



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

**FDP (Cyclone) NOC Report Dated 28<sup>th</sup> November, 2021**

**Time of Issue: 1200 UTC**

**Synoptic features (based on 0900 UTC analysis):**

- ❖ Yesterday's cyclonic circulation over Comorin area & adjoining Sri Lanka coast, extending upto 1.5 km above mean sea level persisted over the same region at 0900 UTC of today, the 28<sup>th</sup> November.
- ❖ A Low Pressure Area (LPA) is likely to form over south Andaman Sea around 30<sup>th</sup> November, 2021. It is likely to become more marked and move west-northwestwards during subsequent 48 hours.

**Dynamical and thermo-dynamical features**

Parameter	Bay of Bengal (BoB)	Arabian Sea (AS)
<b>Sea Surface Temperature (SST) °C</b>	29-31°C over entire BoB region.	28-29°C over eastern parts of AS. 26-27°C over western parts of AS off Somalia, Yemen & Oman coasts.
<b>Tropical Cyclone Heat Potential (TCHP) kJ/cm<sup>2</sup></b>	(a) 120-130 over eastern equatorial Indian Ocean and adjoining south Andaman Sea & southeast BoB. (b) 80-100 over major parts of central & north BoB (c) Less than 50 over southwest BoB to the east of Sri Lanka	(a) 50-60 over eastern parts of central & north AS (b) 60-80 over south AS. (c) It is less than 50 over western parts of AS and along & off Oman, adjoining Yemen & Somalia coasts.
<b>Cyclonic Relative vorticity at 850 hPa (X10<sup>-6</sup>s<sup>-1</sup>)</b>	40-50 over equatorial Indian Ocean to the south of Sri Lanka and Comorin area with vertical extension upto 500 hPa level. 50-60 over southern parts of Gulf of Thailand with vertical extension upto 500 hPa level. Another zone of 40-50 over equatorial Indian Ocean and adjoining south Andaman Sea.	Small pockets of 30-40 over southeast AS and Comorin Area extending upto 500 hPa.
<b>Low Level convergence (X10<sup>-5</sup> s<sup>-1</sup>)</b>	A large extended zone 05-20 over westcentral BoB & adjoining southwest.BoB off Andhra Pradesh coast extending upto south Odisha and north Tamil	A large extended zone of 05-20 off southwest Sri Lanka and adjoining Comorin area extended upto southeast AS off Kerala coast.

	Nadu. Small pocket of 05 over south Andaman Sea, another over southeast & southwest BoB. A large extended zone 05-10 over Equatorial Indian Ocean and adjoining Gulf of Sumatra and Gulf of Thailand.	over southeast AS off Kerala coast. 05 over central parts of south AS.
<b>Upper Level divergence (<math>\times 10^{-5} \text{ s}^{-1}</math>)</b>	A large extended zone of 05-20 over southwest & adjoining westcentral BoB and adjoining Andhra Pradesh-south Odisha & North Tamil Nadu coasts. 10-20 over south BoB and adjoining Andaman Sea equatorial Indian Ocean and also over Gulf of Thailand.	05-10 over eastcentral AS. 05-20 over southeast and adjoining Equatorial Indian Ocean and Comorin Area. 05-10 over southwest AS off Somalia coast.
<b>Vertical Wind Shear (VWS knots)</b>	Low to moderate (05-20) over south & adjoining central BoB, Andaman Sea and adjoining Equatorial Indian Ocean.	Low to moderate (05-20) over Comorin Area and adjoining southeast AS. 05-20 over southeast & adjoining southwest AS.
<b>Wind Shear Tendency (knots)</b>	Decreasing over south BoB and also over adjoining Equatorial Indian Ocean extending upto southern Peninsular region.	Decreasing over southeast AS, Comorin Area & adjoining Equatorial Indian Ocean.
<b>Upper tropospheric Ridge</b>	Along 15.0°N	Along 15.0°N.

### **Satellite observations based on INSAT imagery (0900 UTC):**

#### **(a) Convection over southwest and adjoining westcentral BoB and Comorin Area:**

At 0900 UTC, scattered to broken low & medium clouds with embedded intense to very intense convection lay over southwest and adjoining westcentral BoB off Tamil Nadu-Andhra Pradesh coast. Intense convection over Comorin area, Sri Lanka and neighbourhood. Minimum cloud top temperature is minus 93 deg C.

#### **(b) Bay of Bengal & Andaman Sea:**

At 0900 UTC, scattered to broken low & medium clouds with embedded intense to very intense convection lay over central BoB, south BoB and south Andaman Sea.

#### **(b) Arabian Sea**

At 0900 UTC, scattered to broken low & medium clouds with embedded intense to very intense convection lay over southeast AS and Comorin area. Scattered low & medium clouds with embedded moderate to intense convection lay over central AS and southwest AS.

#### **M.J.O. Index:**

MJO index is currently in Phase 4 with amplitude close to 1. It will remain insame phase during next 1 day. Thereafter, it will move to phase 5 with amplitude remaining close to 1 for subsequent 3 days and further propagate eastwards into Phase 6 from 3<sup>rd</sup> December onwards. Thus, MJO phase is conducive for enhancement of convective activity and hence cyclogenesis during next 5 days.

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

No Storm or Depression prevails over these areas as on today.

