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

FDP (Cyclone) NOC Report Dated 27th October, 2019

Time of Issue: 1200 UTC

Synoptic features:

- The Very Severe Cyclonic Storm (VSCS) 'KYARR'over east-central Arabian Sea (AS) moved west-northwestwards, intensified further into an Extremely Severe Cyclonic Storm (ESCS) by yesterday night. Continuing to move west-northwestwards, it then rapidly intensified into a **Super Cyclonic Storm (SuCS)** and lay centred at 0300 UTC of today, the 27th October, 2019 near latitude 17.1°N and longitude 67.8°E over eastcentral Arabian Sea. Further moving west-northwestwards, it lay over east-central AS, near latitude 17.4°N and longitude 67.0°E about 630 km west-southwest of Mumbai (Maharashtra), 1390 km east-northeast of Salalah (Oman) and 920 km east-southeast of Masirah (Oman). It is very likely to move west-northwestwards towards Oman coast during next 5 days. It is very likely to maintain the intensity of a Super Cyclonic Storm till 28th October morning and weaken gradually thereafter.
- Yesterday's trough of low at mean sea level from north Sri Lanka coast to southeastern parts of southwest Bay of Bengal lay over southwest Bay of Bengal off Sri Lanka coast.
- A fresh Low Pressure Area is likely to form over southeast Arabian Sea & adjoining Lakshadweep area on 30th October and it is likely to become more marked subsequently.

Dynamical and thermodynamical features

Sea Surface Temperature (SST):

SST is 29-30ºC over east-central & southeast Arabian Sea (AS) and Gulf of Oman, 28-29ºC over rest AS, except over west central & southwest AS off Oman and Somalia coasts where it is 26- 27ºC.This tongue of colder SSTs is seen to be extending upto parts of central & south AS, ie., between 10-17ºN & 60-63ºE.

SST is 30 - 32ºC over north and adjoining east-central Bay of Bengal (BOB) & Myanmar coast and 29- 30ºC over the rest of BOB.

Tropical Cyclone Heat Potential (TCHP):

TCHP is 80-100 kJ/cm^2 over southeast & adjoining central AS, 100-110 kJ/cm^2 over west equatorial Indian Ocean (IO). It is < 40 kJ/cm^2 over most parts of north & west-central AS and Oman – Yemen coasts.
TCHP is 110-130 kJ/cm^2 over west-central & southwest BOB, 100-110 kJ/cm^2 over north Andaman Sea and east-central BOB and 60-80 kJ/cm^2 elsewhere over the BOB.

Relative Vorticity:

An area of cyclonic relative vorticity at 850 hPa of 3000 X10^{-6}s-1 is seen over east-central AS to the south of the centre of the SuCS.
Cyclonic relative vorticity at 850 hPa 5 - 10 X10^{-6}s-1 over east equatorial Indian Ocean (IO), to the east of Sri Lanka.

Low level Convergence:

Lower level convergence is about 40 x 10^{-5}s^{-1} over east-central AS to the south of the centre of the SuCS.

Lower level convergence of about 05-10 x $10^{-5}s^{-1}$ is seen over east equatorial IO off south Sri Lanka coast and 20 - 30 X10^{-6}s-1over east equatorial IO off Malay Peninsula.

Upper level Divergence:
A zone of upper level divergence of 20x10^{-5} s-1 is seen over the centre of the SuCS and 05 - 10 x10-5 s-1 over east-central and some part of west-central AS.
Upper level divergence of 10 - 20x10^{-5} s-1 is seen over east equatorial IO and adjoining southwest BOB off Sri Lanka coast and 30x10^{-5} s-1 over south Andaman Sea .

Wind Shear:
Wind shear is 05-10 knots over central AS, and increasing to the north as well as to the south.
Wind shear is 10-15 knots over major parts of the BOB and Andaman Sea.

Wind Shear Tendency:
The wind shear is in decreasing tendency over northwest AS and neutral over the rest of AS.
It is increasing over central parts south BOB, north BOB & decreasing over Andaman Sea.

Upper tropospheric ridge:
The upper tropospheric ridge at 200 hPa runs roughly along 19°N over the north IO.

Satellite observations based on INSAT imagery:

Arabian Sea:-

According to 0900 UTC satellite imagery, vortex (Kyarr) over east-central AS & neighbourhood is centered near 17.4N/67.0 E with intensity T 6.5. Eye pattern prevails with eye temperature of +12.7ºC. Diameter of the 'eye' is about 40 km. Associated broken low / medium clouds with embedded intense to very intense convection prevails over east-central AS between Lat 15.0N to 19.5N and Long 65.0E to 69.0E (minimum CTT is minus 93 deg C).

Bay of Bengal & Andaman Sea:-

According to 0900 UTC satellite imagery, scattered low/medium clouds with embedded intense to very intense convection prevails over south BOB to the south of Lat. 10ºN and over Andaman Sea.

Large scale features

M.J.O. Index:
MJO index is in Phase 3 (eastern Indian Ocean) with amplitude more than 1. It will continue in same phase with reduction in amplitude for 3 more days and enter into Phase 4 (western maritime Continent) with subdued amplitude thereafter.

Storms and Depression over South China Sea/ South Indian Ocean: None over south China Sea and over south Indian Ocean.

NWP Input for FDP Cyclone based on 0000 UTC of today

IMD-GFS T-1534
(i) Indicates : SuCS over east-central AS on 27th and 28th, ESCS over northern parts of central AS on 29th**,** ESCS over northwest and adjoining west central AS on 30th, ESCS over central parts of north AS on 31st October. ESCS over northwest AS on 1st November,

VSCS over Kutch on 2nd, SCS over east Rajasthan and neighbourhood on 3rd, less marked on 4th November.

(ii) Indicates: Lopar over west equatorial IO and adjoining Maldives area on 31st October, WML over southeast AS and adjoining Lakshadweep area on 1st November, WML/D over southeast AS and adjoining Lakshadweep area on 2nd, WML over eastcentral and adjoining southeast AS on 3rd, Lopar over southeast and adjoining eastcentral AS on 4th November. However, the model predicts further intensification of this low pressure system over the AS in the wind field during 1st to 4th November.

IMD-GEFS

(i) Indicates: ESCS over east-central AS on 27th, SuCS over eastcentral and adjoining west central AS on 28th, SuCS over central AS on 29th, ESCS over central and adjoining north AS on 30th, SCS over central and adjoining north AS on 31st October. SCS over west central AS on 1st November D over west central AS off Yemen coast on 2nd , MLW over Gulf of Oman off Yemen coast on 3rd November.

