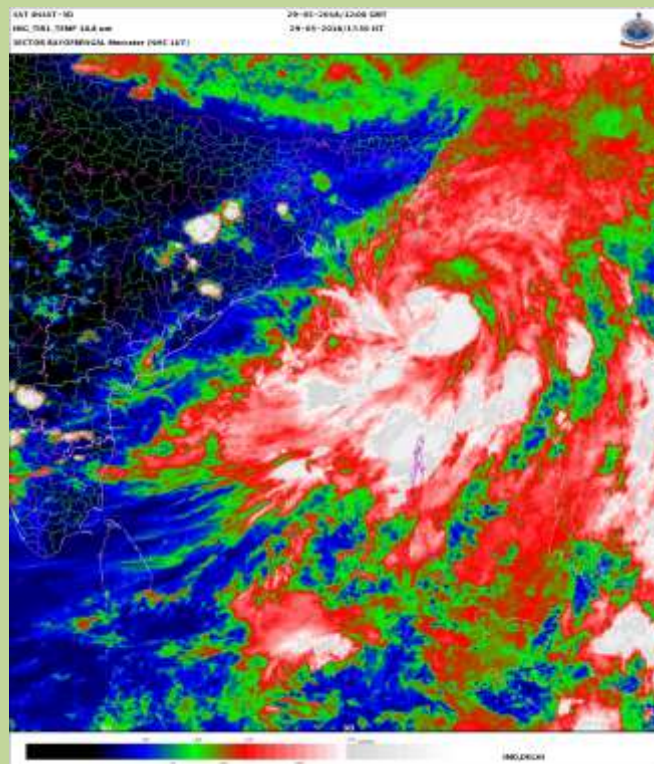




**GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
INDIA METEOROLOGICAL DEPARTMENT**

**Deep Depression over northeast Bay of Bengal
(29-30 May, 2018): A Report**



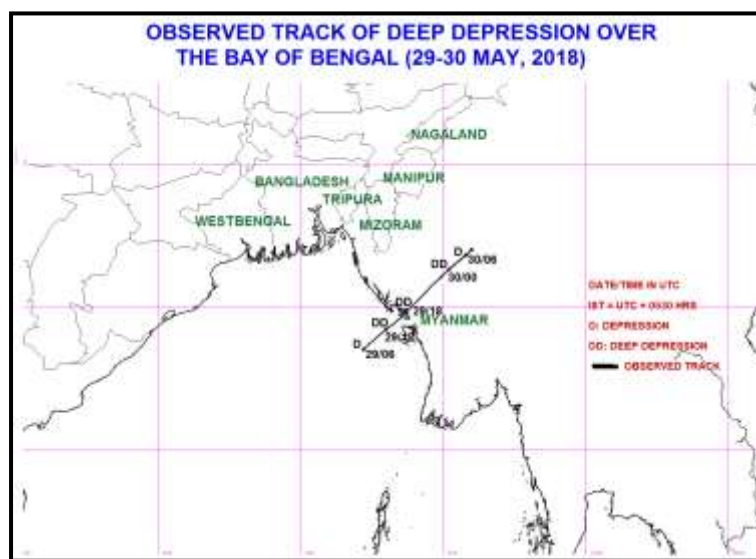
INSAT-3D enhanced colored IR imagery based on 1200 UTC of 29th May

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

Deep Depression over northeast Bay of Bengal (29-30 May, 2018)

1. Introduction

A low pressure area formed over eastcentral Bay of Bengal (BoB) and neighbourhood in the morning (0300 UTC) of 28th May. It lay as a well marked low pressure area (WML) over eastcentral and adjoining northeast BoB in the morning (0300 UTC) of 29th May. It concentrated into a depression (D) over the same area around noon (0600 UTC) of 29th May. It moved northeastwards, intensified into a deep depression (DD) in the same evening (1200 UTC) and crossed Myanmar coast to the north of Kyakpyu between 1700 & 1800 UTC of same night. It continued to move northeastwards and weakened gradually into a depression in the early morning (0000 UTC) of 30th May over Myanmar and into a well marled low pressure area over Myanmar around noon (0600 UTC) of same day. Advisories were provided to WMO/ESCAP Panel member countries including Bangladesh and Myanmar. The track of the deep depression is presented in Fig.1.



