

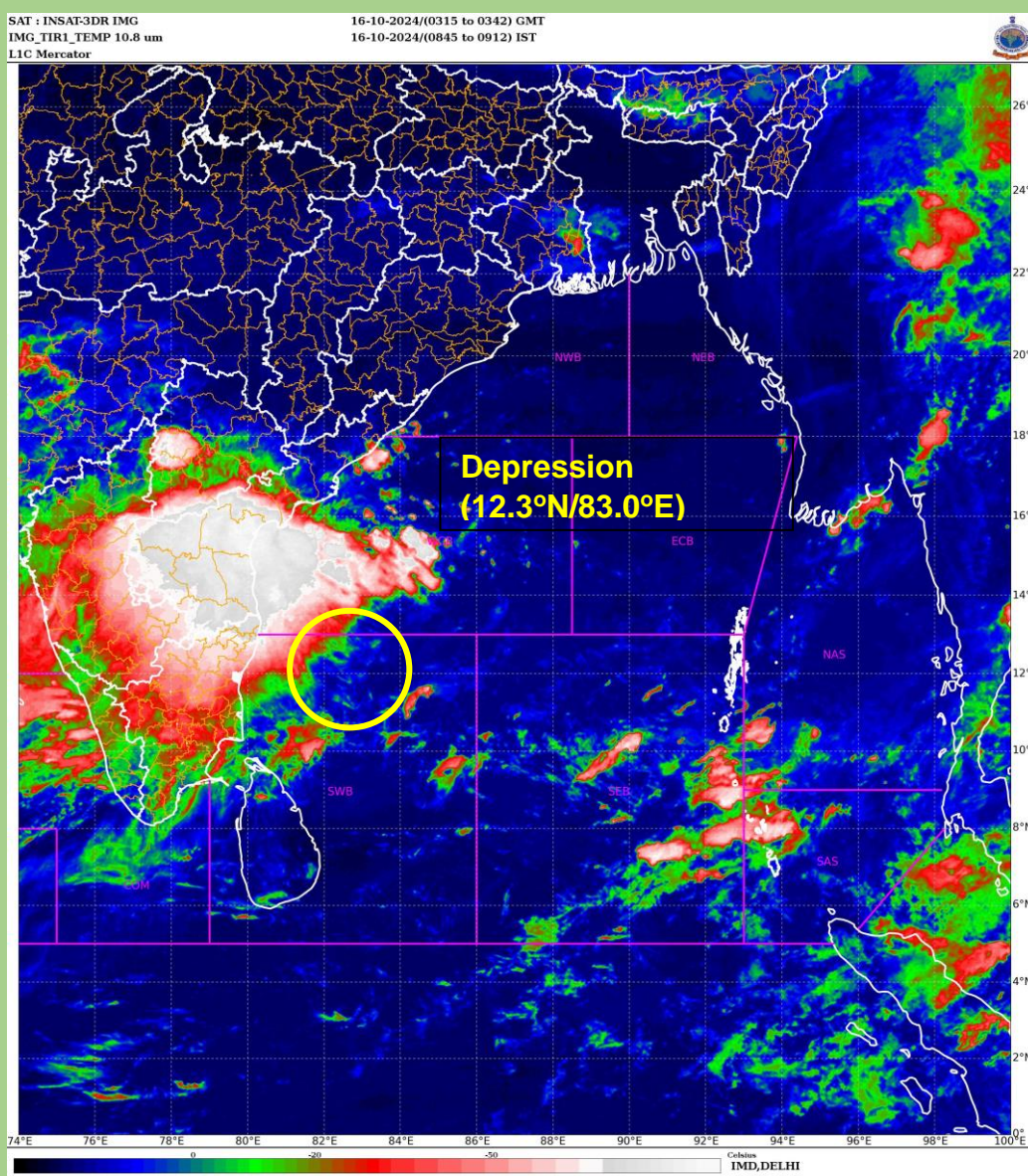


GOVERNMENT OF INDIA

MINISTRY OF EARTH SCIENCES

INDIA METEOROLOGICAL DEPARTMENT

**Depression over Southwest Bay of Bengal during
(15th October-17th October, 2024): A Report**



**INSAT-3D Satellite imagery of Depression over Southwest Bay of Bengal
at 0300 UTC of 16th October, 2024**

**Cyclone Warning Division
India Meteorological Department**

Depression over Southwest Bay of Bengal during 15th–17th October

1. Introduction

- An upper air cyclonic circulation lay over southeast Bay of Bengal (BoB) and adjoining North Equatorial Indian Ocean in the morning (0300 UTC/0830 hours IST) of the 12th October, 2024.
- Under its influence, a **Low Pressure Area** formed over southeast BoB in the early morning (0000 UTC/0530 hours IST) of the 14th October 2024.
- It lay as a **Well Marked Low Pressure Area** over the central parts of south BoB in the early morning (0000 UTC/0530 hours IST) of 15th October 2024.
- It intensified into a **Depression** over southwest BoB in the same evening (1200 UTC/1730 hours IST). It moved west-northwestwards and crossed north Tamil Nadu - South Andhra Pradesh coasts between Puducherry and Nellore, close to north of Chennai, near latitude 13.5°N and longitude 80.2°E around 2300 UTC (0430 hrs IST) of the 17th October.
- Subsequently, it weakened into a Well Marked Low Pressure Area and lay over South coastal Andhra Pradesh and adjoining North coastal Tamil Nadu in the early morning (0000 UTC/0530 hrs IST) of the 17th October, 2024.
- The observed track of the system is presented in Fig.1. Best Track parameters associated with the system are presented in Table1.

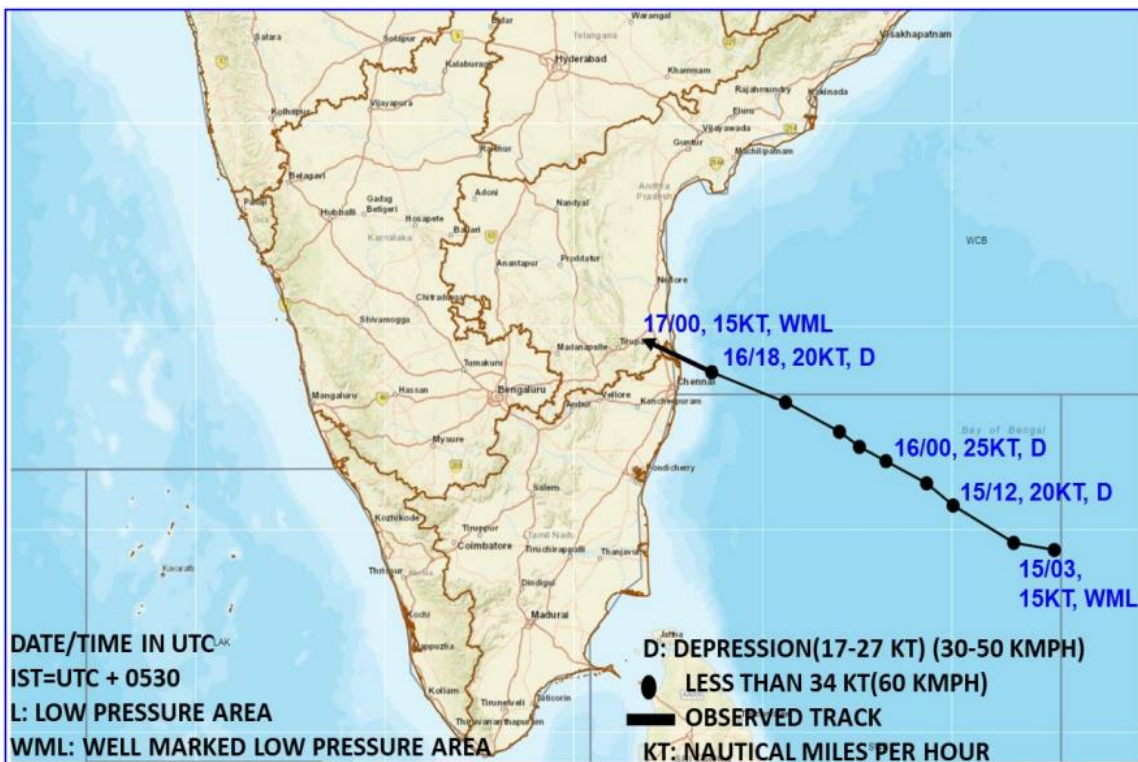


Fig. 1: Observed track of Depression over Southwest BoB

Table1: Best track positions and other parameters of the Depression over Southwest BoB during 15th October-17th October 2024

