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

Tropical Cyclone Forecast Programme
Report Dated 22nd December 2022

Time of Issue: 1200 UTC

Synoptic features (based on 0600 UTC analysis):

The Depression over Southwest & adjoining Southeast Bay of Bengal moved north-northwestwards with a speed of 20 kmph during past 3 hours and lay centered at 1130 hours IST of today, the 22nd December over the same region near latitude 9.5°N and longitude 84.8°E about 400 km east-northeast of Trincomalee (Sri Lanka), 550 km east-southeast of Nagappattinam (Tamil Nadu) and 630 km southeast of Chennai (Tamil Nadu). It is likely to continue to move north-northwestwards during next 24 hours and thereafter gradually recurve west-southwestwards towards Comorin Area across Sri Lanka during subsequent 48 hours.

Dynamical and thermo-dynamical features

Parameter	Bay of Bengal (BoB)	Arabian Sea (AS)
Sea Surface Temperature (SST) ºC	About 27°C around the system, 28°C over the south Andaman Sea and adjoining southeast bay of Bengal, eastcentral BoB, 29-30°C over north Andaman Sea.	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, north Andhra Pradesh and south Odisha coasts, northeast BoB, 70-80 over north Andaman Sea, north parts of southwest BoB and adjoining westcentral BoB, off Sri Lanka, north BoB, and less than 40 over western parts of westcentral BoB, along and off south Andhra Pradesh and Tamil Nadu coasts, west coast of SriLanka, Gulf of Mannar, some parts of southwest BoB.	90-100 over central parts of southeast AS, 70-90 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.

Cyclonic Relative vorticity ($X10^{-6}s^{-1}$)	50-100 over the system centre. 25 over the southeast BoB.	10-20 over southeast AS, along and off Kerala coast, 30-40 over northeast AS.
Low Level convergence ($X10^{-5}$ s^{-1})	20-30 to the northeast of system centre. 5-10 over the Andaman Sea and adjoining southeast BoB.	-5 over southern parts of south AS.
Upper Level divergence ($X10^{-5}$ s^{-1})	30-40 to the north of the system centre. 5-10 to the south of the system centre.	5-10 over southeast AS and adjoining EIO.
Vertical Wind Shear (VWS knots)	15-20 to the northeast of system centre. 25-30 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 the system centre.	Decreasing over southwest AS and adjoining southeast AS & adjoining EIO.
Upper tropospheric Ridge	Along 12.5°N over the BoB.	Along 10.0°N over the AS.
Trough in westerlies	No significant trough	

Satellite observations based on INSAT imagery (0300 UTC):

a) Over the BoB & Andaman Sea:-

Vortex over southwest BoB & neighbourhood now lay centered within half a degree of 9.6N/84.7E. Intensity T1.5. Associated scattered to broken low/med clouds with embedded intense to very intense convection over southwest and adj southeast BoB & adj central BoB. Minimum CTT is -93°C.

scattered to broken low/med clouds with embedded intense to very intense convection over south. Scattered low/med clouds with embedded moderate to intense convection over north, central BoB & south Andaman Sea.

b) Over the Arabian Sea:-

Scattered to low/med clouds with embedded moderate to intense convection over southeast and adj southwest AS & Comorin area.

M.J.O. Index:

The Madden Julian Oscillation (MJO) Index is currently in Phase 6 with amplitude greater than 1. Thereafter, it would move to phase 7 till 29th Dec with amplitude greater than 1.

Equatorial Waves:

The equatorial waves prediction indicates, strong easterly winds (5-7 mps) over south & adjoining central BoB, strong westerly winds (5-7 mps) over south BoB & adjoining east Equatorial Indian Ocean, low frequency background waves over south BoB 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 3-4 days.

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

Super Cyclonic Storm Darian over south Indian ocean centered near 13.0S/87.0E. Intensity T5.5/6.0. Corresponding maximum sustained winds of 120 kts. Associated broken low/med

clouds with embedded intense to very intense convection over area between lat 10.0S to 15.5S and long 83.5E to 88.5E.

Model guidance based on 0000 UTC for the next 7 days

MODEL GUIDANCE	Bay of Bengal (BoB)	Arabian Sea (AS)
IMD-GFS	WML/Depression over southwest BoB on 22nd, to move initially north-northwestwards till 23rd/0000 UTC, thereafter gradually recurve southwestwards and reach Comorin Area on 26/0000 UTC as a low pressure area. To move westwards thereafter and become less marked on 28/0000 UTC.	Depression over southwest BoB to reach Comorin Area on 26/0000 UTC as a low pressure area. To move westwards thereafter and become less marked on 28/0000 UTC.
IMD-GEFS	WML/Depression over southwest BoB on 22nd, to move initially north-northwestwards till 23rd/0000 UTC, thereafter gradually recurve southwestwards and reach Comorin Area on 26/0000 UTC as a low pressure area. To move westwards thereafter and become less marked on 28/0000 UTC.	Depression over southwest BoB to reach Comorin Area on 26/0000 UTC as a low pressure area. To move westwards thereafter and become less marked on 28/0000 UTC.
GEFS Probabilistic guidance	NA	NA
IMD WRF	WML/Depression over southwest BoB on 22nd, to move initially north-northwestwards till 23rd/0000 UTC, thereafter gradually recurve southwestwards and reach Comorin Area on 26/0000 UTC as a low pressure area.	No significant system till 26th/0000
NCMRWF-NCUM (G)	Low pressure area over southwest BoB on 22nd, to move initially north-northwestwards till 23rd/0000 UTC, thereafter gradually recurve southwestwards and reach Comorin Area on 26/1200 UTC as a low pressure area.	Well marked low pressure area over Lakshadweep on 27th/0000 UTC to move westwards and become less marked on 29th Dec.
NCMRWF-NEPS	Low pressure area over southwest BoB on 22nd, to move initially north-northwestwards till 23rd/0000 UTC, thereafter gradually recurve southwestwards and reach Comorin Area on 26/1200 UTC as a low pressure area.	Well marked low pressure area over Lakshadweep on 27th/0000 UTC to move westwards and become less marked on 29th Dec.
NCMRWF-UM (Regional)	Low pressure area over southwest BoB on 22nd, to move initially north-northwestwards till 23rd/0000 UTC, thereafter gradually recurve southwestwards and reach Comorin Area on 26/1200 UTC as a low pressure area.	No significant system
ECMWF	WML/Depression over southwest Bay of Bengal on 22nd, to move nearly north-northwestwards till 23rd/0000 UTC, to gradually recurve west-southwestwards thereafter, reaching Comorin area on 26th as a low pressure area	Low pressure area over Comorin to move nearly westwards with marginal intensification on 28th/0000 UTC and weakening on 29th/0000 UTC.
ECMWF	80-90% probability of depression over	Over the Arabian Sea 10-30%

