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

FDP (Cyclone) NOC Report Dated 19 October, 2019

Time of Issue: 1200 UTC

Synoptic features:

- The Low Pressure Area over southeast Arabian Sea & adjoining areas of Lakshadweep and eastcentral Arabian Sea lay over east central Arabian Sea at 0300 UTC of today. Associated cyclonic circulation extends upto 4.5 km above mean sea level. It is likely to become more marked over eastcentral Arabian Sea & neighbourhood during next 48 hours.
- Also a trough of low at mean sea level lay over southwest Bay of Bengal off Sri Lanka coast extending upto 0.9 km above mean sea level 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):

Positive relative vorticity at 850 hPa is 50X10^{-6}s-1 over east central AS and also over west equatorial IO.

No other significant positive vorticity zones are seen over both BOB and AS at 0600 UTC of today.

Low level Convergence:

A small area of lower level convergence of about 20 x 10^{-5}s^{-1} is seen over equatorial IO and adjoining southeast AS and equatorial IO to the south of Sri Lanka and 15 x 10^{-5}s^{-1} over east central AS to the west of Maharashtra coast.

Upper level Divergence:

A zone of upper level divergence of 30x10^{-5} s-1 is seen over equatorial and adjoining central parts of south AS and also over equatorial IO along the equator to the south of Sri Lanka; 20x10^{-5} s-1 over eastcentral AS off Maharashtra coast and 05x10^{-5} s-1 over west central BOB and adjoining coastal Andhra Pradesh.

Wind Shear:

Wind shear is 5 knots over the BOB.

Wind shear is 5-10 knots over south and adjoining central AS and is increasing towards northern parts of AS.

Wind Shear Tendency:

The wind shear tendency is mostly negative over southwest BOB and neutral elsewhere.
The shear tendency is decreasing over southeast & east-central AS, increasing over north AS and neutral elsewhere.

Upper tropospheric ridge:

The upper tropospheric ridge at 200 hPa runs roughly along 17°N over BOB Region and 14ºN over the Arabian Sea.

Satellite observations based on INSAT imagery:

Bay of Bengal & Andaman Sea:-

According to 0900 UTC satellite imagery, scattered low/medium clouds with embedded intense to very intense convection is seen over west central BOB off north Andhra Pradesh-Tamil Nadu coast and south BOB and Andaman Sea.

Arabian Sea:-

According to 0900 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 lo pressure area over the region.

Large scale features

M.J.O. Index:

MJO index is in Phase 1 with amplitude more than 1. It will continue in same phase with amplitude greater than 1 for next 2 days and will move to phase 2 thereafter.

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

NWP Input for FDP Cyclone based on 0000 UTC

IMD-GFS T-1534

The present low pressure area over east central AS is simulated in the analysis of today. Without much intensification and movement, it is predicted to persist over central parts of AS on 20th and 21st October and forecast to move away westwards on 23rd October. However, some strengthening in the wind field is indicated on 20th October.

A fresh trough of low could develop over east central AS off Maharashtra coast on 24th October with gradual organization in to a low pressure area over east central and adjoining south east AS off Karnataka coast by 27th October, in to a well marked low pressure area and a marginal depression with northwestward movement on 28th and 29th October, respectively.

IMD-GEFS

The present low pressure area is located over southeast AS as against the location of east central AS in the analysis field. It is forecast to persist over east central AS on 20th and 21st and weaken on 22nd October. A fresh low pressure area is forecast over east central AS off Maharashtra coast on 24th, persist there on 25th and 26th and weakens on 27th October.

IMD-WRF

Indicate the persistence of the low pressure area over east central AS up to 21st and becoming well marked over the same region on 22nd October.

NCMRWF-NCUM:

The present low pressure area is located over southeast AS as against the location of east central AS in the analysis field. It is forecast to lie over central parts of AS up to 22nd as a weak low. It is forecast to intensify over east central AS on 23rd and into a depression over east central AS on 24th October. Simultaneously a low pressure area is forecast over west central

BOB off south Andhra Pradesh-north Tamil Nadu coasts on 23rd and forecast to become a well marked low pressure area over west central BOB off south Andhra Pradesh coast on 24th October. Both the vortices are predicted to further intensify and move northwards subsequently.

NCMRWF-UM-Regional Model: This indicates the probability of the current AS system to become a well marked low pressure area by 21st and in to a depression over east central AS by 22nd October. Formation of a low pressure area over west central and adjoin south west BOB is also indicated on 22nd October.

NEPS Model: The present low pressure area is forecast to persist over central parts of AS and to become a well marked low pressure area on 21st over the same region, persist there up to 23rd and concentrate in to a depression over east central AS on 24th October.

Development of a low pressure area over west central BOB off south Andhra Pradesh-north Tamil Nadu coast on 23rd is becoming more marked over west central BOB off north Andhra Pradesh coast on 24th October is also indicated.

Further intensification and northward movement of both the systems is predicted from 25th October.

ECMWF: Indicates the present low pressure area could move westwards and slightly become more marked over west central AS on 22nd October (only for one day). A fresh low pressure area is forecast over west central AS on 26th and its westward movement and further intensification in to a depression on 27th October.

A fresh low pressure area is forecast over south east and adjoining east central AS off north Kerala-Karnataka coast on 27th and its west northwestward movement and intensification in to a depression and cyclonic storm on 28th and 29th October, respectively.

NCEP-GFS : Model suggests a low pressure area formation over south west BOB on 22nd without any further intensification.

ARP-Meteo France : Analysis shows a low pressure area over east central and adjoining south east AS today and with slight intensification over east central AS on 20th and 21st and as a depression over central parts of AS on 22nd October.

