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

Tropical Cyclone Forecast Programme
Report Dated 23rd December 2022

Time of Issue: 1400 UTC

Synoptic features (based on 0600 UTC analysis):

- The Depression over Southwest Bay of Bengal moved east-northeastwards with a speed of 15 kmph during past 06 hours and lay centered at 1130 hours IST of today, the 23 rd December over the same region near latitude 10.3°N and longitude 85.0°E about 450 km east-northeast of Trincomalee (Sri Lanka), 570 km east of Nagappattinam (Tamil Nadu) and 600 km eastsoutheast of Chennai (Tamil Nadu).
- It is likely to move slowly over southwest Bay of Bengal, make a loop over the same region and then move west-southwestwards towards Comorin Area across Sri Lanka during next 48 hours.

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 parts of westcentral BoB, less than 50 over along and off	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.

	south Andhra Pradesh and Tamil Nadu coasts, west coast of SriLanka, Gulf of Mannar, some parts of southwest BoB.	
Cyclonic Relative vorticity ($X10^{-6}s^{-1}$)	50 over the system centre.	10-20 over southeast AS, along and off Kerala coast, 30-40 over some parts of eastcentral and northeast AS.
Low Level convergence ($X10^{-5}$ s^{-1})	10-20 to the east-northeast of system centre and over north Andaman Sea.	-5 over southern parts of south AS.
Upper Level divergence ($X10^{-5}$ s^{-1})	10 to the northeast and southeast of the system centre and over the Andaman Sea and southeast BoB.	5over southeast AS.
Vertical Wind Shear (VWS knots)	5-10 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 northeast to the system centre.	Decreasing over southwest AS and adjoining southeast AS & adjoining EIO, central AS.
Upper tropospheric Ridge	Along 14°N over the BoB.	Along 09.0°N over the AS.
Trough in westerlies	No significant trough	

Satellite observations based on INSAT imagery (0600 UTC):

a) Over the BoB & Andaman Sea:-

Vortex over southwest BoB & neighbourhood now lay centered within half a degree of 10.7N/85.5E. Intensity T1.5. Associated scattered to broken low/med clouds with embedded intense to very intense convection over southcentral BoB & adj central BoB between latitude 9.0N to 17.0N and longitude 83.0E to 91.0E. Minimum CTT is -93°C.

scattered to broken low/med clouds with embedded intense to very intense convection over south and central BoB. Scattered low/med clouds with isolated weak to moderate convection over north north BoB.

b) Over the Arabian Sea:-

Scattered to low/med clouds with embedded isolated moderate to intense convection over south parts of south AS & Comorin area.

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.

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 2-3 days.

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

Super Cyclonic Storm Darian over south Indian ocean centered near 12.4S/83.8E. Intensity T 7.0/7.0. 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 14.0S and long 81.0E 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	Low pressure area (LPA) over southwest BoB on 23rd, to move westwards till 24th/0000 UTC, thereafter gradually recurve southwestwards and reach Comorin Area on 26/0000 UTC as a low pressure area. To move west-southwestwards thereafter and become less marked on 29/0000 UTC.	Low pressure area over Comorin Area on 26/0000 UTC. To move west-southwestwards thereafter and become less marked on 29/0000 UTC.
IMD-GEFS	Low pressure area (LPA) over southwest BoB on 23rd, to move westwards till 24th/0000 UTC, thereafter gradually recurve southwestwards and reach Comorin Area on 26/0000 UTC as a low pressure area. To move west-southwestwards thereafter and become less marked on 29/0000 UTC.	Low pressure area over Comorin Area on 26/0000 UTC. To move west-southwestwards thereafter and become less marked on 29/0000 UTC.
GEFS Probabilistic guidance	NA	NA
IMD WRF	Low pressure area (LPA) over southwest BoB on 23rd, to move westwards till 24th/0000 UTC, thereafter gradually recurve southwestwards and reach Comorin Area on 26/0000 UTC as a low pressure area.	No significant system
NCMRWF-NCUM (G)	Low pressure area over southwest BoB on 23rd, to move initially west-southwestwards and reach Comorin Area on 26/0000 UTC as a low pressure area.	Low pressure area over Comorin on 26th/0000 UTC, LPA over Lakshadweep on 27th/0000 UTC, to move westwards and become less marked on 29th Dec.over southeast Arabian Sea
NCMRWF-NEPS	Low pressure area over southwest BoB on 23rd, to move initially west-southwestwards and reach Comorin Area on 26/0000 UTC as a low pressure area.	Low pressure area over Comorin on 26th/0000 UTC, LPA over Lakshadweep on 27th/0000 UTC, to move westwards and become less marked on 29th Dec.over southeast Arabian Sea
NCMRWF-UM (Regional)	Low pressure area over southwest BoB on 23rd, to move initially west-southwestwards and reach Comorin Area on 26/0000 UTC as a low pressure area.	Low pressure area over Comorin on 26th/0000 UTC, LPA over Lakshadweep on 27th/0000 UTC, to move westwards and become less marked on 29th Dec. over southeast Arabian Sea
ECMWF	Depression over southwest Bay of Bengal on 23rd, to gradually recurve west-southwestwards thereafter, well marked low pressure area over southwest BoB on 24th,	Cyclonic circulation over Comorin on 26th/0000 UTC to move nearly westwards with marginal intensification on 27th/0000 UTC

	reaching Comorin area on 26th as a low pressure area/cyclonic circulation	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 23rd -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.	Over the Arabian Sea 40-50% probability of formation of depression with westwards movement during 26th-28th December.
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 northwards movement of system initially till 24th/0000 UTC, followed by gradual southwestwards movement with system crossing Sri Lanka as a depression and emerging into Comorin Area on 26th/0000 UTC and move westwards thereafter with weakening into a well marked low pressure area on 27th Dec. over southeast Arabian Sea.	Depression over Comorin Area on 26th/0000 UTC and move westwards thereafter with weakening into a well marked 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 on 23rd & 24th Dec.	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 ($50X10^{-6}s^{-1}$), positive outflow ($10X10^{-5}s^{-1}$) and positive convergence ($10X10^{-5}s^{-1}$).

