



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

**Tropical Cyclone Forecast Programme
Report Dated 21st December 2022**

Time of Issue: 1200 UTC

Synoptic features (based on 0600 UTC analysis):

- ❖ Yesterday's Low Pressure Area over central parts of South Bay of Bengal (BoB) and adjoining Equatorial Indian Ocean (EIO) lay as well marked low pressure area over southwest BoB and adjoining EIO at 0000 UTC/0530 hrs IST and persisted over the same region at 0600 UTC of today the 21st December, 2022.
- ❖ It is likely to move northwestwards and intensify into a depression over southwest BoB off Sri Lanka coast during next 24 hours. It would move northwestwards during subsequent 24 hours and thereafter recurve southwestwards towards Comorin Area across Sri Lanka.

Dynamical and thermo-dynamical features

| Parameter | Bay of Bengal (BoB) | Arabian Sea (AS) |
|---|---|---|
| Sea Surface Temperature (SST) °C | 28-29°C over entire BoB | 27-28°C over major parts of south and central Arabian Sea. |
| Tropical Cyclone Heat Potential (TCHP) kJ/cm² | 90-100 over eastcentral BoB, 90-100 over south Andaman Sea, southeast BoB adjoining Equatorial Indian Ocean (EIO). Less than 40 along the Andhra Pradesh and Tamil Nadu coasts, Gulf of Mannar, western parts of southwest BoB. | 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 (X10⁻⁶s⁻¹) | Increased significantly and is about 100 to the southwest of system centre (near 6.4N/85.4E) at 850 hPa level with vertical extension upto 200 hPa level. | 30-40 over Equatorial Indian Ocean and adjoining areas of Comorin Area and southeast Arabian Sea. |
| Low Level convergence (X10⁻⁵ s⁻¹) | Increased significantly and is about 30 to the northwest of system centre. | 5-10 over Equatorial Indian Ocean and adjoining areas of Comorin Area. |
| Upper Level divergence (X10⁻⁵ s⁻¹) | Increased significantly and is about 40 to the northwest of system centre. | 10-20 over Equatorial Indian Ocean and adjoining areas of Lakshadweep. |
| Vertical Wind Shear (VWS knots) | Low to moderate (10-15 kt) over system area over southwest Bay of Bengal with increasing tendency towards west. | 05-10 over Southeast Arabian Sea and Lakshadweep. |
| Wind Shear Tendency | Decreasing over southwest BoB | Decreasing over south AS and |

| | | |
|---------------------------------|--|----------------------------|
| (knots) | upto southeast Sri Lanka and over eastcentral BoB. | adjoining EIO. |
| Upper tropospheric Ridge | 11°N over the Bay of Bengal. | 11°N over the Arabian Sea. |
| Trough in westerlies | Deep trough near 30°N / 70°E | |

Satellite observations based on INSAT imagery (0600 UTC):--Santosh

a) Over the BoB & Andaman Sea: -

Vortex over southwest and adjoining southeast Bay of Bengal near 6.4N/85.5E. Intensity is characterized as T 1.0. Associated scattered to broken low and medium clouds with embedded intense to very intense convection lay over southwest and adjoining southeast Bay of Bengal and neighbourhood. Minimum cloud top temperature (CTT) is minus 93 deg Celsius.

b) Over the Arabian Sea: -

Scattered low and medium clouds with embedded intense to very intense convection over southeast Arabian Sea and Comorin Area. Scattered low and medium clouds with embedded isolated weak to moderate convection lay over southwest Arabian Sea and Lakshadweep area.

M.J.O. Index:

The Madden Julian Oscillation (MJO) Index is currently in Phase 5 with amplitude more than 1. It will continue in same phase for next 5 days with amplitude remaining more than 1 and move to phase 6 thereafter.

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:

Cyclonic storm (Darian) over south Indian Ocean centered near 13.7S / 90.8E. Intensity of the system is T7.0/7.0. Corresponding maximum sustained winds is ≥ 120 kts. Associated broken low/med clouds with embedded intense to very intense convection lay over area between latitude 11.0S to 17.0S and longitude 88.0E to 92.0E.

Model guidance based on 0000 UTC for the next 7 days

| MODEL GUIDANCE | Bay of Bengal (BoB) | Arabian Sea (AS) |
|-----------------------|--|--|
| IMD-GFS | A well marked pressure area (WML) over Southwest Bay of Bengal on 21 st , to move gradually northwestwards & intensify into a marginal depression over southwest BoB on | Depression over southwest BoB to move southwestwards and lie as a Depression/WML over Comorin on 25 th and weaken gradually while |

| | | |
|------------------------------------|---|--|
| | 23 rd . Would lie as depression over southwest BoB off Sri Lanka coast on 24 th , to move southwestwards and lie as a Depression/WML over Comorin on 25 th , weaken gradually while moving westwards over south Arabian Sea. | moving westwards over south Arabian Sea. |
| IMD-GEFS | LPA over Southwest Bay of Bengal on 20 th , to move gradually west-northwestwards over southwest BoB till 25 th December and emerge gradually into Comorin area on 27 th December. | LPA over Comorin on 27 th December moving gradually westwards without any intensification till 28 th Dec. |
| GEFS Probabilistic guidance | WML over southwest BoB off Sri Lanka coast on 21 st , to move slightly northwards and lie as a WML over southwest BoB over southwest BoB on 22 nd . Thereafter, recurve southwestwards and weaken over southwest BoB off North Sri Lanka coast on 24 th and emerge into Comorin Area on 25 th as a Cycir. | Cycir over Comorin Area on 25 th , LPA over Lakshadweep on 26 th , LPA over southeast AS on 27 th |
| IMD WRF | A well marked pressure area (WML) over Southwest Bay of Bengal on 21 st , to move gradually northwestwards & intensify into a marginal depression over southwest BoB on 23 rd . Would lie as depression over southwest BoB off Sri Lanka coast on 24 th | No significant system |
| NCMRWF-NCUM (G) | LPA over southwest BoB on 21 st , to move gradually westwards and lie as a WML over southwest BoB on 22 nd . Further, it is predicted to move northwards gradually, lie as a WML over southwest BoB on 23 rd , WML/depression over southwest BoB on 24 th & 25 th , LPA over southwest Sri Lanka on 26 th . | LPA over southwest BoB is likely to emerge into Comorin Area on 26 th Dec. To move nearly westwards thereafter over south Arabian and weaken into a well marked low pressure area over southeast Arabian Sea on 28 th December, becoming less marked thereafter. |
| NCMRWF-NEPS | LPA over southwest BoB on 21 st , to move gradually westwards and lie as a WML over southwest BoB on 22 nd . Further, it is predicted to move northwards gradually, lie as a WML over southwest BoB on 23 rd , WML/depression over southwest BoB on 24 th & 25 th , LPA over southwest Sri Lanka on 26 th . | LPA over southwest BoB is likely to emerge into Comorin Area on 26 th Dec. To move nearly westwards thereafter over south Arabian and weaken into a well marked low pressure area over southeast Arabian Sea on 28 th December, becoming less marked thereafter. |
| NCMRWF-UM (Regional) | LPA over southwest BoB on 21 st , to move gradually westwards and lie as a WML over southwest BoB on 22 nd . Further, it is predicted to move northwards gradually, lie as a WML over southwest BoB on 23 rd , WML/depression over southwest BoB on 24 th . | No significant system during next 3 days. |
| ECMWF | WML over southwest Bay of Bengal on 21 st , to move nearly north-northwestwards with marginal intensification, becoming depression on 23 rd over southwest BoB, to move west-southwestwards thereafter, reach Comorin area on 26 th as a WML | WML over Comorin on 26 th , weakening gradually while moving westwards over southeast Arabian Sea. |
| ECMWF ensemble | 80-90% probability of depression over southwest Bay of Bengal during 22 nd -25 th | Over the Arabian Sea 10-30% probability of formation of |