**Fig.1. Observed track of Deep Depression over northeast Bay of Bengal
(29-30 May, 2018)**

2. Brief life history

A low pressure area formed over eastcentral Bay of Bengal & neighbourhood with associated cyclonic circulation extending upto mid-tropospheric level at 0300 UTC of 28th May, 2018. It lay as a WML over the eastcentral and adjoining northeast BoB at 0300 UTC of 29th May with associated cyclonic circulation extending upto 3.1 km above mean sea level. Under favourable environmental conditions, it concentrated into a D over eastcentral and adjoining northeast BoB near latitude 18.5°N and longitude 92.2°E at 0600 UTC of 29th May. At 0600 UTC of 29th, the sea surface temperature (SST) was 30-31°C over northeast and adjoining eastcentral BoB. The tropical cyclone heat potential was around 90-100 KJ/cm² over the above region. The low level relative vorticity had increased significantly and was about 200x10⁻⁶sec⁻¹ to the south of system centre. The lower level convergence was about 50 x10⁻⁵sec⁻¹ to the southeast of system centre. The upper level divergence was about 40 x10⁻⁵ sec⁻¹ to the southeast of the system centre. The vertical wind shear was low to moderate (10-20 knots) near the system centre. The upper tropospheric ridge ran along 16°N latitude over BoB. Similar conditions prevailed and the system intensified into a DD at 1200 UTC of 29th May. The system was steered into northeast direction as it lay to the north of ridge in association with anticyclonic circulation lying to the southeast of system centre. Moving northeastwards, it crossed Bangladesh coast to the north of Kyakpyu near 19.7°N/93.6°E between 1700 & 1800 UTC of 29th May. Under the influence of land interactions and cut-off in moisture supply, the system weakened into a D 0300 UTC of 30th May and into a WML over Myanmar at 0600 UTC of the same day.

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 Deep Depression over northeast and adjoining eastcentral BoB during 29-30 May, 2018

Date	Time (UTC)	Centre lat. ^o N/ long. ^o E	C.I. NO.	Estimated Central Pressure (hPa)	Estimated Maximum Sustained Surface Wind (kt)	Estimated Pressure drop at the Centre (hPa)	Grade	
29/05/2018	0600	18.5	92.2	1.5	996	25	3	D
	1200	19.2	93.0	2.0	992	30	4	DD
	Crossed Myanmar coast near 19.7°N/93.6°E to the north of Kyakpyu between 1700-1800 UTC							
	1800	19.8	93.7	-	994	30	4	DD
30/05/2018	0000	21.3	95.2	-	996	25	3	D
	0300	21.8	95.8	-	998	20	2	D
	0600	Weakened into a well-marked low pressure area over Myanmar at 0600 UTC of 30 th May 2018.						

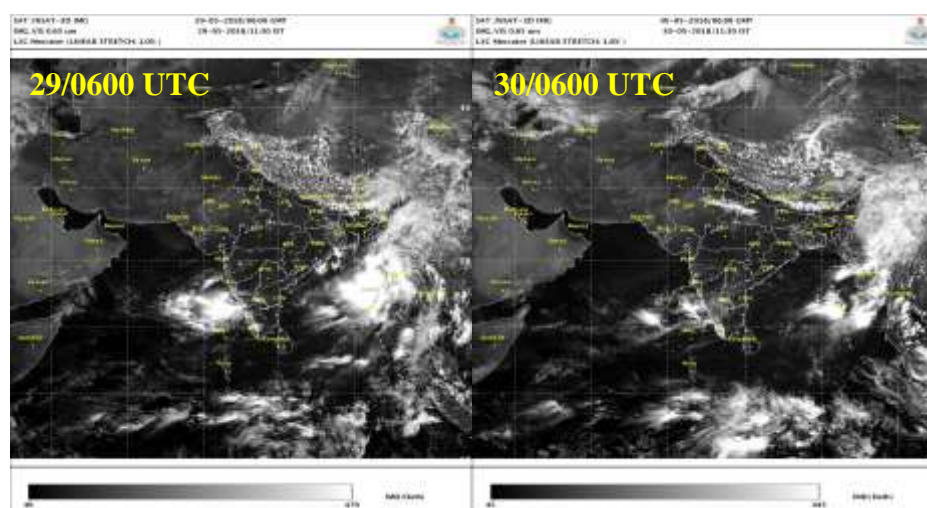


Fig. 2(i): INSAT-3D visible imageries of Deep Depression at 0600 UTC of 29 & 30 May, 2018