Date	Time (UTC)	Lat.	Long.	C.I no	ECP	ΔP	MSW (kt)
15.10.24	1200	11.4	84.4	1.5	1002	3	25
	1800	11.8	84.0	1.5	1002	3	25
16.10.24	0000	12.1	83.4	1.5	1002	3	25
	0300	12.3	83.0	1.5	1004	4	25
	0600	12.5	82.7	1.5	1004	4	25
	1200	12.9	81.9	1.5	1002	4	25
	1800	13.4	80.8	1.5	1002	4	25
	Crossed north Tamil Nadu – south Andhra Pradesh coast between Puducherry and Nellore, close to north of Chennai around 2300 UTC of 16th October (0430 hrs IST of 17 th October) as a depression with wind speed of 25 gusting to 35 knots						
17.10.24	0000	Weakened into a well-marked low-pressure area over south coastal Andhra Pradesh and adjoining north coastal Tamil Nadu					

KT: Knots (nautical mile per hour), 1 KT=1.85 kmph, D: Depression, DD: Deep Depression

2. Brief life history – Genesis, Intensification and movement

At 0000 UTC of 14th October, the Madden-Julian Oscillation (MJO) was in phase 4, with amplitude more than 1, and it was predicted to move across phase 4 during next 4 days with further increasing amplitude. Thus, MJO was likely to support enhancement of convective activity over BoB during next 4 days. NCICS based forecast indicated strong westerly winds (5-7 mps) over south BoB and adjoining Equatorial Indian Ocean and strong easterly winds (5-7 mps) over Westcentral BoB. MJO & Kelvin waves along with Rossby waves were also predicted to prevail over the BoB during next 4 days. Thus, Equatorial waves and MJO were supporting convective activity over BoB during next 4 days.

Under these favourable features, a Low Pressure Area formed over southeast BoB in the early morning (0530 hours IST/0000 UTC) of the 14th October 2024. It

became a Well Marked Low Pressure Area over the central parts of south BoB in the early morning (0530 hours IST/0000 UTC) of 15th October 2024.

At 1200 UTC of 15th October, a zone of positive cyclonic vorticity of $50 \times 10^{-6} \text{ s}^{-1}$ was seen over Southwest BoB. Positive low-level convergence of $5-10 \times 10^{-6} \text{ s}^{-1}$ was seen over Southwest BoB and westcentral BoB. Positive upper-level divergence was around $10-20 \times 10^{-6} \text{ s}^{-1}$ over southwest BoB. Vertical wind shear (VWS) was low (5-10 knots) over central and adjoining areas of South BoB (over the system area). Under these favourable features, the Well Marked Low Pressure Area over the central parts of south BoB intensified into a Depression over southwest BoB in the same evening (1730 hours IST) of 15th October, 2024.

At 0300 UTC of 16th October, low-level vorticity was around $60-70 \times 10^{-6} \text{ s}^{-1}$ over Southwest BoB off Tamil Nadu & north Sri Lanka coasts. Positive low-level convergence increased and was around $20 \times 10^{-6} \text{ s}^{-1}$ over Southwest BoB off Tamil Nadu coast to the west of system centre. Positive upper-level divergence was around $30 \times 10^{-6} \text{ s}^{-1}$ over interior Tamil Nadu to the west of system area. The VWS was low to moderate (05-15 knots) over central and adjoining areas of south BoB (around the system area). The system maintained its intensity.

At 1200 UTC of 16th October, low-level vorticity reduced slightly and was around $50-60 \times 10^{-6} \text{ s}^{-1}$ over Southwest BoB off Tamil Nadu & North Sri Lanka coasts. Positive low-level convergence also decreased and was around $5 \times 10^{-6} \text{ s}^{-1}$ over Andhra Pradesh coast to the Northwest of system centre. Positive upper-level divergence was around $5 \times 10^{-6} \text{ s}^{-1}$ over interior Karnataka to the west of system area. The VWS remained low to moderate over the system area. The system maintained its intensity. The southeasterly winds prevailing over the system area steered it northwestwards.

Under these features, the system maintained its intensity and crossed north Tamil Nadu – south Andhra Pradesh coast between Puducherry and Nellore, around 2300 UTC of 16th October (0430 hrs IST of 17th October) as a depression.

Thereafter, due to land interactions and reduction of moisture supply, it weakened into a Well Marked Low Pressure Area over South coastal Andhra Pradesh and adjoining North coastal Tamil Nadu in the early morning (0000 UTC /0530 hrs IST) of the 17th October, 2024.

3. Monitoring

India Meteorological Department (IMD) maintained round the clock watch over the north Indian Ocean (NIO) and the system was monitored well in advance since 3rd October (12 days ahead of formation of depression). The movement towards north Tamil Nadu – south Andhra Pradesh was also indicated in the Extended Range Outlook issued on 3rd October. For monitoring the system, IMD utilized all available data sources like satellite observations from INSAT 3D and 3DR, polar orbiting

satellites, available ships & buoy observations in the region and coastal observations on the day of landfall. Various numerical weather prediction models run by Ministry of Earth Sciences (MoES) institutions, global models and dynamical-statistical models were utilized to predict the genesis, track, landfall and intensity of the system. A digitized forecasting system of IMD was utilized for analysis and comparison of various models' guidance, decision making process and warning products generation.

3.1 Features observed through satellite

Satellite monitoring of the system was mainly done by using half hourly INSAT-3D and 3DR imageries. Satellite imageries of other international geostationary satellites, high resolution polar orbiting satellites and scatterometer imageries from ASCAT were also considered for monitoring of the system. Typical INSAT-3D enhanced coloured imageries, visible/ IR, brightness temperature and water vapour imageries are presented in **Fig.2 (a) to 2 (d)**. During the entire life cycle, the clouds were organized in shear pattern. The detailed features from the satellite pictures are discussed in this section.

