



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



FDP (Cyclone) NOC Report Dated 22nd October, 2019

Time of Issue: 1200 UTC

Synoptic features:

- The Low Pressure Area over east central Arabian Sea lay over central parts of Arabian Sea at 0300 UTC and has become **well marked** over the same region by 0900 UTC of today. Associated cyclonic circulation extends upto 4.5 km above mean sea level. It is very likely to concentrate into a Depression during next 48 hours. It is likely to move initially east-northeastwards over eastcentral Arabian Sea till 25th October and then west-northwestwards with gradual intensification.
- Another Low Pressure Area formed over southwest & adjoining westcentral Bay of Bengal today morning and lay as a **well marked Low Pressure Area** over the same region by 0900 UTC. Associated cyclonic circulation extends upto 5.8 km. above mean sea level, tilting southwestwards with height. It is very likely to concentrate into a Depression during next 48 hours and move north-northwestwards, towards Andhra Pradesh coast.

Dynamical and thermodynamical features

Surface Temperature (SST):

SST is 29-30°C over east-central & south Arabian Sea (AS) 28-29°C over north AS and the least (26-27 °C) over west central and adjoining southwest Arabian Sea (AS) and along south Oman – Yemen – Somalia coasts.

SST is 29 - 30°C over west-central and south-west Bay of Bengal (BOB) & Andaman Sea, 30 - 32°C over Myanmar coast and north & east-central BOB.

Tropical Cyclone Heat Potential (TCHP):

TCHP is 80-100 kJ/cm² over southeast & adjoining central AS, 100-110 kJ/cm² over west equatorial Indian Ocean (IO). It is < 40 kJ/cm² over most parts of north & west-central AS and Oman – Yemen coasts.

TCHP is 110-130 kJ/cm² over west-central & southwest BOB, 100-110 kJ/cm² over north Andaman Sea and east-central BOB and 60-80 kJ/cm² elsewhere over the BOB.

Relative Vorticity:

An area of cyclonic relative vorticity at 850 hPa of 50 – 80 X10⁻⁶s⁻¹ is seen over central AS. Cyclonic relative vorticity at 850 hPa of 80 – 90 X10⁻⁶s⁻¹ also seen over south Andhra Pradesh - north Tamil Nadu coasts.

Low level Convergence:

Lower level convergence is about 20 x 10⁻⁵s⁻¹ over east-central AS off south Maharashtra – Karnataka coasts.

Lower level convergence of about 05 - 10 x 10⁻⁵s⁻¹ is seen over southwest and adjoining west central BOB and south Andhra Pradesh coasts.

Upper level Divergence:

A zone of upper level divergence of 30x10⁻⁵ s⁻¹ is seen over east-central AS and another zone of 20x10⁻⁵ s⁻¹ over west equatorial IO and adjoining southeast AS.

A zone of upper level divergence of 30x10⁻⁵ s⁻¹ is seen over west-central & south west BOB and adjoining Andhra Pradesh – north Tamil Nadu coasts.

Wind Shear:

Wind shear is 05-10 knots over east-central AS to the west of south Maharashtra coast and increases to high values (25-40) to the north as well as to the south.

Wind shear is 10-15 knots over west-central, northeast & east-central BOB and Andaman Sea. It increases to 20 knots to the north & south.

Wind Shear Tendency:

The wind shear is in increasing tendency over south and adjoining central AS & southwest AS and decreasing over north AS.

It is increasing over southwest and parts of north BOB and decreasing over Andaman Sea.

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:

Arabian Sea:-

According to 0600 UTC satellite imagery, scattered low/medium clouds with embedded intense to very intense convection prevails over east-central and adjoining west-central Arabian Sea between Lat. 12° N to 17° N & Long. 61° E to 68° E in association with low level circulation over the area (minimum CTT minus 93° C)

Bay of Bengal & Andaman Sea:-

According to 0600 UTC satellite imagery, broken low/medium clouds with embedded intense to very intense convection prevails over south-west and adjoining west-central BOB off north Tamil Nadu -south Andhra Pradesh coasts and neighbourhood in association with a WML of intensity (T 1.0) over the area. The centre of the WML lies within half a deg of 13.5°N/82.5°E, between Lat. 10°N to 16°N & Long. 80°E to 85°E (minimum CTT minus 93°C)

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 gradual reduction in amplitude for next 5 days.

Storms and Depression over South China Sea/ South Indian Ocean: None over south China Sea and over south Indian Ocean.

Two tropical cyclones, viz., Tropical Storm 21W “Neoguri” and Typhoon 22W “Bualoi” are located over Pacific Ocean.

NWP Input for FDP Cyclone based on 0000 UTC of today

IMD-GFS T-1534

- (i) Indicates : Low pressure area (Lopar) over central AS on 22nd, Well Marked Lopar (WML) over east-central and adjoining west-central AS on 23rd, **Depression (D)** over east-central AS off south Maharashtra-Goa coasts on 24th, persists there as D on 25th & 26th, weakens into a WML on 27th, west-northwestward movement as a WML over east-central AS on 28th, WML over west central AS on 29th, further west-northwestward movement and weakening during 30th October – 1st November.
- (ii) Indicates : Lopar over south west and adjoining west central BOB off north Tamil Nadu-south Andhra Pradesh coasts on 22nd, WML over west-central and adjoining southwest BOB off south Andhra Pradesh – north Tamil Nadu coasts on 23rd, **D over coastal Andhra Pradesh (central) and adjoining west-central BOB on 24th**, Lopar over west-

central BOB off Andhra Pradesh coast on 25th and less marked on 26th October.

IMD-GEFS

- (i) Indicates : WML over central AS on 22nd, WML over east-central AS off Maharashtra coast on 23rd, D over east central AS off south Maharashtra coast on 24th & 25th, Lopar over east central AS off Maharashtra-Goa coast on 24th & 25th, westward movement as D over east-central AS on 26th, Lopar over east-central and adjoining west-central AS on 27th, WML over central AS on 28th, and D over west-central AS on 29th October.
- (ii) Indicates : Lopar over west central & adjoining south-west BOB on 22nd, WML over coastal Andhra Pradesh and adjoining west-central BOB on 23rd and less marked on 24th October.

IMD-WRF

- (i) Indicates : Lopar over central AS on 22nd, Lopar over east-central AS on 23rd, D over east-central AS off Maharashtra coast on 24th and Cyclonic Storm (CS) over the same region on 25th October.
- (ii) Indicates : WML over west central and adjoining southwest BOB off north Tamil Nadu – south Andhra Pradesh coasts on 22nd, WML over west central BOB off south Andhra Pradesh coast on 23rd, WML over west central BOB off north Andhra Pradesh coast on 24th and WML over northwest BOB off south Odisha coast on 25th October.

