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

Tropical Cyclone Forecast Programme
Report Dated 15th October, 2023

Time of Issue: 1000 UTC

Synoptic features (based on 0300 UTC analysis):

A cyclonic circulation lies over Lakshadweep area and adjoining Southeast Arabian Sea & Kerala coast 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 around 17th October. It is likely to move west-northwestwards and intensify further during subsequent 48 hours.

Dynamical and thermo-dynamical features

Parameter	Bay of Bengal (BoB)	Arabian Sea (AS)
Sea Surface Temperature (SST) ºC	About 30-31°C over westcentral and adjoining northwest BOB, 29-30°C over remaining parts of BOB.	➢ 29-30°C over southeast, southwest and eastcentral Arabian Sea. ➢ 30-31°C along the west coast of India.
Tropical Cyclone Heat Potential (TCHP) kJ/cm^2	(a) 100-120 over southeast and central, parts of westcentral & southwest BoB. (b) 60-80 over remaining parts of BoB.	(a) 100-120 over southeast and adjoining east central Arabian sea. (b) 60-80 over western part of Arabian sea and north Arabian sea.
Cyclonic Relative vorticity (X10^{-6}s^{-1})	A small pocket of positive vorticity of 30-40 over southwest BOB, Comorin area off Tamil Nadu coast.	Positive vorticity of 50-60 over Southeast AS with vertical extension upto 500 hpa level.
Low Level convergence (X10^{-5} s^{-1})	A large extended zone of value 10 over south BoB, south Andaman Sea and adjoining East Equatorial Indian Ocean (EEIO)	05 over Lakshadweep area (LAK) off Kerala coast, Another zone of value 05 over eastcentral AS off Maharashtra coast.
Upper Level divergence (X10^{-5} s^{-1})	10-20 over southeast BoB, south Andaman Sea and adjoining EEIO.	20 over southeast AS & adjoining LAK area and eastcentral AS.
Vertical Wind Shear (VWS knots) **Low: 05-10 knots**	Low to moderate over south and central BoB	Low to moderate over south and central AS

Moderate: 10-20 knots High: >20 knots		
Wind Shear Tendency (knots)	Decreasing tendency (-5 knots in past 24 hrs) over southeast and adjoining BoB.	Increasing tendency (5-10 knots in past 24 hrs) over southeast AS, LAK and Comorin area. Decreasing tendency over central parts of south AS.
Upper tropospheric Ridge	Along 15 .0°N over BoB.	Along 13.0°N over AS.

Satellite observations based on INSAT imagery (0300 UTC):

(a) Over the BoB & Andaman Sea:-

Scattered low and medium clouds with embedded moderate to intense convection lay over south BoB south Andaman Sea and weak to moderate convection lay over central BoB.

(b) Over the Arabian Sea:-

Scattered to broken low and medium clouds with embedded moderate to intense convection lay over eastcentral & southeast Arabian sea off Kerala coast, Lakshadweep Islands and Comorin area. Scattered low and medium clouds with embedded weak to moderate convection lay over westcentral Arabian sea and rest of south Arabian sea.

(c) Convection outside India:

Scattered low and medium clouds with embedded moderate to intense convection lay over west Sri Lanka, Palk Strait, Gulf of Mannar, Maldives, Tibet, south Myanmar, Thailand, Gulf Of Thailand, Cambodia, Laos, Vietnam, Gulf Of Tonkin, Hainan, Sumatra, Strait Of Malacca, Malaysia, Borneo, South China Sea, Celebes Sea, Philippines, Sulu Sea and over Indian Ocean between Latitude 5.0 N & 8.0 S and Longitude 50.0 E & 100.0 E.

M.J.O. Index:

MJO index is in Phase 1 with amplitude greater than 1 till 16th. 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 on 22nd, southwest BoB on 23rd. WML over westcentral BoB off south Andhra Pradesh-Tamil Nadu coasts. LPA over AP coast on 25th (16N/81E).	Extended Cycir over southeast AS (11N/70 E) on 17th, Cycir over southeast AS (11N/70E) on 18th. To move westwards towards Somalia coast till 24th Oct.
IMD-GEFS	Cycir over southwest and adjoining westcentral BoB on 21st, LPA over the same region (10N/85E) on 22nd, Well Marked Low (WML) over westcentral	Extended Cycir over southeast AS on 18th, LPA over southeast AS on 19th & 20th. To move nearly westwards as Cycir towards southwest AS till 23rd.

	BoB (14N/83E) on 23rd .	
IMD-WRF	A cycir over eastcentral and adjoining north Andaman Sea (14N/92E) on 18th.	A cycir over southwest AS (09N/54E) on 18th.
NCMRWF-NCUM	Trough over south BoB on 17th, extended cycir over southwest BoB on 18th, cycir over southwest BoB (10N/82E) on 19th, LPA over southwest BoB on (11N/82E) on 20th, WML over westcentral and adjoining BoB (12.5N/82E) on 21st, Deep Depression (DD) over westcentral BoB(14N/82E) on 22nd, Cyclonic Storm (CS) of higher intensity over westcentral BoB (14N/82E) on 23rd, crossing north of Chennai on 23rd evening (around 1200 UTC) on 24th near 14.8/80, LPA over interior Karnataka (16N/75E) on 25th.	Extended Cycir over southeast AS on 15th, Cycir over southwest AS on 18th, LPA over southwest AS (10N/62E) on 19th. To move nearly westwards towards Somalia coasts till 25th.
NCMRWF-NEPS	Cycir over southeast and adjoining South Andaman Sea (5N/94E) on 19th, LPA over southwest BoB (11.5N/83E) on 20th, Depression over southwest and westcentral BoB (13N/83E) on 21st, CS over westcentral BoB (14N/82E) on 22nd, Very Severe CS (VSCS) over westcentral BoB(14.5N/82E) on 23rd, Crossing south AP and adjoining north Tamil Nadu coasts on 24th near (14N/ 80E).	Cycir over southeast AS on 19th & 20th, extended LPA over southwest AS on 21st, LPA over southwest AS on 22nd. To continue to move nearly westwards towards Somalia coasts till 24th.
NCMRWF-UM (Regional)	Extended circulation over southeast BoB on 16th, southwest BoB on 17th, 18th, 19th, LPA over southwest BoB (11N/84E) on 20th.	No significant system over AS
ECMWF	Cycir over eastcentral BoB (13N/89E) on 20th, LPA over eastcentral BoB(12.9N/89E) on 21st, WML over westcentral BoB on 24th & 25th.	Extended Cycir over southeast AS (11N/69E) on 15th, Cycir over southeast AS (8.5N/67E) on 16th, LPA over southeast AS (11N/67E) on 17th, Depression over southeast AS (11.5N/66E) on 19th. CS over westcentral AS (11.5N/61.7E) on 21st. To move northwestwards with further intensification into VSCS and cross Oman coast to the north of Salalah Airport (18.4N/56.7E) on 24th.
NCEP-GFS	Cycir over eastcentral BoB on 20th (12.9N/91.4E), LPA over eastcentral and adjoining westcentral BoB on 22nd (13.9N/89.9E). Depression over westcentral BoB (15N/87E) on 23rd, CS over westcentral BoB (16.9N/87E) on 24th. To move nearly northwards and cross Odisha coast near (19.8N/86E) on 25th/0600 UTC as a DD.	Cycir over southeast AS (8.4N/69E) on 16th, LPA over southeast AS (10.3N/67E) on 17th. To move nearly westwards and intensify into a Deperssion on 21st (10.6N/64.3E), CS over westcentral AS (12N/62.4E) on 22nd, SCS over westcentral AS (14.5N/61.6E) on 23rd. To move nearly northwestwards and weaken gradually in to a DD on 25th over westcentral AS (16.7N/59.2E). To cross Oman coast as an LPA on 27th

		(19.1N/67.2E).
IMD-Genesis Potential Parameter	Significant zone for cyclogenesis over southwest BoB on 21st & 22nd.	Significant zone for cyclogenesis over southeast AS (10/67) on 17th, same region on 18th, southeast AS (10/65) on 19th, southwest AS (10/64) on 21st, westcentral and adjoining southwest AS (13/63) on 22nd.

