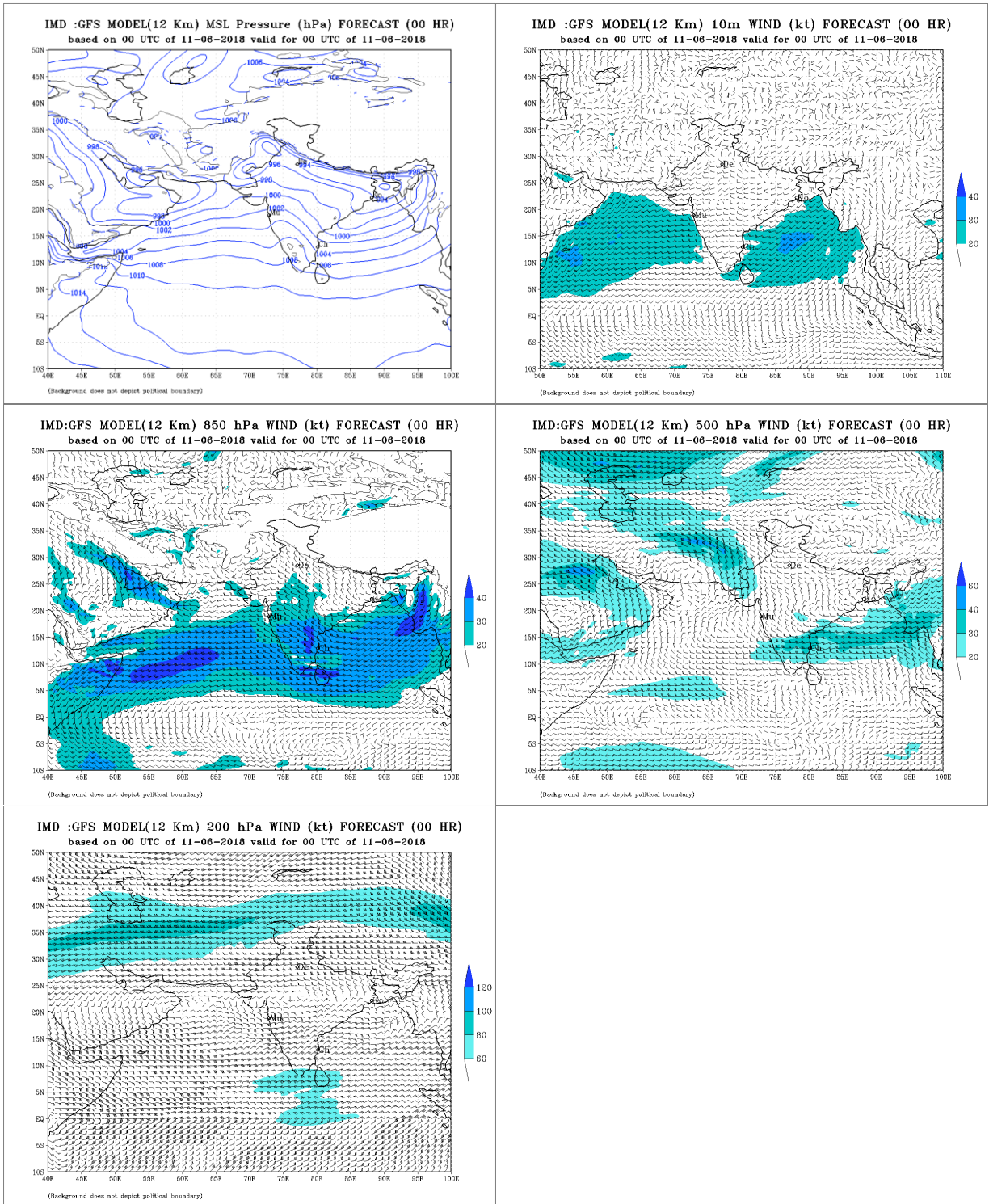
**Fig. 2(iii): Enhanced IR imageries at 0600 and 1800 UTC of 10<sup>th</sup> and 0600 UTC of 11<sup>th</sup> June, 2018**

**3. Dynamical features**

IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10 m, 850, 500 and 200 hPa levels are presented in Fig.3. GFS (T1534) could not capture the genesis of system. However, it picked up the presence of associated cyclonic circulation upto middle tropospheric levels and anticyclone in middle and upper tropospheric levels over southeast Bangladesh and location of ridge near 22°N.