(ii) Indicates: WML over northeast AS on 1st November and less marked on 2nd November.

(iii) Indicates : Trough of Low over southeast and adjoining east central AS on 1st November, less marked on 2nd November.

(iv) Indicates : WML over north Andaman Sea and adjoining east central BOB on 3rd November.

(v) Indicates : CS over south China sea on 30th October and crossing Thailand on 31st October.

IMD-WRF

(i) Indicates: SuCS over east-central AS on 27th & SuCS over central AS on 28th, SuCS over west-central AS on 29th and 30th October.

NCMRWF-NCUM:

(i) Indicates: SuCS over east-central AS 0n 27th and 28th. ESCS over central AS on 29th, ESCS over west central AS on 30th, VSCS over west central AS on 31st October. VSCS moving southeastward over west central AS on 1st November (An apparent Fujiwarah effect). VSCS over southwest AS on 2nd and 3rd November.

(ii) Indicates: Lopar over east equatorial IO and adjoining southwest BOB and south Sri Lanka on 28th, Lopar east equatorial IO and Sri Lanka on 29th, WML over Lakshadweep area and adjoining Kerala on 30th, CS over south east AS off Karnataka coast on 31st October, D over east-central AS on 1st November, CS over northeast AS on 2nd and 3rd November.

(iii) Shows weakening of both the systems on 4th November and a fresh cyclogenesis over north Andaman Sea from 5th November.

NCMRWF-UM-Regional Model:

(i) Indicates: SuCS over east-central AS on 27th and 28th, SuCS over central AS on 29th and 30th October.

(ii) Indicates : Lopar over east equatorial IO and adjoining south Sri Lanka on 29th, Lopar over Comorin area on 30th October.

NEPS Model:

(i) Indicates : ESCS over east central AS on 27th, ESCS over east AS on 28th, ESCS over central and adjoining north AS on 29th , ESCS over west-central and adjoining north west AS on 30th, VSCS over west-central AS on 31th October and 1st November, VSCS over southwest AS on 2nd and 3rd, weakening on 4th November.

(ii) Indicates: Lopar over east equatorial IO and south Sri Lanka on 28th, Lopar over Sri Lanka on 29th, DD over Kerala and adjoining Lakshadweep area on 30th, SCS east-central AS off Karnataka coast on 31st October, CS over east central AS on 1st November, CS over northeast AS on 2nd, CS over north east AS off north Gujarat coast on 3rd November.

(iii) It also indicates D over north Andaman Sea on 5th November.

ECMWF:

(i)Indicates : ESCS over east-central AS on 27th, ESCS over central and adjoining west central AS on 28th, ESCS over central AS on 29th , ESCS over west-central AS on 30th, VSCS over west-central AS on 31st October, SCS /CS over west central AS on 1st November SCS entering Gulf of Oman on 2nd November, CS over Gulf of Oman moving further westwards on 3rd November.

(ii) Indicates: Lopar Trough of Low over east equatorial IO and adjoining Sri Lanka on 27th, trough of low over Sri Lanka on 28th, Lopar over south Sri Lanka on 29th, WML over Maldives area on 30th, D over southeast AS and adjoining Lakshadweep area on 31st October, CS over south east AS on 1st November, D over east-central AS on 2nd, November.

(iii) Lopar over north Andaman Sea on 3rd November, Lopar over east-central BOB and adjoining north Andaman Sea on 4th, Lopar over east central BOB weakens, a fresh Lopar seen over central BOB on 5th, a fresh Lopar seen over central BOB on 6th November.

NCEP-GFS :

(i) Indicates : ESCS over east central and adjoining west central AS on 28th, ESCS over central AS on 29th, VSCS over central parts of north and adjoining central AS on 30th, SCS over central parts of north AS on 31st October, CS over north east AS on 1st November , D over north east AS on 2nd and D over north east AS on 3rd November.

(ii) Indicates : Trough of low over south east AS off Kerala-Karnataka coasts on 30th, trough of low over Lakshadweep area and adjoining south east AS on 31st October, Lopar over Lakshadweep area and neighbourhood on 1st November, Lopar over south east AS and adjoining Lakshadwep area on 2nd, Lopar over east central AS on 3rd November.

(iii) Trough of low over Arakan coast on 2nd and 3rd November, Lopar over north Andaman sea and neighbourhood on 4th November.

(iv) D over south China Sea on 30th, westward movement and crossing Thailand on 1st November.

ARP-Meteo France :

(i) Indicates: SuCS over east-central AS on 27th, SuCS over east-central and adjoining west-central AS on 28th, SuCS over central AS on 29th, SuCS over west-central AS on 30th October.

(ii) Indicates: Lopar over Comorin area on 29th, WML over Comorin & adjoining Lakshadweep area on 30th October.

Dynamical statistical models

IMD Genesis Potential Parameter (GPP):

(i) Significant zone of GPP seen over east central AS on 27th, over central AS on 28th & 29th and over central parts of north AS on 30th, over northeast AS on 31st October and 1st November and also over Lakshadweep area on 1st November.

(ii) No Significant zone of GPP seen over BOB.

IMD NWP products are available at:

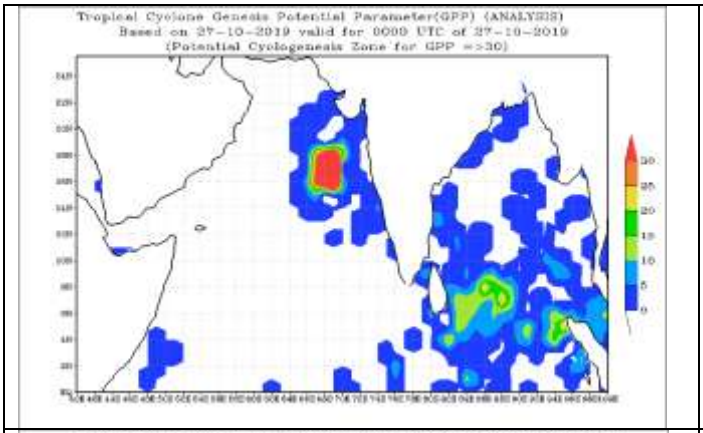
http://nwp.imd.gov.in/bias/gfsproducts.php
http://nwp.imd.gov.in/bias/wrf27pro.php
http://www.rsmcnewdelhi.imd.gov.in/NWP_CYC/Analysis.htm or
http://www.rsmcnewdelhi.imd.gov.in/NWP_CYC/<HH> hrs.htm
<HH> are forecast hours i.e. 24, 48, 72 and etc.