Model guidance: Most of the models are indicating that the depression over southwest Bay of Bengal would move northwestwards till 23rd/0000 UTC. Thereafter, it would gradually recurve and move southwestwards across Sri Lanka reaching 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 Bay of Bengal is likely to move slowly over southwest Bay of Bengal, make a loop over the same region and then move west-southwestwards towards Comorin Area across Sri Lanka during next 48 hours.

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

"-" 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 moderate to low probability is assigned to cyclogenesis over the Arabian Sea on day 3 to 5.

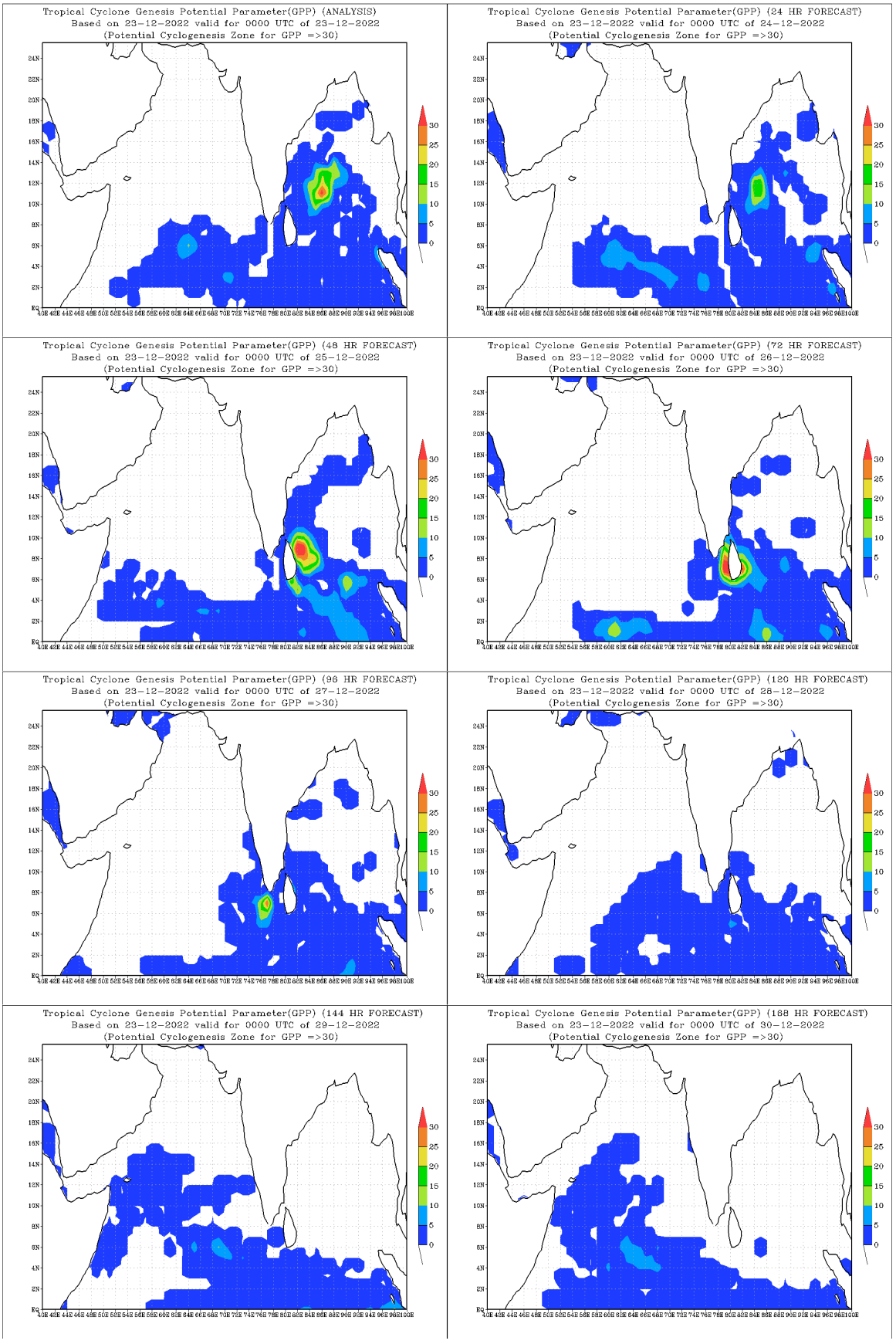
Probability of cyclogenesis (formation of depression and above intensity systems) over the Arabian Sea during next 168 hours:

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

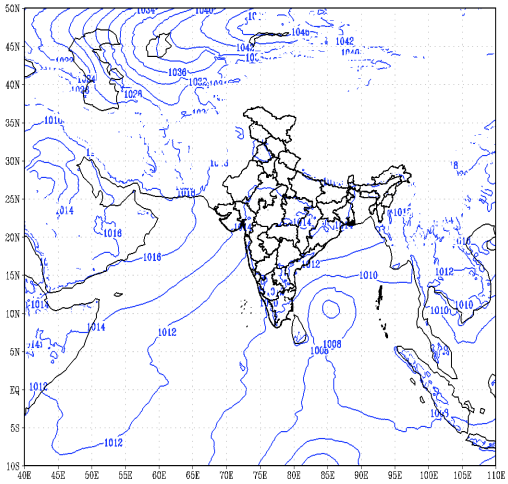
IOP: **Tamil Nadu and Sri Lanka during 23rd-26th December, Kerala on 26th & 27th and Lakshadweep Islands on 27th December.**

Annexure


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

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

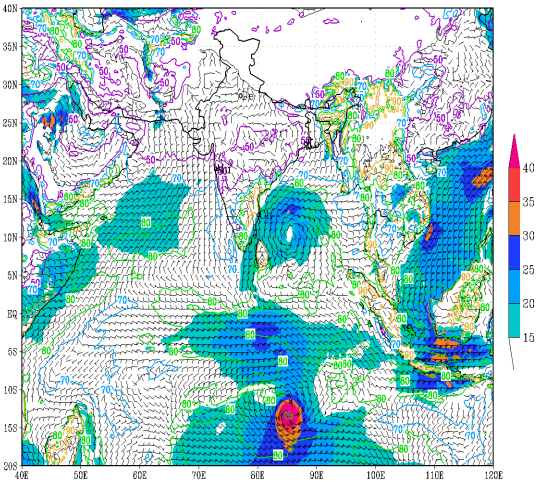
based on 06 UTC of 23-12-2022 valid for 06 UTC of 23-12-2022



