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

Tropical Cyclone Forecast Programme
Report Dated 28th November, 2023

Time of Issue: 1200 UTC

Synoptic features (based on 0300 UTC analysis):

Yesterday's Low Pressure Area over South Andaman Sea & adjoining Malacca Strait moved westwards and lay over South Andaman Sea at 0830 hours IST of today, the 28th November. It is likely to move west-northwestwards and intensify into a Depression over southeast Bay of Bengal around 30th November, 2023. Thereafter, it is likely to move northwestwards and intensify further into a Cyclonic Storm over Southwest & adjoining Southeast Bay of Bengal during subsequent 48 hours.

Dynamical and thermo-dynamical features

Parameter	Bay of Bengal (BoB)	Arabian Sea (AS)
Sea Surface Temperature (SST) ºC	27-28 over major parts of BoB, Andaman Sea. Around 26^{0}C over north and adjoining westcentral BoB.	29-30 over southeast and adjoining southwest AS, along and off Karnataka coast. 26-28 over major parts of central and southwest AS, Around 26^{o}C over north and adjoining westcentral AS.
Tropical Cyclone Heat Potential (TCHP) kJ/cm^2	80-100 over parts of Andaman Sea, parts of eastcentral BoB, Gulf of Mannar, southwest BoB close to Sri Lanka coast.	120-130 over southeast and adjoining southwest AS. 80-100 over eastcentral AS. Less than 40 over westcentral AS along and off Yemen-Oman coast, north AS.
Cyclonic Relative vorticity (X10^{-6}s^{-1})	60-80 over Malacca Strait and southeast BoB adjoining to EIO. 10-20 over south of south BoB.	60-70 over southwest AS, 10-25 over parts of central and north AS.
Low Level convergence (X10^{-5} s^{-1})	5-10 over South Andaman Sea, southwest BoB, Gulf of Mannar.	5-10 over Comorin area. 10-30 over central parts of south AS, southwest AS.
Upper Level divergence (X10^{-5} s^{-1})	5-10 over Mallaca Strait and South Andaman Sea, southwest BoB, northwest and adjoining westcentral BoB.	10-30 over southwest and adjoining southeast AS, -5 to -10 over north and adjoining central AS. -10 over north and adjoining central AS.
Vertical Wind Shear (VWS knots) **Low: 05-10 knots** **Moderate:10-20 knots**	5-10 over southern parts of south BoB and south Andaman Sea. 20 over rest of south BoB and parts of north Andaman Sea. High (>20knots) over central & north BoB.	5-15 over southern parts of southeast AS, Comorin area, southwest AS. 20 over rest of southeast AS and southern parts of westcentral AS. High (>20knots) over central & north AS.

High: >20 knots		
Wind Shear Tendency (knots)	Increasing over Andaman Sea and most parts of BoB. Decreasing over southeast BoB adjoining to EIO.	Decreasing over south AS, north AS. Increasing over central and adjoining north AS.
Upper Tropospheric Ridge	Along 12^{o}N over BoB.	Along 12^{0}N over AS.

Satellite observations based on INSAT imagery (0600 UTC):

(a) Over the Bay of Bengal & Andaman Sea:-
Scattered to broken low/med clouds with embedded intense to very intense convection over south Bay of Bengal (BoB), south Andaman Sea. Scattered low/med clouds with embedded mod to intense convection over EC BoB, north Andaman Sea and weak to mod convection over WC BoB.

Over the Arabian Sea:-
scattered to broken low/med clouds with embedded intense to very intense convection over south Arabian Sea. Scattered low/med clouds with embedded isolated mod to intense convection over central Arabian Sea, Comorin area.

convection outside India:-
Scattered low/med clouds with embedded mod to intense convection over Maldives, Sri Lanka, Pakistan, south Thailand, Gulf of Thailand, Sumatra, Strait of Malacca, Malaysia, Borneo, South China Sea, south of lat 11.5N, Java Sea, Celebes Islands & Sea, north Madagascar and over Indian Ocean between lat 5.0N to 10.0S east of long 80.0E and between lat 5.0N to 18.0S long 40.0E to 85.0E.

M.J.O. Index:
MJO index is currently in Phase 2 with amplitude greater than 1. It will be in phase 3 with amplitude greater than 1 on 29th Nov, it will be in the same phase but with amplitude less than 1 till 4th Dec. It will be in the phase 4 with amplitude less than 1 till 8th Dec.

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	Low pressure area (LPA) over southeast BoB (7.5^{o}N/90.5^{o}E) on 30th Nov, moving westnorthwestward and lay over southwest BoB (11.5^{o}N/85^{o}E) as DD on 2nd Dec, moving in the same direction and lay over same region (12^{o}N/83.5^{o}E) as CS/SCS on 3rd Dec, it lay as SCS/VSCS over southwest BoB (12.5^{o}N/83^{o}E) on 4th Nov, It moves in the same direction and lay over westcentral BoB close to Andhra Pradesh coast (15.5^{o}N/82^{o}E) as VSCS on 5th Dec, and crosses the coast (17^{o}N/81.5^{o}E) on the same day.	No significant circulation for the next 7 days.
IMD-GEFS	An extended low over southeast and adjoining southwest BoB (6^{o}N/89.5^{o}E) on 30th Nov, moving westnorthwestward and lay over southwest BoB (11^{o}N/83^{o}E) as WML on 2nd Dec. It moves in the same direction and lay over southwest BoB as WML/Depression on 3rd Dec. It moves then in northwestward and lay over westcentral and adjoining southwest BoB (15.0^{o}N/82.0^{o}E) as a DD	No significant circulation for the next 7 days.

	on 4th Dec. It moves in the same direction and lay close to central Andhra Pradesh coast (16.0°N/81.5.0°E) as a WML on 5th Dec. It moves then northeastward along the coast while weakening.	
IMD-WRF	No significant system during next 3 days.	No significant system during next 3 days.
NCMRWF-NCUM	LPA over southeast and adjoining southwest BoB (7.0°N/90.5°E) on 30th Nov, it moves westnorthwestward and lay over southwest BoB (11°N/80.5°E) as WML on 4th Dec, it moves in same direction and lay over southwest BoB close to Tamil Nadu coast (10.5°N/80.5°E) as a depression on 4th Dec, it moves then parallel to the coast and lay over westcentral BoB close to Andhra Pradesh coast (15.5°N/81.5°E) as a D/DD on 6th Dec. Not indicating landfall but weakening close to the coast.	An extended cycir over southwest and adjoining southeast AS during 3rd and 4th Dec without intensification.
NCMRWF-NEPS	LPA over southeast and adjoining southwest BoB (8.5°N/88°E) on 01st Nov, it moves westnorthwestward and lay over southwest BoB (9°N/83°E) as WML on 2nd Dec, it moves in same direction and lay over southwest BoB (10.5°N/80.5°E) as a depression on 4th Dec, it crosses the Tamil Nadu coast (11.5°N/80.5°E) as a WML on 4th Dec. It moves in the same direction and crosses Tamil Nadu coast (12°N/80°E) on the same day i.e., 4th Dec as a WML.	No significant circulation for the next 7 days.
NCMRWF-UM (Regional)	No significant system during next 3 days.	-
ECMWF	Cycir over southeast BoB (6.0°N/92.7°E), moving westnorthwestward and lay over southeast and adjoining southwest BoB (8.5°N/88.6°E) as a depression around 30th Nov, moving in the same direction and lay over southwest BoB (10.5°N/83.6°E) on 12 UTC of 2nd Dec as DD/CS, it lay over southwest BoB (11.2°N/82.7°E) as DD/CS on 00 UTC of 3rd Dec, it lay over southwest and adjoining westcentral BoB (12.5°N/81.3°E) as DD/CS at 21 UTC of 3rd Dec. It moves then northwestward and lay touch the north Tamil Nadu – south Andhra Pradesh coast (13.7°N/80.2°E) as DD/CS on 18 UTC of 4th Dec. It continues to move northeastward while weakening. It continues to move in the same direction over land while weakening.	No significant circulation for the next 7 days.
NCEP-GFS	LPA over southeast BoB 8.4°N/90.7°E) on 29th Dec, moving westnorthwestward and lay over southeast and adjoining southwest BoB (10.4°N/89.2°E) as a depression on 06 UTC of 01st Dec, moving in the same direction and lay over southwest BoB and adjoining areas (12.4°N/86.6°E) as a CS/CS on 06 UTC of 2nd Dec. Moving in the same direction and lay over southwest BoB (13.5°N/85.9°E) as a CS/SCS on 06 UTC of 3rd Dec. It moves then northeastward lay over westcentral and adjoining eastcentral BoB (16.5°N/86.9°E) as a SCS/VSCS on 06 UTC of 4th Dec. Moving in the same direction and lay over northwest BoB (19.5°N/88.3°E) as VSCS on 06 UTC of 5th Dec. It continues to move northeastward towards Bangladesh coast while weakening.	No significant circulation for the next 7 days.
IMD-Genesis Potential Parameter	Potential zone over south Andaman Sea and adjoining Malacca Strait as on today i.e., 28th Nov over. It moves westnorthwestward and lay over southeast BoB on 29th and 30th Nov and on 1st Dec. It lay over southeast and adjoining southwest BoB on 2nd Dec, and over central parts of central BoB on 3rd Dec. It lay over northwest BoB on 5th Dec.	No potential zone of cyclogenesis over AS.

