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

FDP (Cyclone) NOC Report Dated 20th October, 2019

Time of Issue: 1200 UTC

Synoptic features:

- The Low Pressure Area over east central Arabian Sea persists over the same region at 0300 UTC of today. Associated cyclonic circulation extends upto 4.5 km above mean sea level. It is very likely to become Well Marked Low Pressure Area during next 36 hours and is likely to intensify into Depression during subsequent 24 hours. It is likely to initially move north-northeastwards over eastcentral Arabian Sea till 24th October and then recurve west-northwestwards towards Oman-Yemen coasts with gradual intensification.
- Another Low Pressure Area is likely to form over southwest & adjoining westcentral Bay of Bengal off north Tamilnadu and south Andhra Pradesh coasts around 23rd October.
- The trough of low at mean sea level over southwest Bay of Bengal off Sri Lanka coast has shifted westwards, reduced in vertical extension and runs from Comorin area to north coastal Andhra Pradesh at 0300 UTC of today.

Dynamical and thermodynamical features

Surface Temperature (SST):

SST is > 30ºC over eastern Bay of Bengal (BOB) along Myanmar coast; 29-30ºC over east central and northeast Bay of Bengal & Andaman Sea; 28-30°C over rest of BOB and southeast, east central and northwest Arabian Sea.

SST is the least (26-27 °C) over west central and adjoining southwest Arabian Sea (AS) and along Oman – Yemen coasts.

Tropical Cyclone Heat Potential (TCHP):

TCHP is > 50 kJ/cm^2 over most parts of BOB and southeast & east central AS. There are pockets in southwest and central BOB and over equatorial Indian Ocean (IO) and adjoining south AS, where it is 100 -120 kJ/ cm $^{2.}$

Over parts of the AS comprising north & west central AS, it is < 50 kJ/cm^2.

Relative Vorticity (at 850 hPa):

An extended area of cyclonic relative vorticity at 850 hPa of 20 - 50X10^{-6}s-1 is seen over central AS and adjoining south AS.

No significant cyclonic vorticity zone is seen over the BOB at 0600 UTC of today.

Low level Convergence:

Lower level convergence of about 15 - 20 x 10^{-5}s^{-1} is seen over eastcentral AS off Maharashtra – Karnataka coasts & and 05 - 10 x 10^{-5}s^{-1} over southeast AS and adjoining equatorial IO.

Lower level convergence of about 15 - 20 x 10^{-5}s^{-1} is seen also over east equatorial IO and adjoining central parts of south Bay of Bengal.

Upper level Divergence:

A zone of upper level divergence of 20-30x10^{-5} s-1 is seen over southeast & east central AS and also over east equatorial IO and south BOB.

Wind Shear:

Wind shear is 10-15 knots over east central & southeast Arabian Sea and Comorin – Maldives area. It increases to the west & north except for a neutral shear region over central parts of AS and 5- 10 knots over northwest Arabian Sea off Oman coast & Gulf of Oman.
Wind shear is 5 knots over south BOB and 10-15 knots over central and north BOB.

Wind Shear Tendency:
The wind shear is in decreasing tendency over east central & southeast AS and increasing elsewhere.
It is increasing over central BOB and north Andaman Sea and no change elsewhere over the BOB.

Upper tropospheric ridge:
The upper tropospheric ridge at 200 hPa runs roughly along 15°N over the north Indian Ocean region.

Satellite observations based on INSAT imagery:

Bay of Bengal & Andaman Sea:-

According to 0600 UTC satellite imagery, scattered low/medium clouds with embedded intense to very intense convection is seen over west central & south BOB and adjoining Andaman Sea.

Arabian Sea:-
According to 0600 UTC satellite imagery, scattered low/medium clouds with embedded intense to very intense convection is seen over east central AS neighborhood in association with the low pressure area over the region. Also scattered low/medium clouds with embedded intense to very intense convection is seen over Comorin – Maldives area.

Large scale features

M.J.O. Index:
MJO index is in Phase 2 (western Indian Ocean) with amplitude more than 1. It will continue in same phase with amplitude greater than 1 for next 7 days and will start gradually reducing in amplitude after 2 days.

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

NWP Input for FDP Cyclone based on 0000 UTC of today

IMD-GFS T-1534

(i) Indicates : Low pressure area (Lopar) over east central AS on 20th, well marked low pressure area (WML) over west central AS on 21st, WML over west central and adjoining east central AS on 22nd, Lopar (within extended) over east central AS on 23rd, WML over east central AS off south Maharashtra coast on 24th, WML over east central AS and adjoining south konkan on 25th and 26th and Lopar over east central AS on 27th and 28th October.

(ii) Indicates : Lopar over south west and adjoining west central BOB off north Tamil Nadu-south Andhra Pradesh coast on 22nd, depression over west central and adjoining southwest BOB off south Andhra Pradesh-north Tamil Nadu coast on 23rd, cyclonic storm over west central BOB off north Andhra Pradesh coast on 24th, Lopar over south interior Odisha and adjoining Chattisgarh on 25th and less marked on 26th October (Annexure-1).

Though the model predicts a more intense system over the BoB, in terms of vertical extension the AS system is forecast to extend up to 5.8 Km above mean sea level on 23rd and 24th and up to 7.6 Km above mean sea level on 25th and 26th October. While the BOB system extends up to 5.8 Km above mean sea level only on 23rd and 24th October.

IMD-GEFS

(i) Indiacates : Lopar over east central and adjoining south east AS on 20th, WML over central AS on 21st and 22nd , WML over east central AS on 23rd, WML over east central AS off Maharashtra coast on 24th, Lopar over the same region on 25th, WML over east central AS off south Maharashtra-Goa coast on 26th, depression over east central AS on 27th and 28th October.