(Background does not depict political boundary)

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

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



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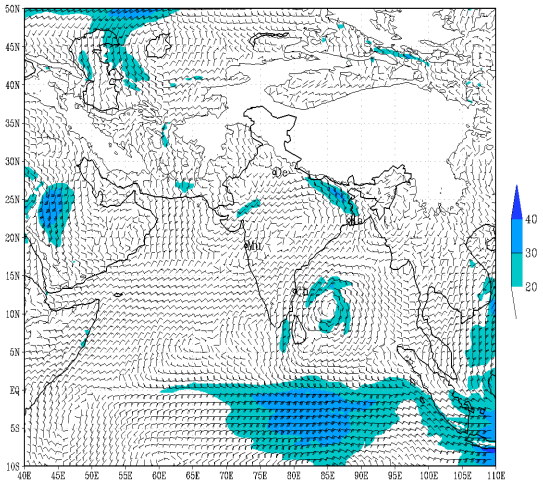

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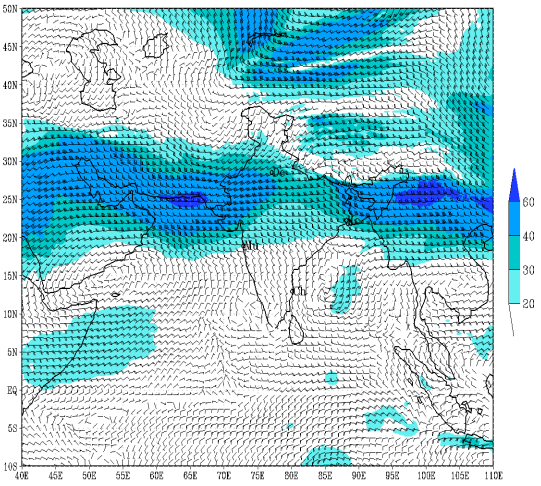

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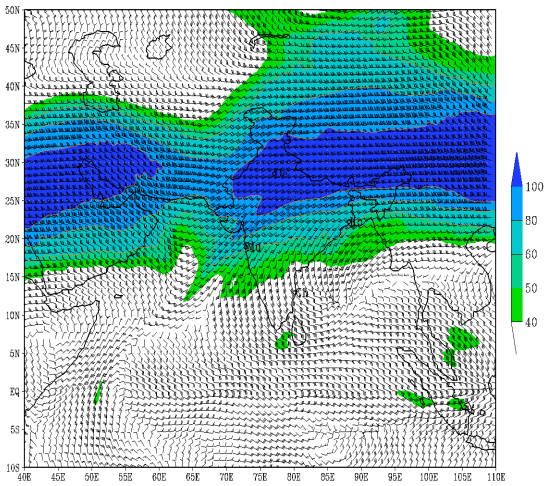

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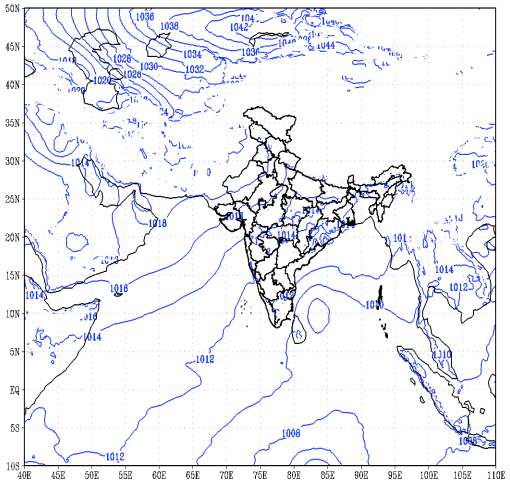

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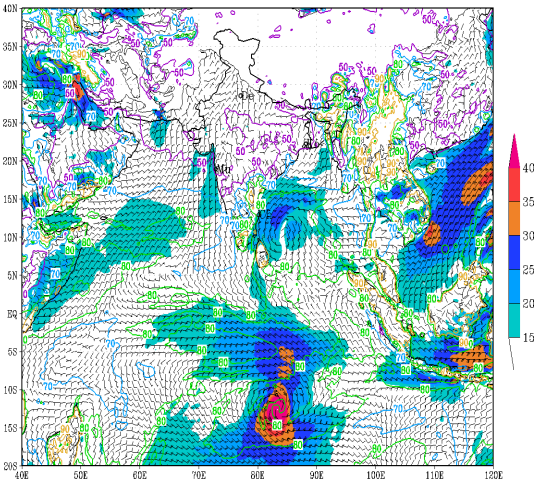
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (24 HR)

based on 00 UTC of 23-12-2022 valid for 00 UTC of 24-12-2022



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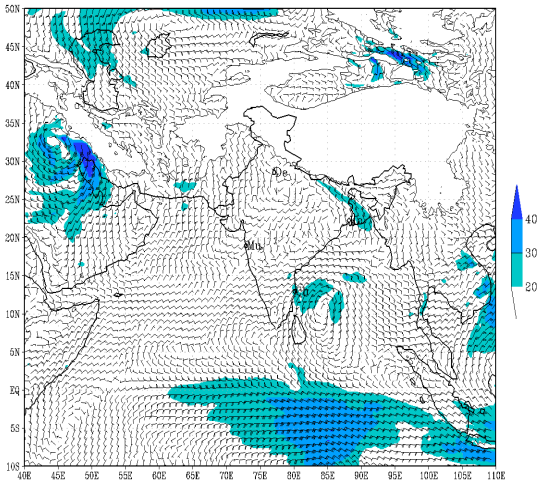

