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

Tropical Cyclone Forecast Programme
Report Dated 16th October, 2023

Time of Issue: 1230 UTC

Synoptic features (based on 0300 UTC analysis):

The cyclonic circulation over Lakshadweep area and adjoining Southeast Arabian sea & Kerala coast now lies over Southeast Arabian Sea & adjoining Lakshadweep area and extends upto 3.1 km above mean sea level. Under its influence, a low pressure area is likely to develop over southeast & adjoining eastcentral Arabian sea during next 48 hours. It is likely to move further westnorthwestwards and intensify into a depression over central Arabian sea around 21st October.

Dynamical and thermo-dynamical features

Parameter	Bay of Bengal (BoB)	Arabian Sea (AS)
Sea Surface Temperature (SST) ºC	29-30°C over entire BOB. 30-31°C over some parts of westcentral BOB.	29-30°C over southeast, southwest and eastcentral Arabian sea.
Tropical Cyclone Heat Potential (TCHP) kJ/cm^2	100-120 over eastcentral BoB. 60-80 over remaining parts of BOB.	60-80 over eastcentral & south Arabian Sea. 20-30 over west coast of Arabian Sea.
Cyclonic Relative vorticity (X10^{-6}s^{-1})	Positive vorticity of 30-40 over south BOB with vertical extension upto 500 hpa levels.	Positive vorticity of 30-40 over SouthEast AS with vertical extension upto 200 hPa level. Positive vorticity of 30-40 over Comorin Area with vertical extension upto 500 hPa level.
Low Level convergence (X10^{-5} s^{-1})	Zone of 15 is observed over south & adjoining central BOB.	Zone of 10 is observed over southeast Arabian sea, Comorin area.
Upper Level divergence (X10^{-5} s^{-1})	20 is observed over south BOB.	20 over southeast Arabian sea adjoining eastcentral Arabian Sea. Small zone of 5 is observed over southeastern Arabian sea.
Vertical Wind Shear (VWS knots)	Low to moderate over south & central BoB.	Low to moderate over south & central AS
Wind Shear	Increasing tendency over major	Decreasing over southeast AS.

Tendency (knots)	parts of BoB.	
Upper tropospheric Ridge	Along 13 .0^{o}N over BoB.	Along 13 .0^{o}N over AS

Satellite observations based on INSAT imagery (0300 UTC):

(a) Over the BoB & Andaman Sea:-

At 0300 UTC, scattered low and medium clouds with embedded intense to very intense convection lay over south BoB and South Andaman Sea. Scattered low and medium clouds with embedded moderate to intense convection lay over North Andaman Sea, Gulf of Martaban and isolated weak to moderate convection lay over central BoB.

(b) Over the Arabian Sea:-

At 0300 UTC, scattered low and medium clouds with embedded moderate to intense convection lay over southeast AS and isolated weak to moderate convection lay over central & southwest AS.

(c) Convection outside India:

Scattered low and medium clouds with embedded moderate to intense convection lay over Palk strait, Gulf of Mannar, Maldives, northeast Pakistan, Tibet, China, south Myanmar, Thailand, Gulf of Thailand, Cambodia, Laos, Vietnam, Hainan, Sumatra, Strait of Malacca, Malaysia, Borneo, South China sea, Celebes Sea, Philippines, Taiwan, south Mozambique Channel and over Indian Ocean between Lat 5.0N to 2.0S and east of long 50.0E.

M.J.O. Index:

MJO index is in Phase 1 with amplitude greater than 1. It will continue in same phase during next 7 days with amplitude becoming less than 1 from 17th with gradually decreasing trend.

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

Nil

Input for FDP Cyclone based on 0000 UTC for the next 7 days

MODEL GUIDANCE	Bay of Bengal (BoB)	Arabian Sea (AS)
IMD-GFS	A Cyclonic circulation (Cycir) over Andaman Sea on 21st (10N/95E). Low pressure area (LPA) over central parts of south BoB and adjoining central BoB on 21st, southwest and adjoining southeast BoB on 23rd. Depression/Deep Depression over westcentral and adjoining southwest BoB on 23rd, Severe/Very Severe cyclonic storm over westcentral BoB off south Andhra Pradesh coast on 24th, cross Andhra Pradesh coast around 16N/82E on 25th with reduced intensity and lay over AP coast as LPA/Depression on 25th.	Extended Cycir over southeast AS and adjoining Lakshadweep area on 16th, southeast AS on 17th, Cycir over southeast AS on 18th, cycir over southwest and adjoining south AS on 19th. To move westwards towards Somalia coast till 24th Oct.
IMD-GEFS	Cycir over southwest and adjoining westcentral BoB on 21st, extended low over southwest and adjoining southeast	Extended Cycir over southeast AS and adjoining Lakshadweep area on 18th, LPA over southeast AS on 19th &

	BoB (10N/87E) on 18th , LPA over the central parts of central and south BoB (14N/87E) on 21st, Well Marked Low (WML) over westcentral BoB off AP coast (16N/83E) on 24th.	20th. To move nearly westwards as Cycir towards southwest AS till 23rd.
IMD-WRF	A cycir over eastcentral and adjoining north Andaman Sea (14N/92E) on 19th.	An extended cycir over southeast and adjoining southwest AS on 18th and 19th.
NCMRWF-NCUM	Extended cycir over southwest BoB (12N/82E) on 20th, over the same region on 21st. LPA over southwest BoB (11N/82E) on 22nd, Depression over westcentral Bob (15N/82E) on 24th, Deep Depression (DD) over westcentral BoB(17N/83E) on 25th. Crossing south AP/north AP coasts (72.5N/82.5E) as DD on 26th.	Extended Cycir over southeast AS during 16th-19th with gradual westwards movement, LPA over southwest AS (11N/64E) on 20th. Depression over westcentral AS (13N/60E) on 22nd. To move nearly west-northwestwards towards Oman-Yemen coasts and cross near (16N/52E) at 0000 UTC of till 26th as depression.
NCMRWF-NEPS	LPA over southwest BoB (11N/82E) on 21st, WML over southwest and adjoining westcentral BoB (12N/82E) on 23rd, Depression over westcentral BoB (15N/82.5E) on 24th. DD over westcentral BoB off north AP-south Odisha coasts (16.5N/82.5E) on 25th, Crossing north AP and adjoining south Odisha coasts near (17.5N/82E) on 25th/0600 UTC as DD.	LPA over southeast AS (10N/69.5E) on 19th, WML over southwest and adjoining westcentral AS (12.5N/62E) on 21st, Depression over westcentral AS (14.5N/60E) on 23rd, DD over westcentral AS (14.5N/58E) on 24th. DD over westcentral AS (15N/56E) on 25th. The model is indicating movement towards Oman-Yemen border.
NCMRWF-UM (Regional)	LPA over southwest BoB (10.2N/84E) on 21st.	LPA over southeast AS (10N/67E) on 19th, WML over southwest and adjoining southeast AS (12N/64E) on 21st.
ECMWF	Cycir over eastcentral BoB (13.5N/91.0E) on 20th, LPA over eastcentral BoB (13.3N/88.2E) on 21st, WML over westcentral BoB (13.0N/87.0E) on 22nd (15.0N/86.3E) on 23rd. To intensify further and move gradually north-northwestwards over northwest BoB on 24th cross north Odisha-West Bengal coasts on 25th.	Extended Cycir over southeast AS (11.5N/69E) on 16th, Cycir over southeast AS 11.5N/68.6E) on 17th, LPA over southeast AS (11.8N/68.5E) on 18th, Depression over southeast AS (11.0N/64.4E) on 19th. Deep Depression over westcentral AS (11.0N/62.9E) on 20th and Cyclonic storm over westcentral AS (12.0N/59.8E). To move northwestwards with further intensification into VSCS and cross Oman-Yemen coasts to the south of Salalah Airport (17.0N/54.0E) on 24th.
NCEP-GFS	Extended Cycir over eastcentral BoB on 20th (14.0N/90.4E), LPA over eastcentral BoB on 22nd (17.0N/90.0E). WML over eastcentral BoB (18.5N/90.4E) on 23rd, To move nearly northward and Depression over northeast BoB (20.7N/90.5E) on 24th and cross Bangladesh coast near (22.5N/91.0E) on 25th/0600 UTC as a LPA.	Extended Cycir over southeast AS (11.2N/66.5E)) on 16th, LPA over southeast AS (11.7N/66.0E) on 19th WML (10.0N/64E) on 20th. To move nearly westwards and intensify into a Depression on 21st (10.3N/63.7E), CS over westcentral AS (12.5N/63.0E) on 22nd, SCS over westcentral AS (14.3N/63.2E) on 23rd and (16.5N/62.2E) on 24th. To move