(ii) Indicates : Lopar over south west adjoining west central BOB off south Andhra Pradesh-north Tamil Nadu coast on 22nd, Lopar over west central and adjoining south west BOB and adjoining coastal Andhra Pradesh and Tamil Nadu on 23rd, WML over west central BOB off Andhra Pradesh coast on 24th , Lopar over coastal Andhra Pradesh and adjoining west central BOB on 25th and 26th October.

IMD-WRF

(i) Indicates : An extended Lopar over south and adjoining central AS on 20th, Lopar over east central and adjoining west central and south AS on 21st, WML over west central and adjoining east central AS on 22nd and Lopar over west central AS on 23rd October.

(ii) Indicates : A trough of low over south west BOB off Sri Lanka-Tamil Nadu coast on 20th, trough of low from south west BOB off Sri Lanka coast to west central BOB off Andhra Pradesh coast on 21st, Lopar over central parts of south and adjoining central BOB on 22nd, WML over west central BOB on 23rd October.

NCMRWF-NCUM:

(i) Indicates : A trough of low over south east and east central AS on 20th, Lopar over south east and adjoining east central AS on 21st, Lopar over central AS on 22nd, Lopar over east central AS on 23rd, depression over east central AS off south Maharashtra coast on 24th, deep depression over east central AS off south Maharashtra coast on 25th, cyclonic storm over east central AS off south Maharashtra coast on 26th, severe cyclonic storm over east central AS on 27th, and over central AS on 28th, north westward movement and seen over north AS off Pakistan Coast on 30th as severe cyclonic storm.

(ii) Indicates : Lopar over south west and adjoining west central BOB off north Tamil Nadu-south Andhra Pradesh coast on 23rd, Lopar over west central BOB off Andhra Pradesh coast on 24th, WML /marginal depression over west central and adjoining northwest BOB off north Andhra Pradesh-south Odisha coast on 25th, depression over Bangladesh and adjoining West Bengal on 26th, Lopar over Bangladesh on 27th and less marked on 28th October.

NCMRWF-UM-Regional Model:

(i) Indicates : Lopar over central and adjoining south AS on 20th and 21st, WML over central AS on 22nd, depression over east central AS off Maharashtra coast on 23rd October.

(ii) Indicates : Lopar over west central and adjoining south west BOB off south Andhra Pradesh-north Tamil Nadu coast on 23rd October.

NEPS Model:

(i) Indicates : An extended low over central and adjoining south AS on 20th, Lopar over the same region on 21st, WML over central AS on 22nd, depression over east central AS off south Maharashtra coast on 23rd, cyclonic storm/severe cyclonic storm over east central AS off Maharashtra coast on 24th, very severe cyclonic storm over the same region on 25th, extremely severe cyclonic storm (with large uncertainty over east central AS off Maharashtra coast on 26th and west north westward movement maintaining the intensity up to central parts of north and adjoining central AS on 29th October.

(ii) Indicates : Lopar over west central and adjoining south west BOB on 23rd, WML over west central BOB off Andhra Pradesh coast on 24th, depression over west central and adjoining north west BOB off north Andhra Pradesh south Odisha coast on 25th, deep depression / marginal cyclonic storm over Bangladesh and adjoining West Bengal on 26th and less marked on 27th October.

ECMWF:

(i) Indicates : A trough of low over east central and south east AS on 20th and 21st, Lopar over central AS on 22nd, Lopar over east central and adjoining west central AS on 23rd, WML over east central AS on 24th, depression over east central AS off south Maharashtra-Goa-north Karnataka coast on 25th October.

(ii) Indicates : A trough of low over south west BOB off Sri Lanka-Tamil Nadu coast on 20th and 21st and less marked on 22nd October.

NCEP-GFS :

(i) Indicates : An extended low over central and adjoining south AS on 21st, Lopar over central AS on 22nd, WML over east central AS off Maharashtra coast on 23rd, WML/marginal depression over north Konkan and neighborhood on 24th, WML over Maharashtra and adjoining east central AS on 25th and weakens on 26th October.

(ii) Indicates : Lopar over south west BOB on 21st, extended low over south west and adjoining west central BOB off north Tamil Nadu-south Andhra Pradesh coast on 22nd, less marked on 23rd, Lopar over west central BOB off north Andhra Pradesh coast on 24th, Lopar over south Odisha and north Andhra Pradesh coast on 25th, weakens on 26th October. A fresh Lopar over eastern equatorial Indian Ocean on 25th moves slightly to the west and persists on 26th October. This is forecast to cross north Tamil Nadu coast as depression on 30th October.

ARP-Meteo France : Not Analysed.

Dynamical statistical models

IMD Genesis Potential Parameter (GPP):

(i) No significant zone of GPP seen over AS on 20th, a significant zone develops over central AS on 21st and 22nd, over east central AS off Maharashtra coast on 23rd October.

(ii) No significant zone of GPP seen over BOB on 20th and 21st, develops over west central BOB off south Andhra Pradesh coast north Tamil Nadu coast on 22nd, over west central BOB off Andhra Pradesh coast on 23rd and over west central and adjoining northwest BOB off north Andhra Pradesh-south Odisha coast on 24th October. Another significant zone develops over east equatorial Indian Ocean during 25th to 27th October.

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:

There is a large divergence amongst various model forecasts. However, probable cyclogenesis over the Arabian Sea is forecast by majority of the models during the period 23rd – 25th October. NCMRWF (UM) and NEPS indicates formation of a Depression over east central Arabian Sea on 23rd October, NCUM & NCEP GFS on 24th October, ECMWF on 25th October and GEFS on 27th October. IMD GFS is forecasting cyclogenesis over the Bay of Bengal on 23rd October and its north-northeastward movement and intensification subsequently. NCUM and its ensemble indicate further intensification of the system into cyclonic storm and its further intensification from 25th October.

