



**Ministry of Earth Sciences  
India Meteorological Department  
Cyclone Warning Division, New Delhi**



**FDP (Cyclone) NOC Report Dated 09<sup>th</sup> November, 2019**

**Time of Issue: 1200 UTC**

**Synoptic features:**

- The Very Severe Cyclonic Storm 'Bulbul' (Pronounced as Bul bul) over northwest Bay of Bengal moved nearly northwards and lay centred at 0900 UTC of today, the 9<sup>th</sup> November 2019, over northwest Bay of Bengal, near Lat.20.9°N and Long. 87.9°E about 140 km east-northeast of Paradip (Odisha), 85 km south of Sagar Islands (West Bengal), 120 km east of Chandbali, 120 km south-southeast Balasore, 90 km south-southeast of Digha, 185 km south-southwest of Kolkata and 270 km west-southwest of Khepupara (Bangladesh). It is very likely to weaken gradually, move northeastwards and cross West Bengal – Bangladesh Coasts between Sagar Islands (West Bengal) and Khepupara (Bangladesh), across Sunderban delta by late evening/ night (between 2000 & 2300 hours IST) of 9<sup>th</sup> November as a Severe Cyclonic Storm with maximum sustained wind speed of 110-120 Kmph gusting to 135 Kmph.

**Dynamical and thermodynamical features**

**Sea Surface Temperature (SST):**

Sea Surface Temperature is around 25-28°C over most parts of central Arabian Sea. It increases to 28-30°C over north Arabian Sea and south Arabian Sea.

SST is around 27-28 °C over the system area and also in rest of north BoB. It is around 28 - 30°C over most parts of the BOB with higher values over central BoB.

**Tropical Cyclone Heat Potential (TCHP):**

Tropical Cyclone Heat Potential (TCHP) is 20-40 kJ/cm<sup>2</sup> over most parts of central Arabian Sea and north Arabian sea. There is a narrow strip of value 50-70 kJ/cm<sup>2</sup> off west coast of India. It is around 80-100 kJ/cm<sup>2</sup> over south Arabian Sea.

TCHP is around 30-50 kJ/cm<sup>2</sup> over the system area and is around 80-100 kJ/cm<sup>2</sup> also over rest of the BOB.

**Relative Vorticity:**

Cyclonic relative vorticity at 850 hPa of value 250 X10<sup>-6</sup>s<sup>-1</sup> is seen around the centre of Very Severe Cyclonic Storm Bul bul over northwest BoB.

Cyclonic relative vorticity at 850 hPa of value 10-20X10<sup>-6</sup>s<sup>-1</sup> is seen over the eastcentral Arabian Sea off Maharashtra coast.

**Low level Convergence:**

An area of lower level convergence about 20 x 10<sup>-5</sup>s<sup>-1</sup> is seen to the south of the centre of VSCS Bul bul over NW BoB.

No significant positive lower level convergence area is seen over Arabian Sea.

**Upper level Divergence:**

Upper level divergence of value 40x10<sup>-5</sup> s<sup>-1</sup> to the northeast of VSCS Bul bul over NW BoB.

There is no area of positive upper level divergence over Arabian Sea.

**Wind Shear:**

Wind shear is high over north and central Arabian Sea. It is low to moderate over south AS.

Wind shear is moderate to high over the system area and is becoming high in the forecast direction of the system.

**Wind Shear Tendency:**

The wind shear tendency is positive over western parts of westcentral BoB. It is negative or neutral elsewhere.

It is negative over some parts of southeast Arabian Sea and Comorin area and also over north Arabian Sea. It is positive or neutral over rest Arabian Sea.

**Upper tropospheric ridge:**

The upper tropospheric ridge at 200 hPa runs roughly along 21°N over BoB.

**Satellite observations based on INSAT imagery:****Arabian Sea:-**

As per the satellite imagery at 0900 UTC of 08<sup>th</sup> November, 2019, scattered low to medium clouds with embedded isolated weak to moderate convection lies over Gulf of Cambay and adjoin south Gujarat coast and extreme north Maharashtra in association with a low level circulation over the area.

**Bay of Bengal & Andaman Sea:-**

According to 0900 UTC satellite imagery, the intensity of the system (VSCS Bul bul) is T4.5. It has eye pattern. The eye temperature is minus 7.6<sup>0</sup>C. The Associated broken low/medium clouds with embedded intense to very intense convection lies over NW and adjoining WC BoB to the north of Lat 18.5<sup>0</sup>N and west of Long 90.0<sup>0</sup>E and also over Jharkhand, east Odisha, Gangetic West Bengal and Bangladesh. The minimum CTT is minus 93<sup>0</sup>C.

**Large scale features****M.J.O. Index:**

MJO index is in Phase 6 with amplitude more than 1. It is likely to remain there for next 2 days and move to phase 7 thereafter.