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 15th 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 movement towards North Tamil Nadu-South Andhra Pradesh coasts and some are indicating towards Odisha coast. GFS group and ECMWF are indicating formation of LPA around 22nd and NCUM group of models are indicating formation of LPA around 19th. NCUM group and NCEP GFS are indicating further intensification of system into a depression around 21st and into a cyclonic storm thereafter.

Hence, it is inferred that, a fresh cycir 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.

2. For the Arabian Sea:

IMD GFS, GEFS, WRF and NCUM group of models are indicating 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 19th (ECMWF)-21st(NCEP) and into an intense cyclonic storm. However NCEP is indicating weakening of the system before landfall while ECMWF is indicating the system to maintain its intensity till landfall. Both these models are indicating crossing over Oman.

Hence, it is inferred that a Low Pressure Area is likely to develop over Southeast & adjoining Eastcentral Arabian Sea around 17th October. It is likely to move west-northwestwards and intensify further into a depression during subsequent 48 hours. Hence low-moderate probability has been assigned to cyclogenesis over Arabian Sea during 19th-22nd 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	Low	Moderate

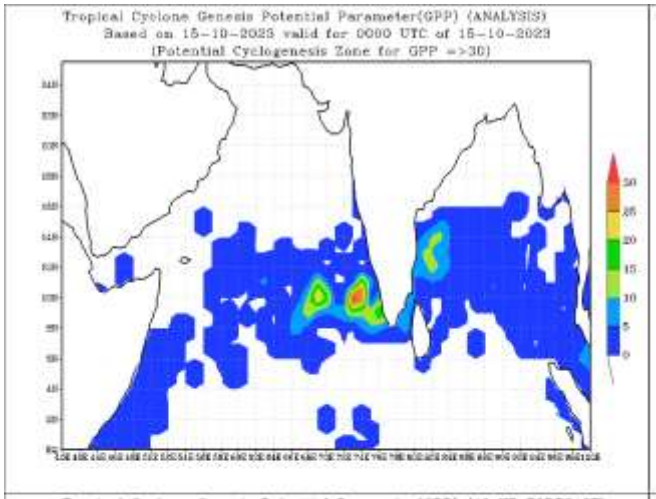
Advisory:

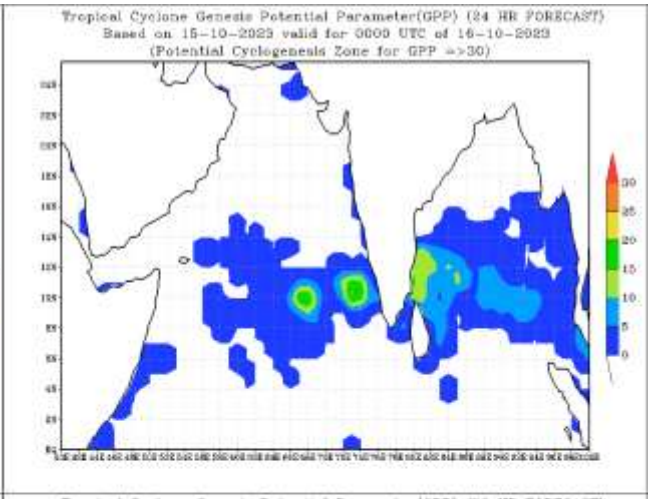
(i) The intensification & movement of cycir over Lakshadweep and adjoining southeast Arabian Sea and

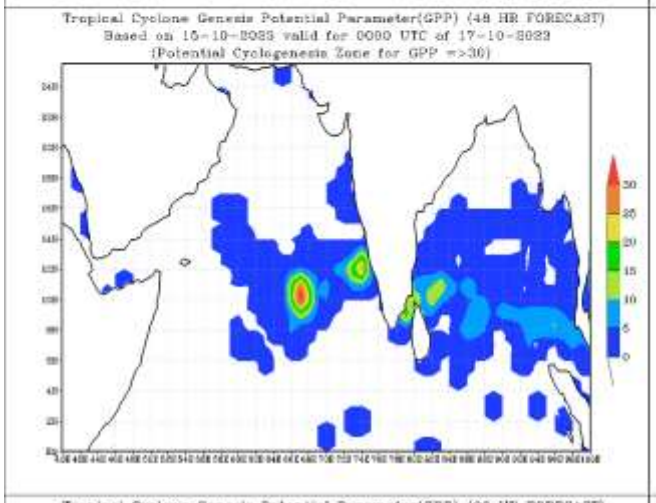
(ii) formation of cyclonic circulation over eastcentral Bay of Bengal around 20th October need to be monitored critically.

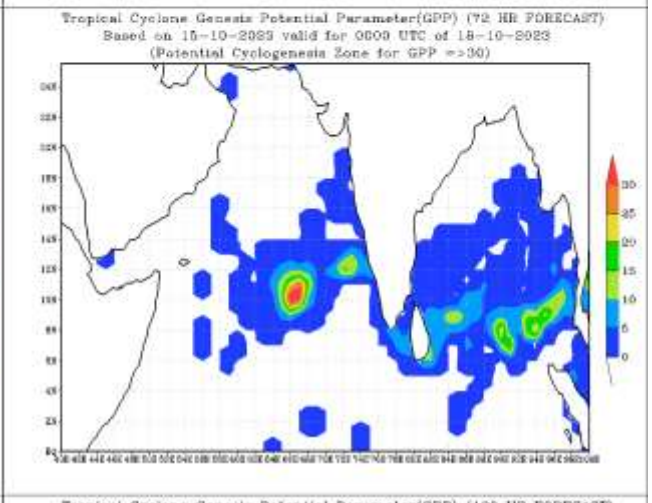
Intense Observation Period (IOP) is suggested for Lakshadweep Islands, Kerala, west Sri Lanka on 15th and 16th.

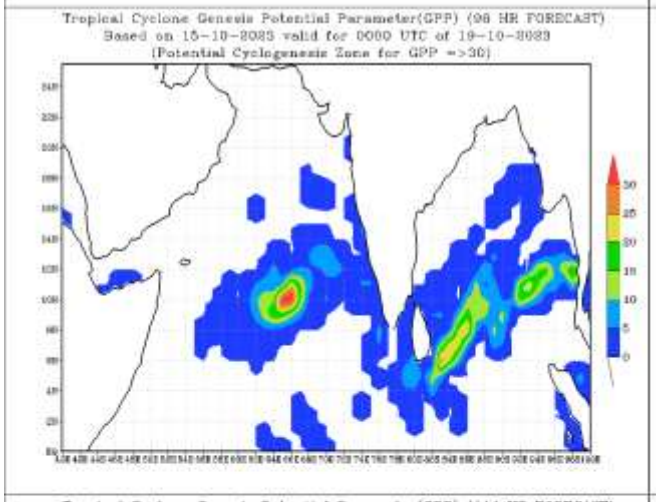
Annexure

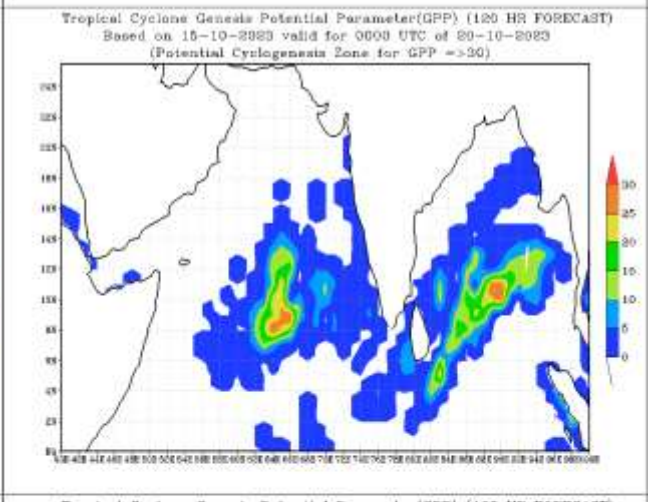

Tropical Cyclone Genesis Potential Parameter(GPP) (ANALYSIS)
Based on 15-10-2023 valid for 0000 UTC of 15-10-2023
(Potential Cyclogenesis Zone for GPP =>30)