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

<b>Model</b>	<b>BoB</b>	<b>AS</b>
<b>IMD-GFS</b>	Indicates an LPA over south China Sea on 28 <sup>th</sup> , over Gulf of Thailand on 29 <sup>th</sup> , as a <b>Depression</b> over east coast of Thailand on 30 <sup>th</sup> , its emergence over <b>south Andaman Sea</b> and intensification into a <b>Cyclonic Storm (CS)</b> at 12 UTC of 30 <sup>th</sup> , its rapid intensification into a Very Severe Cyclonic Storm (VSCS) over Andaman Sea on 1 <sup>st</sup> December, its further intensification into an Extremely Severe Cyclonic Storm (ESCS) and west-northwestward movement over to southeast & adjoining east-central BoB on 2 <sup>nd</sup> December, over west-central BoB off Andhra Pradesh coast on 3 <sup>rd</sup> , crossing north Andhra Pradesh coast with very severe intensity around 1200 UTC of 3 <sup>rd</sup> , weakening and as a Severe Cyclonic Storm (SCS) south Odisha & adjoining north Andhra Pradesh coast on 4 <sup>th</sup> December early morning (00 UTC).	Indicates an extended low over southeast AS off Lakshadweep area on 30 <sup>th</sup> November, getting amplified as a trough in easterlies from southeast to east-central AS on 1 <sup>st</sup> December, from east-central to northeast AS on 2 <sup>nd</sup> and dissipation on 3 <sup>rd</sup> .
<b>IMD-GEFS</b>	Same as above. But shows rapid weakening after crossing north Andhra Pradesh coast, as the system is predicted as a Depression over north coastal Andhra Pradesh at 00 UTC of 4 <sup>th</sup> December. Also the large uncertainty in the forecast intensity continues.	Same as above
<b>IMD-WRF</b>	An LPA over Gulf of Thailand on 30 <sup>th</sup> November and emerging over Andaman Sea & becoming as CS on 1 <sup>st</sup> December (0000 UTC)	An LPA over southeast AS on 30 <sup>th</sup> November and weakens into a broadscale Low over south AS and adjoining Equatorial Indian Ocean (EIO) on 1 <sup>st</sup> December.
<b>NCMRWF-NCUM(Global)</b>	Indicates an LPA over south China Sea & adjoining Gulf of Thailand on 29 <sup>th</sup> , over Gulf of Thailand on 30 <sup>th</sup> November, over south Andaman Sea and adjoining Thailand on 1 <sup>st</sup> December, as a Well Marked Low (WML) over south Andaman Sea on 2 <sup>nd</sup> , as a Depression over west-central & adjoining southwest BoB on 3 <sup>rd</sup> , as a CS over west-central BoB off Andhra Pradesh coast on 4 <sup>th</sup> and as a CS very close to north Andhra Pradesh coast at 00 UTC of 5 <sup>th</sup> .	An LPA over Lakshadweep area off Kerala coast on 29 <sup>th</sup> , over southeast AS & adjoining Lakshadweep area on 30 <sup>th</sup> November, as a broad-scale low over southeast & adjoining east-central AS on 1 <sup>st</sup> & 2 <sup>nd</sup> December and further weakening on 3 <sup>rd</sup> .
<b>NCMRWF-NEPS</b>	Similar to NCUM-G	Similar to NCUM-G
<b>NCMRWF-UM (Regional)</b>	Similar to NCUM-G upto 1 <sup>st</sup> December.	Similar to NCUM-G upto 1 <sup>st</sup> December.
<b>ECMWF</b>	An LPA over south Andaman Sea off Thailand coast on 1 <sup>st</sup> December, as a WML over southeast BoB and adjoining Andaman Sea on	Indicates an feeble Low over southeast AS on 29 <sup>th</sup> November, an

	2 <sup>nd</sup> , as a Depression over southwest & adjoining west-central BoB on 3 <sup>rd</sup> , as a Deep Depression (DD) over west-central BoB off south Andhra Pradesh coast at 1800 UTC of 3 <sup>rd</sup> , as a CS over west-central BoB off Andhra Pradesh coast at 00 UTC of 4 <sup>th</sup> and crossing Andhra Pradesh coast as a DD at 1200 UTC of 4 <sup>th</sup> .	extended low over southeast & adjoining east-central AS on 30 <sup>th</sup> November, its extension upto northeast AS with an embedded Low over the region off south Gujarat – north Maharashtra coasts on 1 <sup>st</sup> & 2 <sup>nd</sup> December and weakening on 3 <sup>rd</sup> .
<b>ECMWF-EPS</b>	10-20 % probability of cyclogenesis / strike over south Andaman Sea on 1 <sup>st</sup> & 2 <sup>nd</sup> December, over Andaman Sea & also over west-central BoB off Andhra Pradesh coast on 3 <sup>rd</sup> and 20-30 % over north Andhra Pradesh coast on 4 <sup>th</sup> .	50-60% genesis & strike probability over northeast AS on 1 <sup>st</sup> December, 60-70% over northeast AS on 2 <sup>nd</sup> & 3 <sup>rd</sup> and 20-30 % over northeast AS and adjoining north Maharashtra- south Gujarat coasts on 4 <sup>th</sup> .
<b>NCEP-GFS</b>	Indicates an extended Low over Gulf of Thailand on 29 <sup>th</sup> , over south Andaman Sea & adjoining Thailand on 30 <sup>th</sup> November, as a Depression over Andaman & Nicobar Islands on 1 <sup>st</sup> Dec., as a CS over southeast BoB on 2 <sup>nd</sup> December, as an SCS over west-central BoB on 3 <sup>rd</sup> , and as a DD, after crossing north coastal Andhra Pradesh over north coastal Andhra Pradesh & adjoining south coastal Odisha on 4 <sup>th</sup> .	Indicates an extended Low over Lakshadweep area & adjoining southeast AS on 29 <sup>th</sup> & 30 <sup>th</sup> Nov., as a trough of Low from southeast to east-central AS on 1 <sup>st</sup> December, from east-central to northeast AS on 2 <sup>nd</sup> and weakening on 3 <sup>rd</sup> .
<b>IMD-GPP</b>	Potential zone (very small) one each over equatorial Indian Ocean off Sumatra coast and Malacca strait on 28 <sup>th</sup> , over EIO and adjoining south Andaman Sea off Sumatra coast on 29 <sup>th</sup> , over Gulf of Thailand on 30 <sup>th</sup> November, over Andaman Sea & adjoining Islands on 1 <sup>st</sup> December, over southeast & adjoining east-central BoB on 2 <sup>nd</sup> , over west-central BoB on 3 <sup>rd</sup> and over west-central BoB off north Andhra Pradesh – south Odisha coasts on 4 <sup>th</sup> .	Potential zone over southeast AS and adjoining Lakshadweep area on 30 <sup>th</sup> November, and elongated zone over east-central AS on 1 <sup>st</sup> December and NIL thereafter.