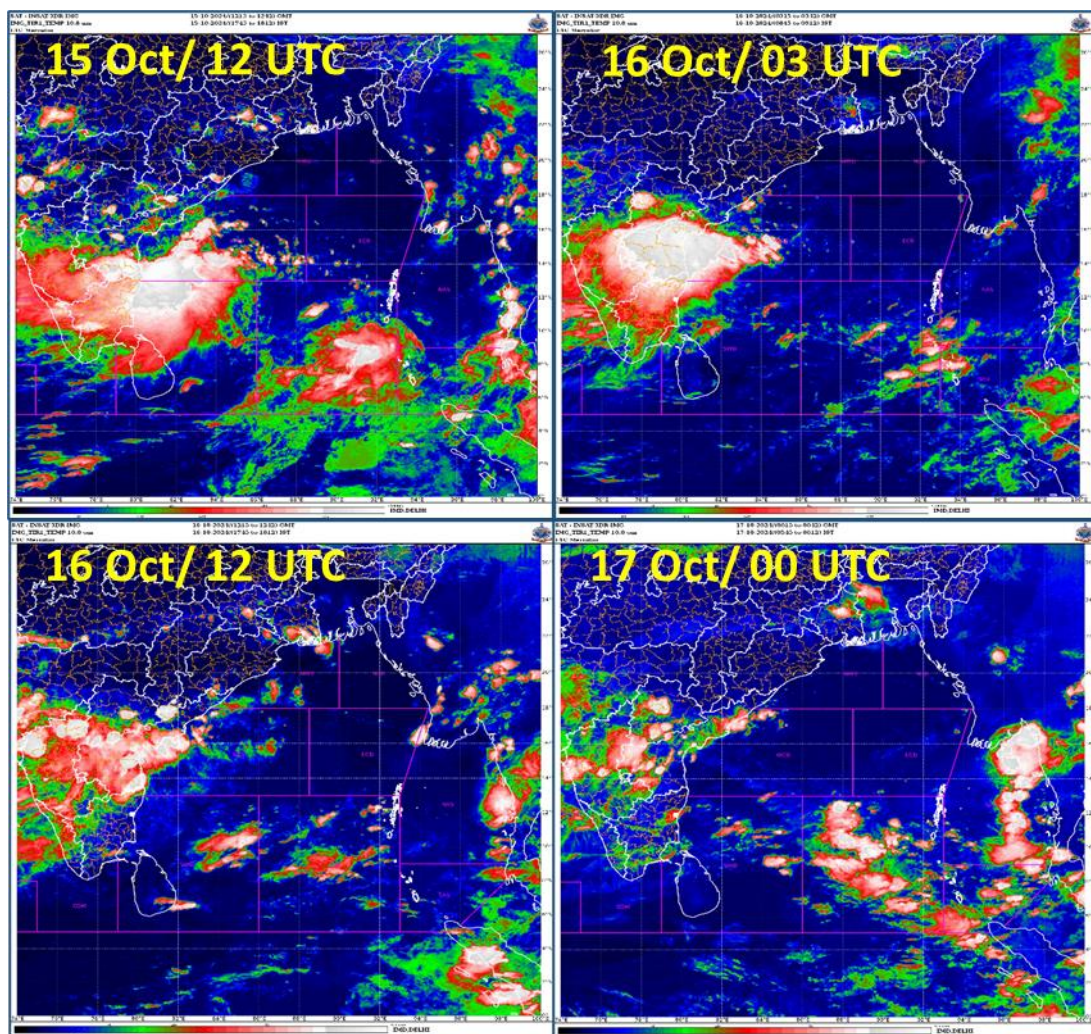


Fig.2(a): INSAT-3D enhanced coloured imageries during life cycle of Depression over Southwest BoB during 15th Oct-17th Oct 2024

At 1200 UTC of 15th October, the intensity of the system was characterised as T1.5. Associated scattered to broken low and medium clouds with embedded intense to very intense convection lay over west-central and south BoB. Minimum Cloud Top Temperature was minus 80-93°C.

At 0300 UTC of 16th October, the INSAT-3D imagery indicated shearing of the cloud mass to the northwest of the system centre. Intensity of the system was characterised as T1.5. Intense convection was seen over Andhra Pradesh, Rayalaseema, North Tamilnadu, South Telangana, and south interior Karnataka. Associated scattered to broken low and medium clouds with embedded intense to very intense convection lay over BoB between latitude 9.0N to 16.0N and west of longitude 85.0E, and minimum cloud top temperature was minus 80-93°C.

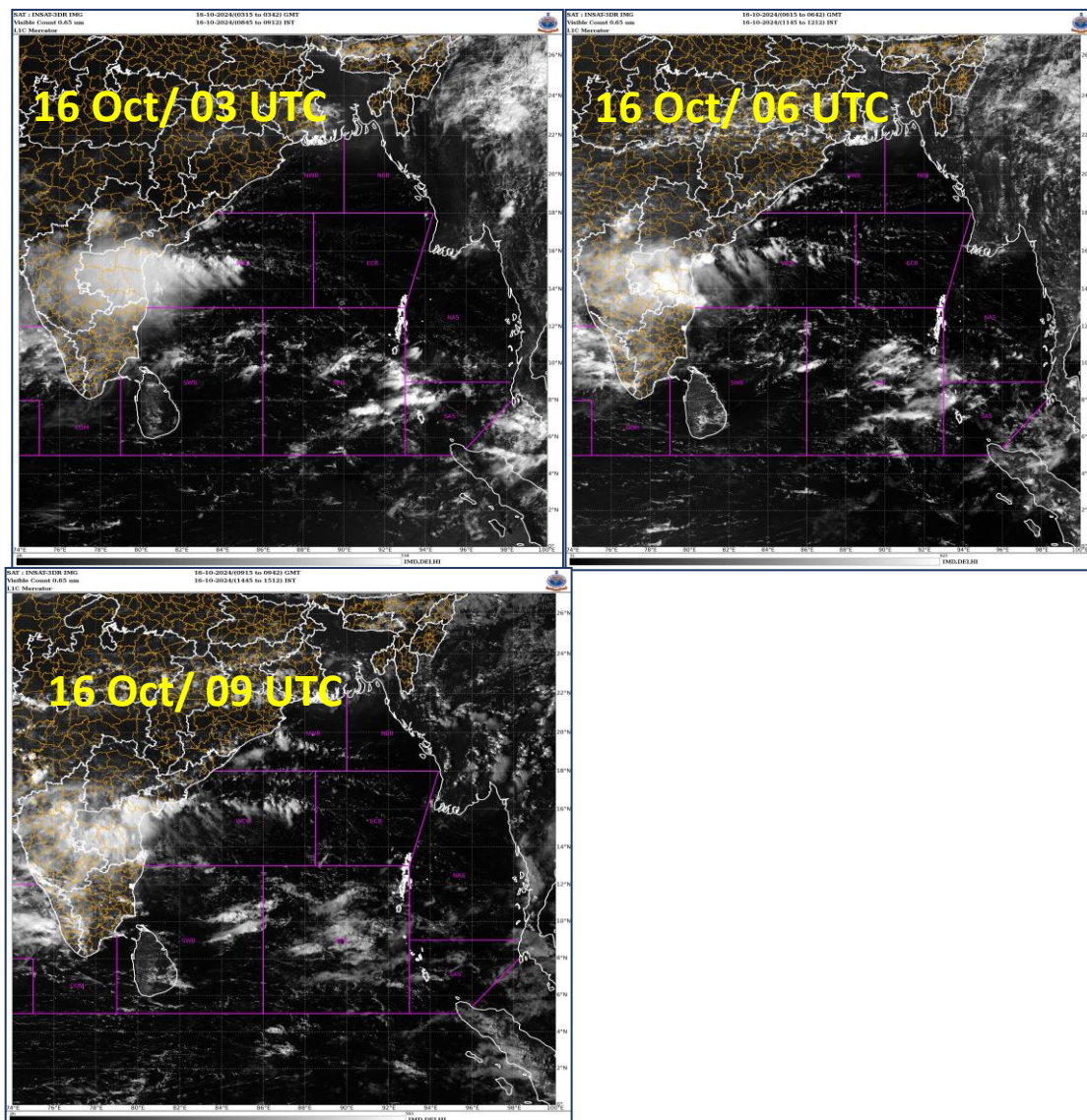


Fig.2(b): INSAT-3D Visible imageries during life cycle of Depression over Southwest BoB during 15th Oct-17th Oct 2024

At 1200 UTC of 16th October, the INSAT-3D imagery indicated the intensity of the system was characterised as T 1.5. Intense to very intense convection was seen over BoB between latitude 9.0°N to 16.0°N and west of longitude 85.0E and south coastal Andhra Pradesh, Rayalaseema, and adjoining south interior Karnataka. Minimum cloud top temperature was minus 80°C.