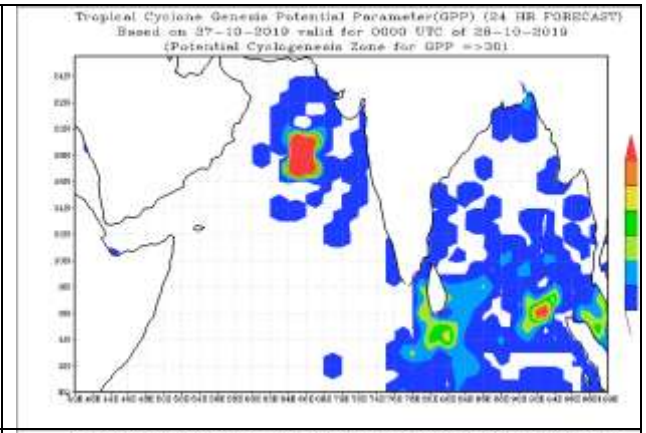
Summary and Conclusion:

- The SuCS over east central Arabian Sea is very likely to move west-northwestwards towards Oman coast with gradual weakening from tomorrow and a rapid weakening from 30th October.
- The MJO lies in the phase 3 with amplitude greater than 1. It will remain in the same phase during next 3 days with diminishing amplitude and move over to phase 4 thereafter. This along with the prevailing Positive Indian Ocean Dipole and overall sea surface temperature > 29ºC and TCHP > 80 kJ/cm -2 over major parts of south & central AS & BOB are favourable factors for cyclogenesis over north IO at present. However, over the AS, a cold tongue of SST is observed to extend from the western part towards central AS at present.
- IMD GFS and GPP as against its forecast, yesterday, is indicating a fresh cyclogenesis over the AS today. NCUM & NEPS also suggest probable formation of a CS over east-central and adjoining southeast AS on 1st November and two intense systems over the AS simultaneously during the initial part of 1st week of November and also indicates Fujiwarah effect among the two. ECMWF predicts formation of a D over AS on 1st November and its northwestward movement and further intensification into CS on 2nd November. It also indicates a fresh cyclogenesis over the Bay of Bengal by 5th November along with NCUM & NEPS.

Advisory: No IOP for next 5 days.

Annexure-1


Tropical Cyclone Genesis Potential Parameter(GPP) (ANALYSIS)
Based on 27-10-2019 valid for 0000 UTC of 27-10-2019
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (24 HR FORECAST)
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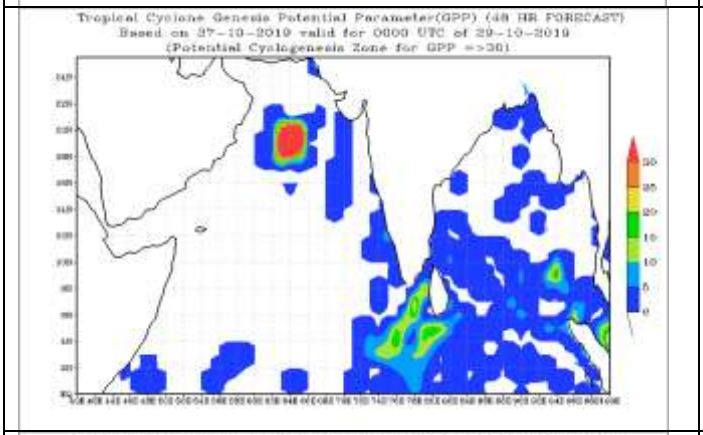
(Potential Cyclogenesis Zone for GPP =>30)