The genesis potential parameter indicates a significant potential zone for cyclogenesis over central Arabian Sea on 21st, which persists on 22nd and seen over east central Arabian Sea off Maharashtra coast on 23rd. It shows another potential zone of development over west central Bay of Bengal off south Andhra Pradesh – north Tamil Nadu coasts on 22nd, over west central Bay of Bengal off Andhra Pradesh on 23rd and over west central and adjoining northwest BOB off north Andhra Pradesh-south Odisha coast on 24th October.

Considering the above, possible intensification of the current low pressure area over east central Arabian Sea around 23rd October needs to be closely monitored. The probable formation of a low pressure area over southwest & adjoining westcentral Bay of Bengal off north Tamilnadu and south Andhra Pradesh coasts around 23rd October and its further intensification also need to be monitored.

Probability of cyclogenesis over Bay of Bengal and Andaman Sea during next 120 hours:

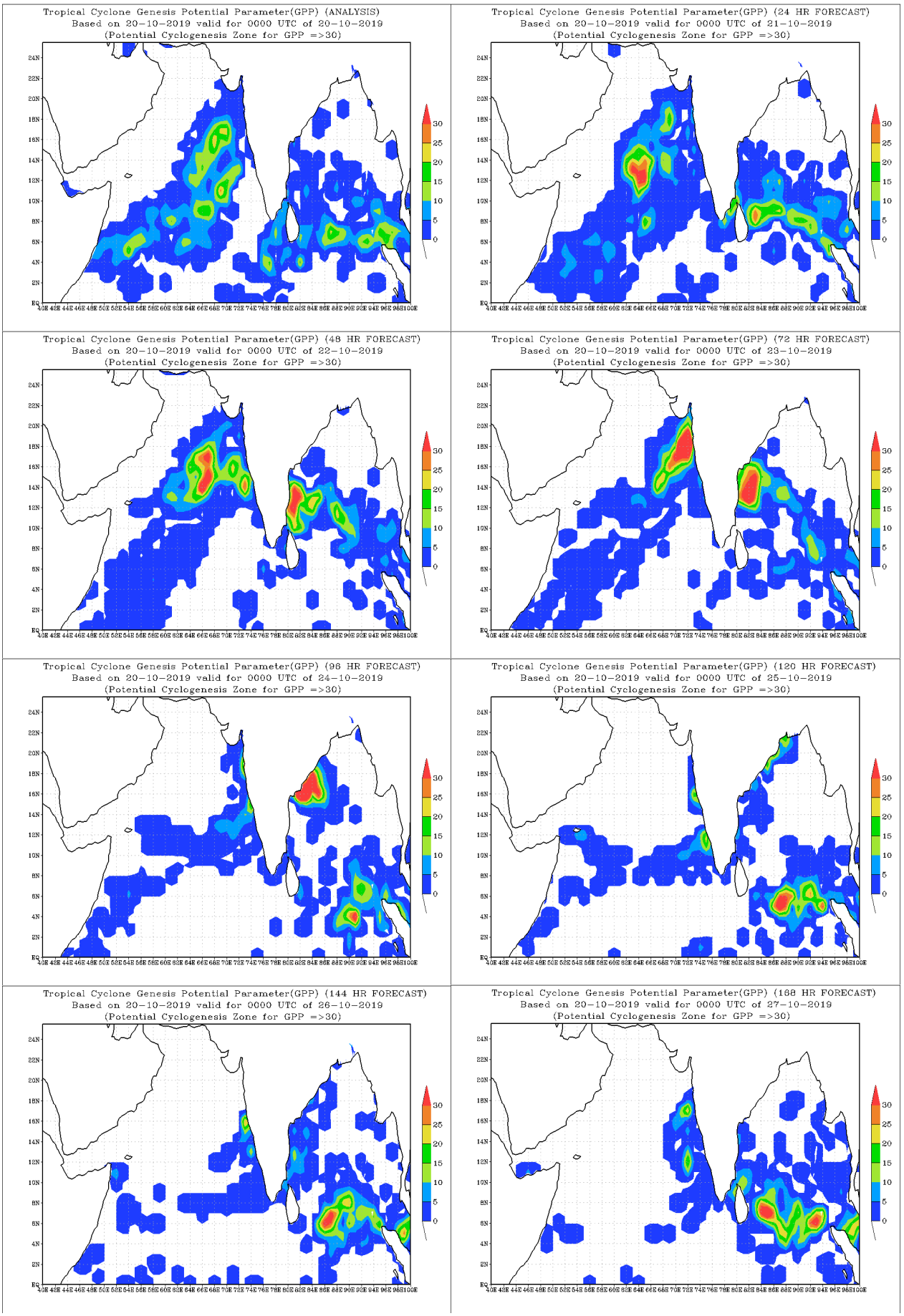
24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
Nil	Nil	Nil	Low	Low

Probability of cyclogenesis over Arabian Sea during next 120 hours:

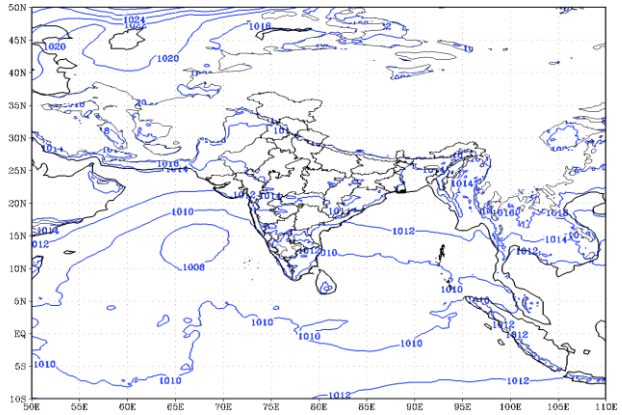
24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
Nil	Nil	Low	Moderate	High

Advisory: No IOP area for the next 5 days.

