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

Tropical Cyclone Forecast Programme
Report Dated 24th December 2022

Time of Issue: 1100 UTC

Synoptic features (based on 0600 UTC analysis):

- The Depression over Southwest Bay of Bengal moved west-southwestwards with a speed of 15 kmph during past 06 hours and lay centered at 1130 hours IST of today, the 24th December over the same region near latitude 10.5°N and longitude 83.7°E about 340 km northeast of Trincomalee (Sri Lanka), 420 km east of Nagappattinam (Tamil Nadu) and 470 km east-southeast of Chennai (Tamil Nadu).

- It is likely to move further west-southwestwards and reach near Sri Lanka coast by 25th morning. Thereafter, it would continue to move west-southwestwards across Sri Lanka and reach Comorin Area and neighbourhood by 26th morning.

Dynamical and thermo-dynamical features

Parameter	Bay of Bengal (BoB)	Arabian Sea (AS)
Sea Surface Temperature (SST) ºC	About 27 around the system, 28 over the south Andaman Sea and adjoining southeast bay of Bengal, eastcentral BoB, 29-30 over north Andaman Sea, less than 25 over north BoB.	About 29-30°C over the southeast and adjoining southwest AS off Karntaka and Kerala, south Gujarat coasts, north AS, 26-28°C over eastcentral and adjoining north AS, along and off kerala and Karnataka coasts, 25-26°C over southwest AS, less than 24°C over southwest AS off Oman and Yemen coasts and adjoining sea areas.
Tropical Cyclone Heat Potential (TCHP) kJ/cm^2	➢ 120 over small pockets of southeast BoB and adjoining EIO, >110 over south Andaman sea, adjoining north Andaman Sea & adjoining southeast BoB, eastcentral BoB, 70-80 over north Andaman Sea, north parts of southwest BoB and adjoining westcentral BoB, north Andhra Pradesh and south Odisha coasts, northeast BoB, off Sri Lanka, north BoB, and less than 40 over western	70-80 over southeast and adjoining eastcentral and adjoining southwest AS, and less than 40 over remaining AS and also off west coast of India, Comorin area.

	parts of westcentral BoB, less than 50 over along and off south Andhra Pradesh and Tamil Nadu coasts, west coast of SriLanka, Gulf of Mannar, some parts of southwest BoB.	
Cyclonic Relative vorticity ($X10^{-6}s^{-1}$)	100 to the south of system centre.	10-20 over south AS
Low Level convergence ($X10^{-5}$ s^{-1})	10-20 to the northeast of system centre.	05 over southern parts of south AS.
Upper Level divergence ($X10^{-5}$ s^{-1})	30 to the east of the system centre.	20 over southwest AS.
Vertical Wind Shear (VWS knots)	15-20 over system centre. High to the southwest of system centre.	25-40 over south and adjoining central AS, 50-60 over north AS and adjoining central AS.
Wind Shear Tendency (knots)	Decreasing over southwest BoB.	Decreasing over southeast AS & central AS.
Upper tropospheric Ridge	Along 10°N over the BoB.	Along 10.0°N over the AS.
Trough in westerlies	Near 30.0°N/ 50.0°E	

Satellite observations based on INSAT imagery (0900 UTC):

a) Over the BoB & Andaman Sea:-

Vortex over southwest BoB & neighbourhood now lay centered within half a degree of 10.5N/83.7E. Intensity is T1.0/C.I.1.5. Associated scattered to broken low/med clouds with embedded intense to very intense convection over south & adjoining central central BoB between latitude 8.0N to 15.0N and longitude 82.0E to 90.0E. Minimum CTT is -85°C. Convection has decreased during past 3 hours.

b) Over the Arabian Sea:-

Scattered to low/med clouds with embedded moderate to intense convection over south parts of southwest Arabian Sea.

M.J.O. Index:

The Madden Julian Oscillation (MJO) Index is currently in Phase 5 with amplitude greater than 1. Thereafter, it would move to phase 6 with amplitude greater than 1 from 26th December onwards.

Equatorial Waves:

The equatorial waves prediction indicates, strong easterly winds (5-7 mps) over Equatorial Indian Ocean & adjoining south BoB, weak easterly winds (1-3 mps) over central BoB, low frequency background waves over south BoB and Equatorial Rossby waves over south Andaman Sea during next 3-4 days. Thereafter, gradual weakening of westerly winds over south BoB & adjoining east Equatorial Indian Ocean and easterly winds over central BoB is predicted. Thus, equatorial waves are likely to support enhancement of convective activity over the BoB during next 2-3 days.

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

Cyclonic Storm Darian over Ssouth Indian ocean centered near 12.5S/83.2E. Intensity of the system is T 5.0/5.5. Corresponding maximum sustained winds of 90-119 kts. Associated broken low/med clouds with embedded intense to very intense convection over area between lat 9.0S to 14.0S and long 80.0E to 86.0E.

Model guidance based on 0000 UTC for the next 7 days

MODEL GUIDANCE	Bay of Bengal (BoB)	Arabian Sea (AS)
IMD-GFS	Well marked low pressure area (WML) over southwest BoB on 24th, to move southwestwards and reach near Sri Lanka on 25th and Comorin Area on 26/0000 UTC as a low pressure area. To move west-northwestwards thereafter and become less marked on 28/0000 UTC.	Low pressure area over Comorin Area on 26/0000 UTC. To move west-northwestwards thereafter and become less marked on 28/0000 UTC.
IMD-GEFS	Well marked low pressure area (WML) over southwest BoB on 24th, to move southwestwards and reach near Sri Lanka on 25th and Comorin Area on 26/0000 UTC as a low pressure area. To move west-northwestwards thereafter and become less marked on 28/0000 UTC.	Low pressure area over Comorin Area on 26/0000 UTC. To move west-northwestwards thereafter and become less marked on 28/0000 UTC.
GEFS Probabilistic guidance	NA	NA
IMD WRF	Well marked low pressure area (WML) over southwest BoB on 24th, to move southwestwards and reach near Sri Lanka on 25th and Comorin Area on 26/0000 UTC as a low pressure area. To move west-northwestwards thereafter.	No significant system.
NCMRWF-NCUM (G)	Well marked low pressure area over southwest BoB on 24th, to move southwestwards and reach near Sri Lanka Coast on 25th, Comorin Area on 26/0000 UTC as a depression.	Depression over Comorin Area on 26th, WML over Lakshadweep on 27th, to move westwards and lie as an LPA over southeast Arabian Sea on 28th becoming less marked on 29th Dec.
NCMRWF-NEPS	Well marked low pressure area over southwest BoB on 24th, to move southwestwards and reach near Sri Lanka Coast on 25th, Comorin Area on 26/0000 UTC as a depression.	Depression over Comorin Area on 26th, WML over Lakshadweep on 27th, to move westwards and lie as an LPA over southeast Arabian Sea on 28th becoming less marked on 29th Dec.
NCMRWF-UM (Regional)	Well marked low pressure area over southwest BoB on 24th, to move southwestwards and reach near Sri Lanka Coast on 25th, Comorin Area on 26/0000 UTC as a depression.	Depression over Comorin Area on 26th, WML over Lakshadweep on 27th Dec.