Summary and conclusion:

1. For Bay of Bengal:

As per today's guidance, models are indicating delayed formation of depression. There is large variation among various models wrt date of formation of depression with date varying between 30th November - 2nd December. However, most of the models are indicating initial westnorthwestwards movement, followed by north-northwestwards movement. Some of the models are also indicating northeastwards recurvature. There is consensus among various models wrt intensification into cyclonic storm and higher intensity storm. IMD-GFS is indicating an extended low pressure area over southeast Bay of Bengal on 28th, depression on 1st December over southeast Bay of Bengal with rapid intensification into a very severe cyclonic storm on 3rd December over southwest Bay of Bengal. It is indicating further intensification. It is indicating initial west-northwestwards movement followed by north-northwestwards movement and crossing over Andhra Pradesh coast on 5th December/0300 UTC. ECMWF is indicating formation of depression on 1st December over southeast Bay of Bengal. It is also indicating intensification into cyclonic storm on 3rd December over southwest Bay of Bengal and further intensification into very severe cyclonic storm. It is indicating crossing over Andhra Pradesh coast near Kakinada, but on 5th December as an intense cyclone. Similarly, NCUM is indicating formation of low pressure area on 1st December over southeast Bay of Bengal with west-northwestwards movement and depression over southwest Bay of Bengal on 2nd December over southwest Bay of Bengal. It is also suggesting further intensification into a cyclonic storm on 4th December. IMD multi model ensemble (MME) is indicating formation of depression around 30th November. Thereafter, the system is indicated to intensify into a cyclonic storm on 2nd December over southeast Bay of Bengal. Model is indicating intensification upto severe cyclonic storm stage and rapid weakening before landfall. Landfall is indicated over north Andhra Pradesh-south Odisha coasts on 5th December as a cyclonic storm.

Considering all the above, the low-pressure area over south Andaman Sea is likely to move west-northwestwards and intensify into a depression over southeast Bay of Bengal around 30th November, 2023. Thereafter, it is likely to move northwestwards and intensify further into a cyclonic storm over southwest & adjoining southeast Bay of Bengal during subsequent 48 hours.

Probability of Cyclogenesis (formation of depression and above intensity systems) over Bay 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	**LOW**	**MOD**	**HIGH**	**HIGH**	**HIGH**	**HIGH**

*Note: Every 24 hour forecast is valid upto 0300 UTC of the next day.

2. For the Arabian Sea:

Most of the models are indicating that there will be no significant system for the next seven days. However, models are indicating a cyclonic circulation over southwest Arabian Sea as on today i.e., 27th November having westward movement till 28th November without further intensification.

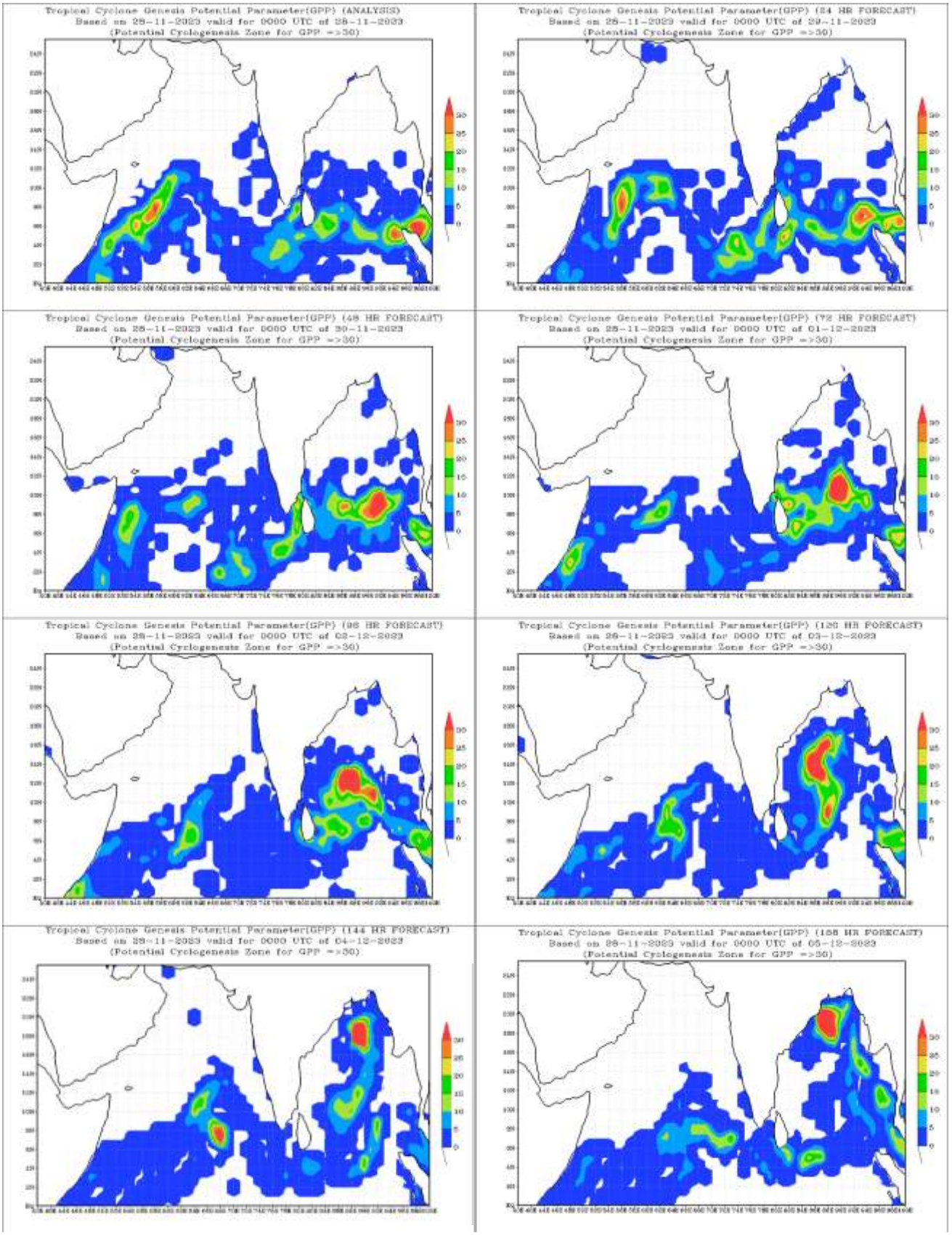
Probability of Cyclogenesis (formation of depression and above intensity systems) over the Arabian Sea during next 168 hours:

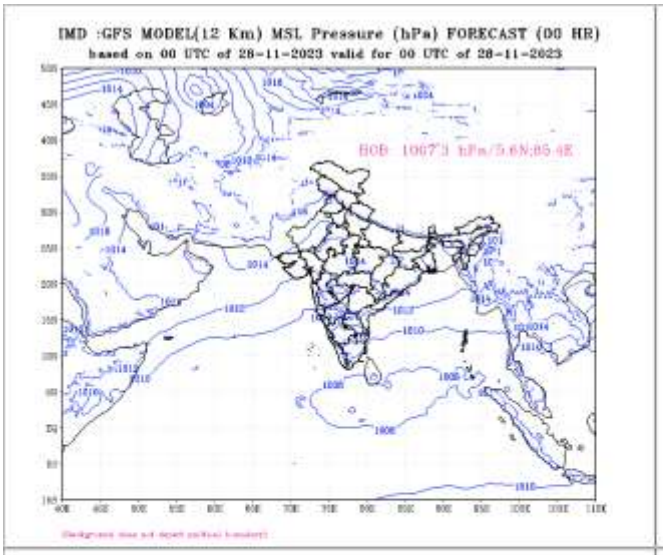
24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS	120-144 HOURS	144-168 HOURS
NIL	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**	**NIL**

*Note: Every 24 hour forecast is valid upto 0300 UTC of the next day.

IOP: IOP for Andaman & Nicobar Islands for 28th - 30th November.

ANNEXURE




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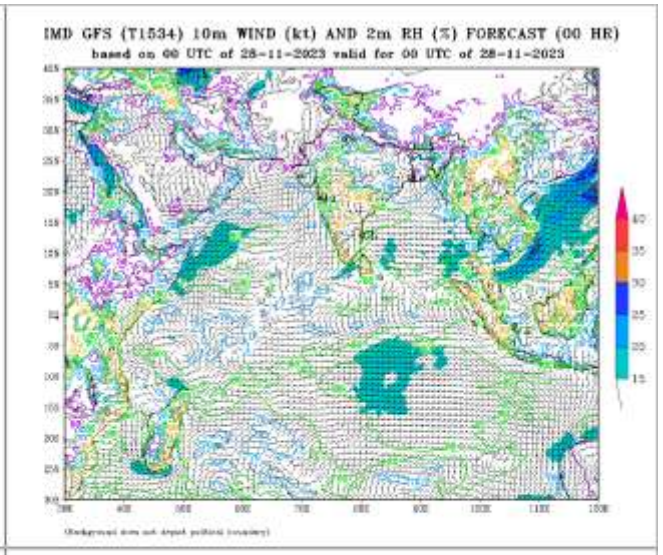
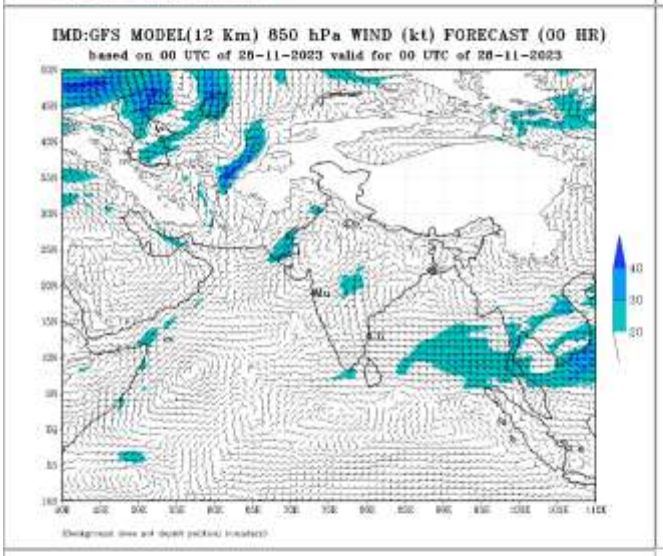