NCMRWF-NCUM:

- (i) Indicates : Lopar over central AS on 22nd, WML over central AS on 23rd, east-northeastward movement and concentrating into D over east central AS on 24th, CS over east central AS off south Maharashtra-Goa coasts on 25th & 26th, west-northwestward movement and further intensification into an SCS/ VSCS on 27th, VSCS or Extremely SCS (ESCS) over east-central and adjoining northeast AS on 28th, ESCS over Gulf of Kutch on 29th, moving north-northwestwards cross Pakistan coast and weakens into CS over west Rajasthan and adjoining Pakistan on 30th and rapid weakening thereafter.
- (ii) Indicates : Lopar over west-central BOB off south Andhra Pradesh coast on 23rd, WML over west central BOB off Andhra Pradesh coast on 24th, Lopar over west central BOB off north Andhra Pradesh coast on 25th, D over West Bengal coast on 26th and weakens in to WML over Bangladesh on 27th and become less marked on 28th October.

NCMRWF-UM-Regional Model:

- (i) Indicates : Lopar over central AS on 22nd, D over east-central AS on 23rd, CS over east-central AS off south Maharashtra coast on 24th, SCS over east-central AS close to south Maharashtra coast on 25th October.
- (ii) Indicates : Lopar over west central & adjoining southwest BOB on 22nd, WML over west central BOB off Andhra Pradesh coast on 23rd, D over north coastal Andhra Pradesh & neighbourhood on 24th and WML over interior Odisha on 25th October.

NEPS Model:

- (i) Indicates : D over east-central AS on 22nd, slight eastward movement of the D over east central AS on 23rd, eastward movement and intensifying into CS over east central AS off south Maharashtra coast on 24th, VSCS over the same region on 25th, ESCS over the same region on 26th, ESCS/ Super Cyclonic Storm (SuCS) over the same region on 27th, SuCS over north and adjoining east-central AS off south Gujarat coast on 28th and ESCS over Gulf of Kutch on 29th October.
- (ii) Indicates : Lopar over west central and adjoining south west BOB on 22nd, WML over west central BOB off Andhra Pradesh coast on 23rd & 24th, D over west central BOB off north Andhra Pradesh coast on 25th, CS over north Odisha – west Bengal coasts on 26th, D over Bangla Desh on 27th and less marked on 28th October.

ECMWF:

- (i) Indicates : Lopar over east-central AS on 22nd, WML over east-central AS on 23rd, D over east-central AS on 24th, CS over east central AS off south Maharashtra coast on 25th, and 26th, west north westward movement and intensification in to SCS on 27th, west north westward movement and further intensification in to VSCS/ESCS on 28th and 29th and gradual weakening west northwestward movement on 30th and 31st October over west central AS.
- (ii) Indicates : A trough of low over west central BOB on 22nd, WML over west central BOB off Andhra Pradesh coast on 23rd, Lopar over north coastal Andhra Pradesh-south Odisha on 24th, Lopar over interior Odisha on 25th, Lopar over Bangladesh and adjoining West Bengal on 26th and weakening on 27th October.

NCEP-GFS :

- (i) Indicates : Extended Low over east central AS on 23rd, Lopar over east central AS off Maharashtra coast on 24th and 25th, WML over east central AS off south Maharashtra coast on 26th, Lopar over east central AS off Maharashtra coast (slight west northwestward movement) on 27th, Lopar over central AS on 28th, Lopar over west central AS on 29th. It is seen as a part of the easterly wave trough thereafter.
- (ii) Indicates : Lopar over coastal Andhra Pradesh and adjoining west central BOB on 23rd, Lopar over south Odisha and adjoining Chhattisgarh on 24th, less marked on 25th, a fresh trough of low over south west BOB on 26th, trough of low over southwest and west central BOB off Tamil Nadu-south Andhra Pradesh coast on 27th, less marked on 28th, fresh trough of low over southwest BOB off Tamil Nadu coast on 29th, fresh development over southwest BOB on 30th and its westward movement as a triugh of low thereafter.

ARP-Meteo France :

- (i) Lopar over central AS on 22nd, WML over east central AS on 23rd, CS over east central AS on off south Maharashtra-Goa coasts on October.
- (ii) Lopar over west central BOB on 22nd, D over west central BOB off Andhra Pradesh coast on 23rd, Lopar over south Chhattisgarh and neighbourhood on 24th October.

Dynamical statistical models

IMD Genesis Potential Parameter (GPP):

- (i) Significant zone of GPP seen over central AS on 22nd, east central AS on 23rd, extended area over east central AS off Maharashtra coast on 24th, over east central AS close to south Maharashtra coast on 25th and 26th, and nil from 27th October onwards.
- (ii) Significant zone of GPP seen over west central BOB on 22nd, west central BOB off Andhra Pradesh coast on 23rd and 24th, over east equatorial IO and adjoining south west BOB on 25th, over south west BOB on 26th, southwest and adjoining west central BOB off north Tamil Nadu-south Andhra Pradesh coasts on 27th and weakens on 28th 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:

Arabian Sea:

ECMWF, NEPS and NCUM are showing intensification of the system upto Cyclonic Storm on 25th and upto very severe cyclonic system stage thereafter. IMDGFS is showing a

depression during 24th – 26th weakening into a well marked low pressure area and west-northwestward movement thereafter. But NCEP GFS forecast is not showing the formation of a depression. However, majority of models suggest that a depression will form around 23rd October over eastcentral Arabian Sea. Given the climatology and dynamical parameters such as poleward out flow and anticyclonic shear suggest that it may intensify into a cyclone. Further, 29-30°C sea surface temperature over most parts of eastcentral Arabian Sea and >80 kJ/cm² tropical cyclone heat potential over eastcentral Arabian Sea area are favorable for cyclogenesis and its further intensification. Most of the models agree for east-northeast ward movement initially towards Maharashtra coast till 25th and then westnorthwestwards.

The MJO lies in the phase 2 with amplitude >1. It will remain in the same phase during next 5 days. It is favorable for genesis and intensification of the system over the Arabian Sea.

Bay of Bengal:

A few models like IMDGFS and NCUM suggest further intensification of the current well marked low pressure over the Bay of Bengal. However all the models suggest the movement of the this low pressure system from southwest and adjoining westcentral Bay of Bengal north-northwestwards towards Andhra Pradesh coast.