**GPP- Genesis Potential Parameter based on Dynamical Statistical model developed by IMD.**

### Summary and Conclusion:

- 1. For the Bay of Bengal:** All the models indicate formation of a Low Pressure Area (emergence of a Low Pressure system from Gulf of Thailand) over south Andaman Sea around 30<sup>th</sup> with initial west-northwestward movement, deepening into a Depression around 3<sup>rd</sup> December, and continued west-northwestward movement towards west-central Bay of Bengal. However, GFS group of models are indicating cyclogenesis around 2<sup>nd</sup> (IMD GFS, even prior to that). All of them also indicate further intensification of this system into a cyclonic storm during the subsequent 24-48 hours time span and crossing north / central coast of Andhra Pradesh. However, still there is large diversity in the temporal phase of

intensification as well as the speed of movement. The timing varies from 1200 UTC of 30<sup>th</sup> November (as in IMD GFS) to 0300 UTC of 3<sup>rd</sup> December (as in ECMWF). Location of formation of Depression also vary from south Andaman Sea (IMD GFS) to west-central BoB (NCUM & ECMWF). Peak intensity ranges from a CS (by NCUM & NEPS) to ESCS (IMD GFS). Land fall point, however is mainly confined to north coastal Andhra Pradesh (16.5 N – 18.5 N) and the time of landfall widely varies from 1200 UTC of 3<sup>rd</sup> (IMD GFS) till 0100 UTC of 5<sup>th</sup> (NCUM & NEPS).

2. **For the Arabian Sea:** No cyclogenesis is indicated buy any of the models during next 7 days.

**It may thus be concluded that,**

1. Emergence of a Low pressure system from Gulf of Thailand into south Andaman Sea is likely around 30<sup>th</sup> November. It is likely to move west-northwestwards with gradual intensification during 1<sup>st</sup> & 2<sup>nd</sup> December. Further it could continue to move west-northwestwards and concentrate into a Depression over west-central & adjoining southwest Bay of Bengal on 3<sup>rd</sup> December. Owing to the temporal variation in the period of formation of the Depression by different models, we are assigning a 'LOW' probability starting from the 72-96 hrs forecast period itself.
2. No significant development is likely over the Arabian Sea, apart from the probable amplification of a trough of Low along the west coast of India & an in-phase interaction with a mid-latitude trough in the mid & upper tropospheric westerlies during 1<sup>st</sup> – 2<sup>nd</sup> December.

**Probability of cyclogenesis (formation of depression and above intensity systems) over the 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	NIL	NIL	LOW	MODERATE	HIGH	HIGH

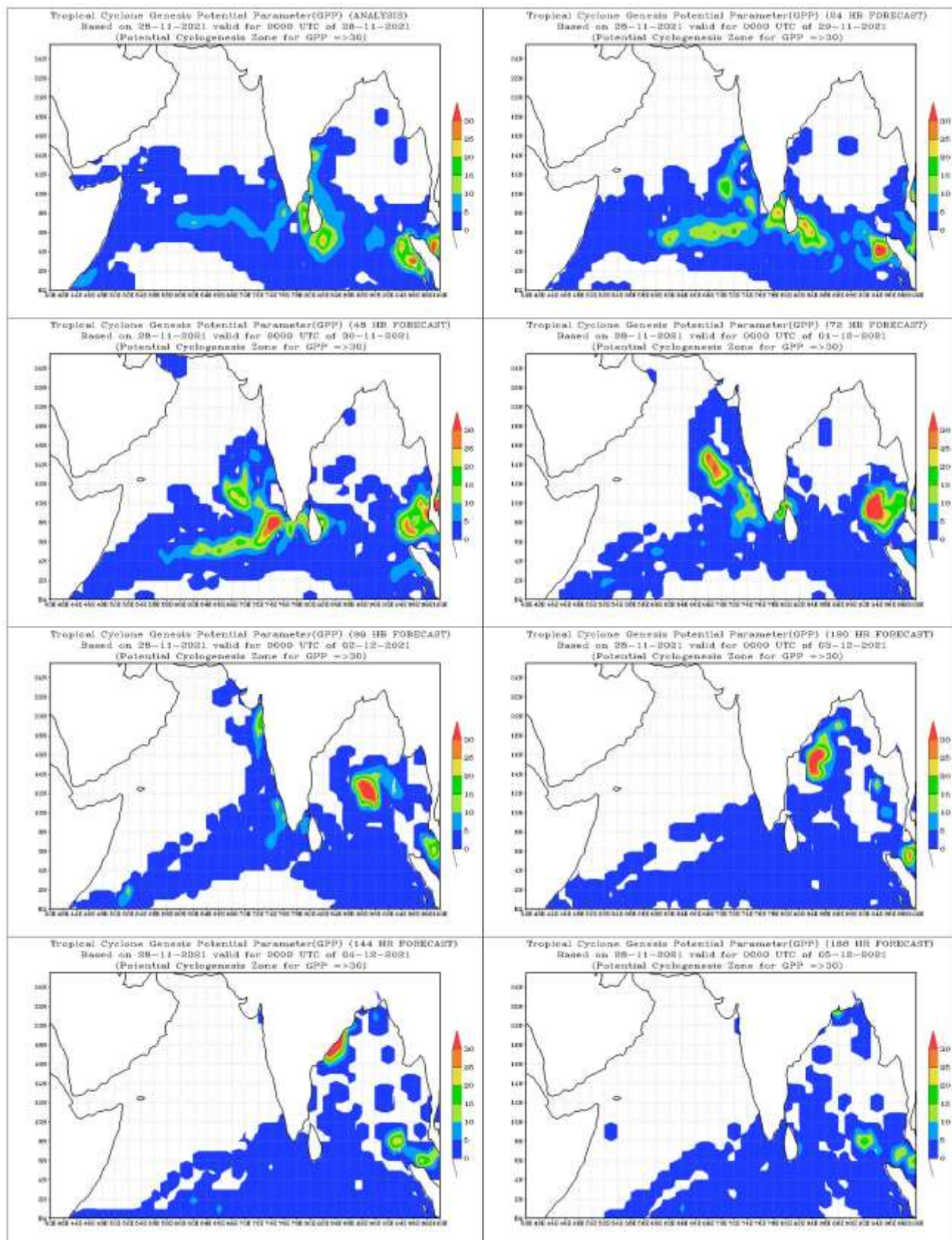
**Probability of cyclogenesis (formation of depression and above intensity systems) over the Arabian Sea during next 168 hours:**

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

**Advisory:** The emergence of a Low pressure system from Gulf of Thailand to Andaman Sea as a Low pressure area around 30<sup>th</sup> November and it's subsequent intensification and movement to be monitored regularly.

