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

FDP (Cyclone) NOC Report Dated 01st November, 2019

Time of Issue: 1200 UTC

Synoptic features:

- The Cyclonic Storm 'Kyarr' over westcentral Arabian Sea moved west-southwestwards and weakened into a Deep Depression at 1500 UTC of 31st October, 2019 and into a Depression at 0000UTC of 01st November, 2019. It lay centred at 0600 UTC of the 01st November, 2019 over westcentral Arabian Sea near latitude 16.0°N and longitude 58.7°E, about 1530 km west-southwest of Mumbai (Maharashtra), 510 km east-northeast of Salalah (Oman) and 510 km south-southeast of Masirah (Oman). It is very likely to move southwestwards across westcentral Arabian Sea and weaken into a Well Marked Low Pressure Area during next 12 hours

- Yesterday's **Severe Cyclonic Storm MAHA** (**Pronounced as M'maha**) over eastcentral Arabian Sea and adjoining Lakshadweep northwestwards and lay centered at 0600 UTC of 01st November, 2019 over eastcentral Arabian Sea near latitude 15.2°N and longitude 70.5°E, about 640 km south of Veraval (Gujarat), 530 km north-northwest of Mangaluru (Karnataka) and 350 km west-southwest of Goa. It is very likely to move northwestwards during next 24 hours, west-northwestwards during 02nd to 04th November and recurve east-northeastwards towards south Gujarat coast thereafter. It is very likely to intensify into a very severe cyclonic storm over eastcentral Arabian Sea during next 24 hours.
- A cyclonic circulation lies over Gulf of Thailand & neighbourhood and extends upto 5.8 Km above mean sea level. Under its influence, a Low Pressure Area is likely to form over north Andaman Sea on 03rd November. It is very likely to move west-northwestwards and concentrate into a Depression over eastcentral Bay of Bengal during subsequent 48 hours.

Dynamical and thermodynamical features

Sea Surface Temperature (SST):

Sea Surface Temperature is around 26-28°C over the depression area. SST is around 28-30°C over the area of SCS Maha and is decreasing in the forecast direction of movement.

SST is 28 - 30ºC over most parts of the BOB.

Tropical Cyclone Heat Potential (TCHP):

Tropical Cyclone Heat Potential (TCHP) over westcentral Arabian Sea is 20-40 kJ/cm^2 while to the east of the system center over eastcentral Arabian Sea, it is 50-80 kJ/cm^2. It is around 70-90 kJ/cm^2 over the area of SCS Maha and decreases in the forecast direction of the system.
TCHP is 120-130 kJ/cm^2 over small areas in southwest BOB and 80-100 kJ/cm^2 over the rest of the BOB.

Relative Vorticity:

An area of cyclonic relative vorticity at 850 hPa of value 100 X10^{-6}s-1 is seen to the southwest of the centre of the Depression. Cyclonic relative vorticity at 850 hPa of 150 X10^{-6}s-1 is seen to the southwest of the centre of SCS Maha.

Low level Convergence:

Lower level convergence is about 5 x 10^{-5}s^{-1} over the Depression area.
Lower level convergence of about 20 x 10^{-5}s^{-1} to the northeast of the centre of SCS Maha.

Upper level Divergence:

Upper level divergence of value 10x10^{-5} s-1 is seen to the southeast of the centre of Depression and of value 30 x10^{-5} s-1 is seen to the southwest of the centre of SCS Maha.

Wind Shear:

Wind shear is low (05-10 knots) over the area of Depression and also over the area of SCS Maha.

Wind shear is low to moderate over most parts of BOB and Andaman Sea. It is high over extreme north and south BoB.

Wind Shear Tendency:
The wind shear tendency is positive or neutral over most parts of southwest and central AS. It is positive over southwest BOB and north Andaman Sea.

Upper tropospheric ridge:
The upper tropospheric ridge at 200 hPa runs roughly along 17°N over the region of the SCS Maha.

Satellite observations based on INSAT imagery:

Arabian Sea:-

As per the satellite imagery at 0900 UTC of 01st November, 2019, the current intensity of the depression over westcentral Arabian Sea is T 1.0/CI 1.5. Associated broken low to medium clouds with embedded intense to very intense convection lies over westcentral Arabian Sea between Lat 12.0^{0}N to 16.5^{0}N and Long 56^{0}E to 60.5^{0}E. The minimum CTT is minus 93^{0}C.

As per the satellite imagery at 0900 UTC of 01st November, 2019, the current intensity of the system (SCS Maha) is T 3.5. Associated scattered low to medium clouds with embedded intense to very intense convection lies over southeast adjoining eastcentral Arabian Sea between Lat 12.5^{0}N to 16.0^{0}N and Long 67.0^{0}E to72.0^{0}E. The minimum CTT is minus 93^{0}C.z

Bay of Bengal & Andaman Sea:-

According to 0900 UTC satellite imagery, scattered low/medium clouds with embedded intense convection prevails over south BOB and south Andaman Sea and south Arakan coast.

Large scale features

M.J.O. Index:
MJO index is in Phase 5 with amplitude close to 1. It is likely to remain there for next 3-4 days and enter into phase 6.

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

NWP Input for FDP Cyclone based on 0000 UTC of today

IMD-GFS T-1534

(i) Indicates: DD over west central close to Oman coast on 1st November, becomes a Depression on 2nd November and a WML near Gulf of Aden on 3rd November which becomes less marked by 4th November.

(ii) Indicates: The VSCS over SE Arabian Sea on 1st November further intensify while moving north-northwestwards to reach westcentral BoB till 5th November. Thereafter it is seen to move in a northeast direction to cross Gujarat coast on 7th as a ESCS and becomes less marked thereafter.