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (00 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 28-11-2023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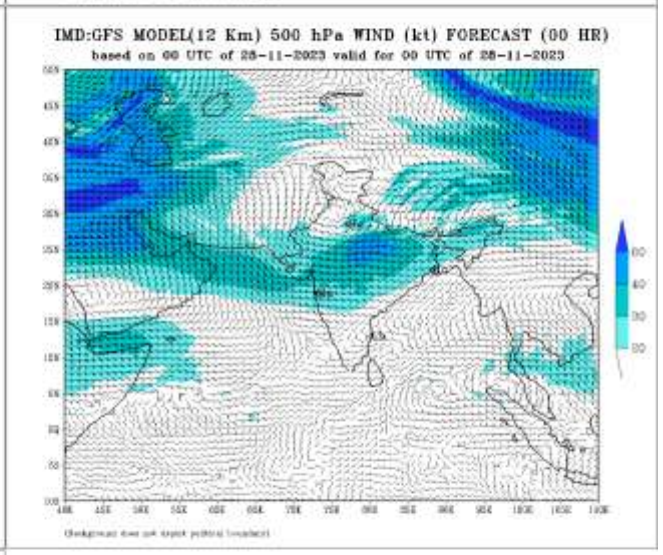
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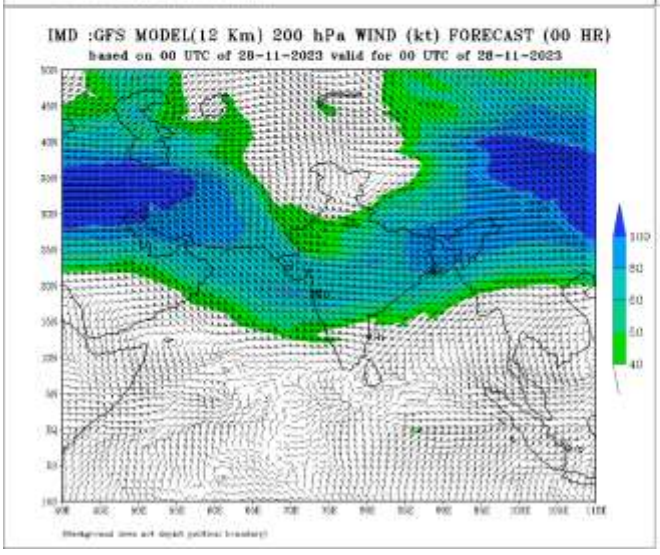
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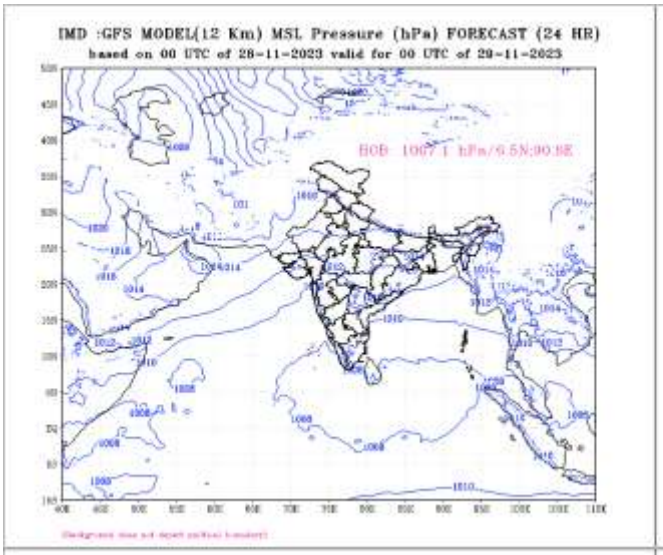
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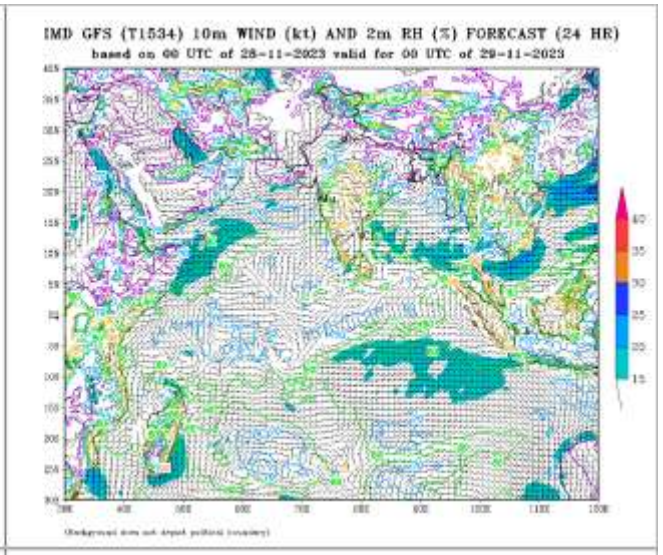
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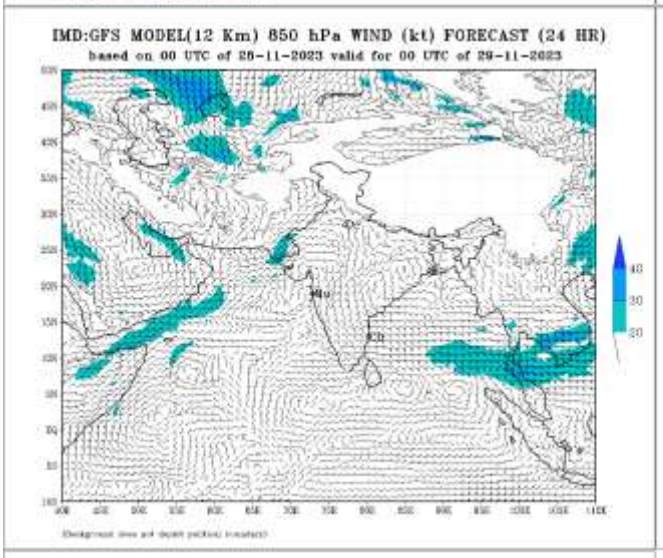
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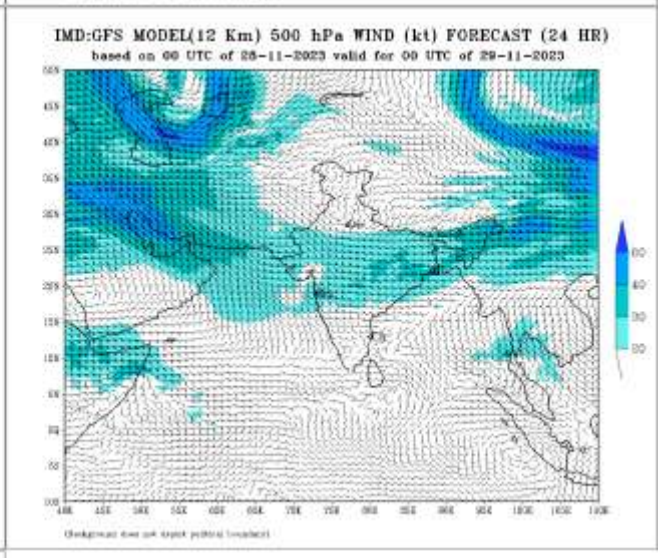
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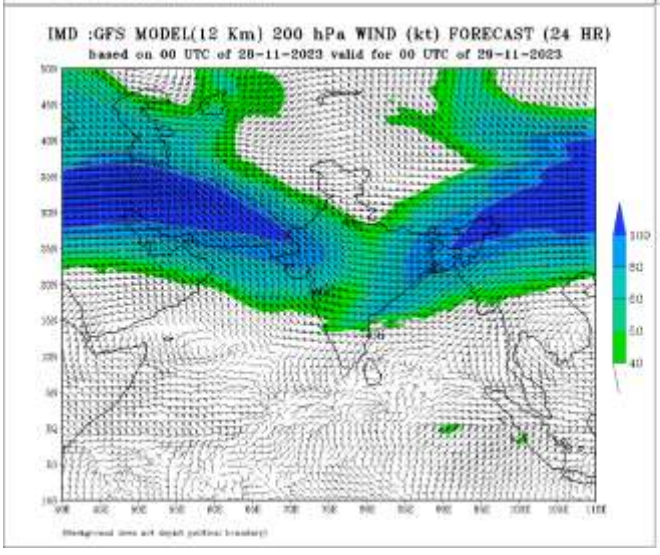
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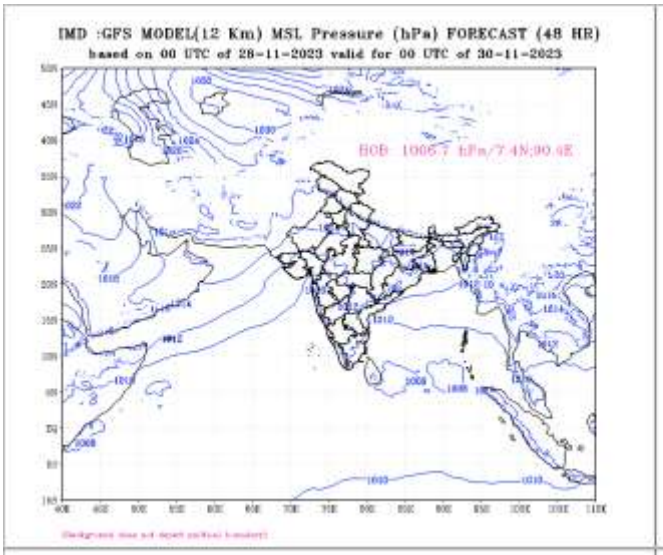
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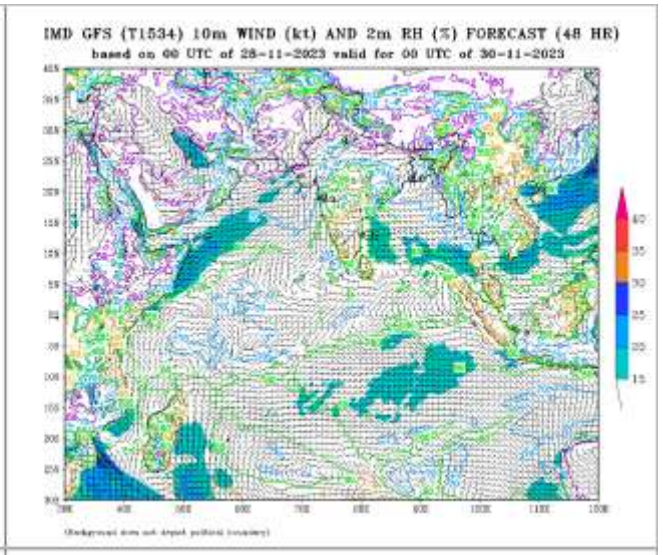
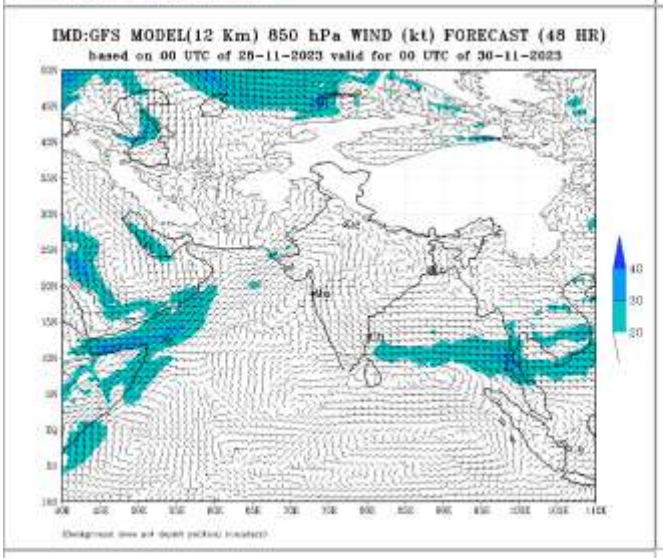