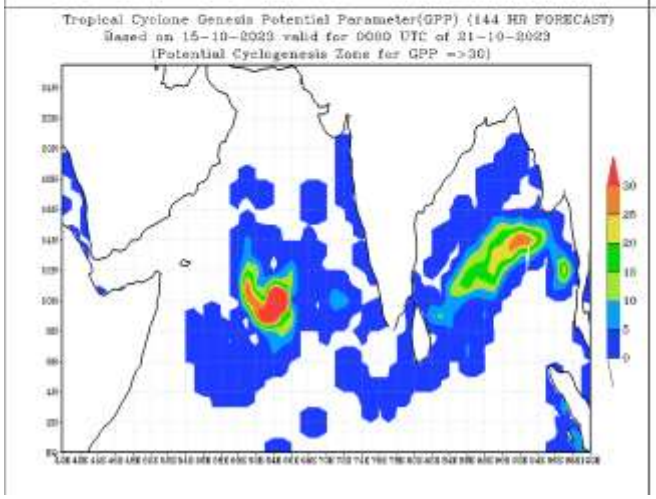

Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 15-10-2023 valid for 0000 UTC of 16-10-2023
(Potential Cyclogenesis Zone for GPP =>30)

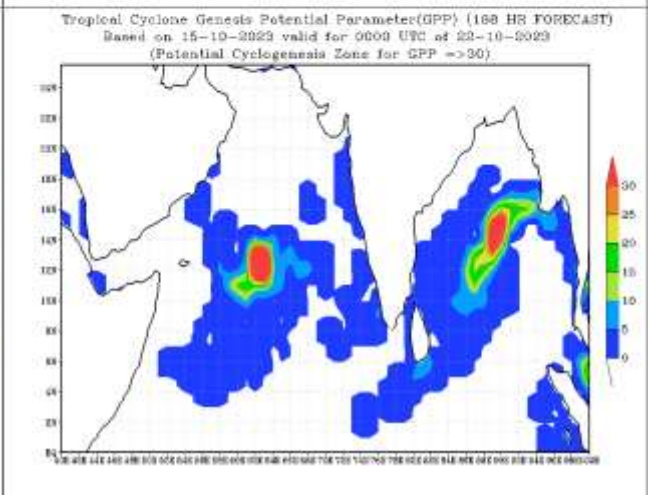

Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 15-10-2023 valid for 0000 UTC of 17-10-2023
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 15-10-2023 valid for 0000 UTC of 18-10-2023
(Potential Cyclogenesis Zone for GPP =>30)

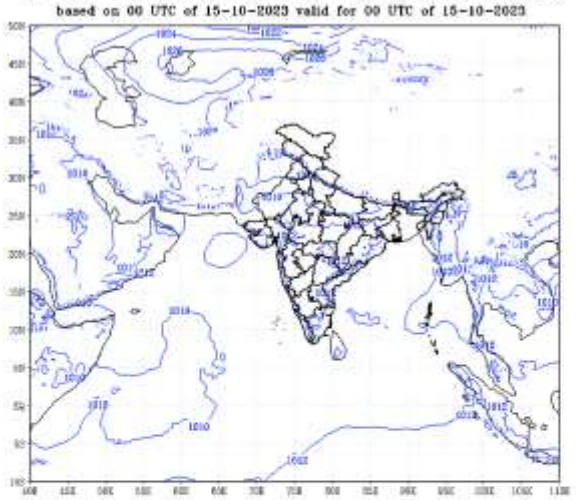

Tropical Cyclone Genesis Potential Parameter(GPP) (96 HR FORECAST)
Based on 15-10-2023 valid for 0000 UTC of 19-10-2023
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
Based on 15-10-2023 valid for 0000 UTC of 20-10-2023
(Potential Cyclogenesis Zone for GPP =>30)

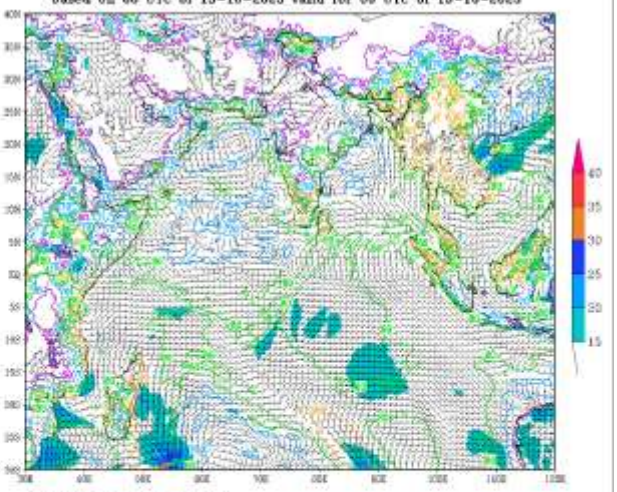

Tropical Cyclone Genesis Potential Parameter(GPP) (144 HR FORECAST)
Based on 15-10-2023 valid for 0000 UTC of 21-10-2023
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (168 HR FORECAST)
Based on 15-10-2023 valid for 0000 UTC of 22-10-2023
(Potential Cyclogenesis Zone for GPP =>30)

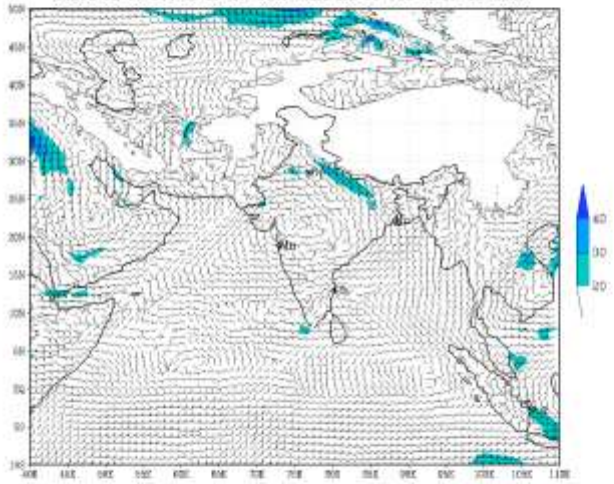
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (00 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 15-10-2023



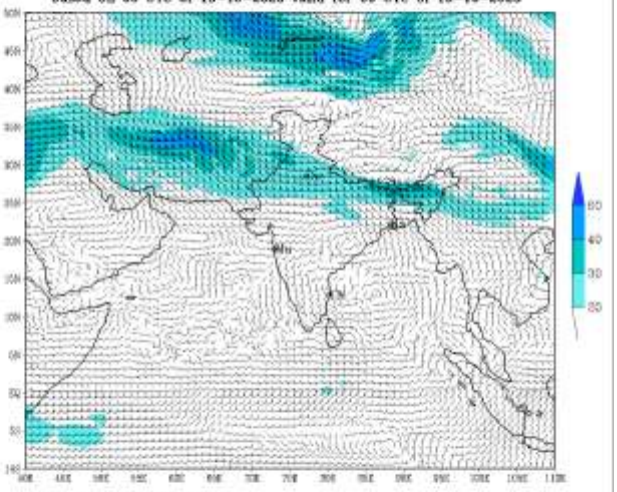
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (00 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 15-10-2023