ECMWF	Depression over southwest Bay of Bengal on 24th, reaching Comorin area on 26th as a low pressure area/cyclonic circulation	Cyclonic circulation over Comorin on 26th/0000 UTC to move nearly westwards with marginal intensification on 27th/0000 UTC over Lakshadweep as a WML/Depression, Depression over southeast Arabian Sea on 28th December and weakening into an LPA on 29th/0000 UTC.
ECMWF ensemble	80-90% probability of depression over southwest Bay of Bengal during 24th -26th Dec. Model members are also indicating initial west-southwestwards movement towards Comorin area across Sri Lanka and then nearly westwards over southeast AS.	Over the Arabian Sea 10-30% probability of formation of depression with westwards movement during 26th-28th December.
NCEP-GFS	Well marked low pressure area (WML) over southwest BoB on 24th, to move southwestwards and reach near Sri Lanka on 25th and Comorin Area on 26/0000 UTC as a low pressure area. To move west-northwestwards thereafter and become less marked on 28/0000 UTC.	Low pressure area over Comorin Area on 26/0000 UTC. To move west-northwestwards thereafter and become less marked on 28/0000 UTC.
IMD MME	MME is indicating southwestwards movement of the system crossing Sri Lanka as a depression and emerging into Comorin Area on 26th/0000 UTC as a depression.	Depression over Comorin Area on 26th/0000 UTC. To move west-northwestwards thereafter with weakening into a well marked low pressure area on 28th Dec. over southeast Arabian Sea.
IMD HWRF	No guidance	No guidance
IMD-Genesis Potential Parameter (GPP)	A significant potential zone over southwest Bay of Bengal on 25th Dec.	A potential zone over Comorin area on 26th.

Summary and conclusion:

Environment features: Current environmental indicate that depression over southwest Bay of Bengal has entered into an unfavourable environment. Middle level relative vorticity show significant decrease in past 24 hours. Gradient wind has also decreased in past 24 hours. Yesterday, it was maximum at lower tropospheric levels and today, it is in middle tropospheric levels. Temperature anomaly plots indicate, that there is cold anomaly in the middle tropospheric levels, unlike yesterday. Thus, various dynamical features like temperature anomaly, gradient wind and vorticity at 500 hpa levels indicate that the vertical extension of deep convective cloud mass is decreasing gradually. The system is losing it's warm core characteristics. Hence the system is likely to weaken gradually. Also with weakening of the system, the steering level would change from deep layer to middle /lower tropospheric layers. Thus, the system would be steered southwestwards under the influence of northeasterly winds prevailing over the region in association with northeast monsoon. Further, as the system would move towards sri lanka coast, it would encounter high vertical wind shear, colder sea surface temperature and decrease in coriolis parameter. All these would lead to gradual weakening of this system while moving southwestwards towards Comorin area across Sri Lanka coast.

Model guidance: Most of the models are indicating that the depression over southwest Bay of Bengal would move southwestwards and reach Sri Lanka coast on 25th/0000 UTC and emerge into Comorin on 26th/0000 UTC. Thereafter, the system would move west-northwestwards and weaken gradually over southeast Arabian Sea around 27th/0000 UTC. There is however slight variation wrt intensity. ECMWF is indicating the system to maintain it's intensityof depression during next 2-3 days.

In view of all the above, it is inferred that

1. For the Bay of Bengal:

The depression over southwest Bay of Bengal is likely to move west-southwestwards and reach Sri lanka Coast by 25th/0000 UTC and Comorin area by 26th/0000 UTC.

Probability of cyclogenesis (formation of depression and above intensity systems) over the BAY OF BENGAL of Bengal and Andaman Sea during next 168 hours:

24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS	120-144 HOURS	144-168 HOURS
-	-	NIL	NIL	NIL	NIL	NIL

"-" Already genesis has occurred

2. For Arabian Sea:

The depression over southwest Bay of Bengal would emerge into Comorin Area around 26th December and move west-northwestwards towards southeast Arabian Sea. Hence low probability is assigned to cyclogenesis over the Arabian Sea on day 3 to 5.

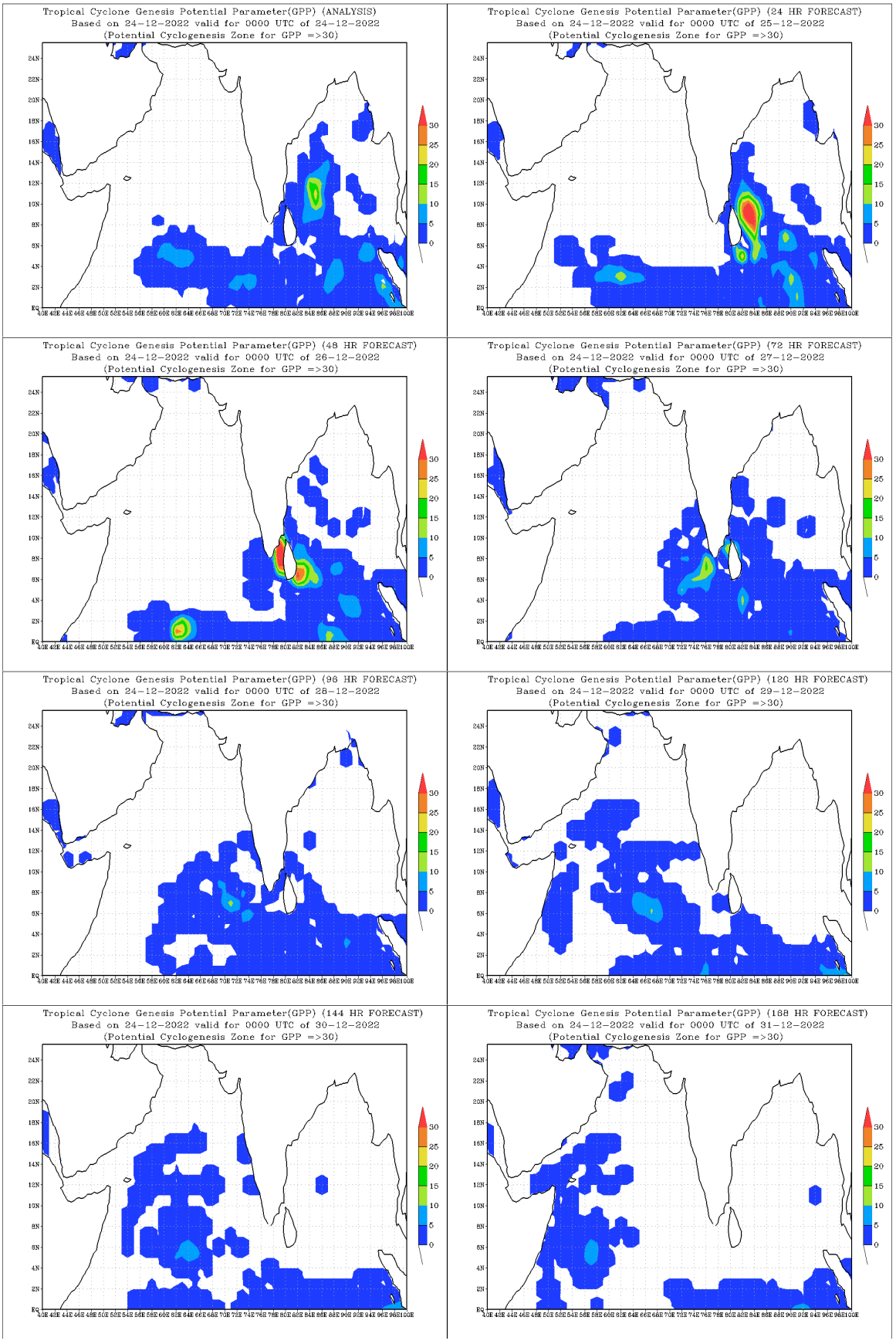
Probability of cyclogenesis (formation of depression and above intensity systems) over the Arabian Sea during next 168 hours:

24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS	120-144 HOURS	144-168 HOURS
NIL	LOW	LOW	NIL	NIL	NIL	NIL

Advisory: The movement of depression over southwest Bay of Bengal and its emergence into Comorin Area during next 2-3 days need to be monitored.

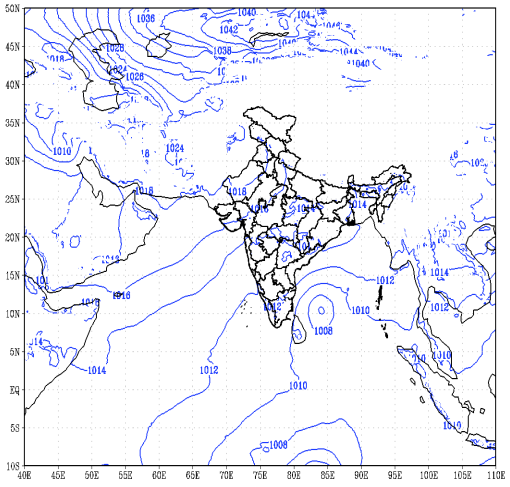
IOP: **Tamil Nadu and Sri Lanka during 24th-26th December, Kerala on 26th & 27th and Lakshadweep Islands on 27th December.**

Annexure


Tropical Cyclone Genesis Potential Parameter(GPP) (ANALYSIS)
Based on 24-12-2022 valid for 0000 UTC of 24-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 24-12-2022 valid for 0000 UTC of 25-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 24-12-2022 valid for 0000 UTC of 26-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 24-12-2022 valid for 0000 UTC of 27-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (96 HR FORECAST)
Based on 24-12-2022 valid for 0000 UTC of 28-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
Based on 24-12-2022 valid for 0000 UTC of 29-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (144 HR FORECAST)
Based on 24-12-2022 valid for 0000 UTC of 30-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (168 HR FORECAST)
Based on 24-12-2022 valid for 0000 UTC of 31-12-2022
(Potential Cyclogenesis Zone for GPP =>30)

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (00 HR)

based on 06 UTC of 24-12-2022 valid for 06 UTC of 24-12-2022



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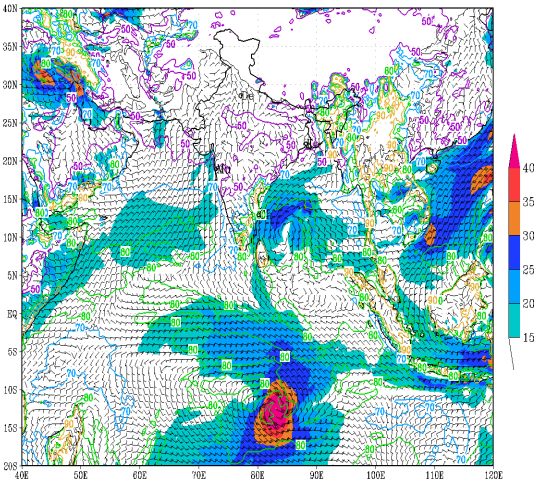
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (00 HR)

based on 00 UTC of 24-12-2022 valid for 00 UTC of 24-12-2022



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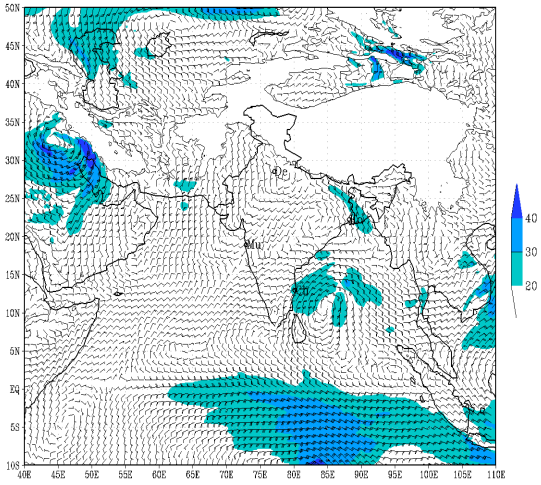

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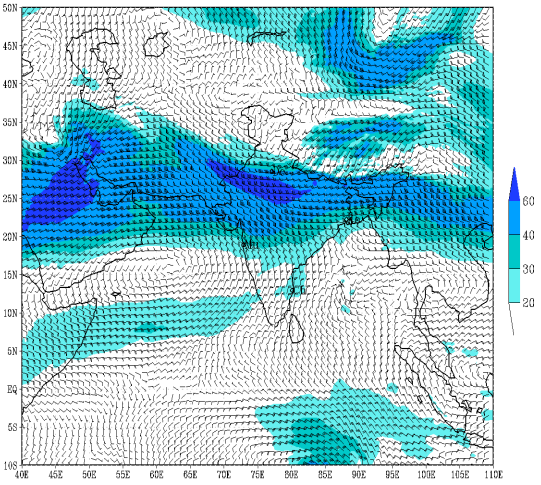
based on 00 UTC of 24-12-2022 valid for 00 UTC of 24-12-2022