**Storms and Depression over South China Sea/ South Indian Ocean:**

- a) The Tropical Storm "NAKRI" is located at 0600 UTC of 09<sup>th</sup> near 12.6°N 114.0°E, approximately 442 NM east-northeast of Ho Chi Minh City, Vietnam. Maximum sustained surface winds were estimated at 60 knots. The system is likely to move nearly westwards with marginal weakening and cross Vietnam coast around 13.7<sup>0</sup> N between 1800 UTC on 10<sup>th</sup> and 0000 UTC on 11<sup>th</sup> November.

**NWP Input for FDP Cyclone based on 0000 UTC of today****IMD-GFS T-1534**

- (i) The VSCS on 9<sup>th</sup> over NW BoB moves in a north-northeast direction and crosses West Bengal coast on in the late night of 9<sup>th</sup>/ early hours of 10<sup>th</sup> and weakens over land thereafter.

**IMD-GEFS**

- (i) The VSCS over NW BoB on 9<sup>th</sup> November cross West Bengal coast on 9<sup>th</sup> night and is seen as a CS over coastal regions of Bangladesh on 10<sup>th</sup> and gradually weakens thereafter.

**IMD-WRF**

- (i) The VSCS over NW BoB on 9<sup>th</sup> weakens over the same area without crossing coast.

**NCMRWF-NCUM:**

- (i) The VSCS over NW BOB on 9<sup>th</sup> November is seen to cross Bangladesh coasts in the early hours of 10<sup>th</sup> November and becomes unimportant by 11<sup>th</sup>.

**NCMRWF-UM-Regional Model:**

- (i) The VSCS over NW BoB on 9<sup>th</sup> moves nearly northwards and crosses West Bengal-Bangladesh coasts on in the early hours of 10<sup>th</sup>.

**NEPS Model:**

- (i) The VSCS over NW BoB is seen to cross West Bengal- Bangladesh coasts in the early hours of 10<sup>th</sup> November and weaken rapidly after making landfall.

**ECMWF:**

- i) The VSCS over NW BoB on 9<sup>th</sup> crosses West Bengal- Bangladesh coast in the early hours of 10<sup>th</sup> and becomes unimportant by 11<sup>th</sup>.

**NCEP-GFS:**

- (i) The VSCS over NW BoB on 9<sup>th</sup> November is seen to cross West Bengal coast in the midnight of 9<sup>th</sup> and weaken thereafter.

**ARP-Meteo France : NIL****Dynamical statistical models****IMD Genesis Potential Parameter (GPP):**

- (i) The significant zone of GPP seen over NW BoB on 9<sup>th</sup> November, is seen to cross West Bengal-Bangladesh coasts in the early hours of 10<sup>th</sup>.

**IMD NWP products are available at:**

<http://nwp.imd.gov.in/bias/gfsproducts.php>

<http://nwp.imd.gov.in/bias/wrf27pro.php>

[http://www.rsmcnewdelhi.imd.gov.in/NWP\\_CYC/Analysis.htm](http://www.rsmcnewdelhi.imd.gov.in/NWP_CYC/Analysis.htm) or

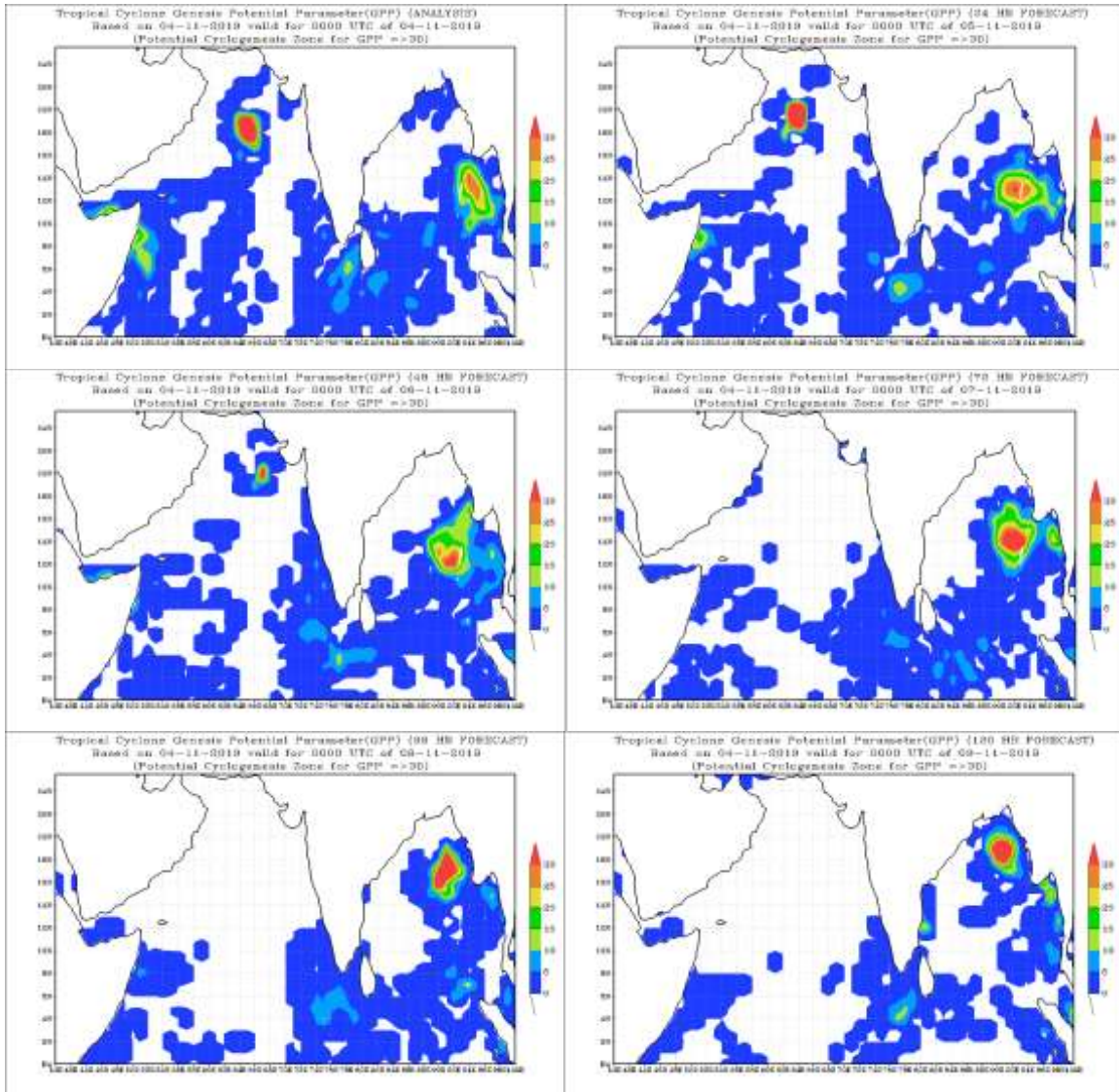
[http://www.rsmcnewdelhi.imd.gov.in/NWP\\_CYC/<HH> hrs.htm](http://www.rsmcnewdelhi.imd.gov.in/NWP_CYC/<HH> hrs.htm)