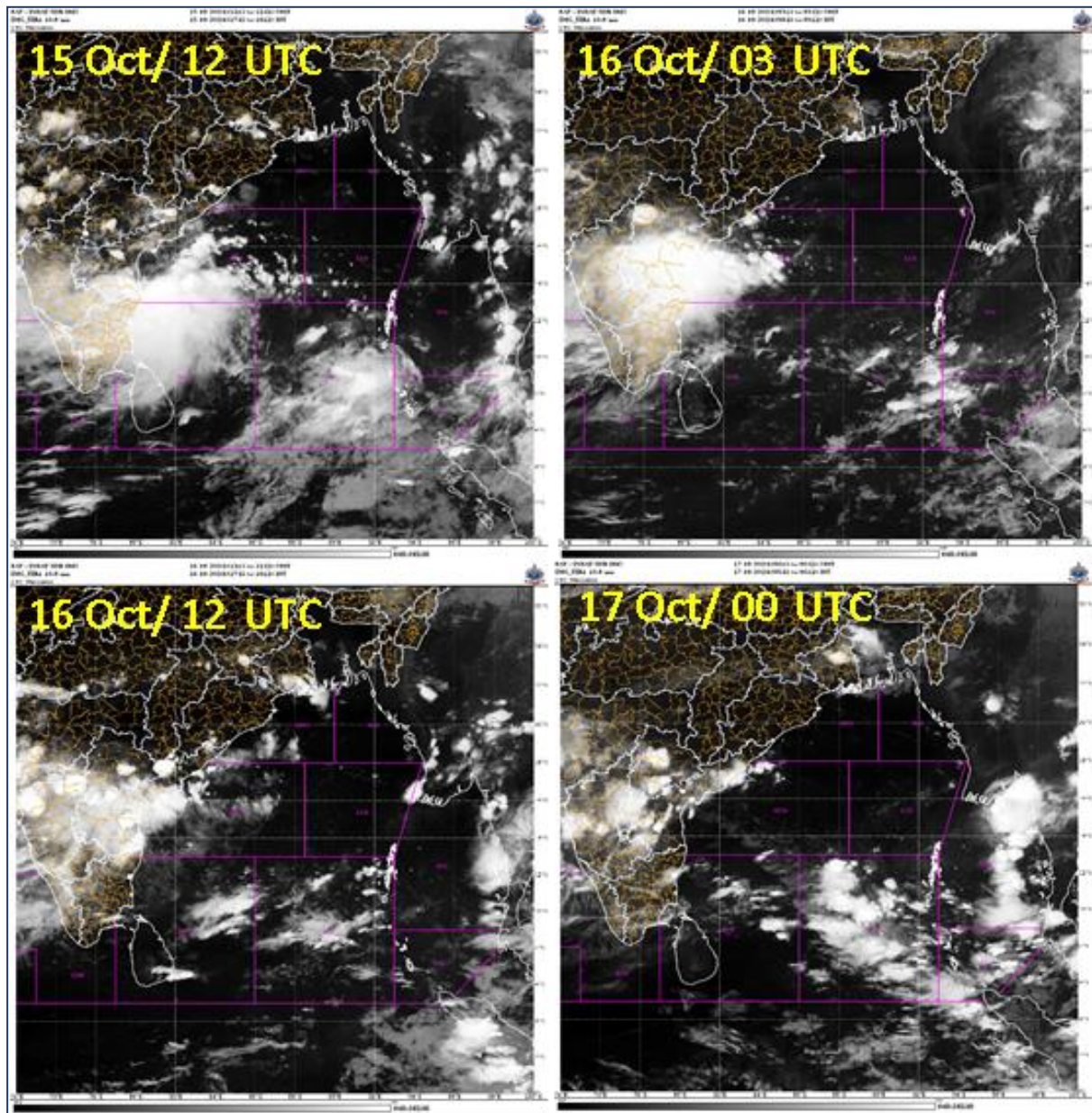


Fig.2(c): INSAT-3D IR imageries during life cycle of Depression over Southwest BoB during 15th Oct-17th Oct 2024

At 0000 UTC of 17th October, the INSAT-3D imagery indicated intense to very intense convection over Karnataka, Telangana, Rayalaseema, coastal Andhra Pradesh. Minimum cloud top temperature was minus 70°-80°C. Moderate to intense convection was seen over Tamil Nadu and Kerala.

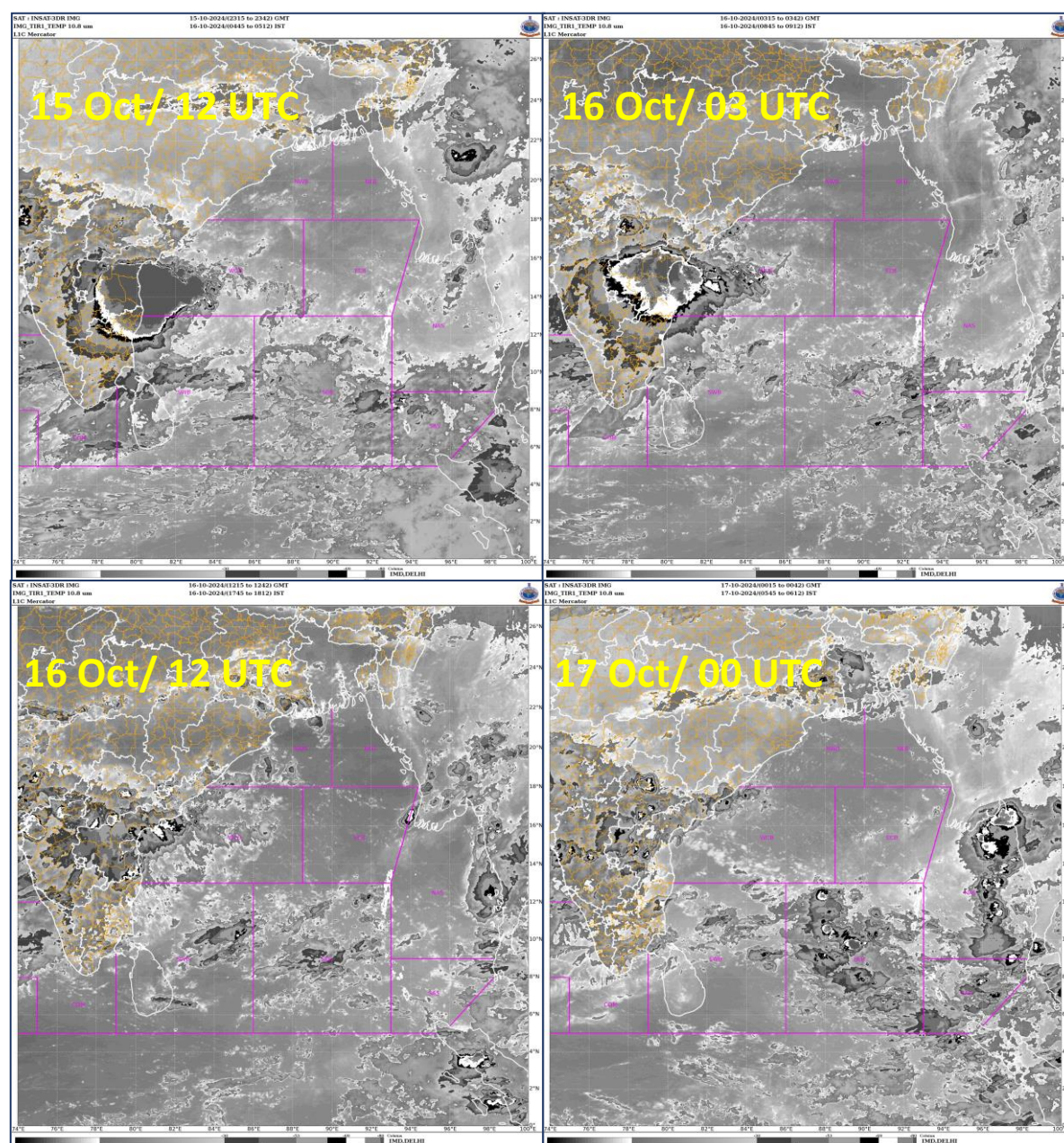


Fig.2(d): INSAT-3D BD curve imageries during life cycle of Depression over Southwest BoB during 15th Oct-17th Oct 2024

4. Dynamical Features

IMD GFS (T1534) analysis of mean sea level pressure (MSLP), winds at 10 m, 850, 500 and 200 hPa levels at 0000 UTC from 15th October to 17th October are presented in **Fig. 3(a) to 3(c)** respectively.