| | | |
|--|--|---|
| | 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. | depression with westwards movement. |
| NCEP-GFS | A well marked pressure area (WML) over Southwest Bay of Bengal on 21 st , to move gradually northwestwards & intensify into a marginal depression over southwest BoB on 23 rd . Would lie as depression over southwest BoB off Sri Lanka coast on 24 th , to move southwestwards and lie as a Depression/WML over Comorin on 25 th , weaken gradually while moving westwards over south Arabian Sea. | Depression over southwest BoB to move southwestwards and lie as a Depression/WML over Comorin on 25 th and weaken gradually while moving westwards over south Arabian Sea. |
| IMD MME | MME is indicating nearly north-northwestwards movement of system initially, followed by southwestwards movement with system crossing Sri Lanka as a depression, emerging into Comorin Area and move westwards thereafter. MME is indicating the system to intensify into depression around 22 nd /1200 UTC and maintain its intensity of depression till 25 th /1200 UTC and weaken thereafter. | Models is also indicating the system over BoB to emerge into Comorin Area on 27 th as a WML, move westwards and weaken gradually thereafter. |
| IMD HWRF | No guidance | No guidance |
| IMD-Genesis Potential Parameter (GPP) | A significant potential zone over southwest Bay of Bengal till 22 nd Dec and then moving gradually northwestwards till 25 th . | On 26 th 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 10-15 kts, enhanced westerly winds (5-7 mps) over south BoB and easterly winds (5-7 mps) over central BoB, favourable MJO, presence of Kelvin Waves & background frequency waves, positive vorticity ($100 \times 10^{-6} \text{s}^{-1}$), good outflow ($40 \times 10^{-5} \text{s}^{-1}$).

Model guidance: Most of the models are indicating that the well marked low pressure area over southwest Bay of Bengal would move west-northwestwards and intensify into a depression during 22/1200 UTC to 23/0000 UTC. Thereafter, it would move southwestwards across Sri Lanka towards Comorin Area. Most of the models are indicating that the system would intensify upto depression stage only. Thus, there is consensus among various models wrt movement and peak intensity.

In view of all the above, it is inferred that

1. For the Bay of Bengal:

The well marked low pressure area over southwest Bay of Bengal and adjoining East Equatorial Indian Ocean is likely to move northwestwards and intensify into a depression during next 24 hours. Thereafter, it is likely to move northwestwards for subsequent 24 hours, recurve

southwestwards thereafter and move towards Comorin Area across Sri Lanka. Hence moderate to high probability is assigned to cyclogenesis over BoB during next 3-4 days.

2. For Arabian Sea:

The depression over southwest Bay of Bengal would emerge into Comorin Area around 25th December move westwards thereafter and weaken gradually over southeast Arabian Sea. Hence moderate to low probability is assigned to cyclogenesis over the Arabian Sea on day 5 & 6.