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

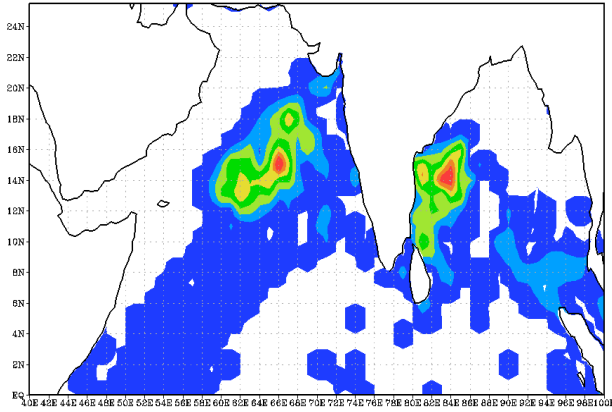
24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
LOW	MODERATE	MODERATE	NIL	NIL

Probability of cyclogenesis over Arabian Sea during next 120 hours:

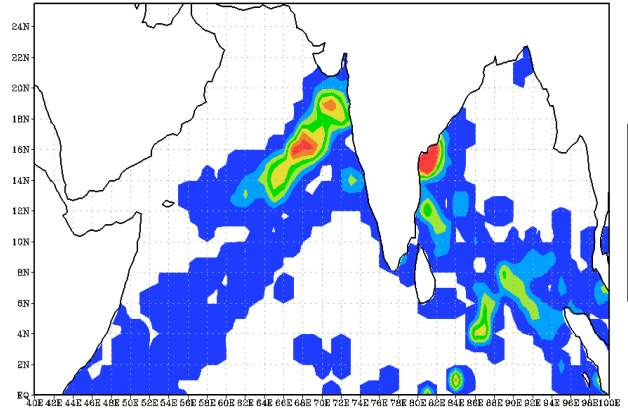
24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
NIL	LOW	MODERATE	HIGH	HIGH

Advisory: (i) IOP for coastal Andhra Pradesh from 23rd October and (ii) IOP for Maharashtra- Goa coasts from 24th October.

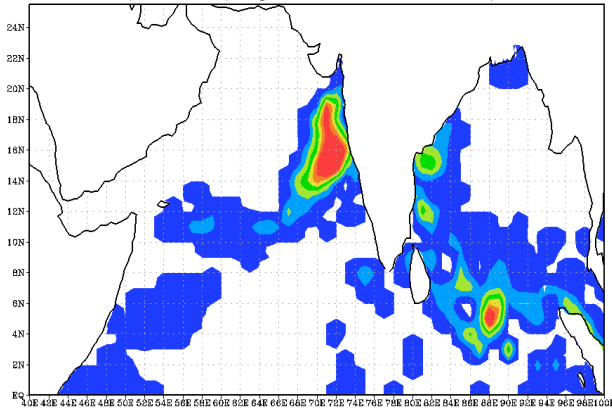
Tropical Cyclone Genesis Potential Parameter(GPP) (ANALYSIS)
Based on 22-10-2019 valid for 0000 UTC of 22-10-2019
(Potential Cyclogenesis Zone for GPP =>30)



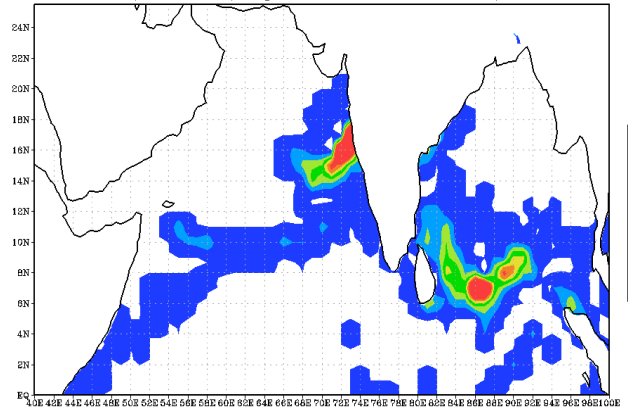
Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 22-10-2019 valid for 0000 UTC of 23-10-2019
(Potential Cyclogenesis Zone for GPP =>30)



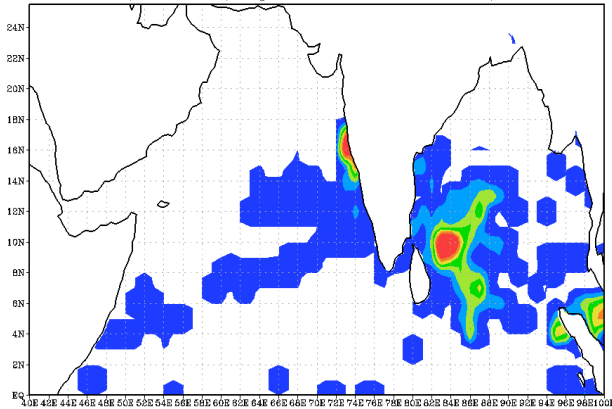
Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 22-10-2019 valid for 0000 UTC of 24-10-2019
(Potential Cyclogenesis Zone for GPP =>30)



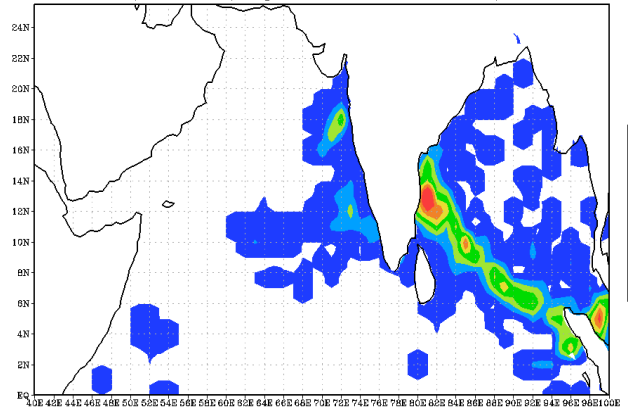
Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 22-10-2019 valid for 0000 UTC of 25-10-2019
(Potential Cyclogenesis Zone for GPP =>30)