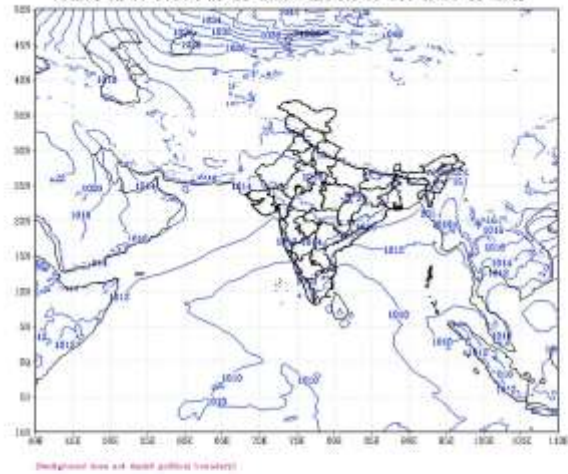
**IOP is suggested for Andaman & Nicobar Islands on 30<sup>th</sup> November & 1<sup>st</sup> December.**





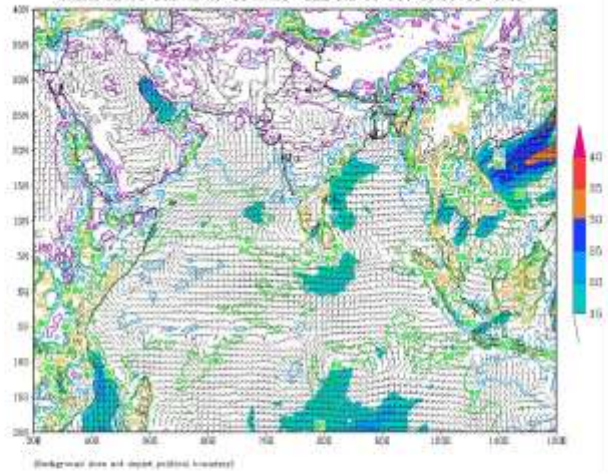


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (00 HR)  
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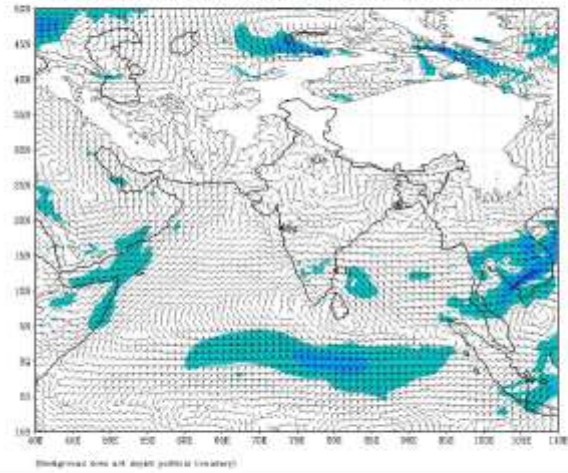
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IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (00 HR)  
based on 00 UTC of 28-11-2021 valid for 00 UTC of 28-11-2021



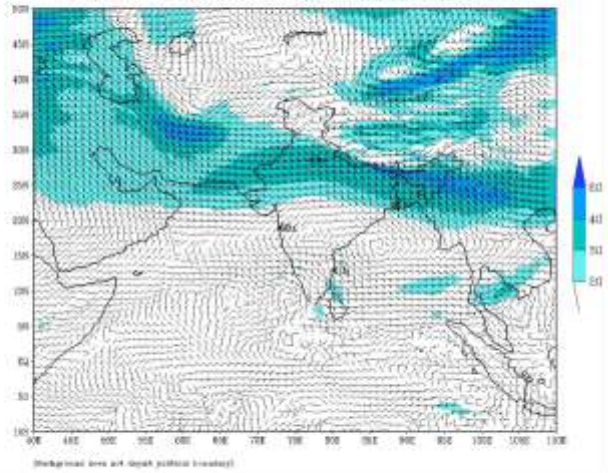
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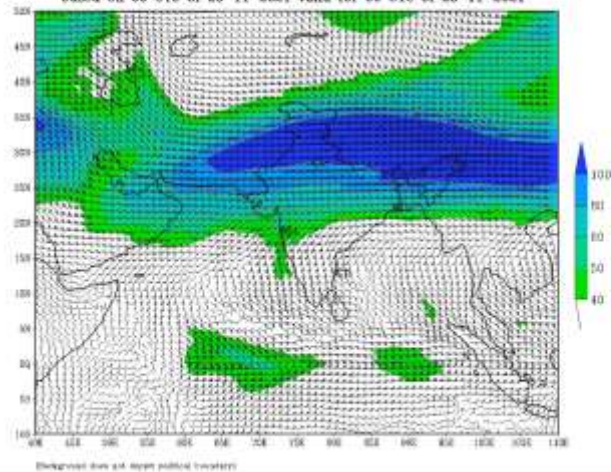
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IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (00 HR)  
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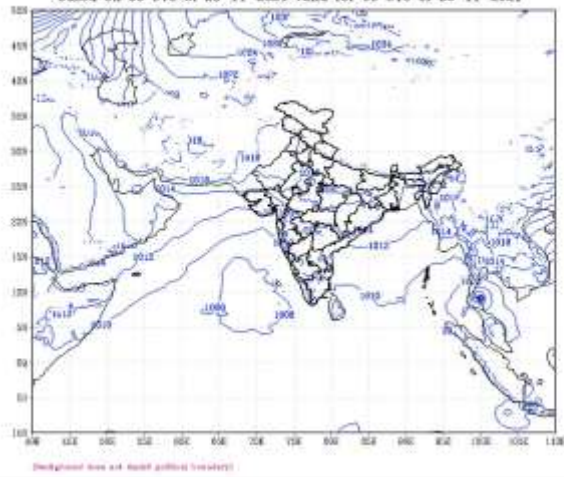
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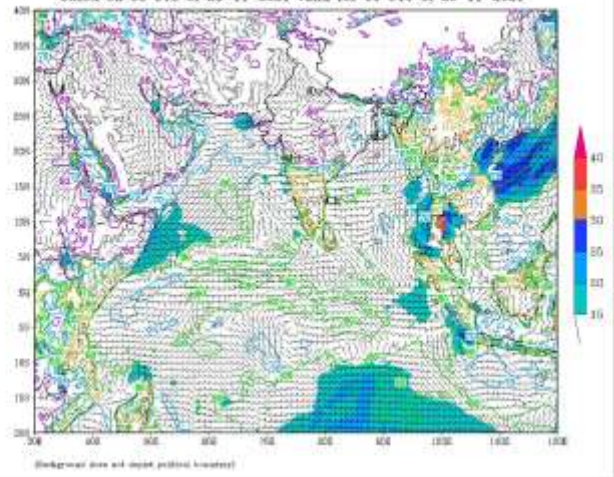




