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

# FDP (Cyclone) NOC Report Dated 9th December, 2019

**Time of Issue: 1200 UTC**

## Synoptic features:

- Yesterday's depression over southwest Arabian Sea moved west-northwestwards and intensified into a deep depression at 0000 UTC of 9th December, 2019. At 0900 UTC it lay centered over southwest Arabian Sea near latitude 10.6°N and longitude 59.2°E, about 640 km east-southeast of Socotra Island (Yemen) and 1870 km west-northwest of Kochi (Kerala). It is very likely to weaken into a depression during next 06 hours. It is very likely to move westwards for some more time and west-southwestwards thereafter.
- A trough in easterlies runs over southwest Bay of Bengal off Sri Lanka coast upto 0.9 km above mean sea level

## Dynamical and thermodynamical features

**Sea Surface Temperature (SST):**

Sea Surface Temperature is around 28°C over the system area.

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

Tropical Cyclone Heat Potential (TCHP) is less than 40-50 kJ/cm$^2$ over system area.

**Relative Vorticity:**

Cyclonic relative vorticity of value 50x10$^{-5}$ s-1 is seen around the system center in southwest Arabian Sea.

**Low level Convergence:**
Positive lower level convergence of value 10x10$^{-5}$ s$^{-1}$ is seen to the south of the system centre.

**Upper level Divergence:**
Positive upper level divergence of value 10x10$^{-5}$ s$^{-1}$ is seen around the depression area over southwest Arabian Sea.

**Wind Shear:**
Wind shear is low to moderate (15-20 knots) over system area.

**Wind Shear Tendency:**
The wind shear tendency is negative or neutral over the system area in southeast Arabian Sea.

**Upper tropospheric ridge:**
The upper tropospheric ridge at 200 hPa runs roughly along 13°N over Arabian Sea.

## Satellite observations based on INSAT imagery:

**Arabian Sea:-**
As per the satellite imagery of 0900 UTC on 09th December, 2019, the intensity of the vortex over southwest and adjoining southeast Arabian Sea is T 1.5/ C.I 2.0. Associated broken low to medium clouds with embedded intense to very intense convection lies over southwest and adjoining southeast Arabian Sea between lat 9.5$^0$N to 13.5$^0$N and long 58.0$^0$E to 64.0$^0$E. Minimum cloud top temperature is minus 87 deg C.

**Bay of Bengal & Andaman Sea:**

According to 0900 UTC satellite imagery, scattered low/medium clouds with embedded moderate to intense convection lies over southwest BoB.

## Large scale features

**M.J.O. Index:**
MJO index is in Phase 2 with amplitude near to 1. It is likely to remain in the same phase for next 5-6 days with amplitude more than 1.

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

Tropical Cyclone (Belna) located near 14.6°S/45.6°E at 0600 UTC of 9th with a maximum sustained wind speed of 80 knots. It is likely to move south-southwestwards and cross west coast of Mozambique between 0600 and 1800 UTC of 09th and weaken gradually.

## NWP Input for FDP Cyclone based on 0000 UTC of today

**IMD-GFS T-1534:**
A Deep Depression is seen over southwest Arabian Sea on 9th and becomes LOPAR on 10th and becomes less marked on 11th. No other system is seen to form over NIO region during the forecast period.

**IMD-GEFS:**
A Deep Depression is seen over southwest Arabian Sea on 9th and becomes LOPAR on 10th and becomes less marked on 11th.

**IMD-WRF:**

A Deep Depression is seen over southwest Arabian Sea on 9th, which becomes a LOPAR on 10th and becomes less marked on 11th.

**NCMRWF-NCUM**:
This model is not indicating any significant low pressure system in NIO region in the next 10 days.

**NCMRWF-UM-Regional Model**: Indicates no low pressure system in its domain for next 3days Sea.
**NEPS Model:** N.A.

**ECMWF**:
A WML is seen over southwest Arabian Sea on 9th which moves westwards and becomes less marked by 11th. No other system is forecast to form over NIO region for next 8 days.

**NCEP-GFS**:
No significant low pressure system is forecast to form over NIO for the next 10 days.
**ARP-Meteo France :**
No significant low pressure system is forecast to form over NIO for the next 3 days

**Dynamical statistical models**
**IMD Genesis Potential Parameter (GPP):**
The area of significant zone of GPP over southwest Arabian Sea on 9th becomes insignificant by 10th. No other significant GPP zone is forecast for next 5 days.

