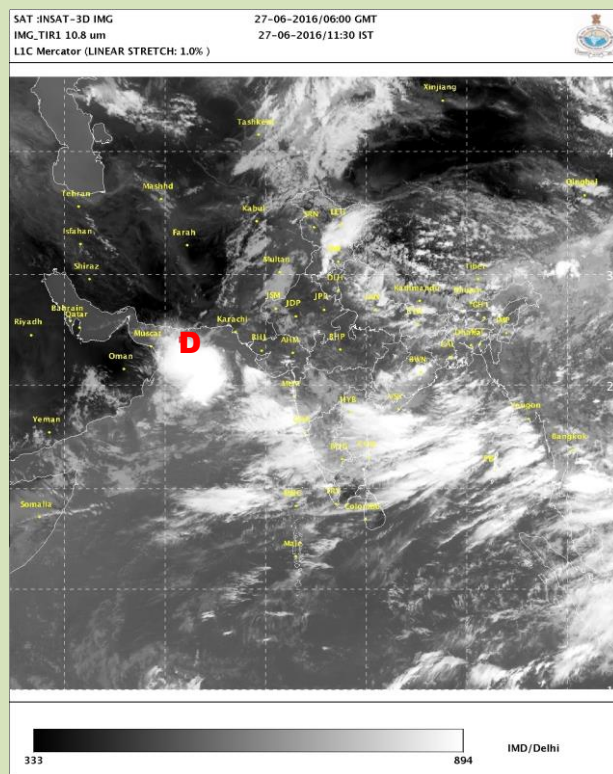




GOVERNMENT OF INDIA
MINISTRY OF EARTH SCIENCES
INDIA METEOROLOGICAL DEPARTMENT

**A Preliminary Report on Depression over Arabian Sea
(27-29th June, 2016)**



INSAT 3D Satellite imagery of 0600UTC of 27th June, 2016

CYCLONE WARNING DIVISION, NEW DELHI

JULY, 2016

Depression over the Arabian Sea (27-29 June 2016)

1. Introduction:

A depression formed over northeast Arabian Sea (AS) in the afternoon of 27th June 2016. It moved initially westwards, then south-southwestwards and weakened into a well-marked low-pressure area over northwest and adjoining westcentral AS in the morning of 29th June. As the depression moved westwards away from Indian coast, there was no adverse weather along the west coast of India due to this system. However, it caused rainfall over coastal Oman. The brief life history of the system along with the associated weather are presented in the following sections. The salient features of the system are as follows.

- (i) The depression moved initially westward and then southwestwards. It then weakened over the Sea due to high vertical wind shear.
- (ii) Despite the high vertical wind shear, the genesis could be possible due to favourable poleward outflow providing upper level divergence and favourable sea surface temperature and Ocean thermal energy.

2. Genesis

Under the influence of the active monsoon condition over AS, the convective activity gradually increased during last week of June. A low pressure area formed over the northeast Arabian Sea on 26th June. Considering the environmental condition, the sea surface temperature (SST) was 30-31°C, Ocean thermal energy was about 75-100 kJ/cm². However, the SST and ocean thermal energy gradually decrease towards the west. The low level convergence was about $10-20 \times 10^{-5}$ second⁻¹ and the maxima lay to the southwest of the system centre. The upper level divergence was about 20×10^{-5} second⁻¹ and the maxima lay to the southwest of the system centre. The low level relative vorticity was about 75×10^{-6} second⁻¹, and maximum value lay to the south of the system centre. The vertical wind shear was high (20-30 knots) around system centre and was unfavourable for intensification. The upper tropospheric ridge ran along latitude 26.0°N. As such there was favourable poleward outflow for intensification which compensated the unfavourable wind shear. Under these conditions the low pressure area concentrated into a depression at 0900 UTC of 27th June 2016 over the northeast and adjoining northwest AS with its centre near latitude 21.5° N and longitude 64.5° E. According to INSAT 3D imageries, the convective clouds got organized gradually on 27th. Associated broken low/medium clouds with embedded intense to very intense convection lay over the area. The convective clouds were sheared towards west due to moderate to high vertical wind shear. According to Dvorak's technique, the intensity was T1.5. The lowest cloud top temperature (CTT) was -93° C. The estimated maximum sustained wind speed was about 25 knots gusting to 35 knots. The estimated central pressure is about 993 hPa. The track of the depression is

shown in Fig.1. The best track parameters of the depression are shown in Table 1. The typical INSAT 3D IR, colour enhancement and grey scale enhancement imageries of the depression as per in its different stages are shown in Fig.2, 3 and 4 respectively.