(iii) Another LOPAR form on 3rd November over north Andaman Sea and adjoining EC BoB, which becomes a depression on 9th and moving in a northwest direction intensifies to reach westcentral BoB on 11th as a CS.

IMD-GEFS

(i) Indicates: D over westcentral AS on 2nd November, weakens into WML over the same region on 3rd and becomes less marked subsequently.

(ii) Indicates: CS over EC Arabian Sea on 02nd November is seen to move north-northwestward while intensifying slightly till 5th November recurves in a northeastward to reach close to Gujarat coast as a CS on 7th.

(iii) Another LOPAR forms on 4th November over north Andaman Sea and adjoining EC BoB which becomes a Depression over EC BoB on 8th and a DD on 9th November.

IMD-WRF

(i) Indicates: The DD over west-central AS on 01st November which moves in a west-southwestward direction till 04th.

(ii) The SCS over EC Arabian Sea on 01st November moves in a NNW direction till 4th November to reach central Arabian Sea.

(iii) Another LOPAR seen over eastcentral BoB on 4th November.

NCMRWF-NCUM:

(i) Indicates: The depression over west central AS close to Oman coast on 01st November weakens while moving west-southwestwards and becomes less marked.

(ii) Indicates: The CS over SE Arabian Sea is seen to move in a west-northwest direction with intensification to reach WC Arabian Sea on 5th November. It is then seen to recurve from 6th November onwards in a northeast direction to reach south Gujarat coast on 7th.

(iii) Shows formation of another LOPAR over southeast BOB and adjoining Andaman Sea on 5th November which becomes a depression on 7th over eastcentral BoB. Thereafter it is seen to move in a north-northeastward direction and further intensify to reach Bangladesh coast as a ESCS on 10th November.

NCMRWF-UM-Regional Model:

(i) Indicates: CS on 01st November over SE Arabian Sea intensifies further while moving northwestwards till 04th November over central Arabian Sea.

(ii) Another LOPAR forms over north Andaman Sea and adjoining EC BoB on 4th November.

NEPS Model:

(iii) Indicates: The DD on 01st November, weakens and becomes less marked on 03rd while moving west-southwestwards.

(iv) Indicates: The CS over SE Arabian Sea on 01st November while moving in a north-northwest direction becomes VSCS over WC Arabian Sea. Further on 6th it is seen to recurve in a northeast direction from 6th onwards to reach south Gujarat coast on 7th.

(v) Another LOPAR seen to form over north Andaman Sea on 3rd which becomes a D over EC BoB on 5th, CS on 7th, and a ESCS on 9th November near Odisha- West Bengal coasts.

ECMWF:

(i)Indicates : The D over west-central AS close to Oman coast on 01st November, which is seen to move in a southwestward direction and becomes unimportant by 3rd November.

(ii) Indicates: CS over eastcentral moves north-northwestward with intensification till 05th November to reach western parts of EC Arabian Sea and adjoining northeast AS. It then recurves and moves north-northeastwards from 6th and crosses south Gujrat coast on 7th.

(iv) Another LOPAR is seen over EC BoB on 06th, which becomes a Depression 8th which moves west-northwestward to reach south Odisha coast as a CS on 10th.

NCEP-GFS:

(i) Indicates D on 1st November over west central AS, which becomes insignificant thereafter.

(ii) Indicates: CS on 01st November over SE Arabian Sea intensifies into SCS/VSCS over WC Arabian Sea on 5th and starts recurving towards north-northeast direction to cross south Gujrat coast on 7th November.

(iii) Another LOPAR forms over EC BoB on 5th which becomes a Depression on 07th, DD on 8th and a CS on 9th. It is seen to intensify to SCS over WC BoB on 10th.

ARP-Meteo France : NIL

Dynamical statistical models

IMD Genesis Potential Parameter (GPP):

(i) Significant zone of GPP seen over east-central AS on 1st November moves northwestward till 5th and is seen to move in a northeast direction on 6th, becomes less marked on 7th November.

(ii) Another significant zone of GPP seen over EC BoB on 6th November, seen to move in north-northwest direction till 8th November.

IMD NWP products are available at:
http://nwp.imd.gov.in/bias/gfsproducts.php
http://nwp.imd.gov.in/bias/wrf27pro.php
http://www.rsmcnewdelhi.imd.gov.in/NWP_CYC/Analysis.htm or
http://www.rsmcnewdelhi.imd.gov.in/NWP_CYC/<HH> hrs.htm
<HH> are forecast hours i.e. 24, 48, 72 and etc.

Summary and Conclusion:

(A) All the environmental, dynamic and thermodynamic conditions are unfavourable and thus causing the weakening of the system. The system is most likely to continue to move in a southwestward direction across west central Arabian sea and weaken into a well marked low pressure area during next 12 hours. Majority of numerical models agree with the above inference.

(B) As the system is lying in a favourable environment, it is likely to intensify further into a very severe cyclonic storm during next 24 hours. Most of the NWP models are in agreement with this observation. As the system is being steered by the southern periphery winds of the anticyclone located to the northeast of the system, it is moving in northwest direction. This movement is likely to continue for next 24 hours and then under the steering of east-northeast winds it is likely to move west-northwestwards till 0000 UTC of 5th November. Majority of the numerical models suggest the system to recurve northeastwards thereafter.

(C) Most of the models considered are indicating the development of a LOPAR over BoB around 4th November, which is forecast to further intensify into a depression subsequently. ECMWF and NCEP GFS models forecast the LOPAR to form around 6th/7th November.