**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 or

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:**

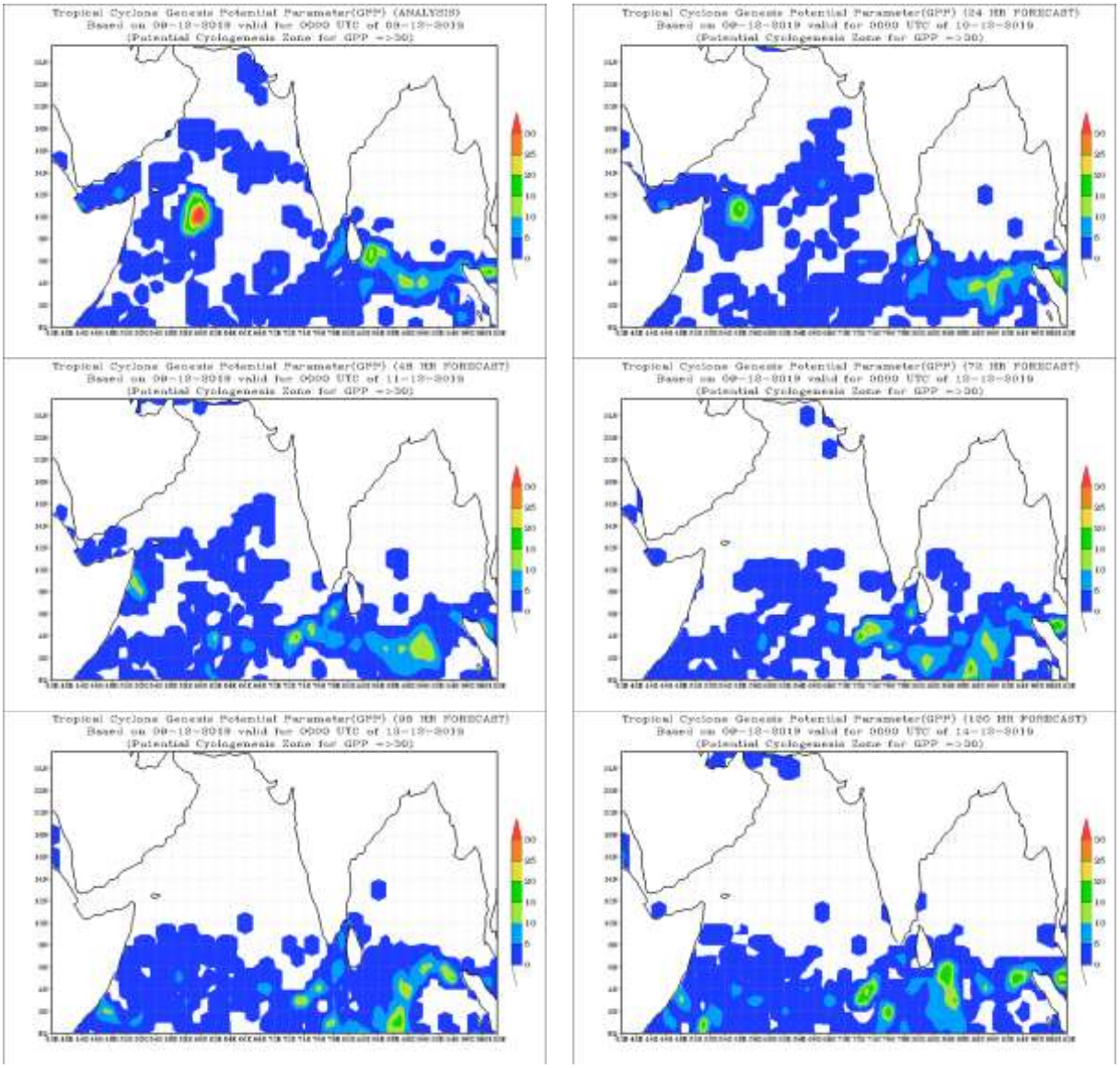
The MJO lies in the phase 2 with amplitude close to 1. It will remain in the same phase during next 4-5 days with amplitude more than 1. The low level relative vorticity is 50 x10-5sec-1 around the system centre. Cyclonic vorticity associated with the system extends upto 500 hpa. The lower level convergence is about 10x10-5s-1 to the south of the system center. The upper level divergence is about 10x10-5s-1 around the system center. The vertical wind shear is low to moderate (10-20 knots) over the system area. The upper tropospheric ridge runs along 13° N.

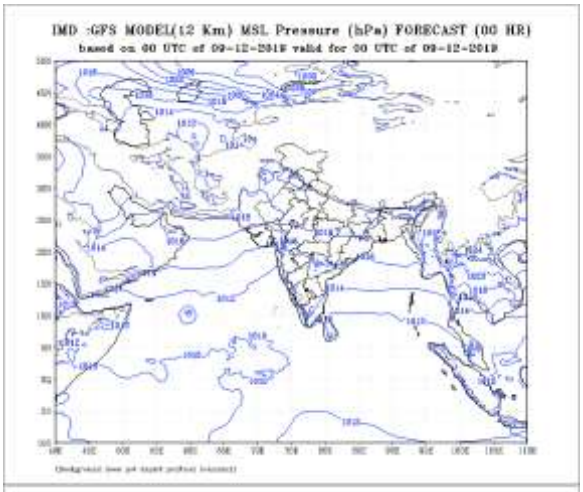
Sea surface temperature over the system area is 28°C and it decreases slightly along the forecast track. Tropical cyclone heat potential is 40-50 kJ/cm2 around the system area and also along the forecast track. Warm air advection is continuing to take place to the system centre. As the system is lying in a marginally favourable environment, it is likely to maintain the intensity of deep depression during next 06 hours.