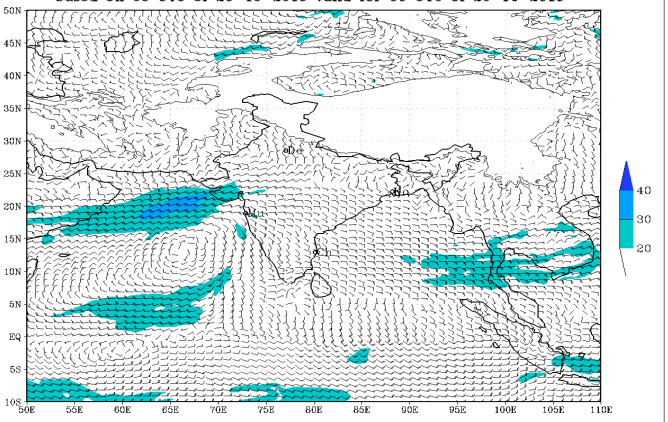
Annexure-I


Tropical Cyclone Genesis Potential Parameter(GPP) (ANALYSIS)
Based on 20-10-2019 valid for 0000 UTC of 20-10-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 20-10-2019 valid for 0000 UTC of 21-10-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 20-10-2019 valid for 0000 UTC of 22-10-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 20-10-2019 valid for 0000 UTC of 23-10-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (96 HR FORECAST)
Based on 20-10-2019 valid for 0000 UTC of 24-10-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
Based on 20-10-2019 valid for 0000 UTC of 25-10-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (144 HR FORECAST)
Based on 20-10-2019 valid for 0000 UTC of 26-10-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (168 HR FORECAST)
Based on 20-10-2019 valid for 0000 UTC of 27-10-2019
(Potential Cyclogenesis Zone for GPP =>30)

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (00 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 20-10-2019



IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (00 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 20-10-2019



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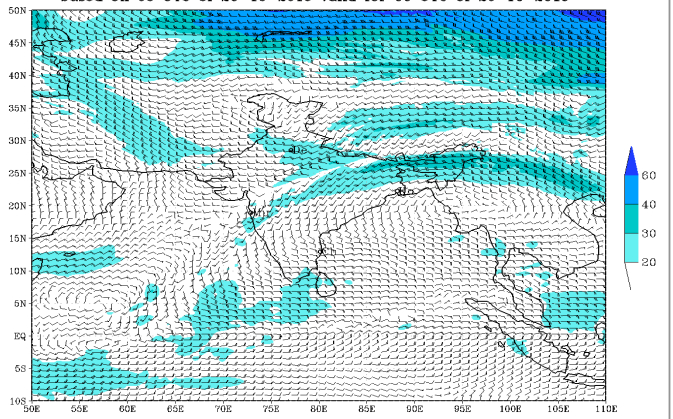
based on 00 UTC of 20-10-2019 valid for 00 UTC of 20-10-2019



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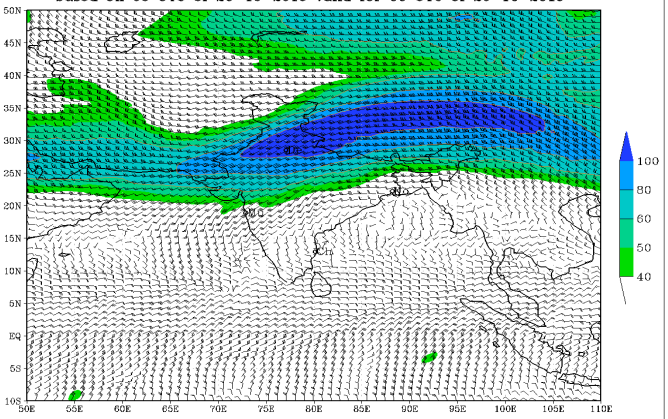
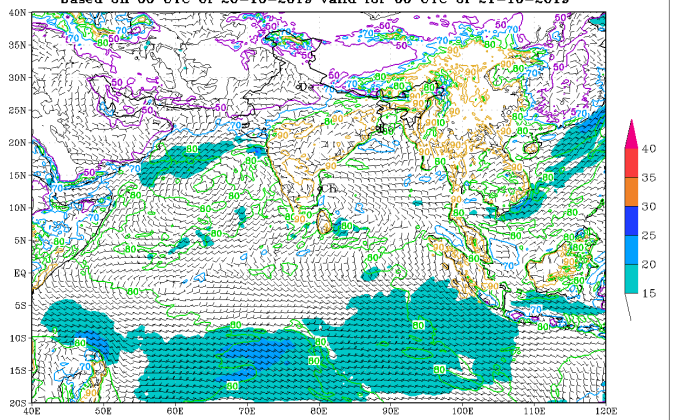
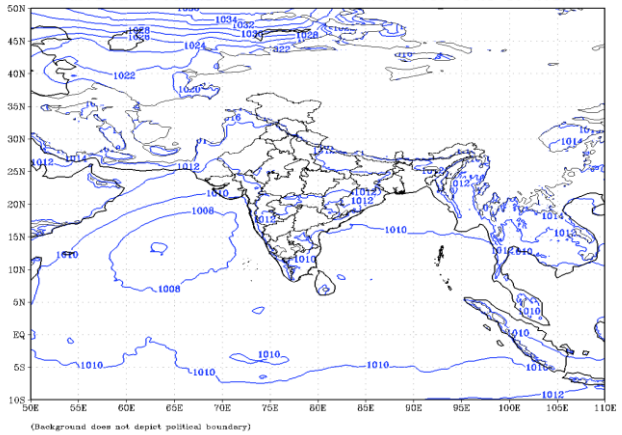
based on 00 UTC of 20-10-2019 valid for 00 UTC of 20-10-2019