At 0000 UTC of 15th October, it indicated a low pressure area over southwest BoB near 11.5°N/84°E. However, at that time the system lay as a depression over southwest BoB near 11.4°N/84.4°E. Vertically the system extended upto 500 hPa levels. East-southeasterly winds prevailing over the system area at 500 hPa levels steered the system nearly northwestwards. Thus, the model correctly captured the location and movement but underestimated the intensity of the system.

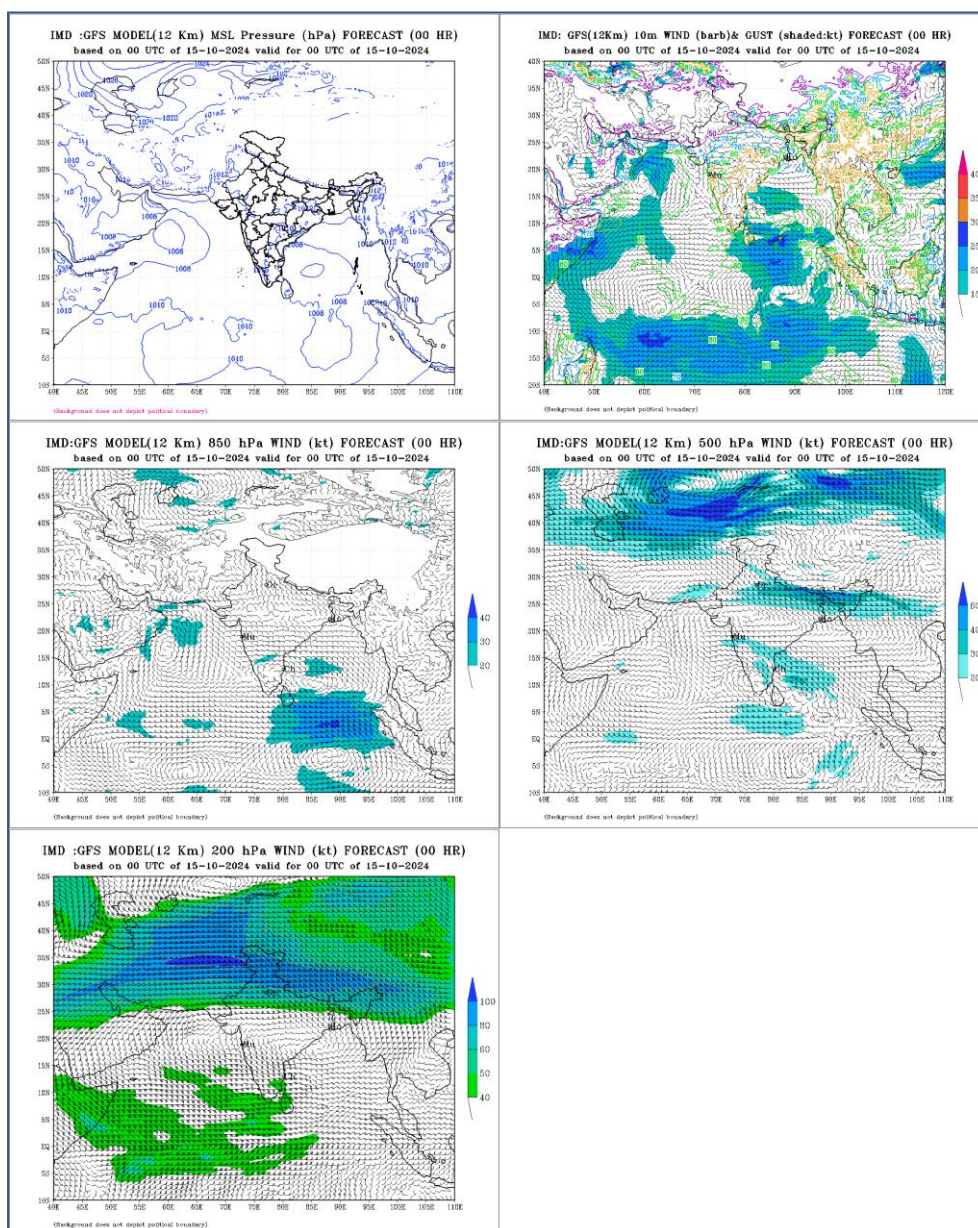


Fig. 3(a): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 15th Oct 2024

The analysis fields at 0000 UTC of 16th October indicated gradual intensification into a well marked low pressure area over southwest & adjoining westcentral BoB near 12.5°N/83.0°E. However, at that time the system lay as a depression over southwest BoB near 12.1°N/83.4°E. Vertically the system extended upto 500 hPa levels tilting southwestwards with height. Southeasterly winds prevailing over the system area at 500 hPa levels steered the system nearly northwestwards. Thus, the model captured the location and movement but underestimated the intensity of the system.