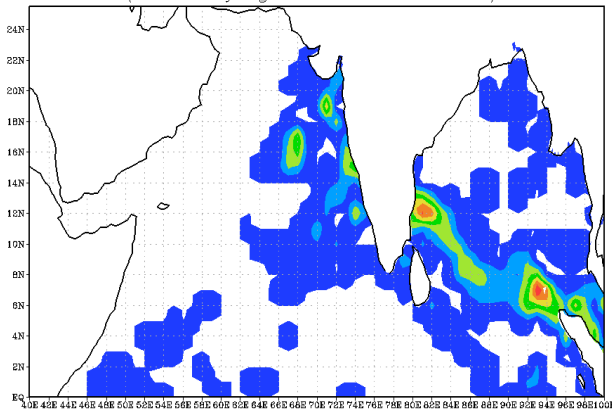
Tropical Cyclone Genesis Potential Parameter(GPP) (96 HR FORECAST)
Based on 22-10-2019 valid for 0000 UTC of 26-10-2019
(Potential Cyclogenesis Zone for GPP =>30)



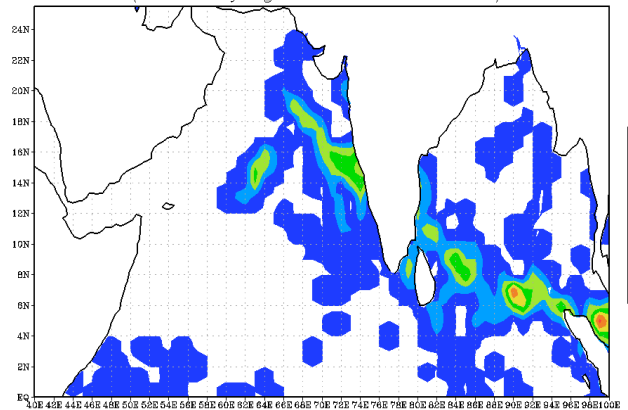
Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
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(Potential Cyclogenesis Zone for GPP =>30)

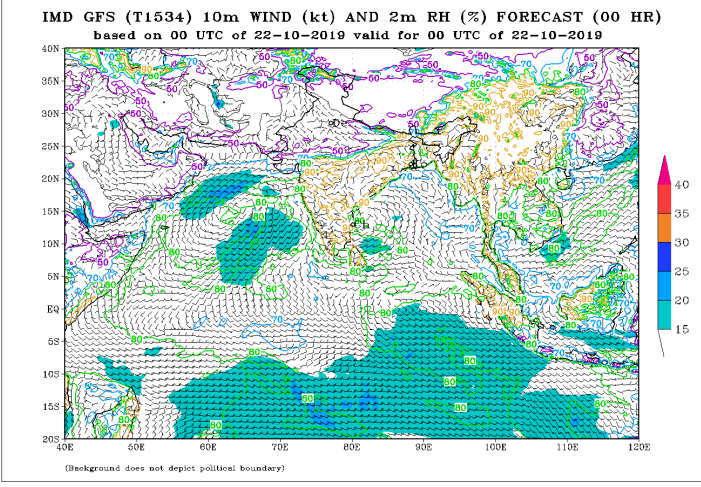
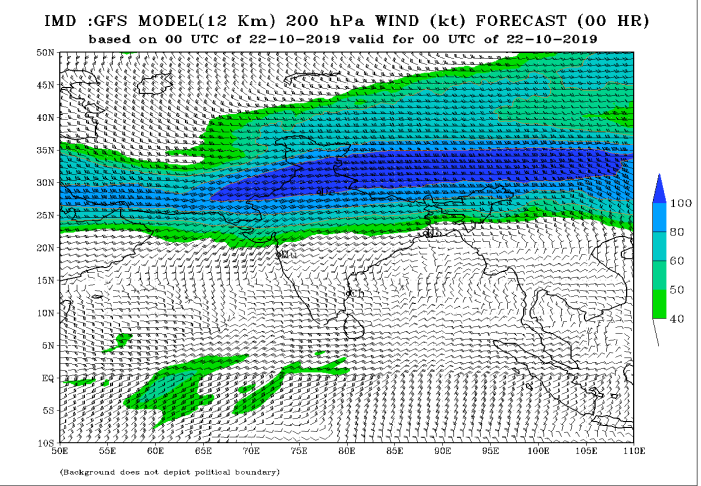
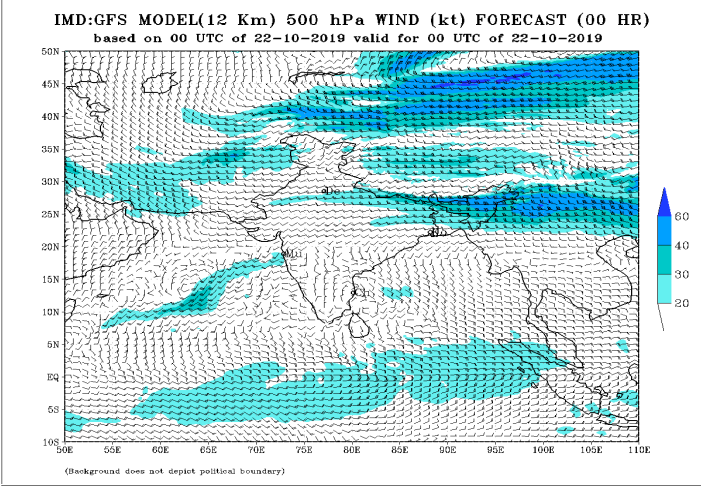
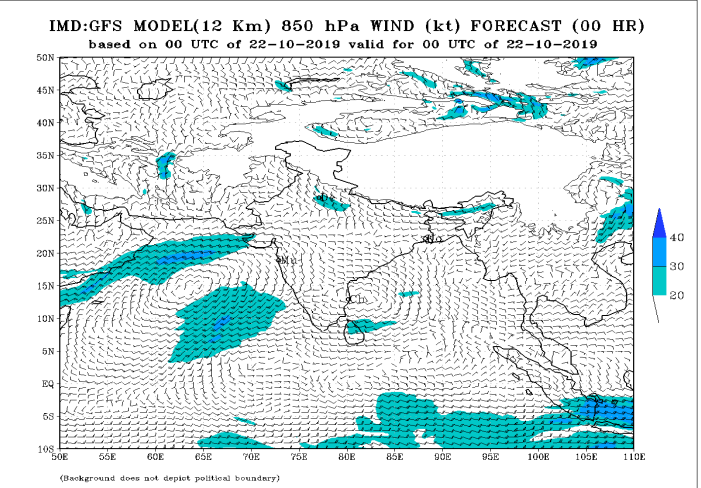
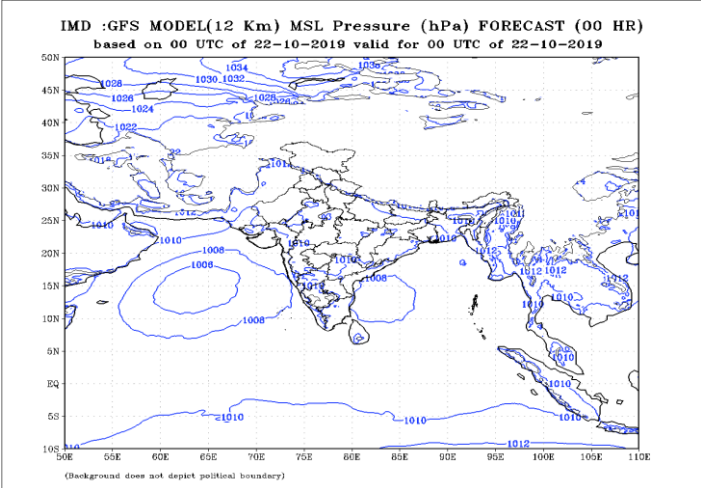