Probability of cyclogenesis over Bay of Bengal and Andaman Sea during next 120 hours:

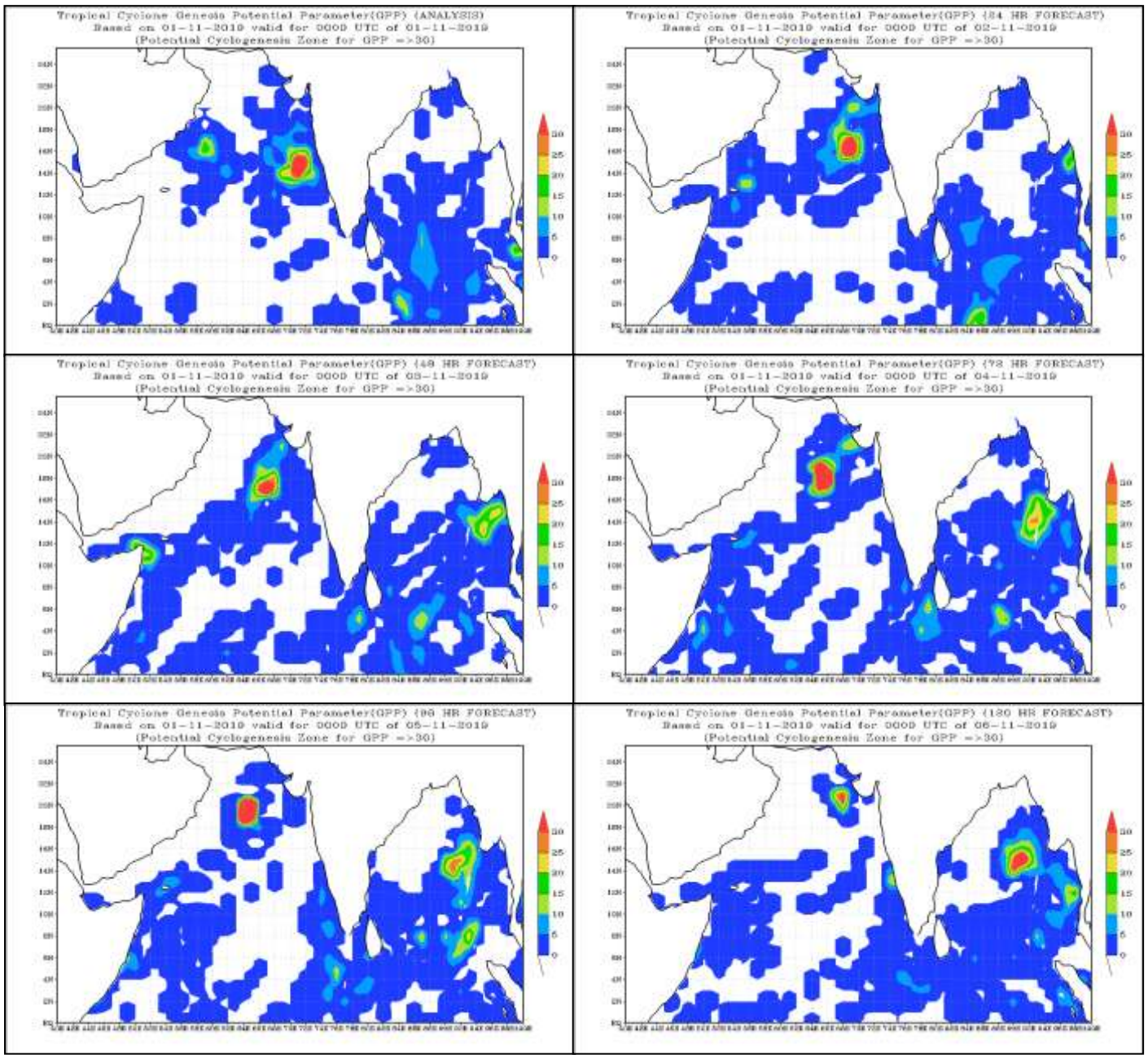
24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
Nil	Nil	Nil	Nil	Nil

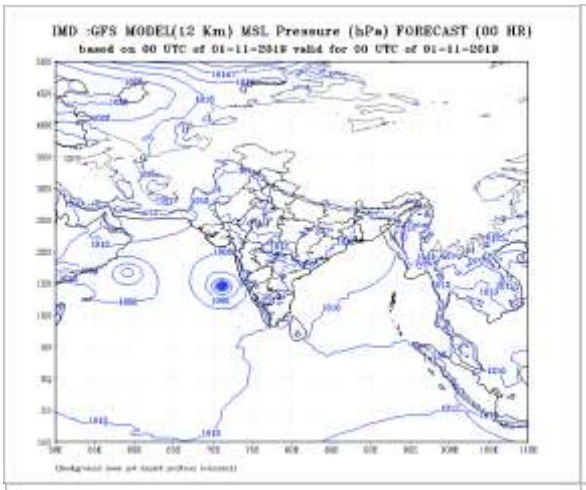
Probability of cyclogenesis over Arabian Sea during next 120 hours:

24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
-	-	-	-	-

Advisory: No IOP for next 5 days.