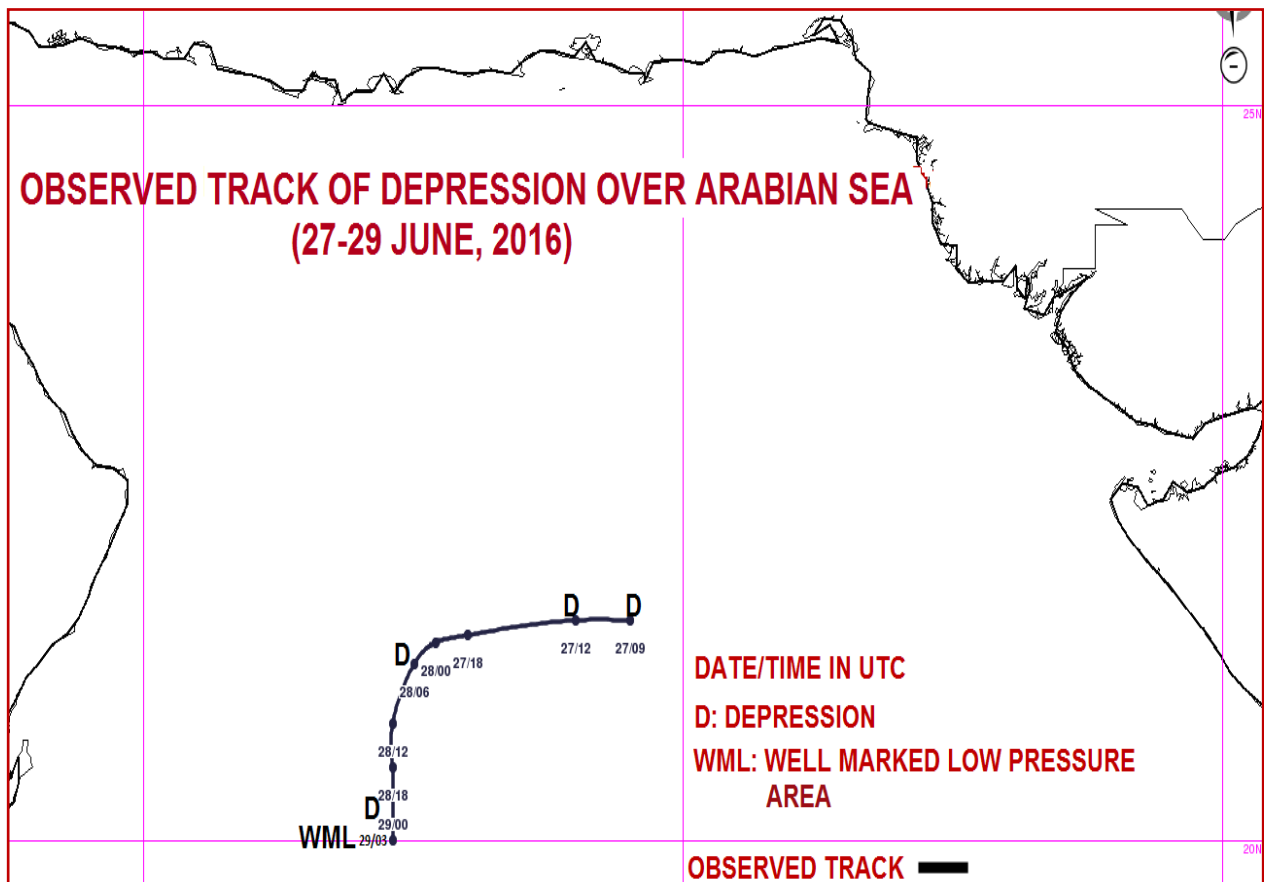


Fig.1: Observed track of depression over the Arabian Sea and typical satellite imagery on 28th June 2016

3. Movement and intensification

The depression over northwest Arabian sea moved slowly southwards with a speed of 5km/hr during 27th and then southwestwards. The movement of the system was guided by the middle and upper tropospheric anticyclonic circulation lying to the northeast of the system centre along with the ridge passing through latitude 26^oN. Due to As the system moved westwards, it came under the influence of another anticyclonic circulation over Oman which steered the depression towards southwest on 28th and 29th. As the system moved southwestwards, it experienced high vertical wind shear (30-40 knots) around system centre under the influence of upper level tropical easterly jet. As a result, the depression weakened into a well-marked low pressure area over northwest and adjoining west-central Arabian Sea at 0300 UTC of 29 June 2016 with the convection showing disorganization. According to Dvorak's technique, the intensity was T 1.0. The lowest CTT was minus 86.0^oc. The estimated maximum sustained wind speed is about 15 knots gusting to 25 knots. The estimated central pressure is about 996 hPa. It then moved northeastwards and lay as a low pressure area over central AS on 30th morning and became less marked on 1st July 2016.

Table 1: Best track positions and other parameters of Depression over the Arabian Sea during 27-29 June 2016

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
27-06-2016	0900	21.5/64.5	1.5	996	25	4	D
	1200	21.5/64.0	1.5	994	25	4	D
	1800	21.4/63.0	1.5	994	25	4	D
28-06-2016	0000	21.3/62.7	1.5	994	25	4	D
	0600	21.2/62.5	1.5	990	25	4	D
	1200	20.8/62.3	1.5	990	25	4	D
	1800	20.5/62.3	1.5	990	25	4	D
29-06-2016	0000	20.3/62.3	1.5	990	25	4	D
	0300	The system weakened into a well-marked low-pressure area over northwest and adjoining the westcentral Arabian Sea.					

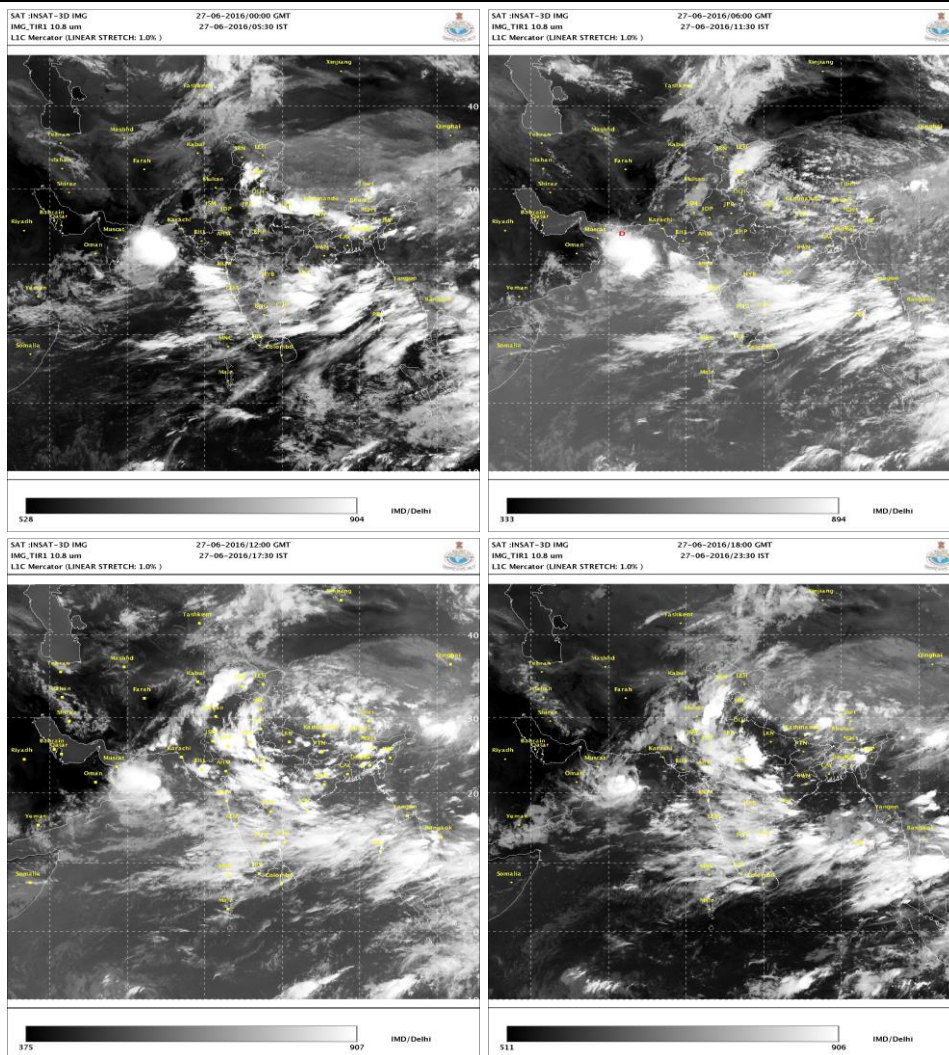


Fig.2 (i) INSAT 3D based imagery of depression at 0000, 0600, 1200 and 1800 UTC of 27th June 2016