		nearly northwards and weaken gradually in to a CS on 26th over northwest AS (21.2N/63.0E). Dissipates over Sea (24.3N/62.0E) off Iran-Pakistan coasts.
IMD-Genesis Potential Parameter	Significant zone for cyclogenesis over north Andaman Sea on 19th and eastcentral BoB during 20th-23rd.	Significant zone for cyclogenesis over southeast and adjoining southwest AS (10/63) on 21st, westcentral and adjoining eastcentral AS (12/63) on 22nd, shifting northward to (14/63) on 23rd.

Summary and conclusion:

1. For the Bay of Bengal:

Most of the models are indicating likely formation of cycir over BoB. However, there is large variation among various models w.r.t. location of cycir, it's further intensification and movement. Based on the 16th October/0000 UTC initial conditions, with area of formation varying from eastcentral BoB and southeast BoB. Some models are also indicating cycir over southwest BoB. The date of formation is varying from 18th to 21st October. Regarding movement, some models are indicating west-northwestward movement towards North Tamil Nadu-South Andhra Pradesh coasts and some are indicating northward towards Bangladesh coast. NCUM group and ECMWF are indicating formation of LPA around 21st and GFS group of models are indicating delayed formation of LPA around 22nd. Both NCUM group and GFS group are indicating further intensification of system into a depression, subsequently NCUM group into a deep depression and IMD GFS intensifying into a CS stage.

Hence, it is inferred that a fresh cyclonic circulation is likely to form over central and adjoining southeast BoB around 20th October. It is likely to move west-northwestwards, become a low-pressure area around 21st October over eastcentral BoB. Further intensification and movement of the system need to be monitored continuously.

2. For the Arabian Sea:

IMD GFS, GEFS and WRF models indicate formation of low pressure area southeast Arabian Sea with nearly westwards movement towards Somalia coast and no further intensification. ECMWF and NCEP GFS are indicating further intensification of this system into a depression during 20th (ECMWF)-21st(NCEP) and into an intense cyclonic storm. NCUM is also showing formation of a low and further intensification into a depression on 22nd along with a west-northwestward movement. However, NCEP is indicating gradually northward movement after 24th weakening of the system before landfall while ECMWF & NCUM models depict the landfall of the system over Oman-Yemen coasts on 24th.

Hence, it is inferred that under the influence of existing cyclonic circulation over southeast AS and adjoining Lakshadweep area, a low pressure area is likely to develop over southeast & adjoining eastcentral AS during next 48 hours. It is likely to move further west-northwestwards and intensify into a depression over central AS around 21st October. Hence, low to moderate probability has been assigned to cyclogenesis over Arabian Sea during 20th-23rd October.

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	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	Low	Moderate	Moderate

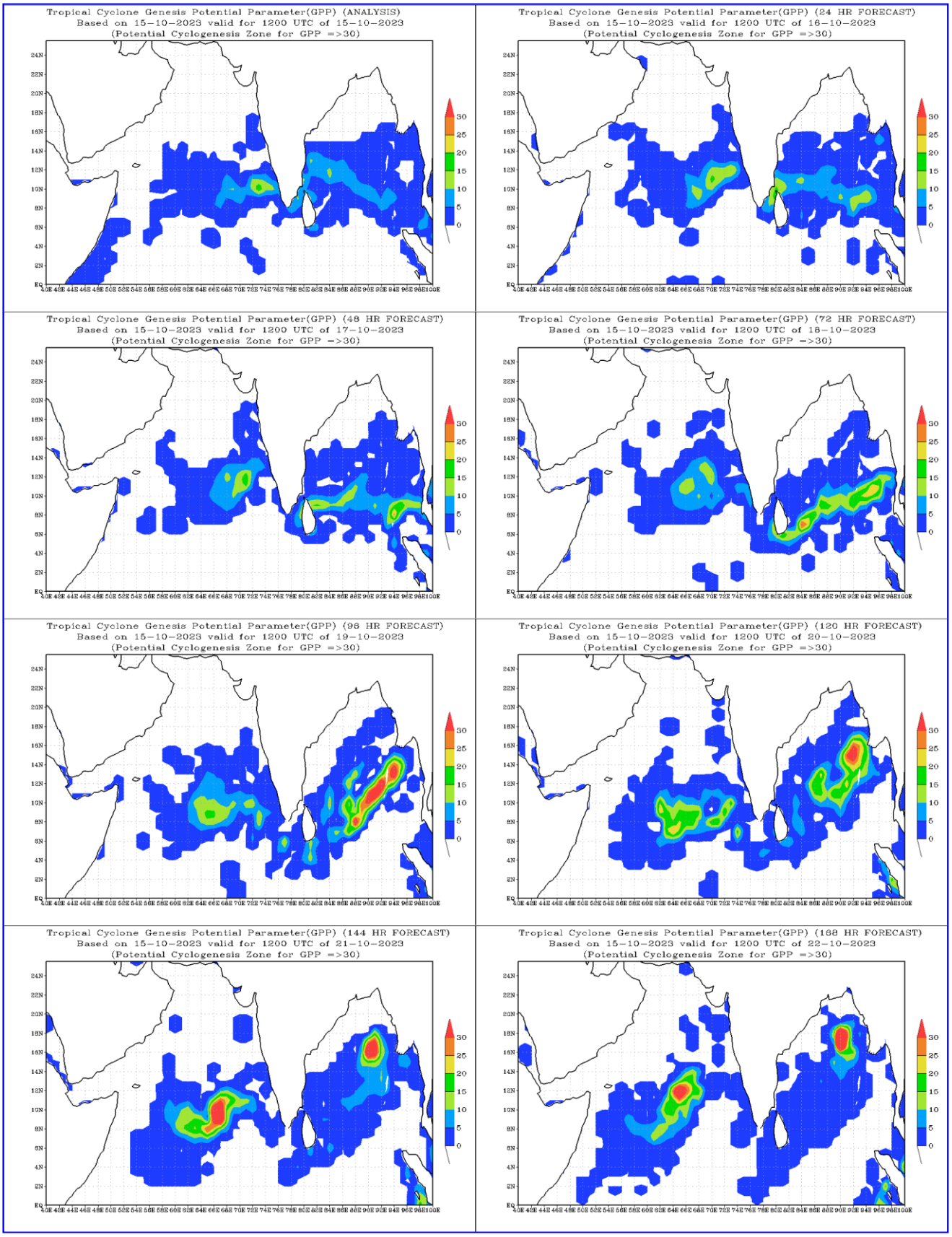
Advisory:

(i) The movement of cyclonic circulation over southeast AS and adjoining Lakshadweep area and formation of a low pressure area over southeast AS.