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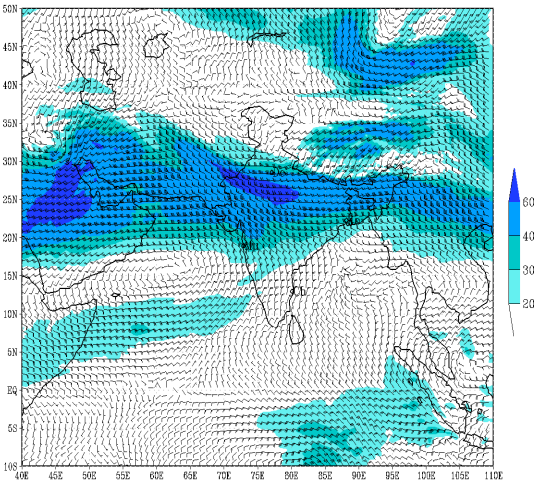
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (24 HR)

based on 00 UTC of 23-12-2022 valid for 00 UTC of 24-12-2022



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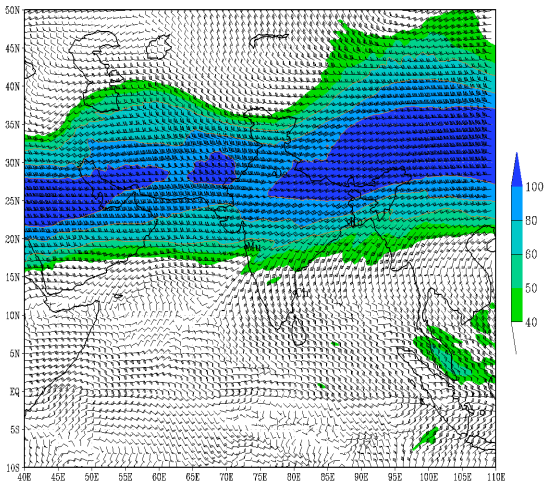

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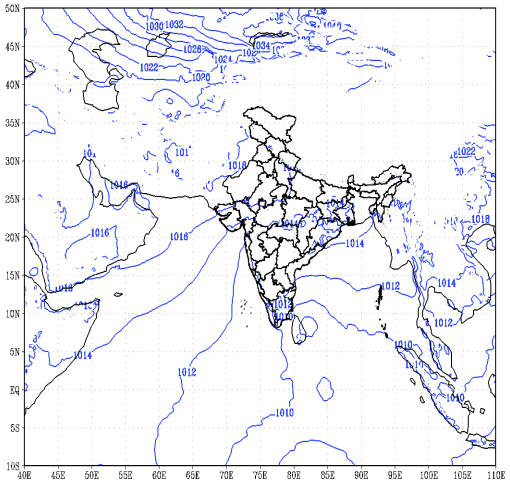
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (48 HR)
based on 06 UTC of 23-12-2022 valid for 06 UTC of 25-12-2022



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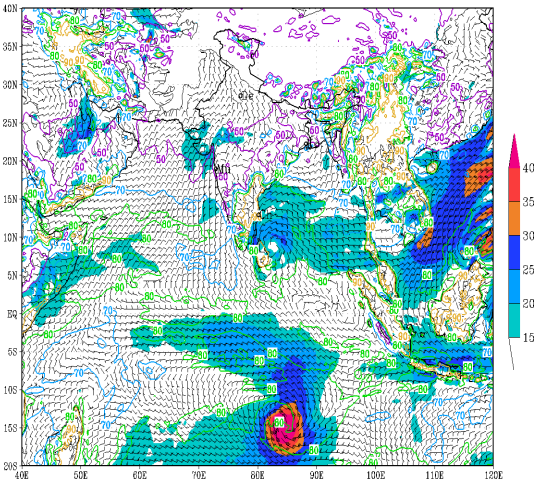
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (48 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 25-12-2022



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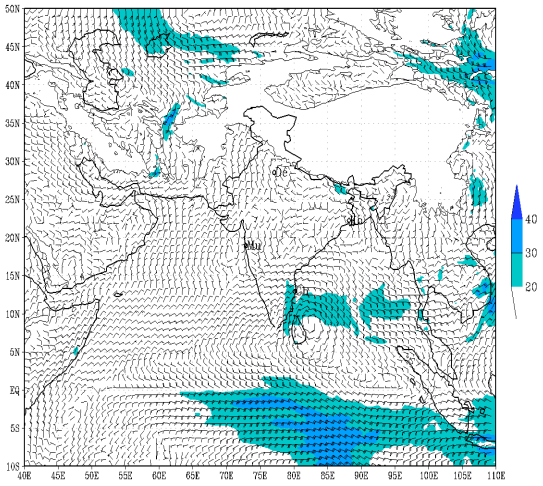

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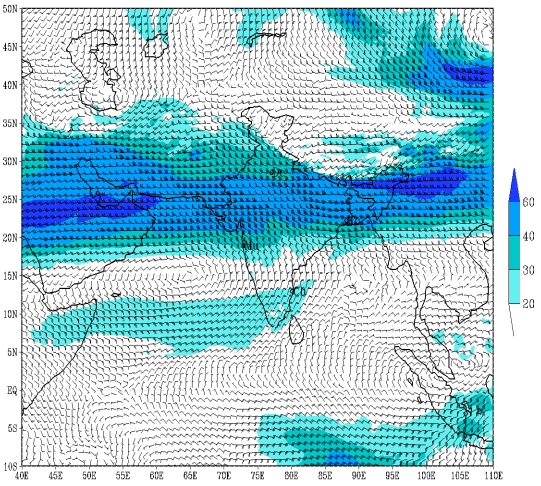

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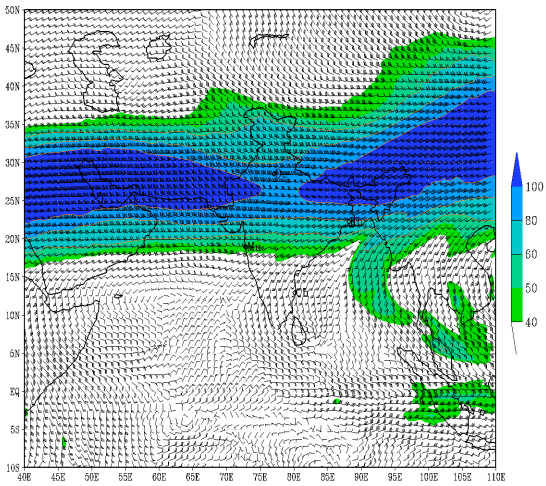