Tropical Cyclone Genesis Potential Parameter(GPP) (144 HR FORECAST)
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(Potential Cyclogenesis Zone for GPP =>30)

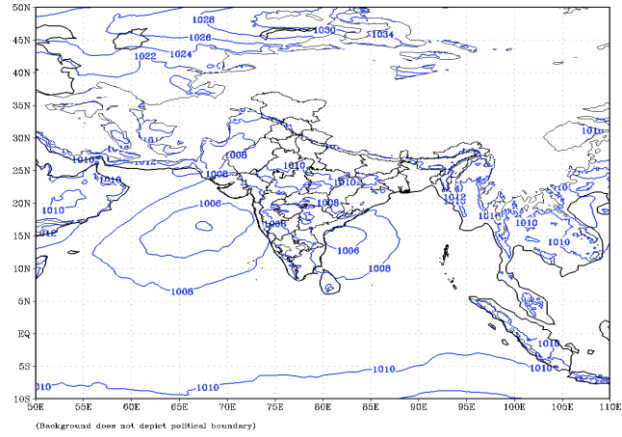


Tropical Cyclone Genesis Potential Parameter(GPP) (168 HR FORECAST)
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(Potential Cyclogenesis Zone for GPP =>30)

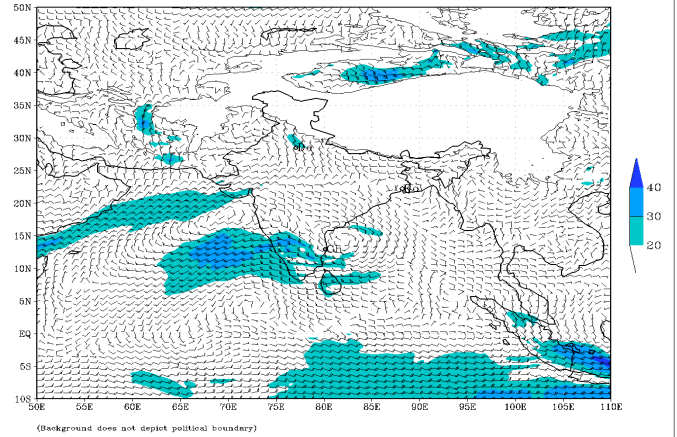




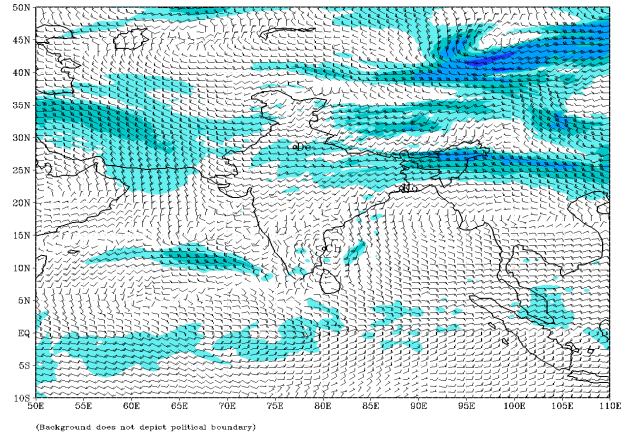
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based on 00 UTC of 22-10-2019 valid for 00 UTC of 23-10-2019



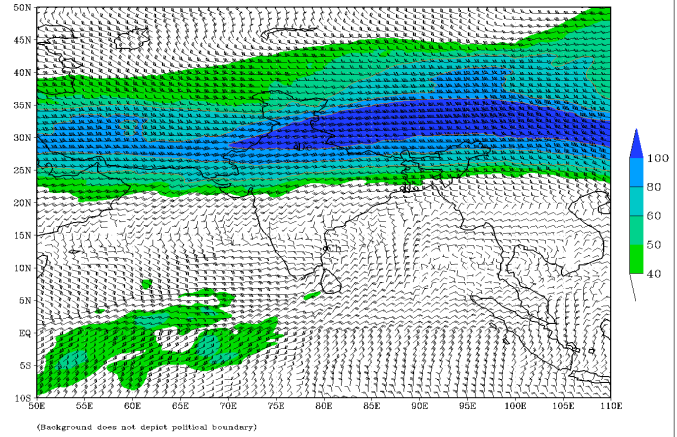
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based on 00 UTC of 22-10-2019 valid for 00 UTC of 23-10-2019



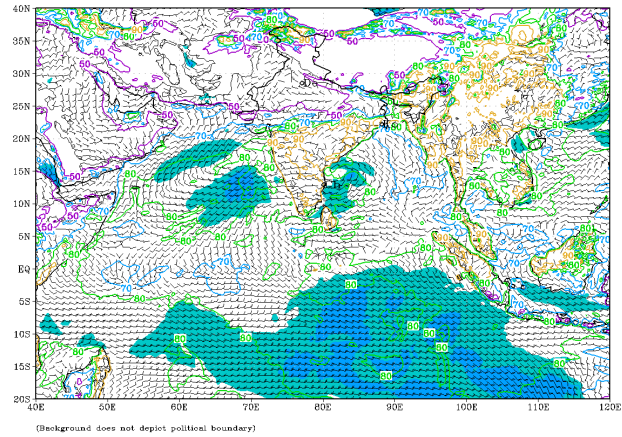
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based on 00 UTC of 22-10-2019 valid for 00 UTC of 23-10-2019