(ii) formation of cyclonic circulation over eastcentral Bay of Bengal around 20th October needs to be monitored critically.

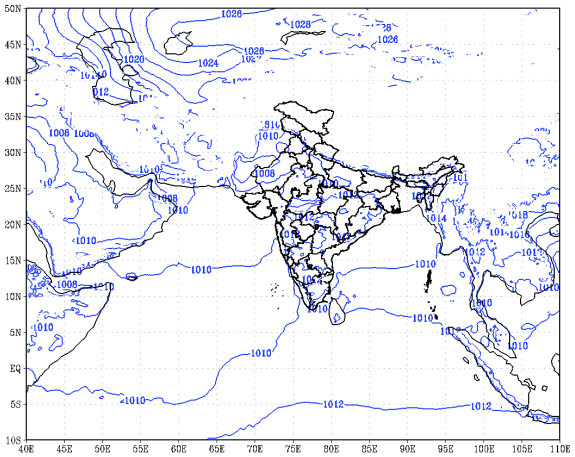
Intense Observation Period (IOP) is suggested for Lakshadweep Islands, Kerala, west Sri Lanka on 16th and 17th.

Annexure


Tropical Cyclone Genesis Potential Parameter(GPP) (ANALYSIS)
Based on 15-10-2023 valid for 1200 UTC of 15-10-2023
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 15-10-2023 valid for 1200 UTC of 16-10-2023
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 15-10-2023 valid for 1200 UTC of 17-10-2023
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 15-10-2023 valid for 1200 UTC of 18-10-2023
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (96 HR FORECAST)
Based on 15-10-2023 valid for 1200 UTC of 19-10-2023
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
Based on 15-10-2023 valid for 1200 UTC of 20-10-2023
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (144 HR FORECAST)
Based on 15-10-2023 valid for 1200 UTC of 21-10-2023
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (168 HR FORECAST)
Based on 15-10-2023 valid for 1200 UTC of 22-10-2023
(Potential Cyclogenesis Zone for GPP =>30)

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

based on 00 UTC of 16-10-2023 valid for 00 UTC of 16-10-2023



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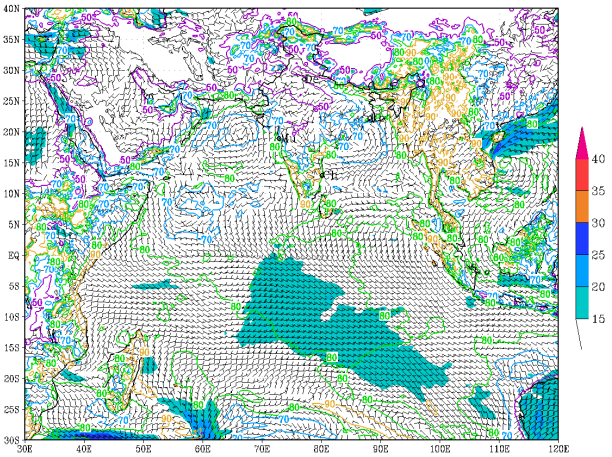
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (00 HR)

based on 00 UTC of 16-10-2023 valid for 00 UTC of 16-10-2023



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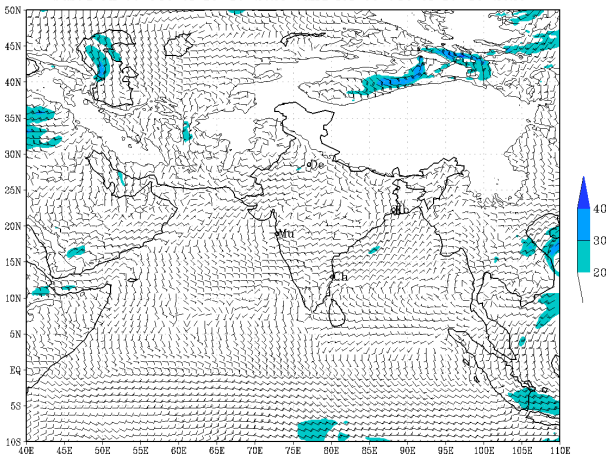

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IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (00 HR)

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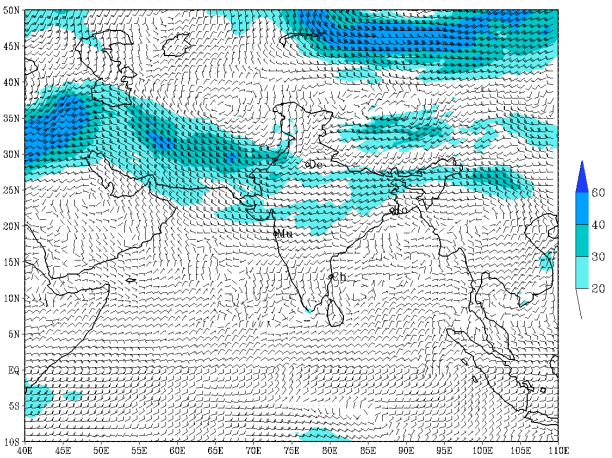

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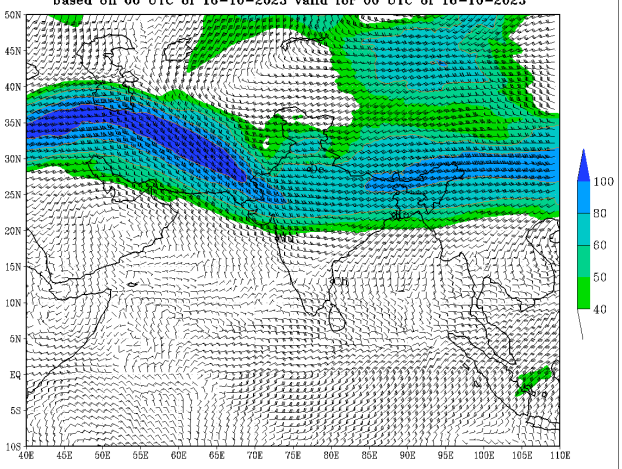