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

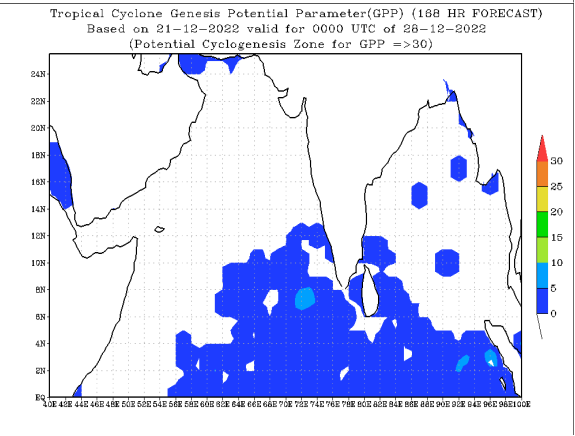
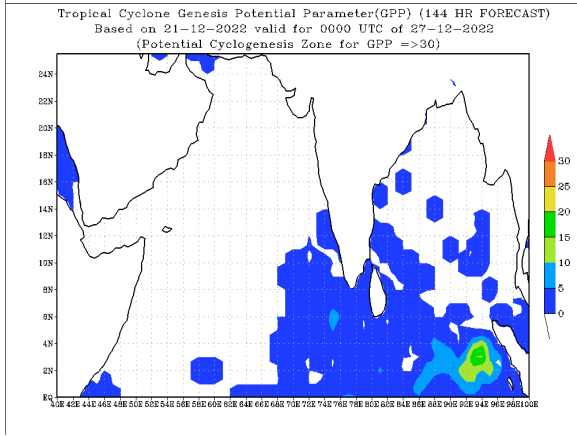
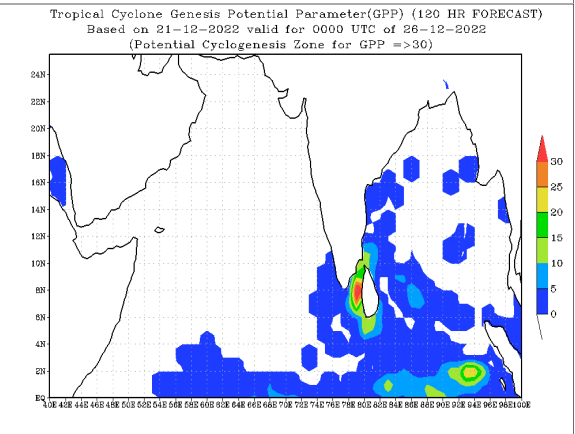
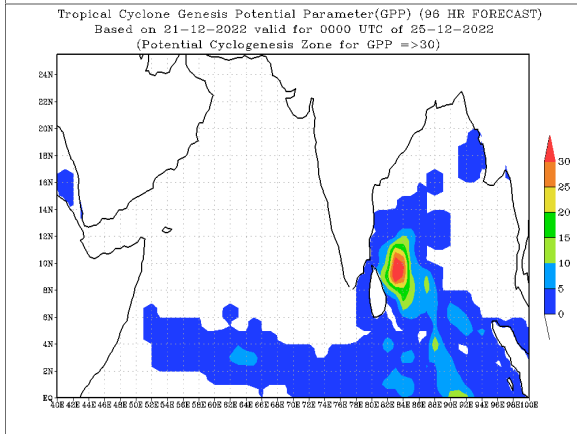
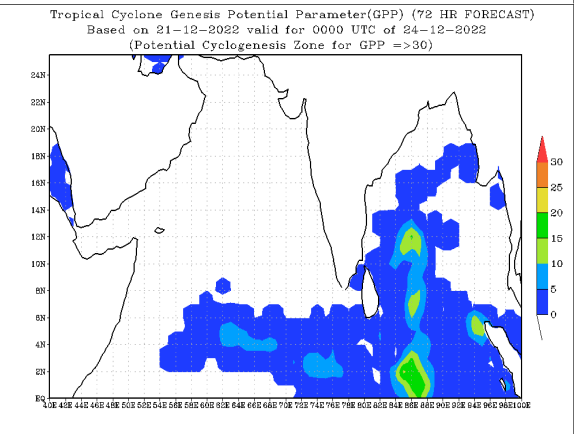
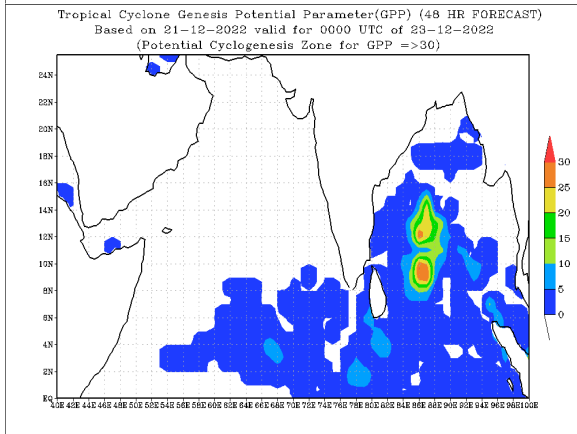
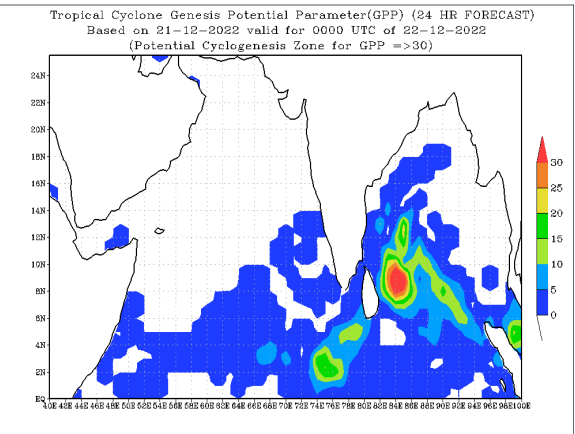
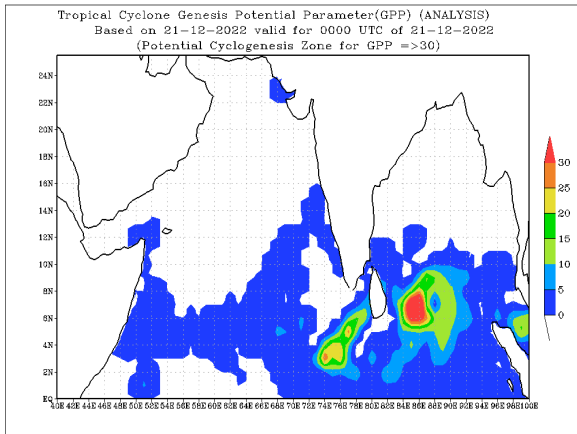
| 24 HOURS | 24-48 HOURS | 48-72 HOURS | 72-96 HOURS | 96-120 HOURS | 120-144 HOURS | 144-168 HOURS |
|----------|-------------|-------------|-------------|--------------|---------------|---------------|
| MOD | HIGH | HIGH | MOD | LOW | NIL | NIL |

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

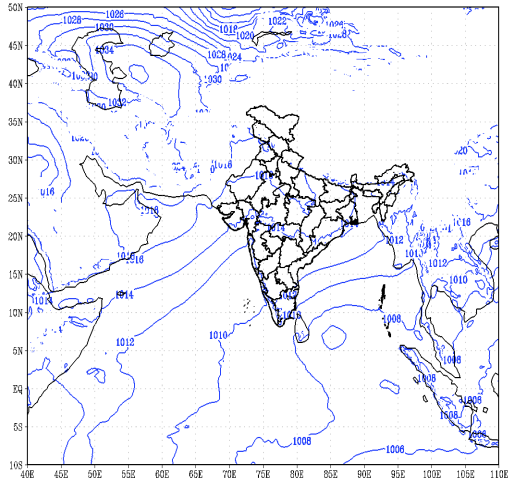
| 24 HOURS | 24-48 HOURS | 48-72 HOURS | 72-96 HOURS | 96-120 HOURS | 120-144 HOURS | 144-168 HOURS |
|----------|-------------|-------------|-------------|--------------|---------------|---------------|
| NIL | NIL | NIL | Nil | MOD | LOW | NIL |

Advisory: The movement and intensification of well marked low pressure area over southwest Bay of Bengal and its emergence into Comorin Area during next 5 days need to be critically monitored.

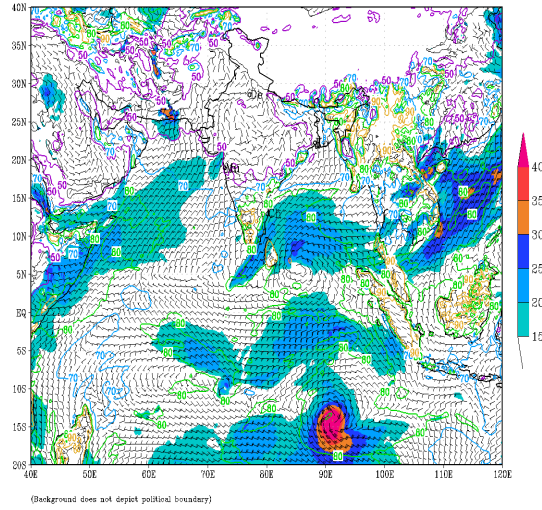
IOP: Tamil Nadu and Sri Lanka during 22nd-26th December.