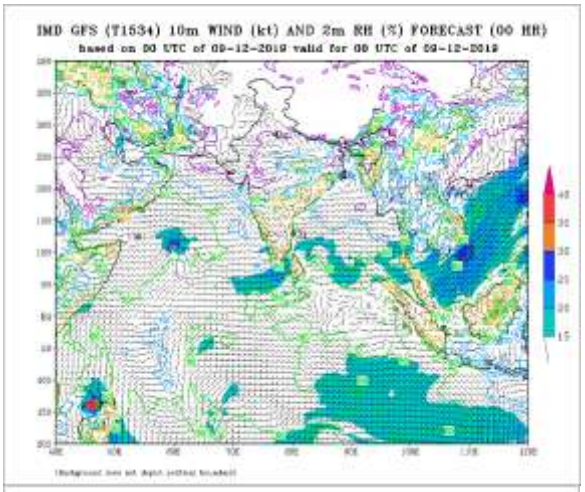
As the system lies to the south of upper tropospheric ridge and is being steered by middle and upper tropospheric winds, it is very likely to move westwards till 1200 UTC of 09$^{th}$ December and then will move west-southwestwards, once it comes in the periphery of an anticyclone located to the west. Majority of numerical models agree with the above analysis.

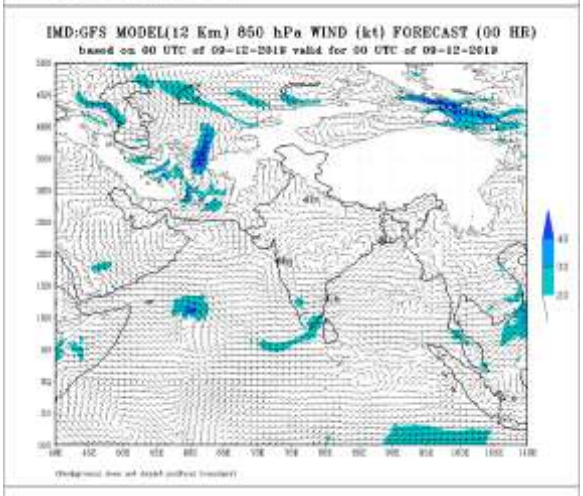
**Advisory: No IOP area for the next 5 days**

Annexure-1


Tropical Cyclone Genesis Potential Parameter(GPP) (ANALYSIS)
Based on 09-18-8019 valid for 0000 UTC of 09-18-8019
(Potential Cyclogenesis Zone for GPP =>50)
Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 09-18-8019 valid for 0000 UTC of 10-18-8019
(Potential Cyclogenesis Zone for GPP =>50)
Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 09-18-8019 valid for 0000 UTC of 11-18-8019
(Potential Cyclogenesis Zone for GPP =>50)
Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 09-18-8019 valid for 0000 UTC of 12-18-8019
(Potential Cyclogenesis Zone for GPP =>50)
Tropical Cyclone Genesis Potential Parameter(GPP) (96 HR FORECAST)
Based on 09-18-8019 valid for 0000 UTC of 13-18-8019
(Potential Cyclogenesis Zone for GPP =>50)
Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
Based on 09-18-8019 valid for 0000 UTC of 14-18-8019
(Potential Cyclogenesis Zone for GPP =>50)


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (00 HR)
based on 00 UTC of 09-12-2018 valid for 00 UTC of 09-12-2018


IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (00 HR)
based on 00 UTC of 09-12-2018 valid for 00 UTC of 09-12-2018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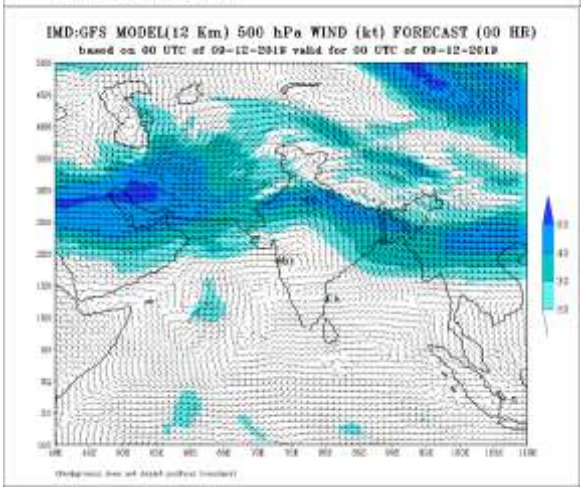
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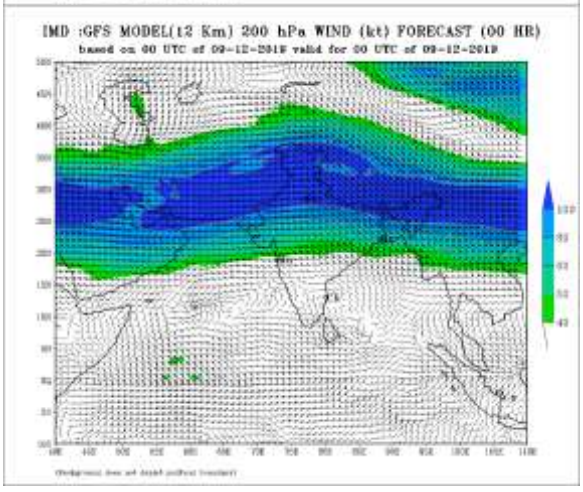
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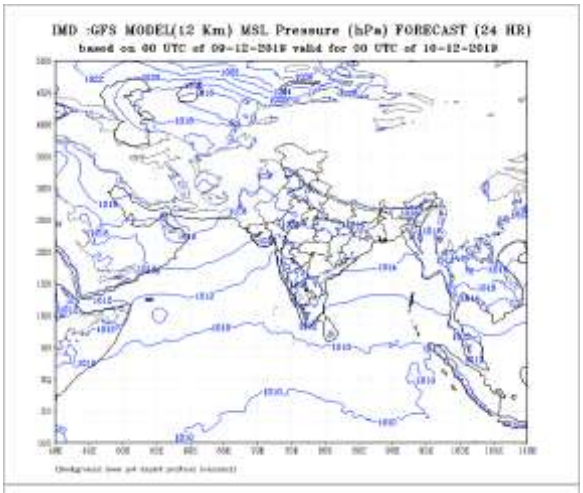
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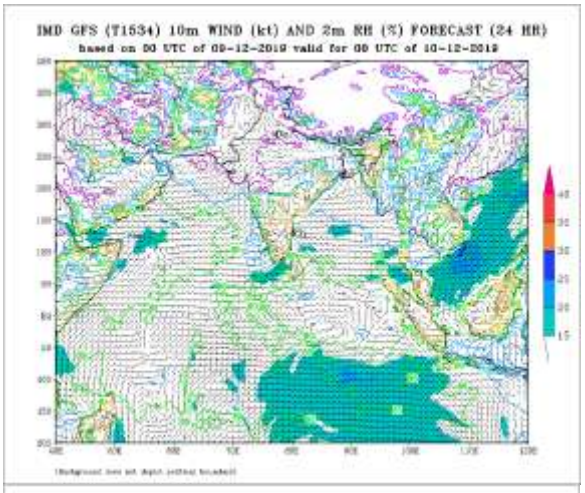