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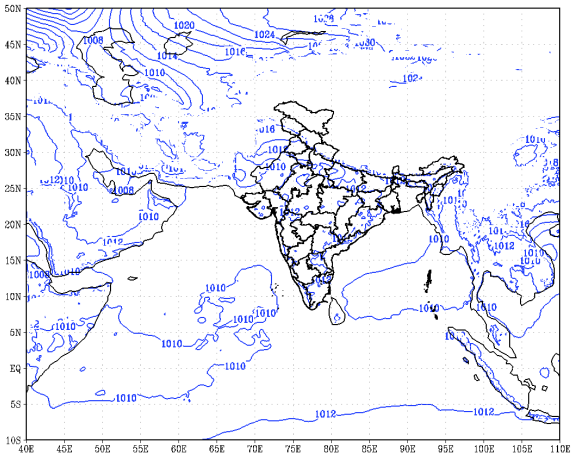
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (24 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 17-10-2023



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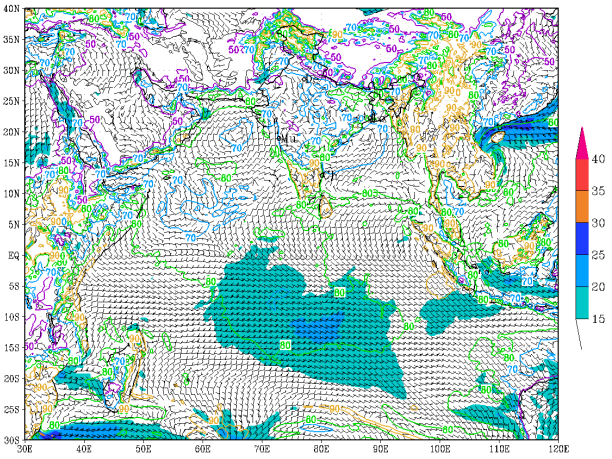
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (24 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 17-10-2023



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IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (24 HR)
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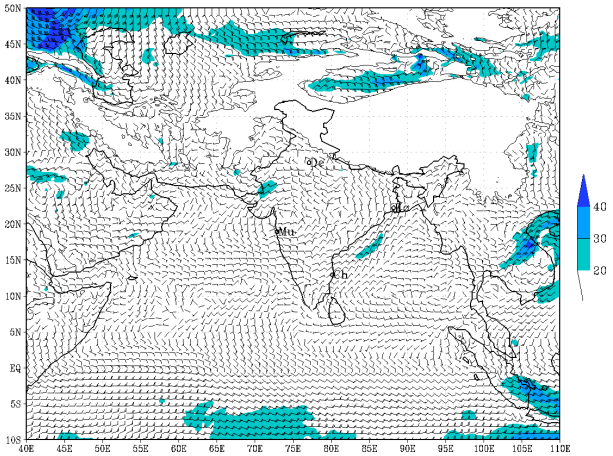

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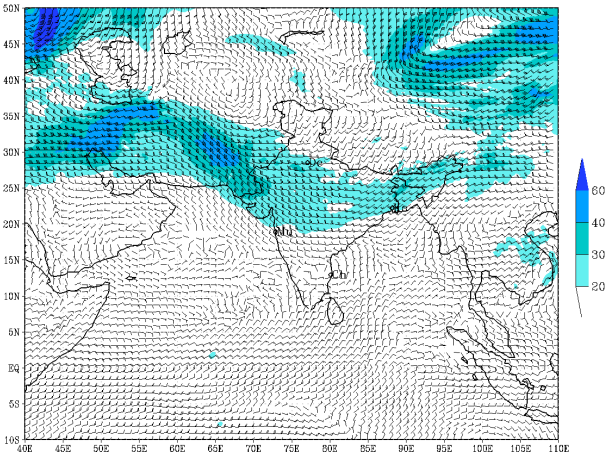
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 17-10-2023



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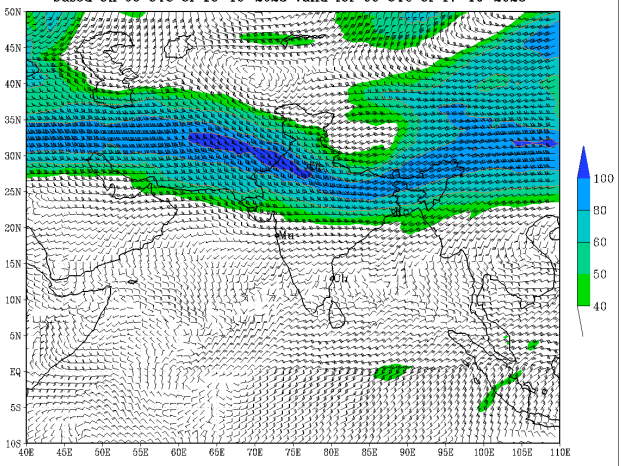
based on 00 UTC of 16-10-2023 valid for 00 UTC of 17-10-2023



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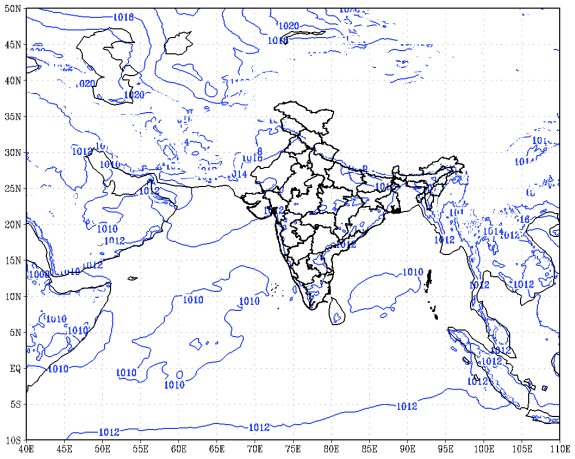
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (48 HR)

based on 00 UTC of 16-10-2023 valid for 00 UTC of 18-10-2023



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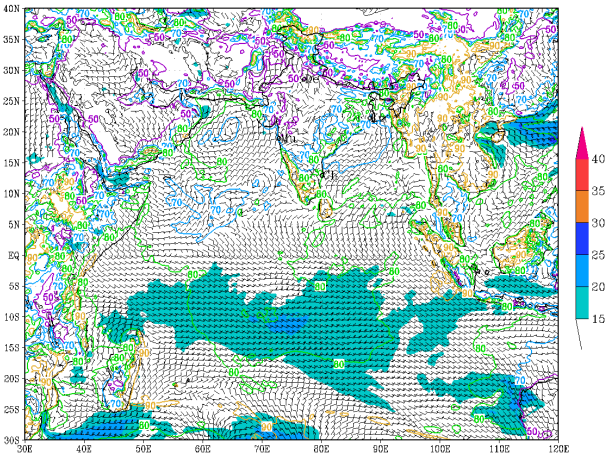
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (48 HR)

based on 00 UTC of 16-10-2023 valid for 00 UTC of 18-10-2023



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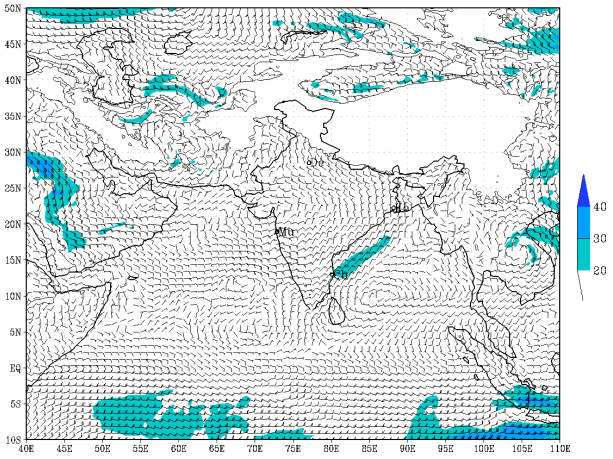
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (48 HR)