Annexure-1


Tropical Cyclone Genesis Potential Parameter(GPP) (ANALYSIS)
Based on 01-11-2019 valid for 0000 UTC of 01-11-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 01-11-2019 valid for 0000 UTC of 02-11-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 01-11-2019 valid for 0000 UTC of 03-11-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 01-11-2019 valid for 0000 UTC of 04-11-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (96 HR FORECAST)
Based on 01-11-2019 valid for 0000 UTC of 05-11-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
Based on 01-11-2019 valid for 0000 UTC of 06-11-2019
(Potential Cyclogenesis Zone for GPP =>30)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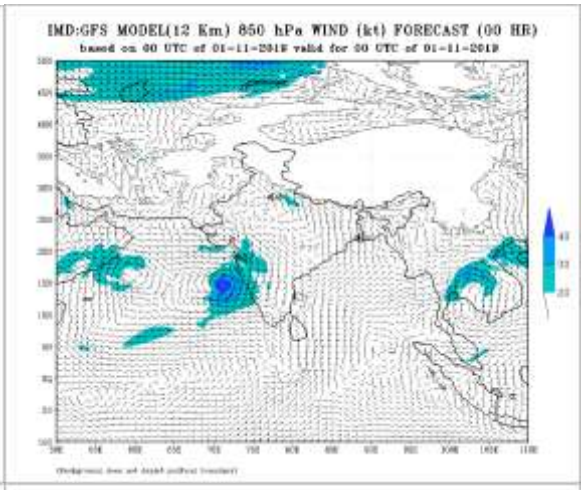
based on 00 UTC of 01-11-2018 valid for 00 UTC of 01-11-2018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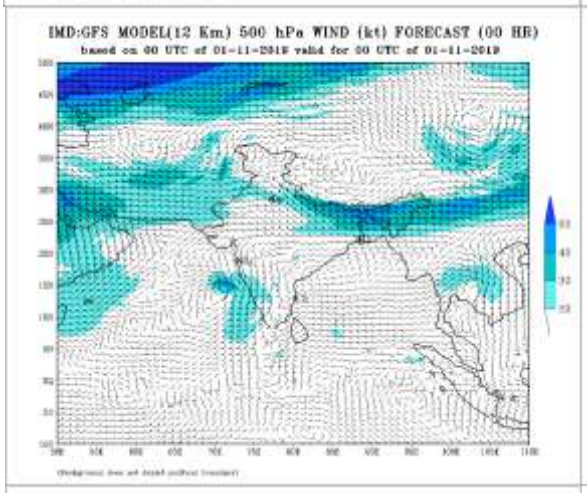
based on 00 UTC of 01-11-2018 valid for 00 UTC of 01-11-2018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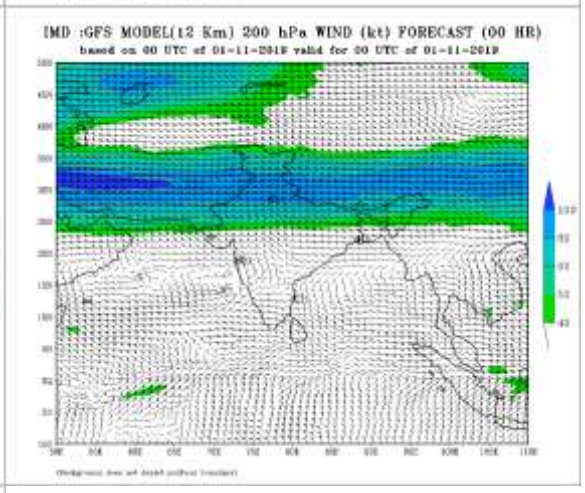
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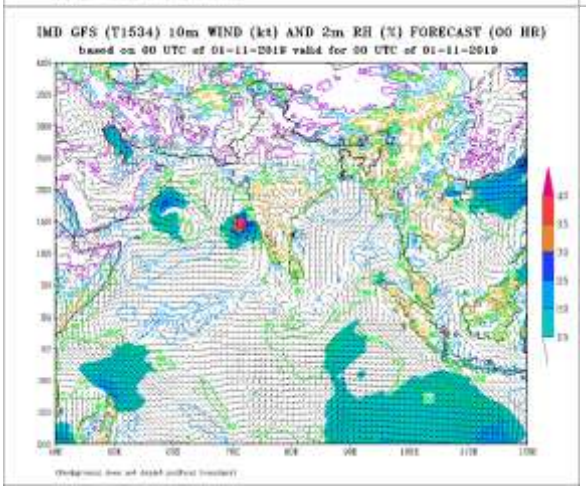
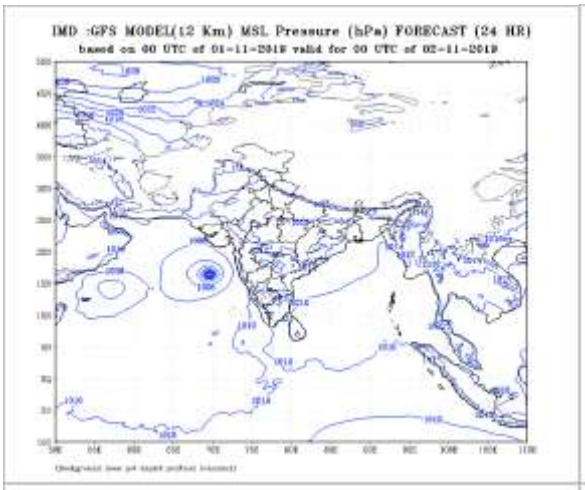