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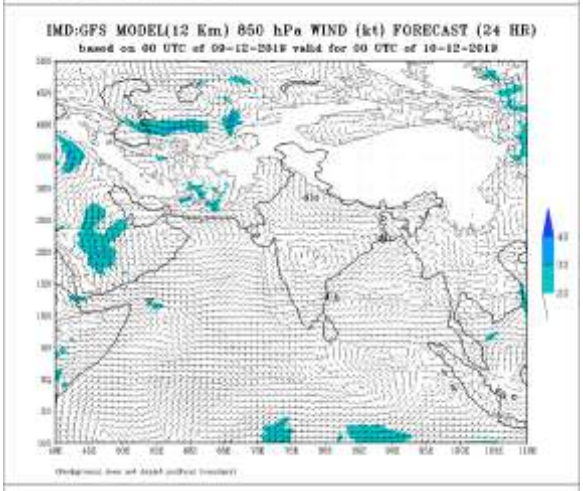
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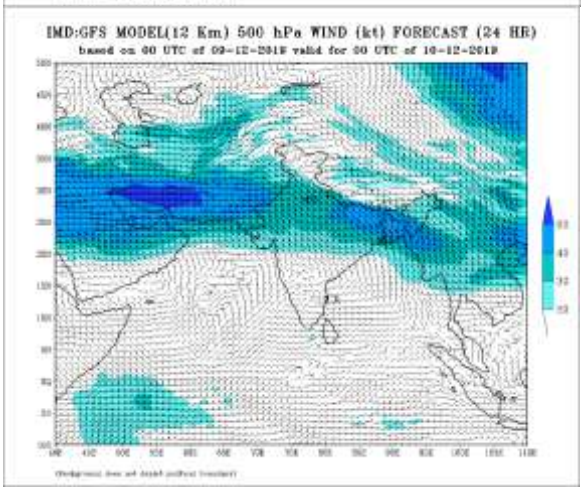
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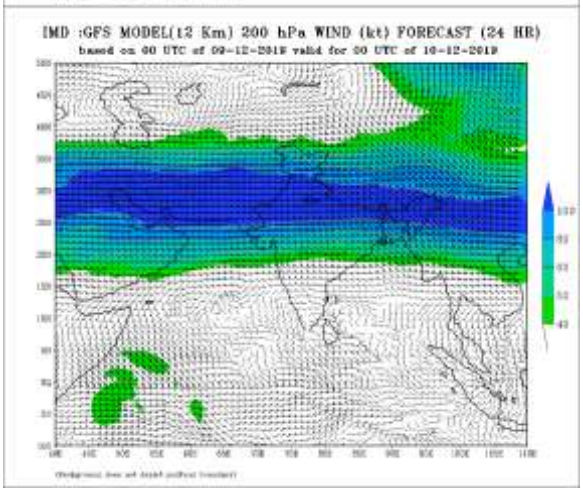
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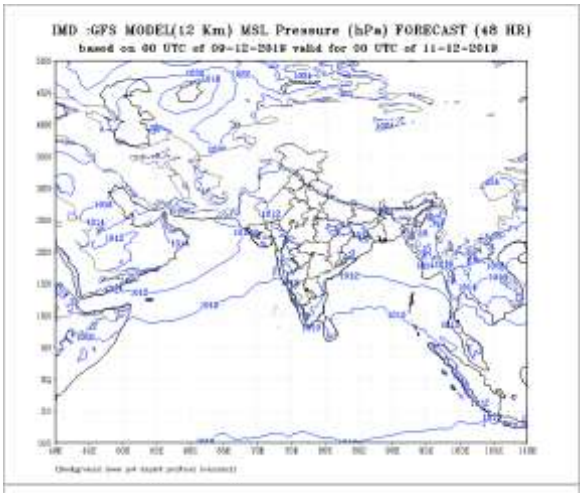
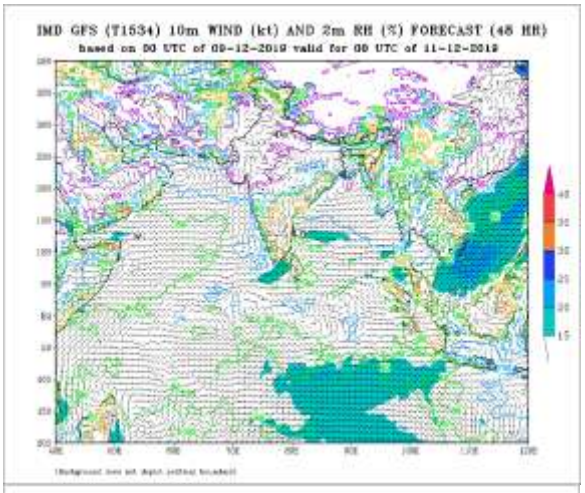