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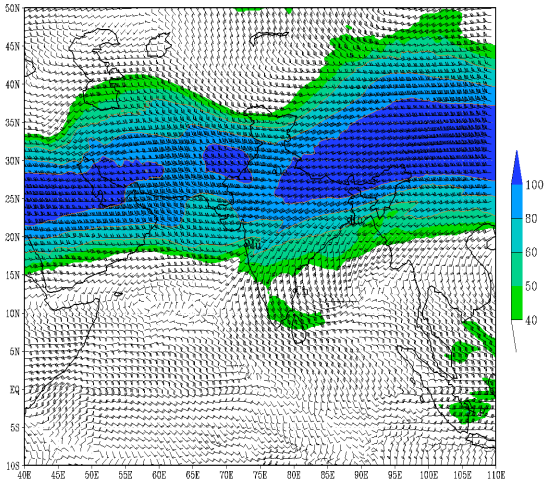

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IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (24 HR)

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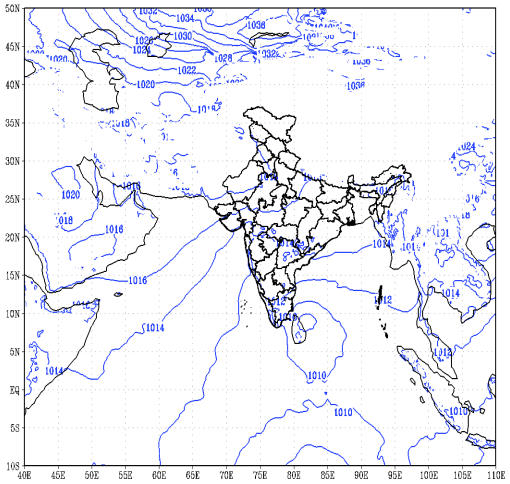

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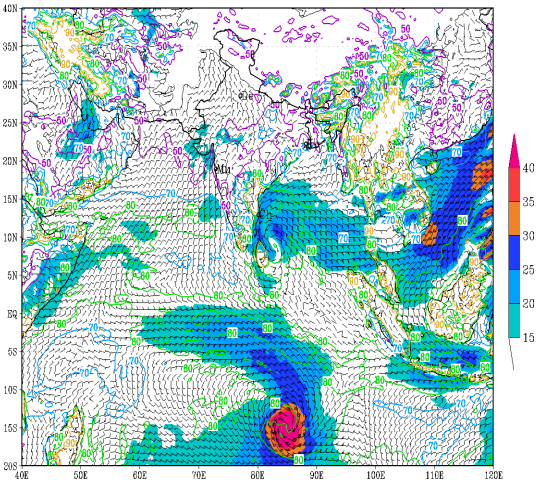
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (24 HR)

based on 00 UTC of 24-12-2022 valid for 00 UTC of 25-12-2022



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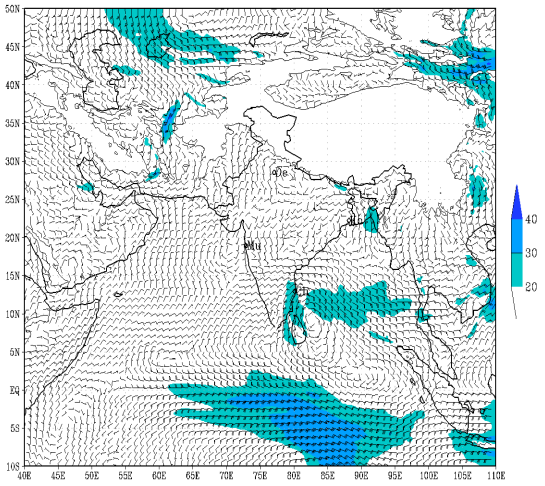

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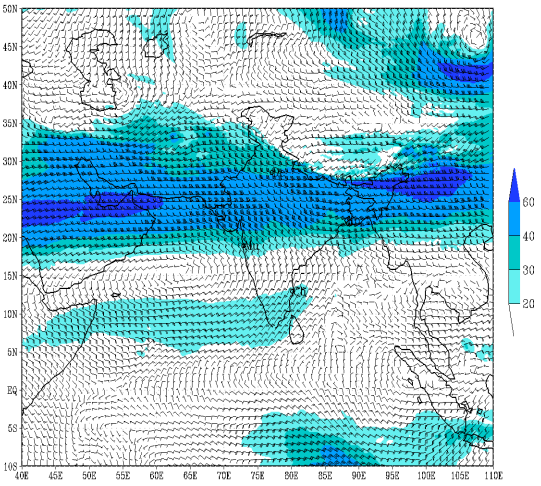
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (24 HR)

based on 00 UTC of 24-12-2022 valid for 00 UTC of 25-12-2022



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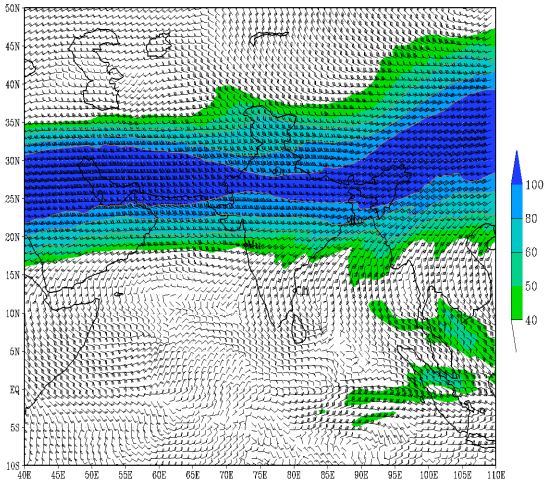

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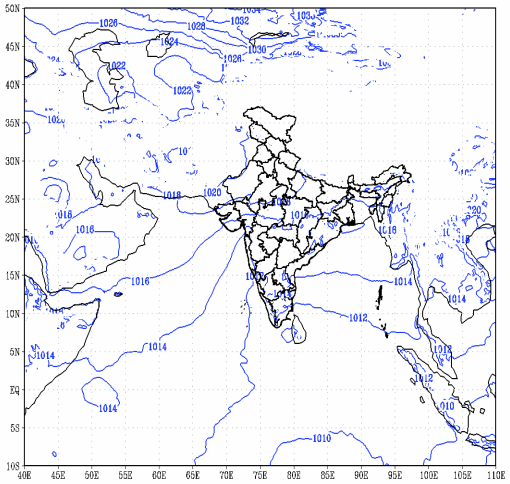
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (48 HR)
based on 06 UTC of 24-12-2022 valid for 06 UTC of 26-12-2022