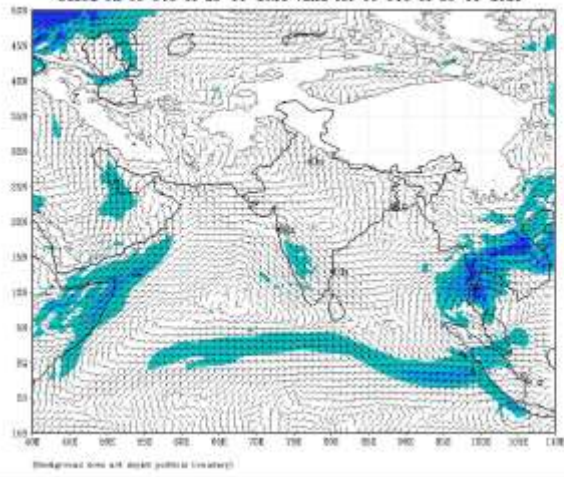
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (48 HR)  
based on 00 UTC of 28-11-2021 valid for 00 UTC of 30-11-2021



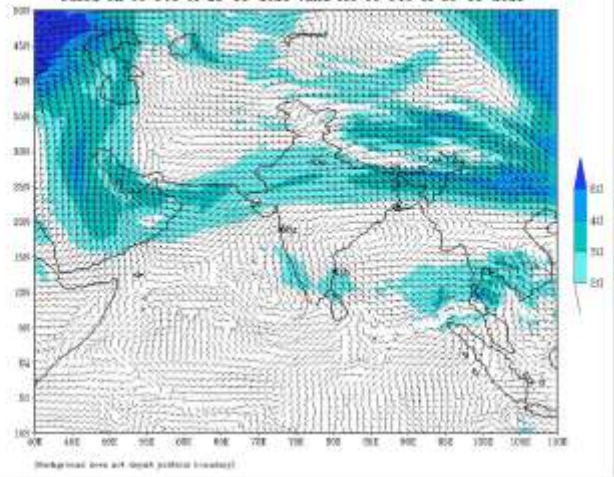
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (48 HR)  
based on 00 UTC of 28-11-2021 valid for 00 UTC of 30-11-2021



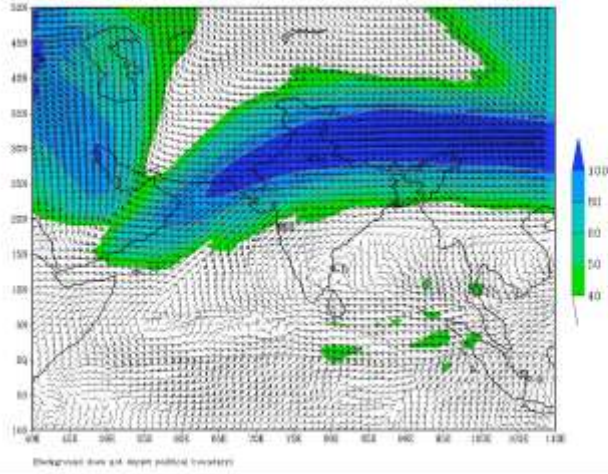
IMD-GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (48 HR)  
based on 00 UTC of 28-11-2021 valid for 00 UTC of 30-11-2021



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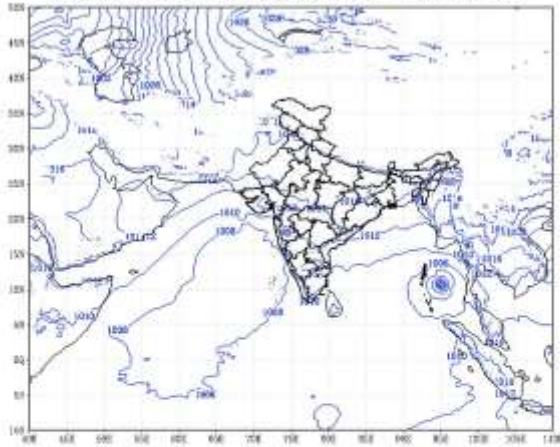


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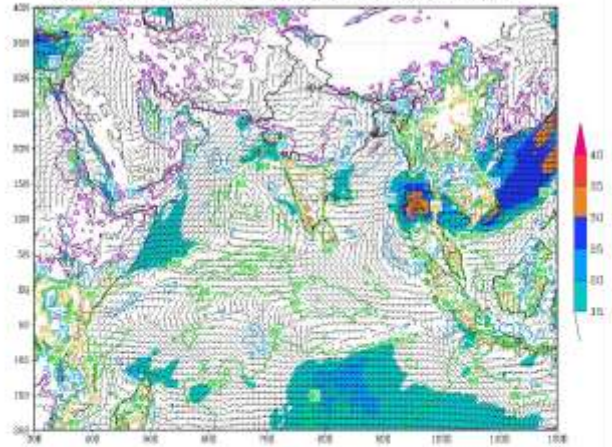