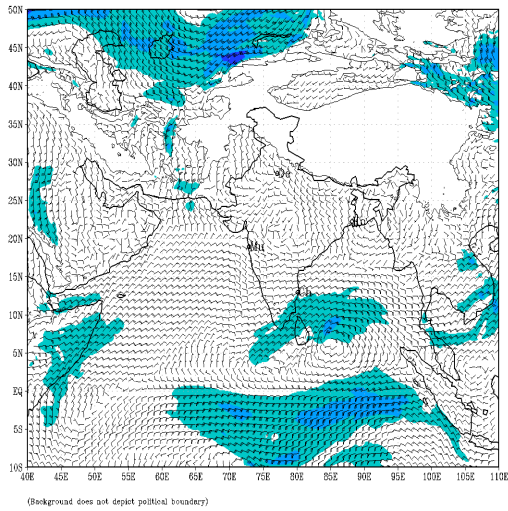
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (00 HR)
based on 06 UTC of 21-12-2022 valid for 06 UTC of 21-12-2022



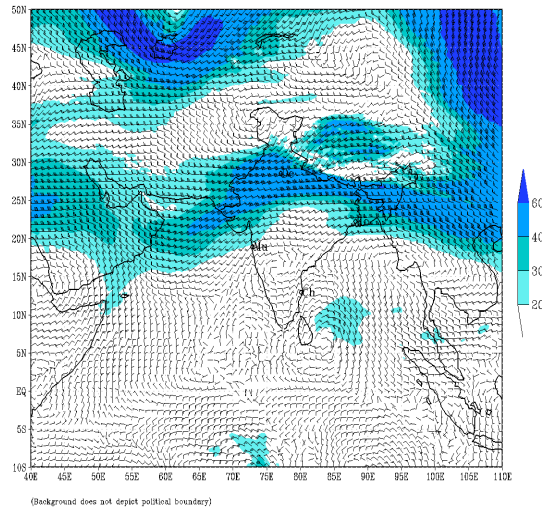
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (00 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 21-12-2022



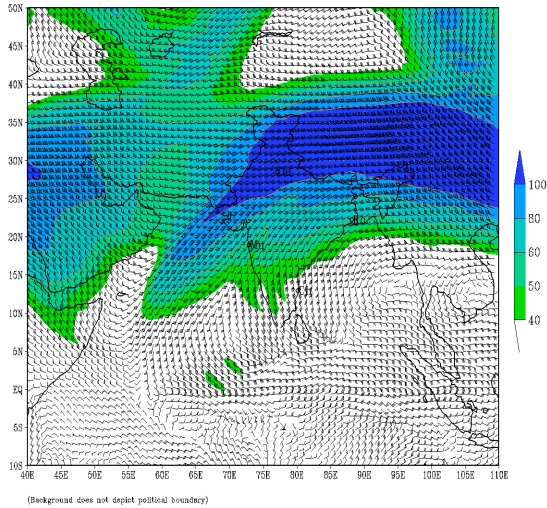
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (00 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 21-12-2022



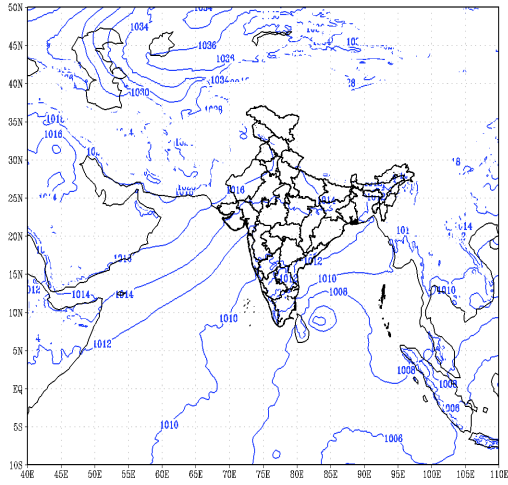
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (00 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 21-12-2022



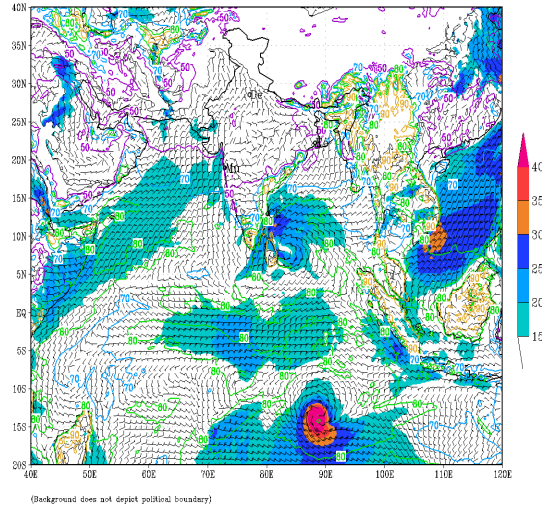
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (00 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 21-12-2022



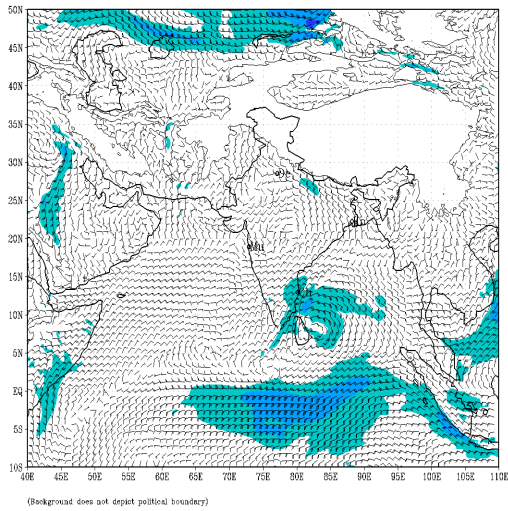
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (24 HR)
based on 06 UTC of 21-12-2022 valid for 06 UTC of 22-12-2022



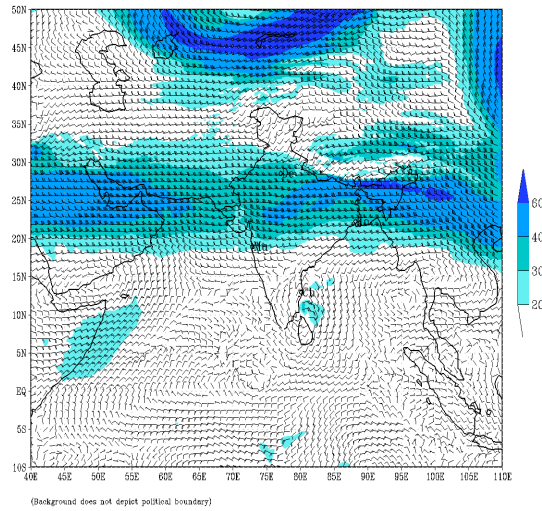
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (24 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 22-12-2022