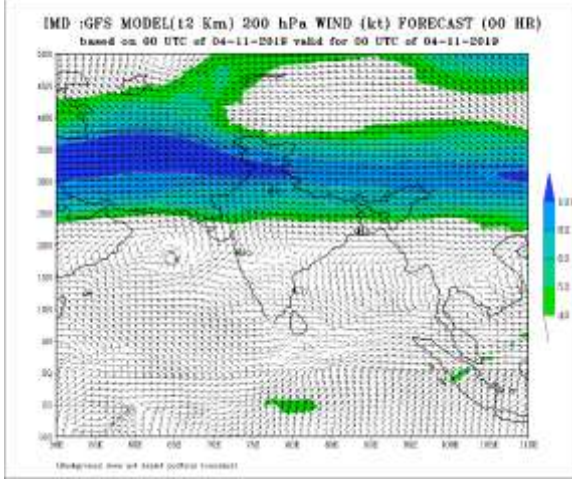
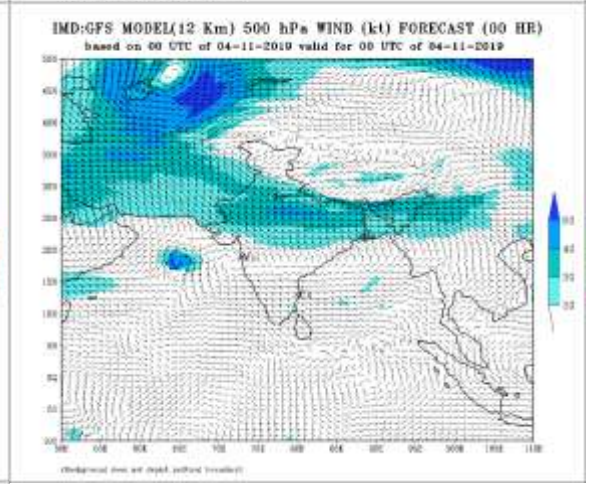
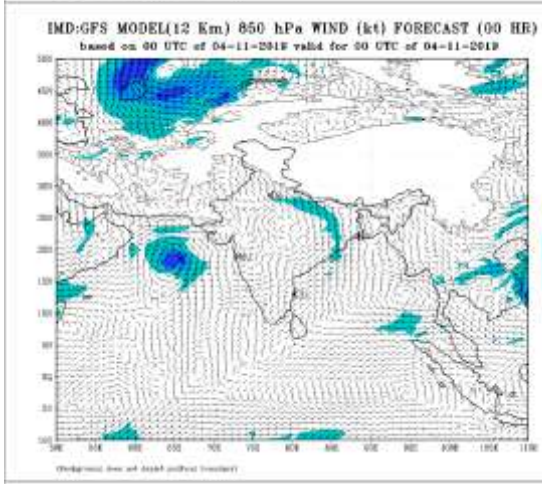
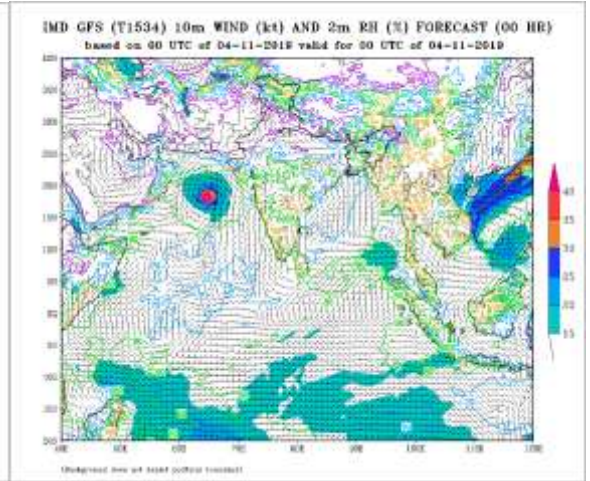
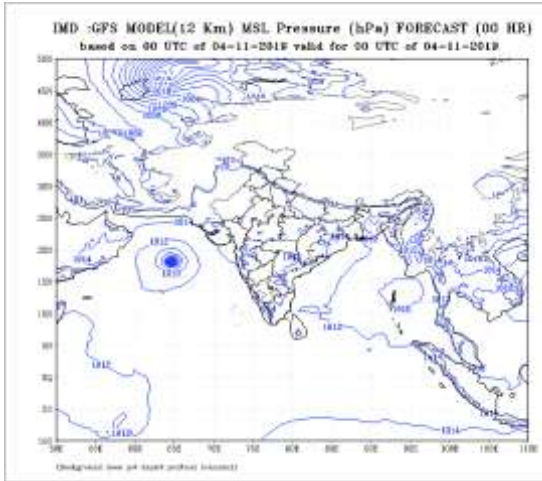
<HH> are forecast hours i.e. 24, 48, 72 and etc.