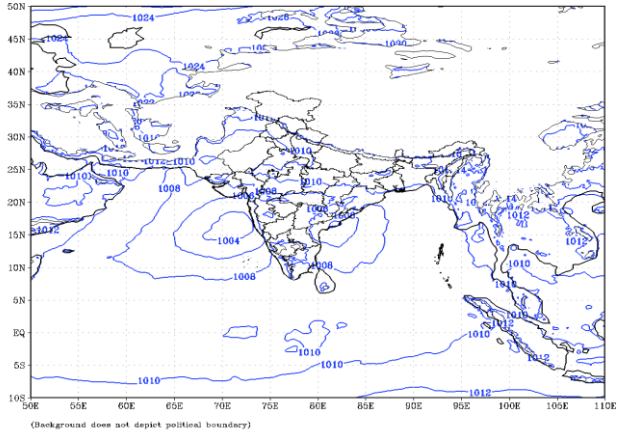
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based on 00 UTC of 22-10-2019 valid for 00 UTC of 23-10-2019



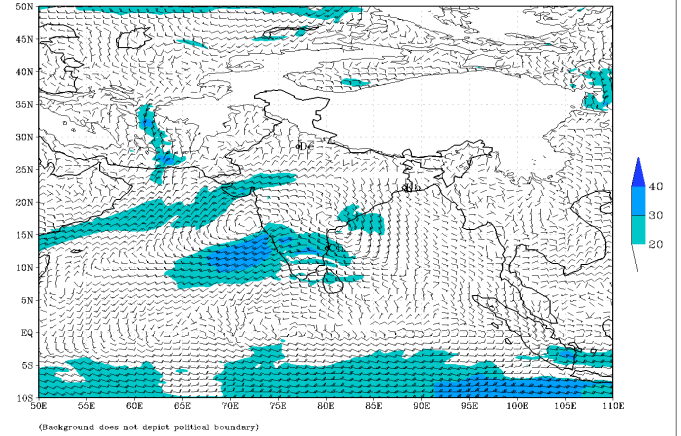
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (24 HR)
based on 00 UTC of 22-10-2019 valid for 00 UTC of 23-10-2019



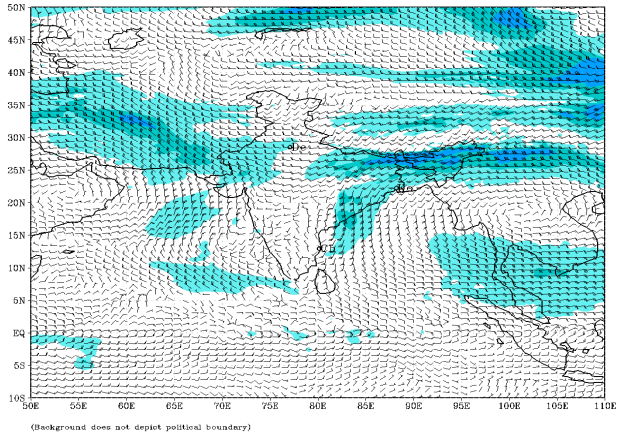
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (48 HR)
based on 00 UTC of 22-10-2019 valid for 00 UTC of 24-10-2019



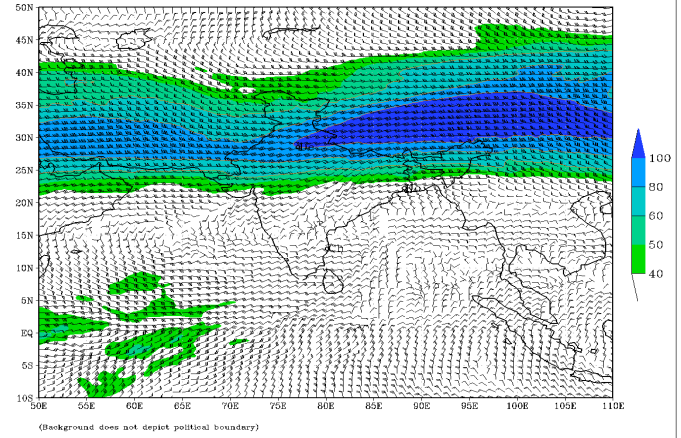
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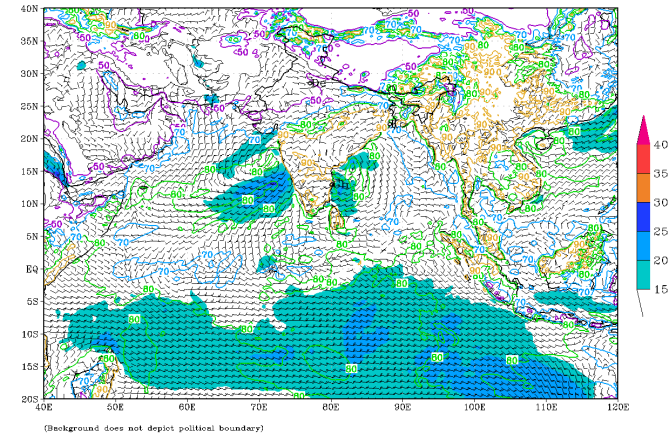
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based on 00 UTC of 22-10-2019 valid for 00 UTC of 24-10-2019



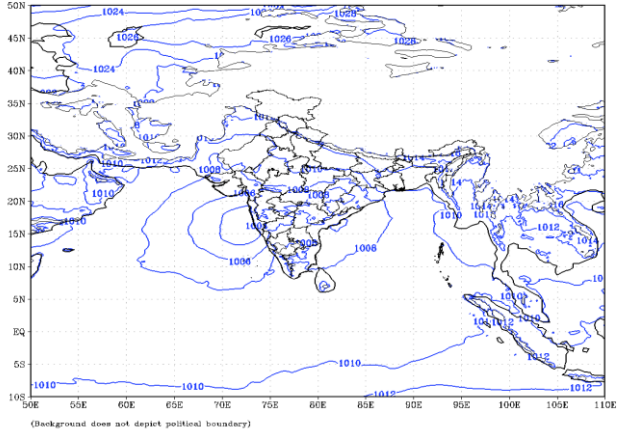
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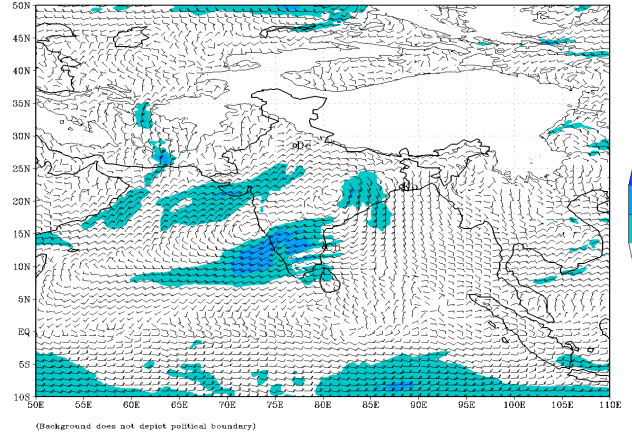
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (48 HR)
based on 00 UTC of 22-10-2019 valid for 00 UTC of 24-10-2019