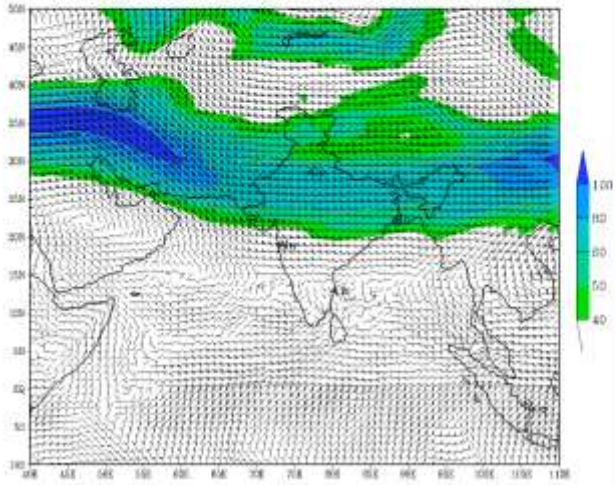
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (00 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 15-10-2023



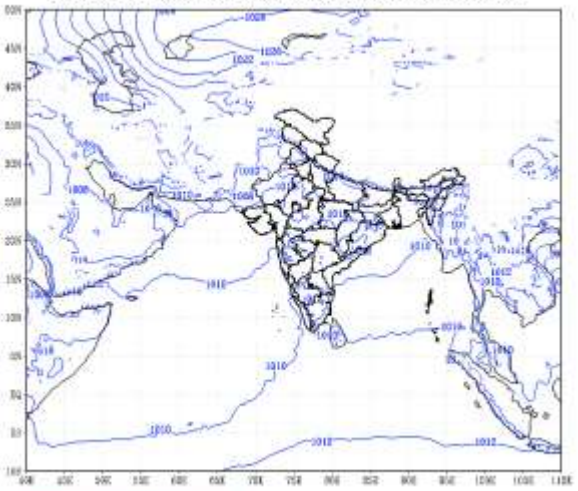
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (00 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 15-10-2023



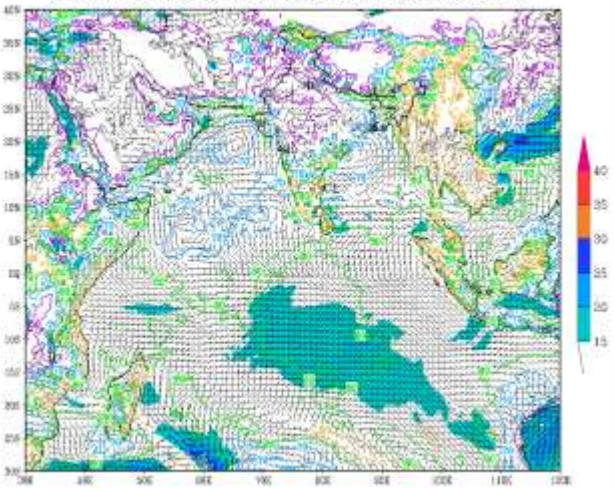
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (00 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 15-10-2023



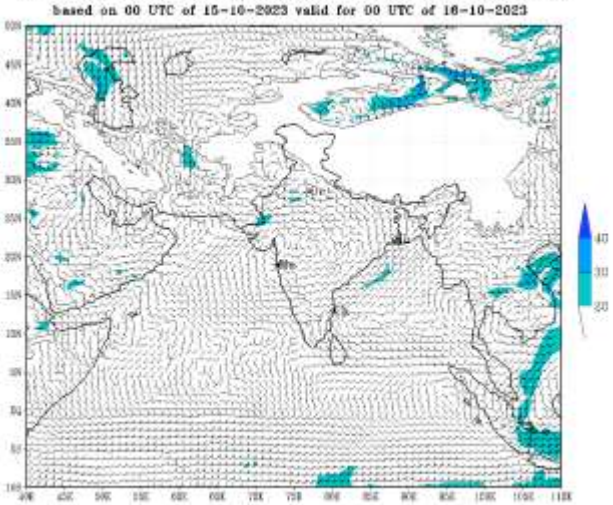
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (24 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 16-10-2023



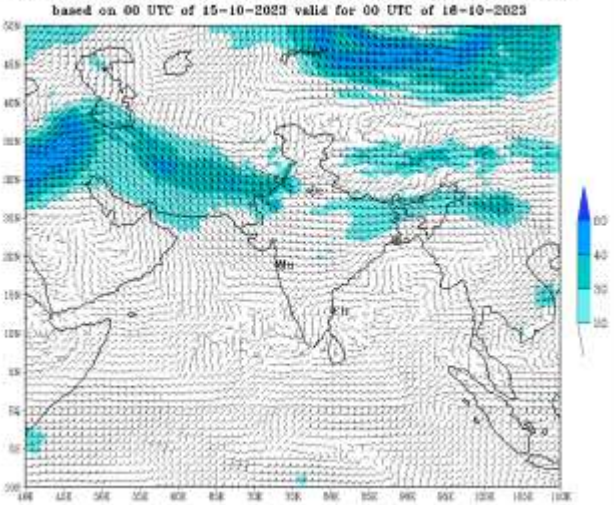
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (24 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 16-10-2023



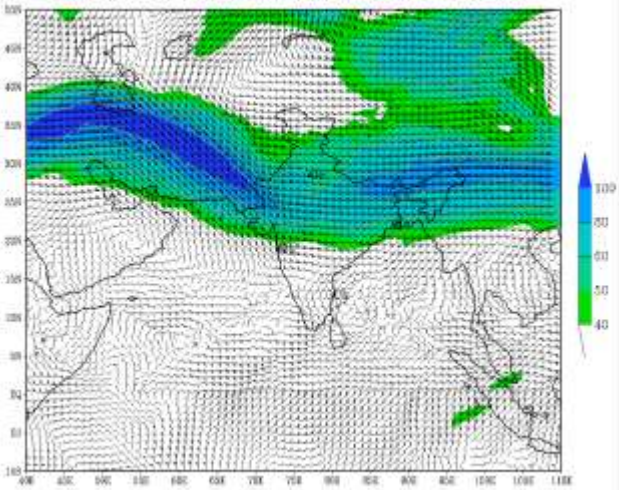
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 16-10-2023

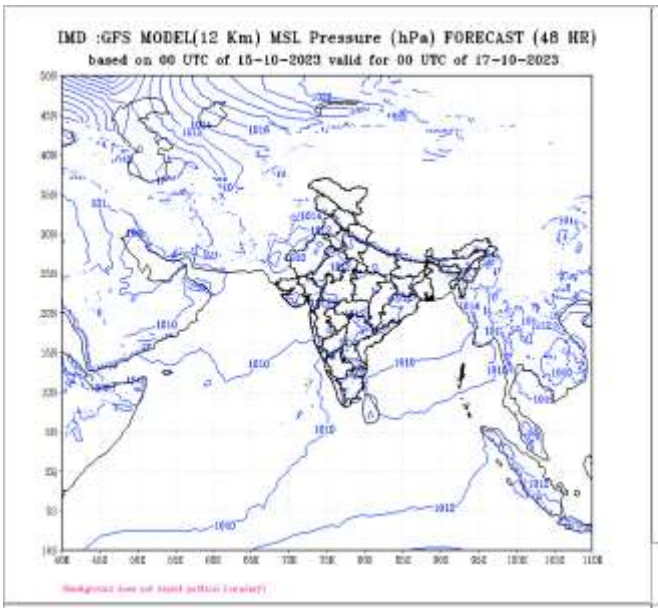


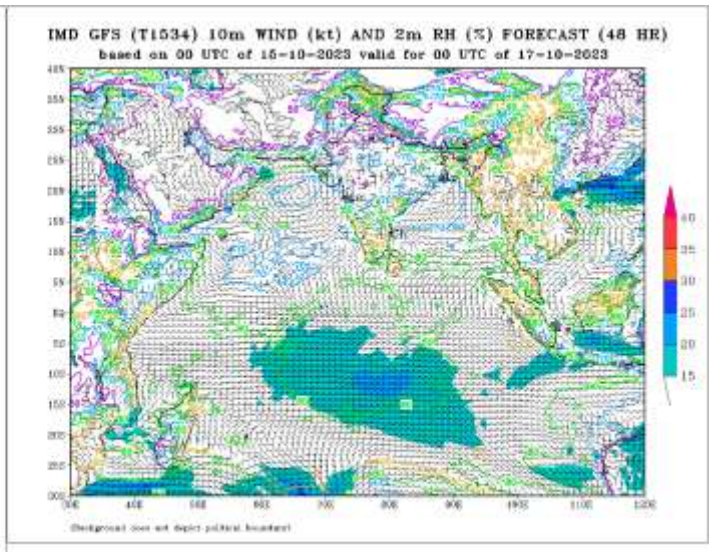
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 16-10-2023