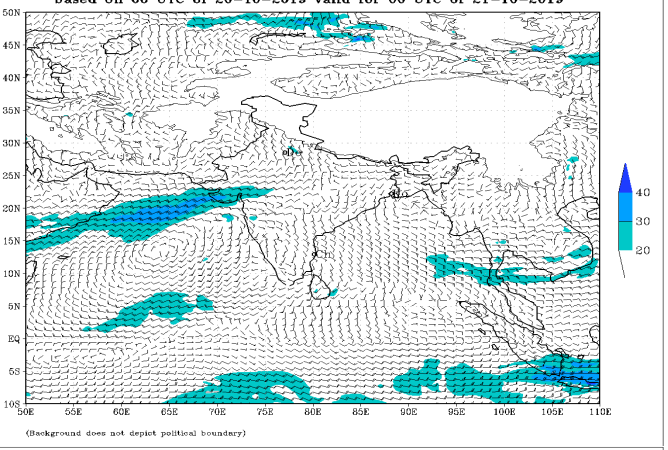
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (24 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 21-10-2019



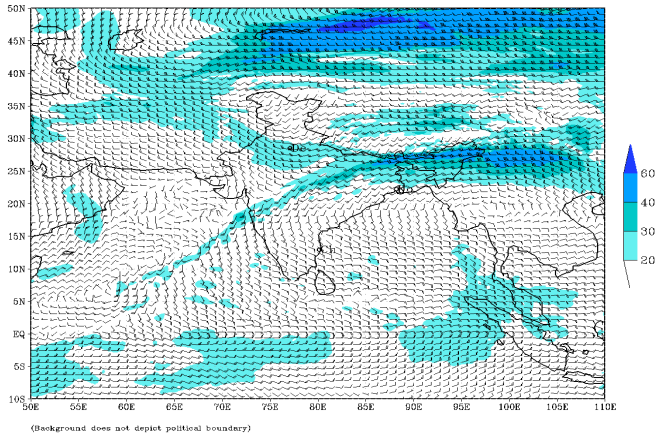
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (24 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 21-10-2019



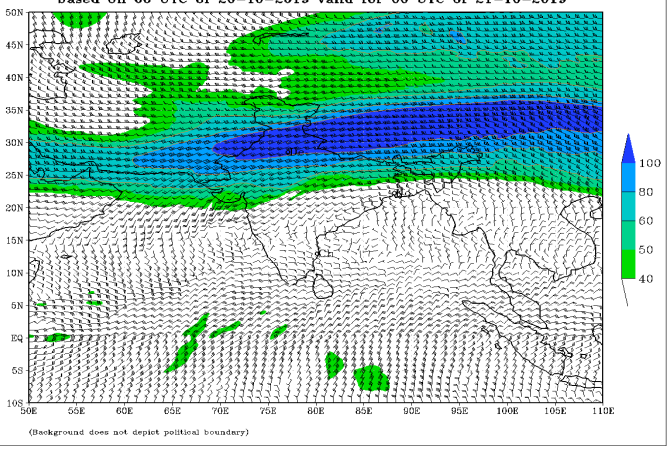
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 21-10-2019



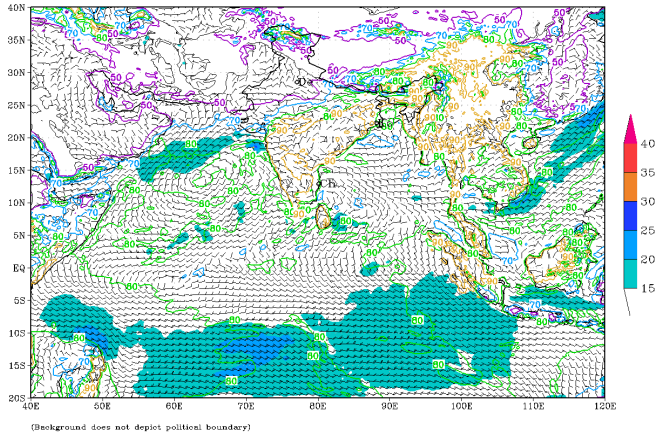
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 21-10-2019



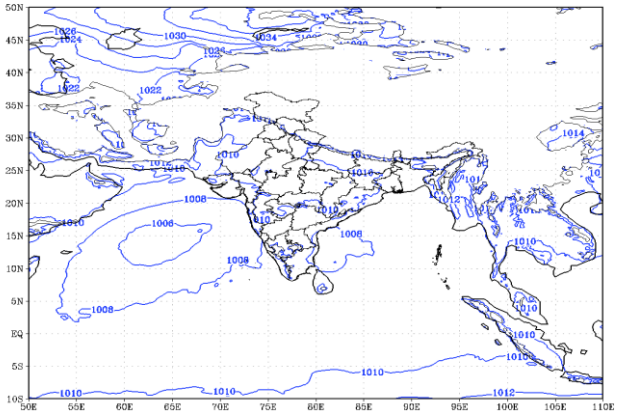
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 21-10-2019



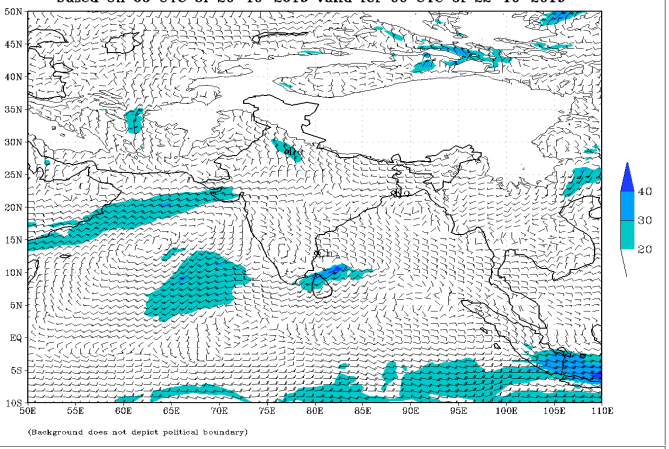
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (24 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 21-10-2019