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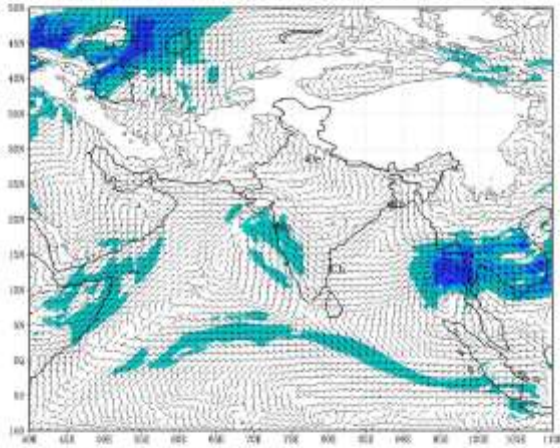
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IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (72 HR)  
 based on 00 UTC of 28-11-2021 valid for 00 UTC of 01-12-2021



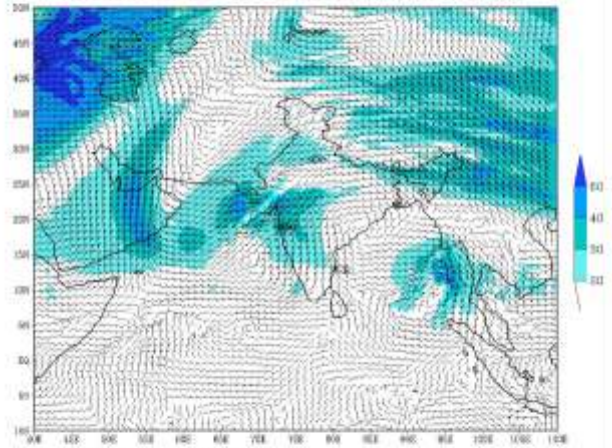
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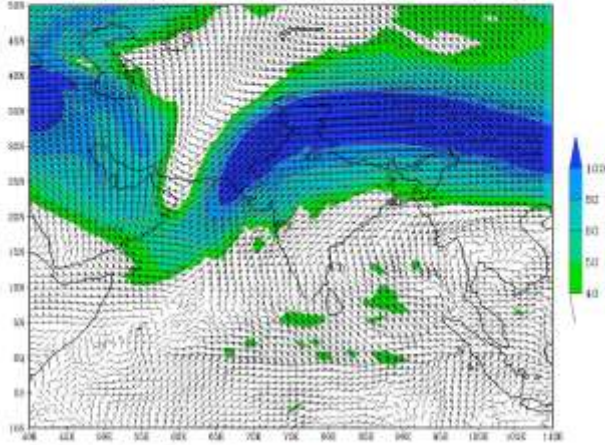
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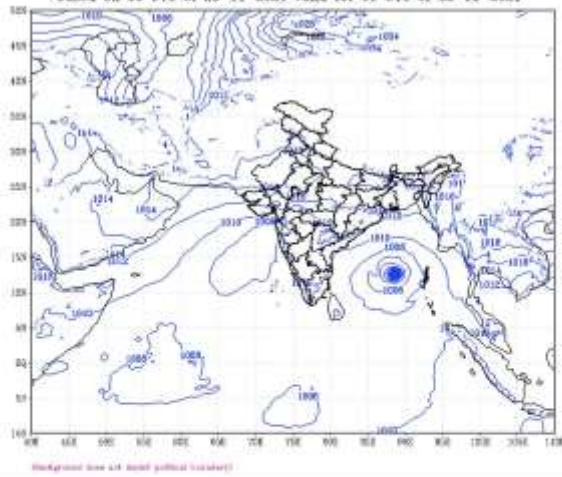
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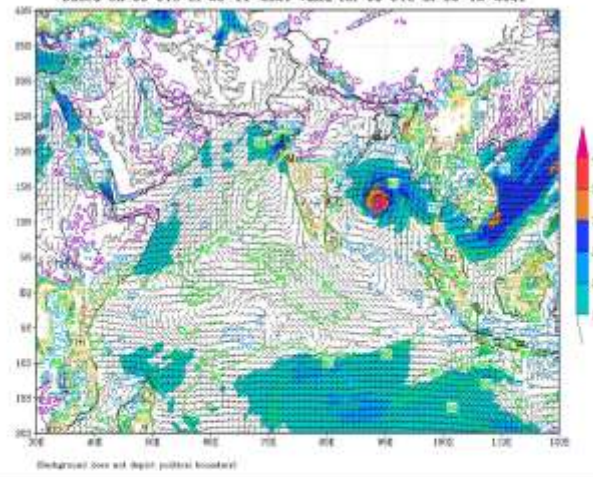
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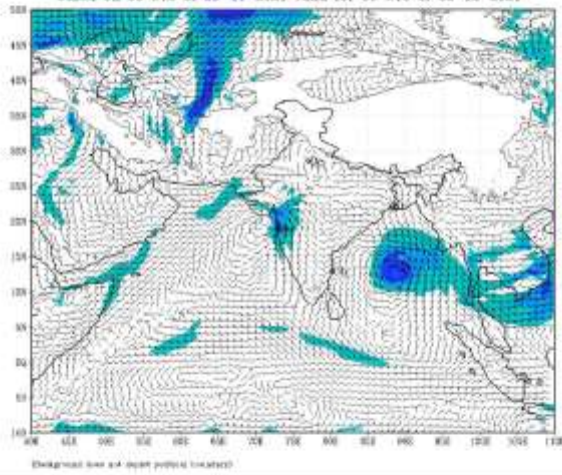
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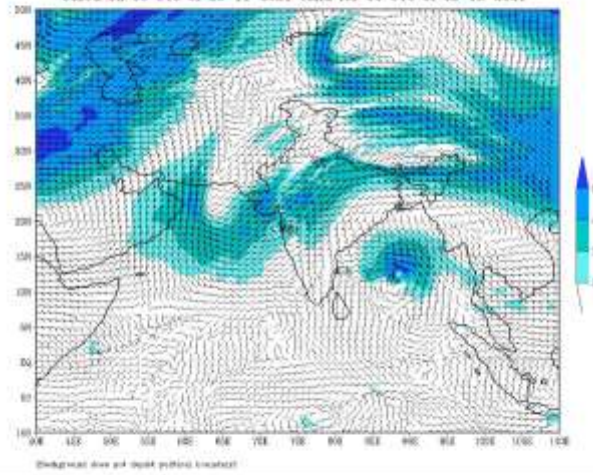
IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (96 HR)  
based on 00 UTC of 28-11-2021 valid for 00 UTC of 02-12-2021