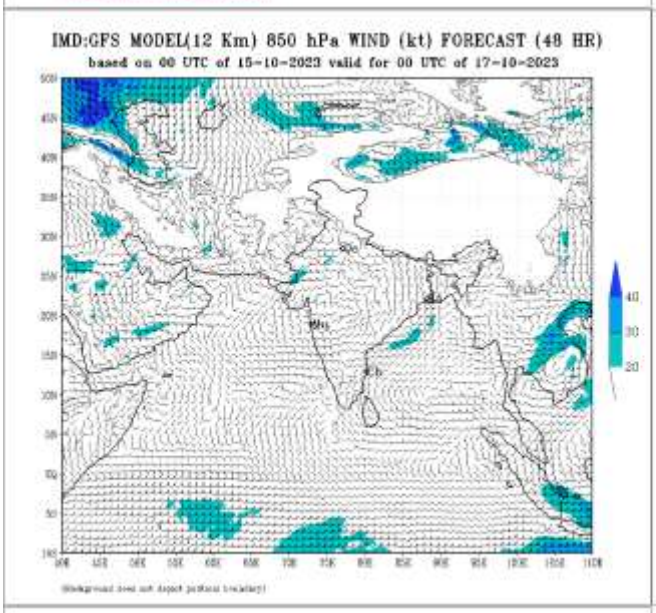


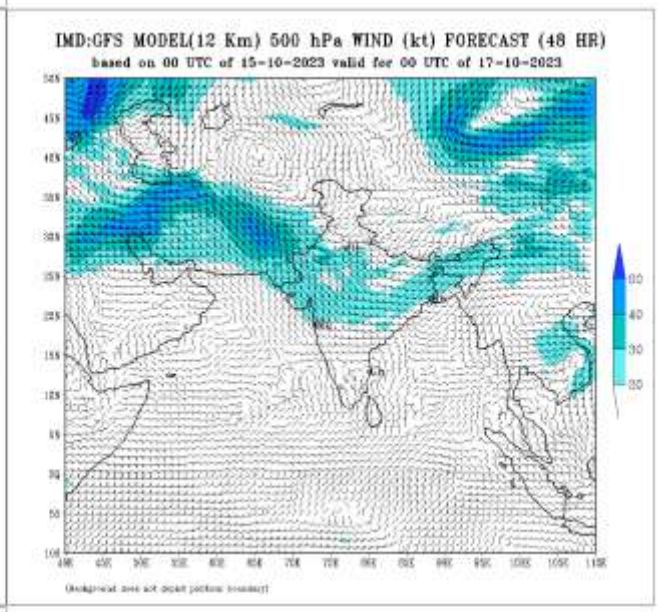
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 16-10-2023

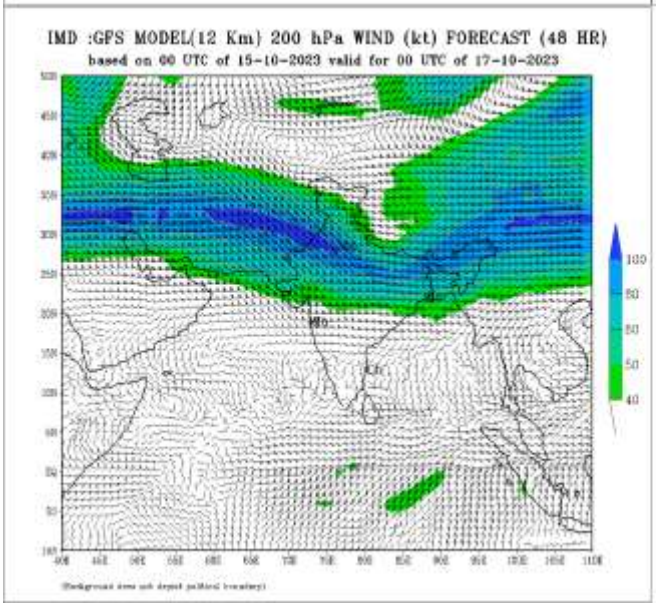



IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (48 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 17-10-2023

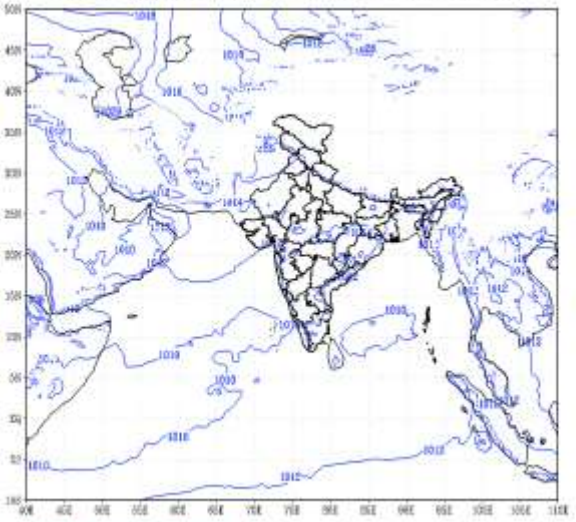

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (48 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 17-10-2023


IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (48 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 17-10-2023

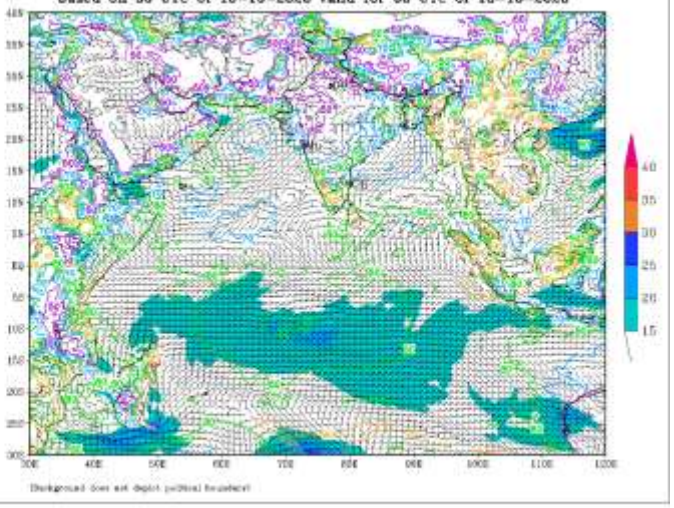

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (48 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 17-10-2023


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (48 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 17-10-2023

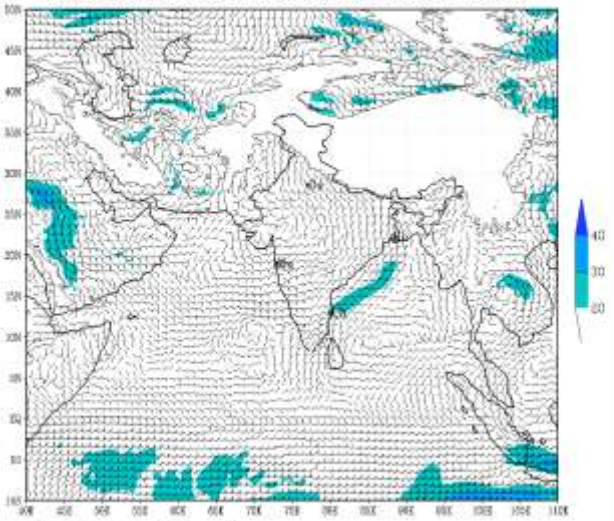
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (72 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 18-10-2023