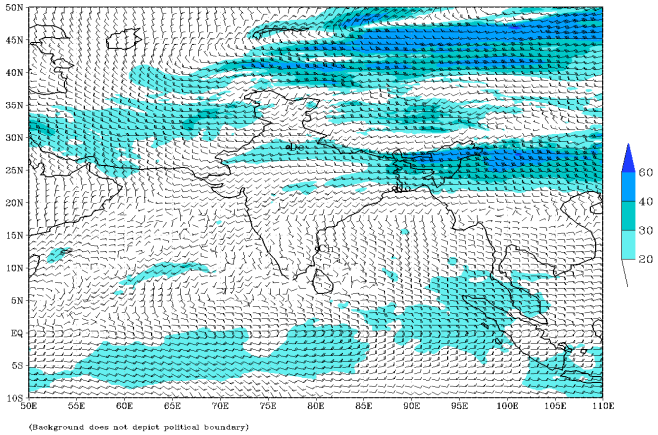
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (48 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 22-10-2019



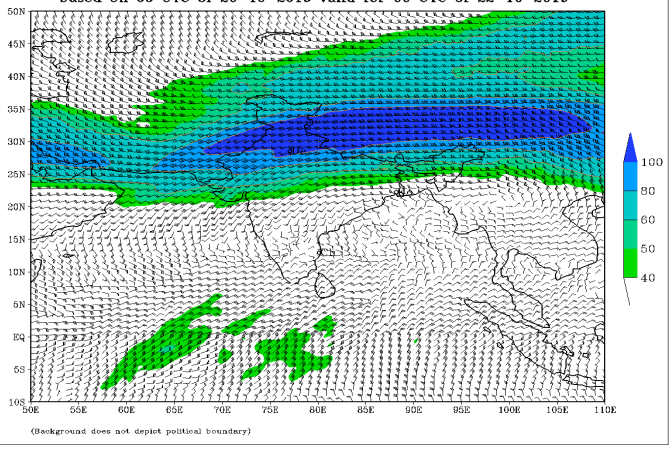
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (48 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 22-10-2019



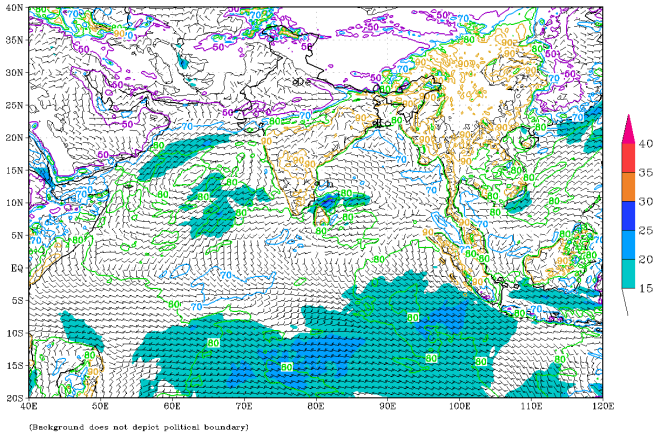
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (48 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 22-10-2019



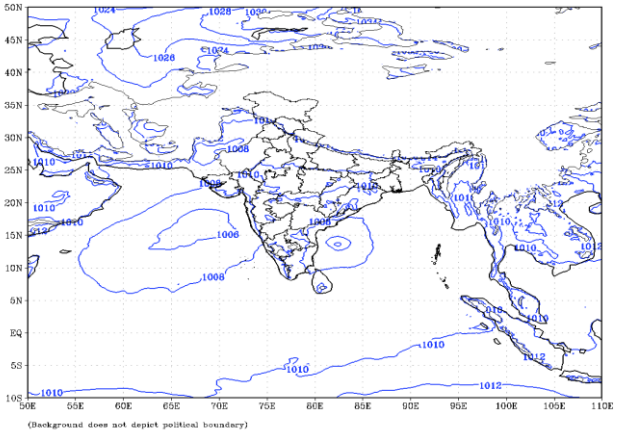
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (48 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 22-10-2019



IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (48 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 22-10-2019



IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (72 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 23-10-2019



IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (72 HR)
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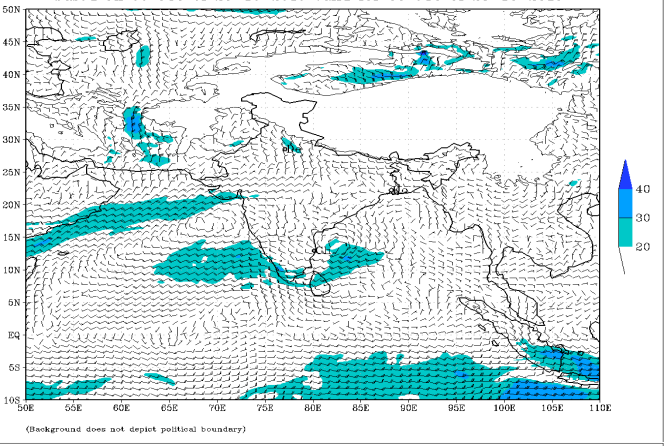