Dynamical statistical models

IMD Genesis Potential Parameter (GPP):

The Genesis Potential Parameter (GPP) analysis and forecasts based on 0000 UTC of 18th October 2019 shows a small area of significant GPP zone developing over southeast Arabian Sea on 20th, disappearing on 21st, re-appearing over west central AS on 22nd October. Another significant zone is developing over west central BOB off Andhra Pradesh coat on 23rd and 24th and over west central AS and over east central AS off south Maharashtra coast on 25th and 26th 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 models forecasts. IMD GFS and its ensemble is forecasting low pressure area over Arabian Sea during the forecast period, and IMD GFS alone is indicating its intensification from 27th October over east central AS. On the other hand NCEP GFS do not suggest formation of any low pressure system over NIO for the next 10 days, whereas, ECMWF, and NCUM group of models suggest formation of the low pressure area over Arabian sea with further intensification, but the day of formation varies. ECMWF is indicating the low pressure area to form on 26th October and intensification into a depression on 27th. NCUM and its ensemble indicate formation of low pressure area on 21st, and further intensification into depression around 22nd and into cyclonic storm around 25th October.

The genesis potential parameter index indicates a significant potential zone for cyclogenesis over southeast & east central AS on 20th, which becomes less significant next day. It shows another potential zone of development over AS on 25th and 26th and also over west central BOB off Andhra Pradesh coast on 23rd and 24th October.

Considering the above, possible intensification of the current low pressure area over east central Arabian Sea needs to be closely monitored. Subsequent formation of low pressure areas over AS around 25th October and its further intensification also need to be monitored. There could be a possibility of formation of a low pressure area over west central BOB off Andhra Pradesh coast 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:

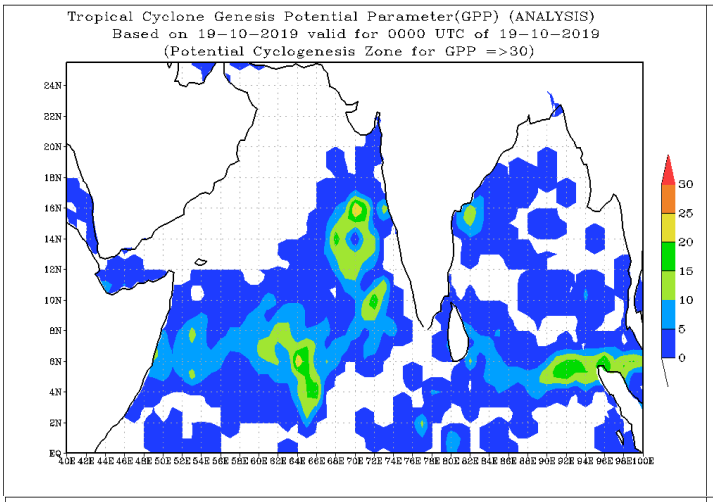
24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
Nil	Nil	Nil	Nil	Nil

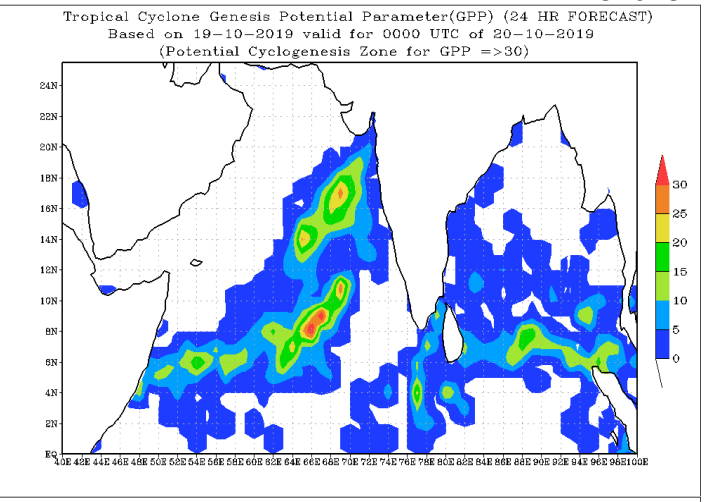
Probability of cyclogenesis over Arabian Sea during next 120 hours:

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

Advisory: No IOP area for the next 5 days.