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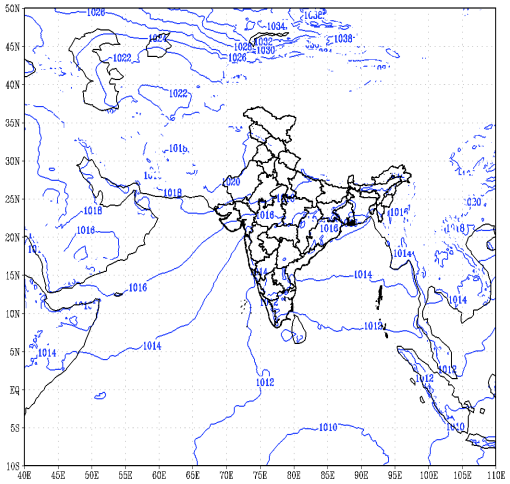
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (72 HR)
based on 06 UTC of 23-12-2022 valid for 06 UTC of 26-12-2022



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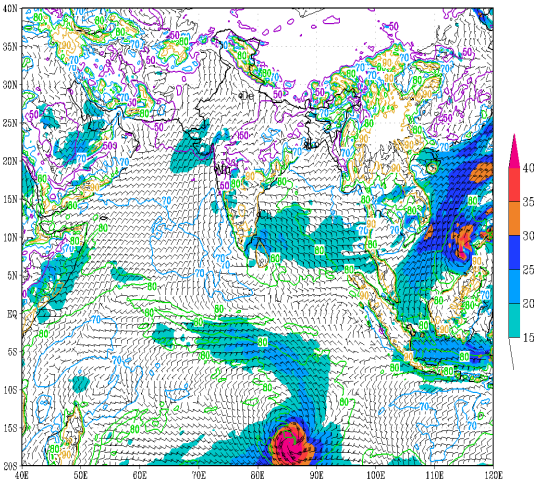

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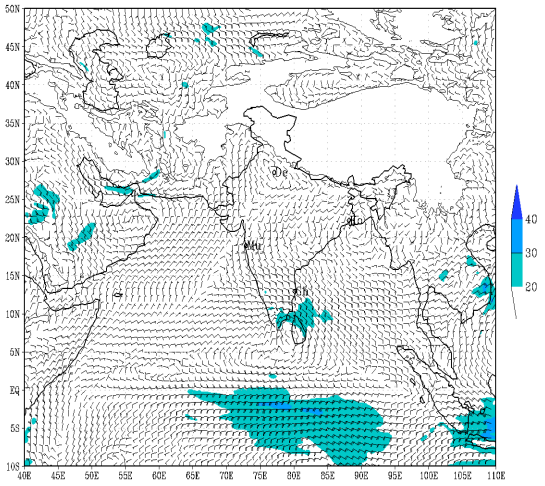

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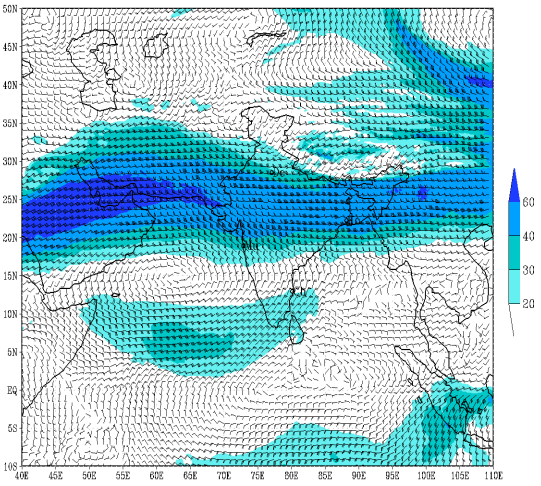

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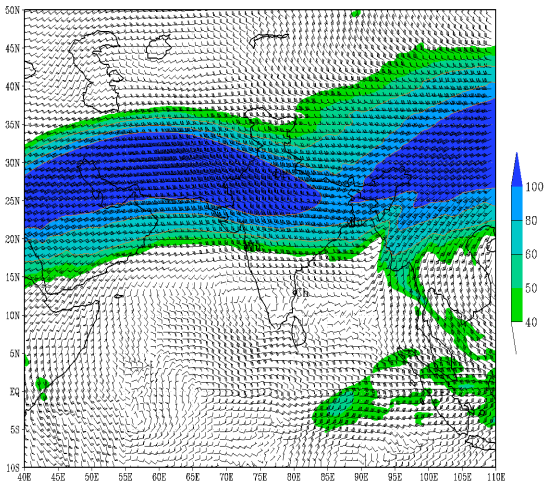