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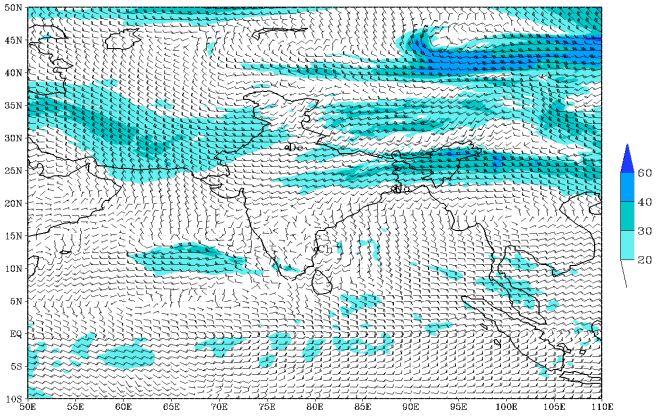
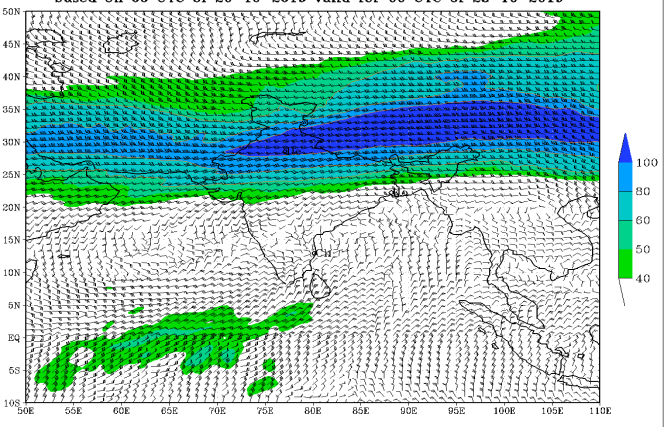
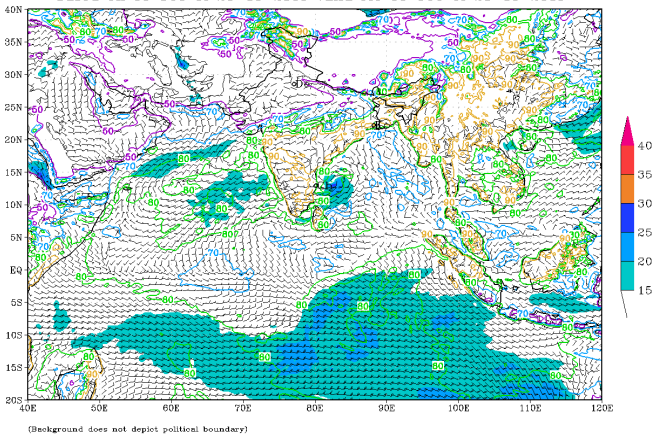


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 23-10-2019



IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (72 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 23-10-2019



IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (96 HR)
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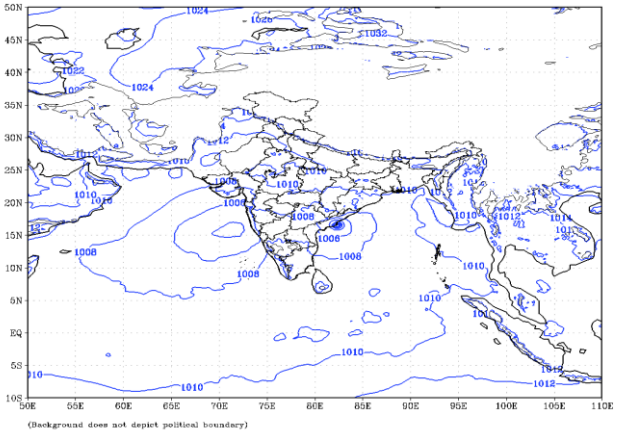
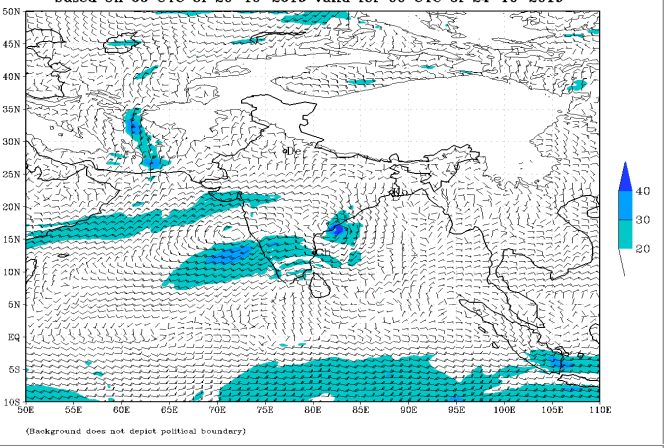
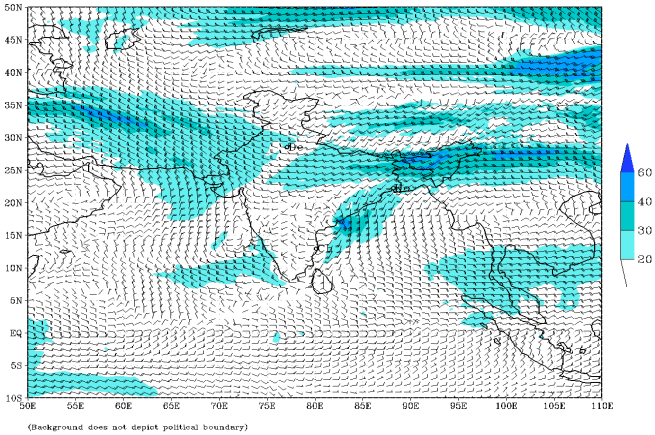