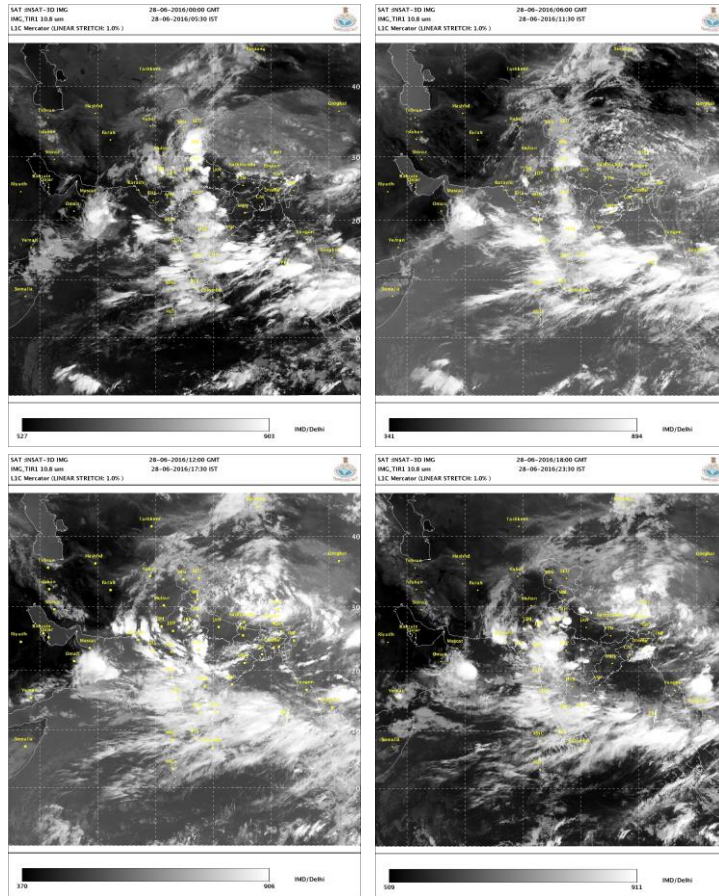


Fig.2 (ii) INSAT 3D based imagery of depression at 0000, 0600, 1200 and 1800 UTC of 28th June 2016

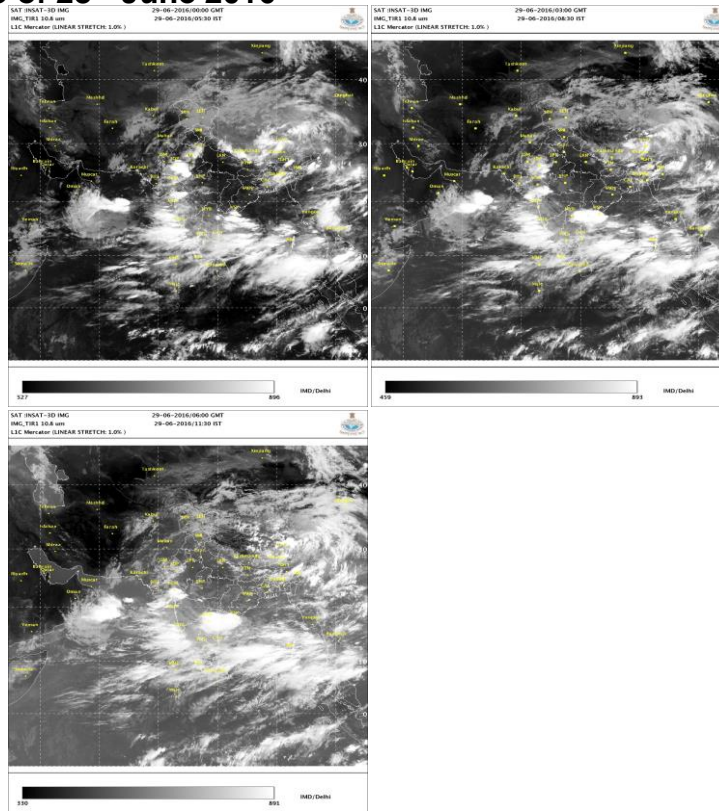


Fig.2 (iii) INSAT 3D based imagery of depression at 0000, 0300 and 0600 UTC of 29th June 2016

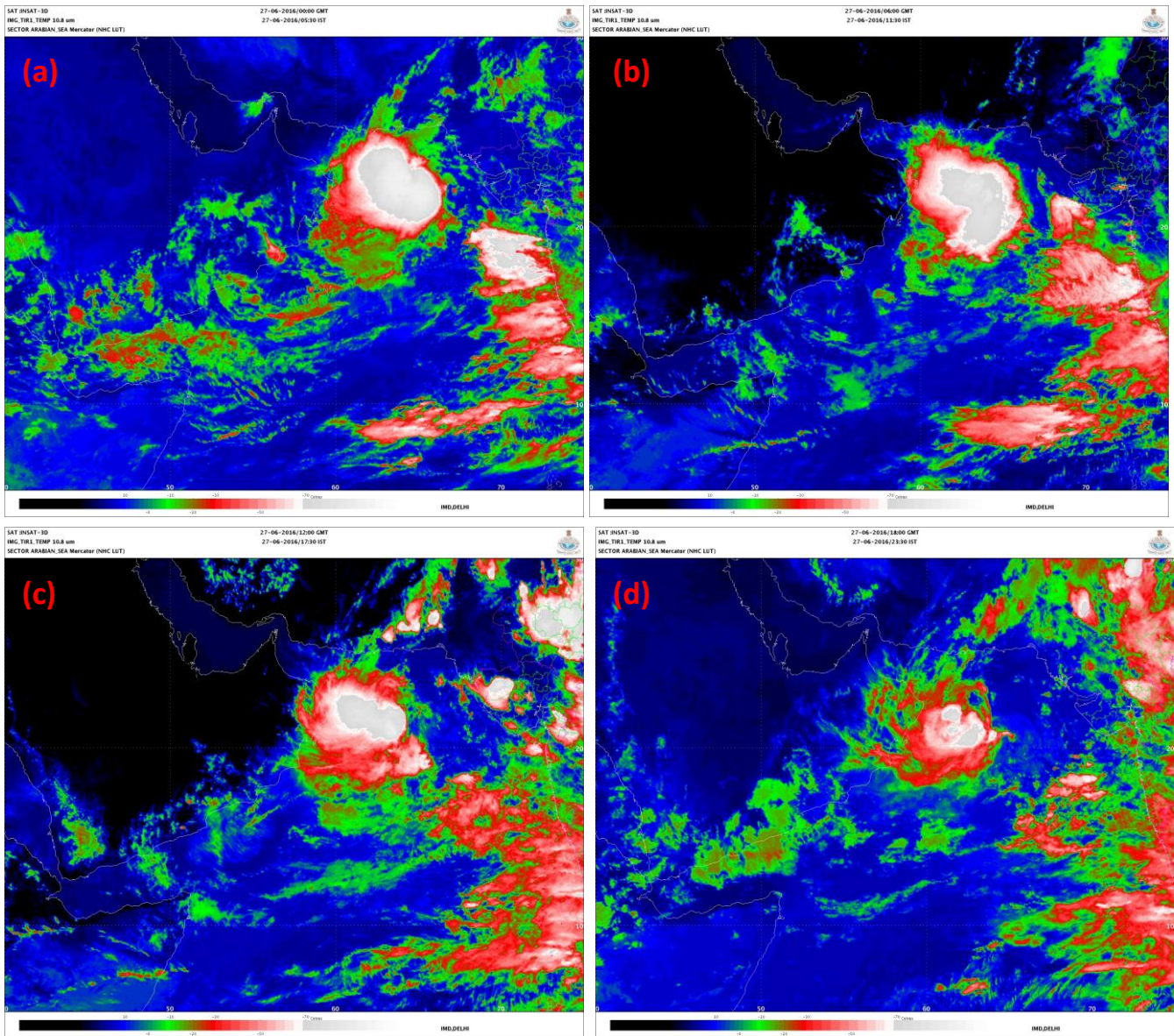


Fig.3 (i) INSAT 3D based enhanced color imagery of depression at (a) 0000 UTC, (b) 0600 UTC, (c) 1200 UTC and (d) 1800 UTC of 27th June 2016