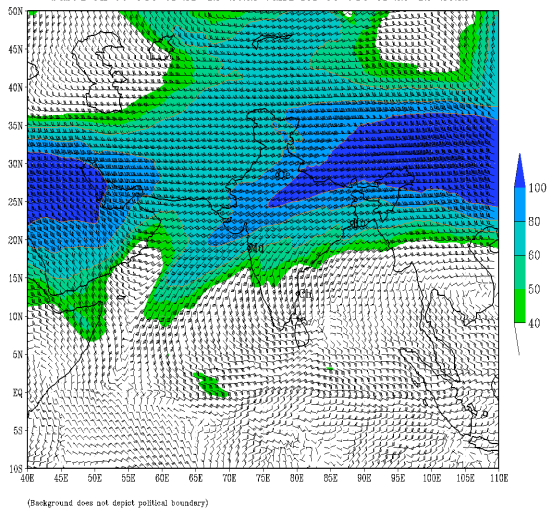
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 22-12-2022



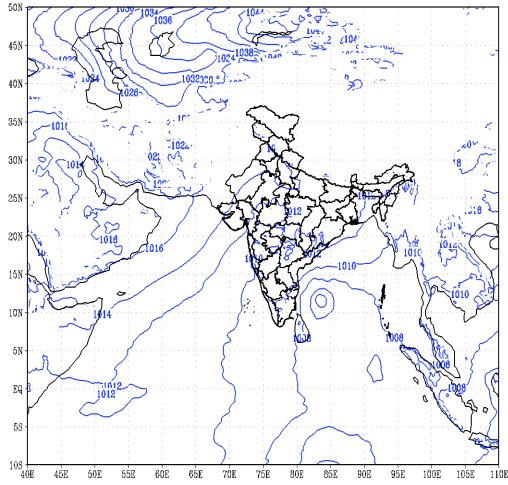
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 22-12-2022



IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 22-12-2022

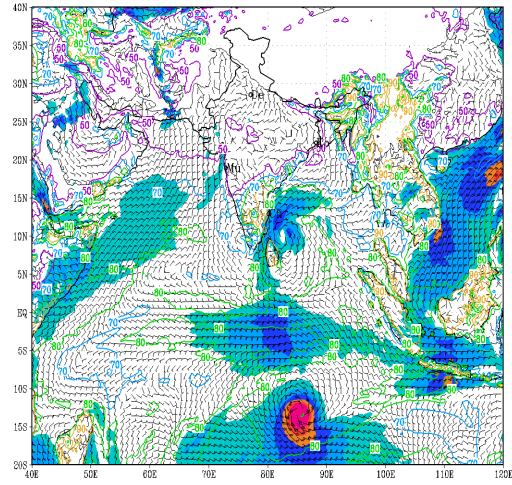


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (48 HR)
 based on 06 UTC of 21-12-2022 valid for 06 UTC of 23-12-2022



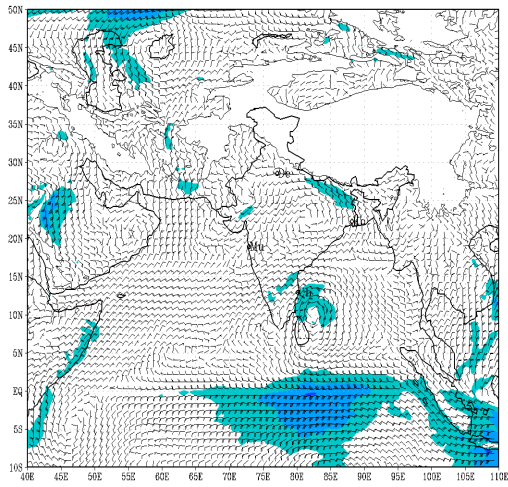
(Background does not depict political boundary)

IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (48 HR)
 based on 00 UTC of 21-12-2022 valid for 00 UTC of 23-12-2022



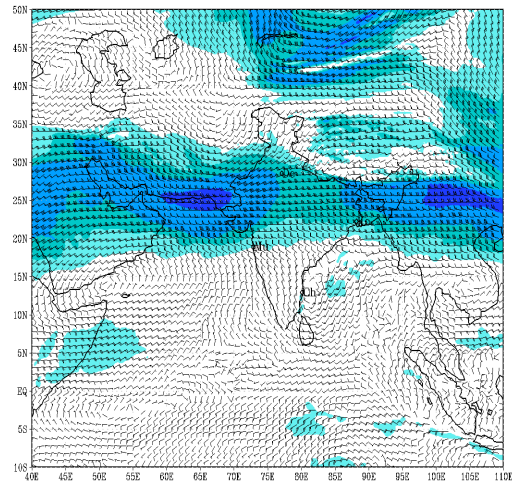
(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (48 HR)
 based on 00 UTC of 21-12-2022 valid for 00 UTC of 23-12-2022



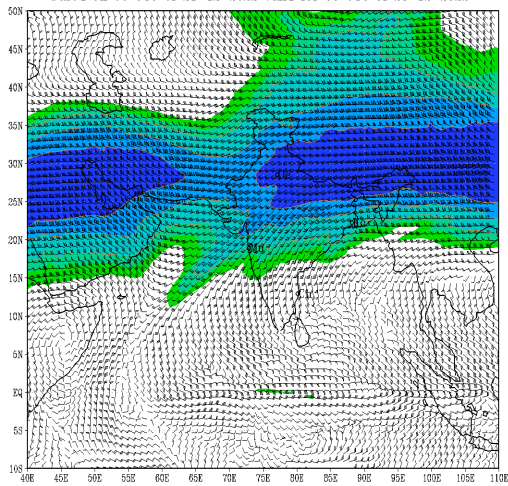
(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (48 HR)
 based on 00 UTC of 21-12-2022 valid for 00 UTC of 23-12-2022



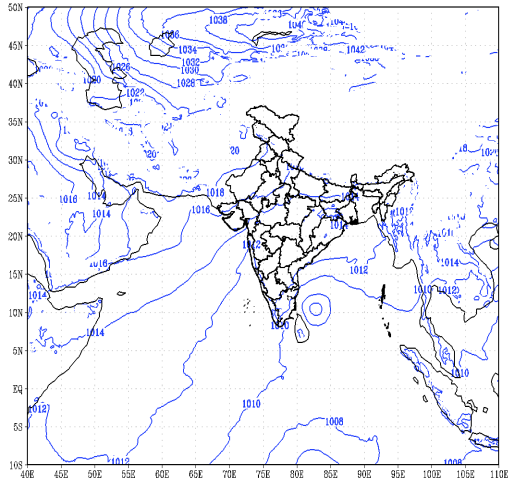
(Background does not depict political boundary)