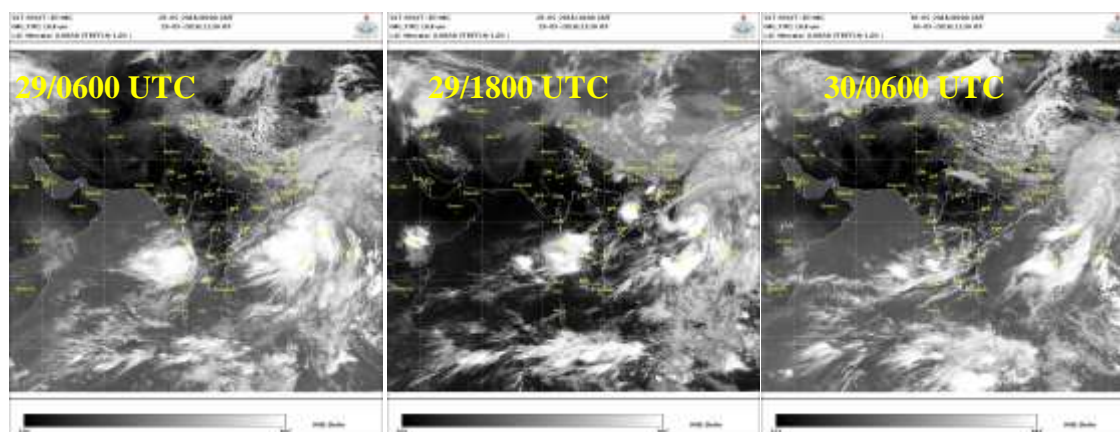


Fig. 2(ii): INSAT-3D IR imageries of Deep Depression at 0600 & 1800 UTC of 29th and 0600 UTC of 30th May, 2018