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (00 HR)
based on 00 UTC of 01-11-2018 valid for 00 UTC of 01-11-2018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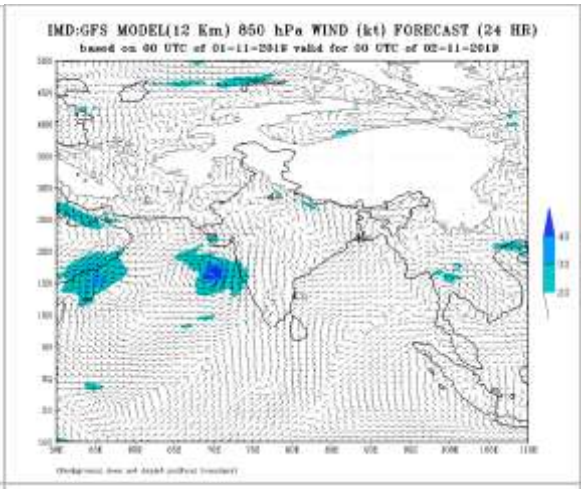
based on 00 UTC of 01-11-2019 valid for 00 UTC of 02-11-2019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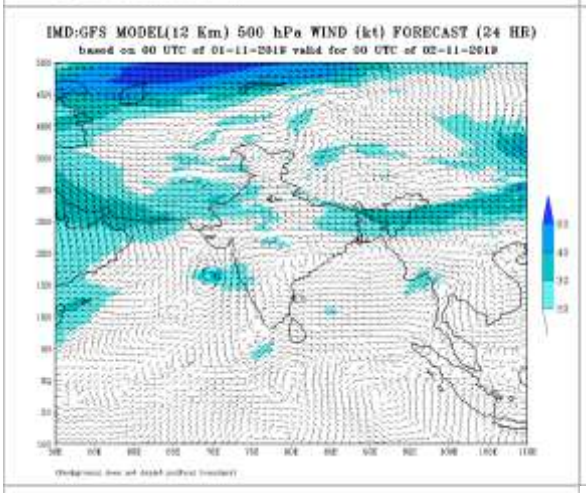
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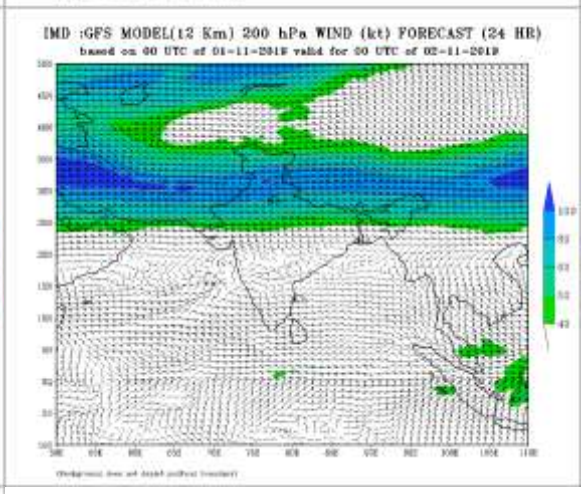
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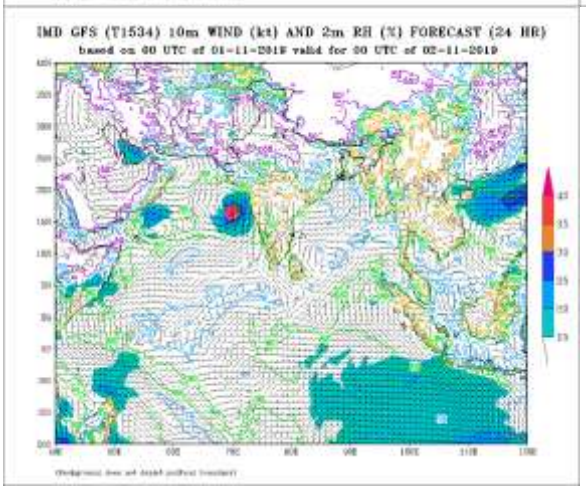
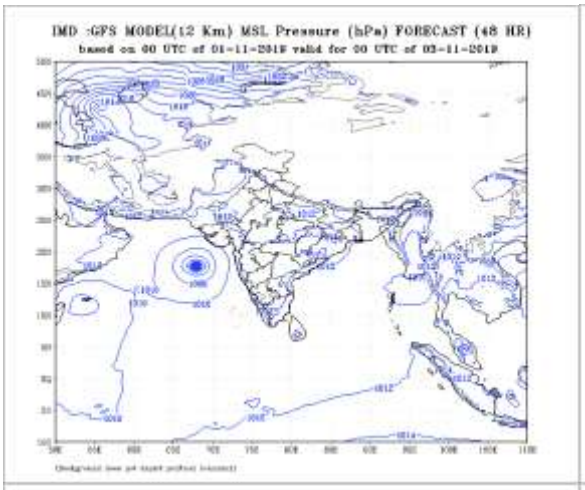