Annexure-I


Tropical Cyclone Genesis Potential Parameter(GPP) (ANALYSIS)
Based on 19-10-2019 valid for 0000 UTC of 19-10-2019
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
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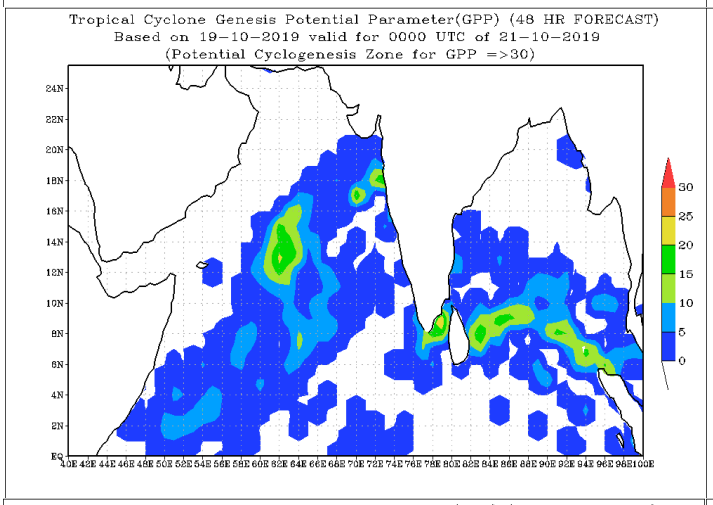
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
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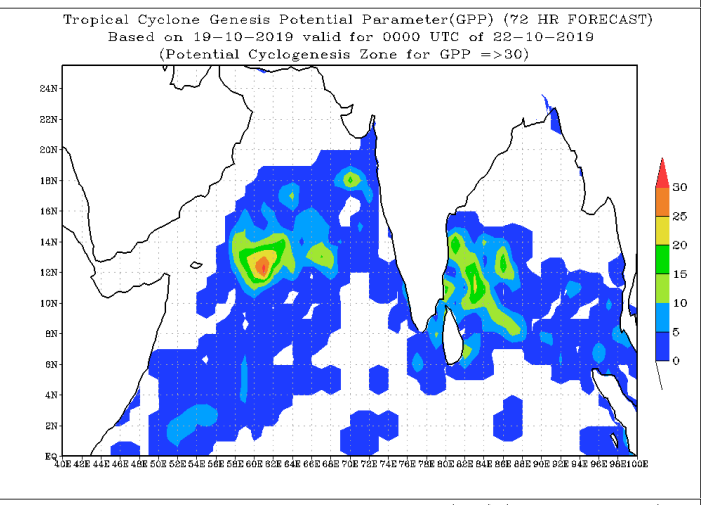
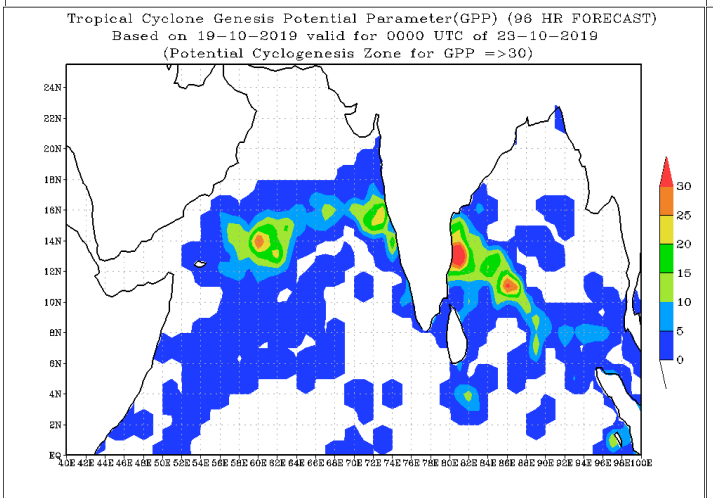
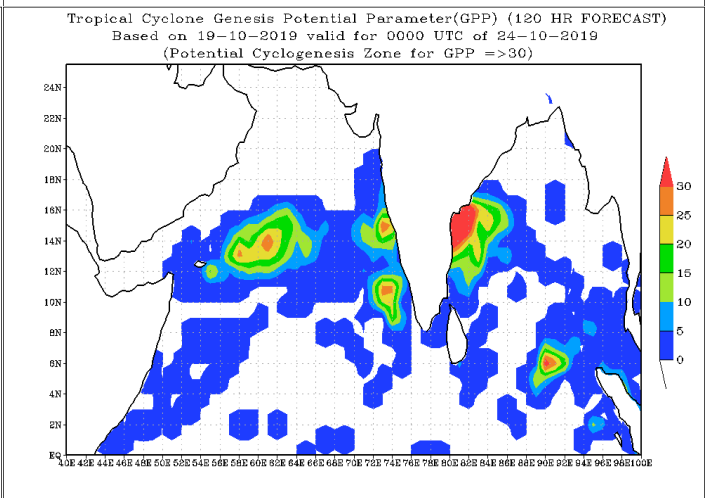
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 19-10-2019 valid for 0000 UTC of 22-10-2019
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (96 HR FORECAST)
Based on 19-10-2019 valid for 0000 UTC of 23-10-2019
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
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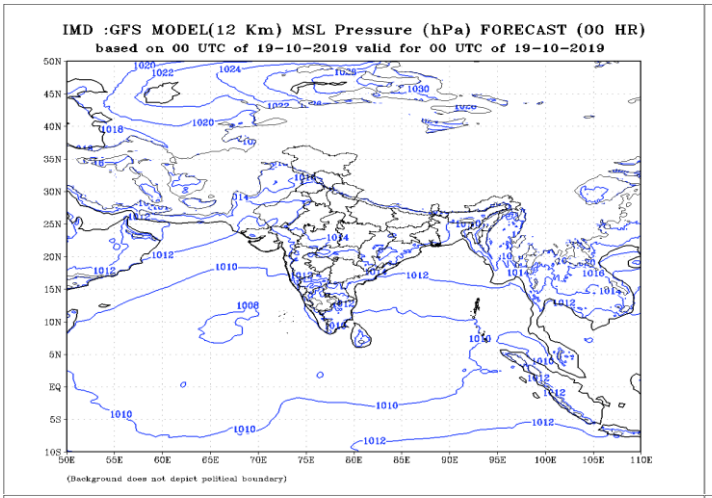
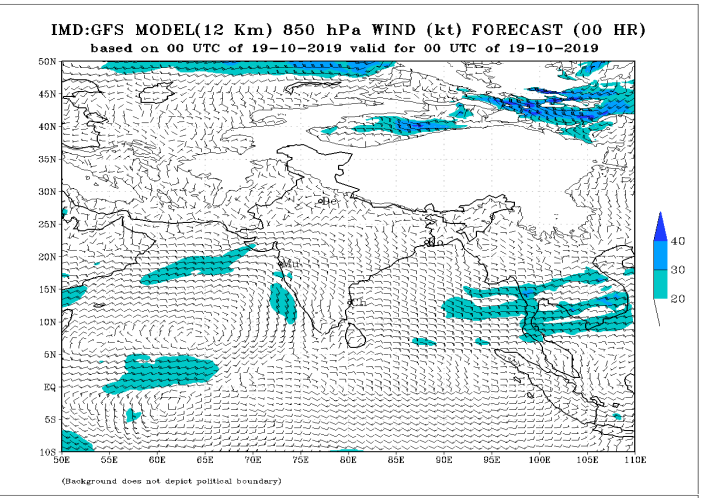
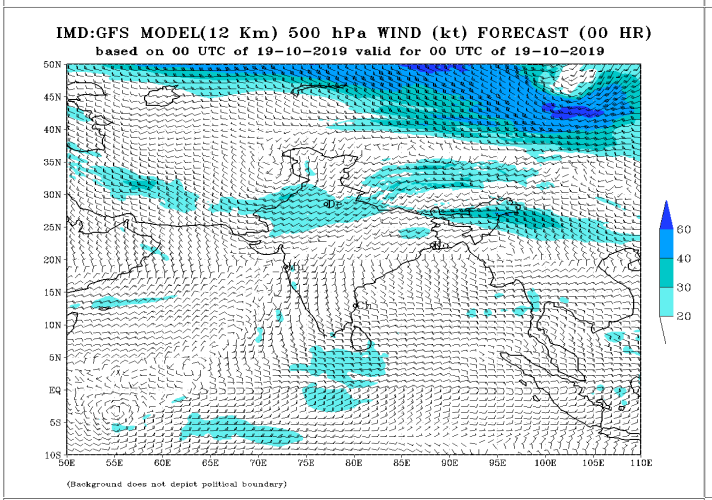
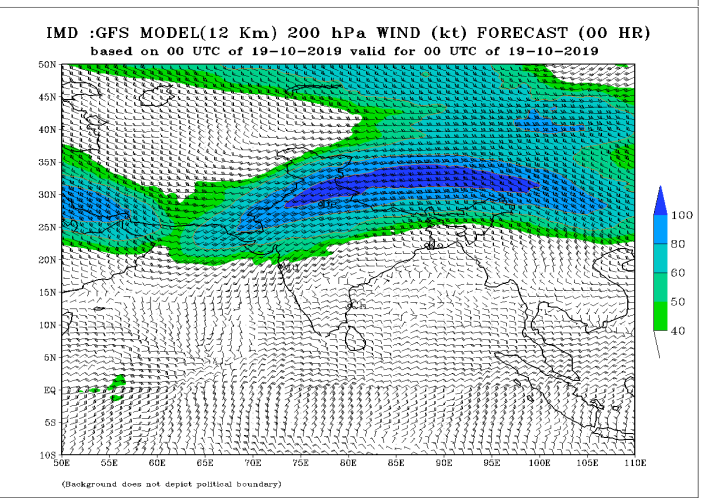
(Potential Cyclogenesis Zone for GPP =>30)