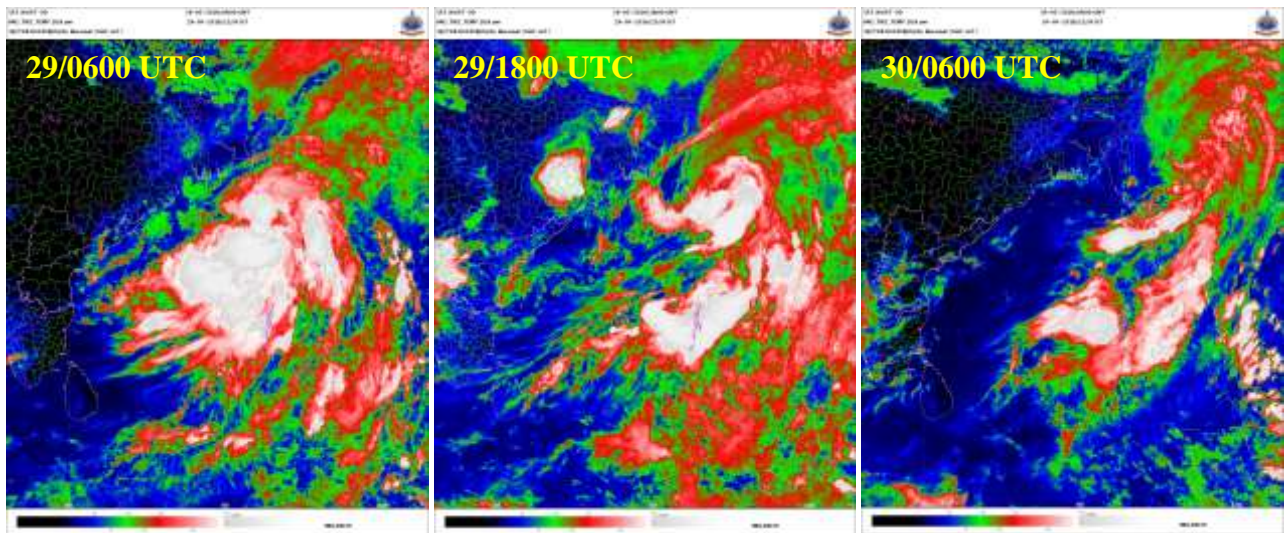


Fig. 2(iii): INSAT-3D enhanced coloured imageries of Deep Depression at 0600 &1800 UTC of 29th and 0600 UTC of 30th May, 2018

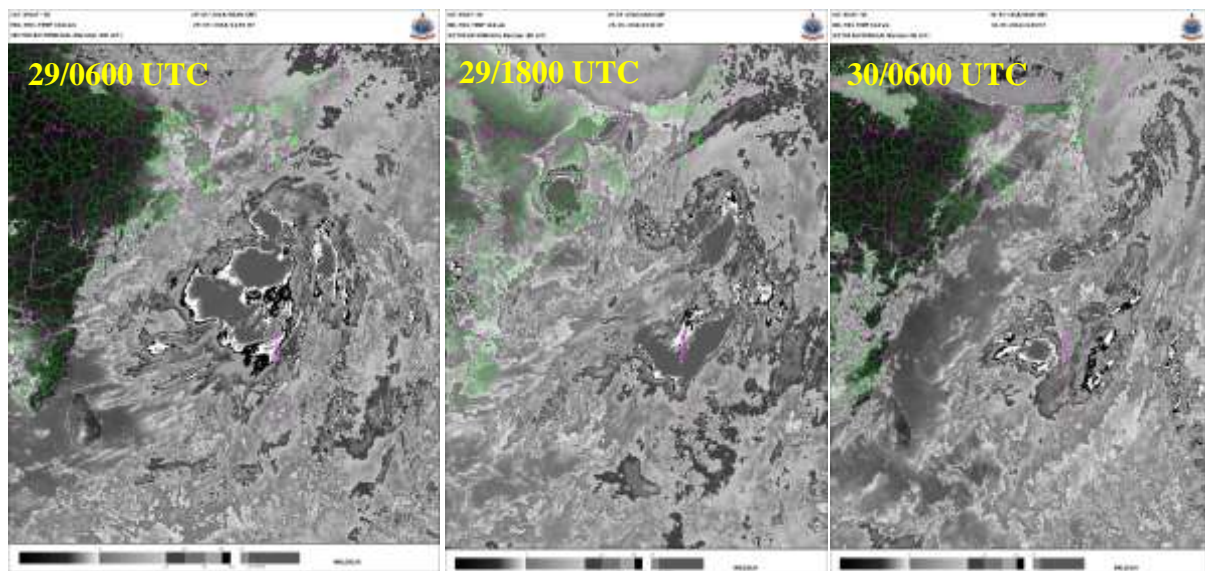


Fig. 2 (iv): Enhanced IR Imageries of Deep Depression at 0600 & 1800 UTC of 29th and 0600 UTC of 30th May, 2018

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 simulate the genesis of the system accurately over northeast and adjoining eastcentral BoB and the associated circulation features during the life period of Depression. Initial conditions based on 1200 UTC indicated intensification of system into DD. The initial conditions based on 0000 UTC of 30th indicated weakening of system. The model analyses indicated stronger winds in the southeast sector followed by northeast sector of the system in association with the cross equatorial flow.