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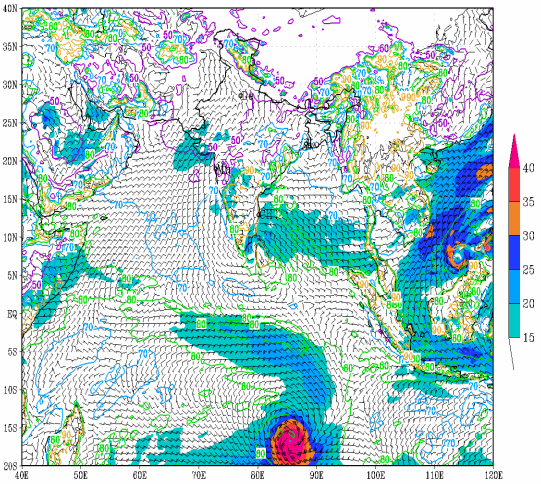
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (48 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 26-12-2022



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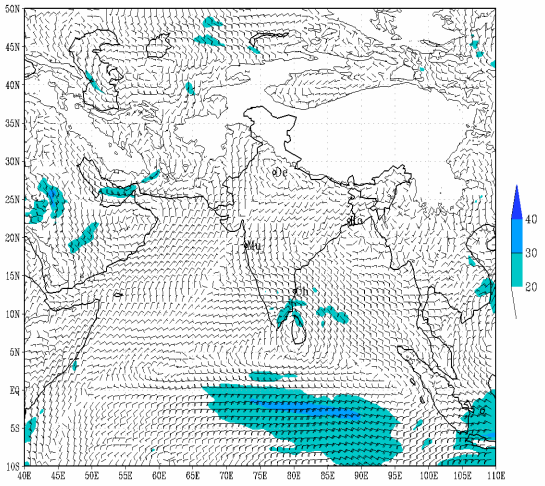

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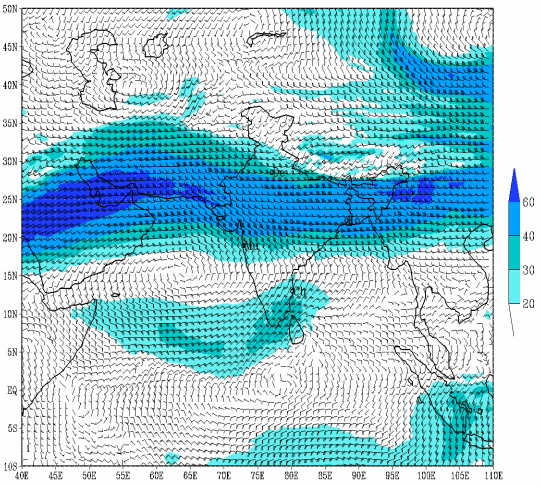

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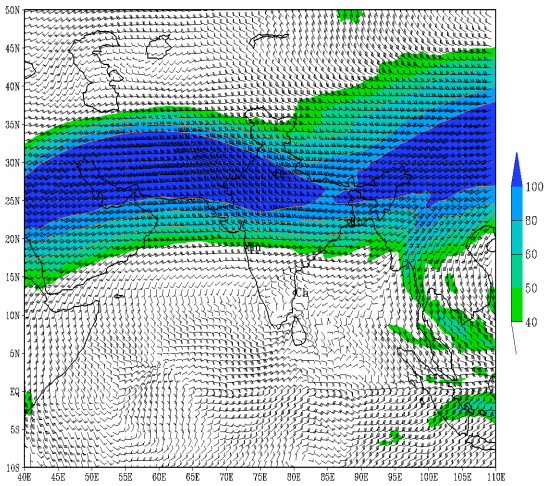

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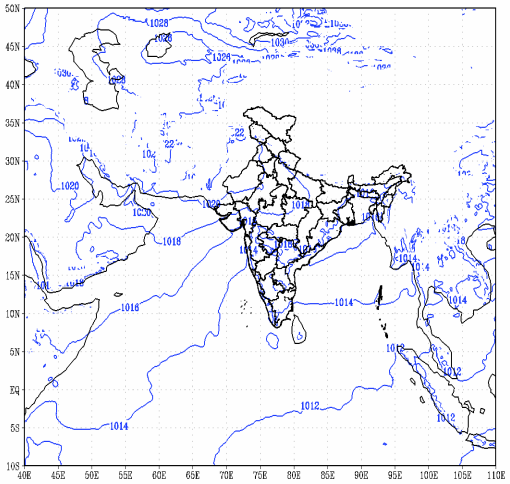
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (72 HR)
based on 06 UTC of 24-12-2022 valid for 06 UTC of 27-12-2022



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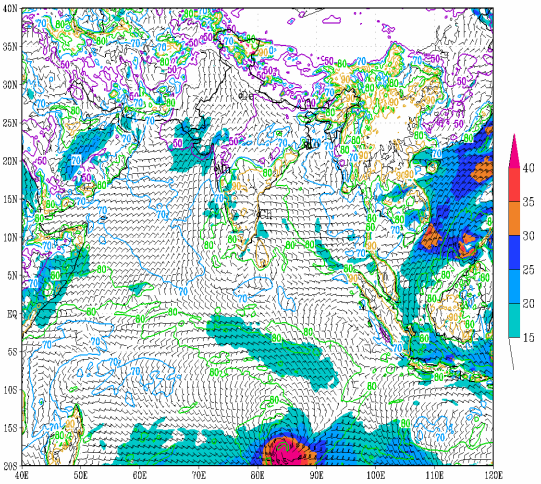
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (72 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 27-12-2022



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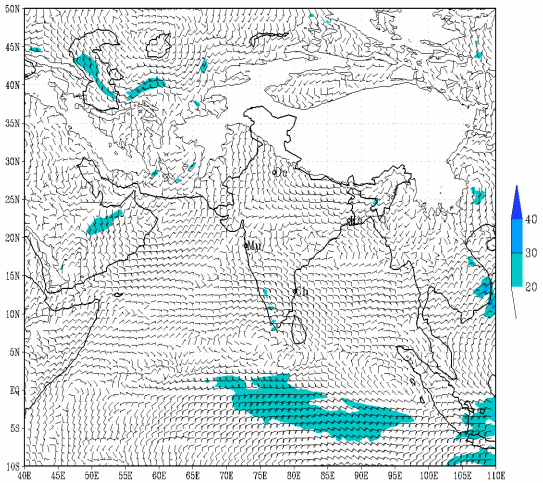

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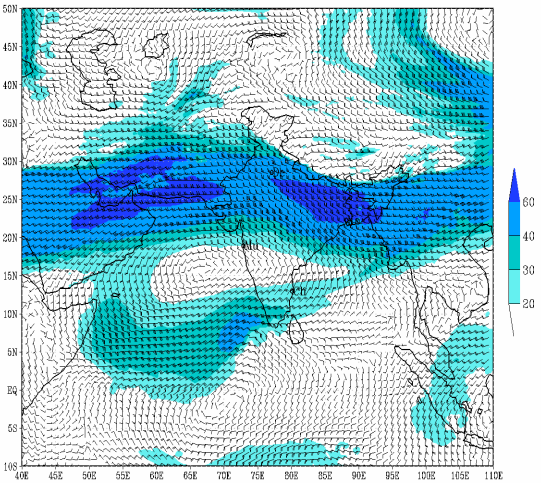
based on 00 UTC of 24-12-2022 valid for 00 UTC of 27-12-2022