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (24 HR)
based on 00 UTC of 01-11-2019 valid for 00 UTC of 02-11-2019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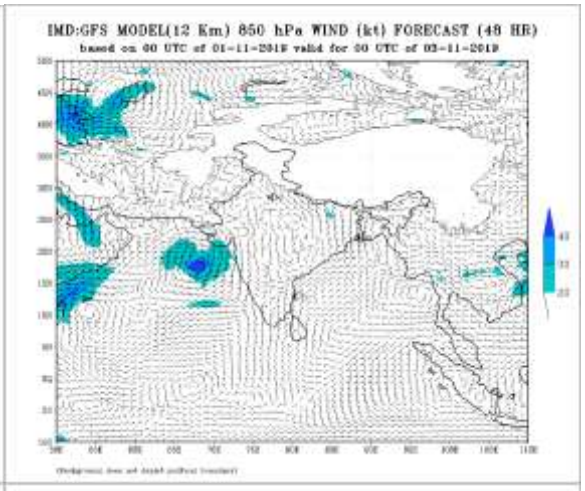
based on 00 UTC of 01-11-2019 valid for 00 UTC of 03-11-2019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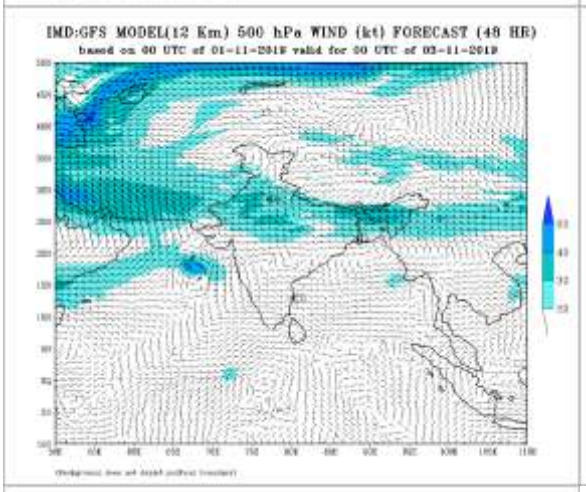
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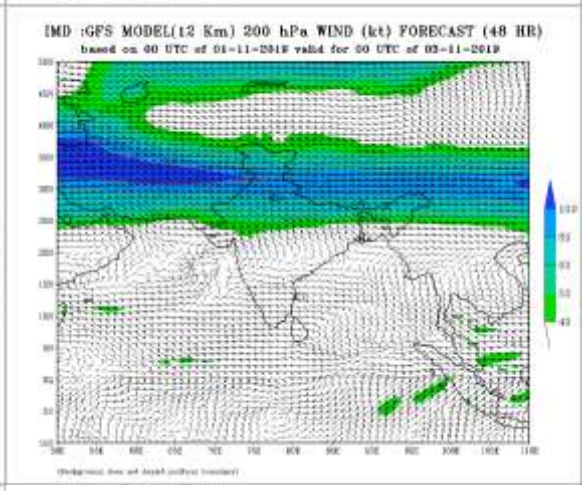
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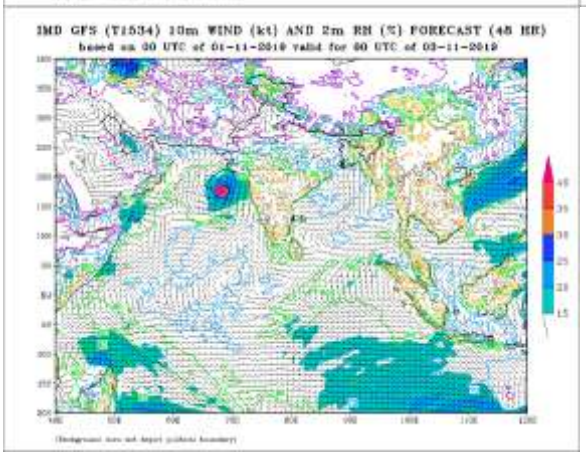
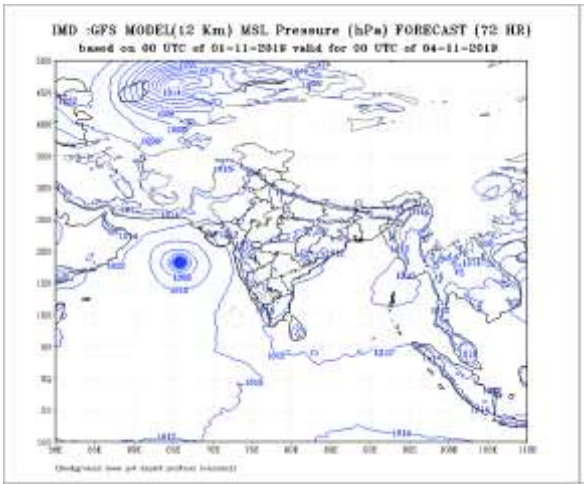

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (48 HR)
based on 00 UTC of 01-11-2019 valid for 00 UTC of 03-11-2019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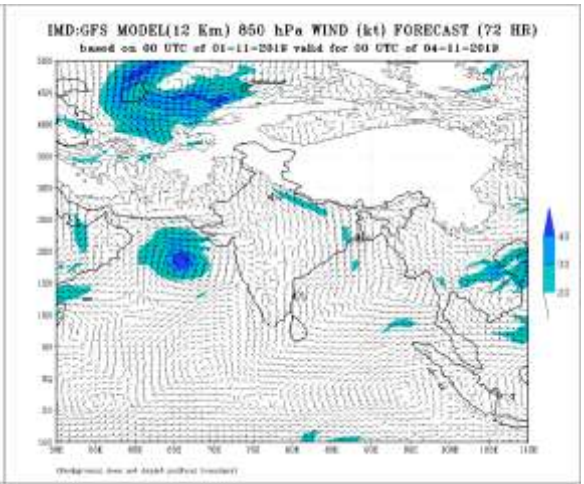
based on 00 UTC of 01-11-2018 valid for 00 UTC of 04-11-2018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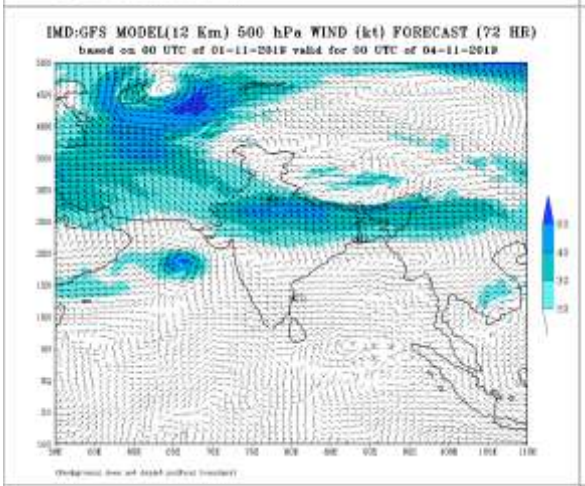
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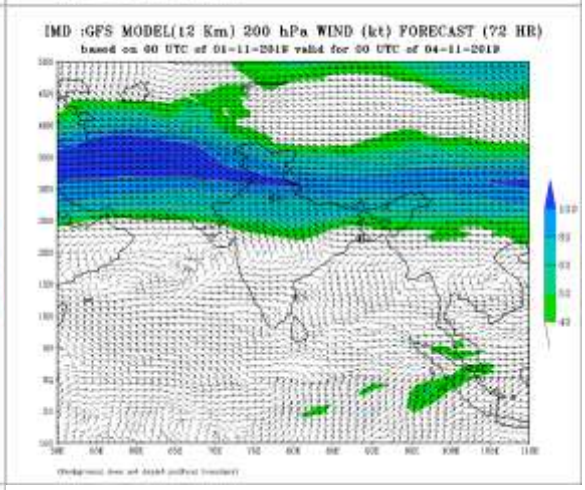
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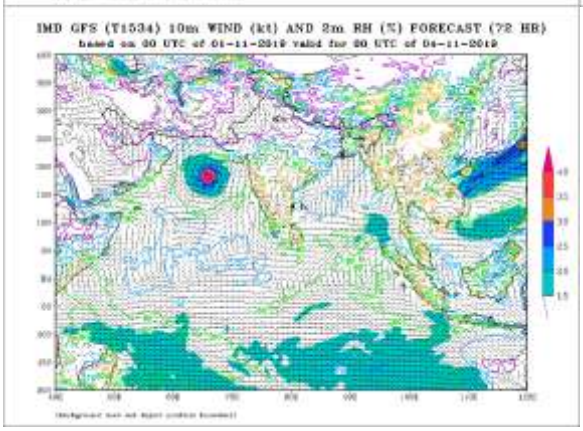
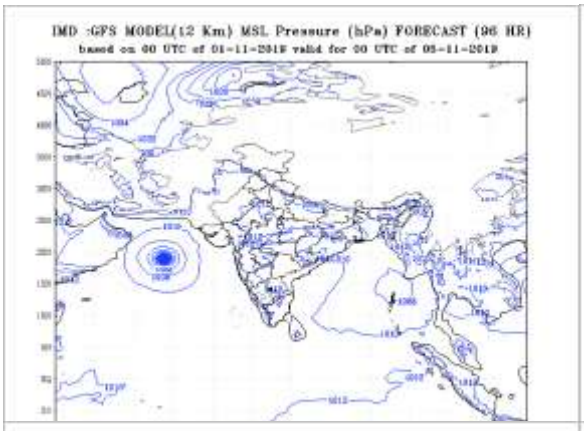