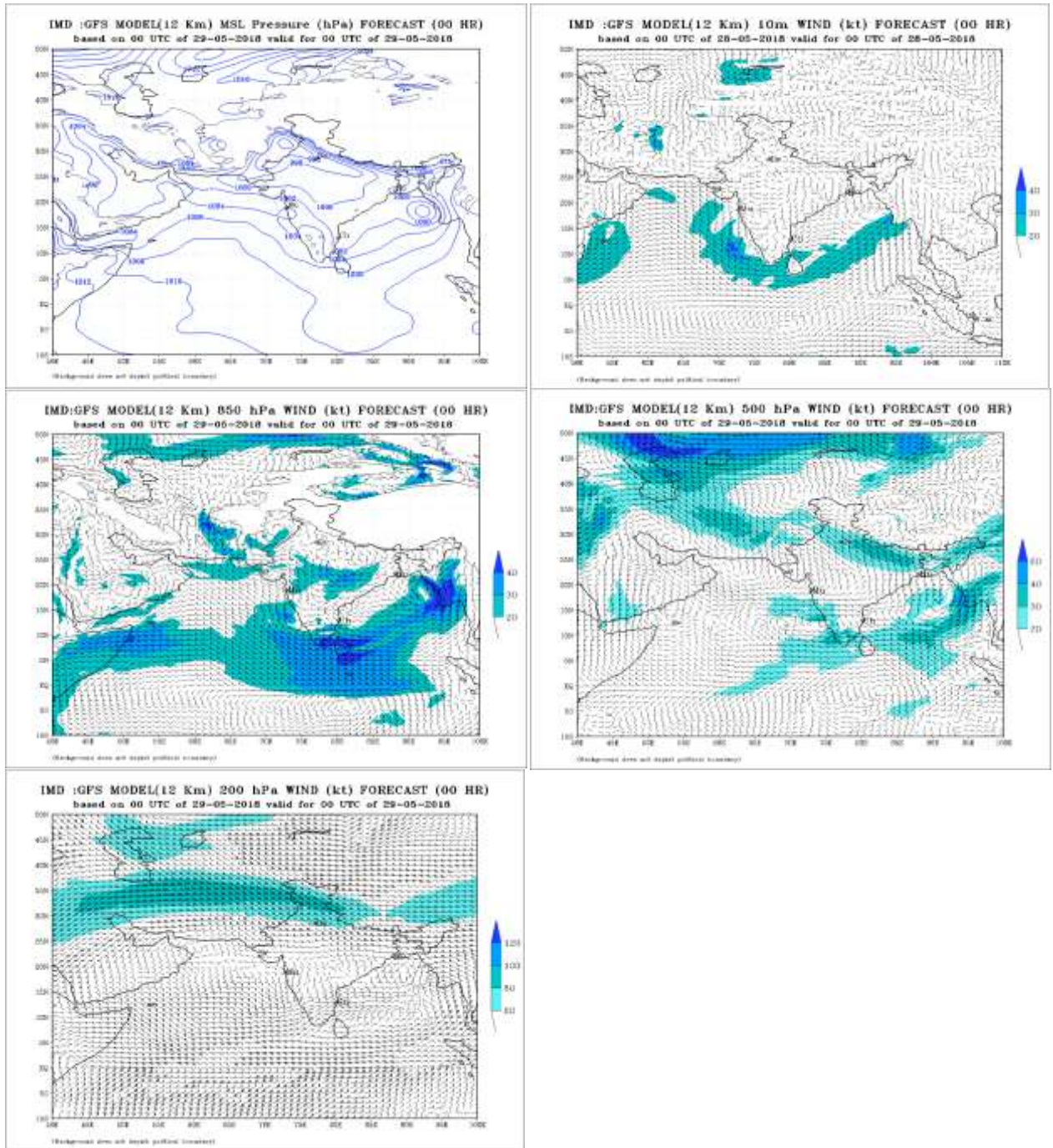


Fig3 (i): IMD GFS (T1534) mean sea level pressure (MSLP) and winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 29th May