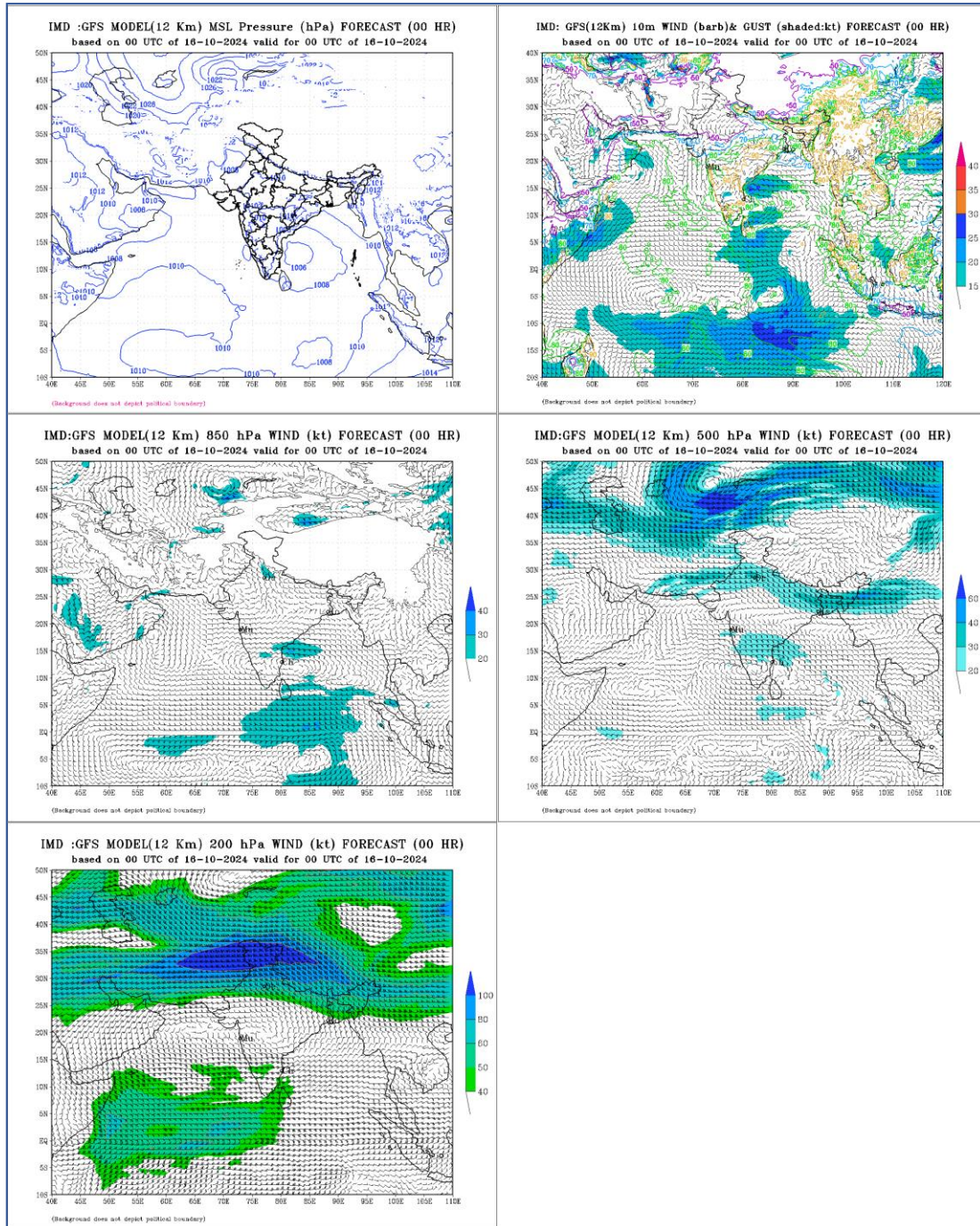


Fig. 3(b): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 16th Oct 2024

The analysis fields at 0000 UTC of 17th October indicated weakening of the system into a low pressure area over south coastal Andhra Pradesh near 14.8°N/80.0°E. However, at that time the system lay as a well marked low pressure area over south coastal Andhra Pradesh and adjoining north coastal Tamil Nadu. Thus, the model captured the location and movement but underestimated the intensity of the system.

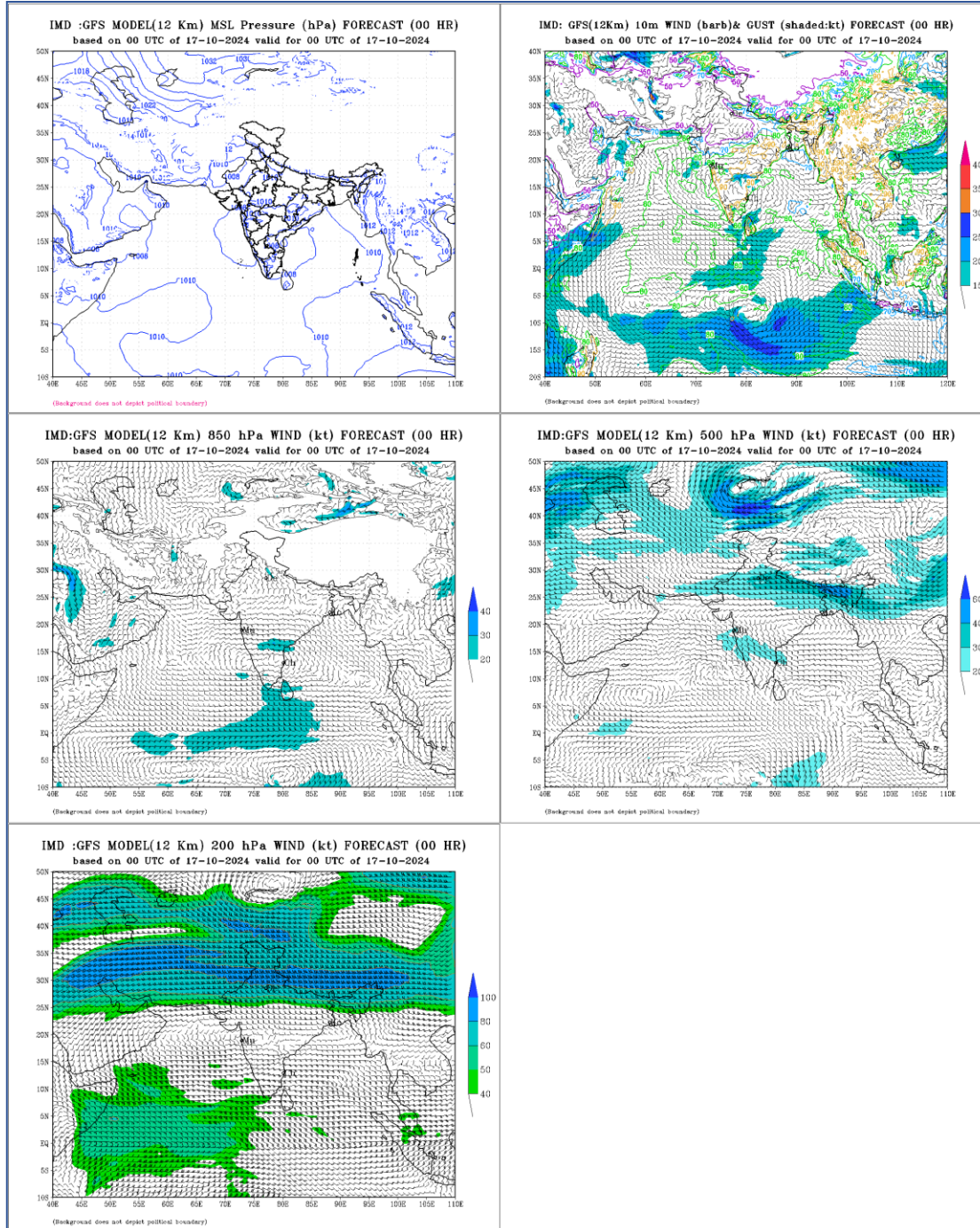


Fig. 3(c): IMD GFS (T1534) mean sea level pressure (MSLP), winds at 10m, 850, 500 and 200 hPa levels based on 0000 UTC of 17th Oct 2024

Thus, throughout its life period IMD GFS could capture the location & movement of the system correctly but intensity was underestimated.

5. Realized Weather

Rainfall associated with the depression based on IMD-NCMRWF satellite gauge merged data are depicted in Fig. 4 respectively.

It is seen that light to moderate rainfall occurred at a few places over coastal Tamil Nadu, Puducherry & Karaikal, Rayalaseema and south Andhra Pradesh on 15th October.

Light to moderate rainfall occurred at most places with extremely heavy rainfall at isolated places and heavy to very heavy rainfall at many places over coastal Tamil Nadu, Puducherry & Karaikal, light to moderate rainfall at a few places with heavy to very heavy rainfall at isolated places over Rayalaseema, south Andhra Pradesh and isolated heavy rainfall over south interior Karnataka on 16th October.

Light to moderate rainfall at a few places with isolated heavy rainfall over Rayalaseema, south Andhra Pradesh, south interior Karnataka and Kerala on 17th October