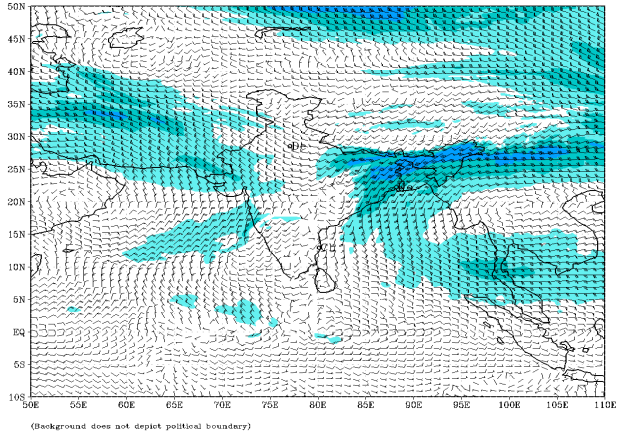
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based on 00 UTC of 22-10-2019 valid for 00 UTC of 25-10-2019



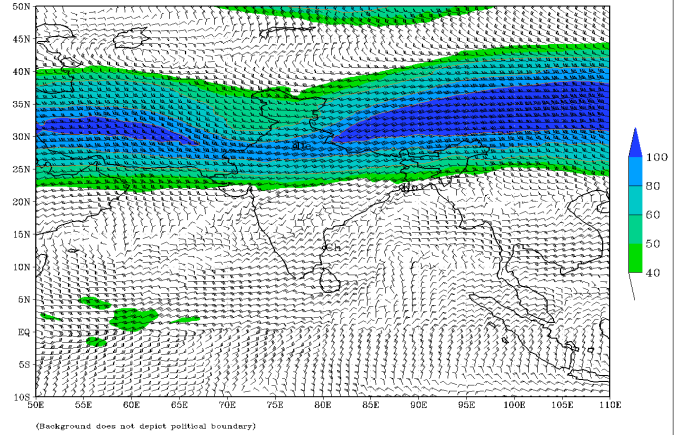
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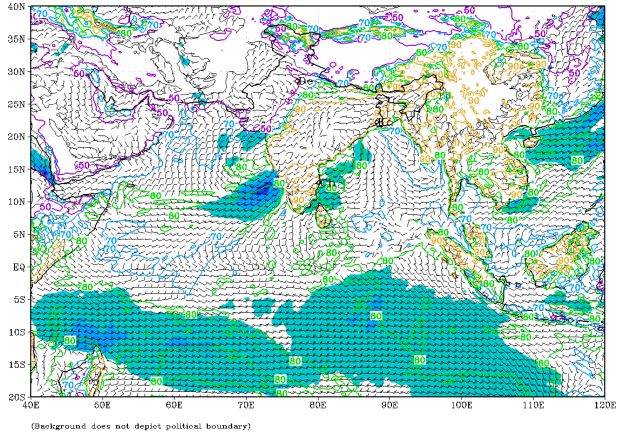
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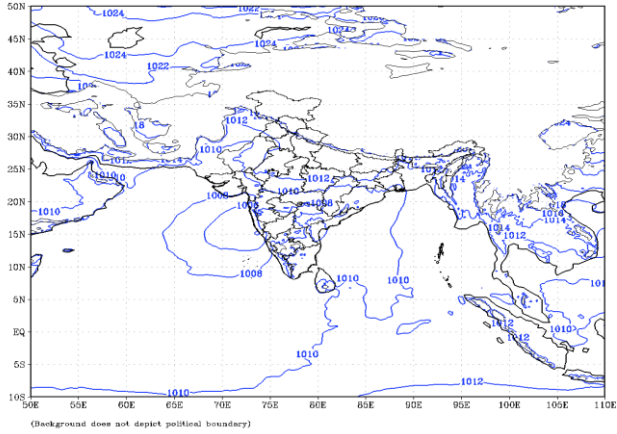
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based on 00 UTC of 22-10-2019 valid for 00 UTC of 25-10-2019



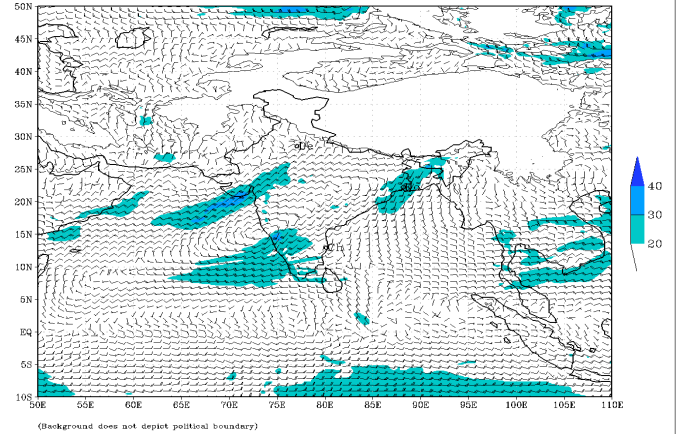
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based on 00 UTC of 22-10-2019 valid for 00 UTC of 25-10-2019



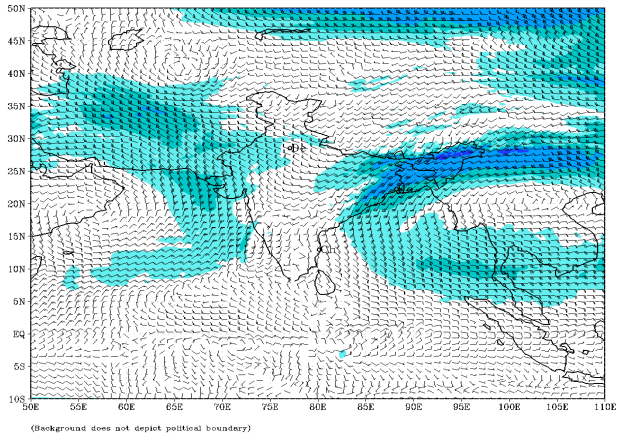
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (96 HR)
based on 00 UTC of 22-10-2019 valid for 00 UTC of 26-10-2019