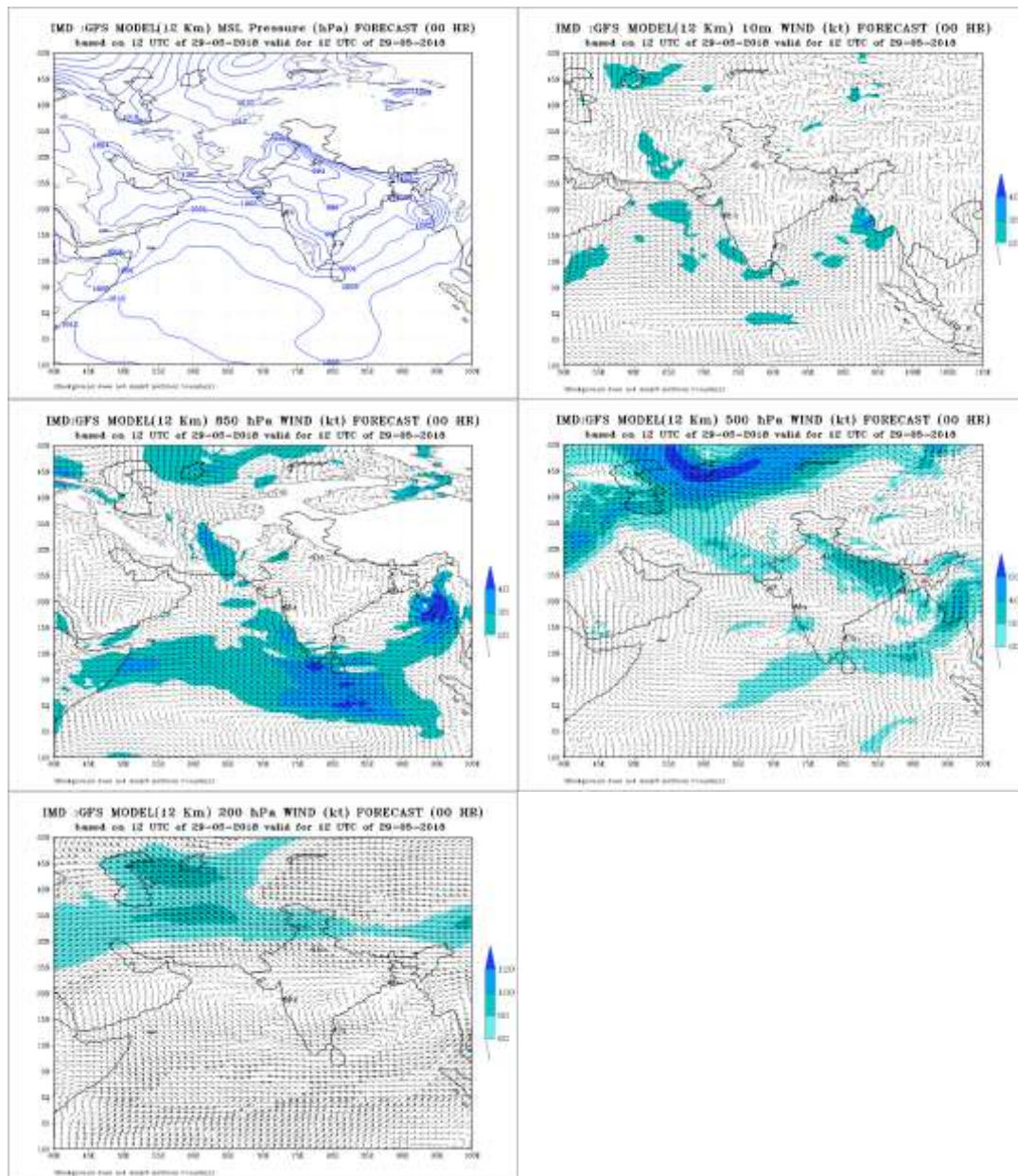


Fig3 (ii): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 1200 UTC of 29th May.