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (48 HR)
based on 00 UTC of 09-12-2019 valid for 00 UTC of 11-12-2019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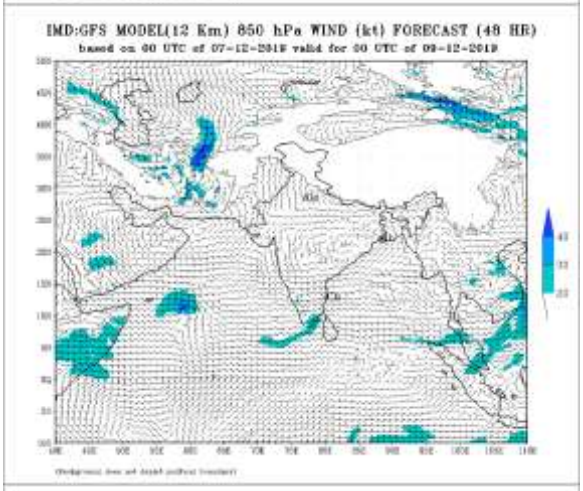
based on 00 UTC of 09-12-2019 valid for 00 UTC of 11-12-2019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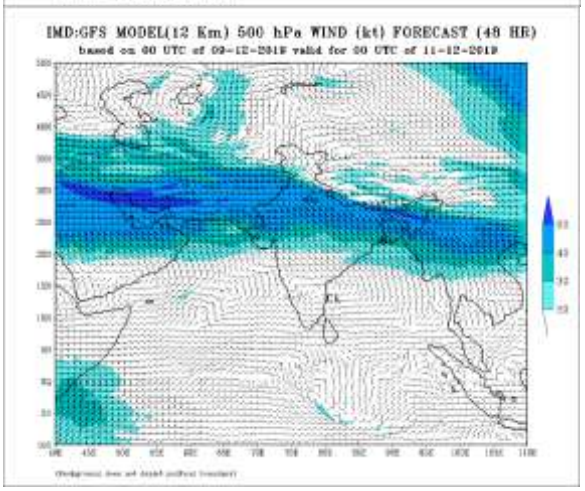
based on 00 UTC of 07-12-2019 valid for 00 UTC of 09-12-2019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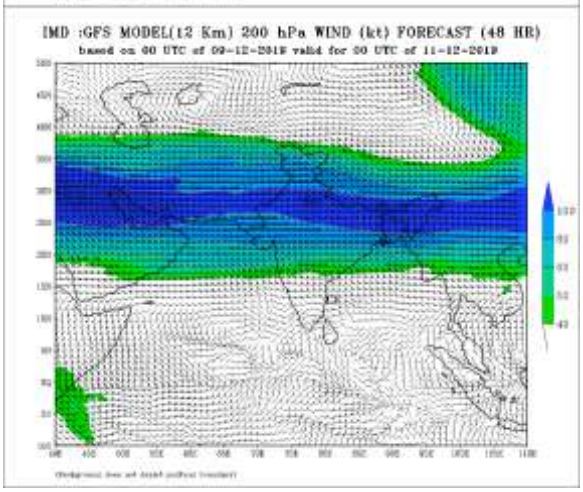
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (48 HR)
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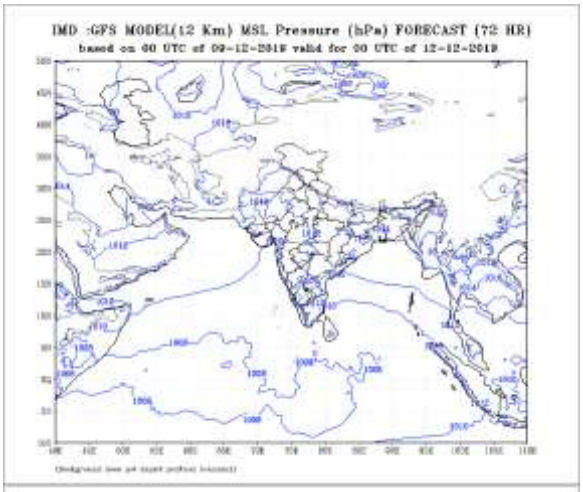
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (72 HR)
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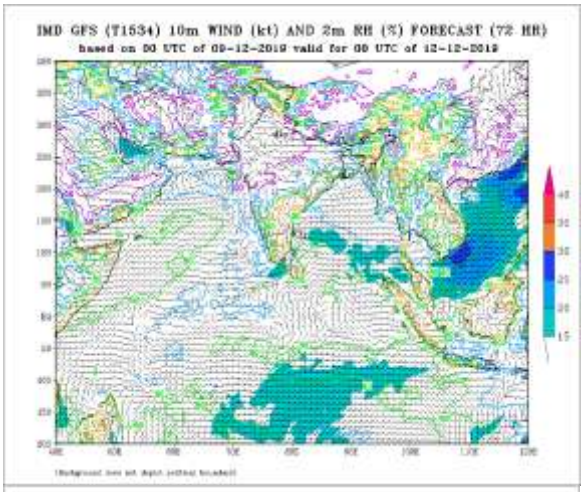
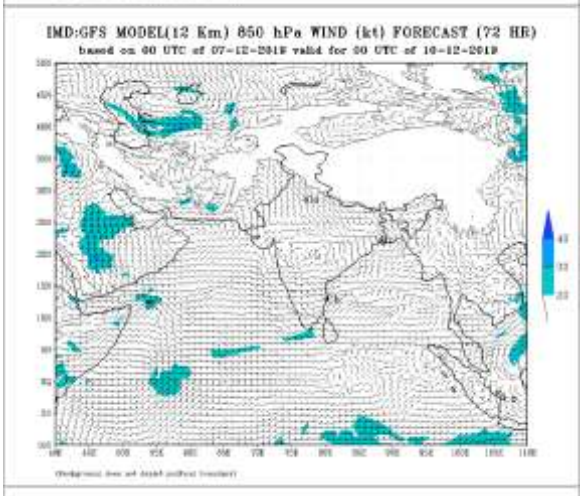