**Fig3 (i): 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> June**



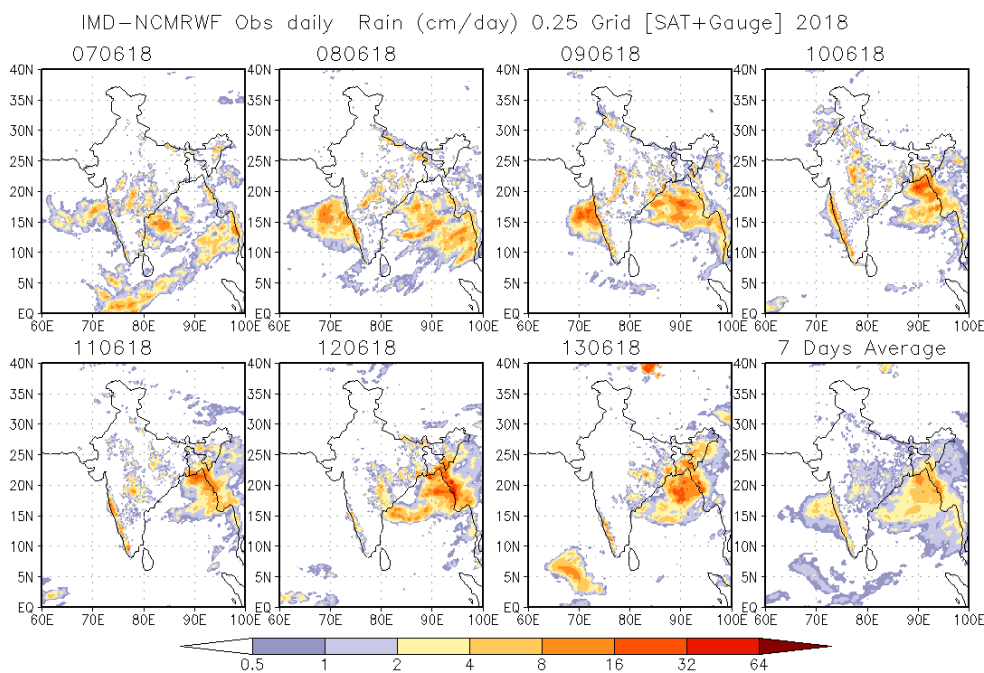
**Fig3 (ii): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 11<sup>th</sup> June**

#### 4. Realized Weather:

##### 4.1 Rainfall:

###### Realised weather:

Under the influence of this depression, heavy rainfall occurred at isolated places over Gangetic West Bengal, Odisha and Jharkhand on 9<sup>th</sup>, over Gangetic West Bengal & Odisha on 10<sup>th</sup> and over Assam & Meghalaya on 11<sup>th</sup>. On 12<sup>th</sup>, the system caused heavy to very rainfall at isolated places over Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Odisha and Bihar. On 13<sup>th</sup>, it caused heavy to very rainfall at isolated places over Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura and Odisha. The daily rainfall distribution based on merged gridded rainfall data of IMD/NCMRWF during depression period is shown in fig.4.



**Fig.4: Daily rainfall distribution based on merged gridded rainfall data of IMD/NCMRWF during 10-11 June 2018.**

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

###### 9<sup>th</sup> June 2018

**Gangetic West Bengal:** Canning and Barrackpur ( IAF)-7 each

**Odisha:** Nimpara-8 and Chandanpur & Sorada-7 each

**Jharkhand:** Ghatsila-7

###### 10<sup>th</sup> June 2018

**Gangetic West Bengal:** Purihansa and Rampurhat (DRMS)-7 each

**Odisha:** Nawana-8

###### 11<sup>th</sup> June 2018

**Assam & Meghalaya:** Beki Mathungari-7

###### 12 June 2018

**Assam & Meghalaya:** Gharmura-11, Kampur, Matijuri & Cherrapunji (RKM) - 8 each and B P Ghat, Lakhipur & Dholai-7 each

**Nagaland, Manipur, Mizoram & Tripura:** Sabroom-27, Serchip (Hydro)-24, Aizwal-15 and Kailashahar Aero-14, Kolasib-11, Lengpui-10 and Dharmanagar/ Panisaga & Belonia-8 each  
**Odisha:** Hemgiri, Burla & Hirkud-7 each,

**Bihar:** Bihpur-8

**13 June 2018**

**Arunachal Pradesh:** Bhalukpong-8, Itanagar-7

**Assam & Meghalaya:** Cherrapunji-21, Cherrapunji(RKM)-17, Kheronighat-15, Majbat-12, Silchar-11, Lumding-9 and A P Ghat & Jia Bharali N T Xing-7 each,

**Nagaland, Manipur, Mizoram & Tripura:** Sabroom-17, Bishalgarh-13, Sonamura-12, Serchip(Hydro)-10, Agartala Aero-9, Arundhutinagar-8,

**Odisha:** Soro-10, Mahanga (ARG)-7

## 5. Bulletins issued by IMD

IMD issued warning bulletins to the concerned central and state disaster management authorities and press & media.

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

Statistics of bulletins issued by Cyclone Warning services of IMD in association with the system is given in Table 2.