based on 00 UTC of 16-10-2023 valid for 00 UTC of 18-10-2023



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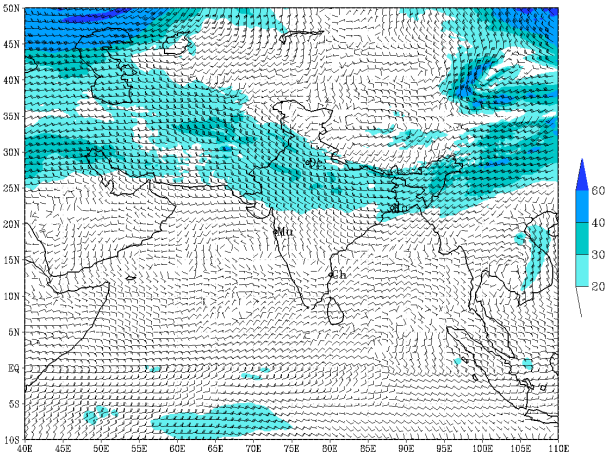
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (48 HR)

based on 00 UTC of 16-10-2023 valid for 00 UTC of 18-10-2023



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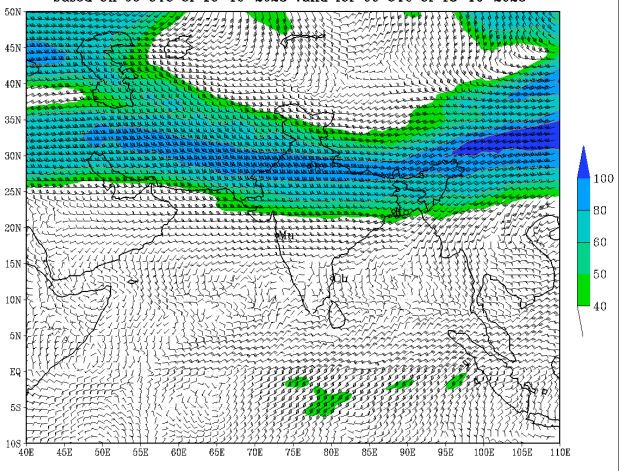
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (48 HR)

based on 00 UTC of 16-10-2023 valid for 00 UTC of 18-10-2023



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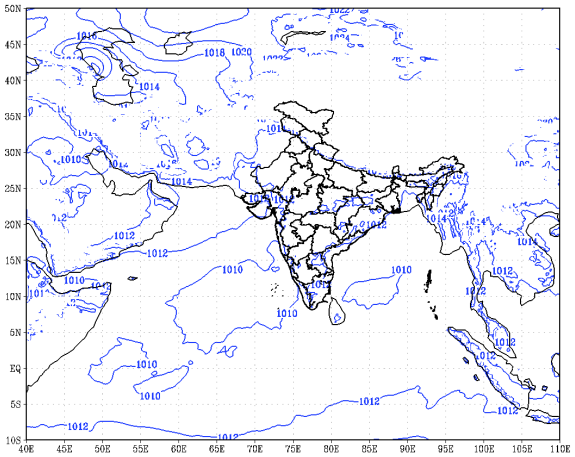
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (72 HR)

based on 00 UTC of 16-10-2023 valid for 00 UTC of 19-10-2023



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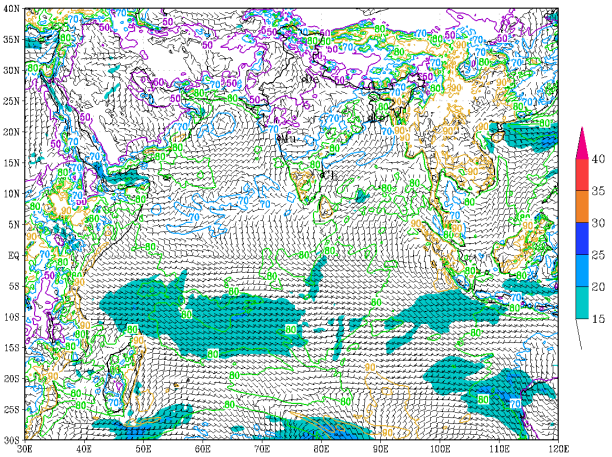
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (72 HR)

based on 00 UTC of 16-10-2023 valid for 00 UTC of 19-10-2023



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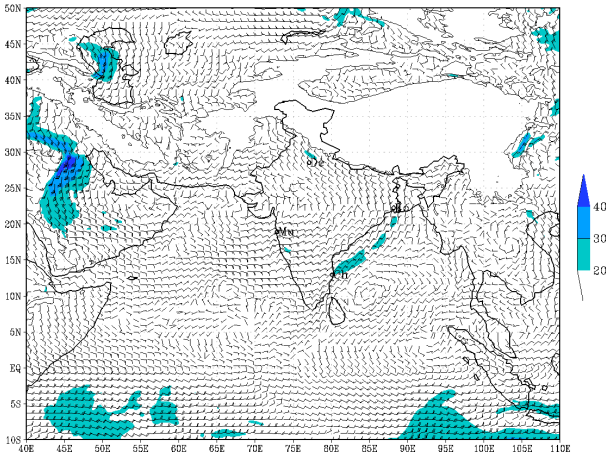
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (72 HR)

based on 00 UTC of 16-10-2023 valid for 00 UTC of 19-10-2023



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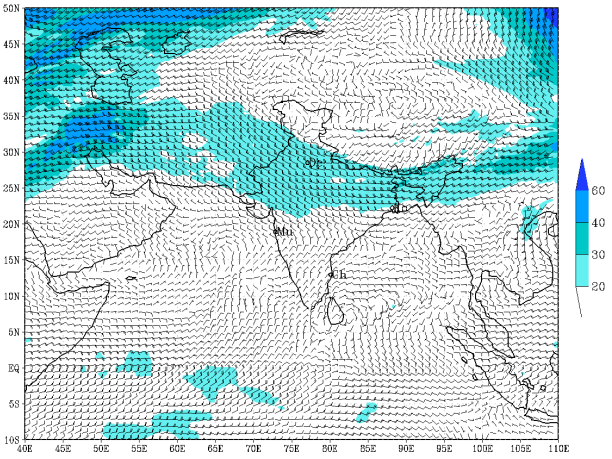
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (72 HR)

