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

FDP (Cyclone) NOC Report Dated 31st October, 2019

Time of Issue: 1200 UTC

Synoptic features:

- The Very Severe Cyclonic Storm "Kyarr"of 30th October over westcentral and adjoining northwest Arabian moved west-southwestwards and weakened into a Severe Cyclonic Storm at 1500 UTC of 30TH October, 2019 over westcentral & adjoining northwest Arabian sea. It further weakened into a cyclonic storm at 0300 UTC of today, the 31st October 2019 and lay centered at 0900 UTC of 31st October, 2019 over westcentral Arabian Sea near latitude 17.5°N and longitude 60.0°E, about 1360 km west-southwest of Mumbai (Maharashtra), 650 km east-northeast of Salalah (Oman) and 350 km south-southeast of Masirah (Oman). It is very likely to move southwestwards across westcentral Arabian Sea during next 36 hours. It is very likely to weaken into a Deep Depression during next 12 hours and further into a Depression during subsequent 06 hours.
- Yesterday's Deep Depression over Lakshadweep and adjoining southeast Arabian Sea and Maldives area moved northwestwards and intensified into **Cyclonic Storm MAHA** (**Pronounced as M'maha**) and lay centered at 1200 UTC of 30th October, 2019 near latitude 9.0°N and longitude 74.1°E over Lakshadweep and adjoining southeast Arabian Sea and Maldives area. It intensified further into a **Severe Cyclonic Storm** at 0600 UTC of 31st October, 2019 and lay centered at 0900 UTC of 31st October, 2019 near latitude 12.3°N and longitude 72.8°E over eastcentral Arabian Sea and adjoining Lakshadweep area about 130 km north-northeast of Aminidivi (Lakshadweep), 200 km north-northeast of Kavaratti (Lakshadweep), 100 km northeast of Chetlat (Lakshadweep) and 340 km west-northwest of Kozhikode (Kerala). It is very likely to move north-northwestwards during next 06 hours. Then, it is very likely to move northwestwards during subsequent 06 hours and thereafter move west-northwestwards. It is very likely to intensify into a very severe cyclonic storm over eastcentral Arabian Sea during next 24 hours.
- A Low Pressure Area is likely to form over north Andaman Sea on 03rd November. It is very likely to move westnorthwestwards 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 area of CS Kyarr. 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 around the centre of the CS Kyarr. Cyclonic relative vorticity at 850 hPa of 200 X10^{-6}s-1 is seen to the south of the centre of SCS Maha.

Low level Convergence:

Lower level convergence is about 10 x 10^{-5}s^{-1} to the southeast of the centre of Kyarr.
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 $20x10^{-5}$ s-1 is seen to the south of the CS Kyarr centre and of value 30 $x10^{-5}$ s-1 is seen around the centre of SCS Maha.

Wind Shear:
Wind shear is low (05-10 knots) over the area of SC Kyarr. It is low to moderate (10-20 knots) over the area of the SCS Maha.

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

Wind Shear Tendency:
The wind shear tendency is positive or neutral over most parts of AS, as well as over the BOB and Andaman Sea.

Upper tropospheric ridge:
The upper tropospheric ridge at 200 hPa runs roughly along 18°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 31st October, 2019, the current intensity of the system (CS Kyarr) is T 2.0/CI 2.5. Associated broken low to medium clouds with embedded intense to very intense convection lies over westcentral Arabian Sea between Lat 14.0^0N to 17.0^0N and Long 58^0E to 62^0E. The minimum CTT is minus 93^0C.

As per the satellite imagery at 0900 UTC of 31st October, 2019, the current intensity of the system over Lakshadweep area (SCS Maha) is T 3.0. Associated scattered low to medium clouds with embedded intense to very intense convection lies over Lakshadweep, southeast adjoining eastcentral Arabian Sea areas between Lat 10.0^0N to 14.0^0N and Long69.0^0E to74.0^0E. The minimum CTT is minus 93^0C.

Bay of Bengal & Andaman Sea:-

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

Large scale features

M.J.O. Index:
MJO index is in Phase 4 with amplitude less than 1. It will enter into Phase 5 with amplitude less than 1 and remain there for next 4-5 days.

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 :CS over west central AS on 31st October, CS close to Oman coast on 1st November, and Depression on 2nd November and a WML near Gulf of Aden on 3rd November which becomes less marked by 4th November.

(ii) Indicates: CS over Lakshdweep Islands and adjoining SE Arabian Sea on 31st. Moving north-northwestwards, it intensifies into a SCS over southeast AS on 1st November, which further intensifies while moving in a northwest direction till 5th November. Thereafter it is seen to move in a northeast direction to cross Gujarat coast on 7th and becomes less marked thereafter.

(iii) Another LOPAR form on 4th over north Andaman Sea and adjoining EC BoB, which becomes a depression on 8th and moving in a northwest direction reach westcentral BoB on 10th as a VSCS.

IMD-GEFS

(i) Indicates: CS over westcentral AS on 1st November, which becomes a D over west-central AS off Oman coast on 2nd November, weakens into WML over the same region on 3rd and becomes less marked subsequently.

(ii) Indicates: CS over Lakshadweep area on 01st November, which is seen to move north-northwestward till 6th November then northeast ward to reach close to Gujarat coast as a Depression.

(iii) Another LOPAR form on 4th November over north Andaman Sea and adjoining EC BoB which becomes a Depression over the same area on 8th.

IMD-WRF

(i) Indicates: SCS over west-central AS on 31st October weakens into a CS on 01st November which moves in a west-southwestward direction till 03rd.

(ii) CS over Lakshadweep area off Kerala-Karnataka coasts on 31st October becomes a SCS over EC Arabian Sea on 01st November and moves in a NNW direction till 4th November.

(iii) Another LOPAR seen over central parts of south BoB on 3rd and 4th November.

NCMRWF-NCUM:

(i) Indicates: CS over west central AS close to Oman coast on 31st October, weakens into DD on 02nd November while moving west-southwestwards and becomes less marked thereafter.