ensemble	southwest Bay of Bengal during 22nd -25th Dec. Model members are also indicating initial north-northwestwards movement followed by southwestwards movement towards Comorin area across Sri Lanka and then nearly westwards over southeast AS.	probability of formation of depression with westwards movement.
NCEP-GFS	WML/Depression over southwest BoB on 22nd, to move initially north-northwestwards till 23rd/0000 UTC, thereafter gradually recurve southwestwards and reach Comorin Area on 26/0000 UTC as a low pressure area. To move westwards thereafter and become less marked on 28/0000 UTC.	Depression over southwest BoB to reach Comorin Area on 26/0000 UTC as a low pressure area. To move westwards thereafter and become less marked on 28/0000 UTC.
IMD MME	MME is indicating nearly north-northwestwards movement of system initially till 23rd/0000 UTC, followed by southwestwards movement with system crossing Sri Lanka as a depression, emerging into Comorin Area on 26th/0000 UTC and move westwards thereafter with weakening into a low pressure area on 27th Dec. over southeast Arabian Sea.	Depression over Comorin Area on 26th/0000 UTC to move westwards with weakening into a low pressure area on 27th 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 till 22nd Dec and then moving gradually northwestwards till 25th.	On 26th a potential zone over Comorin area.

Summary and conclusion:

Environment features: The well marked low pressure area over southwest Bay of Bengal is currently tracking in a favourable environment (warm SST 28-29°C, low wind shear of 05-10 kts, enhanced westerly winds (5-7 mps) over south BoB and easterly winds (5-7 mps) over central BoB, favourable MJO, presence of Kelwin Waves & background frequency waves, positive vorticity ($100X10^{-6}s^{-1}$), good outflow ($40X10^{-5}s^{-1}$) and good convergence ($50X10^{-5}s^{-1}$).

Model guidance: Most of the models are indicating that the depression over southwest Bay of Bengal would move west-northwestwards till 23rd/0000 UTC. Thereafter, it would gradually recurve southwestwards across Sri Lanka raeching Comorin Area on 26th/0000 UTC. Thereafter, the system would move west-northwestwards and weaken gradually over southeast Arabian Sea around 27th/0000 UTC.

In view of all the above, it is inferred that

1. For the Bay of Bengal:

The depression over southwest and adjoining southeast Bay of Bengal is likely to move north-northwestwards during next 24 hours and thereafter gradually recurve west-southwestwards towards Comorin Area across Sri Lanka during subsequent 48 hours.

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 moderate to low probability is assigned to cyclogenesis over the Arabian Sea on day 4 & 5.

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

"-" Already genesis has occurred

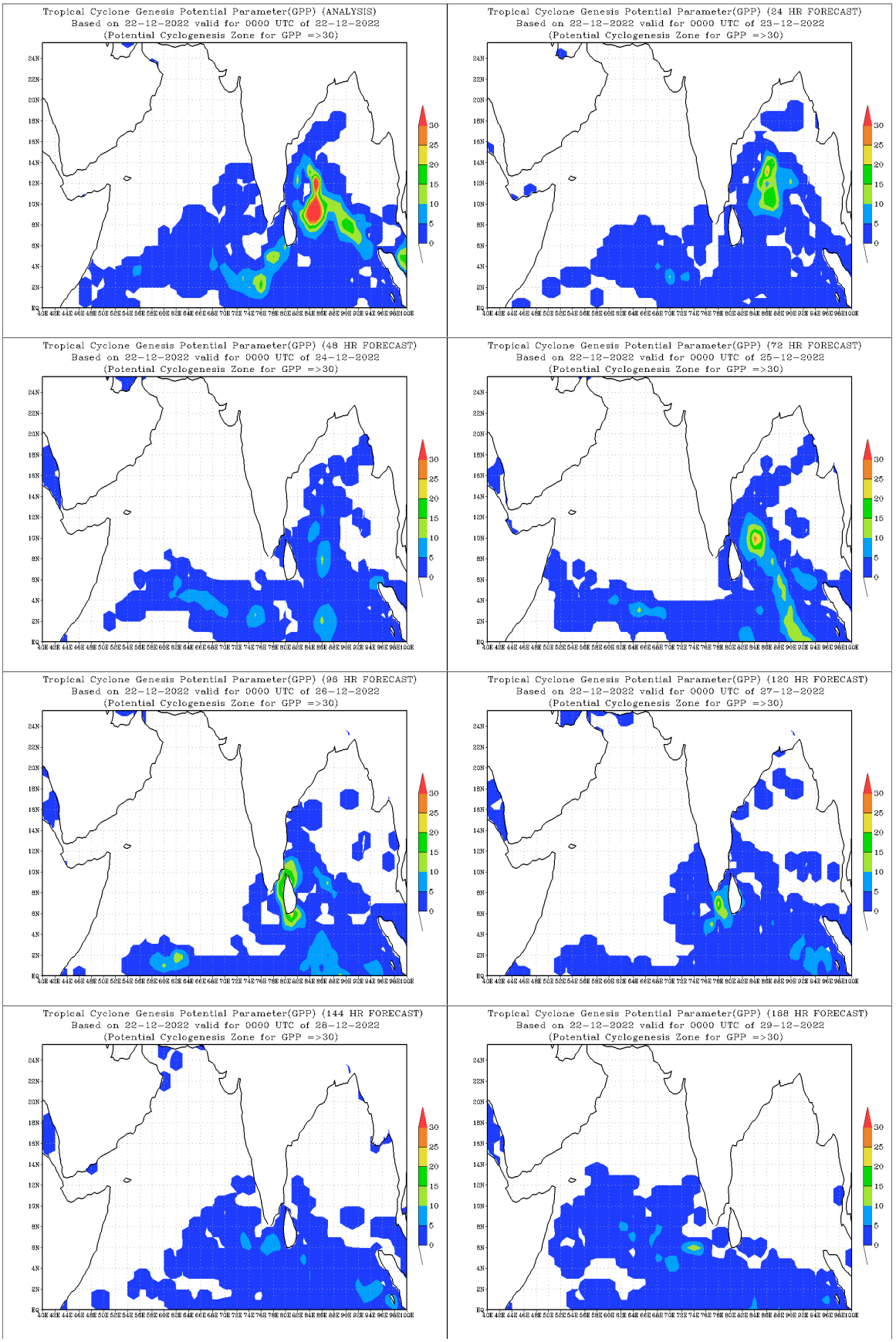
Probability of cyclogenesis (formation of depression and above intensity systems) over the Arabian Sea during next 168 hours:

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

Advisory: The movement and intensification of depression over southwest Bay of Bengal and its emergence into Comorin Area during next 4-5 days need to be critically monitored.