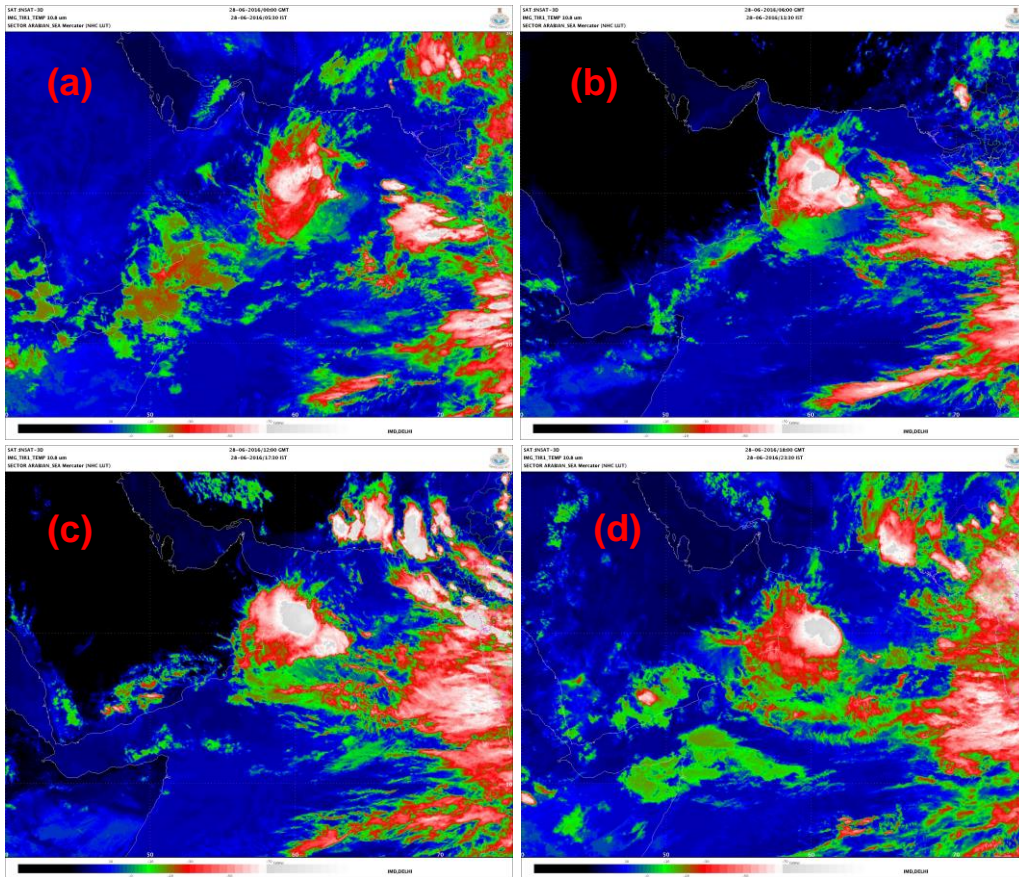


Fig.3 (ii) INSAT 3D based enhanced color imagery of depression at (a) 0000 UTC, (b) 0600 UTC, (c) 1200 UTC and (d) 1800 UTC of 28th June 2016

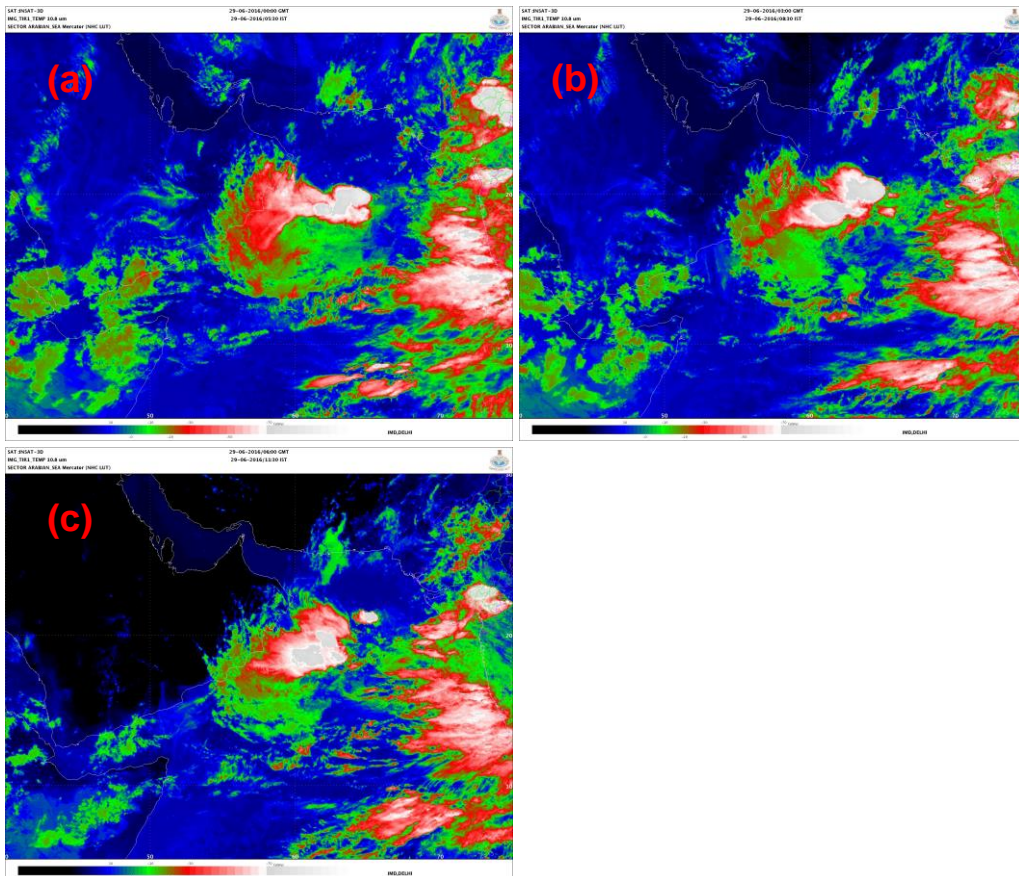


Fig.3 (iii) INSAT 3D based enhanced color imagery of depression at (a) 0000 UTC, (b) 0300 UTC and (c) 0600 UTC of 29th June 2016