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (72 HR)
based on 00 UTC of 09-12-2019 valid for 00 UTC of 12-12-2019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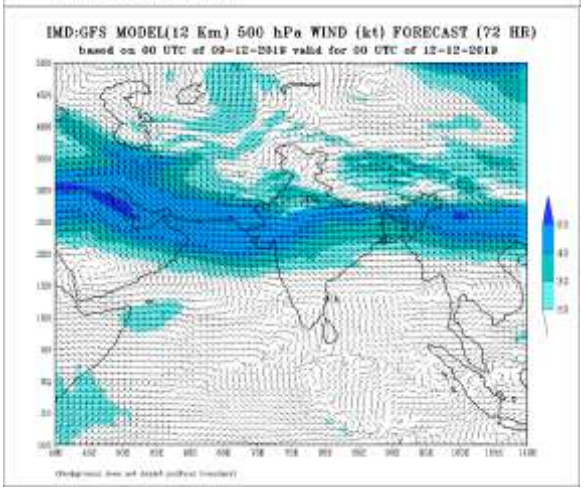
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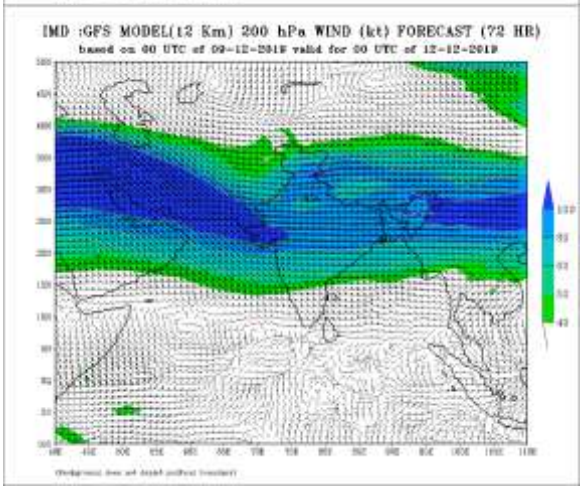
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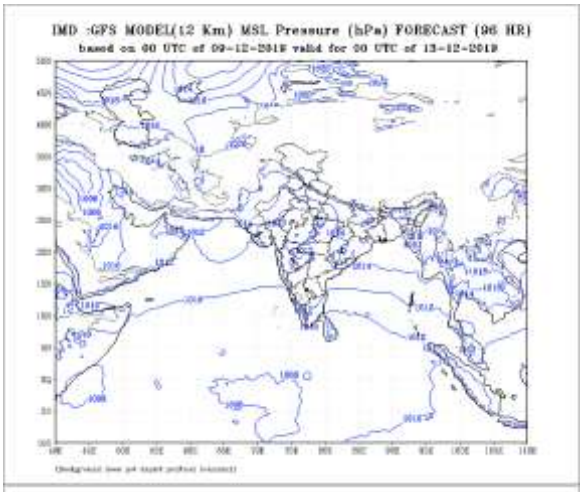
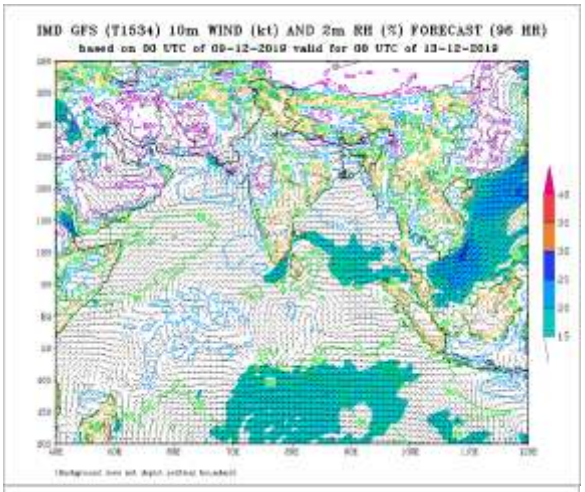
based on 00 UTC of 09-12-2019 valid for 00 UTC of 12-12-2019