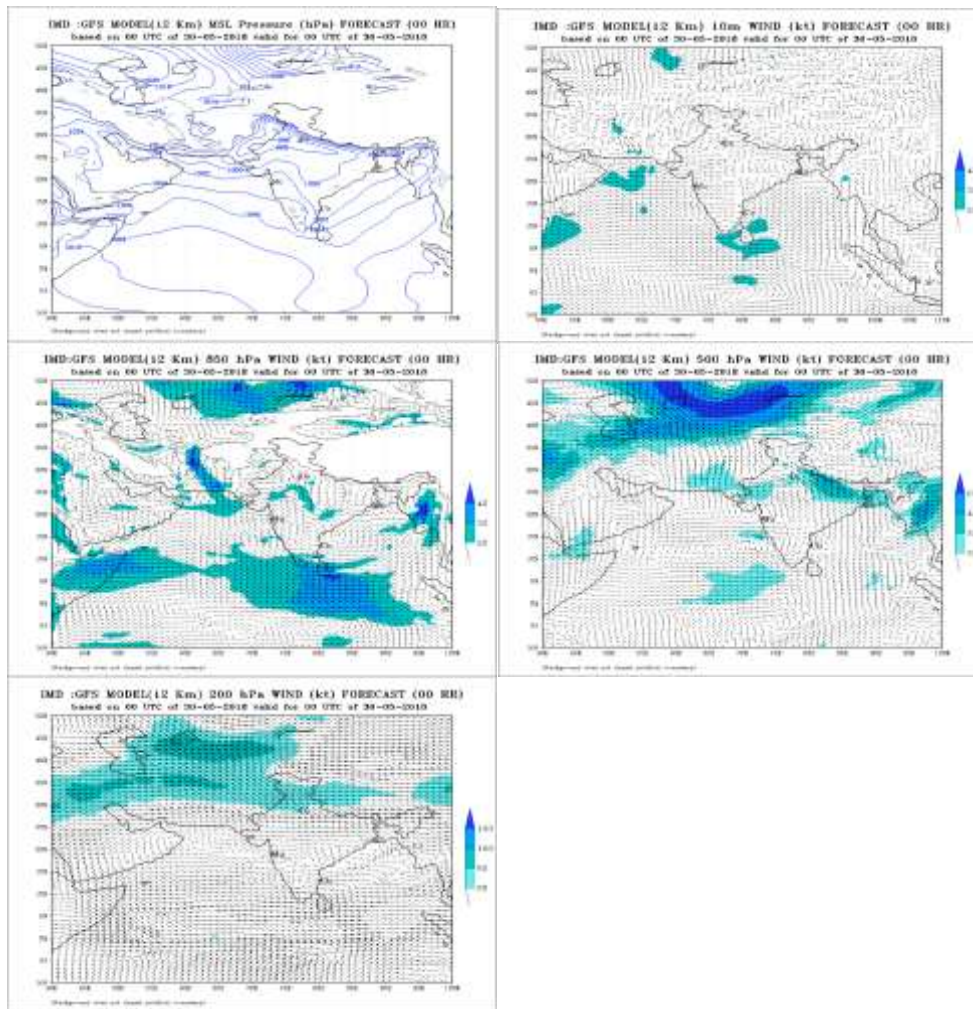


Fig3 (ii): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 30th May.

4. Realized Weather:

4.1 Rainfall:

The daily rainfall distribution based on merged gridded rainfall data of IMD/NCMRWF during depression period is shown in fig.4.

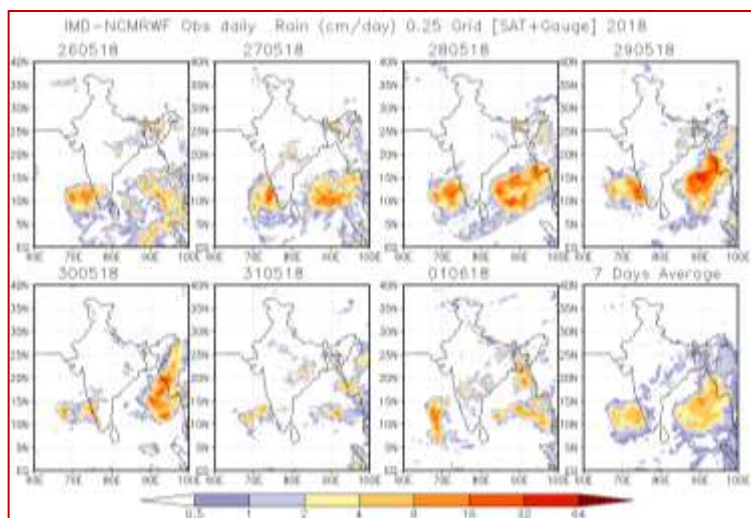


Fig 4: Daily rainfall distribution based on merged gridded rainfall data of IMD/NCMRWF during 26 May-01June, 2018..