based on 00 UTC of 16-10-2023 valid for 00 UTC of 19-10-2023



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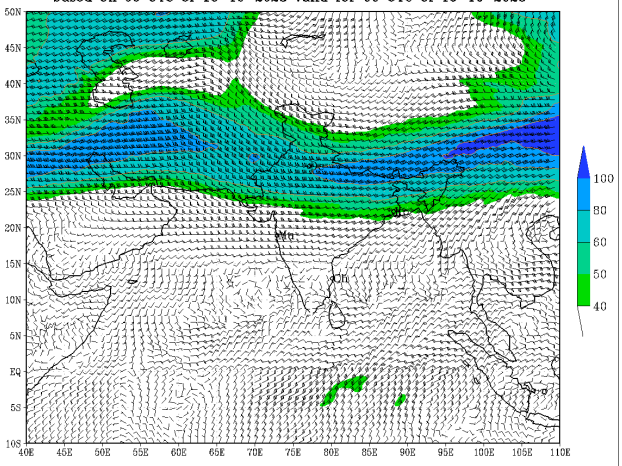
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (72 HR)

based on 00 UTC of 16-10-2023 valid for 00 UTC of 19-10-2023



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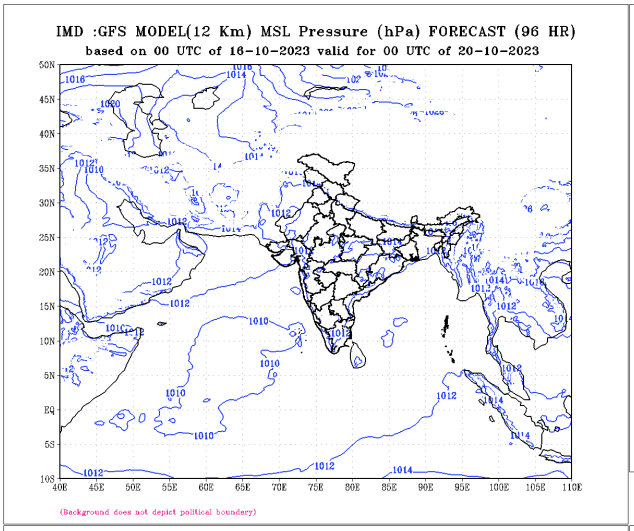
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (96 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 20-10-2023
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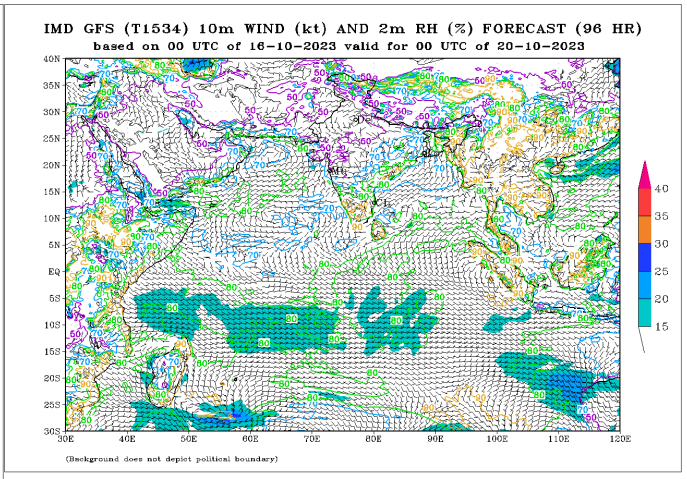
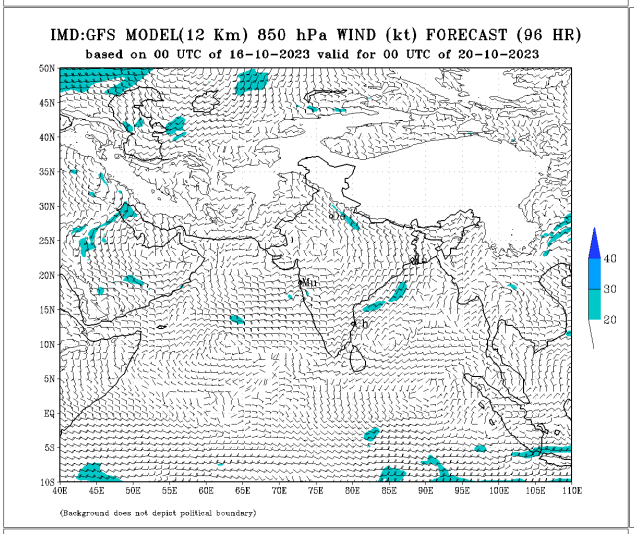
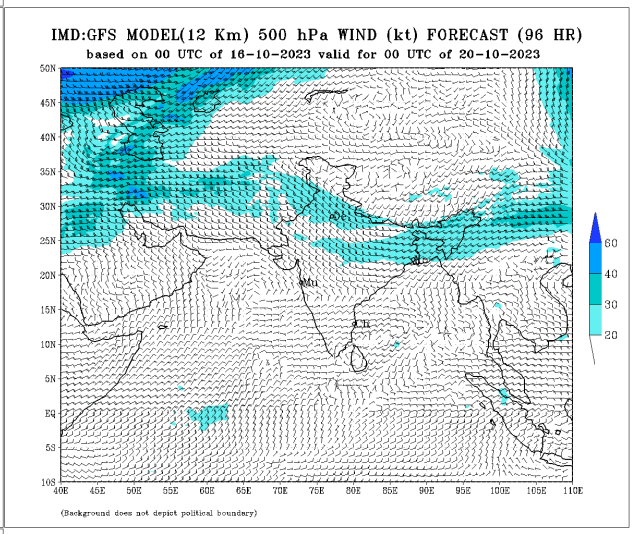
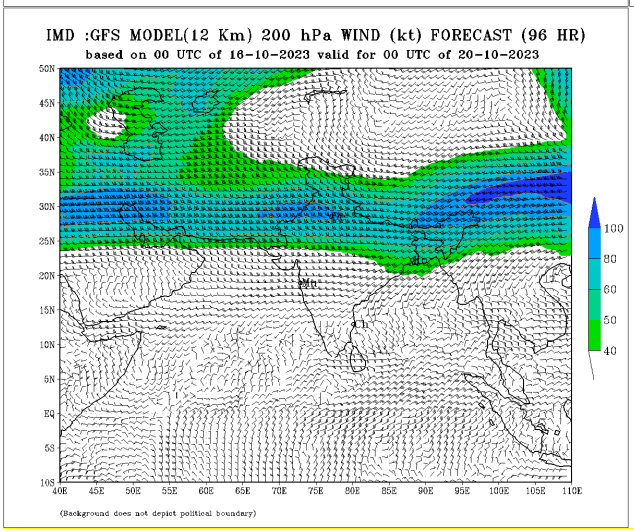
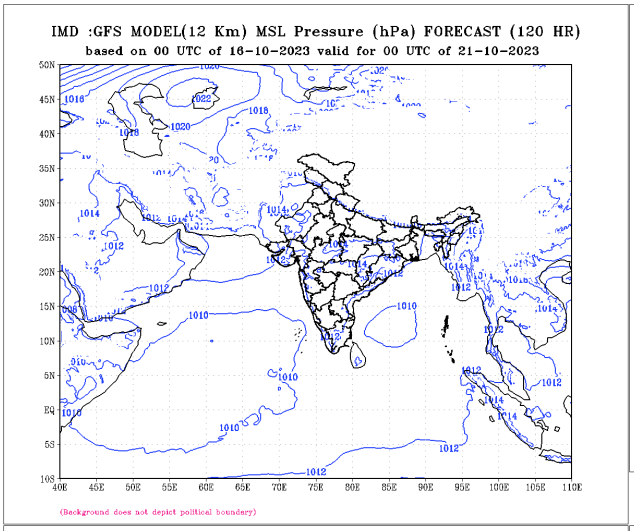
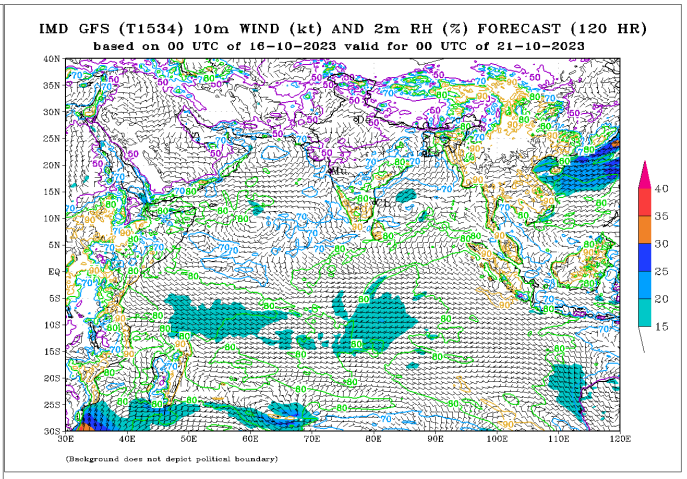