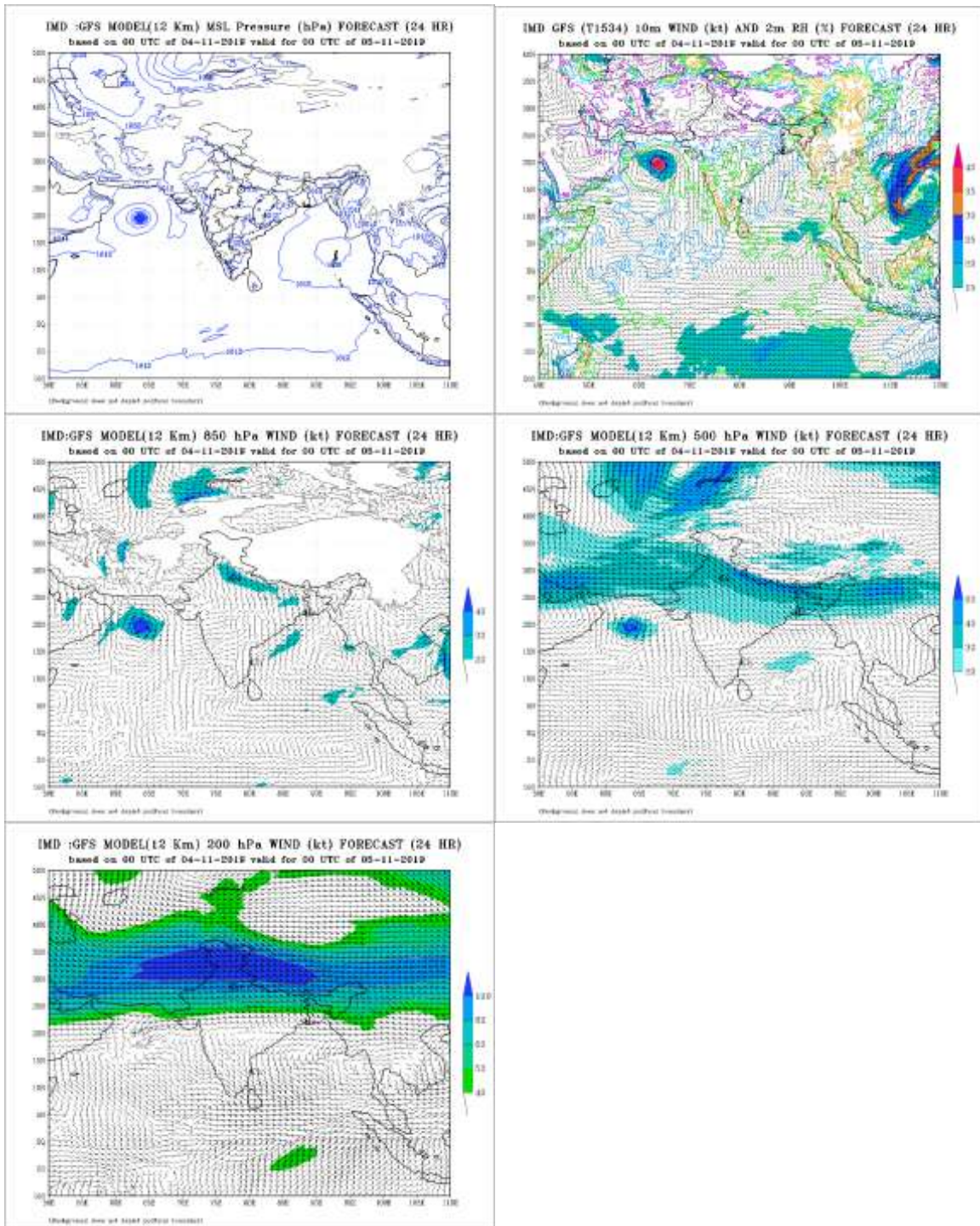
**Summary and Conclusion:**

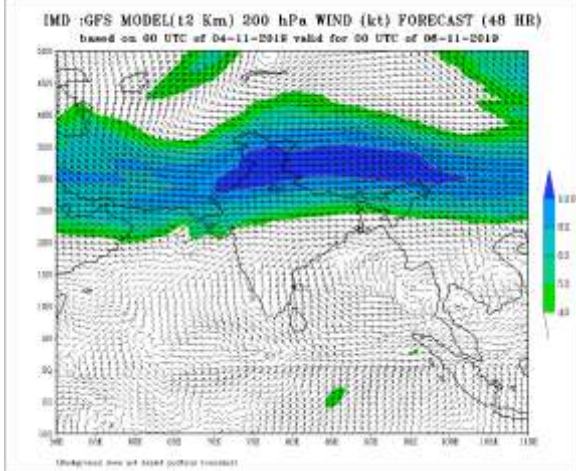
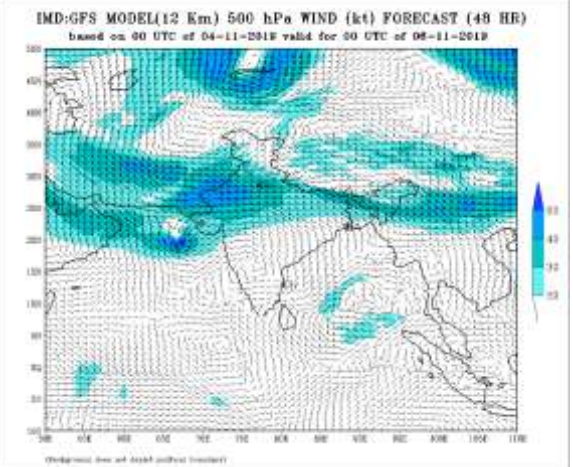
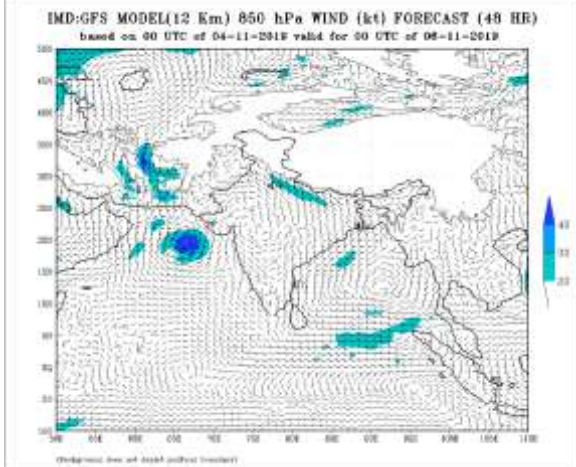
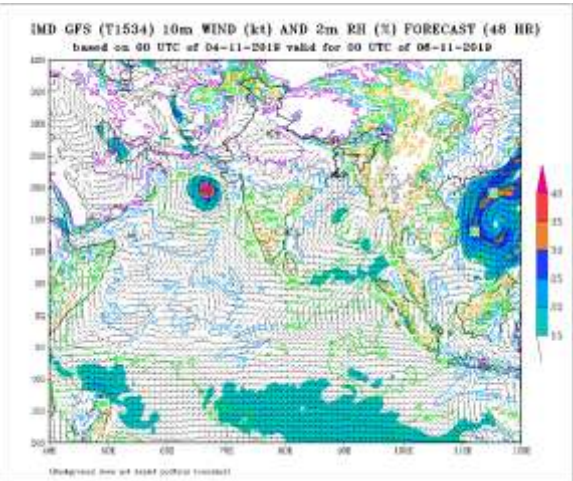
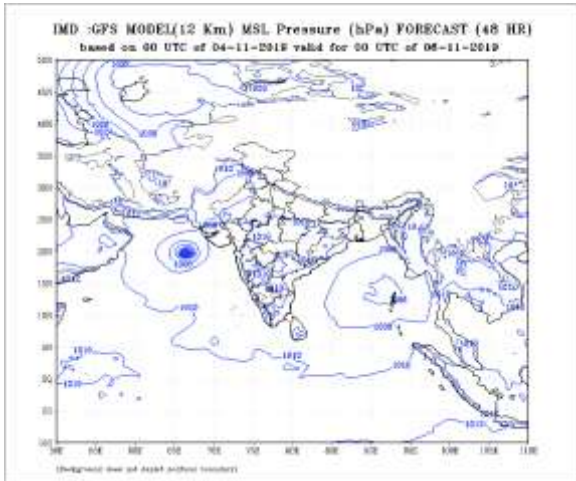
Considering the environmental parameters, the low level relative vorticity is around  $250 \times 10^{-5} \text{ sec}^{-1}$  around the system centre. The lower level convergence is about  $20 \times 10^{-5} \text{ s}^{-1}$  to the south of the system centre and the upper level divergence is about  $30\text{-}40 \times 10^{-5} \text{ s}^{-1}$  to the northeast of the system centre. The vertical wind shear is 25-30 knots to the north-northwest of the system centre and is also further increasing along the forecast track and becoming high along West Bengal – Bangladesh coasts. The ridge runs roughly along 21°N over Bay of Bengal region. Tropical cyclone heat potential of 30-50 kJ/cm<sup>2</sup> around the system area in northwest BoB. Sea surface temperature is between 27-28°C around the system and also in north BoB. As the system is lying near the upper tropospheric ridge line along 21° N. Hence, the system is expected to move northeastwards under the influence of southwesterly winds to the north of the ridge. The system will experience high vertical wind shear as well as cooler SST over the north Bay of Bengal. Due to all these environmental conditions, the system is expected to weaken slightly while moving northeastwards and cross West Bengal-Bangladesh coasts between Sagar Islands (42903) and Khepupara (41984), across Sunderban Delta during 1430-1730 UTC of 9<sup>th</sup> November as a severe cyclonic storm. Most of the NWP models are in agreement with the above analysis.