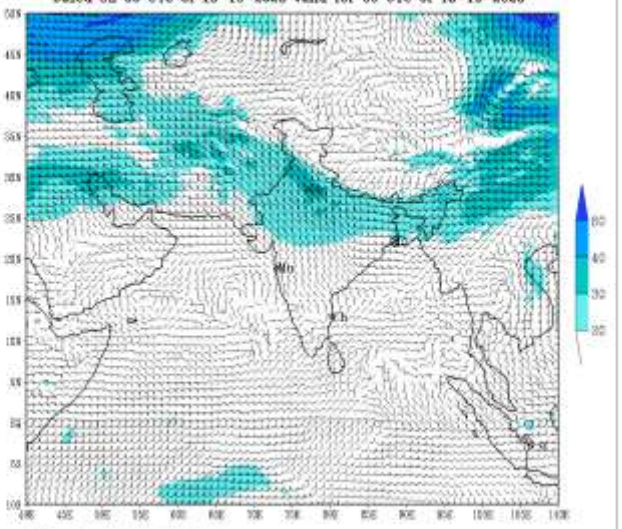
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (72 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 18-10-2023



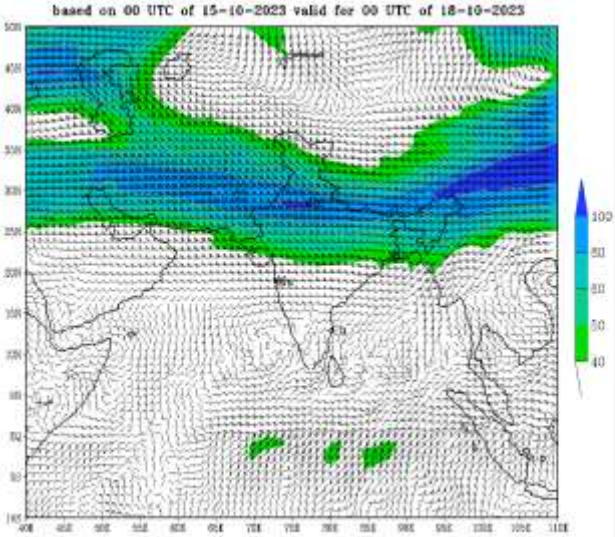
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 18-10-2023

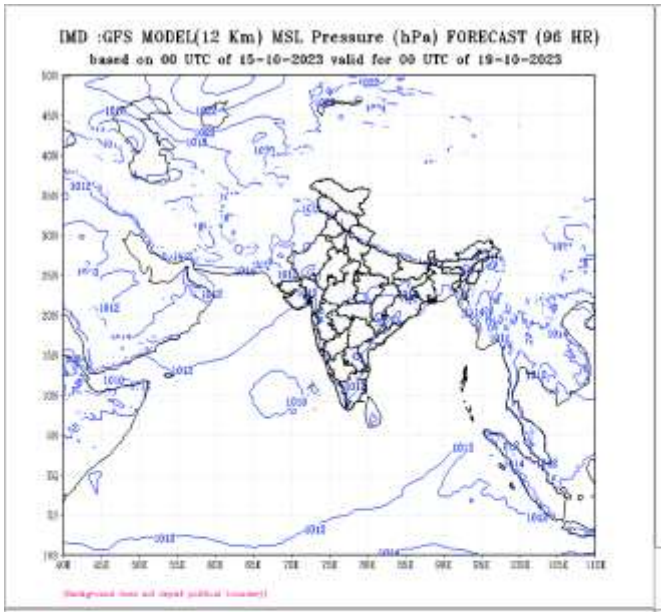


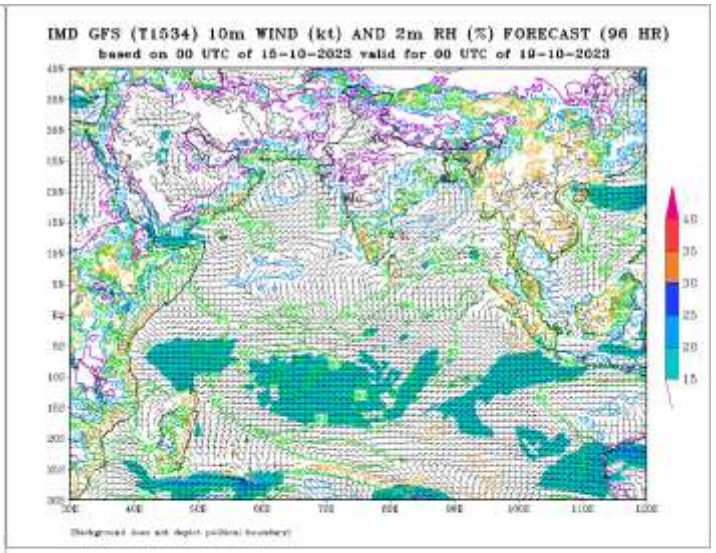
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 18-10-2023

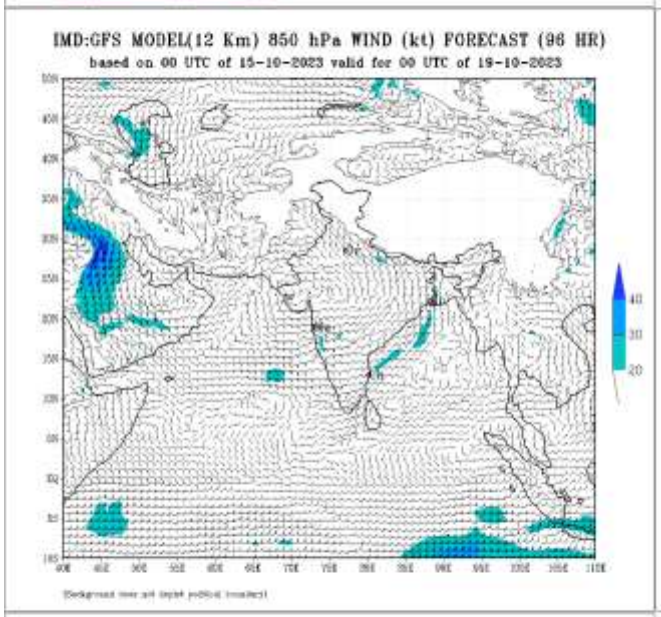


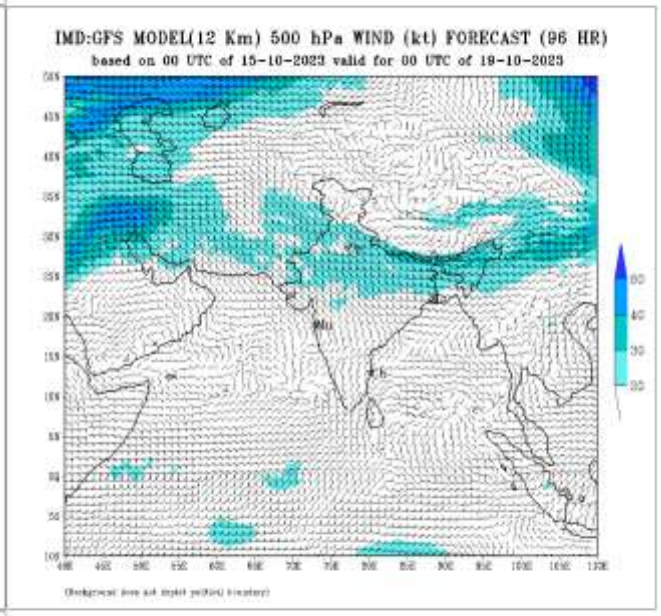
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 18-10-2023