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (00 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 19-10-2019
(Background does not depict political boundary)


IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (00 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 19-10-2019
40
30
20
(Background does not depict political boundary)


IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (00 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 19-10-2019
60
40
30
20
(Background does not depict political boundary)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based on 00 UTC of 19-10-2019 valid for 00 UTC of 19-10-2019
100
80
60
50
40
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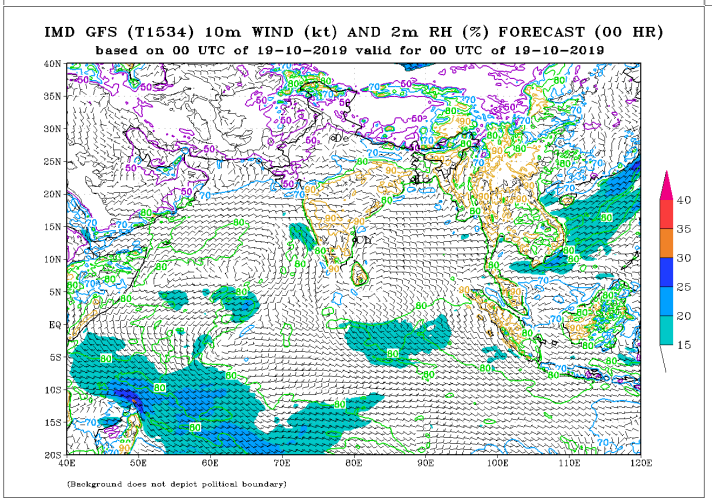
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (00 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 19-10-2019
40
35
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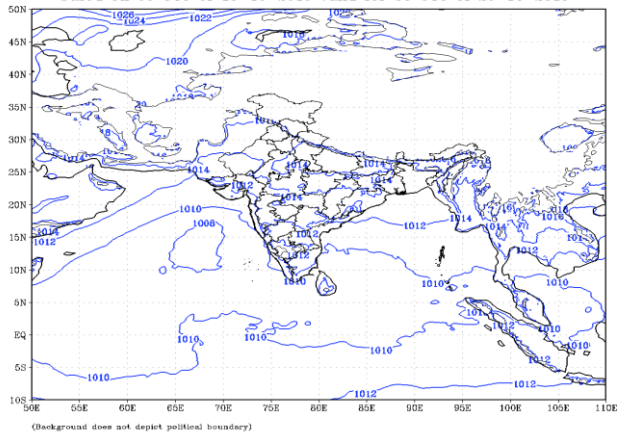
25
20
15
(Background does not depict political boundary)

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (24 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 20-10-2019