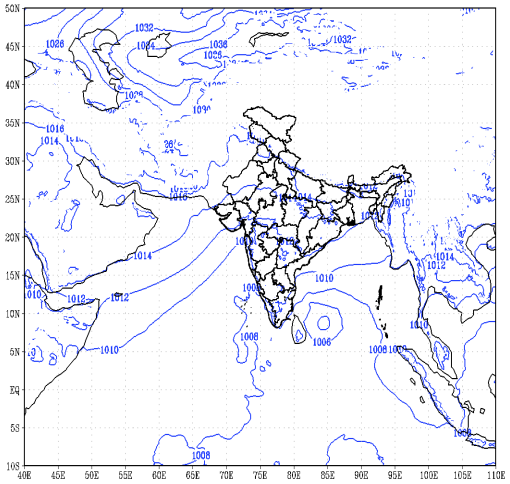
IOP: **Tamil Nadu and Sri Lanka during 22nd-26th December.**

Annexure


Tropical Cyclone Genesis Potential Parameter(GPP) (ANALYSIS)
Based on 22-12-2022 valid for 0000 UTC of 22-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 22-12-2022 valid for 0000 UTC of 23-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 22-12-2022 valid for 0000 UTC of 24-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 22-12-2022 valid for 0000 UTC of 25-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (96 HR FORECAST)
Based on 22-12-2022 valid for 0000 UTC of 26-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
Based on 22-12-2022 valid for 0000 UTC of 27-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (144 HR FORECAST)
Based on 22-12-2022 valid for 0000 UTC of 28-12-2022
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (168 HR FORECAST)
Based on 22-12-2022 valid for 0000 UTC of 29-12-2022
(Potential Cyclogenesis Zone for GPP =>30)

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

based on 00 UTC of 22-12-2022 valid for 00 UTC of 22-12-2022



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

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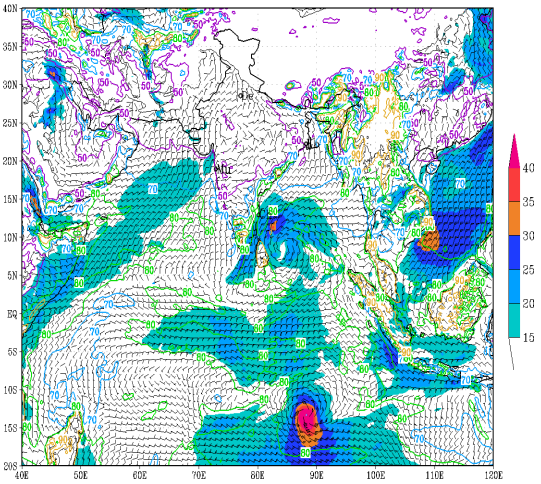

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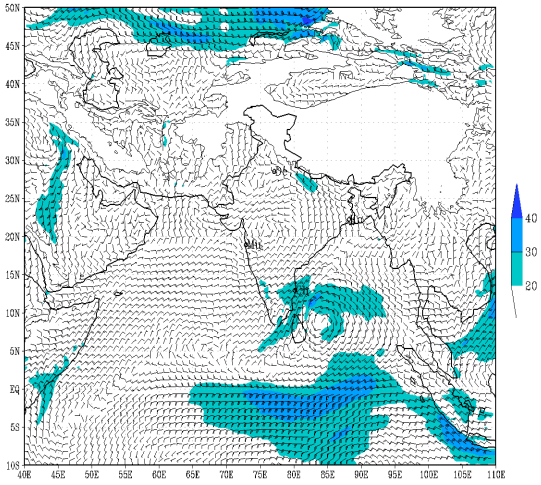

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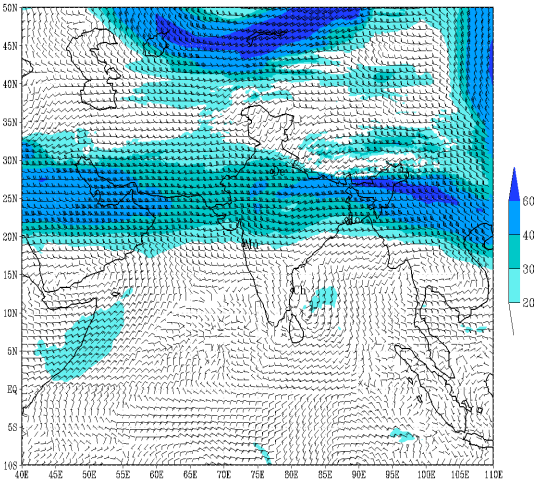

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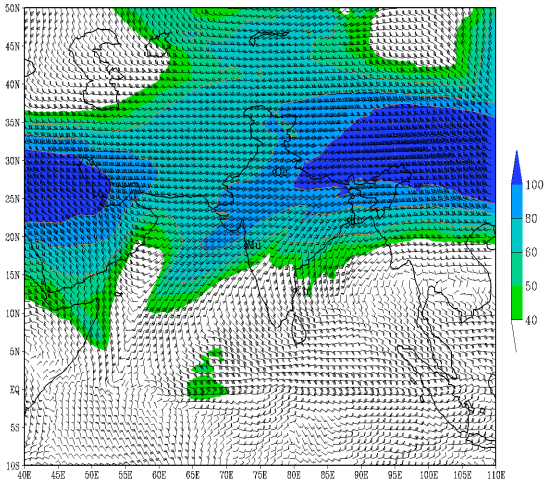

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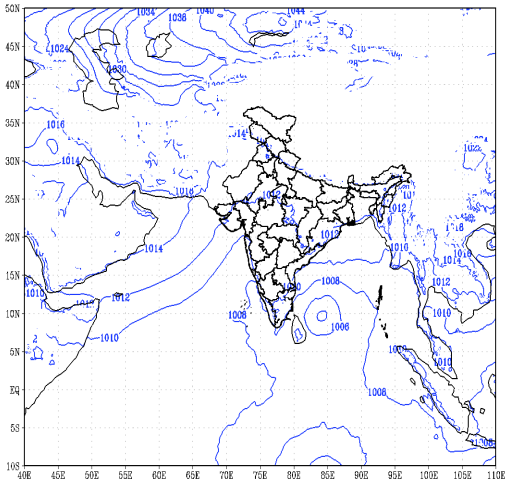

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IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (24 HR)