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (96 HR)
based on 00 UTC of 09-12-2019 valid for 00 UTC of 13-12-2019


IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (96 HR)
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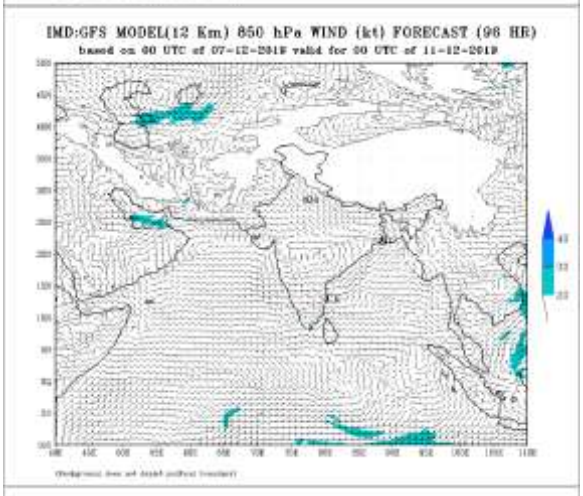
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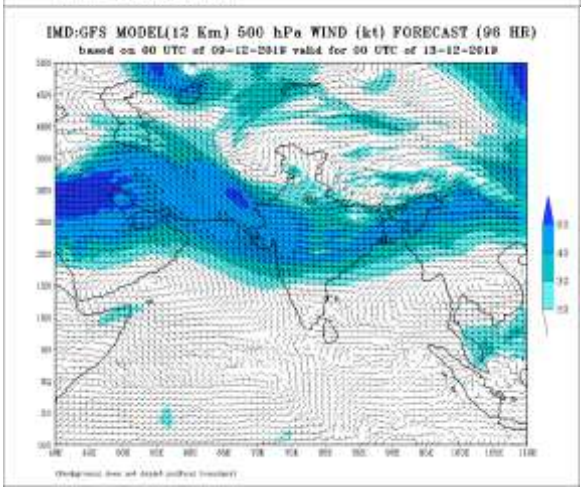
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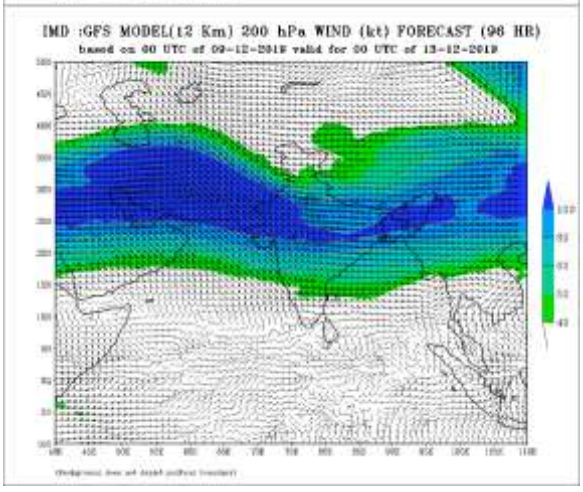
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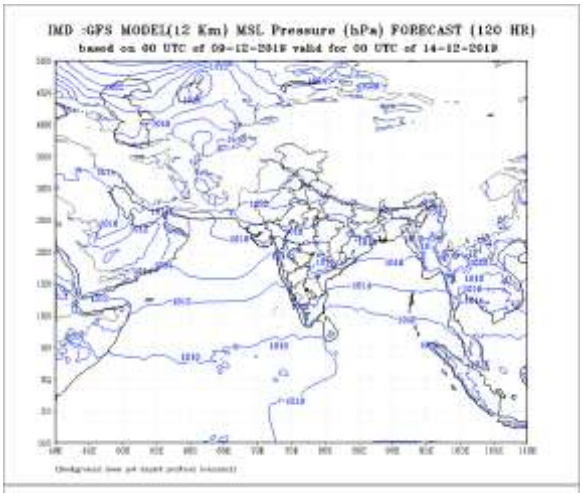
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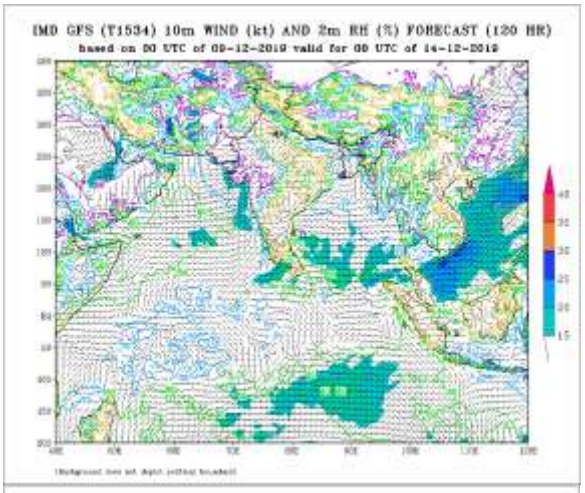
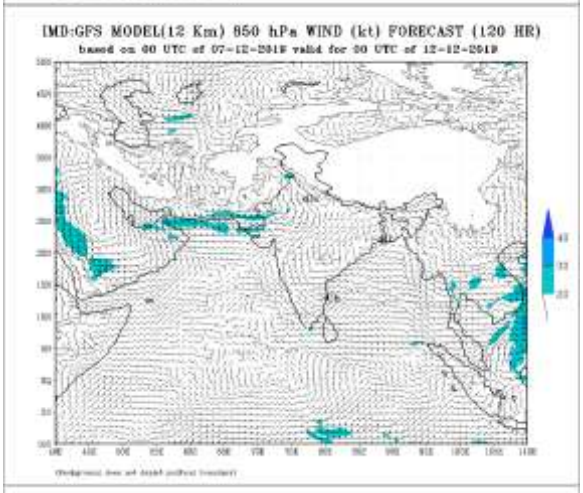
based on 00 UTC of 09-12-2019 valid for 00 UTC of 14-12-2019


IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (120 HR)
based on 00 UTC of 09-12-2019 valid for 00 UTC of 14-12-2019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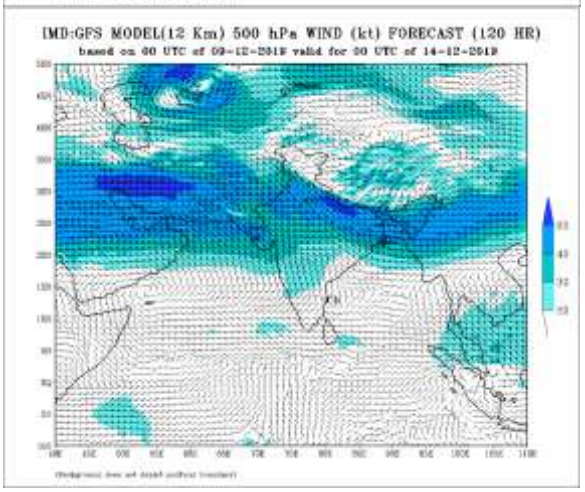
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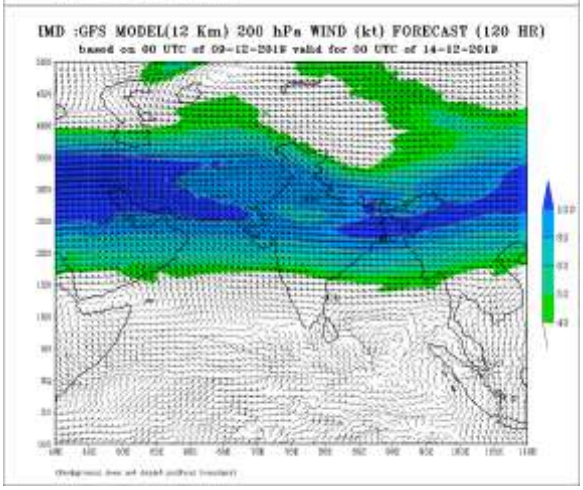
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)
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