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (48 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 30-11-2023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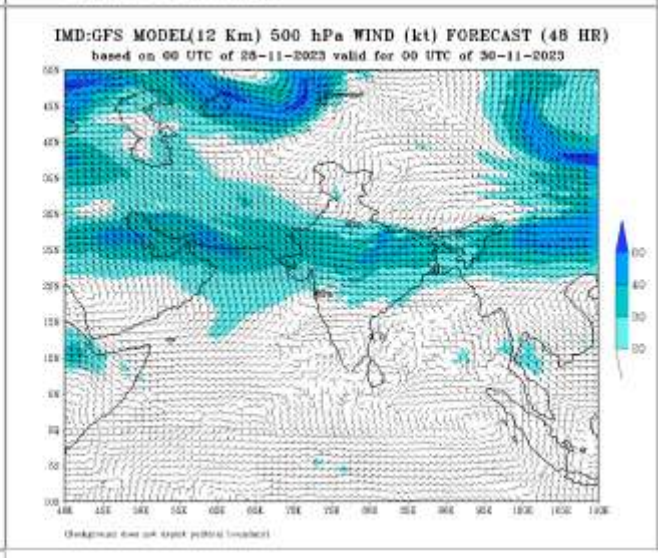
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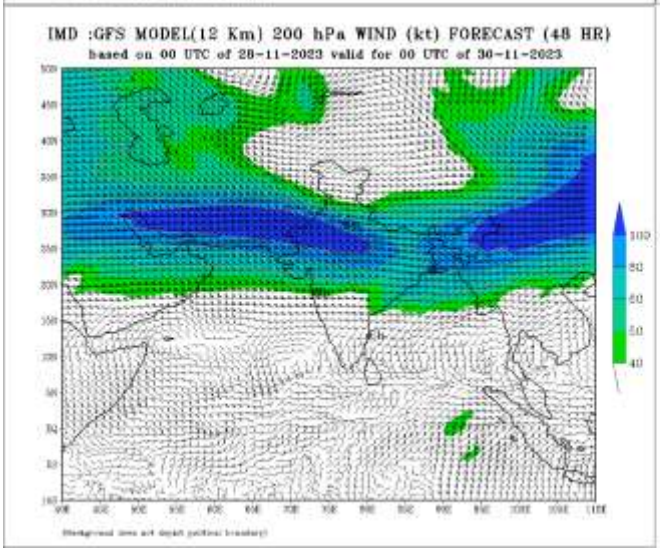
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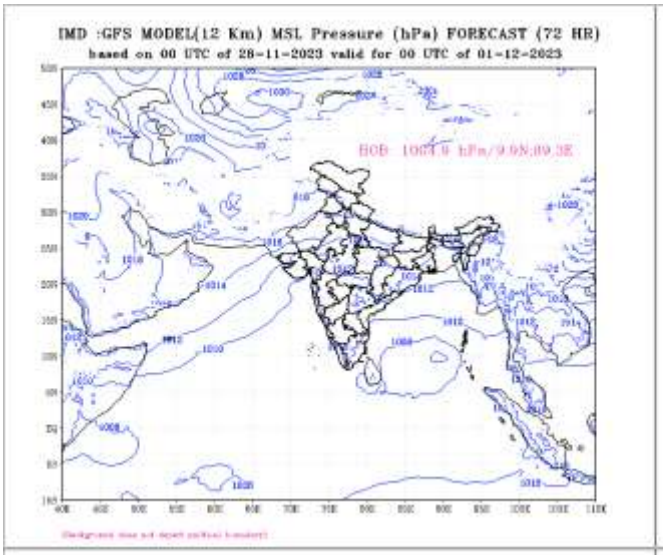
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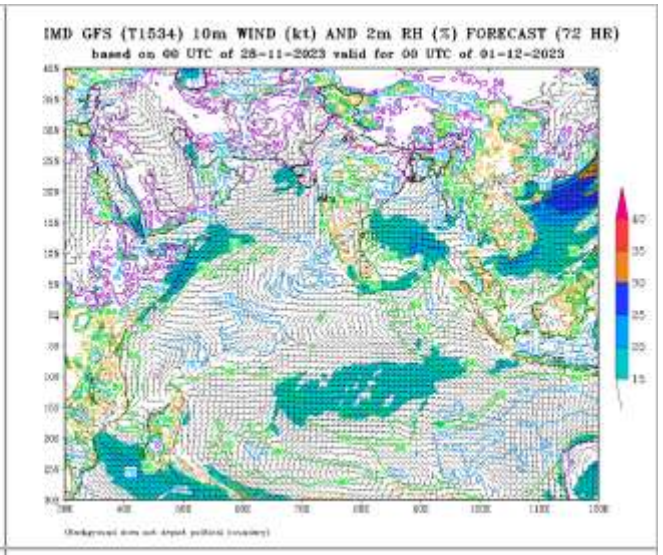
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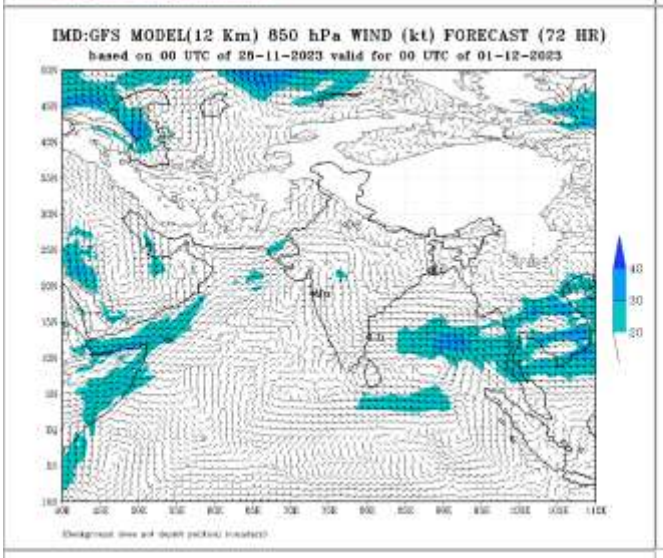
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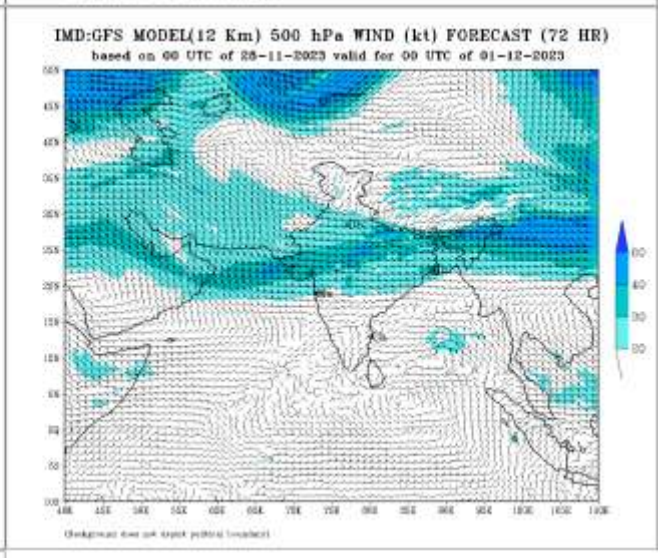