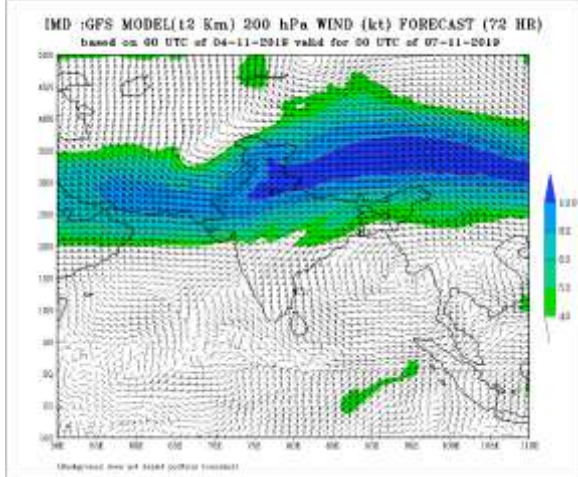
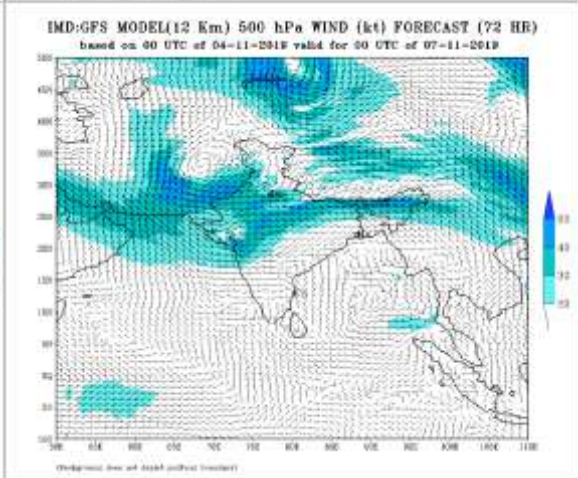
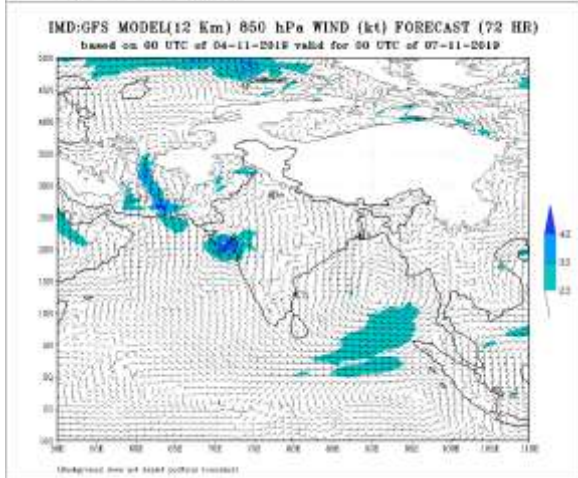
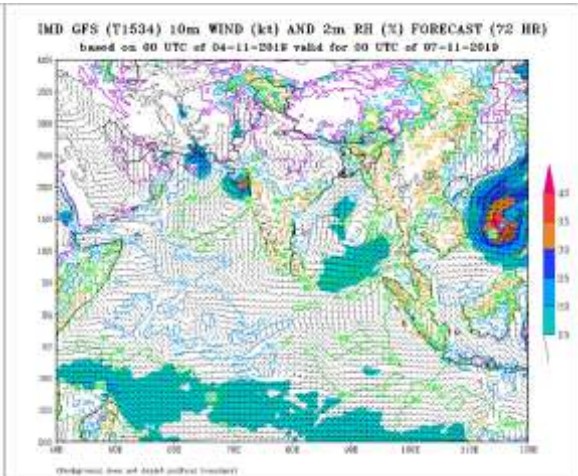
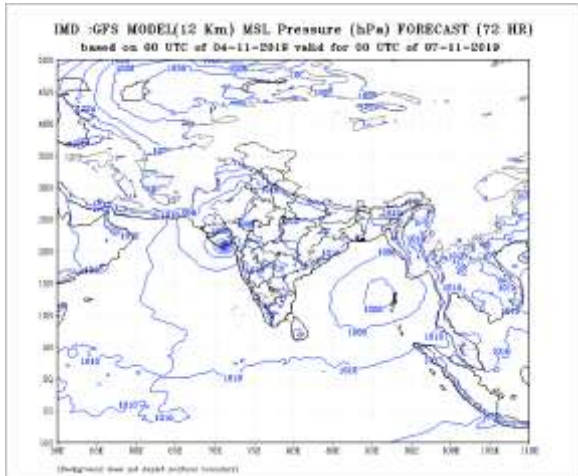
**Advisory: IOP for North Odisha- West Bengal coasts during 9<sup>th</sup> and 10<sup>th</sup> November 2019.**