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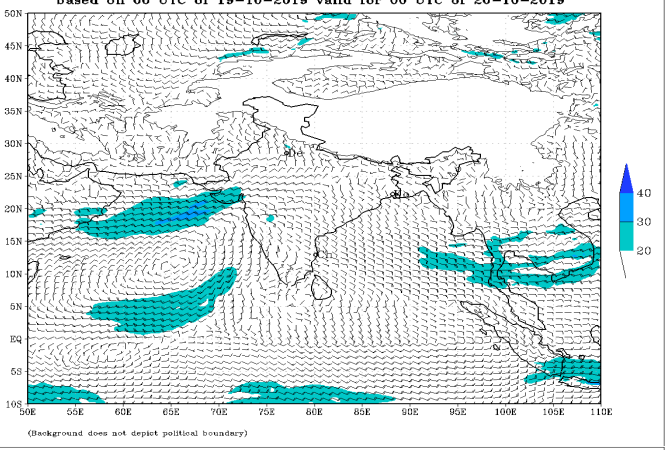
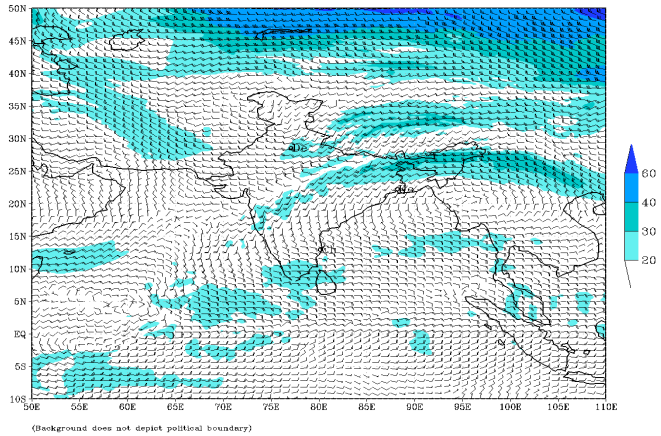
based on 00 UTC of 19-10-2019 valid for 00 UTC of 20-10-2019



IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 20-10-2019



IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (24 HR)
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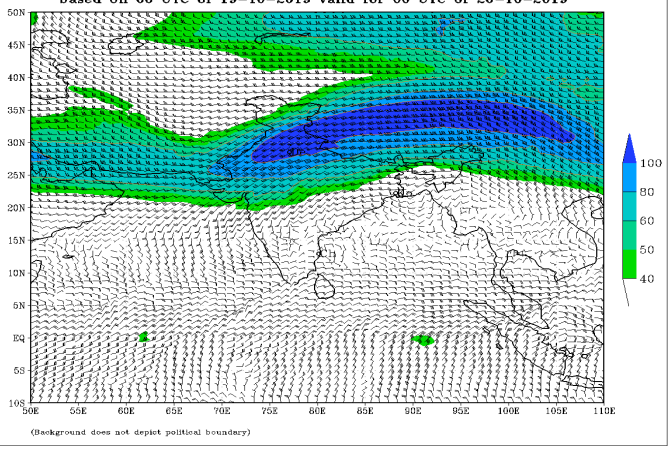
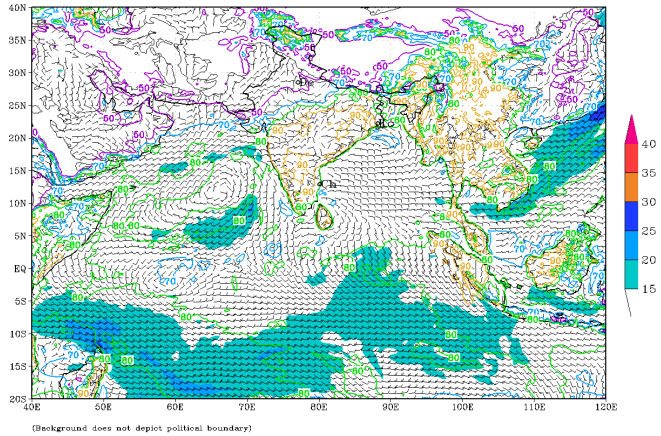


IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (24 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 20-10-2019



IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (48 HR)
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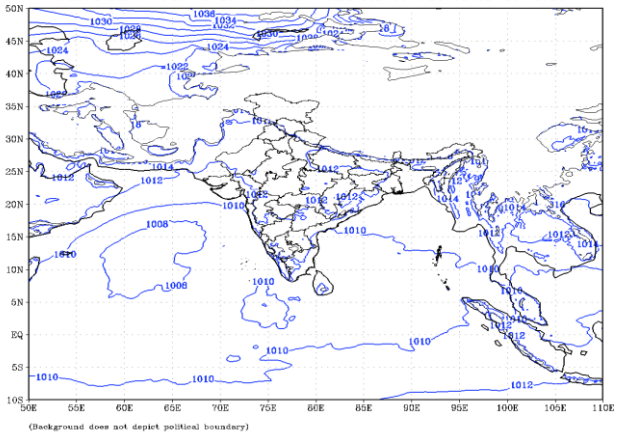

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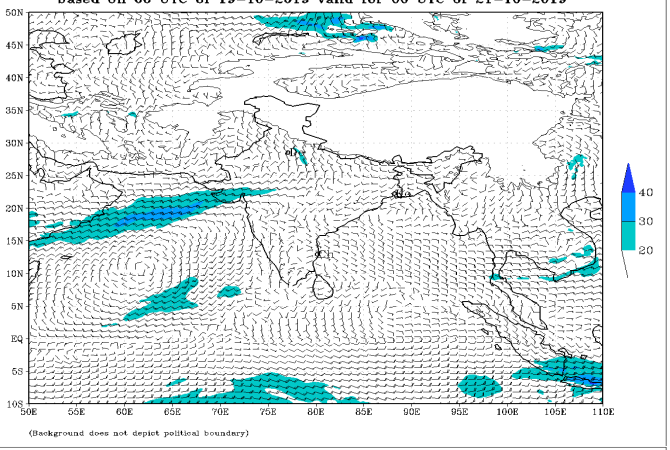

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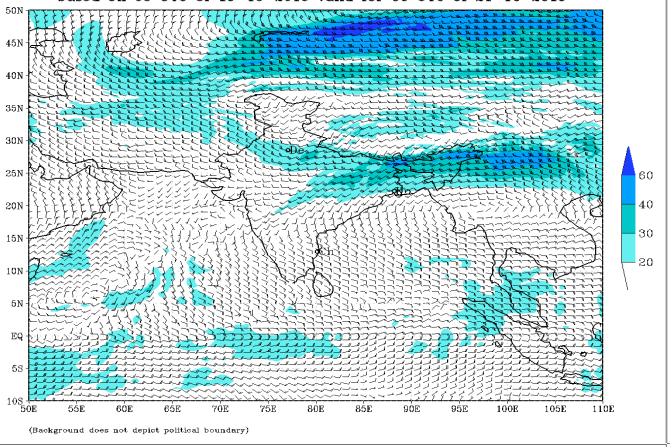