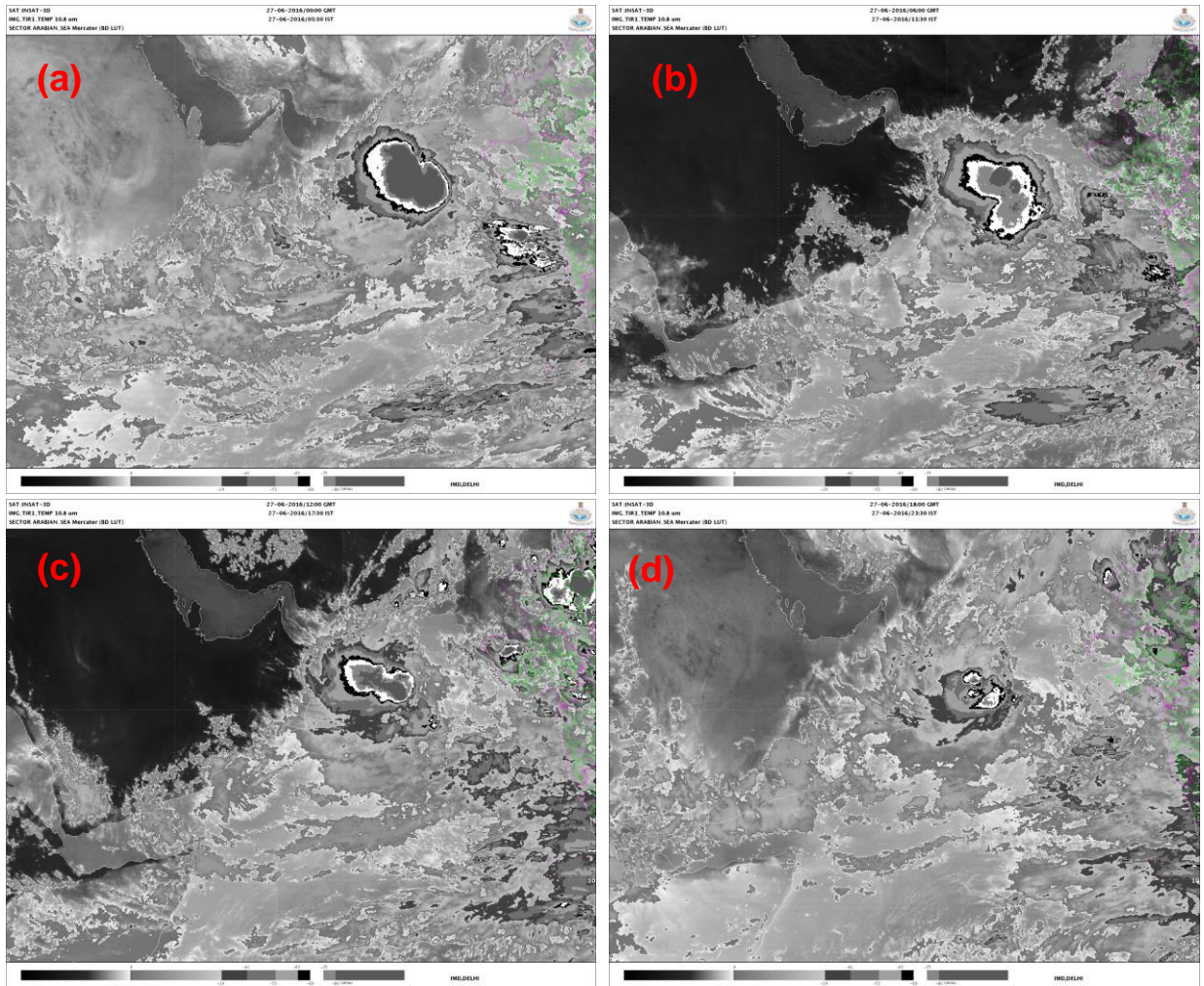


Fig.4 (i) INSAT 3D based IR grey imagery of depression at (a) 0000 UTC, (b) 0600 UTC, (c) 1200 UTC and (d) 1800 UTC of 27th June 2016

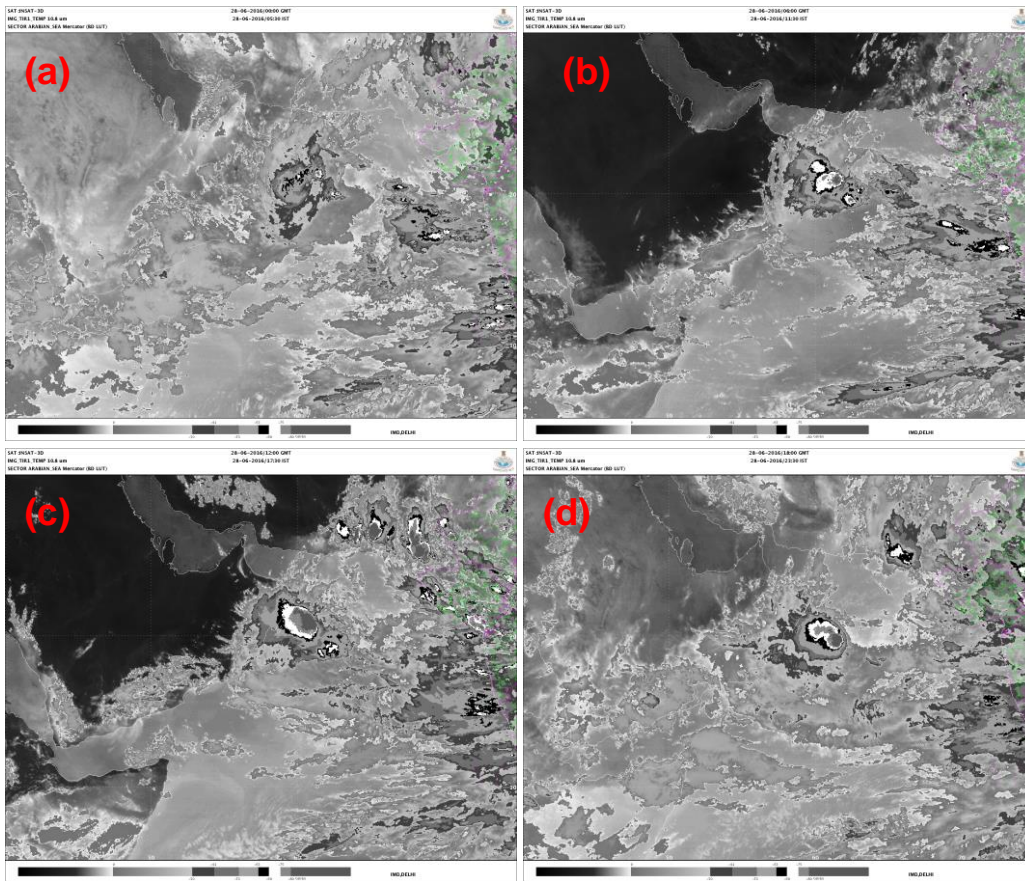


Fig.4 (ii) INSAT 3D based IR grey imagery of depression at (a) 0000 UTC, (b) 0600 UTC, (c) 1200 UTC and (d) 1800 UTC of 28th June 2016