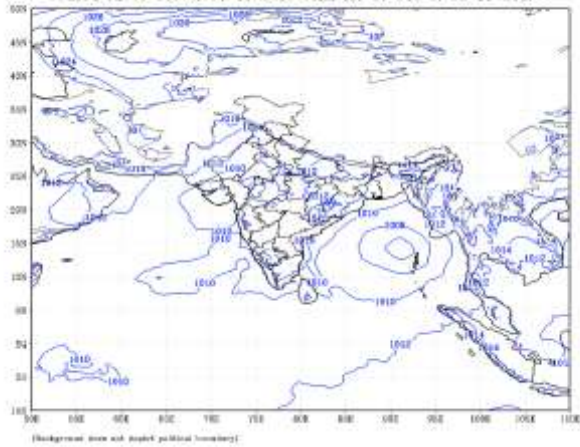




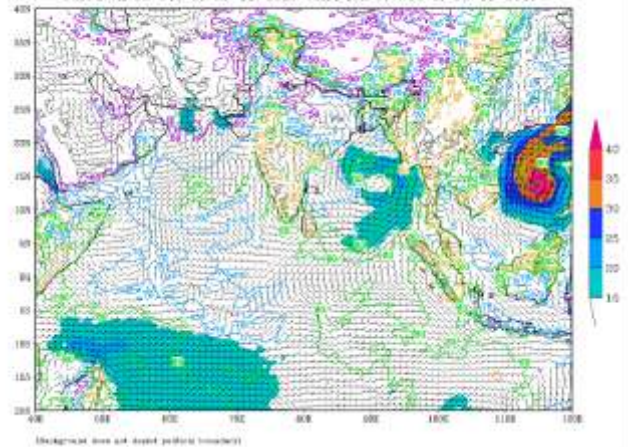




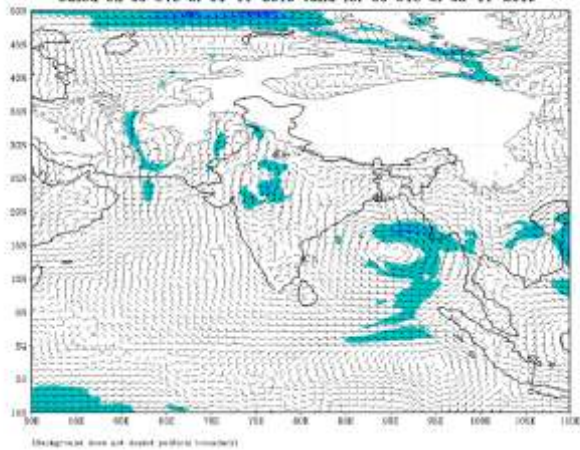
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (96 HR)  
based on 00 UTC of 04-11-2019 valid for 00 UTC of 08-11-2019



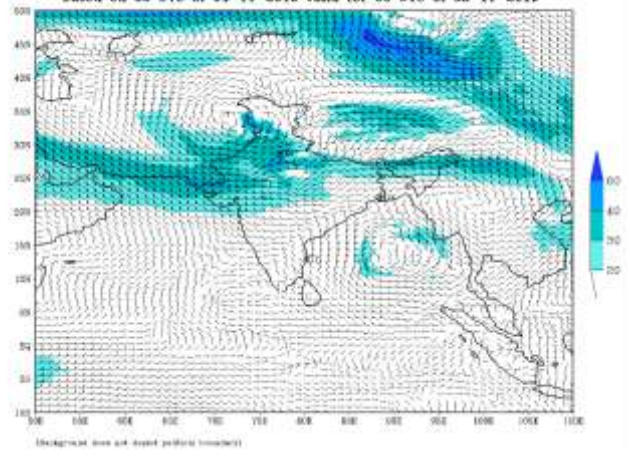
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (96 HR)  
based on 00 UTC of 04-11-2019 valid for 00 UTC of 08-11-2019