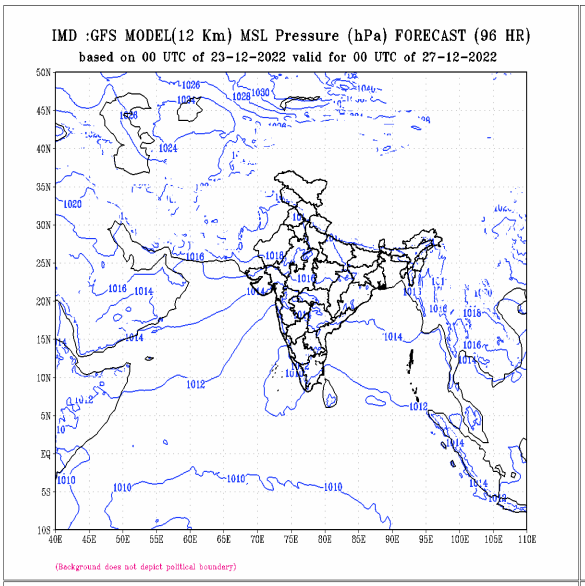
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (96 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 27-12-2022
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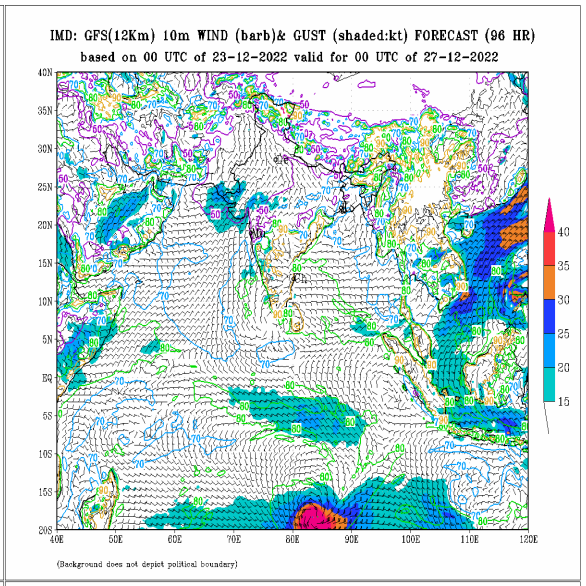
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (96 HR)
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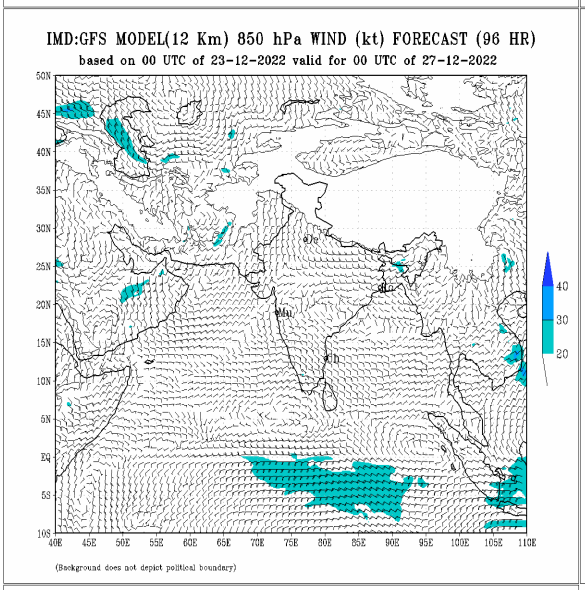
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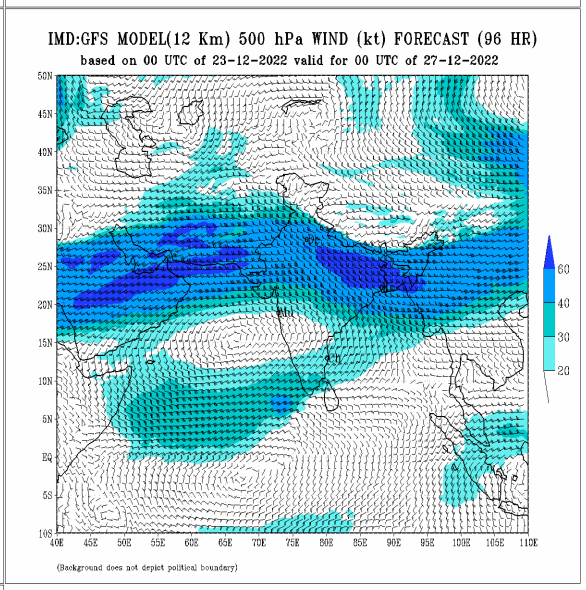
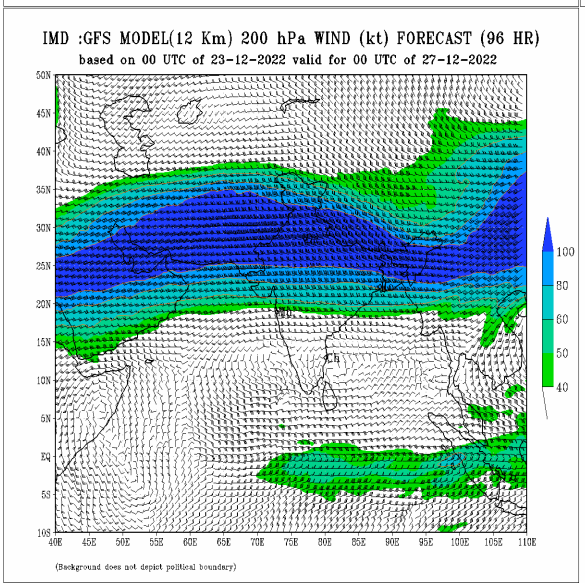
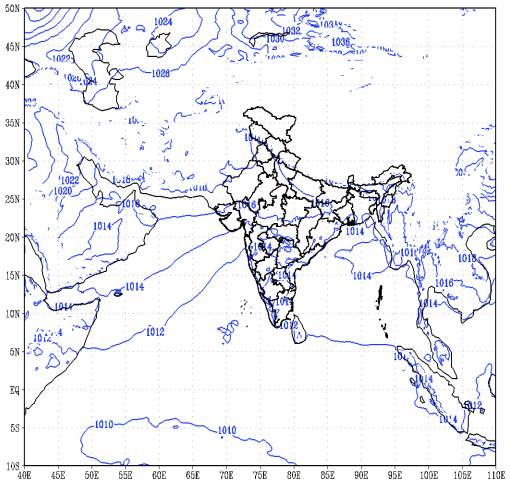

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 27-12-2022
(Background does not depict political boundary)

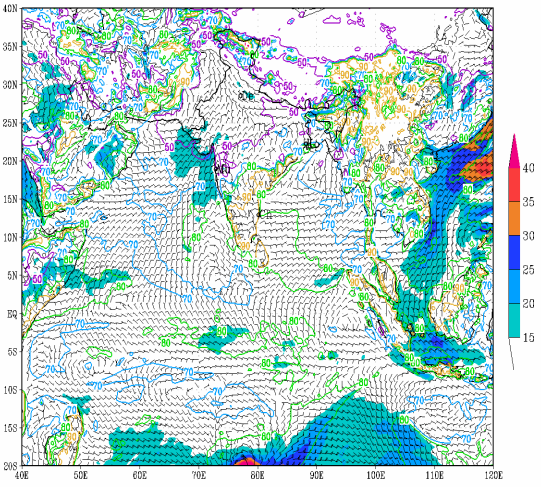

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 27-12-2022
(Background does not depict political boundary)