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (48 HR)
 based on 00 UTC of 21-12-2022 valid for 00 UTC of 23-12-2022

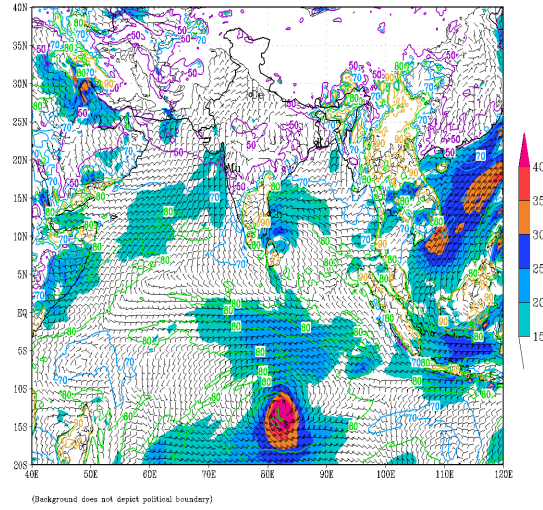


(Background does not depict political boundary)

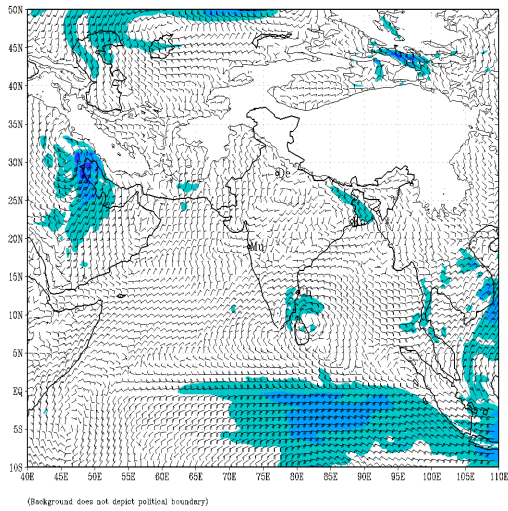
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (72 HR)
based on 06 UTC of 21-12-2022 valid for 06 UTC of 24-12-2022



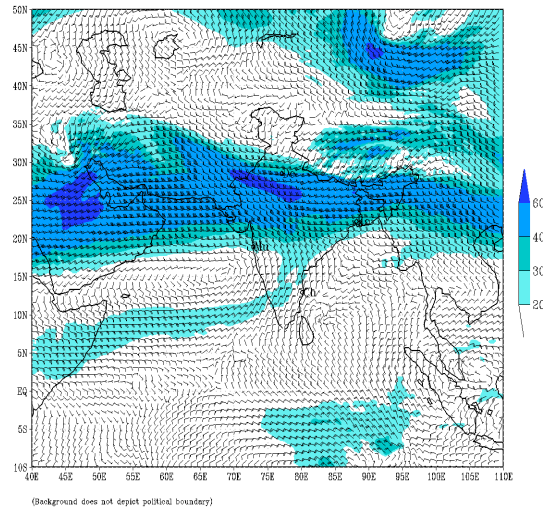
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (72 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 24-12-2022



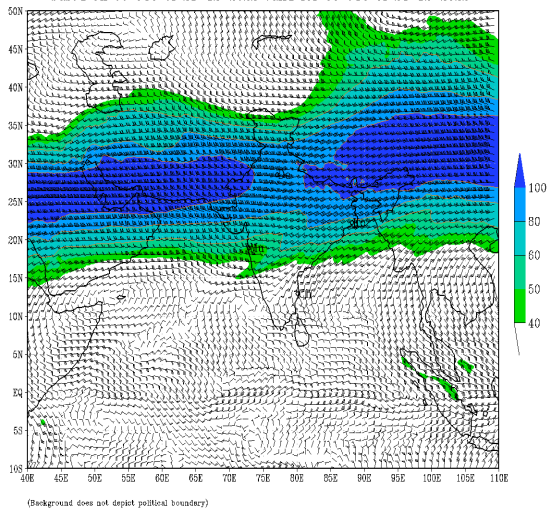
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 24-12-2022



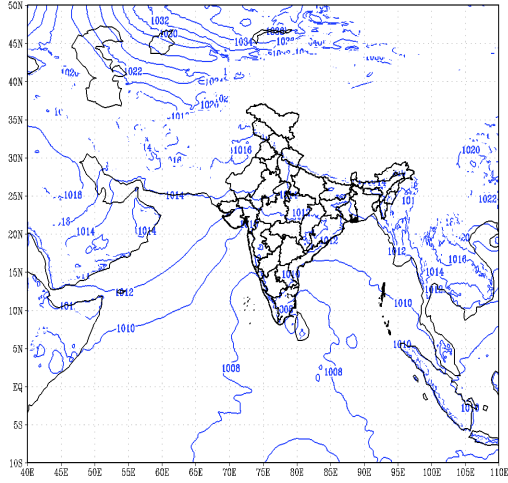
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 24-12-2022



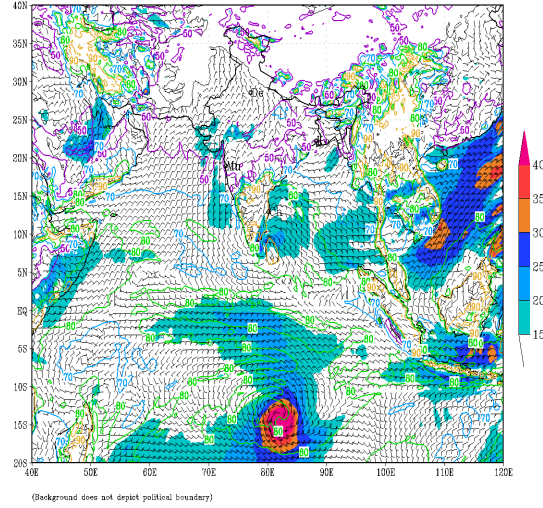
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 24-12-2022



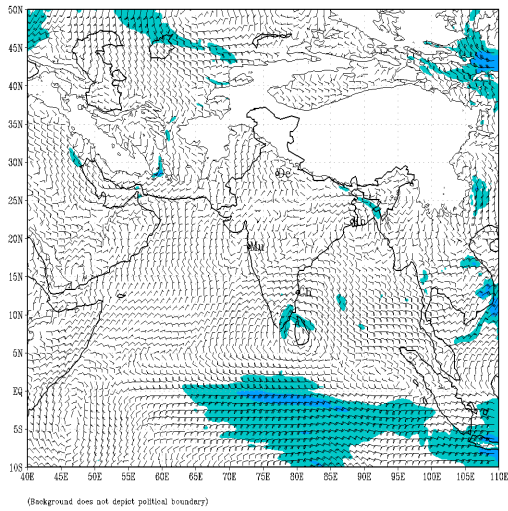
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (96 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 25-12-2022