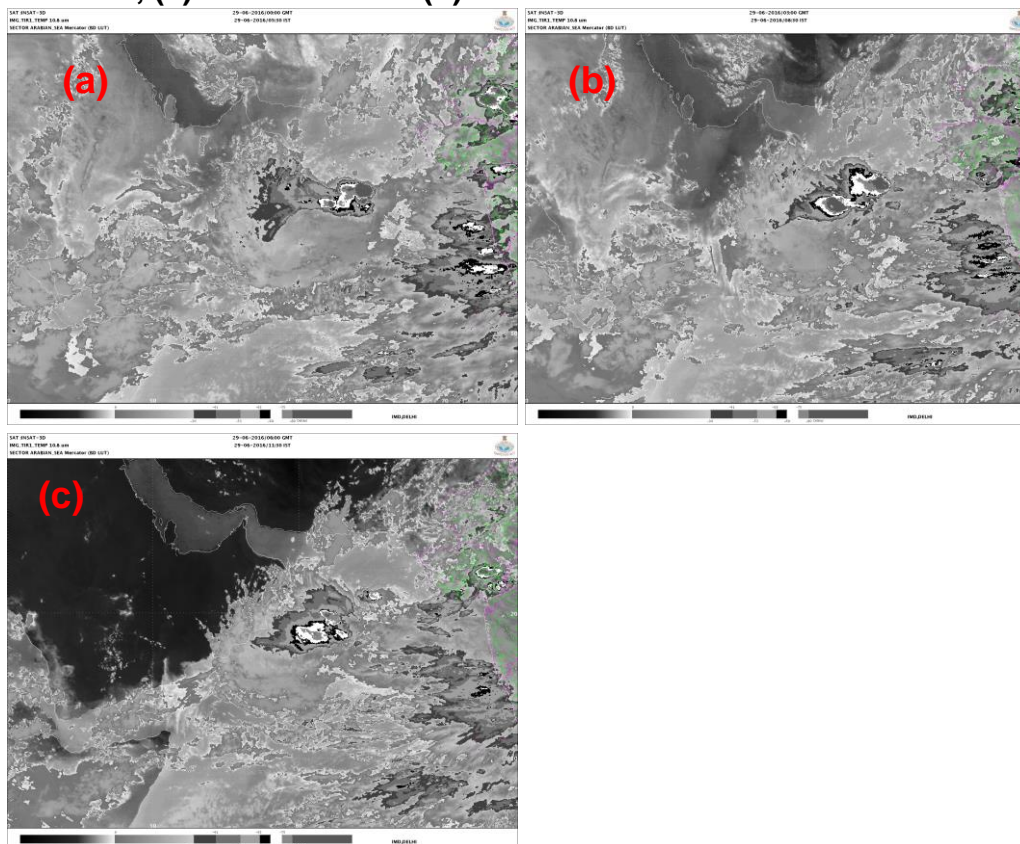


Fig.4 (iii) INSAT 3D based IR grey imagery of depression at (a) 0000 UTC, (b) 0300 UTC and (c) 0600 UTC of 29th June 2016

4. Dynamical features

The dynamical features of the system have been analysed based on the Global Forecast System (GFS) analysis. The mean sea level pressure (MSLP), surface wind and wind at 850, 500 and 200 hPa levels based on GFS analysis are presented in Fig.5 for 27-29th June 2013. The GFS model underestimated the intensity of the system throughout its life period.

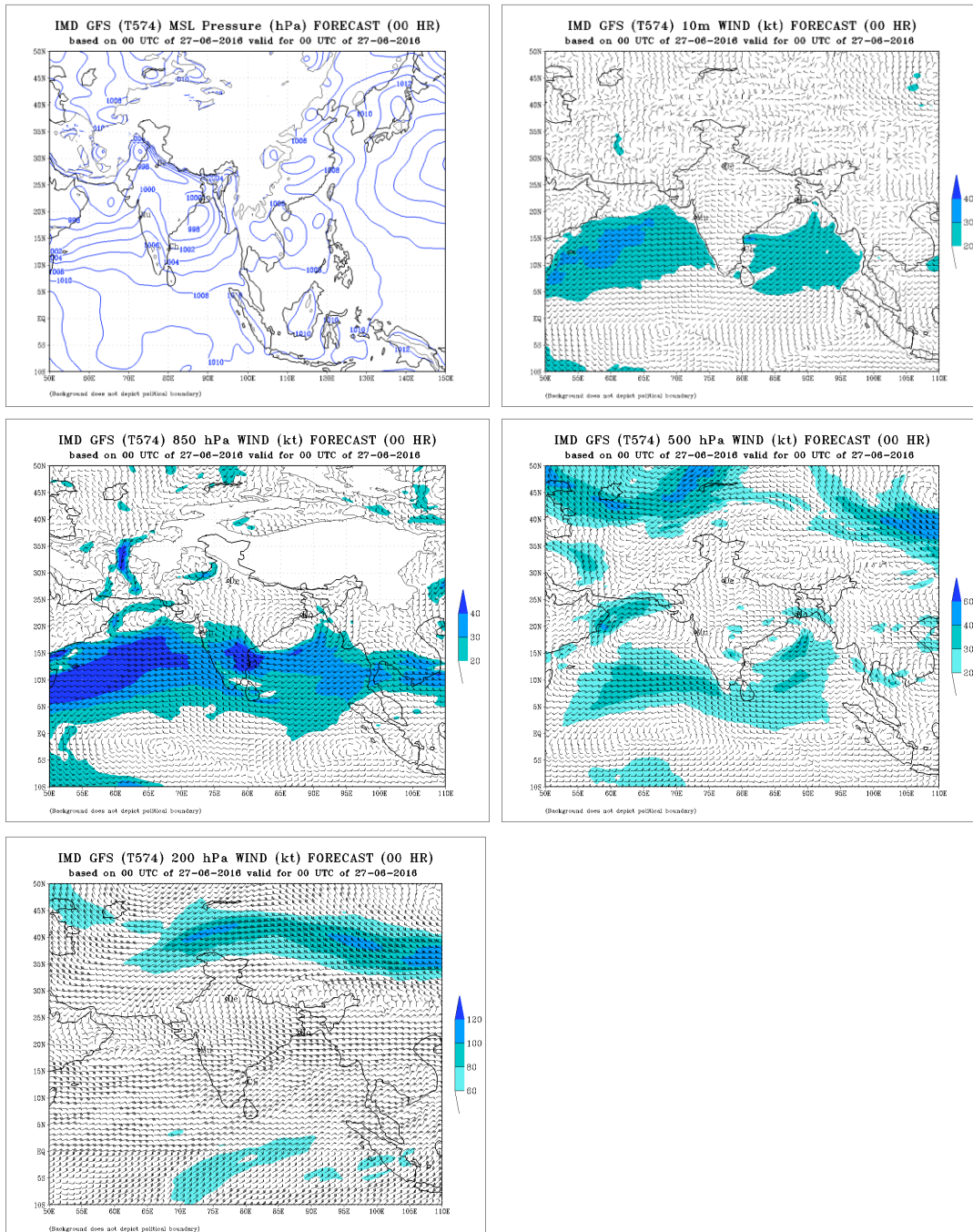


Fig.5 (i) IMD GFS Model analyses of mean sea level pressure (MSLP), surface wind and wind at 850, 500 and 200 hPa levels at 0000 UTC of 27th June 2016.