**Table 2: Bulletins issued by Cyclone Warning Division, India Meteorological Department**

S.No.	Bulletin	No. of Bulletins	Issued to
1	National Bulletin	2	1. IMD's website, RSMC 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, West Bengal, Andaman & Nicobar Islands, Assam, Meghalaya, Nagaland, Manipur, Mizoram, Tripura, Arunachal Pradesh, Jharkhand, Bihar, Sikkim, Chattisgarh.
2	RSMC Bulletins	3	1. IMD's website, RSMC website 2. Through email and GTS to WMO/ESCAP Panel member countries including Bangladesh

## 6. Operational Forecast Performance

- The first information regarding formation of low pressure area over north BoB around 9<sup>th</sup> June with subsequent intensification into depression around 10<sup>th</sup> and crossing near West Bengal, Bangladesh coasts was given in the morning of 3<sup>rd</sup> June (about 102 hours prior to formation of LPA and 168 hours prior to formation of D). Low pressure area formed over northeast BoB & adjoining Bangladesh in the night of 8<sup>th</sup> and depression formed around noon of 10<sup>th</sup> and it crossed Bangladesh coast close to south of Feni in the same night.
- In the bulletin issued on 8<sup>th</sup> June noon, north-northwestward movement of low pressure area towards Bangladesh was predicted (about 48 hours prior to the formation of depression) .



The verification of heavy rainfall warnings issued by IMD for depression during 10-11 June 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 Bay of Bengal (10-11 June, 2018)**

Date/Time of issue	Heavy rainfall warning	Realised heavy rainfall (7cm or more) ending at 0830 hrs IST of date
1730 hours IST of 10 <sup>th</sup> June	Heavy to very heavy rainfall at isolated places very likely over Nagaland, Manipur, Mizoram, Tripura, Assam and Meghalaya during next 48 hrs. Heavy rainfall at isolated places very likely over Odisha, West Bengal, Chhattisgarh, Jharkhand, Bihar and Sikkim during next 48 hrs.	<p><b>11<sup>th</sup> June 2018</b>  <b>Assam &amp; Meghalaya:</b> Beki Mathungari-7</p> <p><b>12 June 2018</b>  <b>Assam &amp; Meghalaya:</b> Gharmura-11, Kampur, Matijuri &amp; Cherrapunji (RKM)-8 each and B P Ghat, Lakhipur &amp; Dholai-7 each  <b>Nagaland, Manipur, Mizoram &amp; Tripura:</b> Sabroom-27, Serchip(Hydro)-24, Aizwal-15 and Kailashahar Aero-14, Kolasib-11, Lengpui-10 and Dharmanagar/ Panisaga &amp; Belonia-8 each  <b>Sub-Himalayan West Bengal and Sikkim:</b> Tadong, Sevoke, Falakata-11 Each, Gangtok-9, Mangan-8,  <b>Odisha:</b> Hemgiri, Burla &amp; Hirakud-7 each,  <b>Bihar:</b> Bihpur-8</p> <p><b>13 June 2018</b>  <b>Arunachal Pradesh:</b> Bhalukpong-8, Itanagar-7  <b>Assam &amp; Meghalaya:</b> Cherrapunji-21, Cherrapunji(Ramakrishna Mission)-17, Kheronighat-15, Majbat-12, Silchar-11, Lumding-9 and A P Ghat &amp; Jia Bharali N T Xing-7 each,  <b>Nagaland, Manipur, Mizoram &amp; Tripura:</b> Sabroom-17, Bishalgarh-13, Sonamura-12, Serchip(Hydro)-10, Agartala Aero-9, Arundhutinagar-8,  <b>Odisha:</b> Soro-10, Mahanga (ARG)-7</p>

## 7. Summary and Conclusion:

A low pressure area formed over north Bay of Bengal (BoB) and neighbourhood in the evening (1200 UTC) of 8<sup>th</sup> June. It concentrated into a D around noon (0600 UTC) of 10<sup>th</sup> June over northeast BoB. Moving nearly north-northwestwards, it crossed Bangladesh coast near latitude 23.1°N / longitude 91.2°E, south of Feni at night (around 1500 UTC) of 10<sup>th</sup> June and weakened into a WML over Bangladesh and neighbourhood in the early morning (0000 UTC) of 11th June. The system caused heavy rainfall at isolated places over east and northeast India.

## **8. Acknowledgements:**

India Meteorological Department acknowledges the contribution from Department of Meteorology & Hydrology, Myanmar for its support in dissemination of advisories during the system and also for providing hourly observations at the time of landfall. 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 Depression over BoB. We specifically acknowledge the contribution of all sister organizations of Ministry of Earth Sciences including National Centre for Medium Range Weather Forecasting Centre (NCMRWF), Indian National Centre for Ocean Information Services (INCOIS), National Institute of Ocean Technology (NIOT). The support from various Divisions/Sections of IMD including Area Cyclone Warning Centre (ACWC) Kolkata, Cyclone Warning Centre (CWC) Bhubaneswar, Meteorological Centre (MC) Agartala, Regional Meteorological Centre Guwahati, Numerical Weather Prediction (NWP) Division, Information System & Services Division (ISSD), Instruments Division and Satellite Division of IMD is also acknowledged.

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