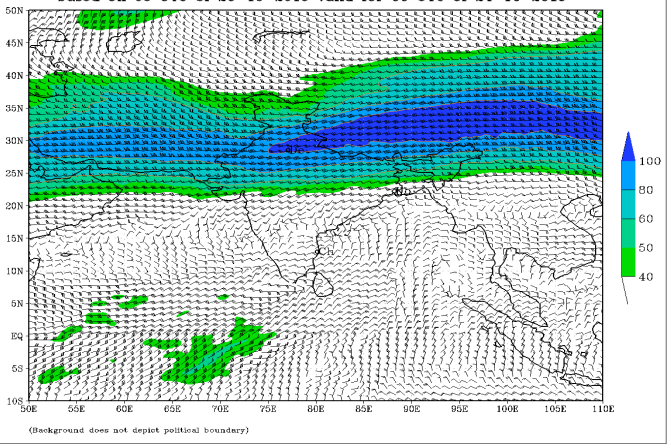
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 24-10-2019



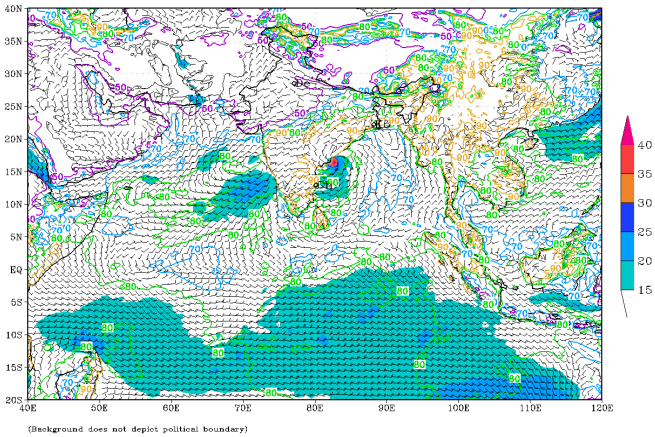
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 24-10-2019



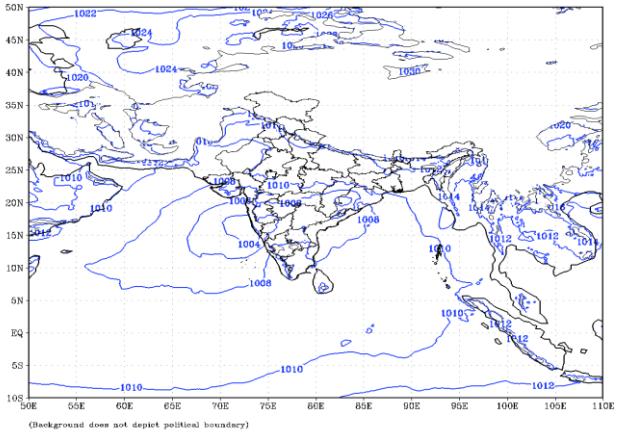
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 24-10-2019



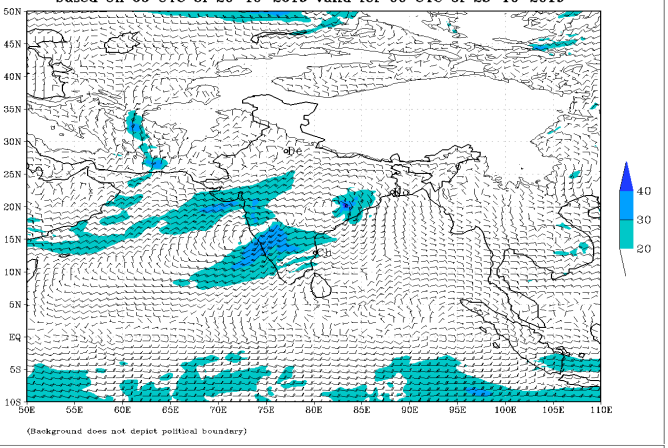
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (96 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 24-10-2019



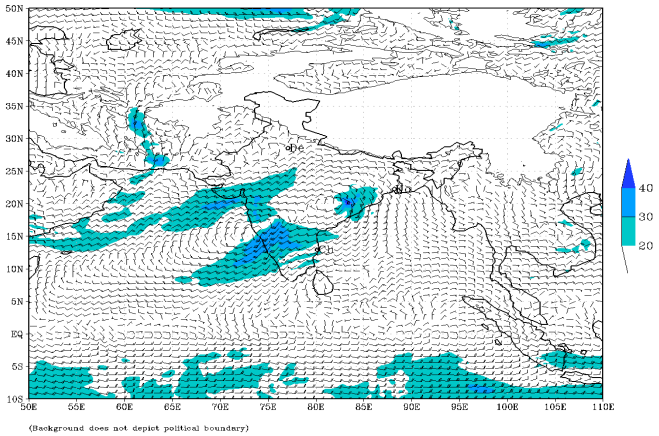
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 25-10-2019



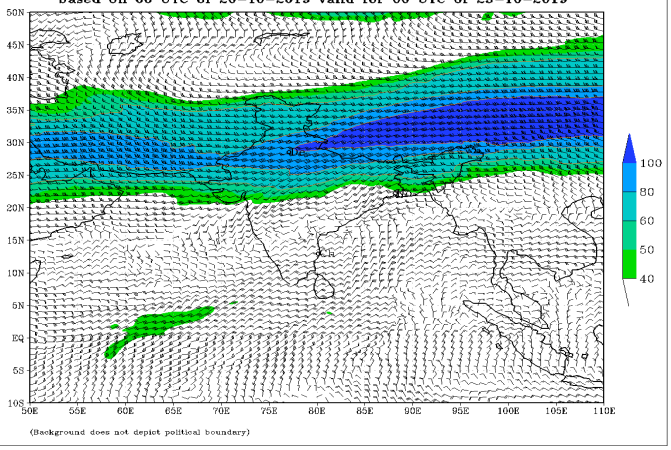
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 25-10-2019



IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 25-10-2019



IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 25-10-2019



IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (120 HR)
based on 00 UTC of 20-10-2019 valid for 00 UTC of 25-10-2019