(ii) Indicates: The DD/CS on 31st over Lakshadweep area and SE Arabian Sea becomes a SCS on 01st November. It 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 in a northeast direction and weaken in subsequently.

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

NCMRWF-UM-Regional Model:

(i) Indicates : CS on 31st over SE Arabian Sea which intensifies while moving northwestwards till 03rd November over central Arabian Sea.

(ii) Another LOPAR forms over north Andaman Sea and adjoining EC BoB on 3rd November.

NEPS Model:

(iii) Indicates: ESCS/VSCS over westcentral and adjoining northwest on 30th October, becomes a SCS over west-central AS close to Oman coast on 31st October, a CS on 01st November, a D on 02nd November, which becomes less marked on 03rd while moving west-southwestwards.

(iv) Indicates: The depression over SE Arabian Sea off Kerala-Karnataka coasts on 31st October while moving in a north-northwest direction becomes SCS EC Arabian Sea off south Maharashtra coast on 01st November. Further moving in a northwest direction it continues to intensify to reach close to Oman coast on 6th, and recurves to northeast direction from 6th onwards and weakens in the process.

(v) Another LOPAR seen to form over EC BoB on 5th, which becomes D over EC BoB on 6th, and a ESCS on 9th November near Bangladesh coast.

ECMWF:

(i)Indicates : CS over west-central AS close to Oman coast on 31st October, which is seen to move in a southwestward direction and becomes D on 01st November, to become unimportant by on 3rd November.

(ii) Indicates: CS over south east AS off Kerala- Karnataka coasts moves north-northwestward till 02 November to reach EC Arabian Sea, then moves northwestwards and weakens into a depression on 4th and become less marked by 6th November over sea.

(iv) Another LOPAR is seen over WC BoB on 09th, which becomes a Depression 10th.

NCEP-GFS:

(i) Indicates CS over west-central AS on 31st October, D on 1st November, which becomes insignificant thereafter.

(ii) Indicates : CS on 31st October over SE Arabian Sea off Kerala-Karnataka coasts which intensifies while moving in a northwest direction towards WC Arabian Sea till 6th November. It then recurves northeastward and weakens to a Depression over EC Arabian Sea on 9th.

(iii) Another LOPAR forms over EC BoB on 8th which becomes a Depression on 09th and is seen as a CS off Andhra Pradesh coast on 10th.

ARP-Meteo France : NIL

Dynamical statistical models
IMD Genesis Potential Parameter (GPP):

(i) Significant zone of GPP seen over west-central AS on 31st October and on 1st November, becomes less marked on 2nd November.

(ii) Another significant zone of GPP seen over Comorin and adjoining Maldives area on 31st October, seen to move in north-northwest direction and becomes insignificant on 5th November over EC Arabian Sea.

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) Total precipitable water imageries indicate continued increase in dry air incursion in all the sectors of the system CS "Kyarr". The environmental, dynamic and thermodynamic conditions are unfavourable and is causing the system to weaken continuously. The system is most likely to move in a west-southwestward direction across west central Arabian sea and weaken into a well marked low pressure area by 1800 UTC of 01st November. Majority of numerical models agree with the above inference.

(B) As the system "SCS Maha" 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.

(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 8th November.

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

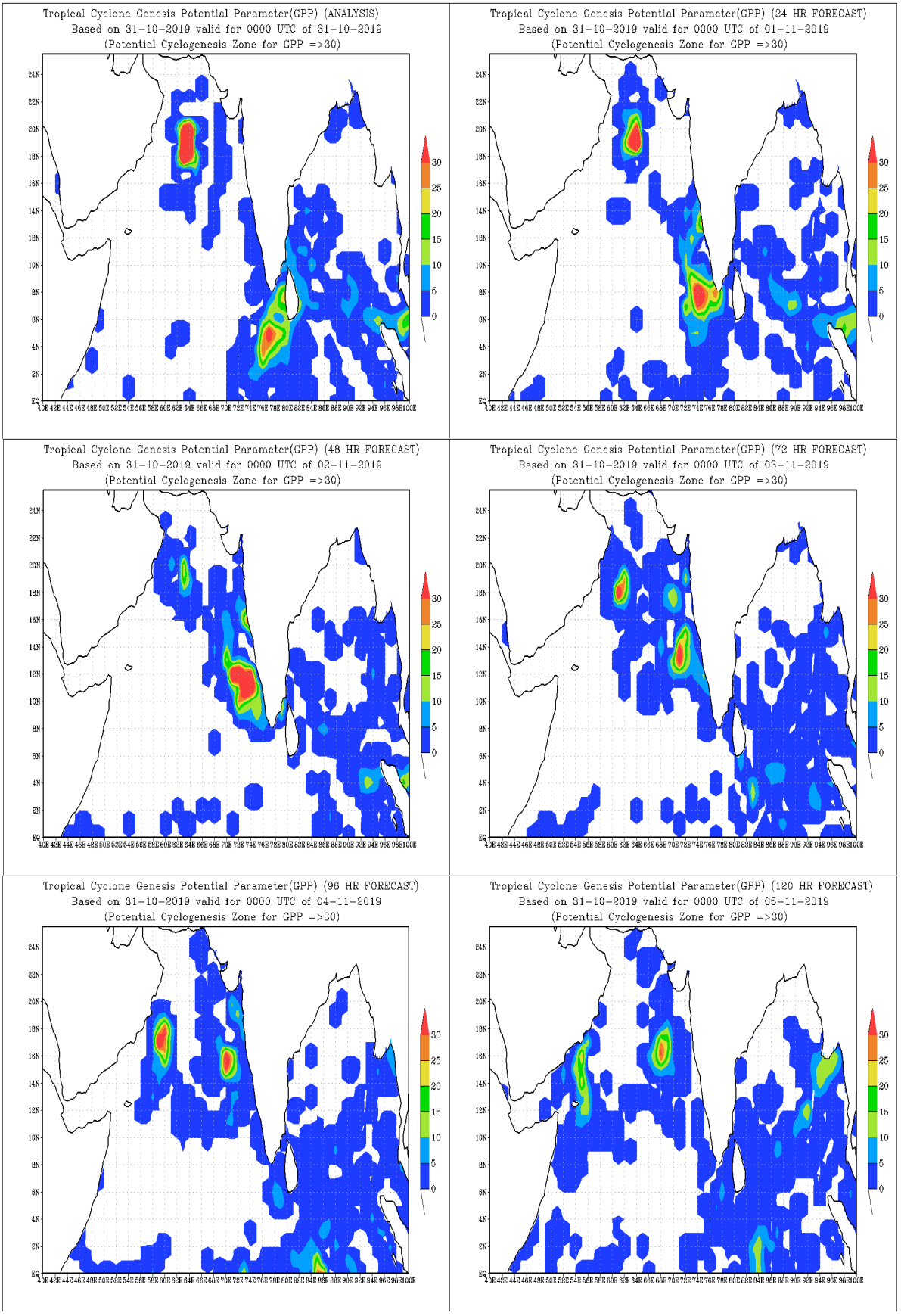
24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
Nil	Nil	Nil	Nil	Nil