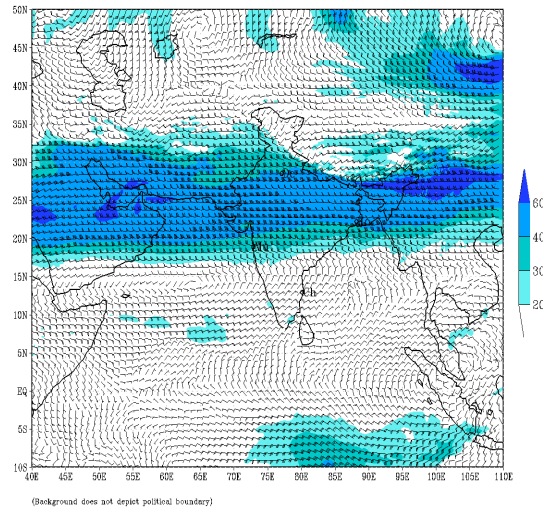
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (96 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 25-12-2022



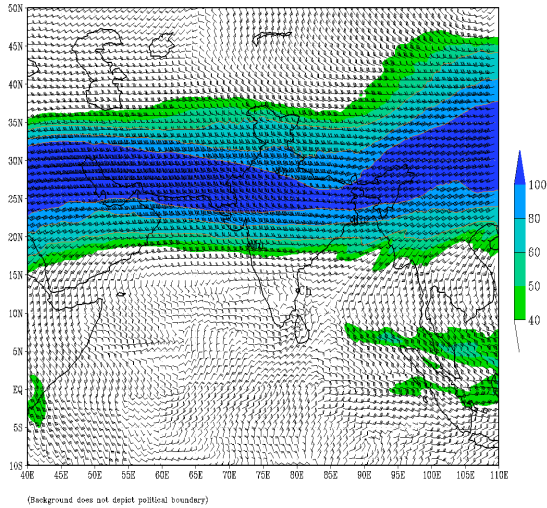
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 25-12-2022



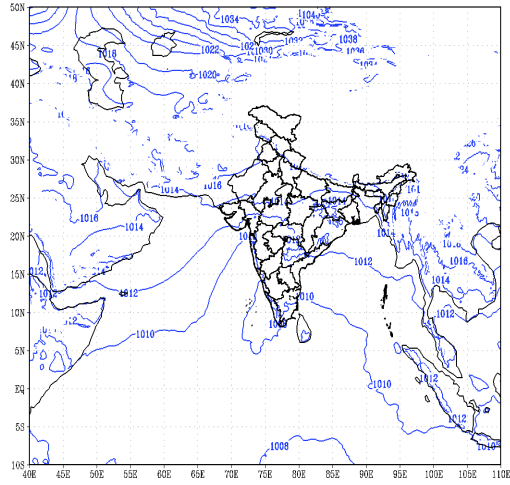
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 25-12-2022



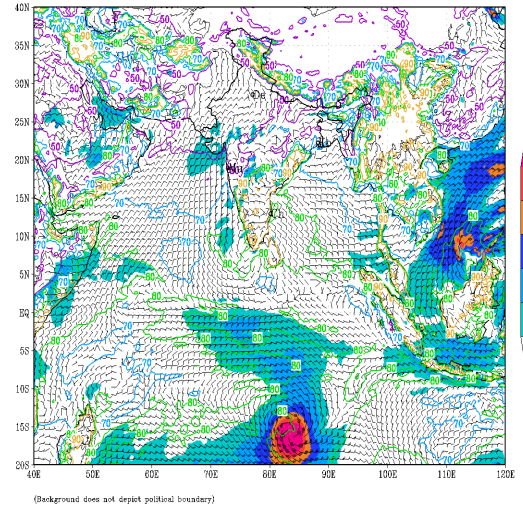
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 25-12-2022



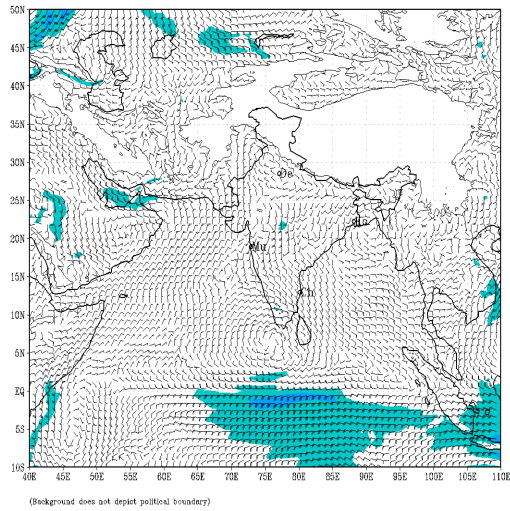
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 26-12-2022



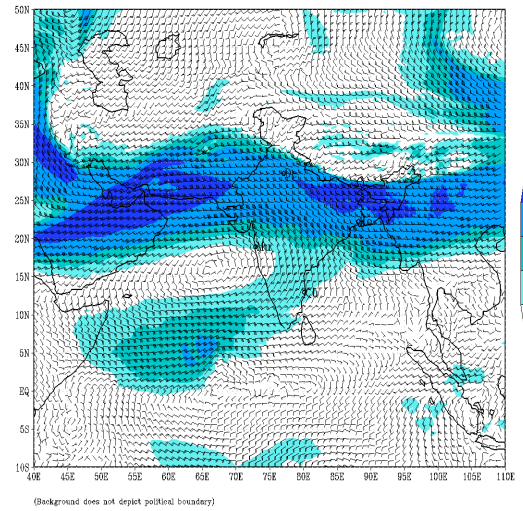
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (120 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 26-12-2022



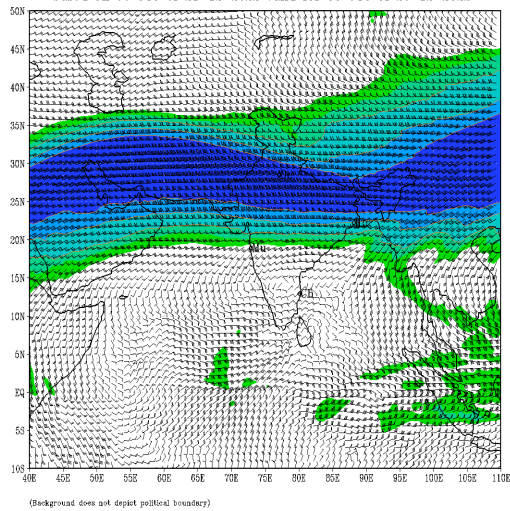
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 26-12-2022