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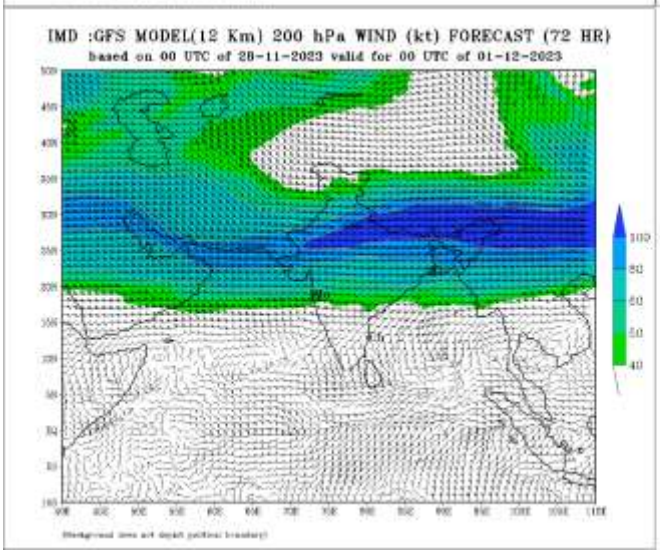
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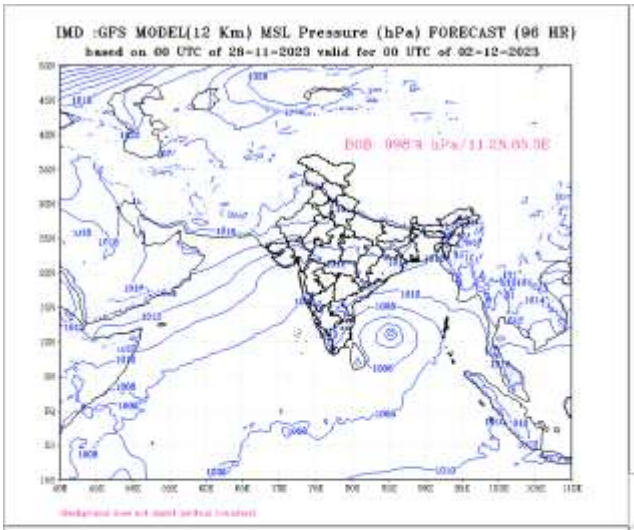
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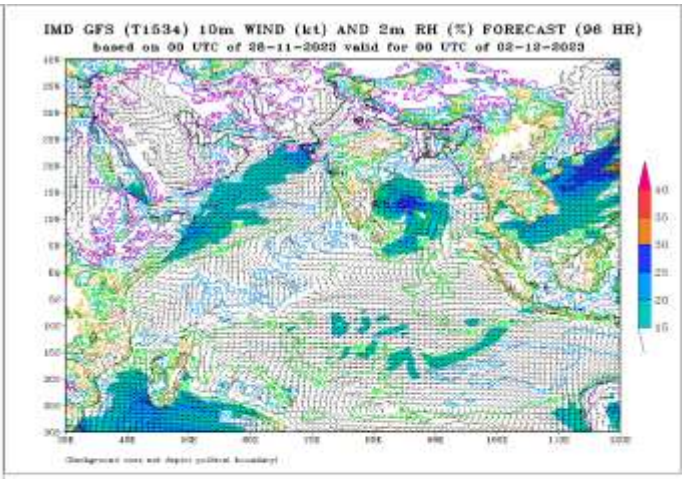
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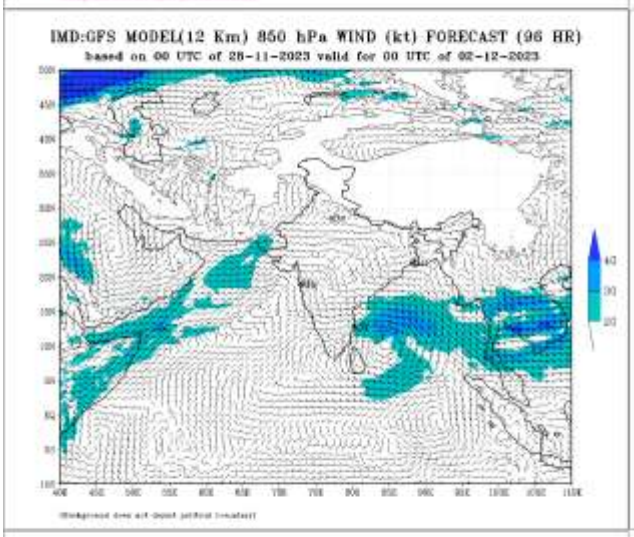
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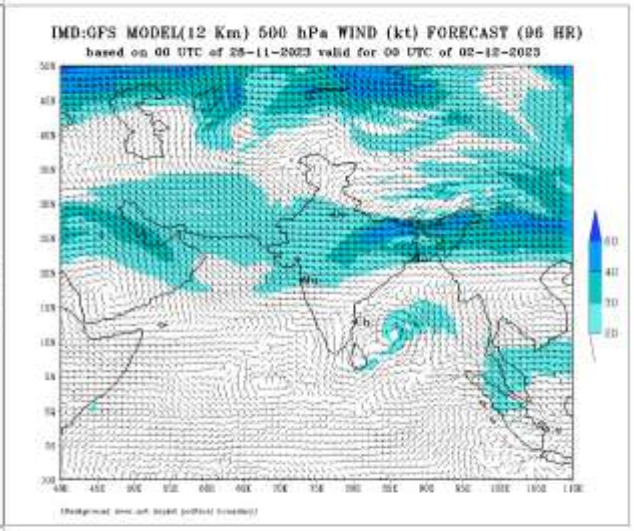
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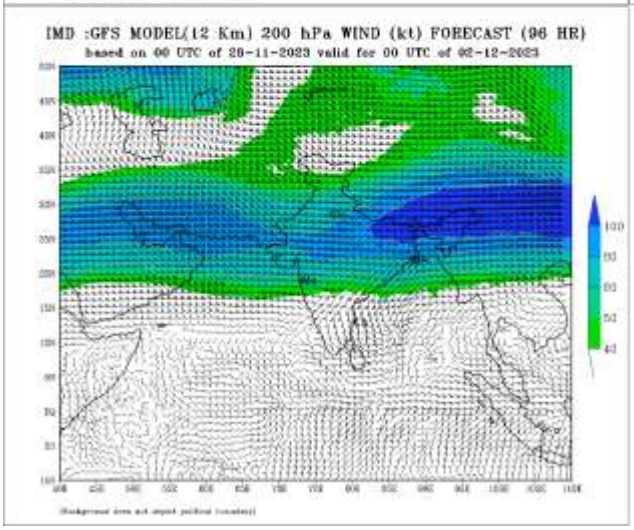
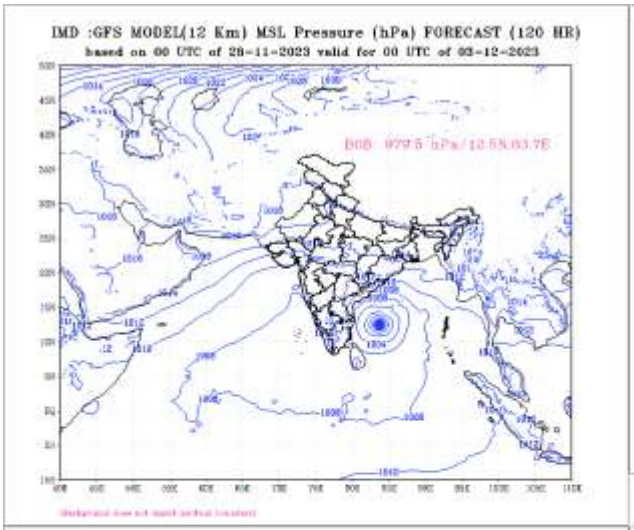
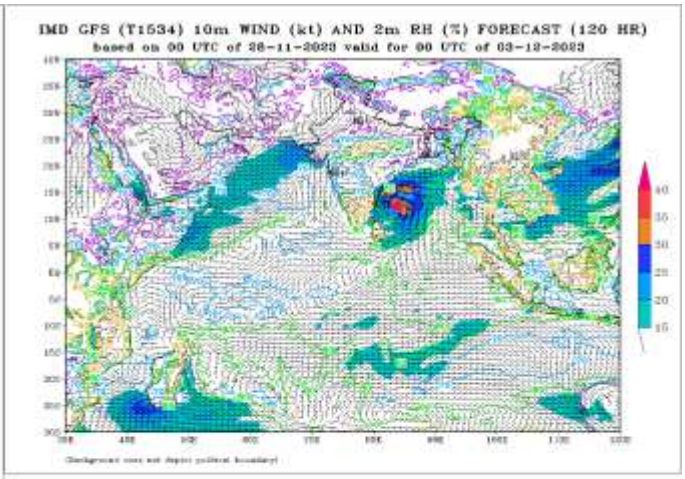
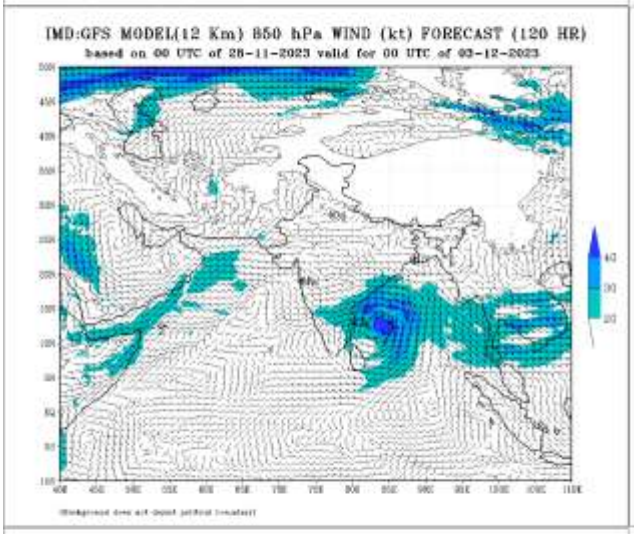
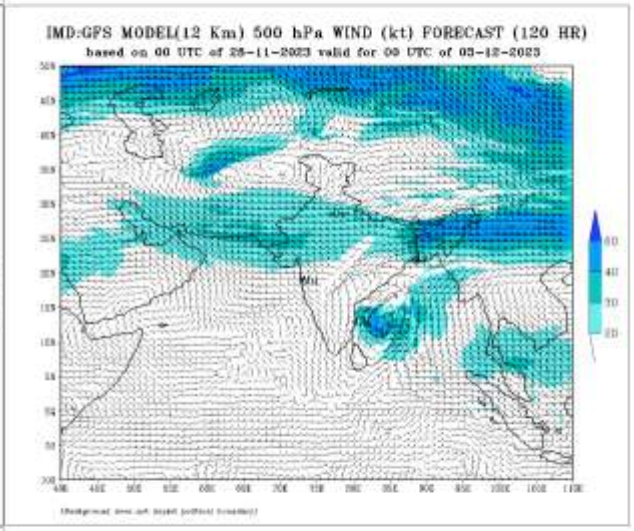
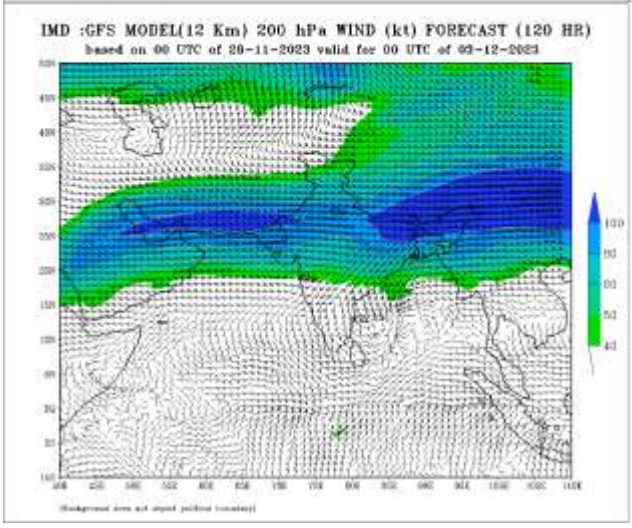