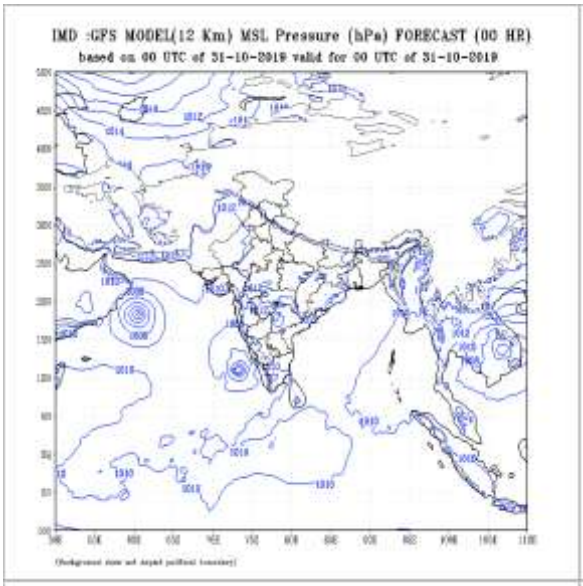
Probability of cyclogenesis over Arabian Sea during next 120 hours:

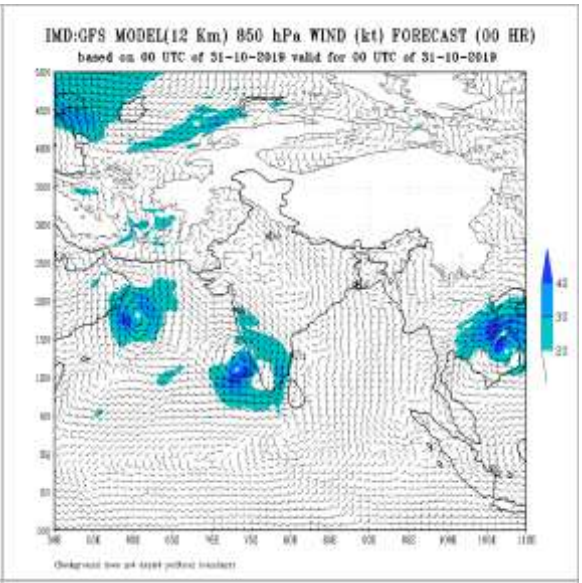
24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
-	-	-	-	-

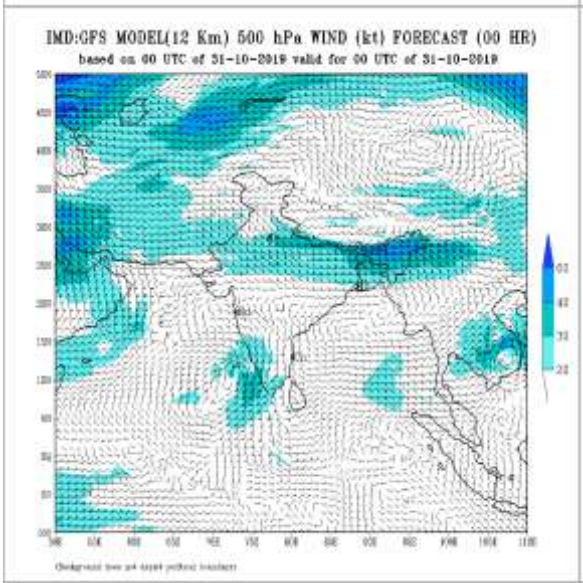
Advisory: IOP for South Tamil Nadu, Kerala, Karnataka and Lakshadweep during 31 October 2019.