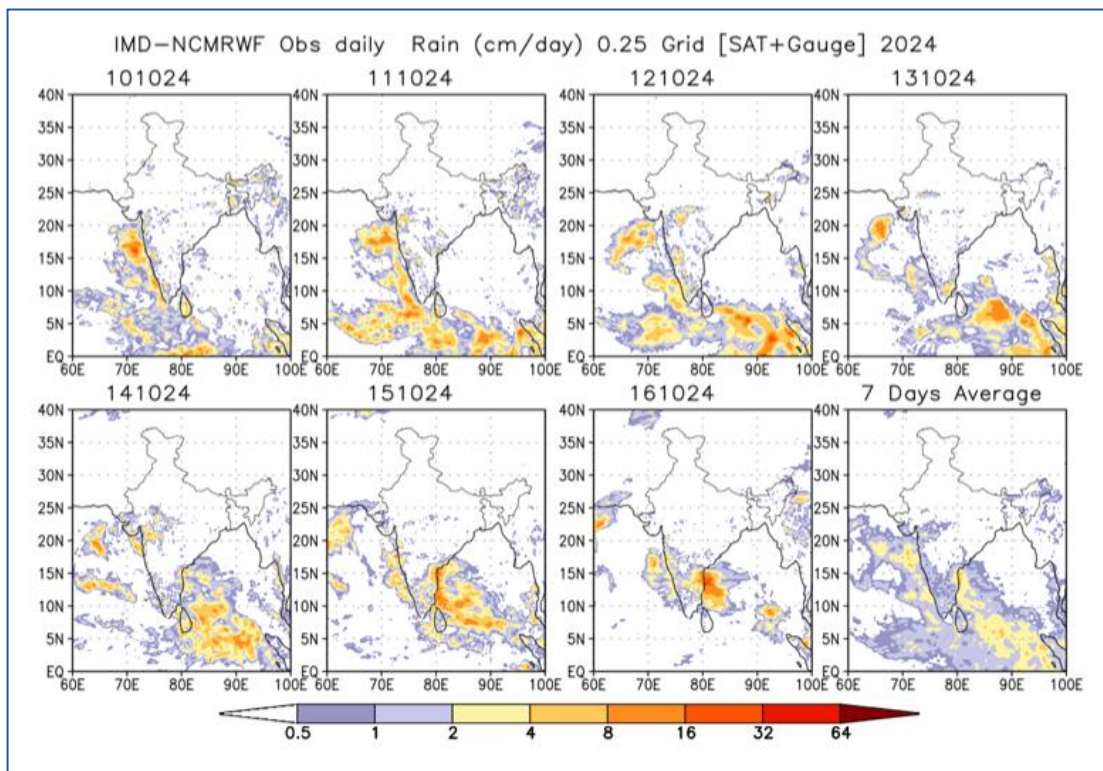


Fig. 4: IMD-NCMRWF Rain gauge and satellite merged rainfall plots ending at 0300 UTC of 10th Oct to 16th Oct, 2024 (cm/day)

5.1 Rainfall forecast verification

The forecast for heavy to extremely heavy rainfall episodes in association with the system are verified with the 24 hours accumulated rainfall realized at various stations. The details of the day-wise verification are given in Table -2.

Table 2: Verification of Heavy Rainfall Forecast

Date/Base Time of observation in UTC	24 hr Heavy rainfall warning ending at 0300 UTC of date	Realised 24-hour heavy rainfall (≥ 7 cm) ending at 0300 UTC of date
15.10.2024 / 0300	<p>Tamil Nadu & Puducherry:</p> <p>Heavy to very heavy rainfall at isolated places over Tamil Nadu & Puducherry and extremely heavy rainfall at isolated places over north Tamil Nadu on 15th October.</p> <p>Heavy to very heavy rainfall at a few places with extremely heavy rainfall at isolated places over north Tamil Nadu & Puducherry on 16th October and isolated heavy to very heavy rainfall over north interior Tamil Nadu on 17th October.</p> <p>Heavy rainfall at isolated places over south Tamil Nadu</p>	<p><u>16th October:</u></p> <p>Tamil Nadu, Puducherry & Karaikal: Cholavaram (Tiruvallur) 30, Red Hills (Tiruvallur) 28, Avadi (Tiruvallur) 25, Kathivakkam (Chennai) 23, Manali (Chennai) 21, T.V.K Nagar (Chennai) 19, Kolathur (Chennai), Adyar (Chennai), Puzhal (Tiruvallur) & Ambattur (Chennai) 18 each, Thiruvottiyur (Chennai), Perungudi (Chennai), Manali (Chennai), Hindustan_University (Kancheepuram) & Ennore (Chennai) 17 each, Perambur (Chennai), Malar Colony (Chennai), Good Will School Villivakkam (Tiruvallur), Puzhal (Chennai), Ayanavaram Taluk Office (Chennai), Anna University (Chennai), Ponneri (Tiruvallur) & Thamarapakkam (Tiruvallur) 16 each, Ambathur (Chennai), Anna University (Chennai), MGR Nagar (Chennai), Sholinganallur (Chennai), Thiru-Vi-Ka Nagar (Chennai), Tondiarpet (Chennai), Royapuram (Chennai) & Adayar (Chennai) 15 each, Madhavaram (Chennai), Tondiarpet (Chennai), Chennai(N) (Chennai), CD Hospital Tondiarpet (Chennai), YMCA Nandnam (Chennai) & Kodambakkam (Chennai) 14 each, Anna Nagar (Chennai), Vanagaram (Chennai), Chennai Collector Office (Chennai), Kodambakkam (Chennai), DGP Office (Chennai) & Royapuram</p>

	<p>during 15th to 17th October.</p> <p>South Andhra Pradesh & Rayalaseema Heavy to very heavy rainfall at isolated places on 15th; heavy to very heavy rainfall at a few places with extremely heavy rainfall at isolated places on 16th October and heavy rainfall at isolated places on 17th October.</p> <p>Kerala & south Interior Karnataka: Heavy to very heavy rainfall at isolated places over Kerala and south Interior Karnataka during 15th to 17th October.</p>	<p>(Chennai) 13 each, Ice House (Chennai), Pallikaranai (Chennai), Teynampet (Chennai), Alandur (Chennai), Chennai (AP) (Chennai), Meenambakkam (Chennai) & Maduravoyal (Chennai) 12 each, Meenambakkam (Chennai), Kolapakkam (Kancheepuram), Valasaravakkam (Chennai), Uthandi (Chennai), GCC (Chennai), Tiruvottiyur (Chennai) & Adyar Eco Park (Chennai) 11 each, Mugalivakkam (Chennai), Jaya Engg College (Tiruvallur), Perungudi (Chennai), Sholinganallur (Chennai) & Tiruppur (Tiruppur) 10 each, Gummidipoondi (Tiruvallur), Perungudi (Chennai), Uthukottai (Tiruvallur), Manimutharu Dam (Kallakurichi), Tiruvallur (Tiruvallur), Kachirayaopalayam (Kallakurichi), Mahabalipuram (Chengalpattu), Satyabama (Kancheepuram), Poonamallee (Tiruvallur) & Chembarabakkam (Kancheepuram) 9 each, ACS Medical College (Kancheepuram), Bhuvanagiri (Cuddalore), VIT Chennai (Chengalpattu), Valavanur (Villupuram), Mahabalipuram (Chengalpattu), Koratur (Tiruvallur) & Koliyanur (Villupuram) 8 each, Uthangarai (Krishnagiri), Tiruttani (Tiruvallur), Pallipattu (Tiruvallur), Kundrathur (Kancheepuram), Tambaram (Chengalpattu) & Tiruppur South (Tiruppur) 7 each;</p>
16.10.2024 / 0300	<p>Tamil Nadu & Puducherry: Heavy to very heavy rainfall at a few places with extremely heavy rainfall at isolated places over north Tamil Nadu & Puducherry on 16th October and isolated heavy to very heavy rainfall</p>	<p>Rayalaseema: Sullurpeta (Tirupati) 22, Tada (Tirupati) 12, Tirupati Aero (Tirupati) 11, Satyavedu (Tirupati) 10, Porumamilla (YSR) 9, Srikalahasti (Tirupati), Thottambedu (Tirupati), Venkatagiri (Tirupati), Penagaluru (Annamayya), Kodur (YSR) & Nagari (Chittoor) 8 each, Gudur (Tirupati) & Pullampeta (Annamayya District) 7 each;</p> <p>Coastal Andhra Pradesh & Yanam: Kavali (Nellore) 18, Nellore (Nellore) 13,</p>