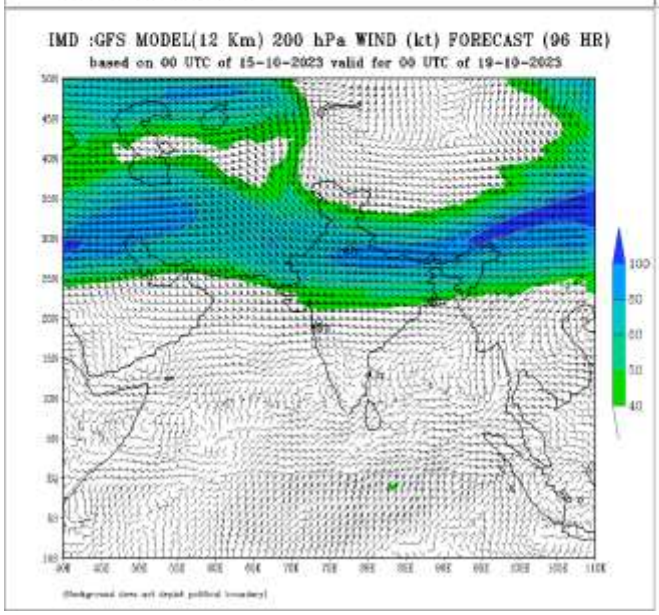



IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (96 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 19-10-2023

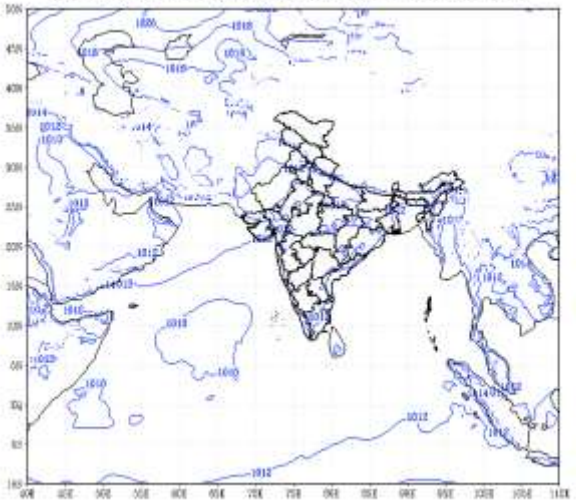

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (96 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 19-10-2023


IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 19-10-2023

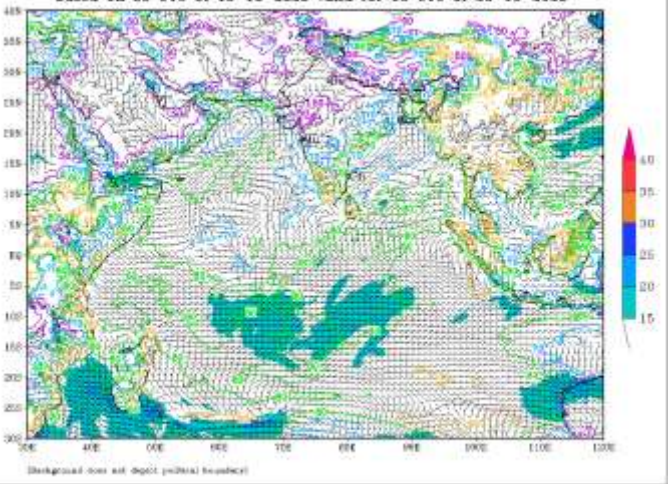

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 19-10-2023


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 19-10-2023

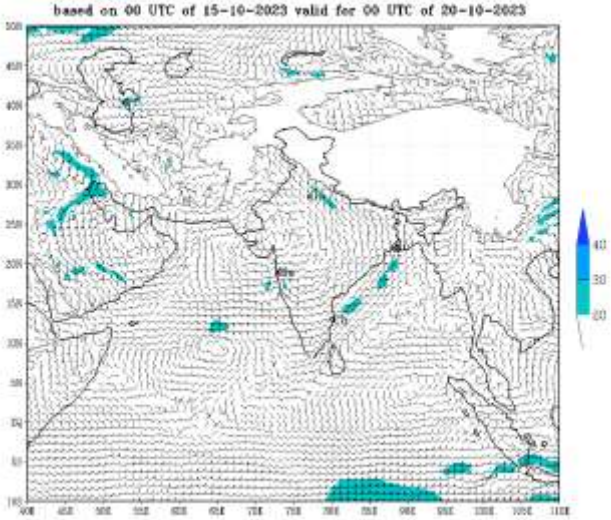
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 20-10-2023



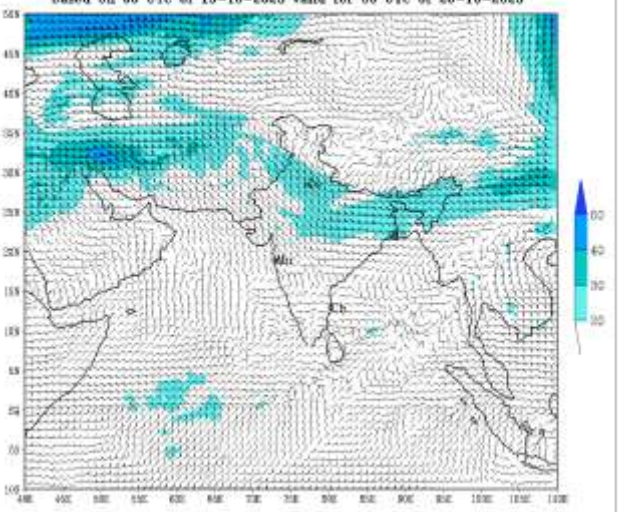
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (120 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 20-10-2023



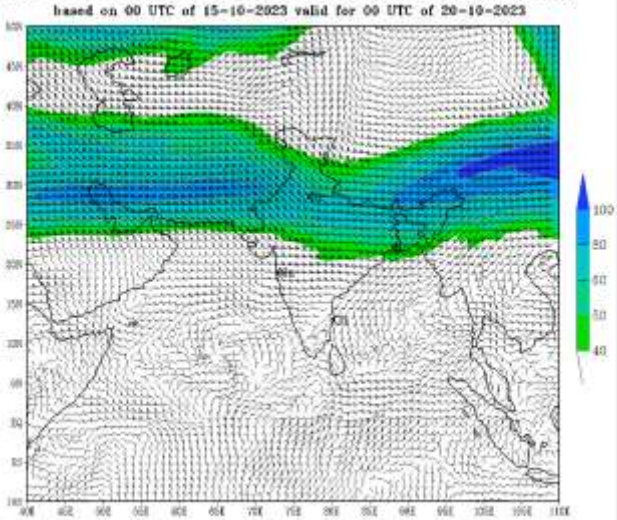
IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 20-10-2023