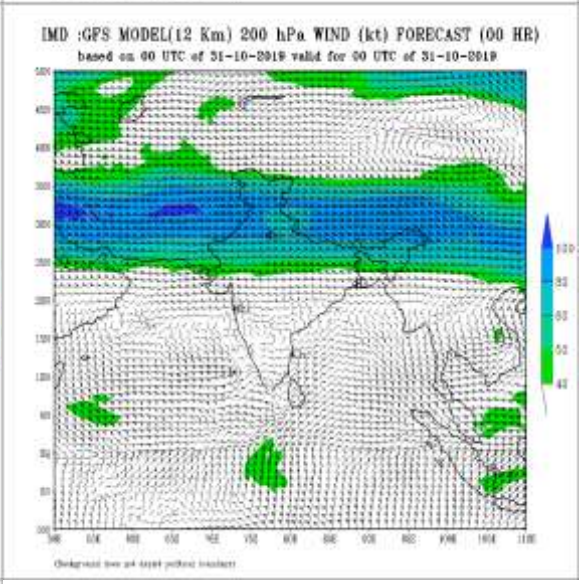
Annexure-1

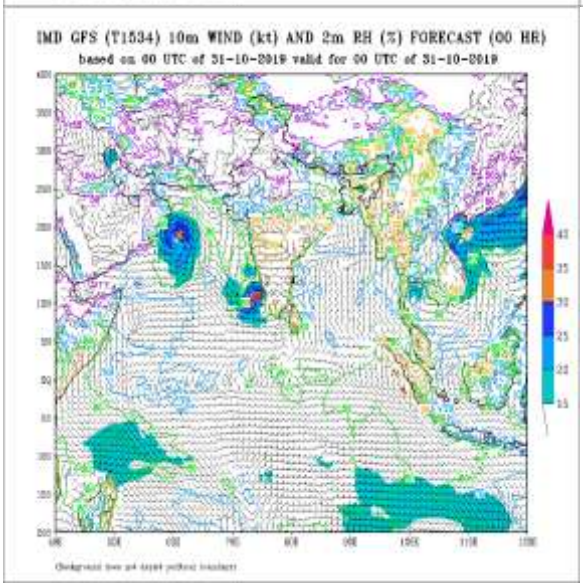

Tropical Cyclone Genesis Potential Parameter(GPP) (ANALYSIS)
Based on 31-10-2019 valid for 0000 UTC of 31-10-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
Based on 31-10-2019 valid for 0000 UTC of 01-11-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
Based on 31-10-2019 valid for 0000 UTC of 02-11-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
Based on 31-10-2019 valid for 0000 UTC of 03-11-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (96 HR FORECAST)
Based on 31-10-2019 valid for 0000 UTC of 04-11-2019
(Potential Cyclogenesis Zone for GPP =>30)
Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
Based on 31-10-2019 valid for 0000 UTC of 05-11-2019
(Potential Cyclogenesis Zone for GPP =>30)

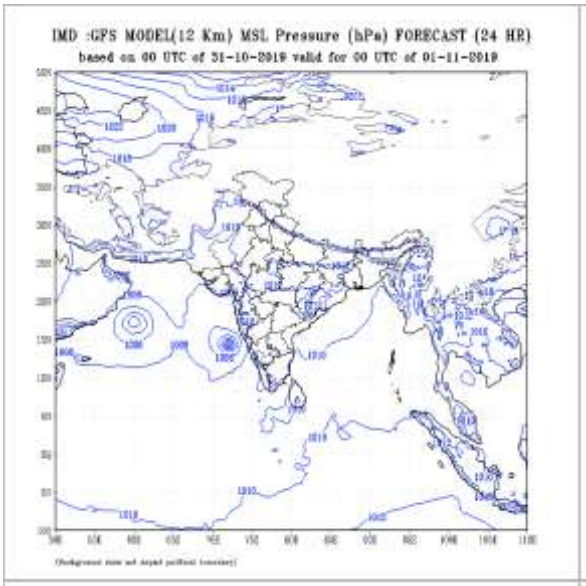

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (00 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 31-10-2019

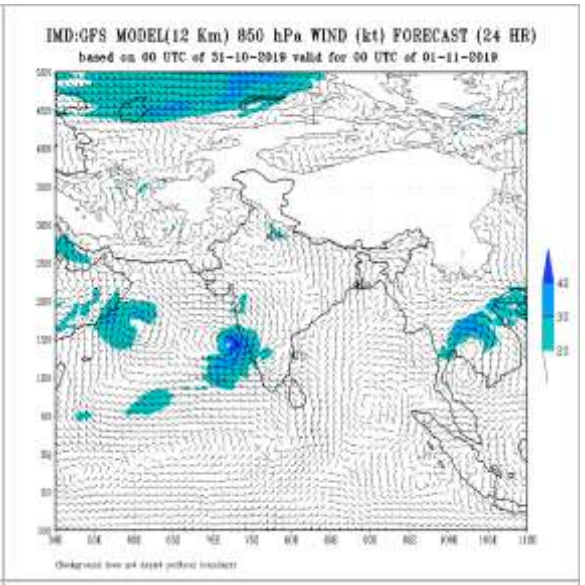

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (00 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 31-10-2019

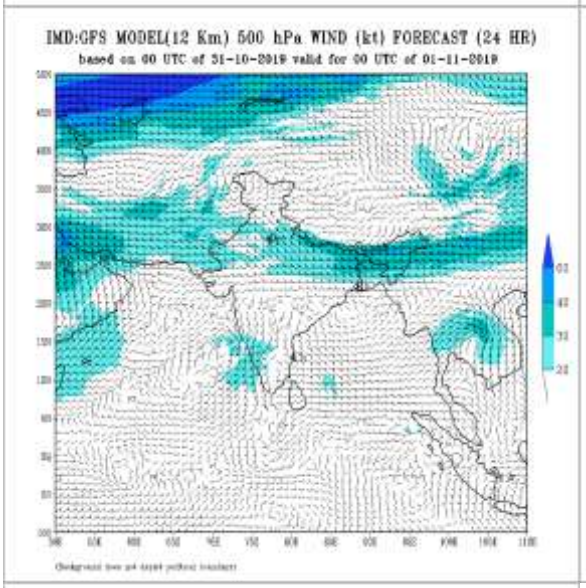

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (00 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 31-10-2019

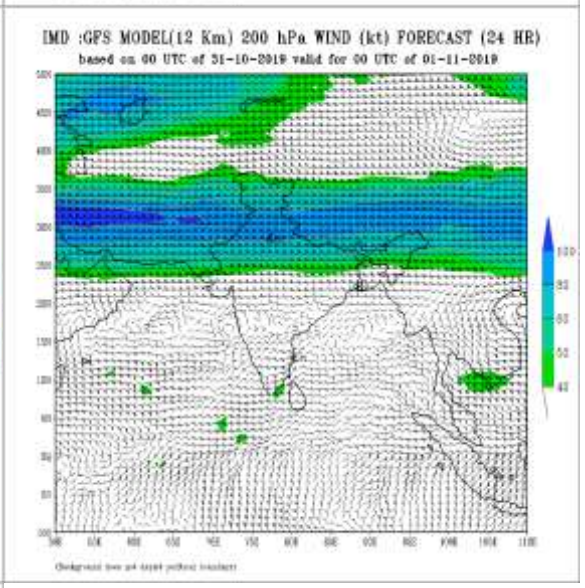

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (00 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 31-10-2019