	<p>over north interior Tamil Nadu on 17th October.</p> <p>Heavy rainfall at isolated places over south Tamil Nadu during 16th to 17th October.</p> <p>South Andhra Pradesh & Rayalaseema:</p> <p>Heavy to very heavy rainfall at a few places with extremely heavy rainfall at isolated places is likely on 16th October and heavy rainfall at isolated places is likely on 17th October.</p> <p>Kerala & south Interior Karnataka:</p> <p>Heavy to very heavy rainfall at isolated places is likely over Kerala and south Interior Karnataka during 16th to 17th October.</p>	<p>Kandukur (Nellore) 10, Seetharamapuram (Nellore) 10, Vinjamur (Nellore) & Udayagiri (Nellore) 9 each;</p> <p>South Interior Karnataka:</p> <p>Bengaluru Hal Ap (Bengaluru Urban) 9, Hesaraghatta (Bengaluru Urban) 7, Bellur (Mandya) & Bengaluru City (Bengaluru Urban) 7 each.</p> <p><u>17th October:</u></p> <p>Rayalaseema:</p> <p>Kodur (YSR) 14, Pullampeta (Annamayya) 10, Penu Konda (Sri Sathyasai) 9, Ramagiri (Sri Sathyasai) & Nandikotkur (Nandyal) 8 each, Chenne Kothapalle (Sri Sathyasai), Jupadu Bungalow (Nandyal), Rajampet (Annamayya), Venkatagiri (Tirupati), Srikalahasti (Tirupati), Nallamada (Sri Sathyasai), Gorantla (Sri Sathyasai), Penagaluru (Annamayya) & Tirupati (Tirupati) 7 each;</p> <p>Coastal Andhra Pradesh & Yanam:</p> <p>Nellore (Nellore) 7;</p> <p>Kerala:</p> <p>Kozhikode (Kozhikode) 7;</p> <p>South Interior Karnataka:</p> <p>Davanagere (Davangere) & Davanagere (Davangere) 9 each, Y N Hoskote (Tumakuru) & Chitradurga (Chitradurga) 7 each.</p>
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6. Operational Forecast Performance

- The extended range outlook issued on 3rd October (12 days prior to formation of the depression) indicated likely formation of an upper-air cyclonic circulation over central parts of south BoB around 12th October. It was also indicated that

under its influence a low pressure area would form over southwest BoB off Tamil Nadu coast and intensify further into a depression during later part of week 1.

- The daily tropical weather outlook issued at 0600 UTC of 12th October, 2024 indicated formation of low pressure area over Southwest BoB around 14th October. Actually, low pressure area formed over southeast BoB on 14th October.
- In the Special Tropical Weather Outlook bulletin based on 1800 UTC of 14th October, it was indicated that the low pressure area would intensify into a Depression and move west-northwestwards towards North Tamil Nadu, Puducherry and adjoining South Andhra Pradesh coasts during subsequent 2 days. Actually, depression formed over southwest BoB on 15th October.
- First track and intensity forecast was issued at 0700 UTC of 15th October on formation of Well Marked Low Pressure Area over central parts of south BoB indicating crossing near Chennai with wind speed of 40-50 kmph gusting to 60 kmph.
- In the bulletin issued at 0640 UTC of 16th October, it was indicated that the depression would cross near Chennai with wind speed of 35-45 kmph gusting to 55 kmph.
- In the Special Tropical Weather Outlook bulletin based on 1200 UTC of 15th October, it was indicated that the system would move west-northwestwards and cross North Tamil Nadu-south Andhra Pradesh coasts between Puducherry and Nellore, close to Chennai in the early morning hours (around 0000 UTC) of 17th October as a depression. Actually, it crossed north Tamil Nadu – South Andhra Pradesh coasts between Puducherry and Nellore, close to north of Chennai, near latitude 13.5N and longitude 80.2E around 0430 hrs IST (2300 UTC) of the 17th October.
- Thus, the track, initial movement intensification/weakening of the system were well predicted by IMD/RSMC New Delhi.

8. Bulletins issued by IMD

- Track, intensity and landfall forecast: IMD continuously monitored, predicted and issued bulletins containing track & intensity forecast from the stage of depression till the system weakened into a low-pressure area. The forecast of these parameters was issued from the 15th October onwards along with the cone of uncertainty every six hourly for 00, +12, +24, +36 and +48 hours lead period.
- Adverse weather warning bulletins: The tropical cyclone forecasts along with expected adverse weather like heavy rain were issued with every six hourly updates to central, state and district level disaster management agencies including MHA NDRF, NDMA for Tamil Nadu, Andhra Pradesh and Puducherry. The bulletins also contained the suggested action for disaster managers and general public in particular for fishermen. These bulletins were also issued to

Defence including Indian Navy & Indian Air Force, NDRF, Indian Coast Guard, ports, Shipping, Fishery, Railways, Surface Transport & Aviation Authorities.

- Warning graphics: The graphical display of the observed and forecast track with cone of uncertainty was disseminated by email and uploaded in the RSMC, New Delhi website (<http://rsmcnewdelhi.imd.gov.in/>) regularly. The adverse weather warnings related to heavy rain were also presented in graphics along with colour codes in the website.
- Warning and advisory for marine community: The six hourly bulletins under Global Maritime Distress Safety System (GMDSS) were issued by the Marine Weather Services Division at New Delhi and bulletins for maritime interest were issued by Area Cyclone Warning centre of IMD at Kolkata & Chennai and Cyclone Warning Centres at Visakhapatnam to ports, fishermen, coastal and high sea shipping community.
- Fishermen Warning: Regular warnings for fishermen for deep sea of BoB and the states of Kerala, Tamil Nadu and Andhra Pradesh were issued since 10th October onwards.
- Warning and advisory through social media: Daily updates (every six hourly or whenever there was any significant change in intensity/track) were uploaded on Facebook and tweeter regularly during the life period of the system from 14th morning onwards, updates were posted on facebook and tweeter.
- Diagnostic and prognostic features of Depression: The prognostics and diagnostics of the system were described in the RSMC bulletins.

Statistics of bulletins issued by RSMC New Delhi in association with this system are given in Table 3.

Table 3: Bulletins issued by Cyclone Warning Division, IMD, New Delhi

S.No.	Bulletins	No. of Bulletins	Issued to
1	National Bulletin	12	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 Defense Staff, DG Doordarshan, All India Radio, DG-NDRF, Director Indian Railways, Indian Navy, IAF, Chief Secretary: West Bengal, Odisha, Andhra Pradesh, Chhattisgarh, Jharkhand, Maharashtra, Gujarat and Telangana, Daman & Diu, Goa, Dadra & Nagar Haveli
2	RSMC Bulletin	12	1. IMD's website 2. WMO/ESCAP member countries through GTS

			and E-mail.
3	GMDSS Bulletins	9	1. IMD website, RSMC New Delhi website 2. Transmitted through WMO Information System (WIS) to Joint WMO/IOC Technical Commission for Ocean and Marine Meteorology (JCOMM)
4	Warnings through SMS	4653	4,653 to General Public and disaster managers along the east coast of India by IMD Headquarters
5	Warnings through Social Media	12	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).
6	Press Release	1	Disaster Managers, Media persons by email and uploaded on website
7	Press Briefings Daily	Daily	Regular & frequent briefing daily during 14th -17th October

9. Acknowledgement

India Meteorological Department (IMD) and RSMC New Delhi duly acknowledge the contribution from all the stake holders and disaster management Page 22 of 23 agencies who contributed to the successful monitoring, prediction and early warning service of the system. We acknowledge contribution from WMO/ ESCAP panel member countries especially Sri Lanka Meteorological Department for sharing coastal observations on the day of landfall. We acknowledge the contribution of all sister organisations 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), Indian Institute of Tropical Meteorology (IITM) Pune, research institutes including IIT Bhubaneswar, and Space Application Centre, Indian Space Research Organisation (SAC-ISRO) for their valuable support. The support from various Divisions/Sections of IMD including Area Cyclone Warning Centre (ACWC) Chennai, Cyclone Warning Centre (CWC) Visakhapatnam is duly acknowledged. The contribution from Numerical Weather Prediction Division, Satellite and Radar Division, Surface & Upper air instruments Divisions, New Delhi and Information System and Services Division at IMD is also duly acknowledged.