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 02-12-2023

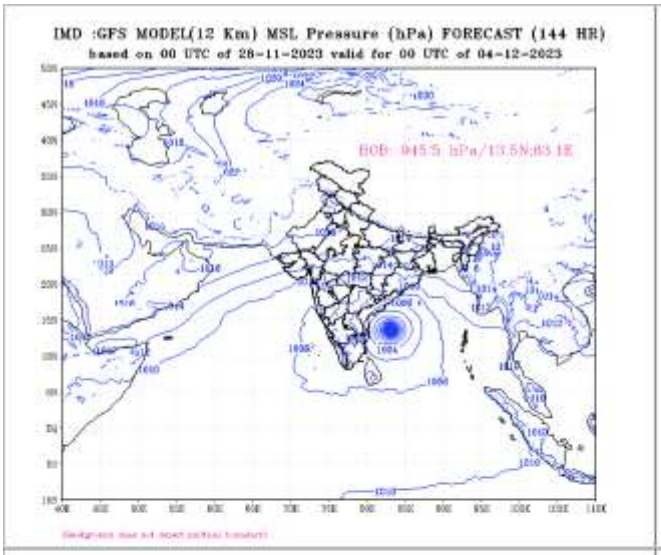

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 03-12-2023
DOB: 979.5 hPa/12.5N,83.7E

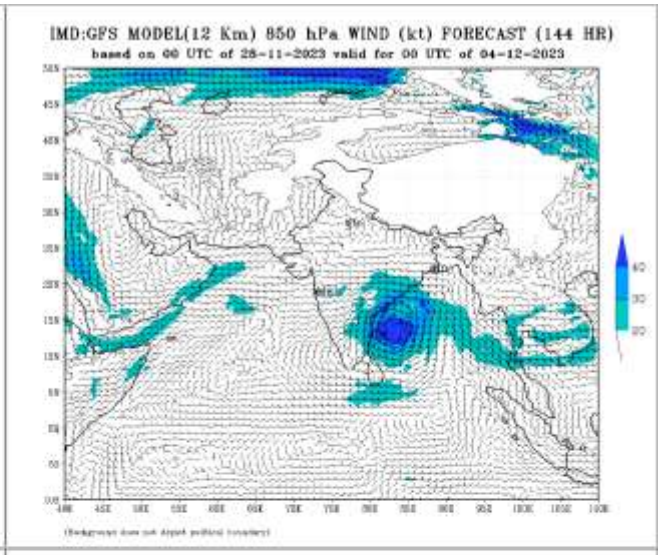

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (120 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 03-12-2023