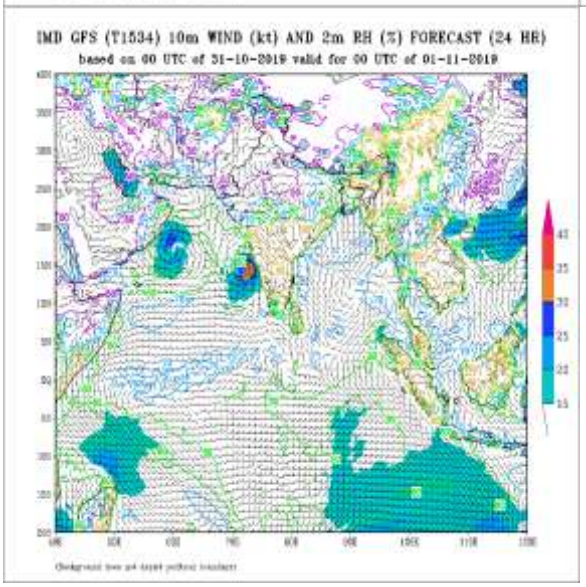

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (00 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 31-10-2019

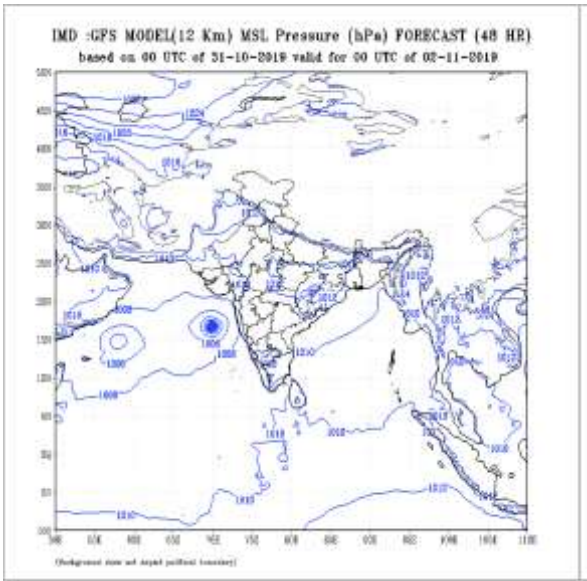

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (24 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 01-11-2019

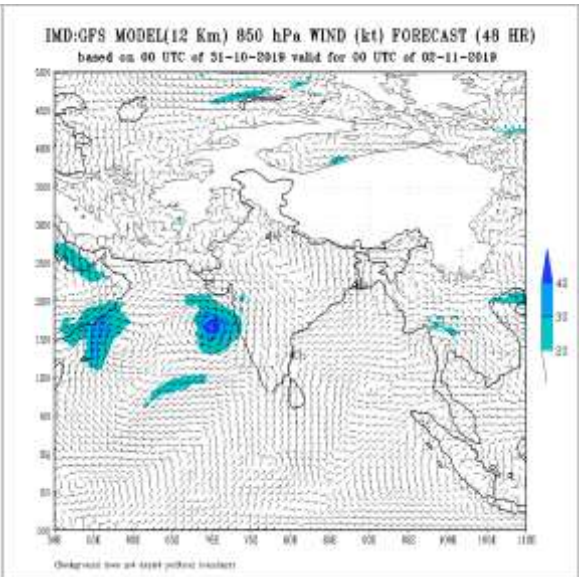

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 01-11-2019

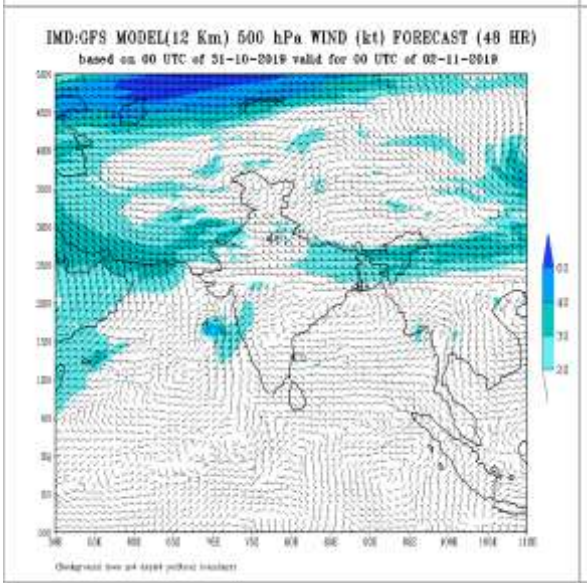

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 01-11-2019

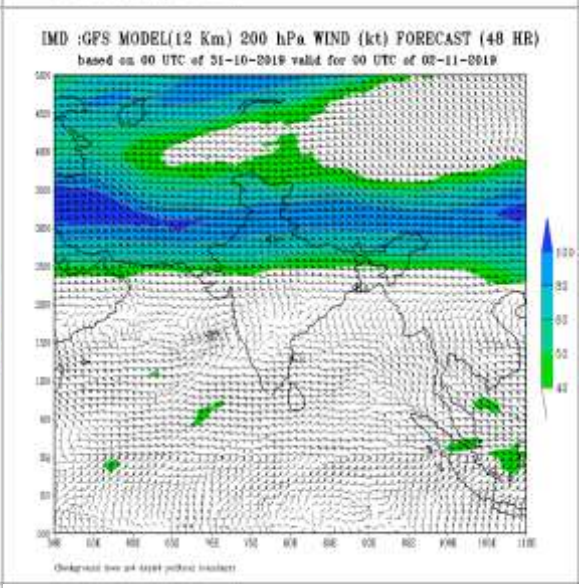

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (24 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 01-11-2019