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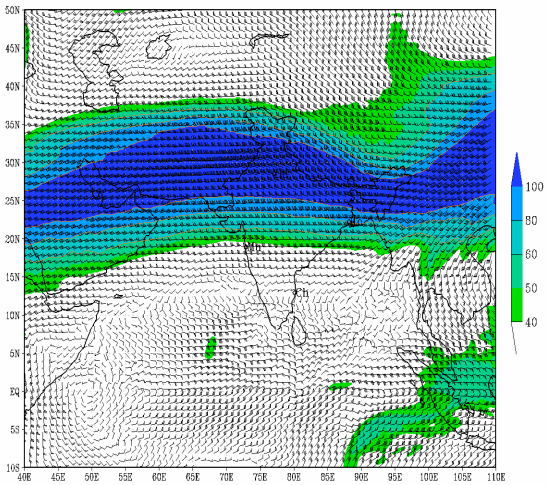
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 27-12-2022



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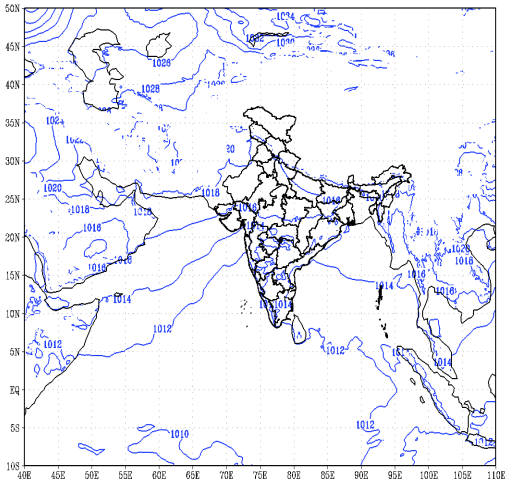
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (96 HR)

based on 00 UTC of 24-12-2022 valid for 00 UTC of 28-12-2022



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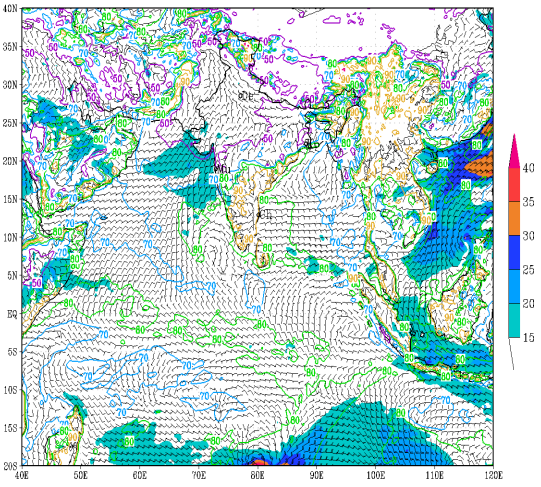
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (96 HR)

based on 00 UTC of 24-12-2022 valid for 00 UTC of 28-12-2022



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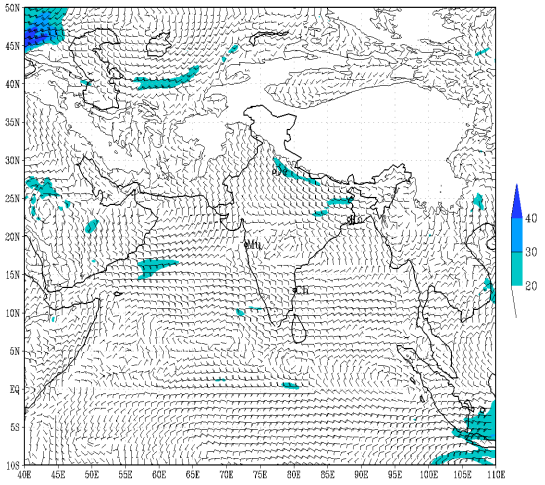
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (96 HR)

based on 00 UTC of 24-12-2022 valid for 00 UTC of 28-12-2022



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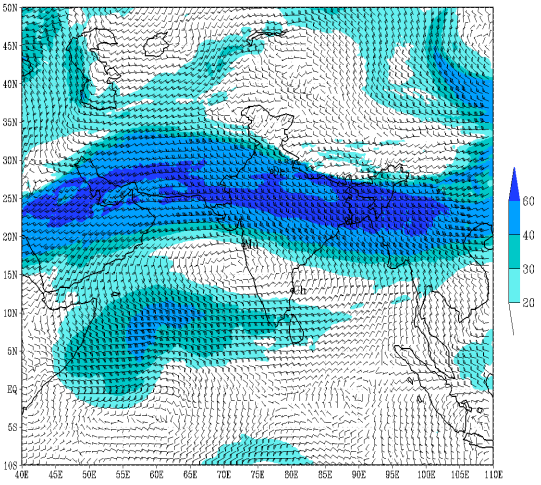
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (96 HR)

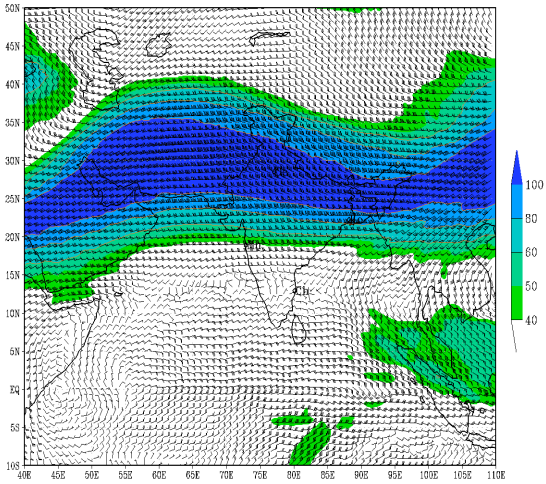
based on 00 UTC of 24-12-2022 valid for 00 UTC of 28-12-2022



(Background does not depict political boundary)