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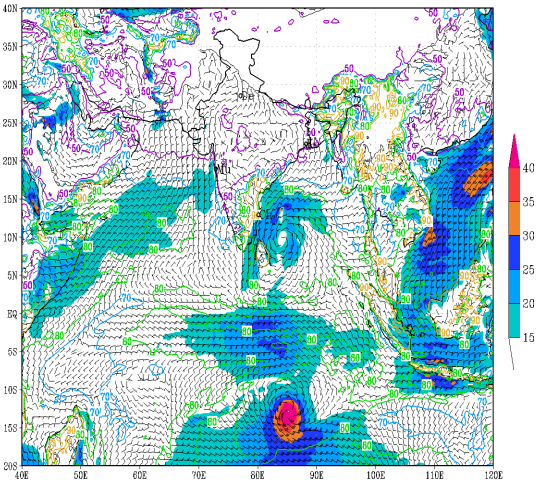

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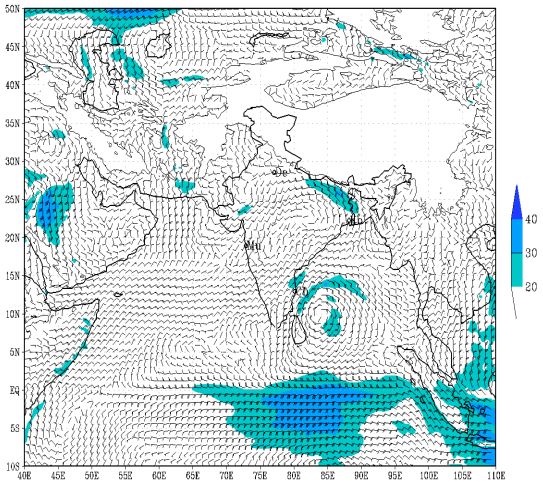

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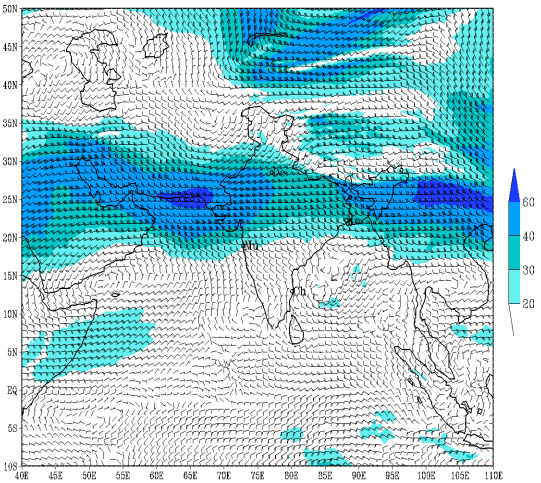
based on 00 UTC of 22-12-2022 valid for 00 UTC of 23-12-2022



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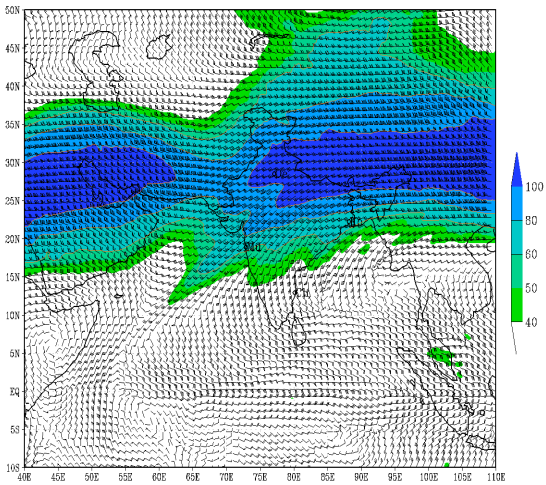

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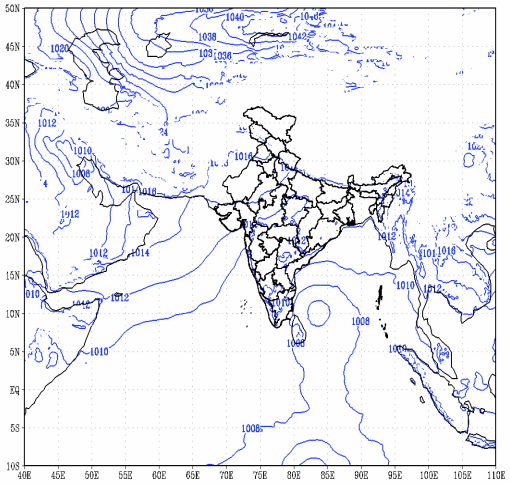
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (48 HR)
based on 00 UTC of 22-12-2022 valid for 00 UTC of 24-12-2022



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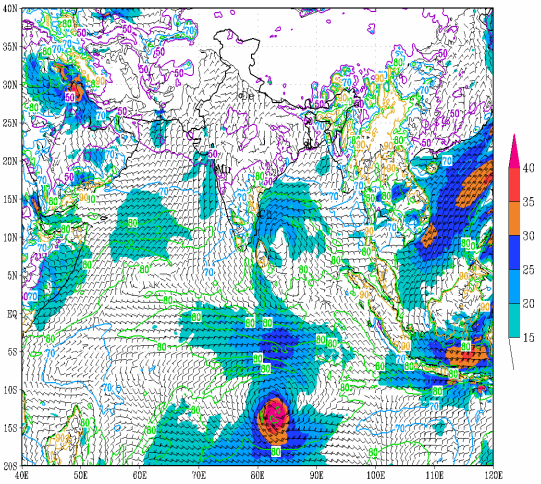
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (48 HR)
based on 00 UTC of 22-12-2022 valid for 00 UTC of 24-12-2022



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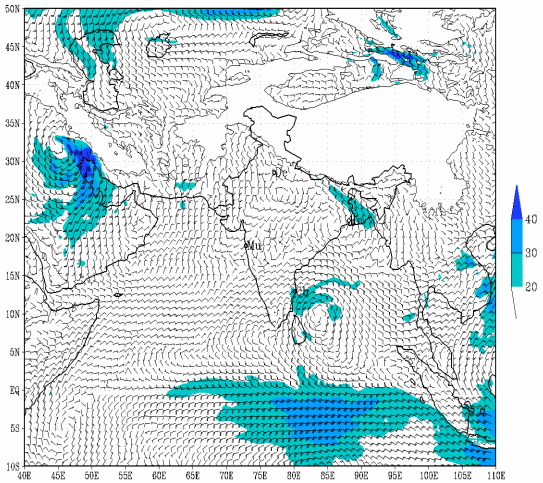