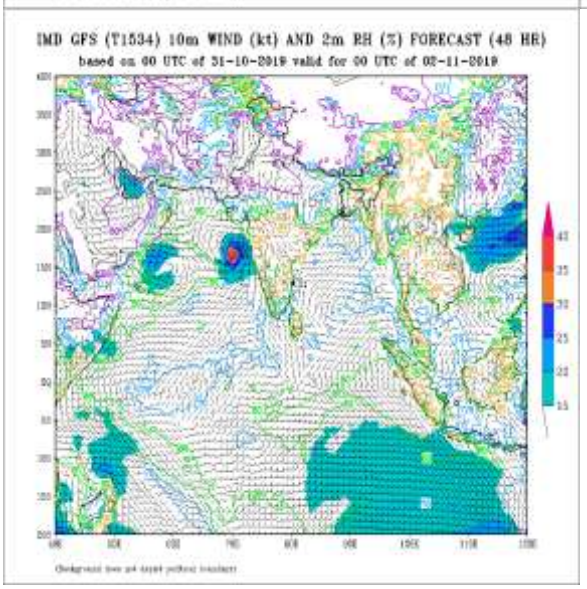

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (24 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 01-11-2019

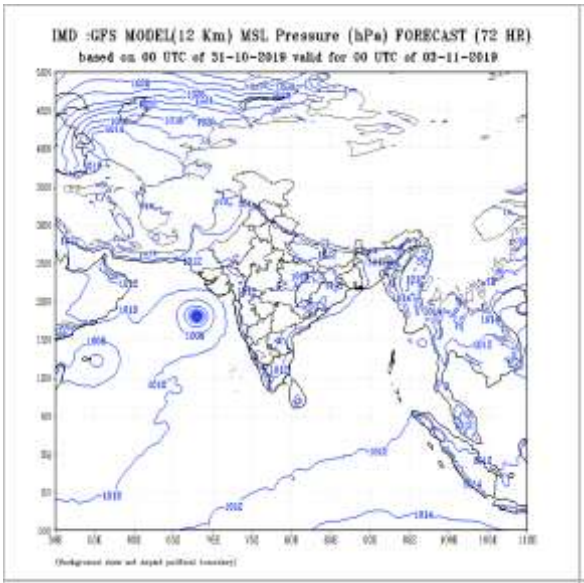

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (48 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 02-11-2019

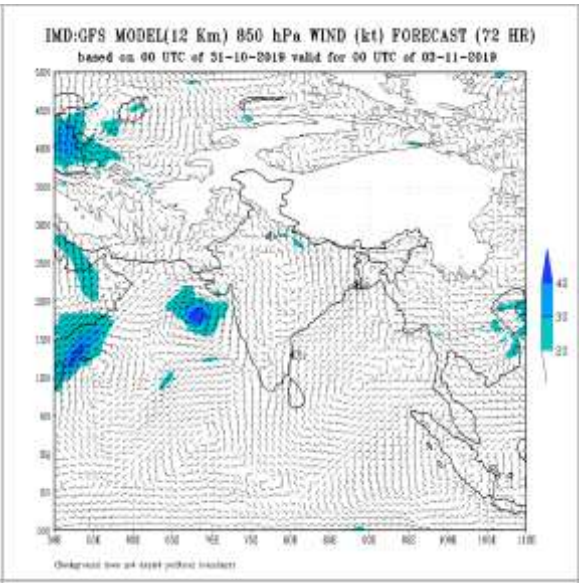

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (48 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 02-11-2019

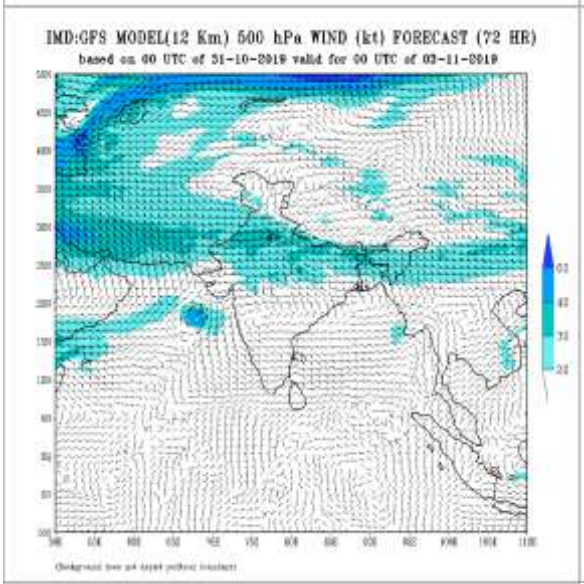

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (48 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 02-11-2019

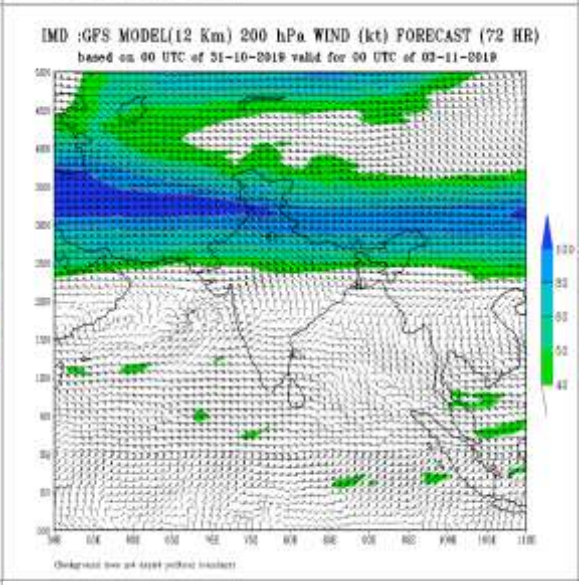

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (48 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 02-11-2019

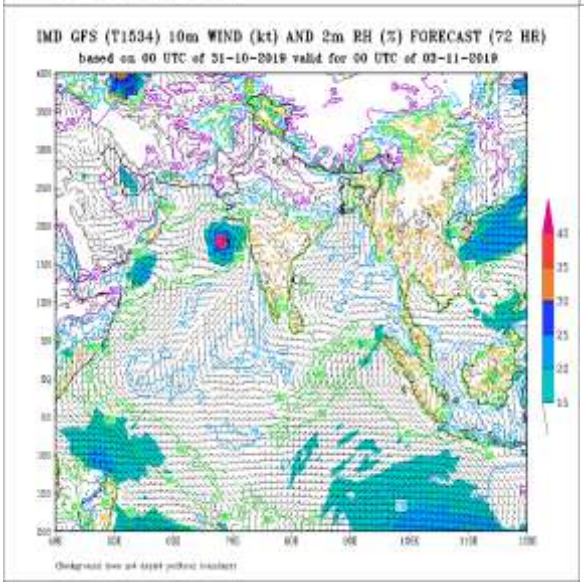

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (48 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 02-11-2019