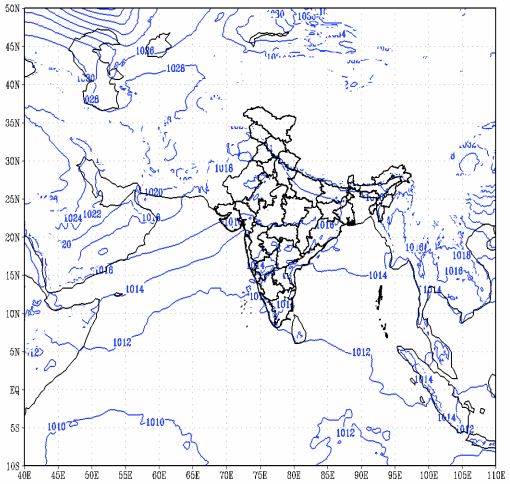
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)

based on 00 UTC of 24-12-2022 valid for 00 UTC of 28-12-2022



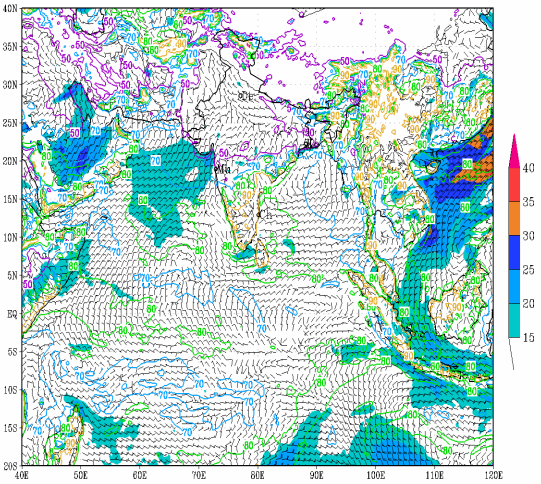
(Background does not depict political boundary)

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 29-12-2022



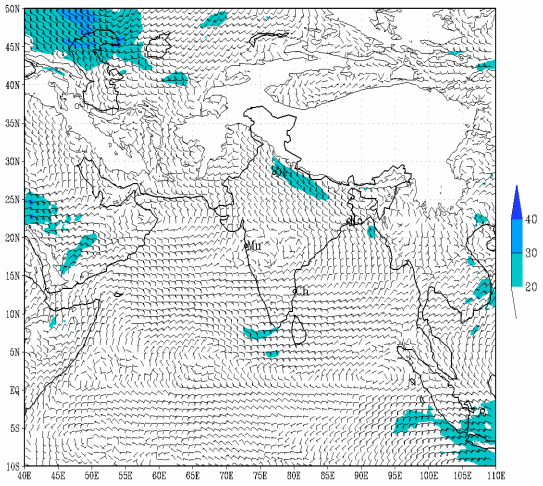
(Background does not depict political boundary)

IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (120 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 29-12-2022



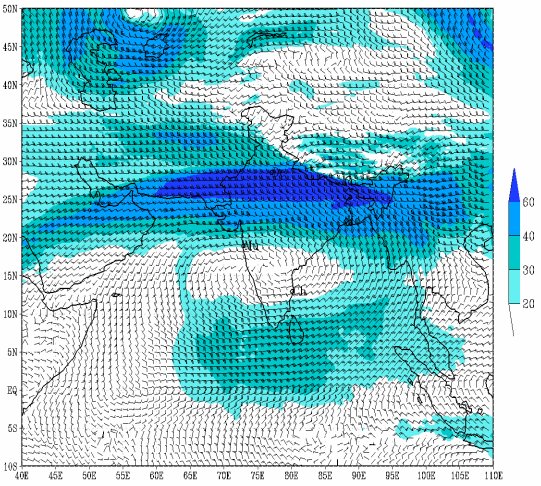
(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 29-12-2022



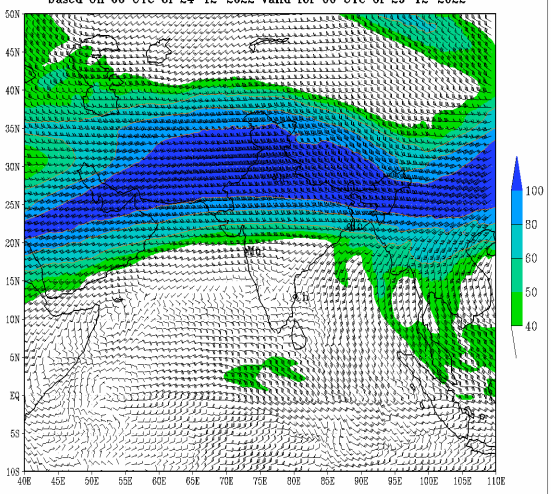
(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 30-12-2022

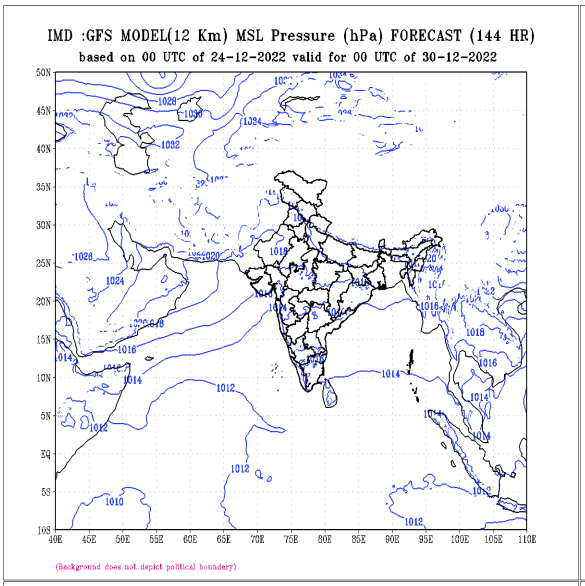


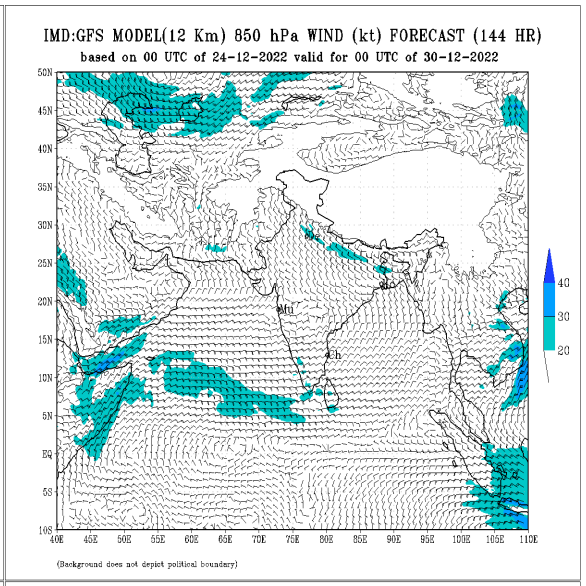
(Background does not depict political boundary)