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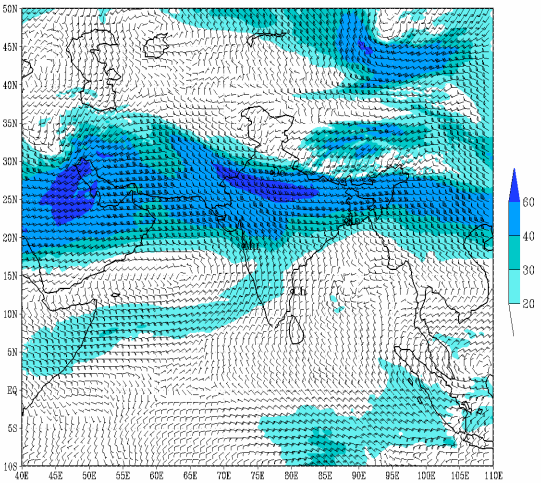

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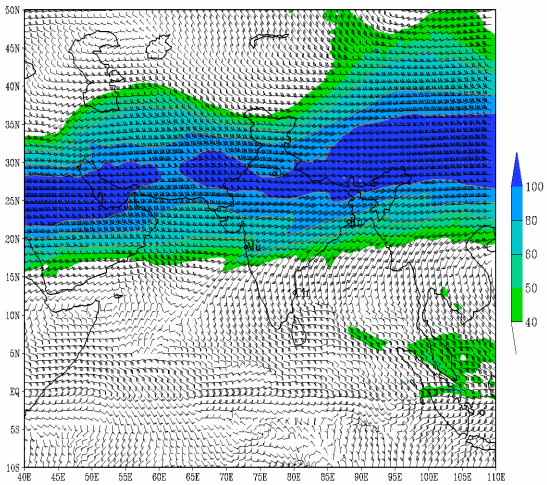

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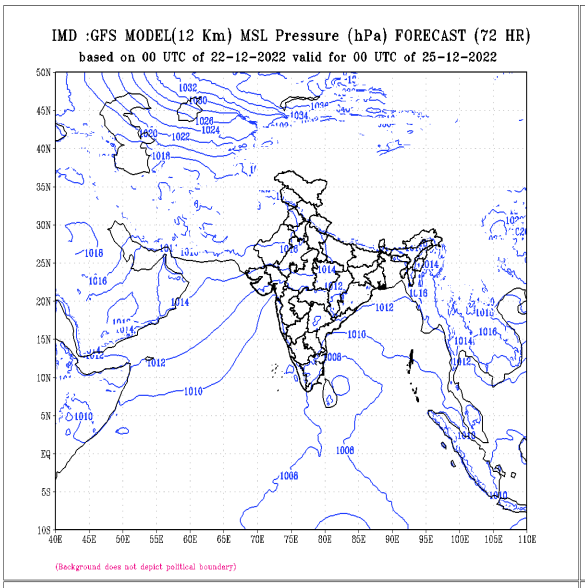
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based on 00 UTC of 22-12-2022 valid for 00 UTC of 25-12-2022
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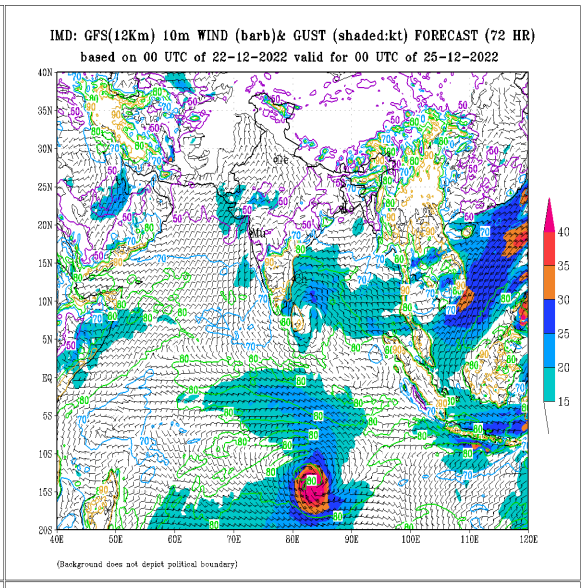
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (72 HR)
based on 00 UTC of 22-12-2022 valid for 00 UTC of 25-12-2022
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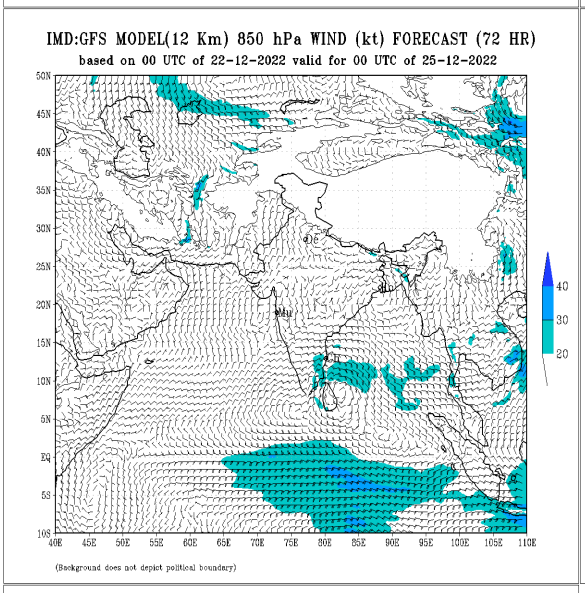
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 22-12-2022 valid for 00 UTC of 25-12-2022
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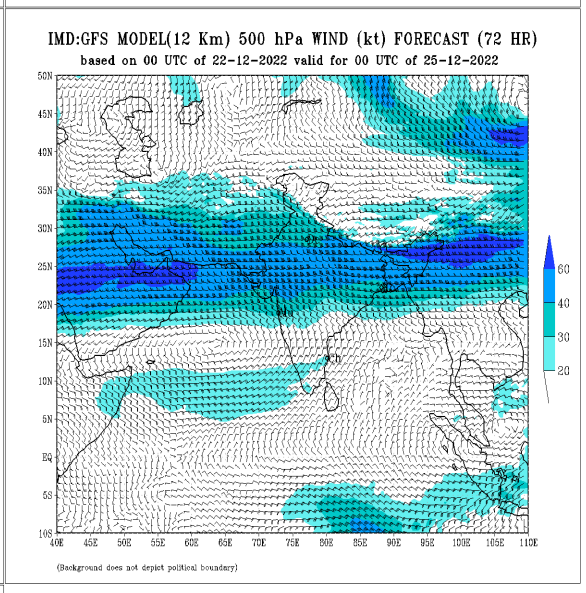
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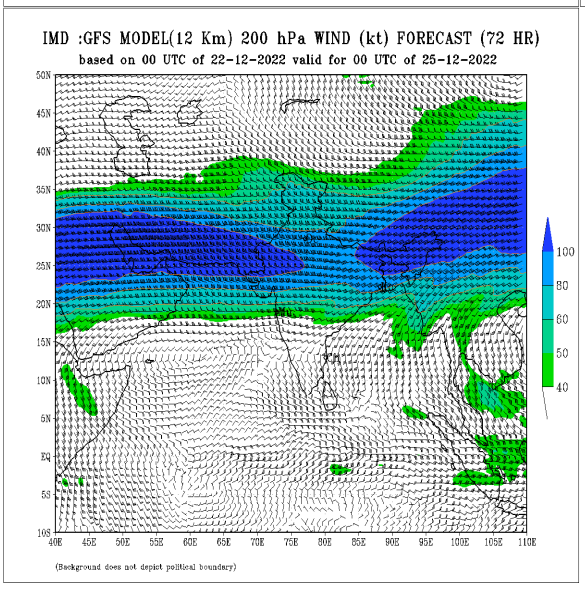
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 22-12-2022 valid for 00 UTC of 25-12-2022
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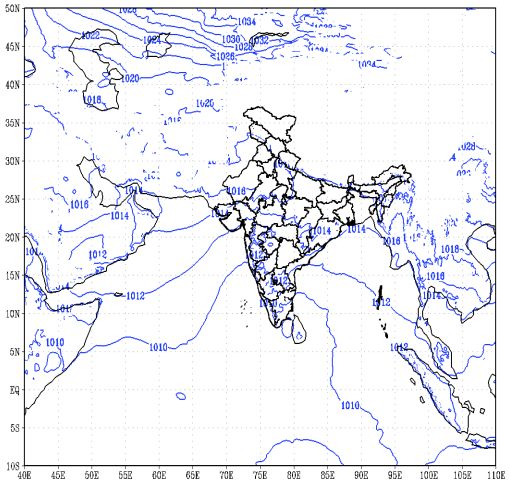
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (96 HR)
based on 00 UTC of 22-12-2022 valid for 00 UTC of 26-12-2022