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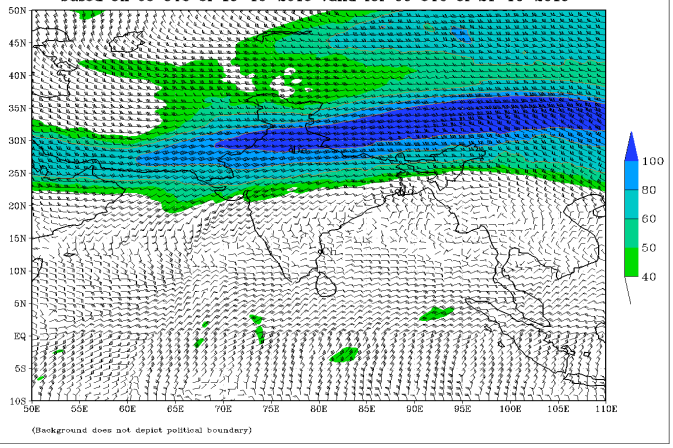
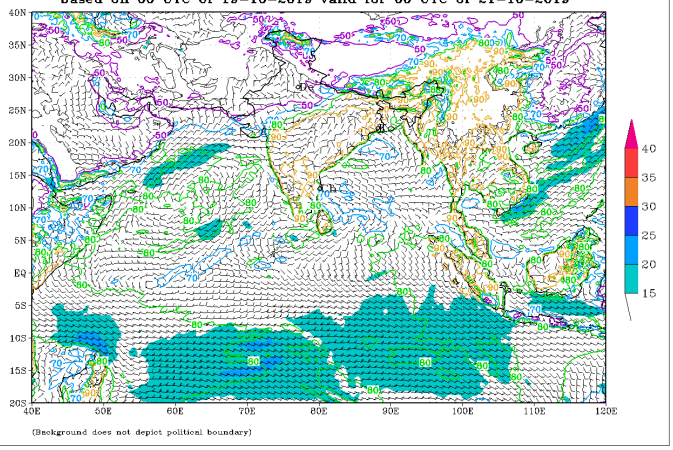


IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (48 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 21-10-2019



IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (72 HR)
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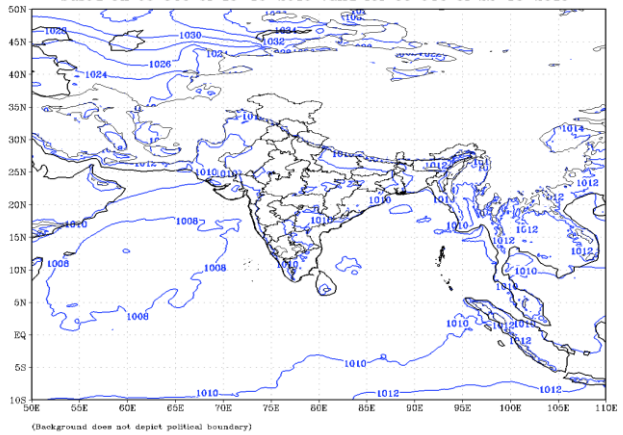

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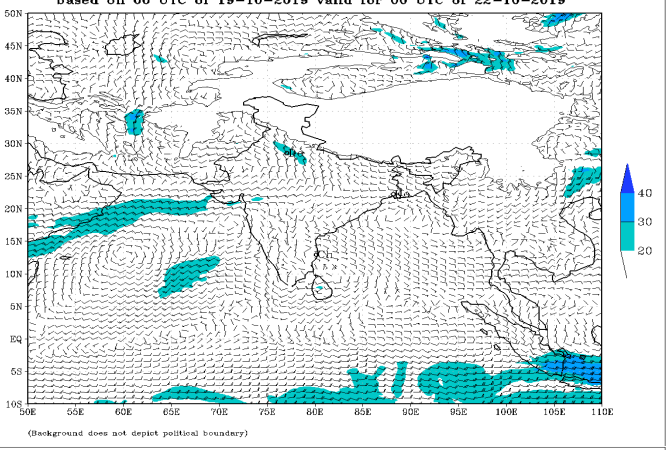