Tropical Cyclone Genesis Potential Parameter(GPP) (48 HR FORECAST)
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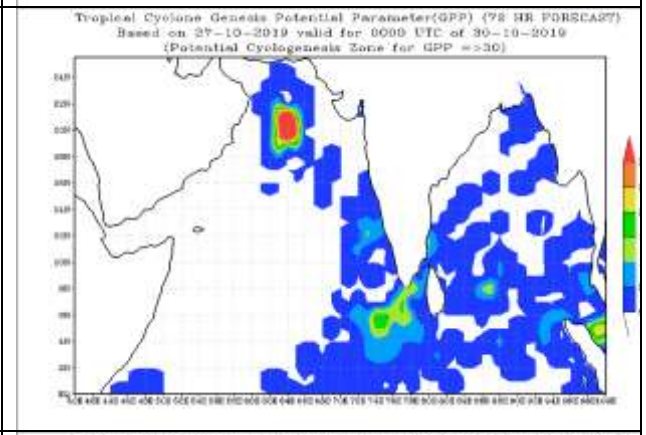
Tropical Cyclone Genesis Potential Parameter(GPP) (72 HR FORECAST)
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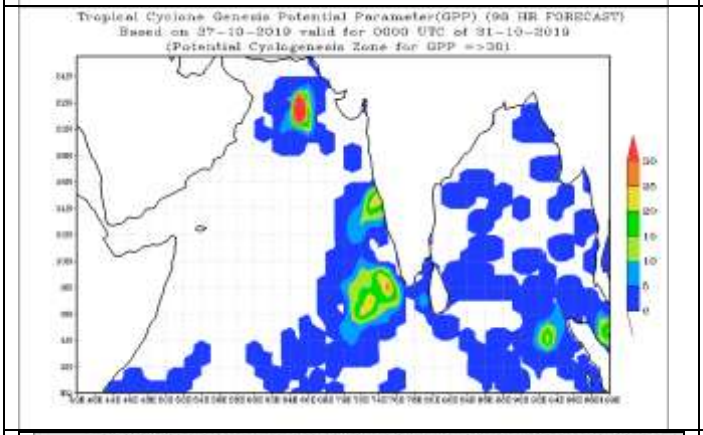
(Potential Cyclogenesis Zone for GPP =>30)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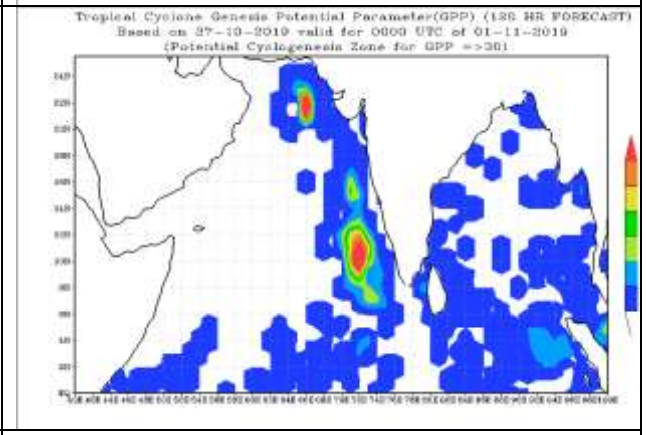
Tropical Cyclone Genesis Potential Parameter(GPP) (120 HR FORECAST)
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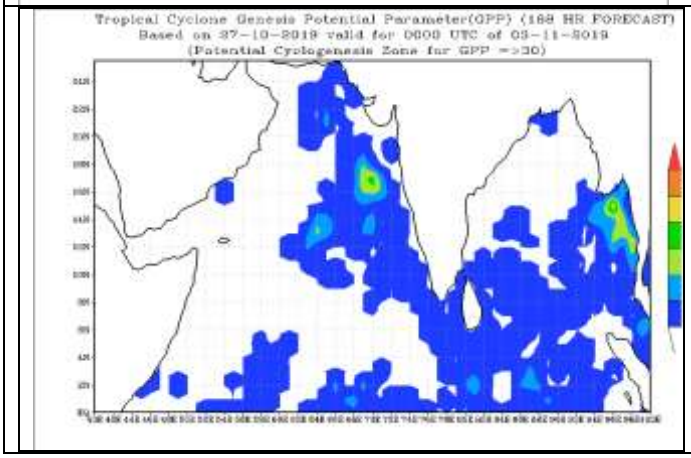
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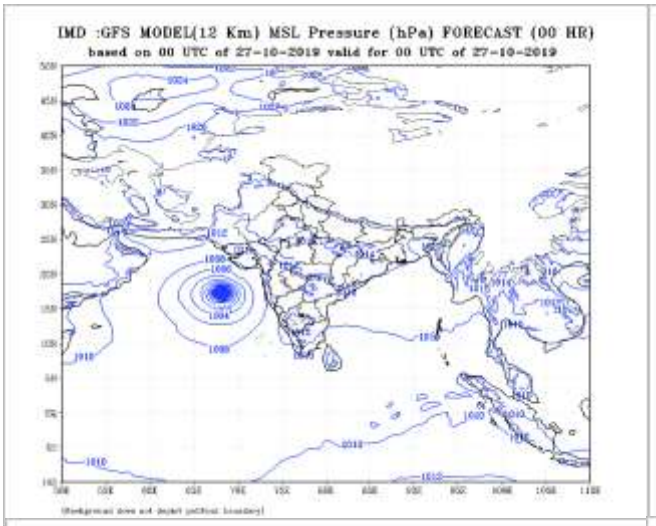
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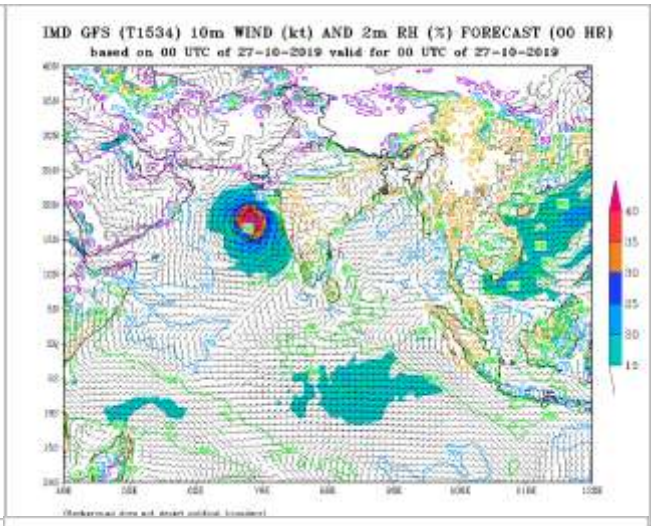
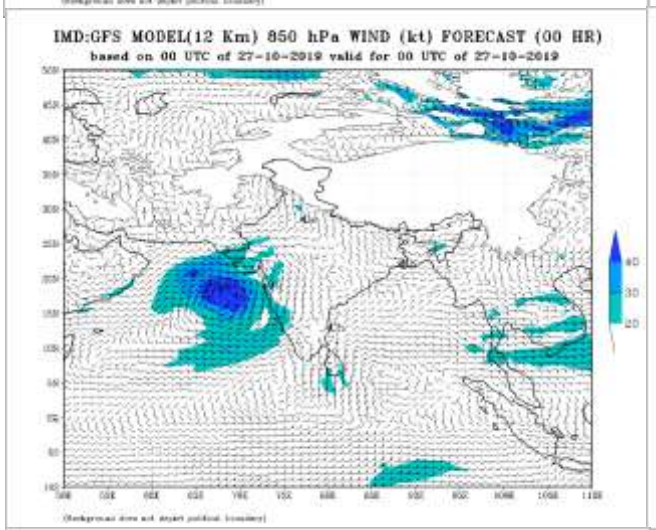
based on 00 UTC of 27-10-2019 valid for 00 UTC of 27-10-2019


IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (00 HR)
based on 00 UTC of 27-10-2019 valid for 00 UTC of 27-10-2019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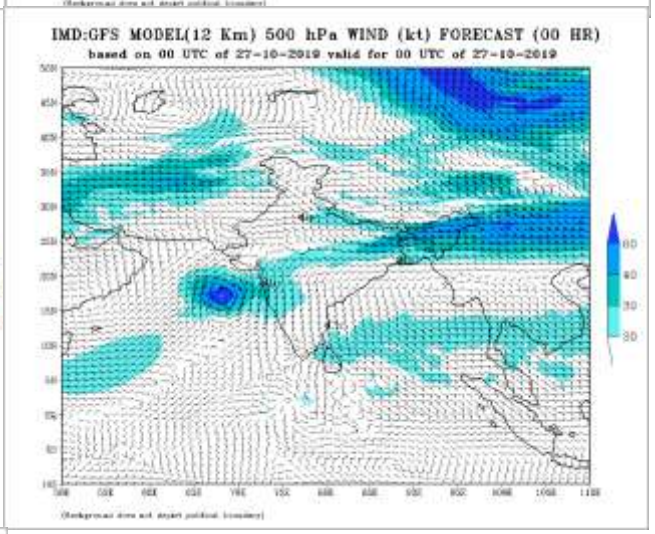
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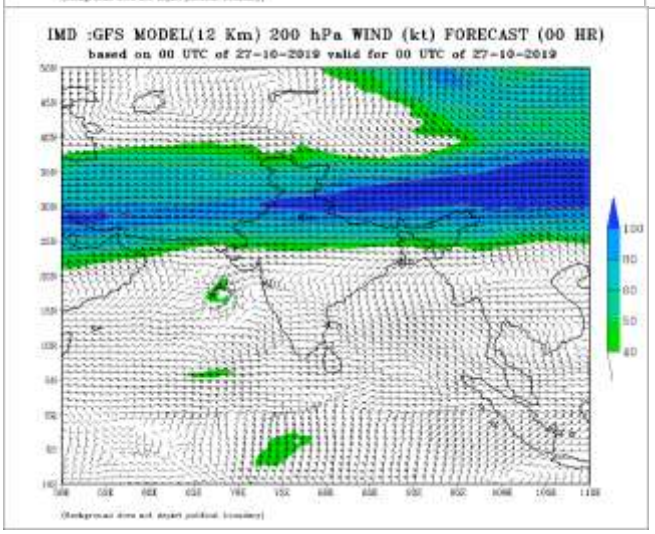
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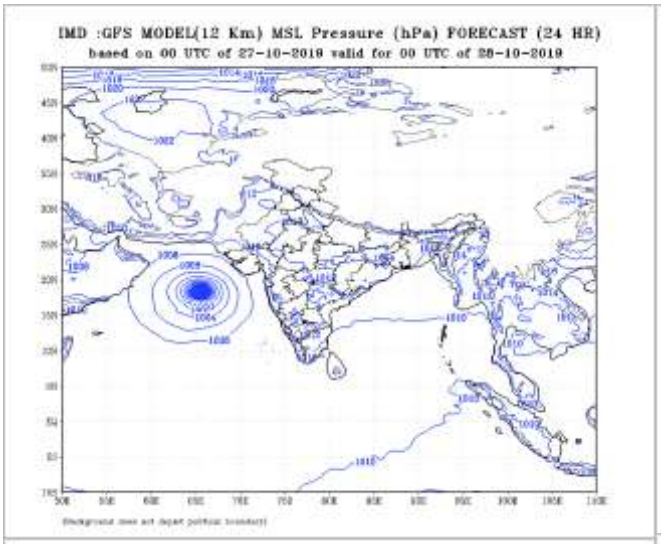
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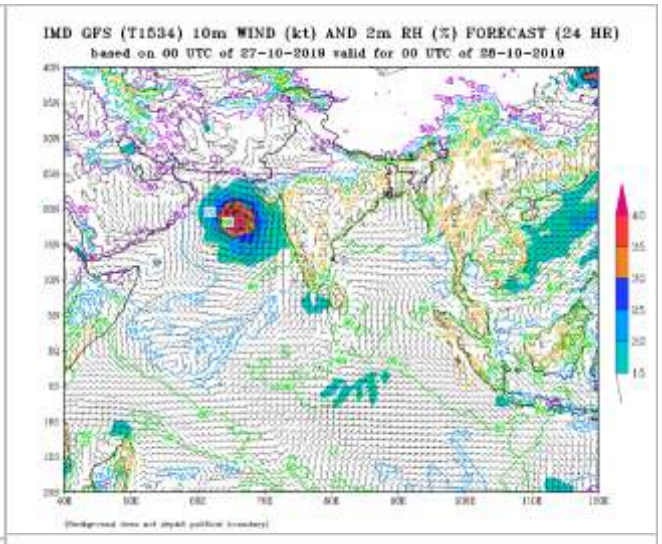
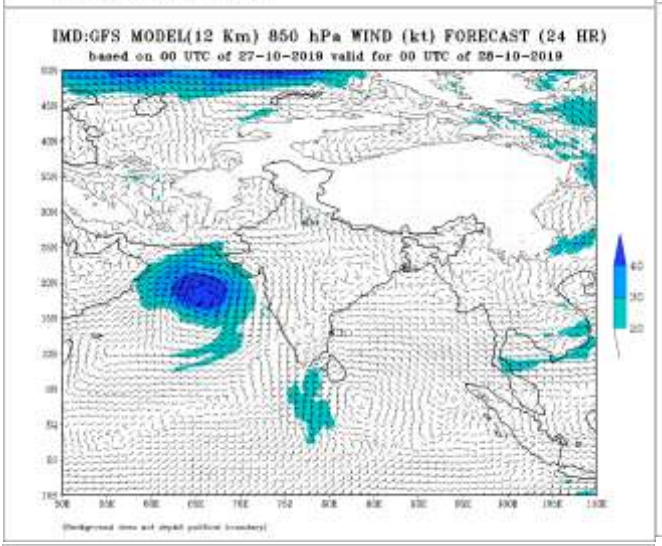

IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (24 HR)
based on 00 UTC of 27-10-2019 valid for 00 UTC of 28-10-2019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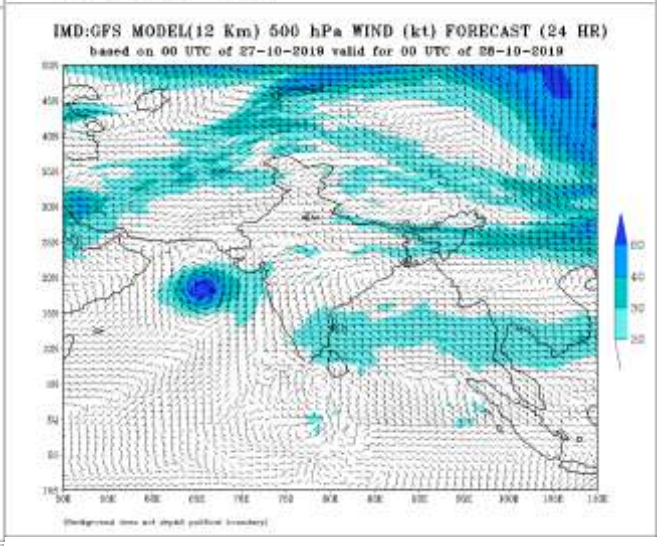
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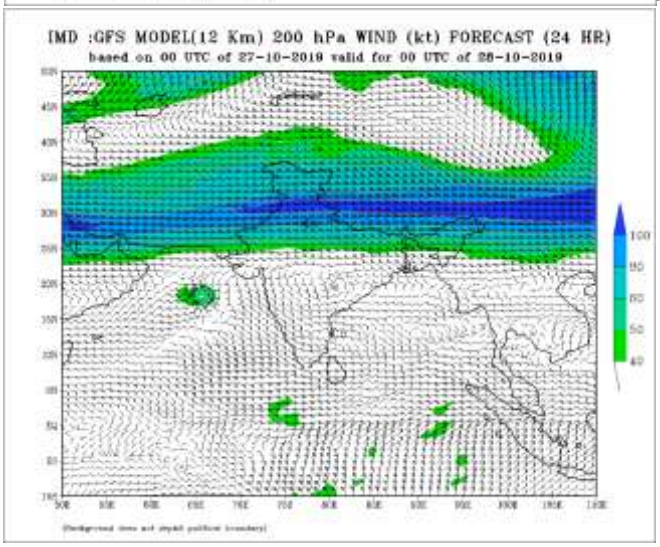
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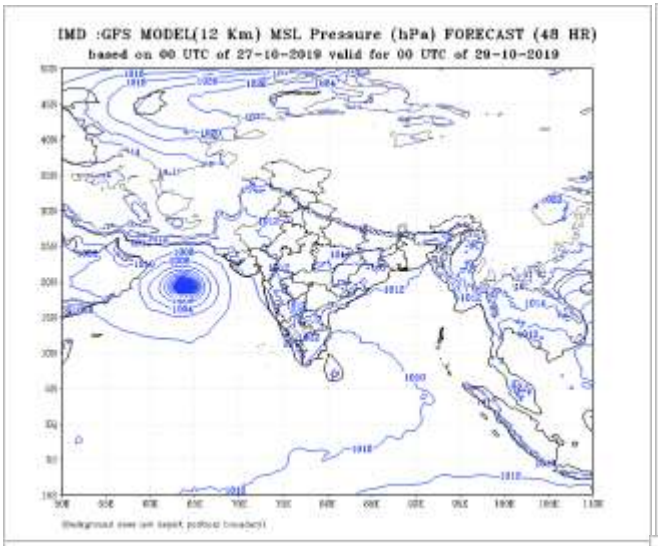
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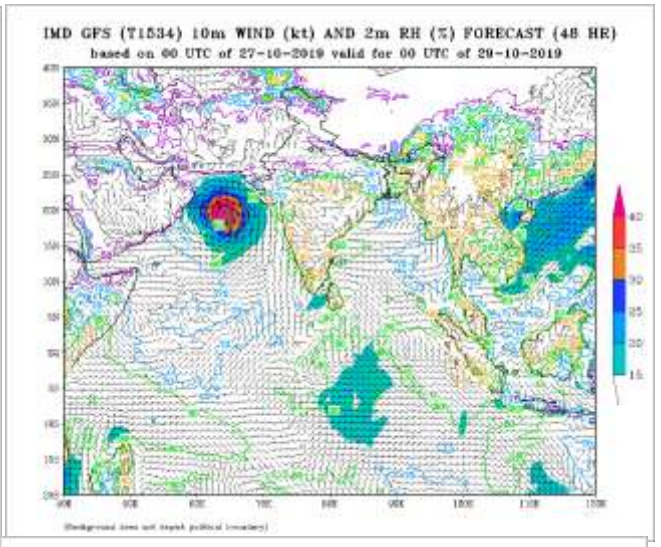
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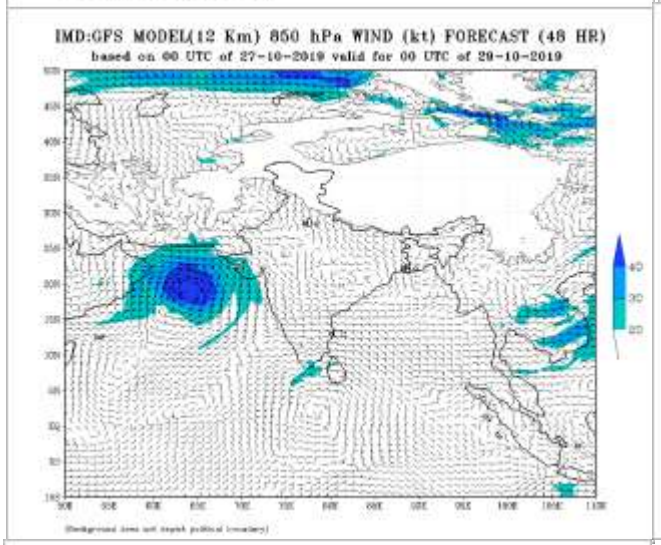
based on 00 UTC of 27-10-2019 valid for 00 UTC of 29-10-2019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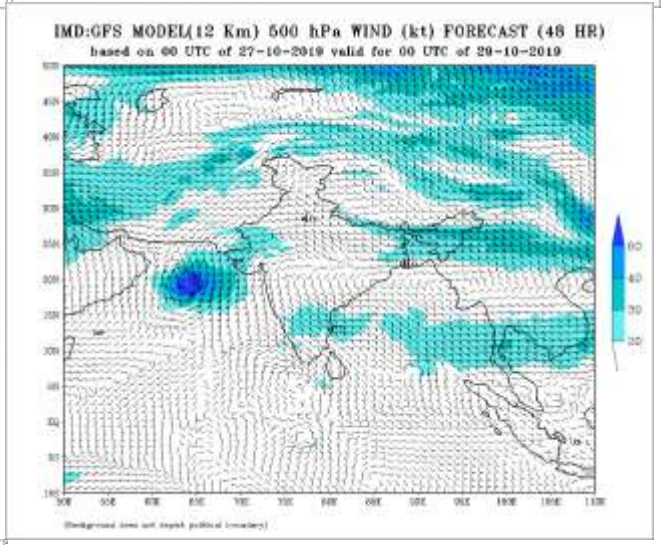