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (96 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 20-10-2023
(Background does not depict political boundary)

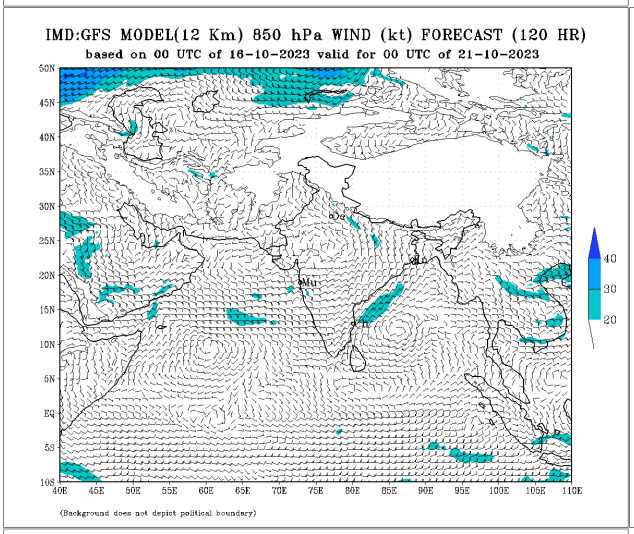

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 20-10-2023
(Background does not depict political boundary)

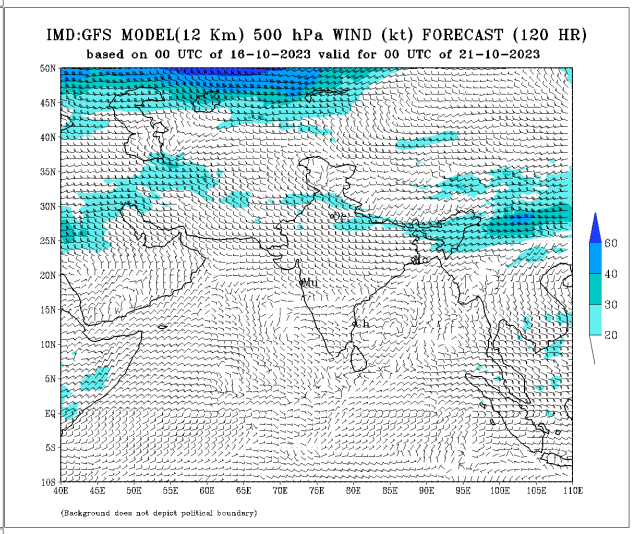

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 20-10-2023
(Background does not depict political boundary)

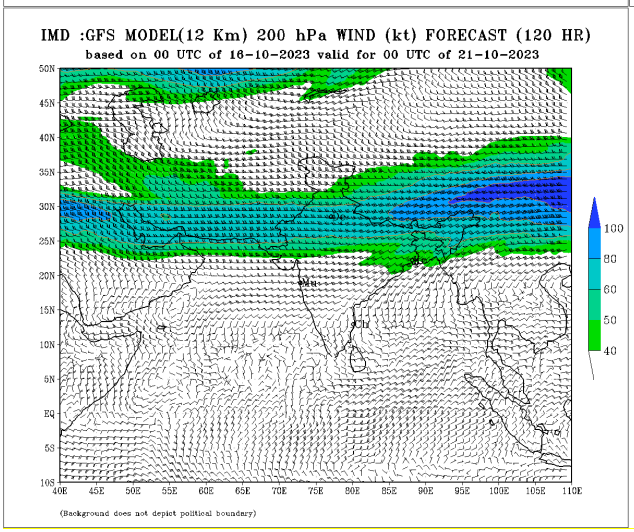

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 20-10-2023
(Background does not depict political boundary)

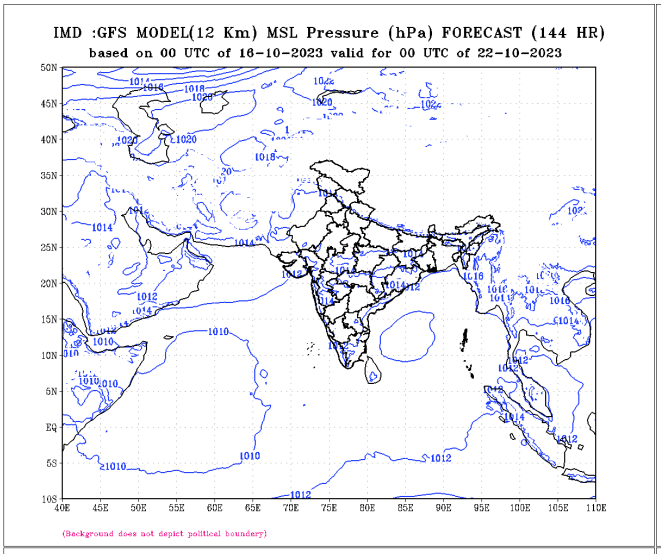

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 21-10-2023
(Background does not depict political boundary)

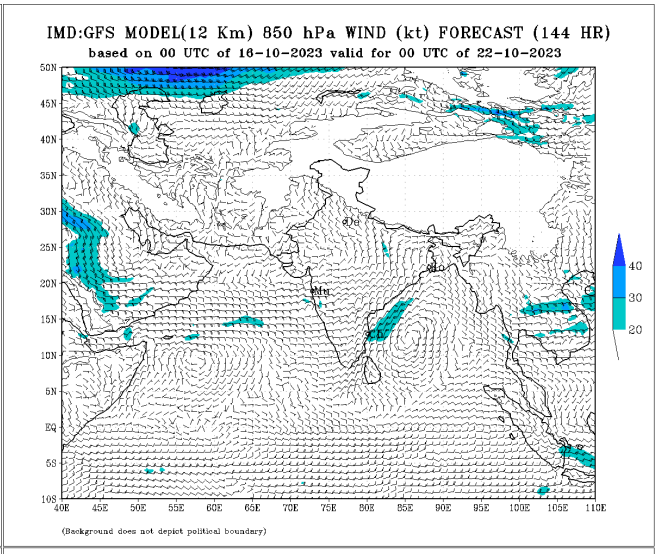

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (120 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 21-10-2023
(Background does not depict political boundary)