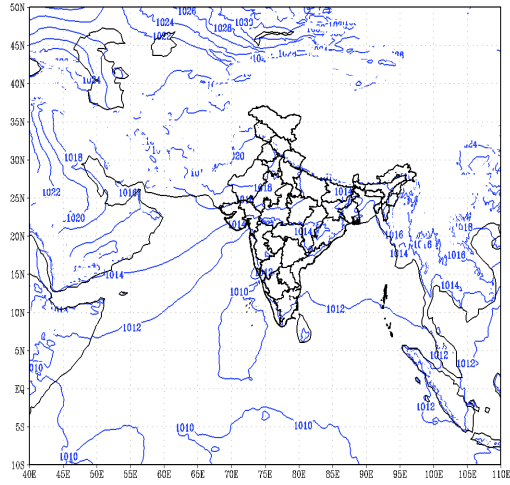
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 27-12-2022



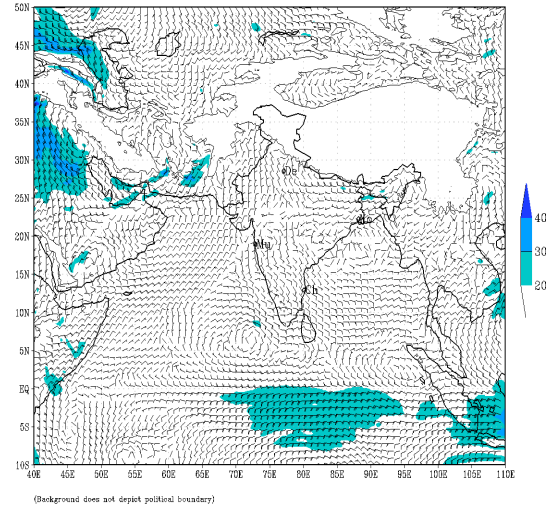
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 26-12-2022



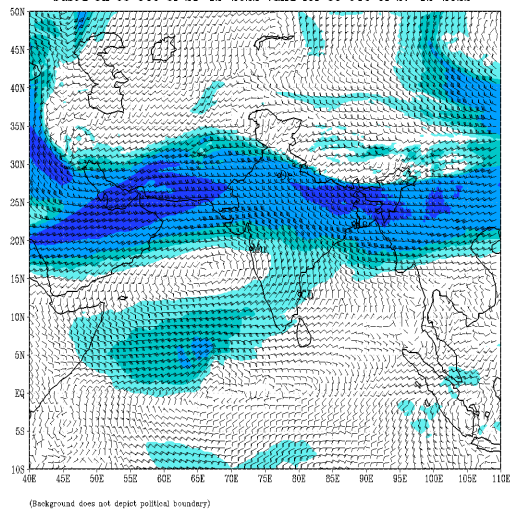
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (144 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 27-12-2022



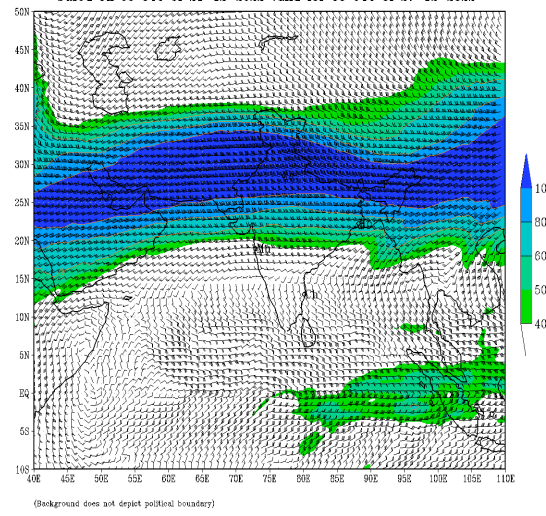
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 27-12-2022



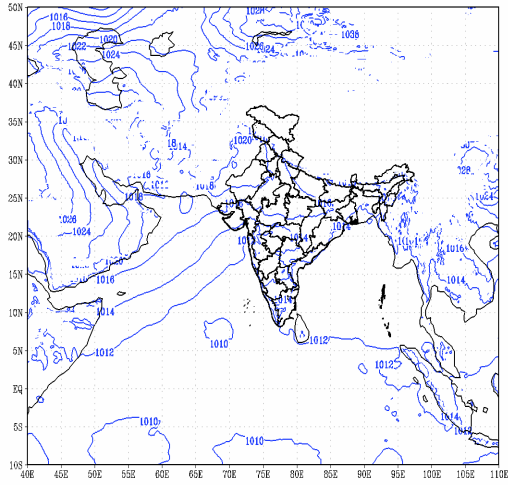
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 27-12-2022



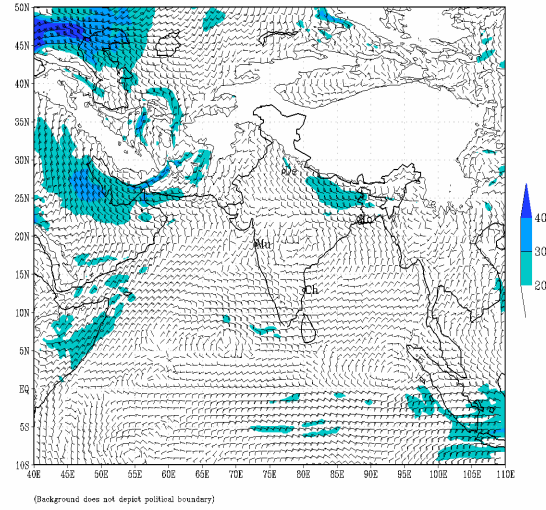
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 27-12-2022



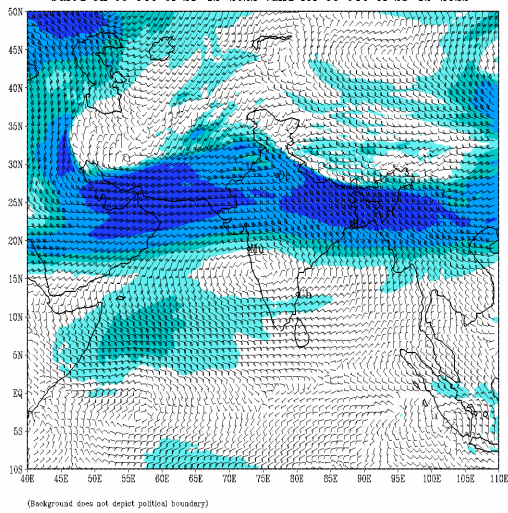
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (168 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 28-12-2022



IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 28-12-2022



IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 28-12-2022



IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 21-12-2022 valid for 00 UTC of 28-12-2022