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 28-12-2022



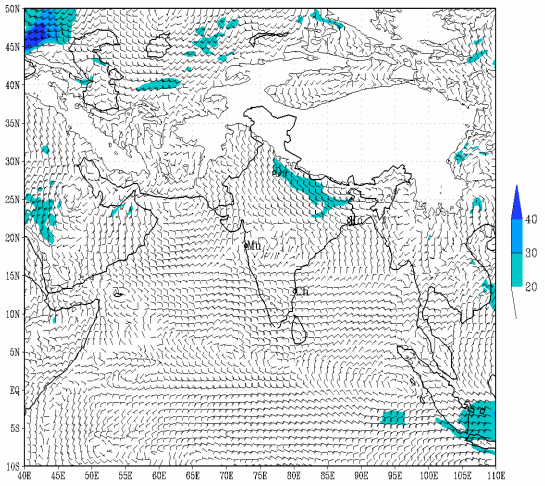
(Background does not depict political boundary)

IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (120 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 28-12-2022



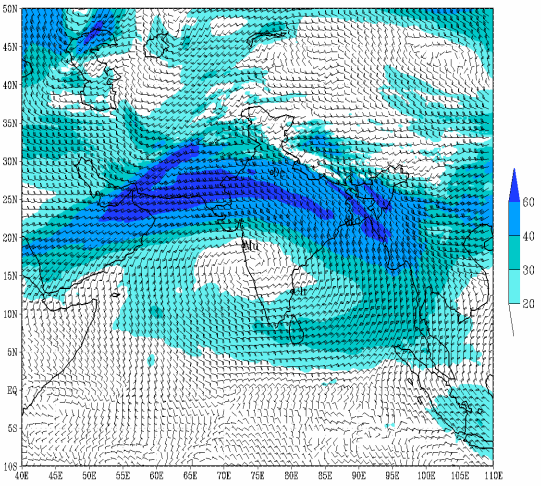
(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 28-12-2022



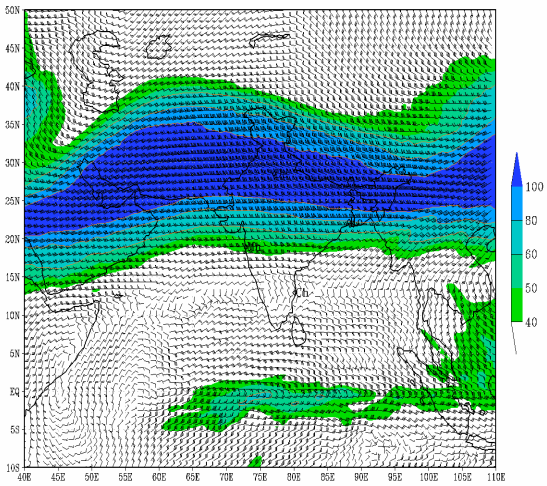
(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 29-12-2022

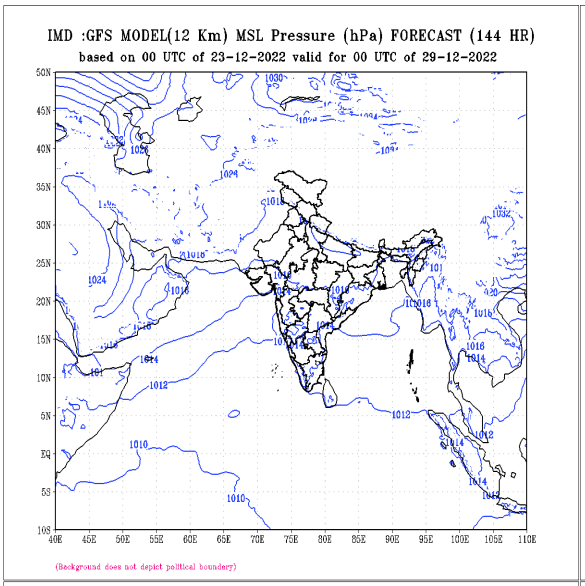


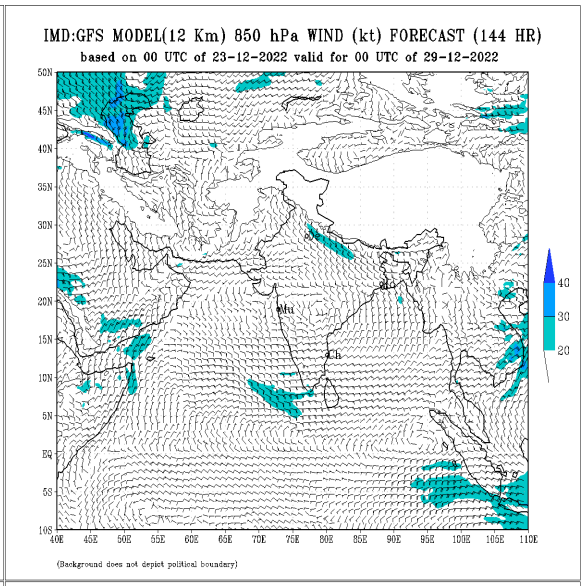
(Background does not depict political boundary)

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 28-12-2022



(Background does not depict political boundary)


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (144 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 29-12-2022
(Background does not depict political boundary)


IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 29-12-2022
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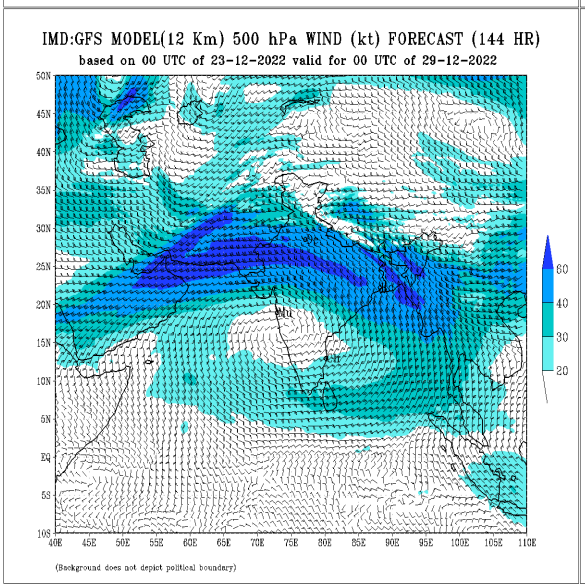
(Background does not depict political boundary)


IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 29-12-2022
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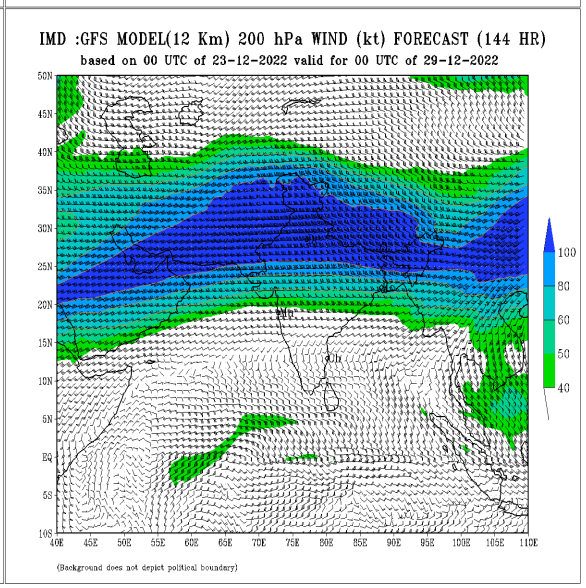
(Background does not depict political boundary)


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 29-12-2022
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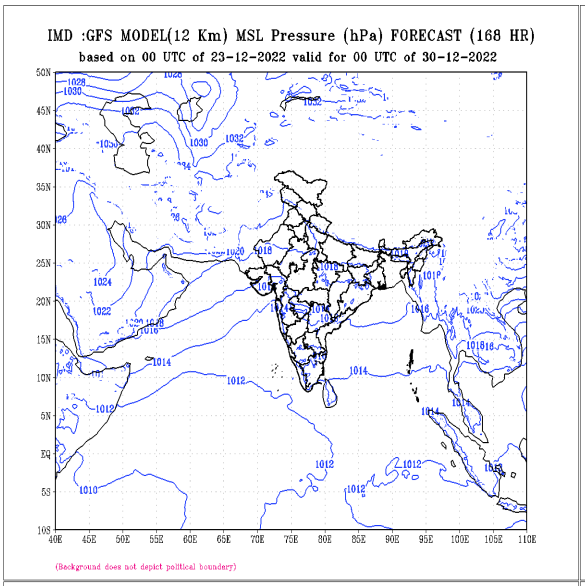
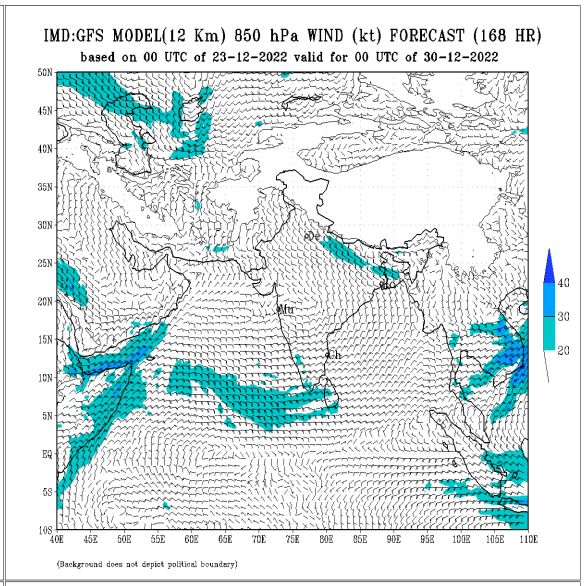
(Background does not depict political boundary)


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (168 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 30-12-2022
(Background does not depict political boundary)


IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 30-12-2022
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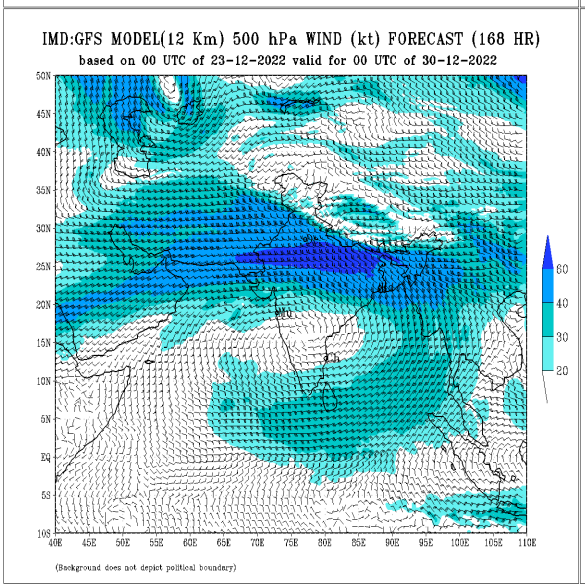
(Background does not depict political boundary)


IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 30-12-2022
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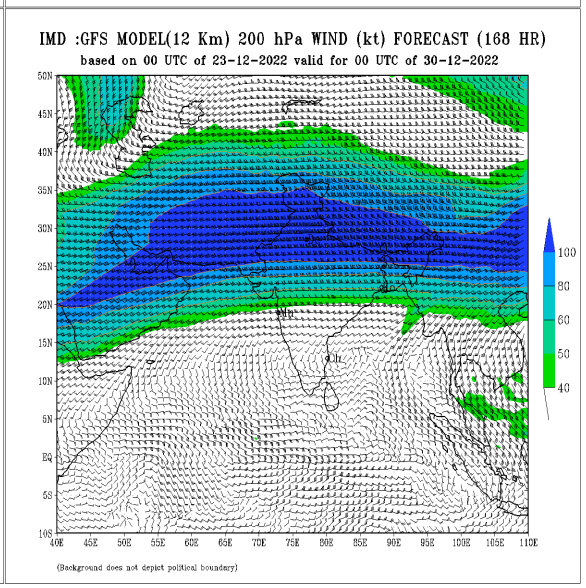
(Background does not depict political boundary)


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 23-12-2022 valid for 00 UTC of 30-12-2022
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(Background does not depict political boundary)