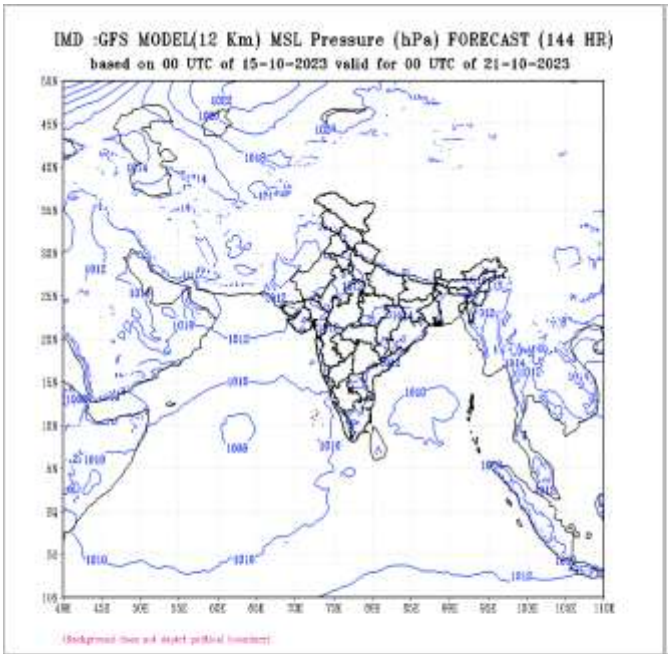


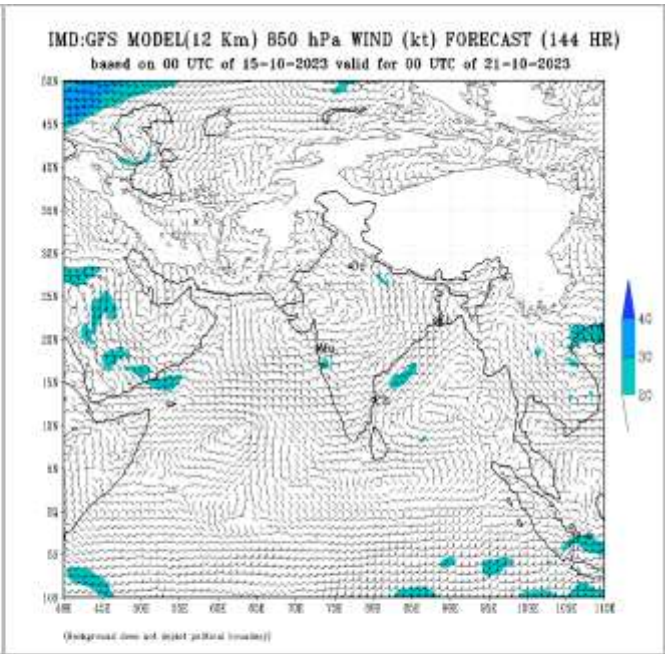
IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 20-10-2023

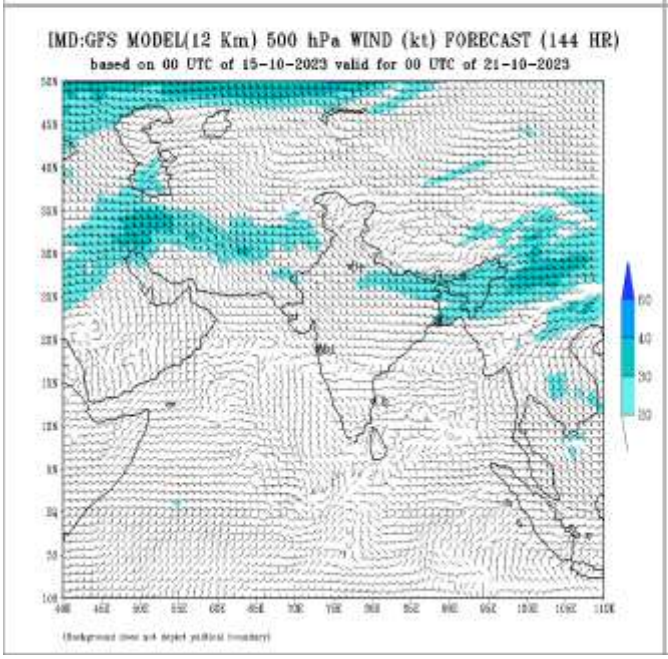


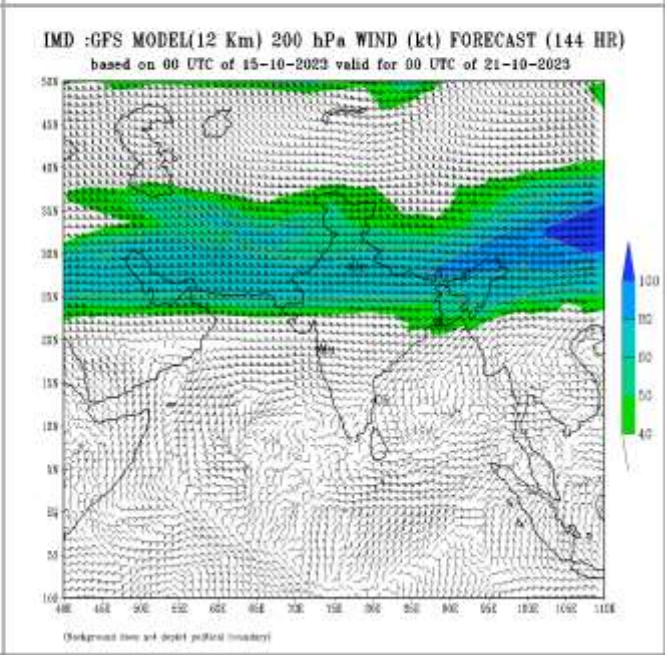
IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 20-10-2023



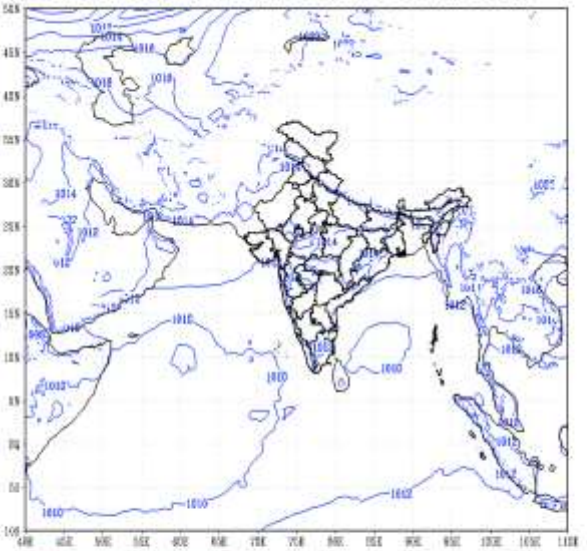

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (144 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 21-10-2023


IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 21-10-2023

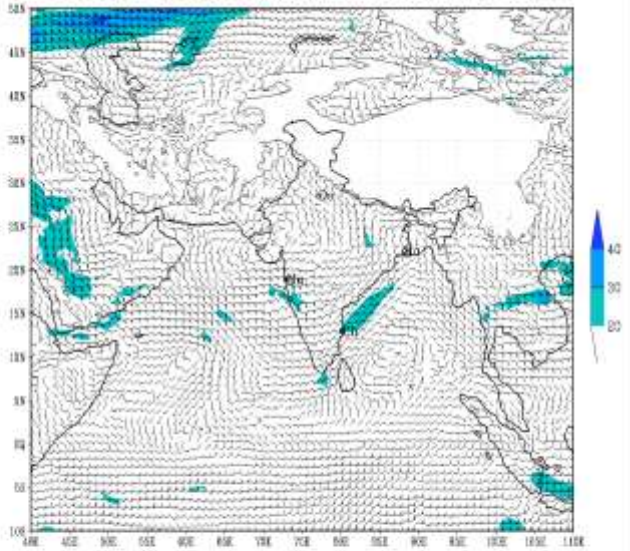

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 21-10-2023


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 21-10-2023

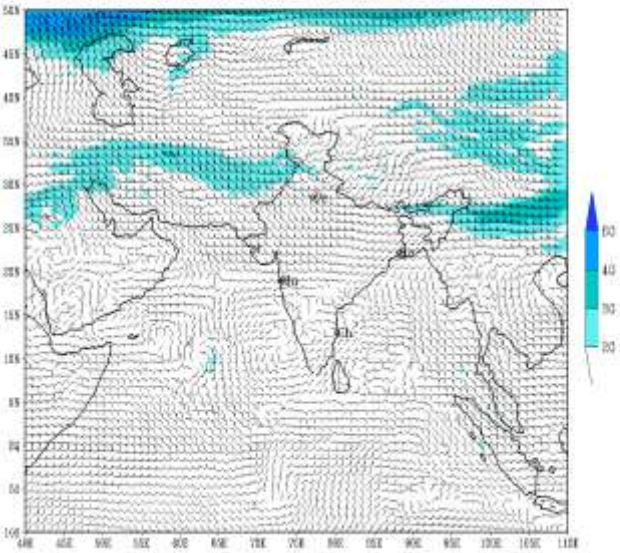
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (168 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 22-10-2023



IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 22-10-2023



IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 22-10-2023



IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 15-10-2023 valid for 00 UTC of 22-10-2023