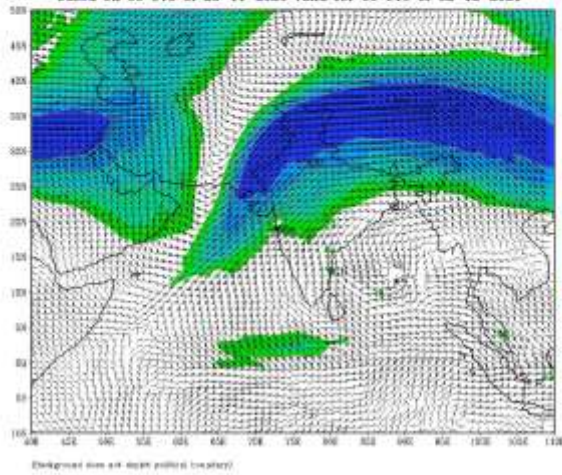
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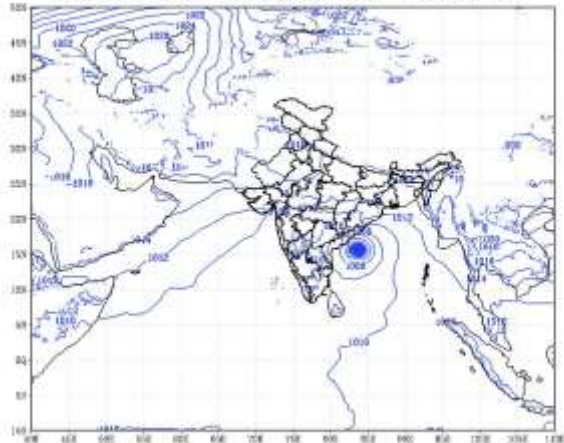


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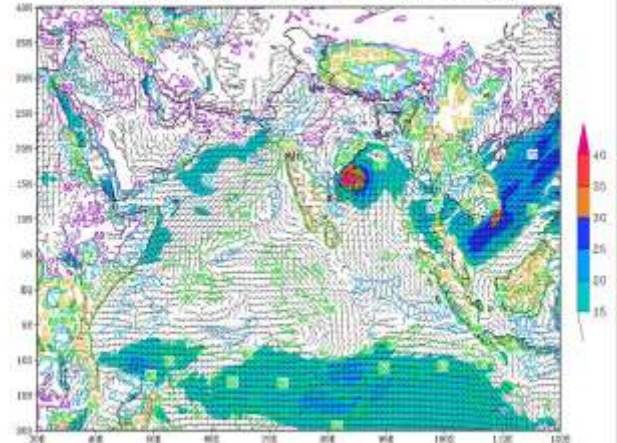


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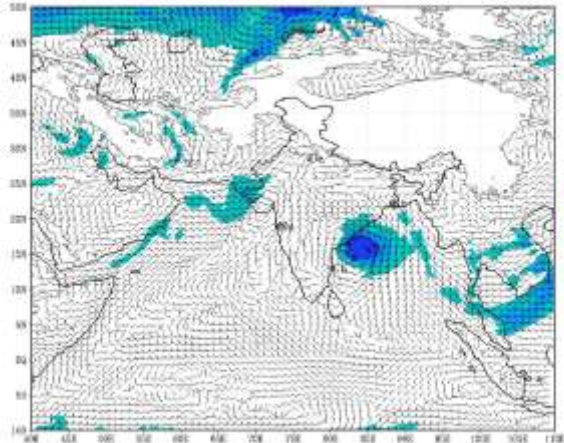
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IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (120 HR)  
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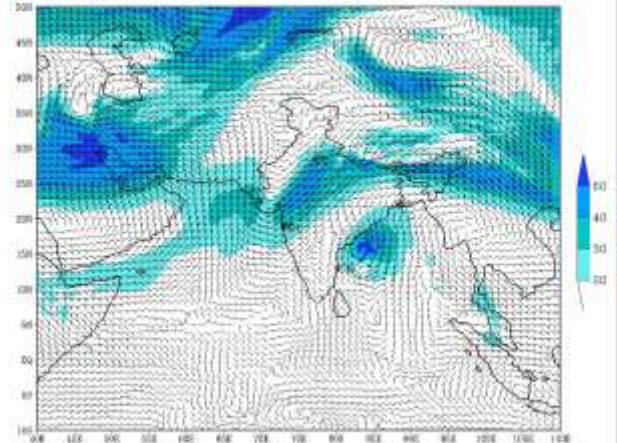
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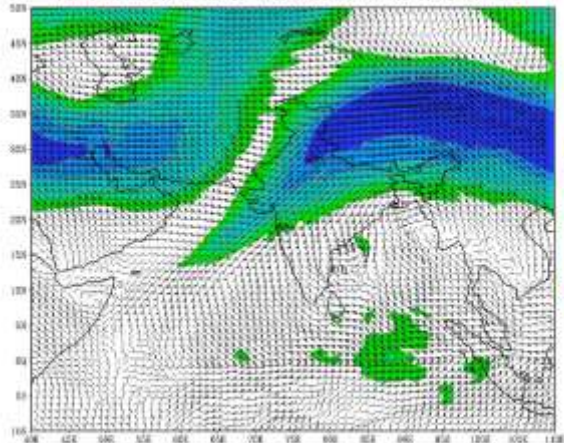
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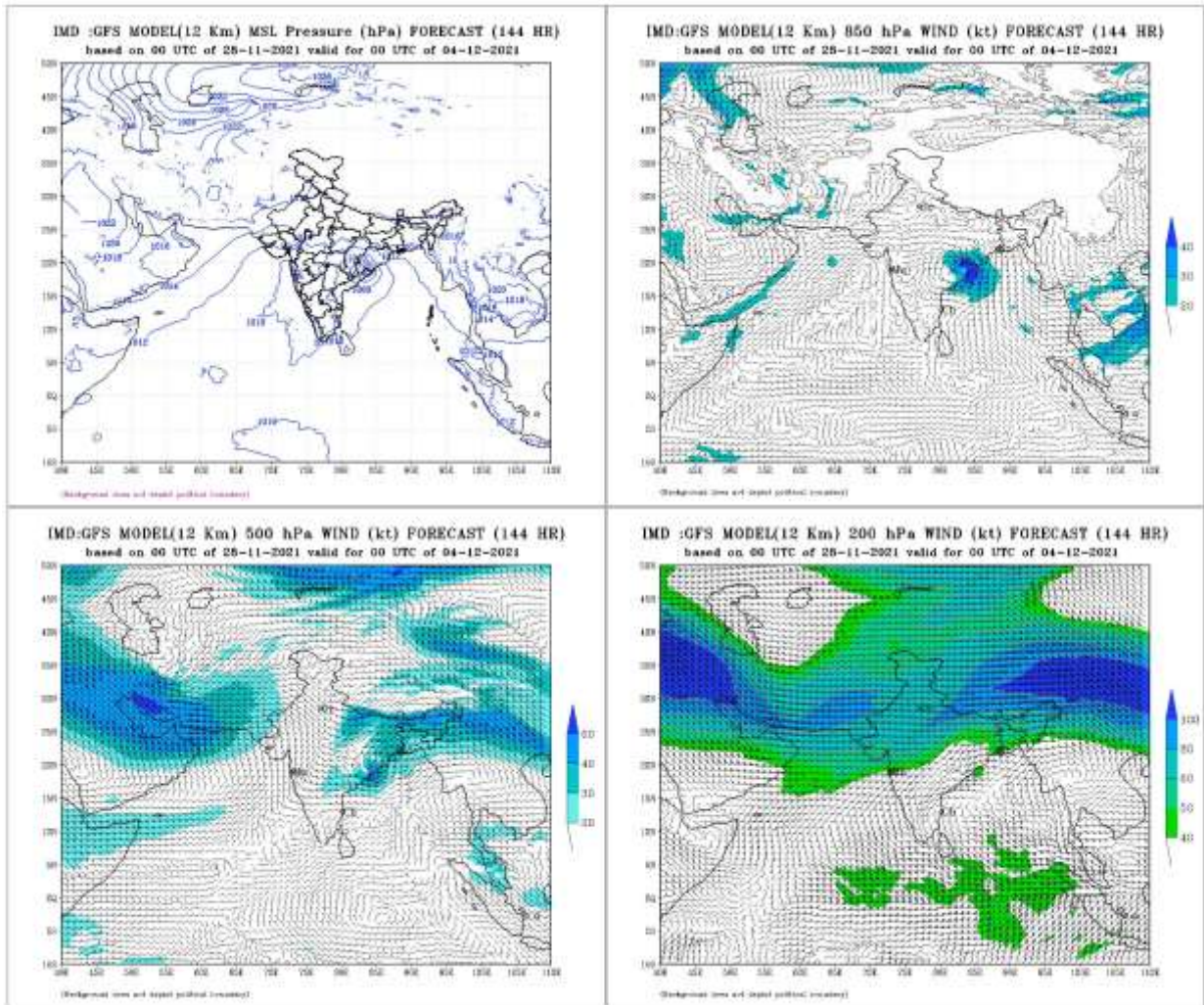