Under the influence of this system, heavy to very heavy rainfall occurred at isolated places occurred Andaman & Nicobar Islands on 29th & 30th, Nagaland, Manipur, Mizoram & Tripura and Sub-Himalayan West Bengal & Sikkim on 1st June and Assam & Meghalaya on 2nd June.

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

29th May

Andaman & Nicobar Islands: Hut Bay-10

30 May 2018

Andaman & Nicobar Islands: Port Blair-23

1 June

Nagaland, Manipur, Mizoram & Tripura: Dharma nagar / Panisagar-10

SHWB & Sikkim: Neora-10 and Champasari-7

2 June

Assam & Meghalaya: Dillighat-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	5	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, Doordarshan, All India Radio, NDRF, Indian Railways, Indian Navy, IAF, Chief Secretary: Tamil Nadu, Andhra Pradesh, Odisha, West Bengal, Andaman & Nicobar Islands, Assam, Meghalaya, Nagaland, Manipur, Mizoram, Tripura and Administrator, Andaman & Nicobar Islands.
2	RSMC Bulletins	5	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 likely formation of low pressure area over eastcentral BoB and neighbourhood on 28th May (1400 hrs IST) was indicated in the bulletin issued by IMD on 25th May (67 hrs in advance). The low pressure area over eastcentral BoB and neighbourhood on 28th May (0830 hrs IST)
- It was further predicted in the bulletin issued at 1400 IST by IMD that the low pressure area would be well marked during next 24 hrs. It concentrated into a Depression over eastcentral & adjoining northeast BoB at 0600 UTC of 29th. In the first bulletin issued in the afternoon (1500 IST) of 29th, it was indicated that the system would intensify further into a DD during next 6 hrs and that it would move north-northeastwards and cross

Myanmar and adjoining Bangladesh coasts between Kyaukpyu and Teknaf (Bangladesh) close to Sittwe around night of 29th May 2018. The DD formed in the evening (1200 UTC) of 29th and moving northeastwards. The system crossed Myanmar coast close to Kyaukpyu between 1700 & 1800 UTC of 29th.

The verification of heavy rainfall warnings issued by IMD for depression during 29-30th May 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 Bay of Bengal (29-30 May, 2018)

Date/Time of issue	Heavy rainfall warning	Realised heavy rainfall (7cm or more) ending at 0830 hrs IST of date
1430 hours IST of 29 th May	Heavy to very heavy rainfall at isolated places over Nagaland, Manipur, Mizoram, Tripura and south Assam on 30 th & 31 st May, 2018.	30 May 2018 Andaman & Nicobar Islands: Port Blair-23 1 June Nagaland, Manipur, Mizoram & Tripura: Dharmanagar/Panisagar-10
0830 hours IST of 30 th May	Heavy rainfall at isolated places over Nagaland, Manipur, Mizoram, Tripura and south Assam during next 24 hours.	2 June Assam & Meghalaya: Dillighat-7

7. Summary and Conclusion:

A low pressure area formed over eascentral Bay of Bengal (BoB) and neighbourhood in the morning (0300 UTC) of 28th May. It concentrated into a depression (D) over the same area around noon (0600 UTC) of 29th May. It moved northeastwards, intensified into a deep depression (DD) in the same evening (1200 UTC) and crossed Myanmar coast to the north of Kyaukpyu between 1700 & 1800 UTC of same night. It continued to move northeastwards and weakened gradually into a depression in the early morning (0000 UTC) of 30th May over Myanmar and into a well marled low pressure area over Myanmar around noon (0600 UTC) of same day. Under the influence of this system, heavy to very heavy rainfall occurred at isolated places occurred Andaman & Nicobar Islands on 29th & 30th, Nagaland, Manipur, Mizoram & Tripura and on 1st June and Assam on 2nd June.

8. Acknowledgements:

India Meteorological Department acknowledges the contribution from Department of Meteorology & Hydrology, Myanmar for it's 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.