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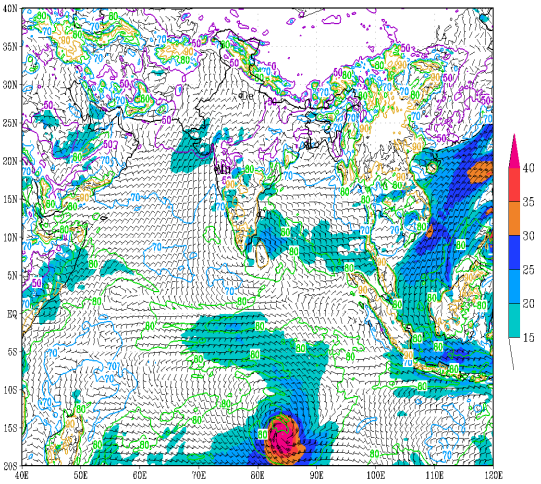
based on 00 UTC of 22-12-2022 valid for 00 UTC of 26-12-2022



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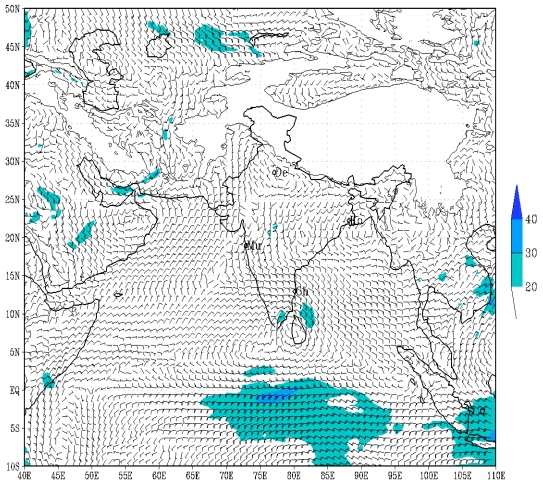

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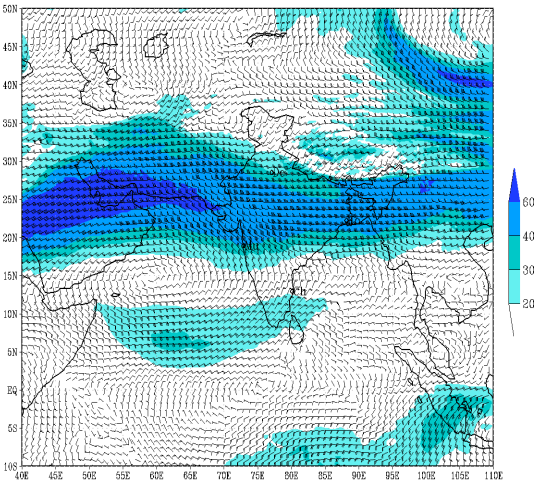
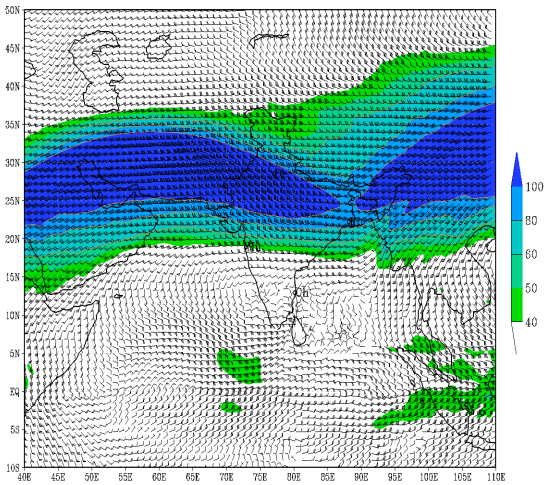


(Background does not depict political boundary)

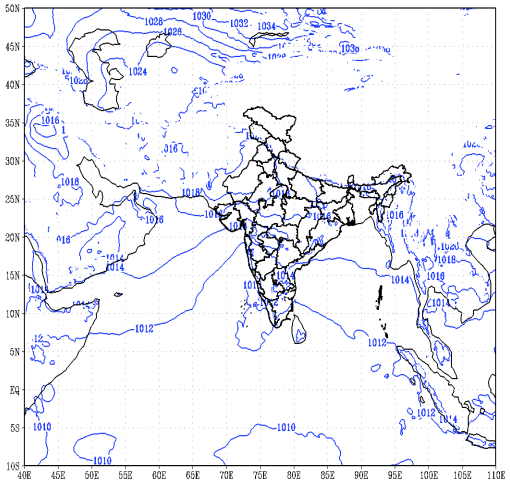
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 22-12-2022 valid for 00 UTC of 26-12-2022