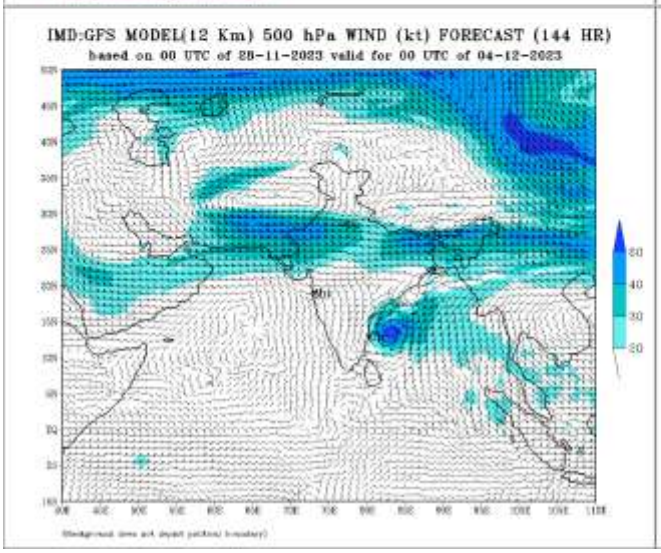

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 03-12-2023

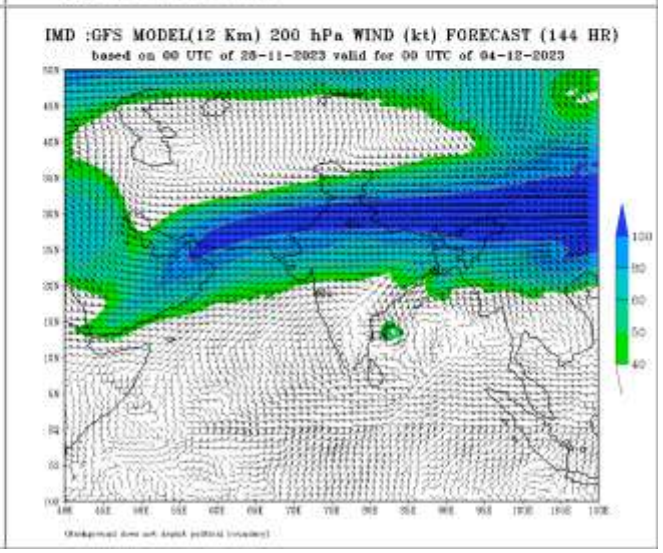

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 03-12-2023

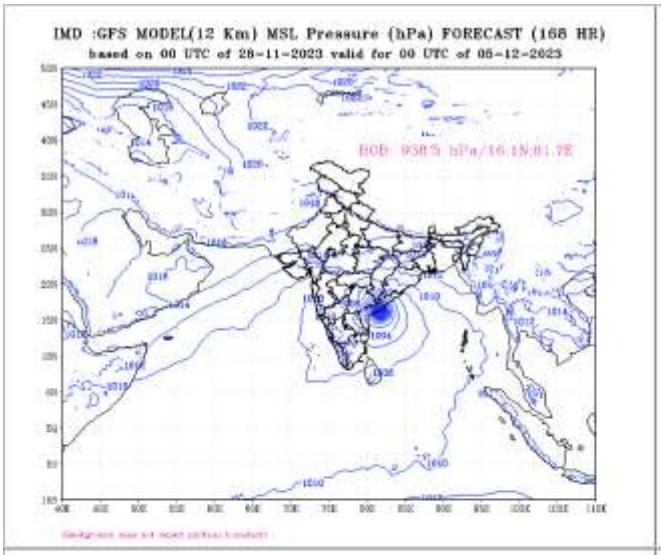

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 03-12-2023

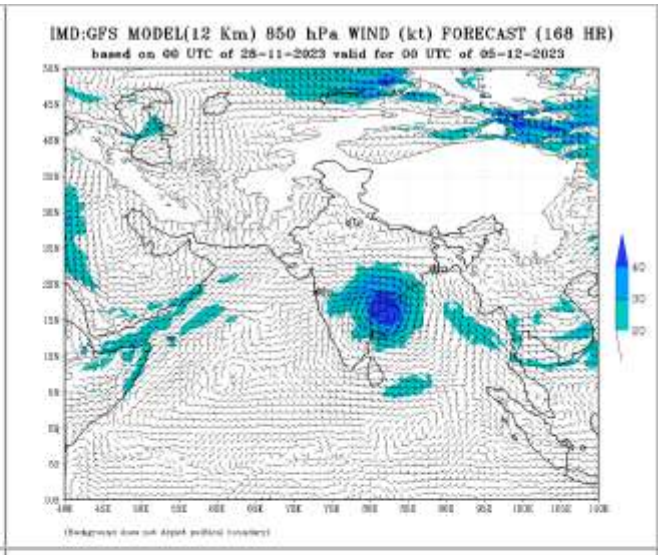

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (144 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 04-12-2023
BOB: 945.5 hPa/13.5N:83.1E

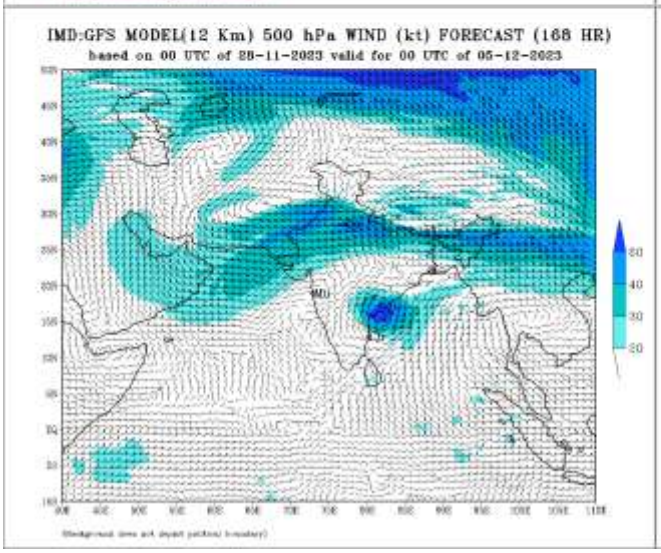

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 04-12-2023

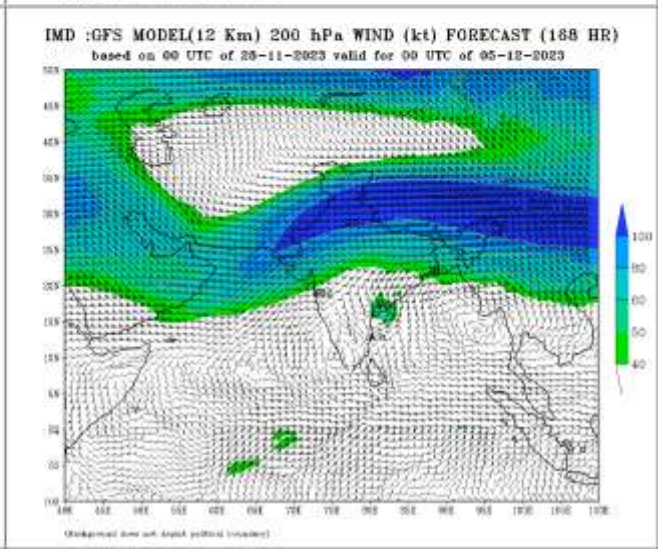

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 04-12-2023


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (144 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 04-12-2023


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (168 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 05-12-2023


IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 05-12-2023


IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 05-12-2023


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (168 HR)
based on 00 UTC of 28-11-2023 valid for 00 UTC of 05-12-2023