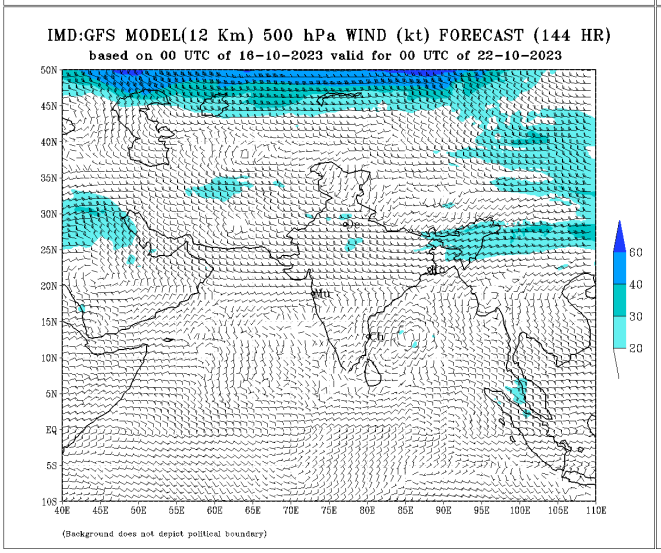

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 21-10-2023
(Background does not depict political boundary)

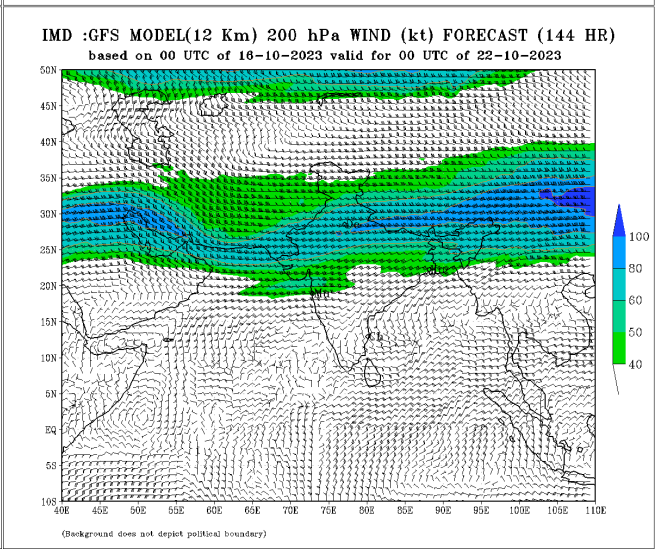

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 21-10-2023
(Background does not depict political boundary)


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 21-10-2023
(Background does not depict political boundary)

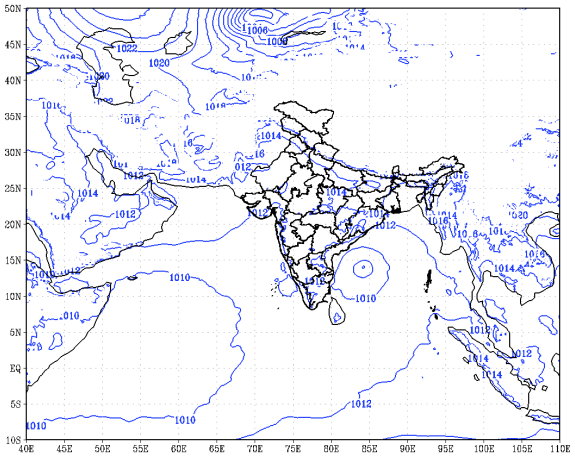

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (144 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 22-10-2023
(Background does not depict political boundary)


IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 22-10-2023
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 16-10-2023 valid for 00 UTC of 22-10-2023
60
40
30
20
(Background does not depict political boundary)

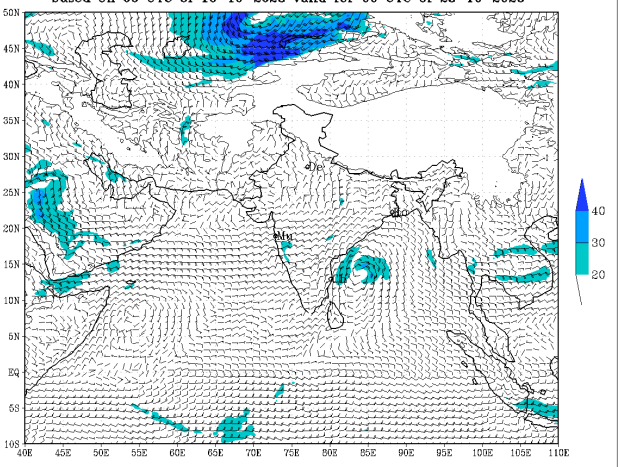

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 22-10-2023
100
80
60
50
40
(Background does not depict political boundary)

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (168 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 23-10-2023



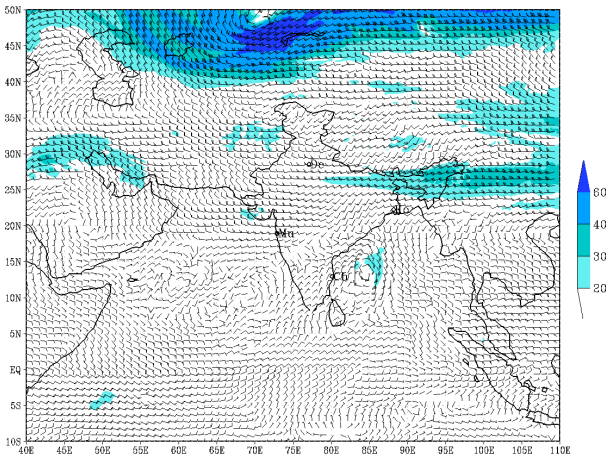
(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 23-10-2023



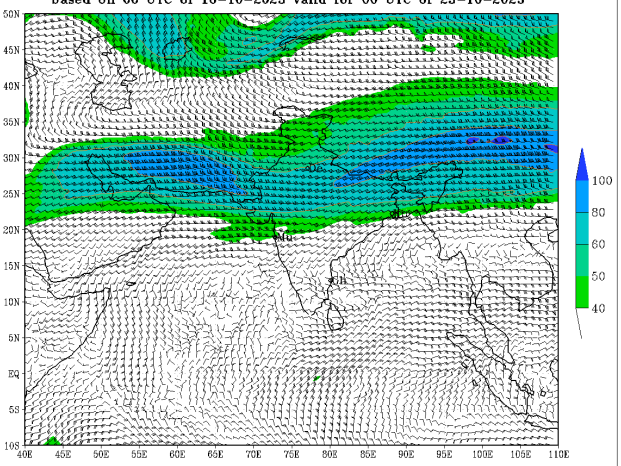
(Background does not depict political boundary)

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 23-10-2023



(Background does not depict political boundary)

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 16-10-2023 valid for 00 UTC of 23-10-2023



(Background does not depict political boundary)