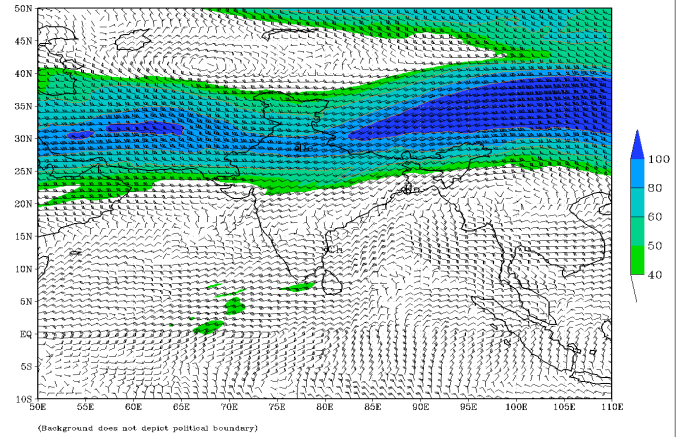
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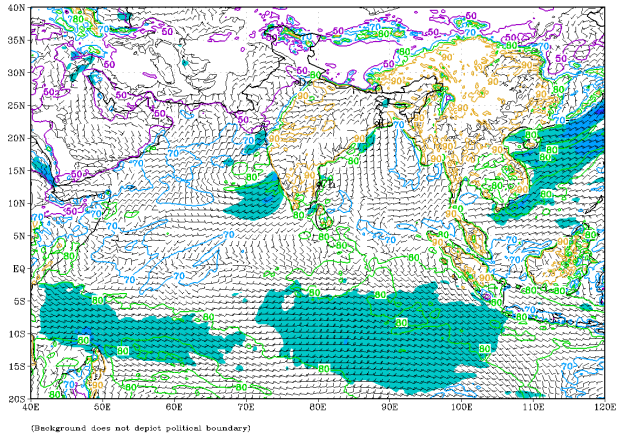
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 22-10-2019 valid for 00 UTC of 26-10-2019



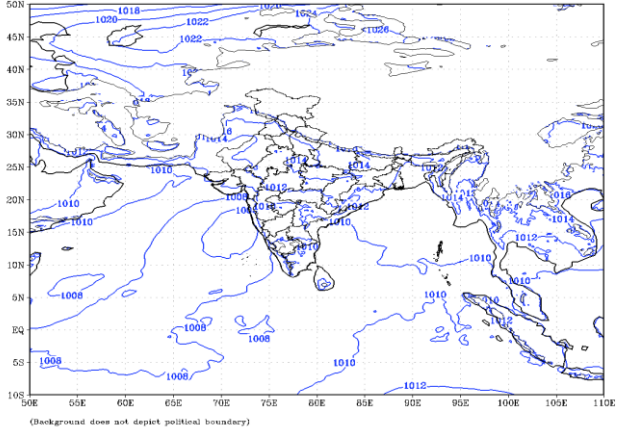
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 22-10-2019 valid for 00 UTC of 26-10-2019



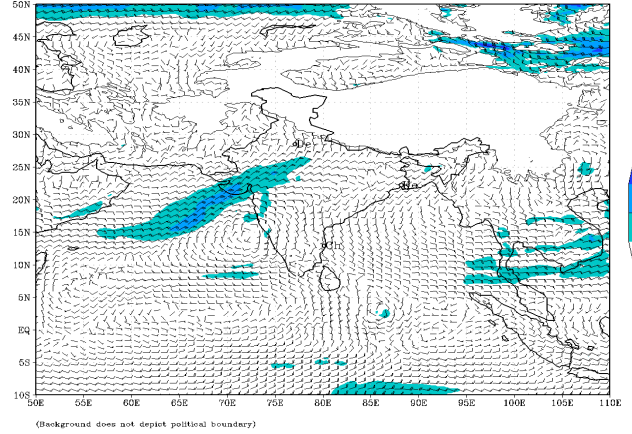
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (96 HR)
based on 00 UTC of 22-10-2019 valid for 00 UTC of 26-10-2019



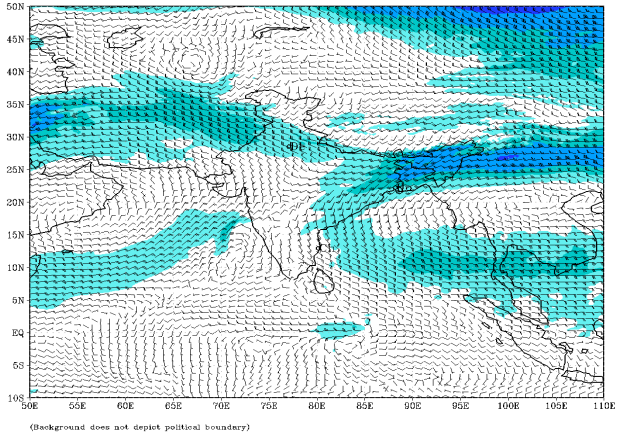
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)
based on 00 UTC of 22-10-2019 valid for 00 UTC of 27-10-2019



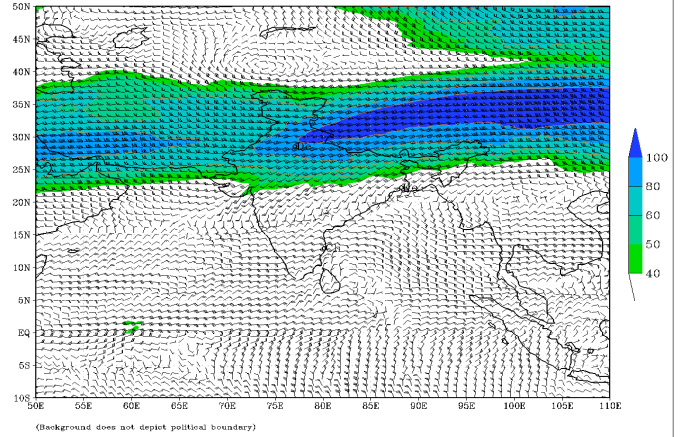
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 22-10-2019 valid for 00 UTC of 27-10-2019



IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 22-10-2019 valid for 00 UTC of 27-10-2019



IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 22-10-2019 valid for 00 UTC of 27-10-2019



IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (120 HR)
based on 00 UTC of 22-10-2019 valid for 00 UTC of 27-10-2019