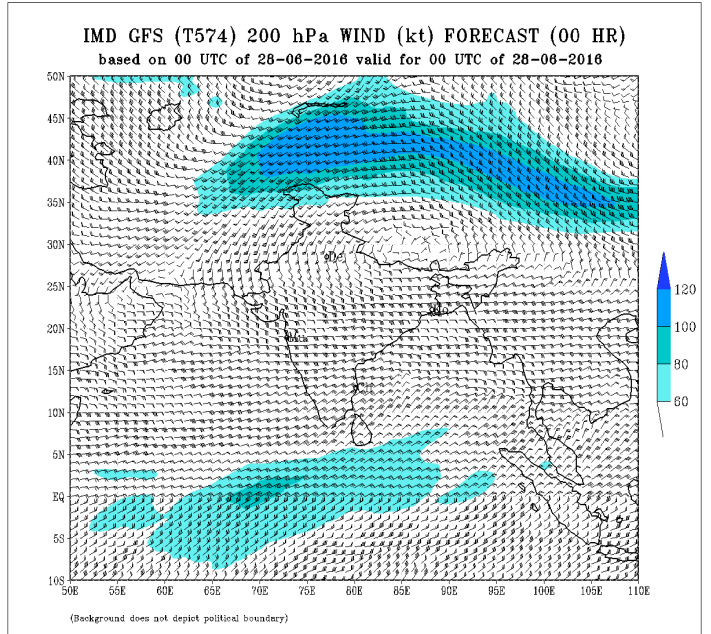
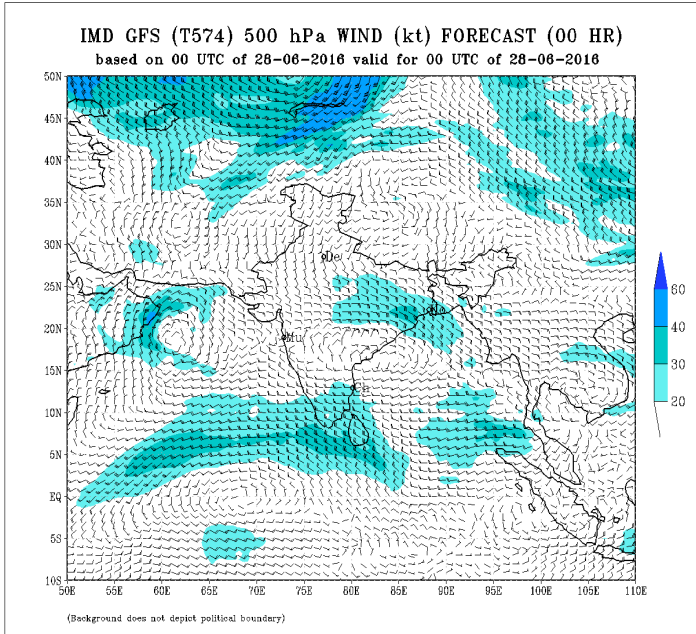
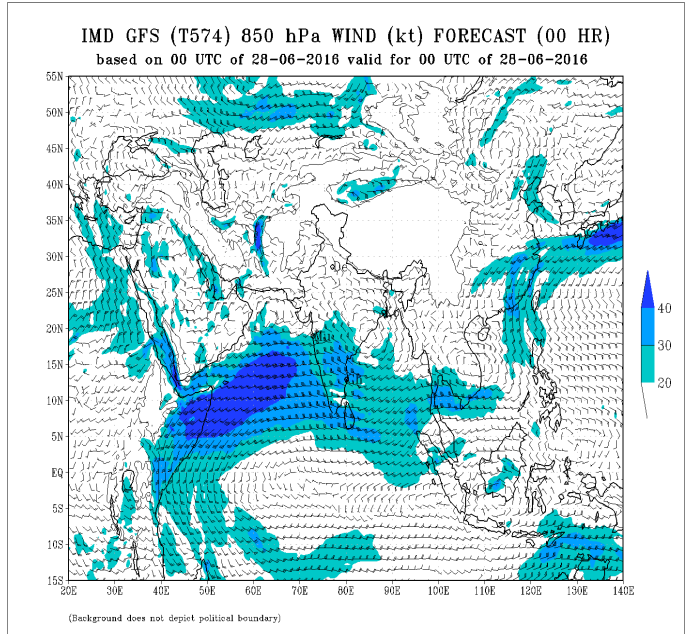
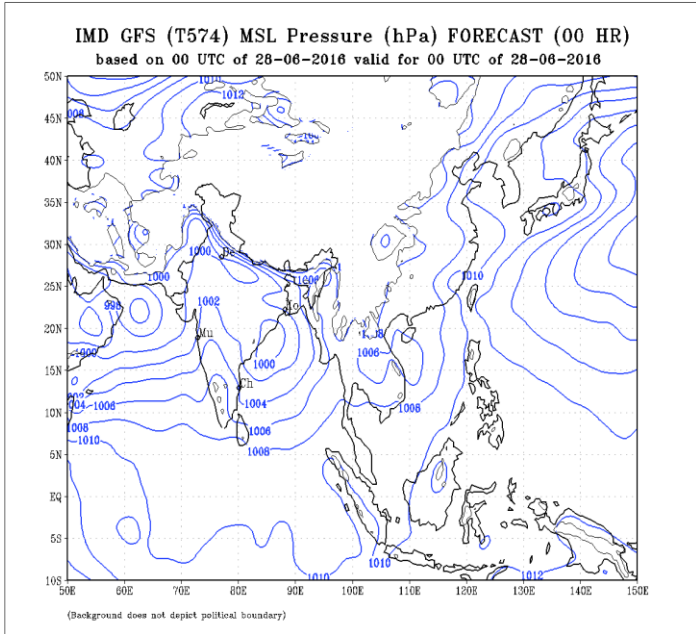


Fig.5 (ii) IMD GFS Model analyses of mean sea level pressure (MSLP), and wind at 850, 500 and 200 hPa levels at 0000 UTC of 28th June 2016