(Background does not depict political boundary)

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)

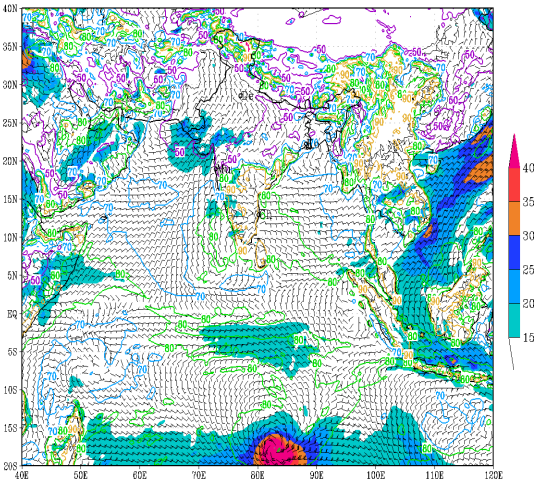
based on 00 UTC of 22-12-2022 valid for 00 UTC of 27-12-2022



(Background does not depict political boundary)

IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (120 HR)

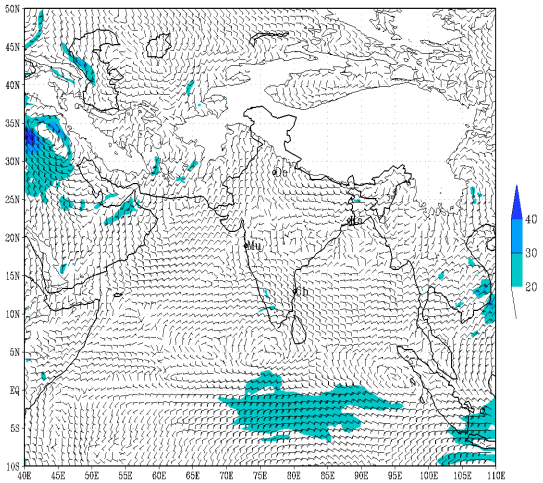
based on 00 UTC of 22-12-2022 valid for 00 UTC of 27-12-2022



(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)

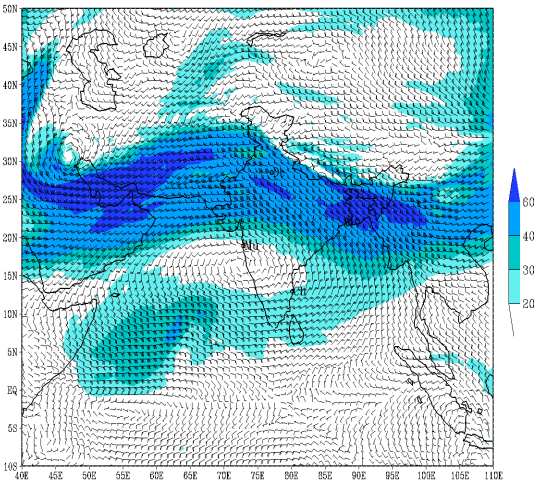
based on 00 UTC of 22-12-2022 valid for 00 UTC of 27-12-2022



(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (144 HR)

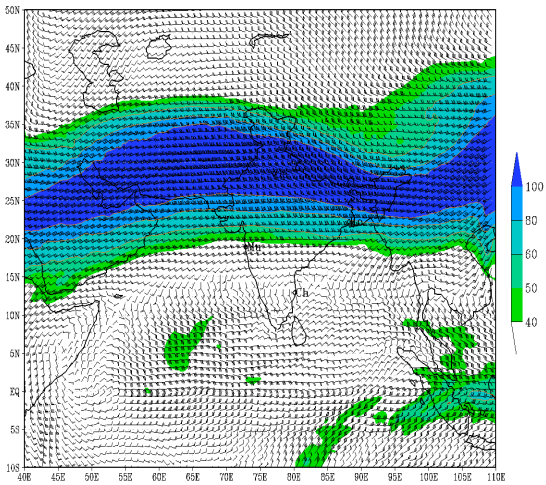
based on 00 UTC of 22-12-2022 valid for 00 UTC of 28-12-2022



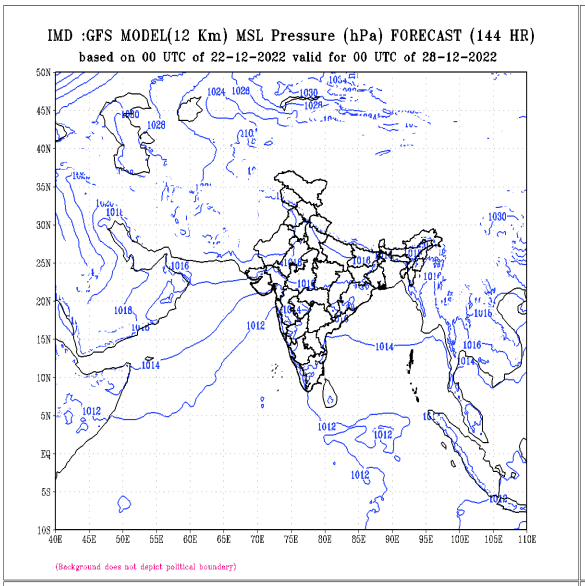
(Background does not depict political boundary)

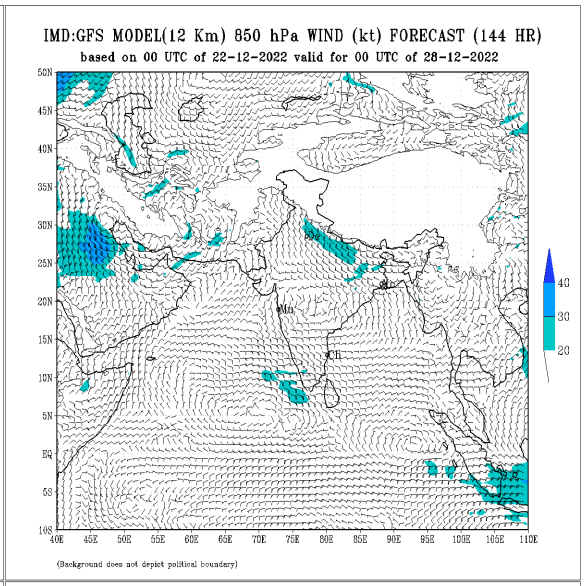
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)