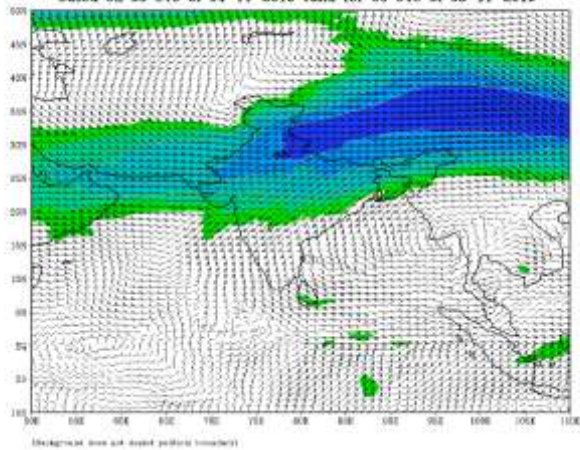
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (96 HR)  
based on 00 UTC of 04-11-2019 valid for 00 UTC of 08-11-2019



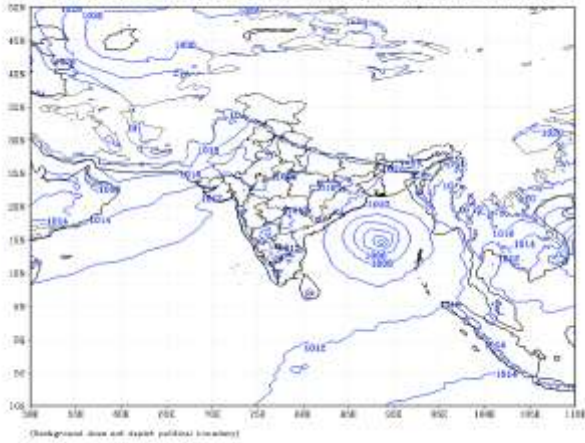
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (96 HR)  
based on 00 UTC of 04-11-2019 valid for 00 UTC of 08-11-2019



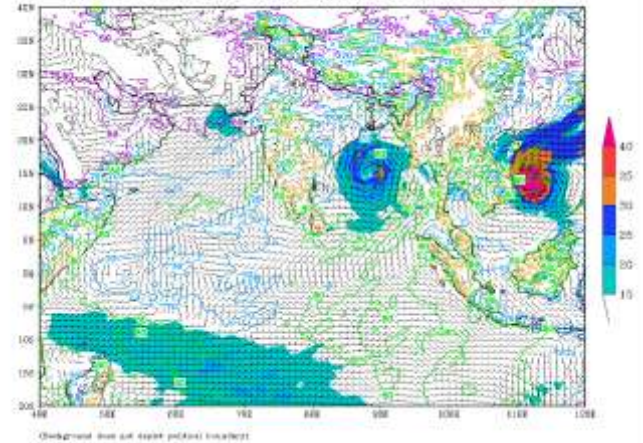
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)  
based on 00 UTC of 04-11-2019 valid for 00 UTC of 08-11-2019



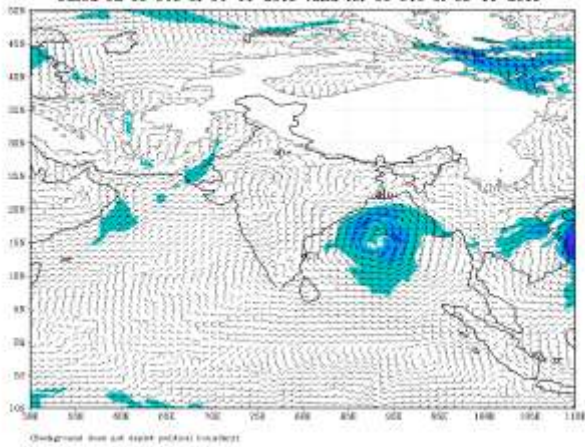
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)  
based on 00 UTC of 04-11-2019 valid for 00 UTC of 09-11-2019



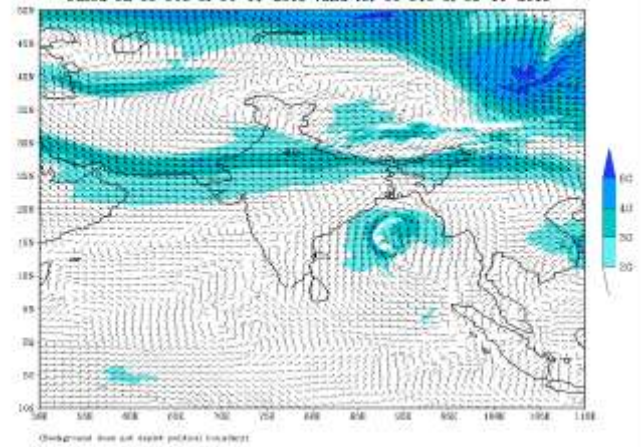
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (120 HR)  
based on 00 UTC of 04-11-2019 valid for 00 UTC of 09-11-2019



IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)  
based on 00 UTC of 04-11-2019 valid for 00 UTC of 09-11-2019



IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (120 HR)  
based on 00 UTC of 04-11-2019 valid for 00 UTC of 09-11-2019



IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)  
based on 00 UTC of 04-11-2019 valid for 00 UTC of 09-11-2019