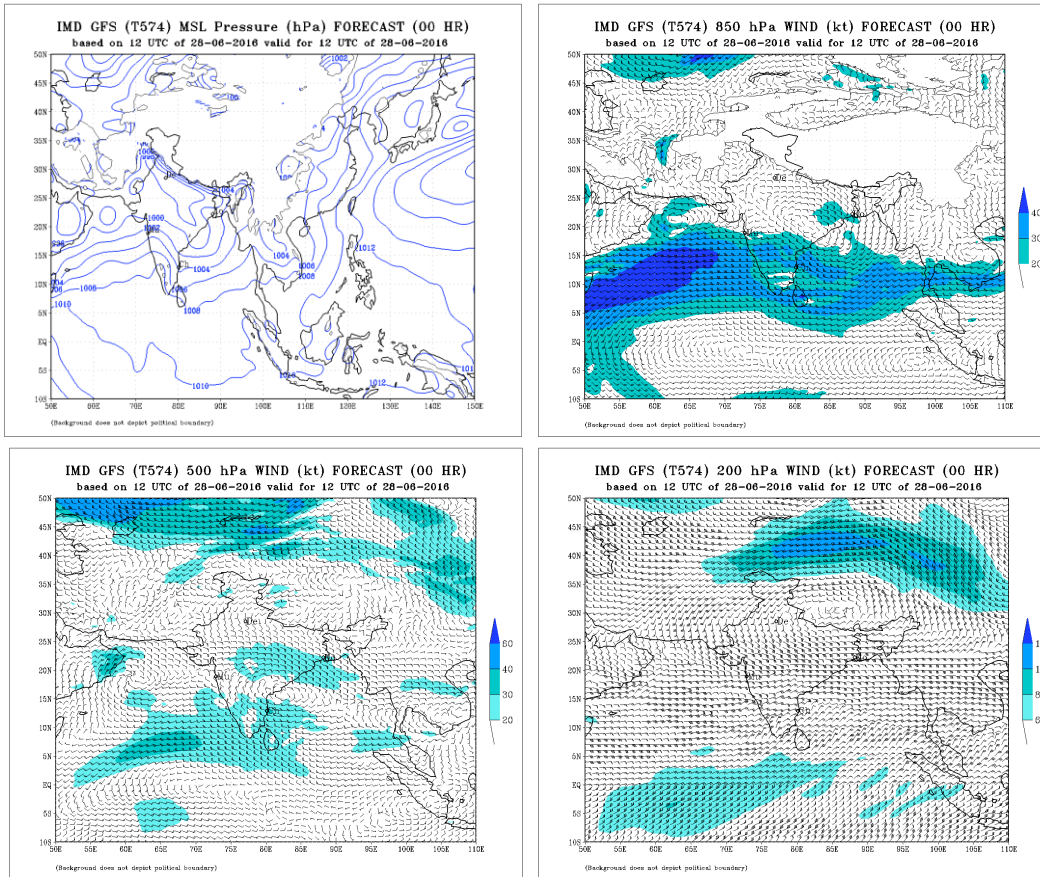


Fig.5 (iii) IMD GFS Model analyses of mean sea level pressure (MSLP), and wind at 850, 500 and 200 hPa levels at 1200 UTC of 28th June 2016

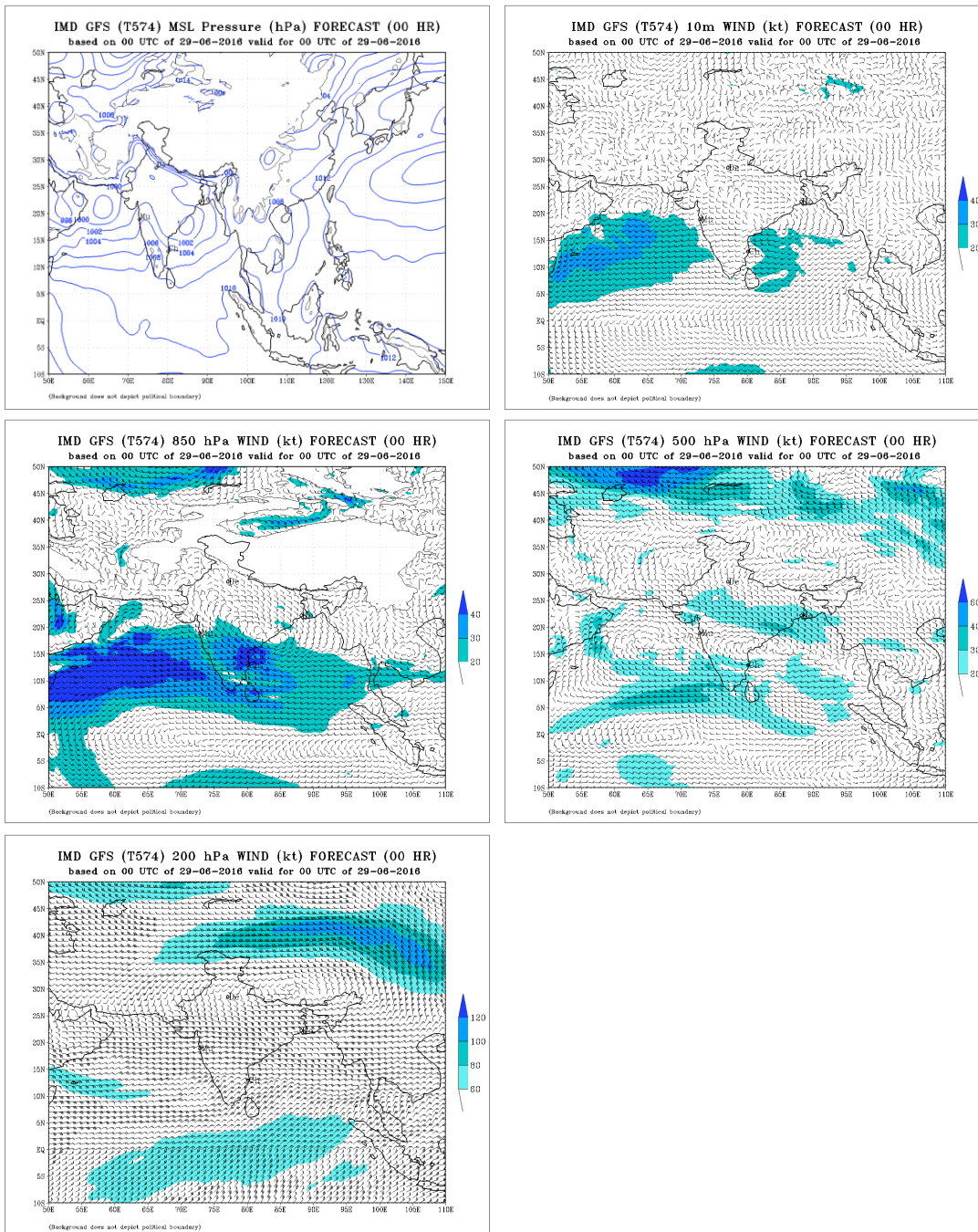


Fig.5 (iv) IMD GFS Model analyses of mean sea level pressure (MSLP), surface wind and wind at 850, 500 and 200 hPa levels at 0000 UTC of 29th June 2016

5. Warning services:

The Cyclone Warning Division/ Regional Specialized Meteorological Centre (RSMC)-Tropical Cyclone, IMD, New Delhi mobilized all its resources for monitoring and prediction of depression. It issued 3/6 hourly warning/advisory bulletins to national disaster management agencies including National Disaster Management (NDM), Ministry of Home Affairs (MHA), concerned state Govts. and other users at regular intervals. It also issued advisories to World Meteorological Organization

(WMO)/Economic and Social Cooperation for Asia and the Pacific (ESCAP) Panel member countries including Bangladesh, Myanmar, Thailand, Pakistan, Oman, Sri Lanka, Maldives and Yemen during depression period.

The number of bulletins issued by the Regional Specialised Meteorological Centre-Tropical Cyclone, New Delhi and by Cyclone Warning Division, IMD, New Delhi is given below.

- National Bulletins : 06
- Special Tropical Weather Outlook WMO/ESCAP Panel countries : 05

6. Realized weather

There was no adverse weather over Indian coast due to the depression as the depression moved away westwards from the Indian coast.