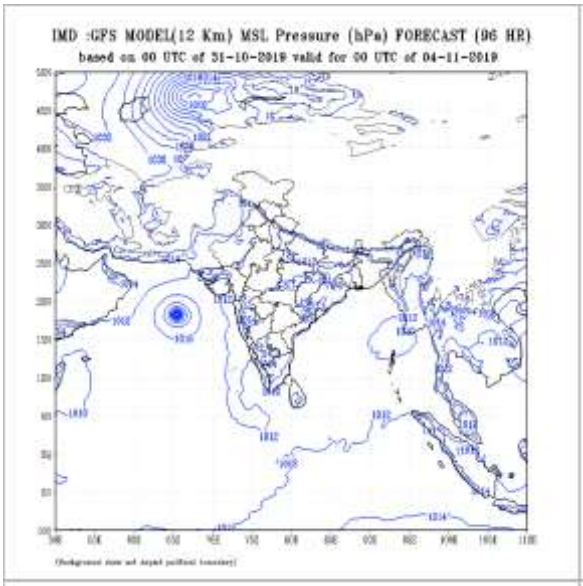

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (72 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 03-11-2019

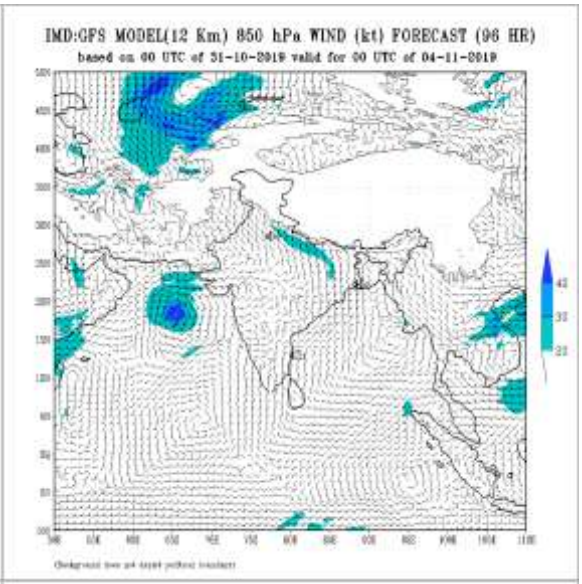

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 03-11-2019

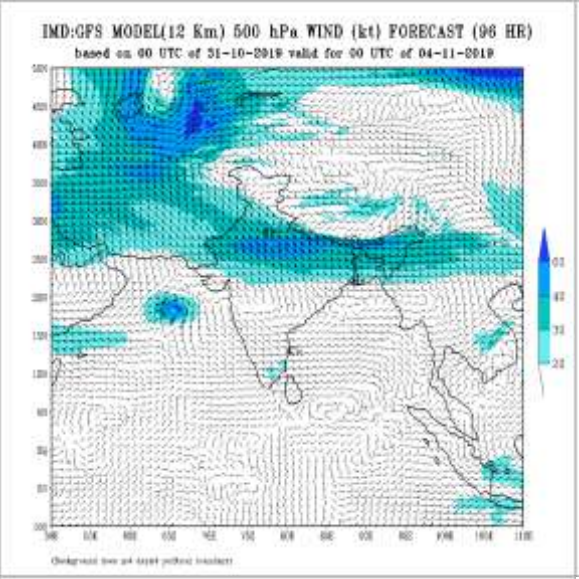

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 03-11-2019

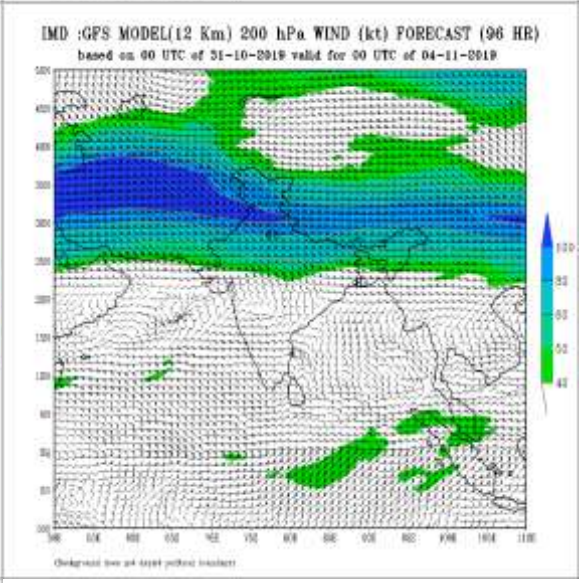

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 03-11-2019

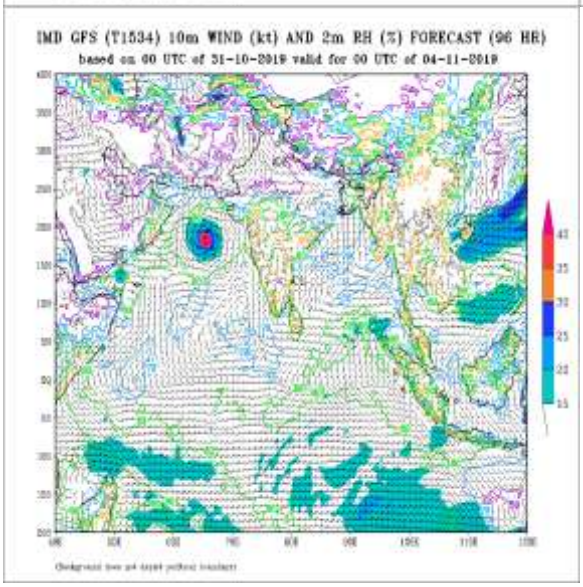

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (72 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 03-11-2019