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (72 HR)
based on 00 UTC of 01-11-2018 valid for 00 UTC of 04-11-2018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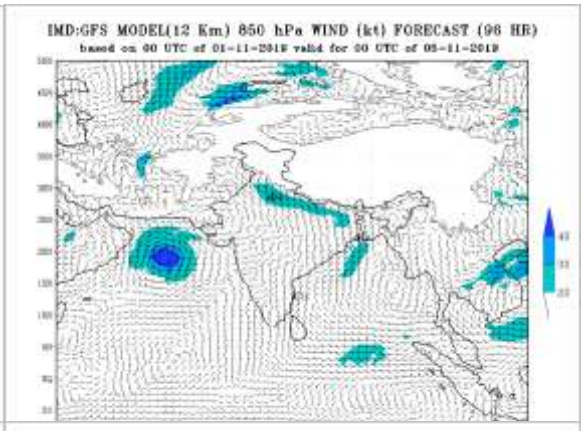
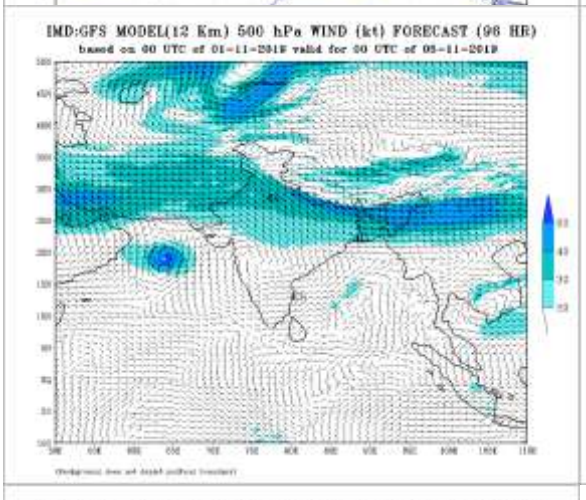
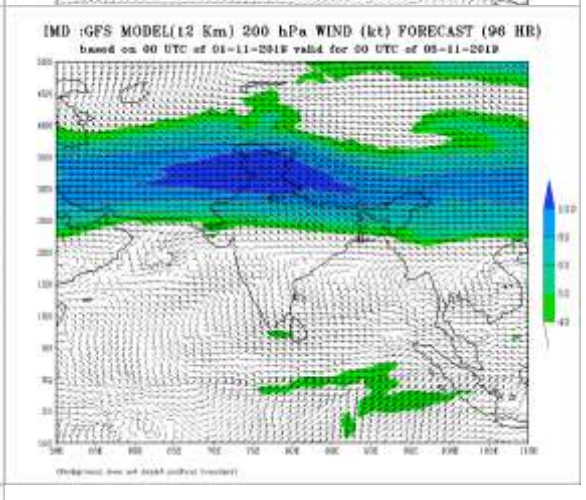
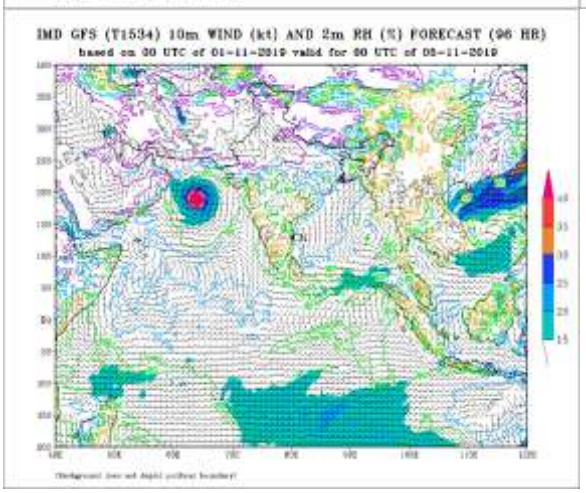
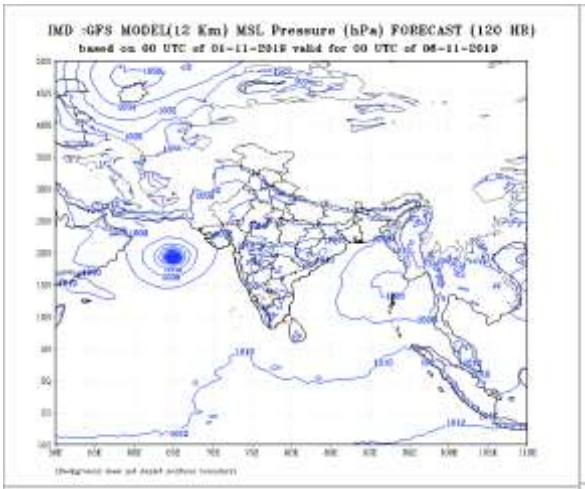
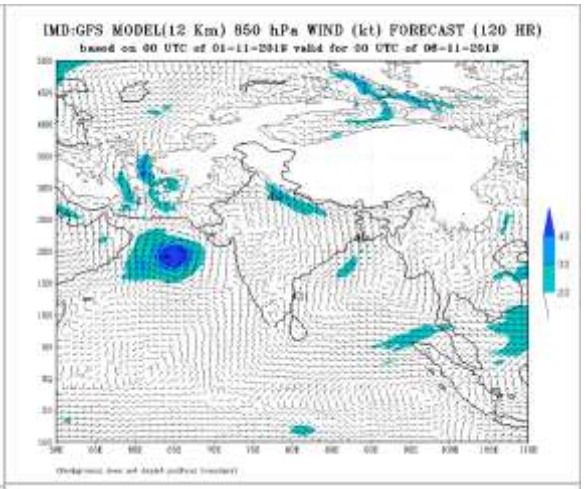