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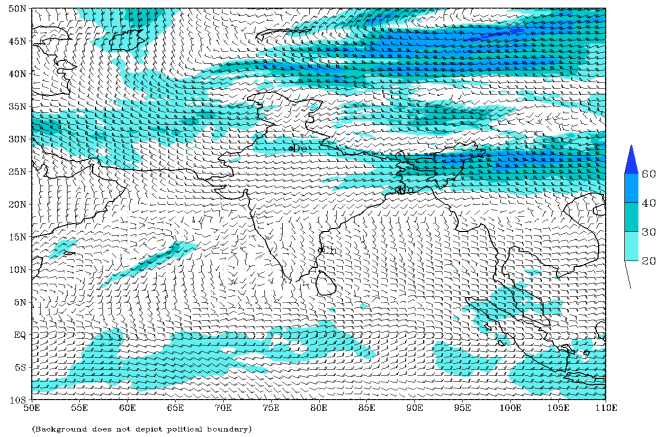
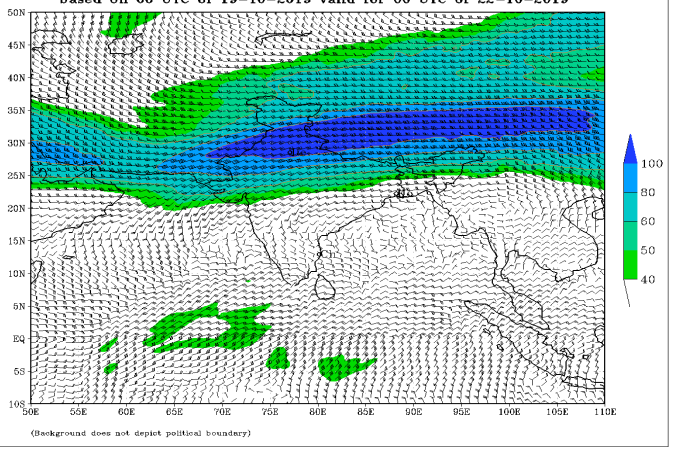
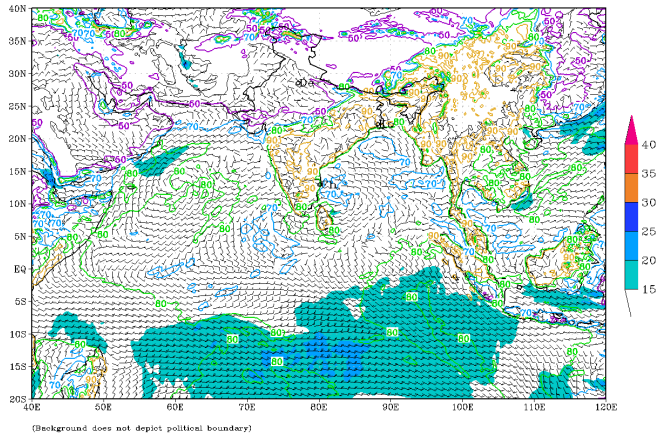


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 22-10-2019



IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (72 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 22-10-2019



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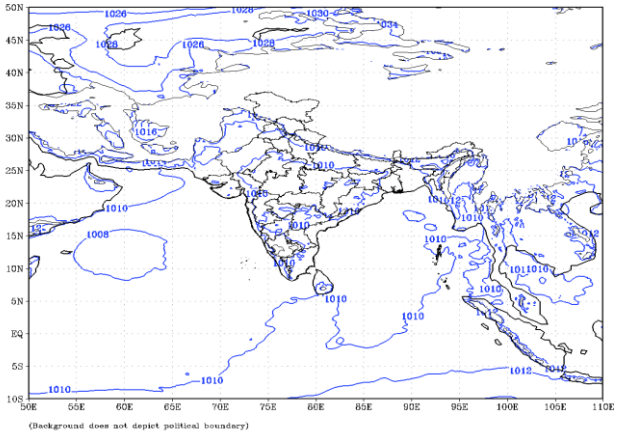
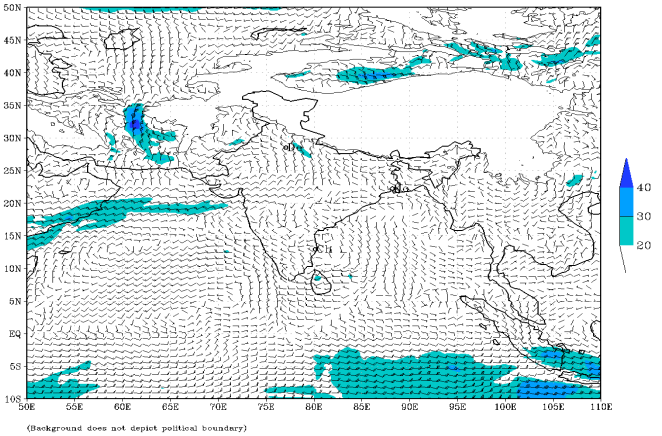


(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 23-10-2019



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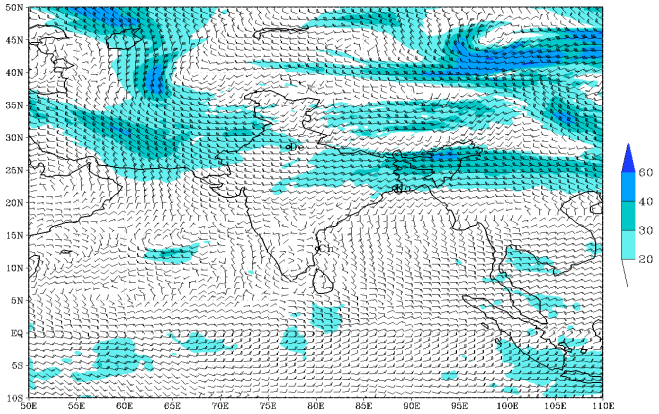

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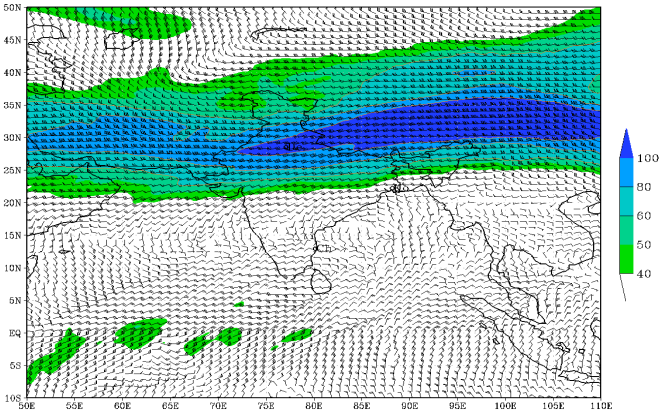
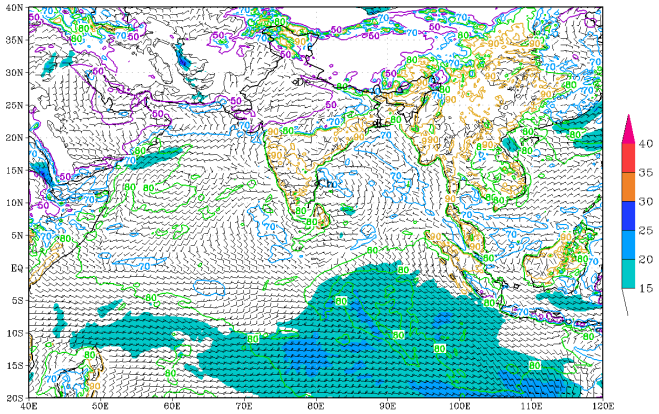
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 23-10-2019