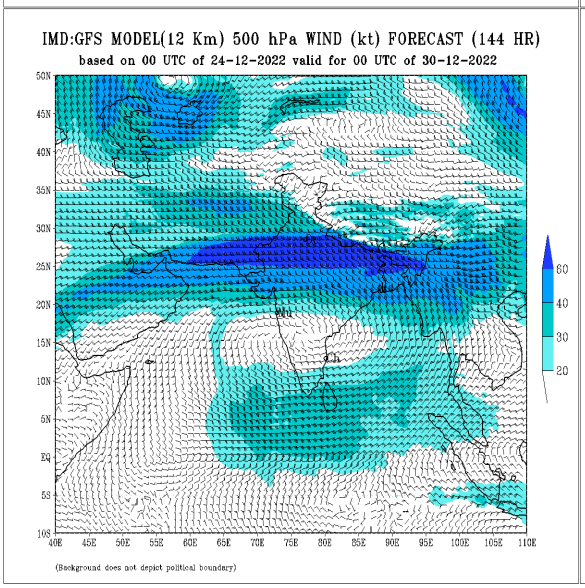
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 29-12-2022



(Background does not depict political boundary)


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (144 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 30-12-2022
(Background does not depict political boundary)


IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 30-12-2022
40
30
20
(Background does not depict political boundary)


IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 30-12-2022
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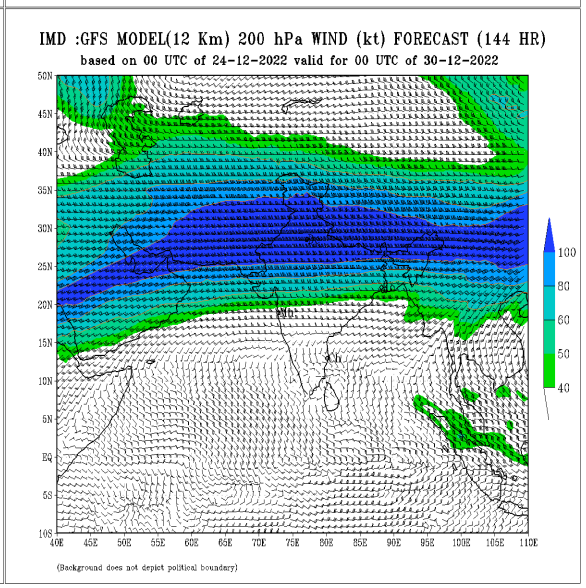
30
20
(Background does not depict political boundary)


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 30-12-2022
100
80
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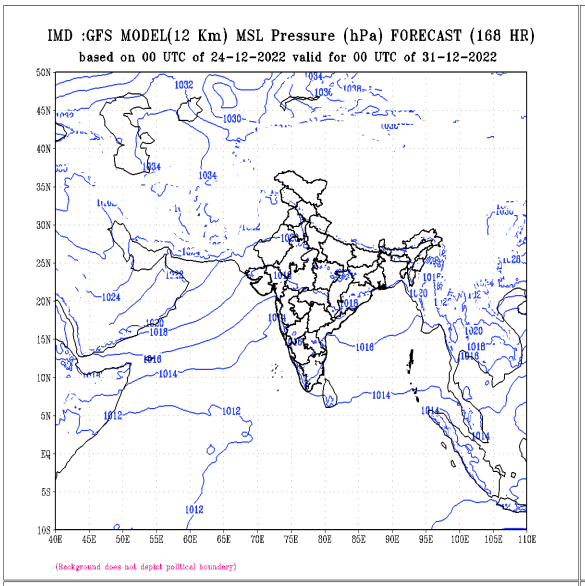
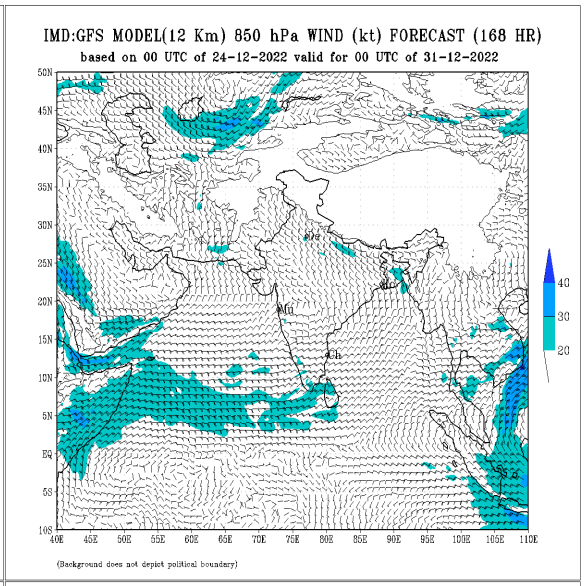
(Background does not depict political boundary)


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (168 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 31-12-2022
(Background does not depict political boundary)


IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 31-12-2022
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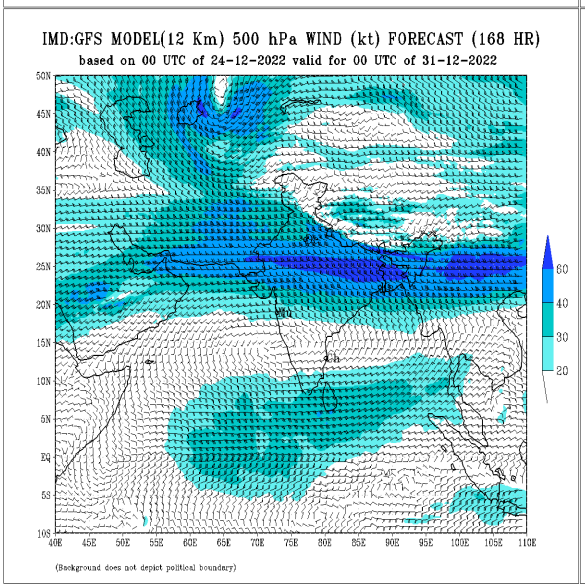
(Background does not depict political boundary)


IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 31-12-2022
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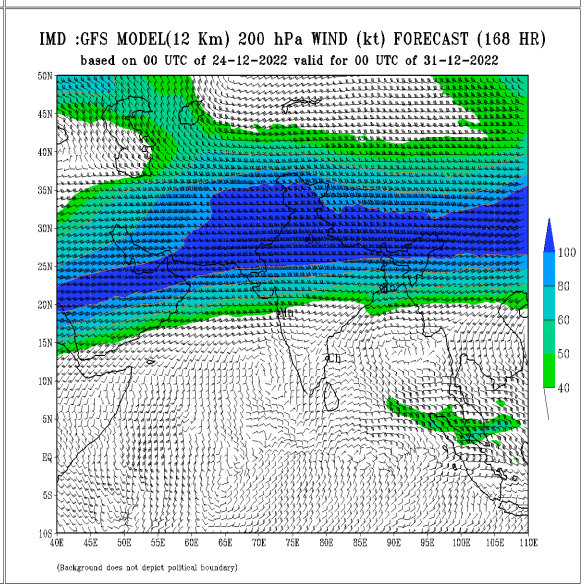
(Background does not depict political boundary)


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 24-12-2022 valid for 00 UTC of 31-12-2022
100
80
60
50
40
(Background does not depict political boundary)