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 01-11-2019 valid for 00 UTC of 05-11-2019

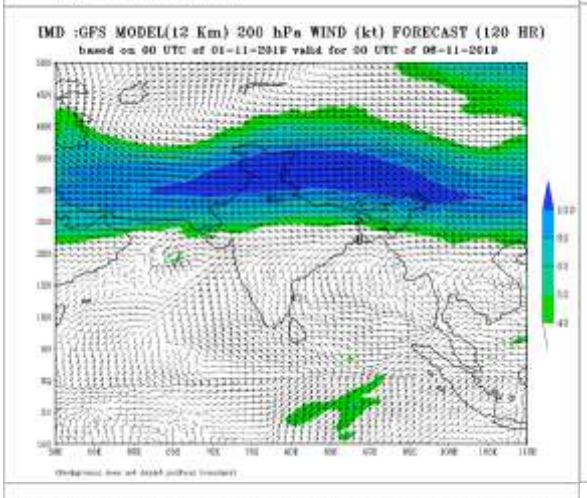

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 01-11-2019 valid for 00 UTC of 05-11-2019

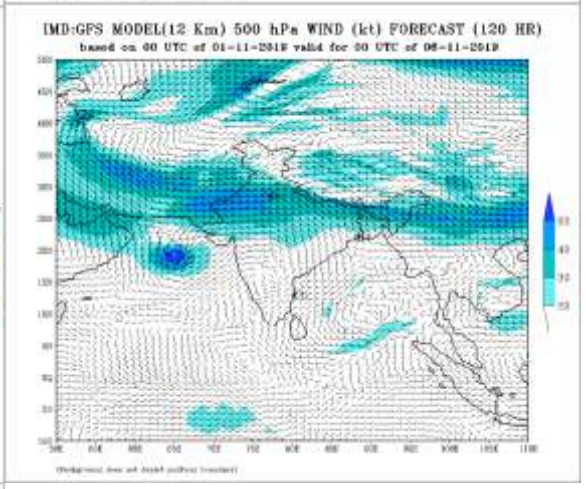

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 01-11-2019 valid for 00 UTC of 05-11-2019

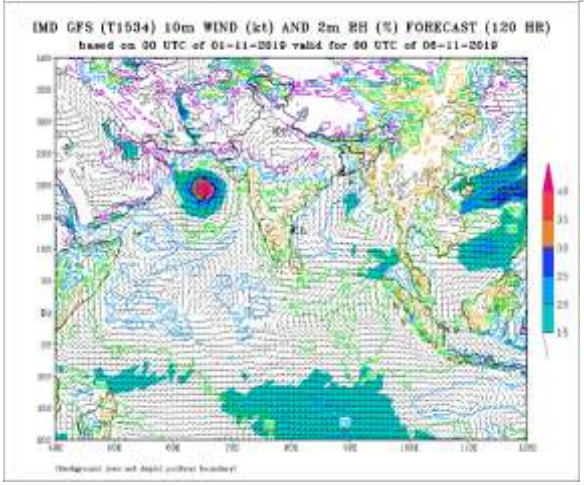

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (96 HR)
based on 00 UTC of 01-11-2019 valid for 00 UTC of 05-11-2019


IMD :GPS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)
based on 00 UTC of 01-11-2019 valid for 00 UTC of 06-11-2019


IMD:GPS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 01-11-2019 valid for 00 UTC of 06-11-2019


IMD :GPS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 01-11-2019 valid for 00 UTC of 06-11-2019


IMD:GPS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 01-11-2019 valid for 00 UTC of 06-11-2019


IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (120 HR)
based on 00 UTC of 01-11-2019 valid for 00 UTC of 06-11-2019