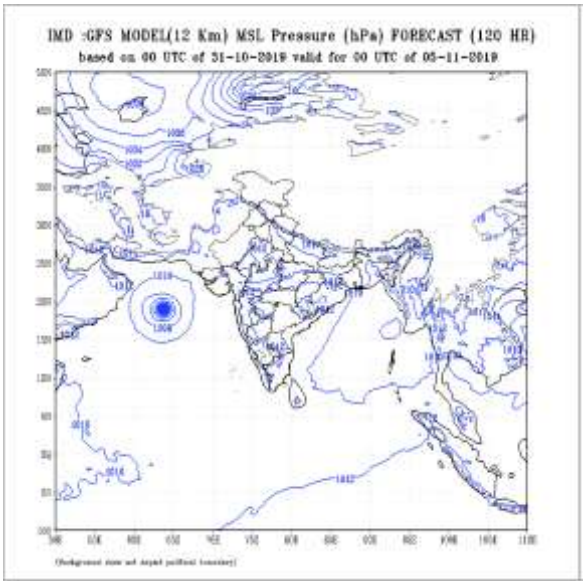

IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (96 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 04-11-2019

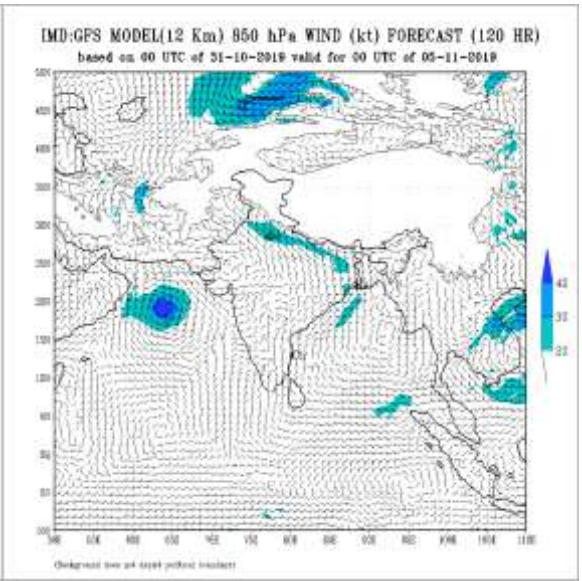

IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 04-11-2019

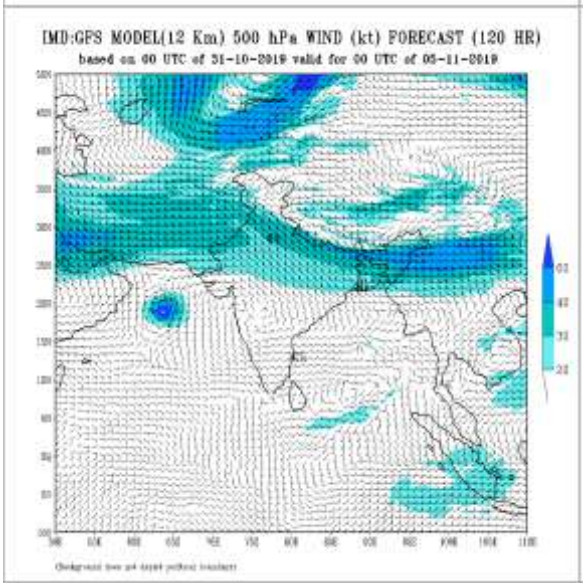

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 04-11-2019

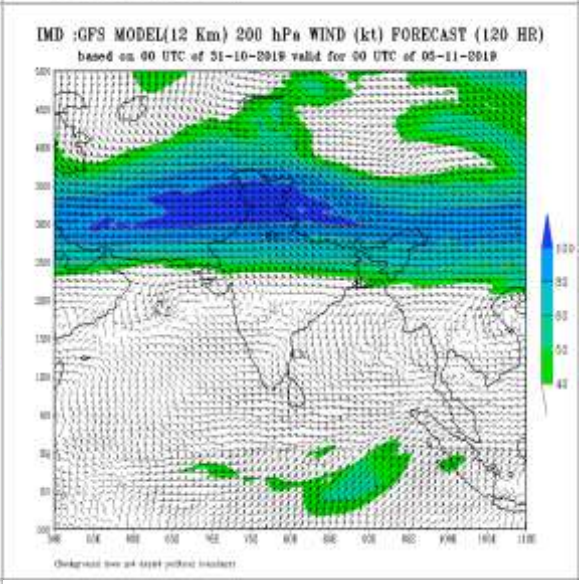

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 04-11-2019

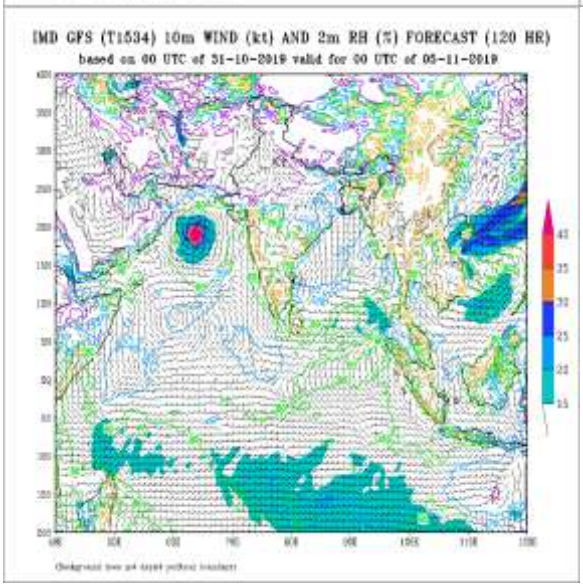

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (96 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 04-11-2019


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (120 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 05-11-2019


IMD:GPS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 05-11-2019


IMD:GPS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 05-11-2019


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (120 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 05-11-2019


IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (120 HR)
based on 00 UTC of 31-10-2019 valid for 00 UTC of 05-11-2019