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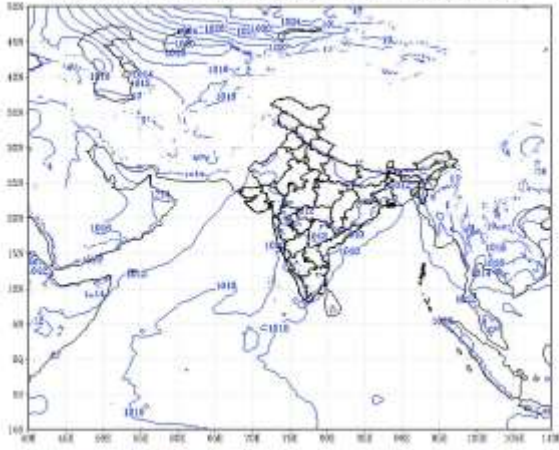


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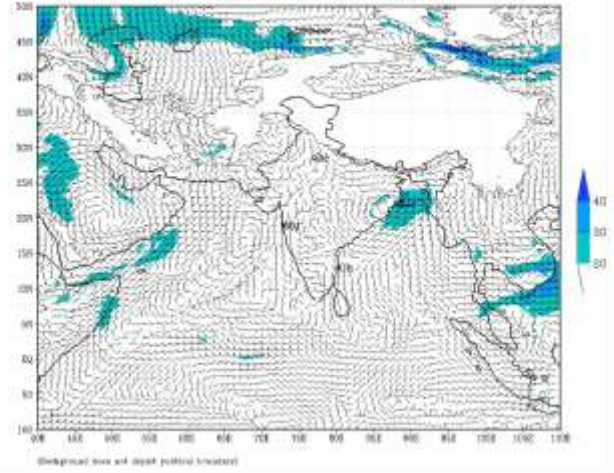




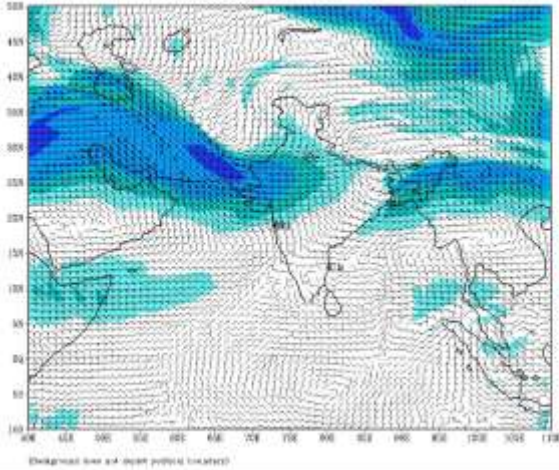
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IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (168 HR)  
based on 00 UTC of 28-11-2021 valid for 00 UTC of 05-12-2021



IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (168 HR)  
based on 00 UTC of 28-11-2021 valid for 00 UTC of 05-12-2021



IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (168 HR)  
based on 00 UTC of 28-11-2021 valid for 00 UTC of 05-12-2021