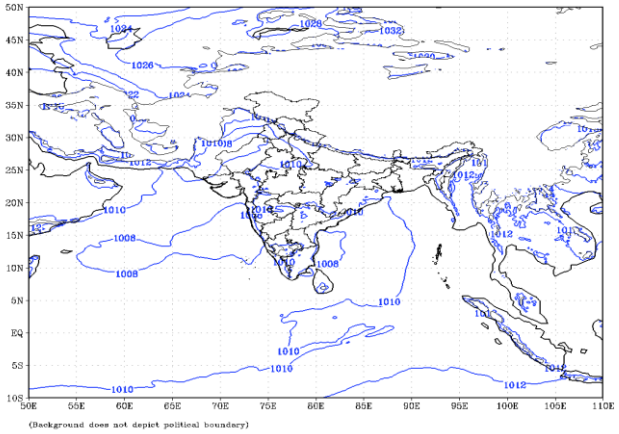
(Background does not depict political boundary)

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (96 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 23-10-2019



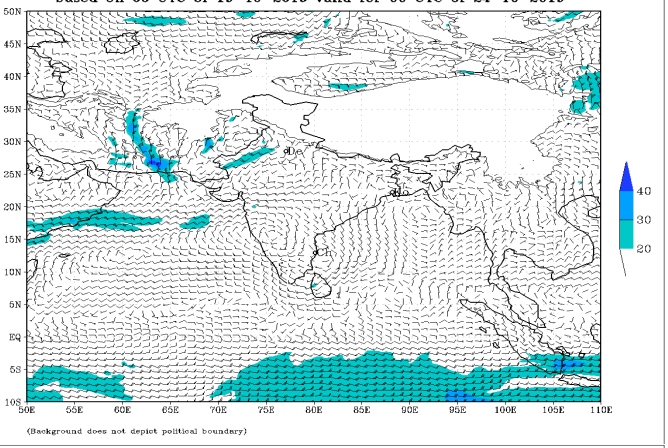
(Background does not depict political boundary)

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 24-10-2019



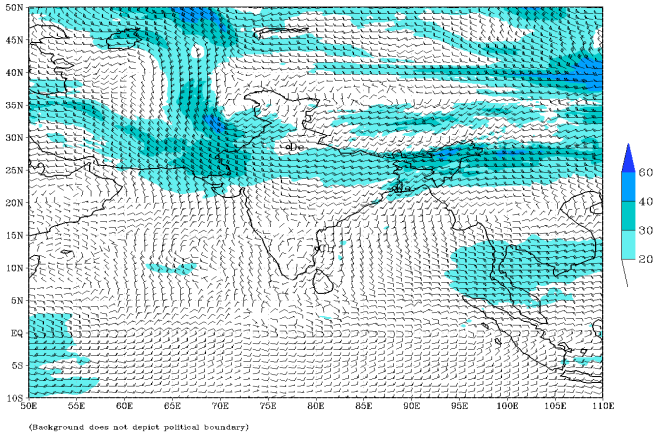
(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 24-10-2019



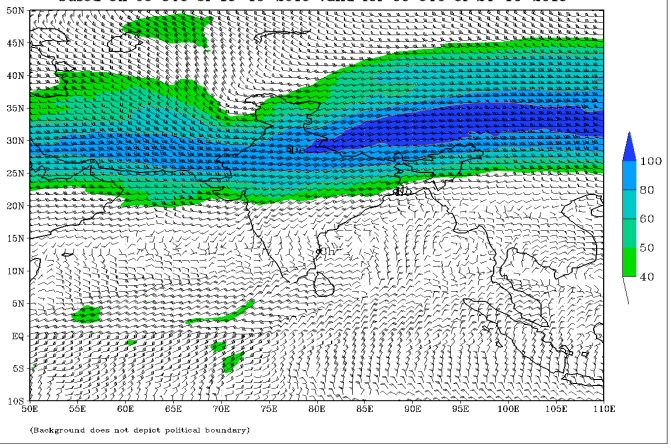
(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 24-10-2019



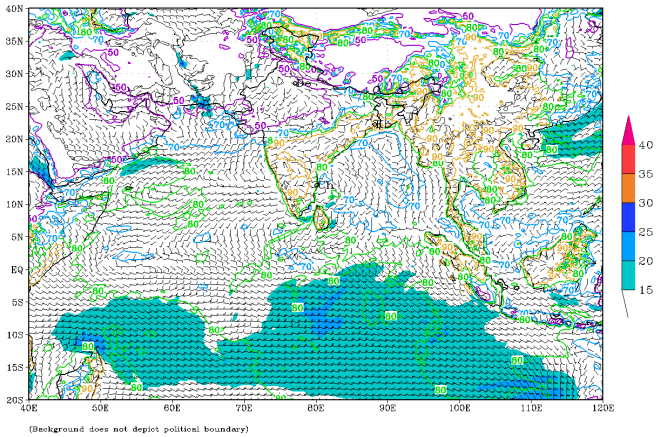
(Background does not depict political boundary)

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 24-10-2019



(Background does not depict political boundary)

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (120 HR)
based on 00 UTC of 19-10-2019 valid for 00 UTC of 24-10-2019



(Background does not depict political boundary)