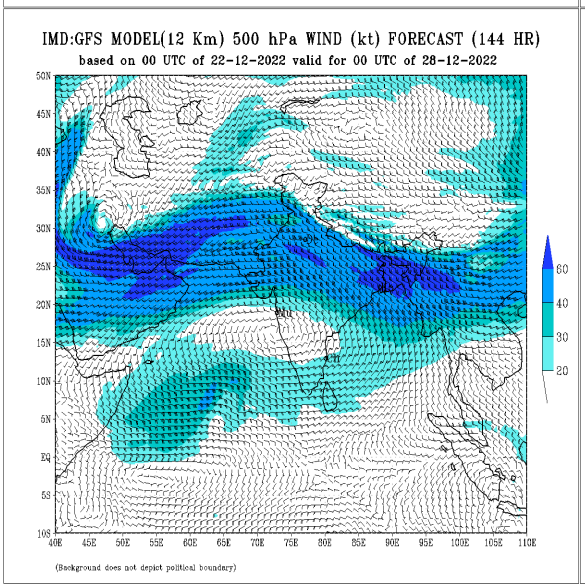
based on 00 UTC of 22-12-2022 valid for 00 UTC of 27-12-2022

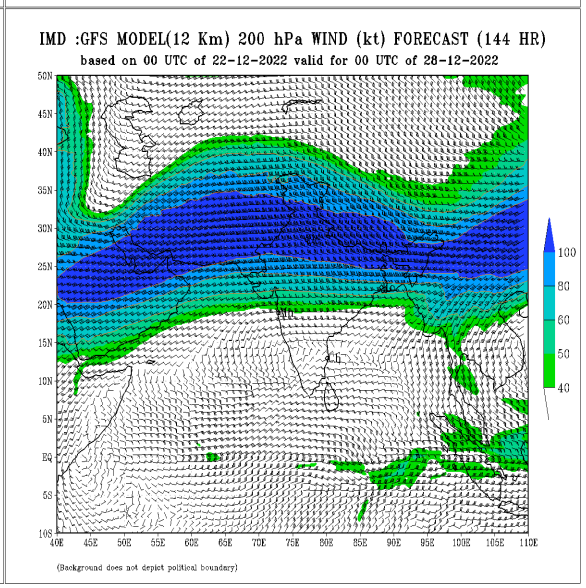


(Background does not depict political boundary)


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (144 HR)
based on 00 UTC of 22-12-2022 valid for 00 UTC of 28-12-2022
(Background does not depict political boundary)

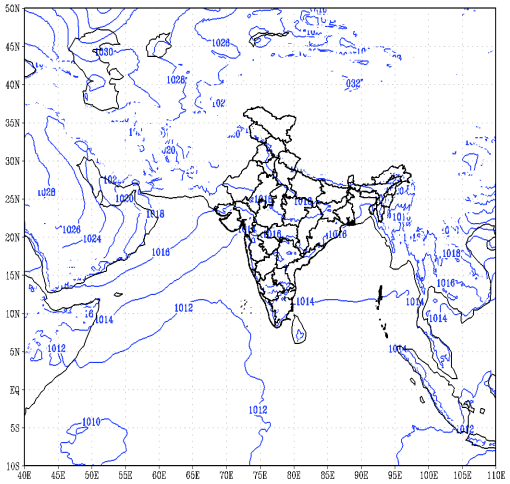

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 22-12-2022 valid for 00 UTC of 28-12-2022
40
30
20
(Background does not depict political boundary)


IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 22-12-2022 valid for 00 UTC of 28-12-2022
60
40
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 22-12-2022 valid for 00 UTC of 28-12-2022
100
80
60
50
40
(Background does not depict political boundary)

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (168 HR)

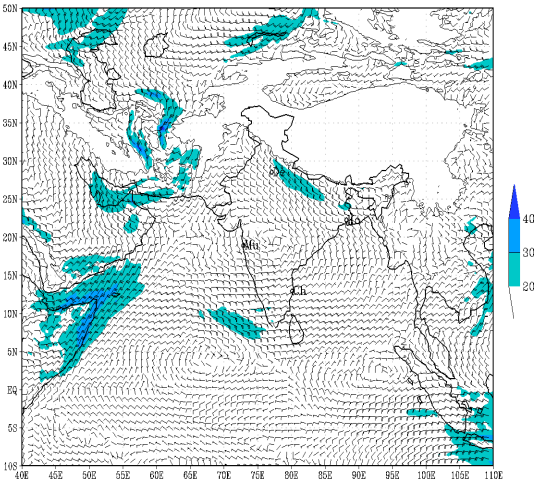
based on 00 UTC of 22-12-2022 valid for 00 UTC of 29-12-2022



(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (168 HR)

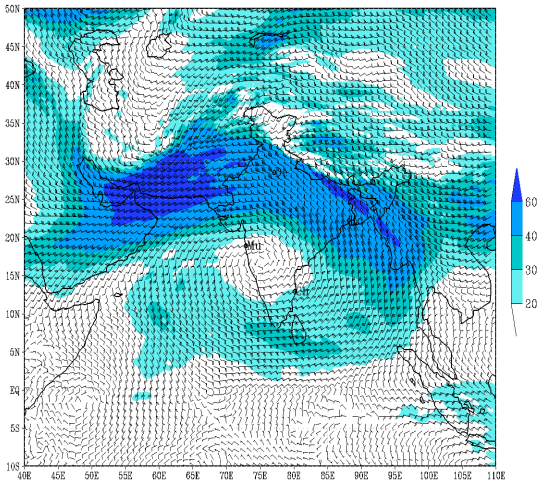
based on 00 UTC of 22-12-2022 valid for 00 UTC of 29-12-2022



(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (168 HR)

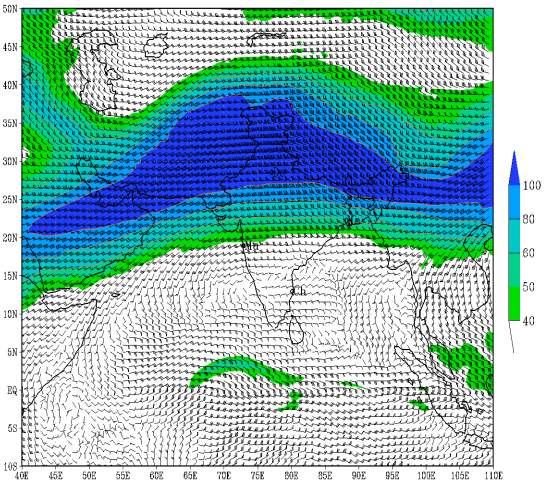
based on 00 UTC of 22-12-2022 valid for 00 UTC of 29-12-2022



(Background does not depict political boundary)

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (168 HR)

based on 00 UTC of 22-12-2022 valid for 00 UTC of 29-12-2022



(Background does not depict political boundary)