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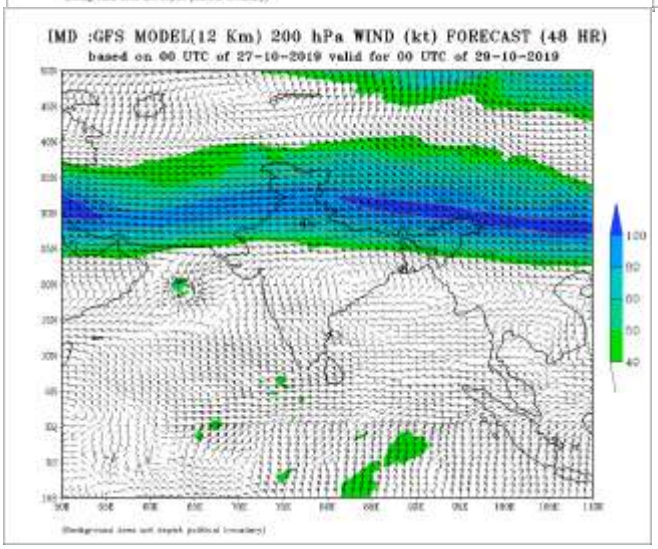
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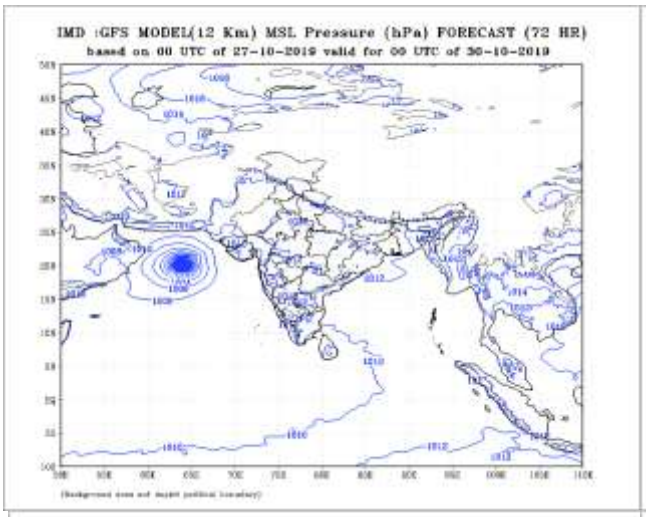
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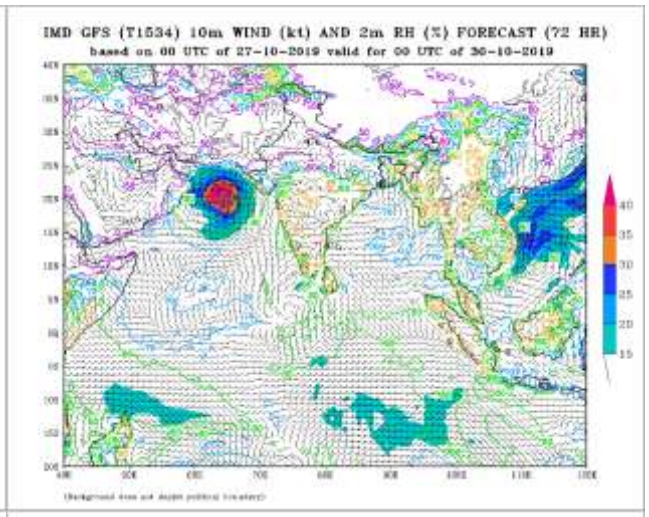
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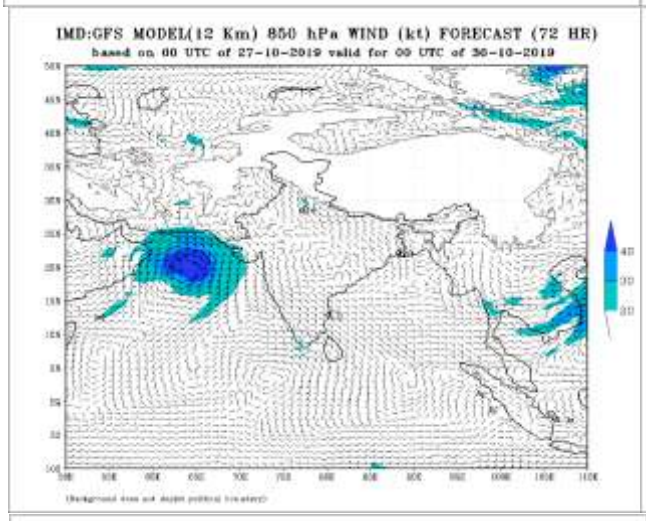
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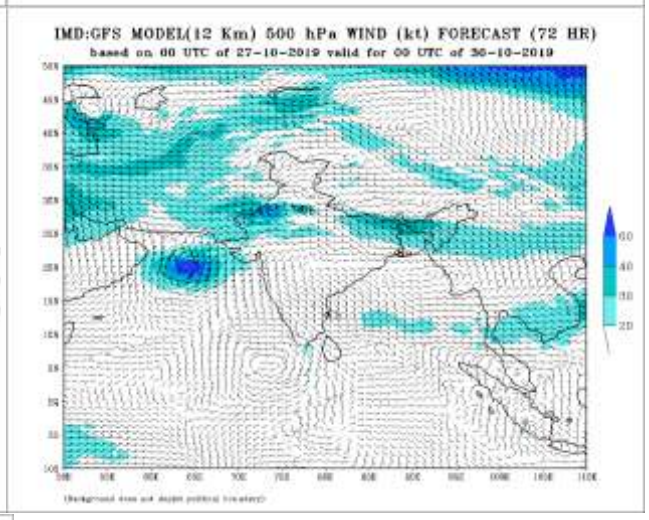
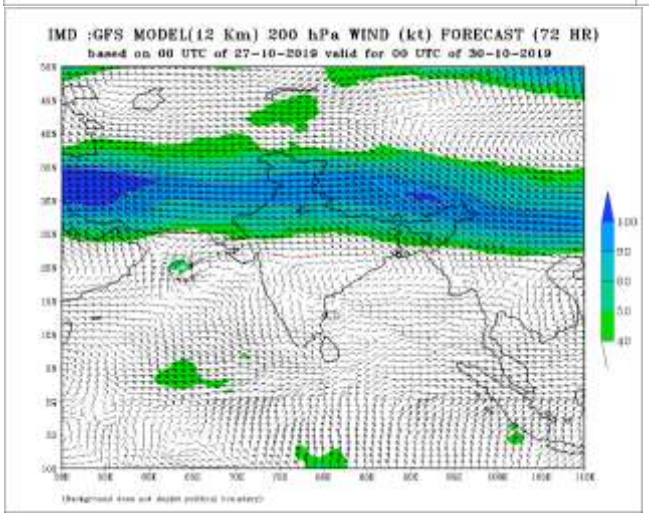
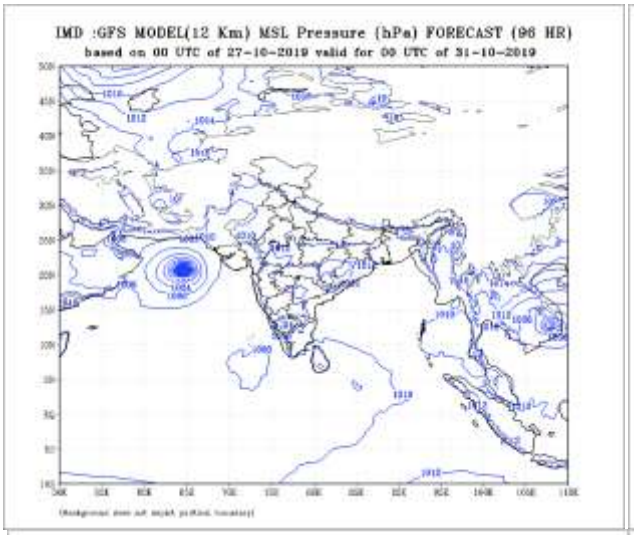
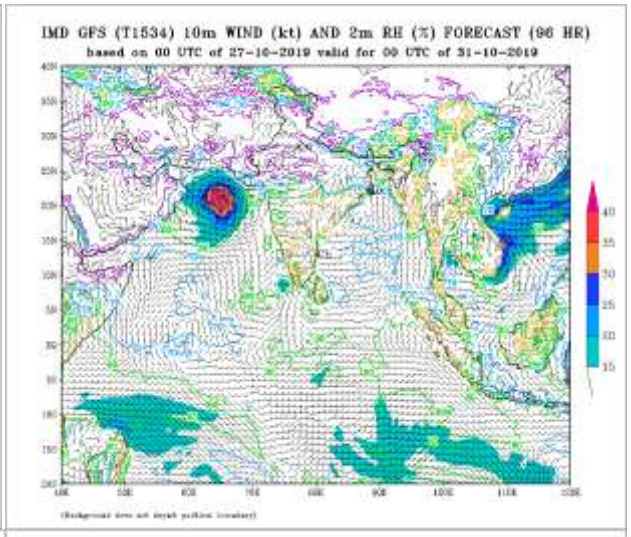
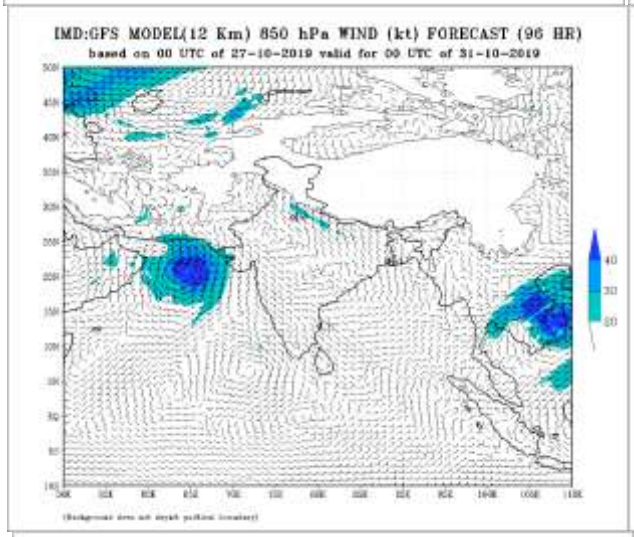
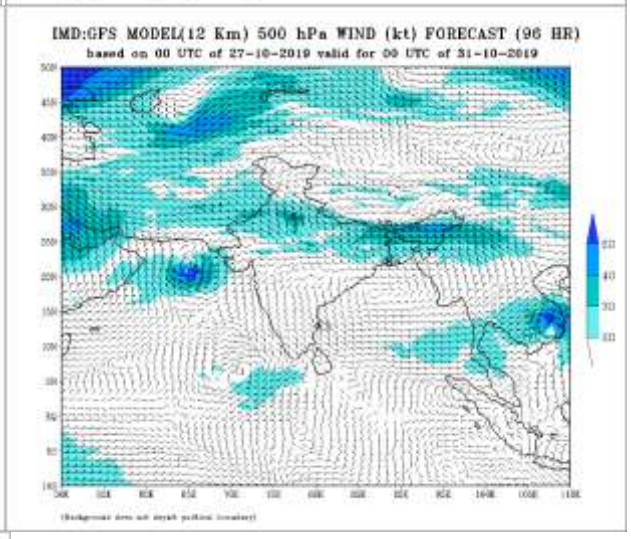

IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 27-10-2019 valid for 00 UTC of 30-10-2019

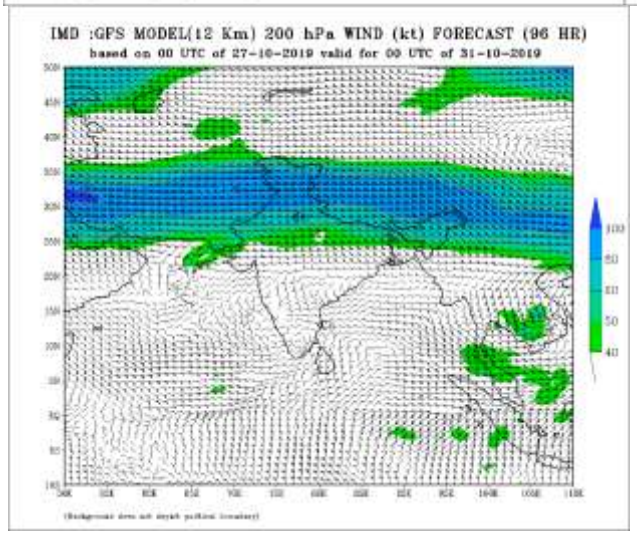

IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 27-10-2019 valid for 00 UTC of 30-10-2019


IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (96 HR)
based on 00 UTC of 27-10-2019 valid for 00 UTC of 31-10-2019


IMD GFS (T1534) 10m WIND (kt) AND 2m RH (%) FORECAST (96 HR)
based on 00 UTC of 27-10-2019 valid for 00 UTC of 31-10-2019


IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 27-10-2019 valid for 00 UTC of 31-10-2019


IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 27-10-2019 valid for 00 UTC of 31-10-2019


IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (96 HR)
based on 00 UTC of 27-10-2019 valid for 00 UTC of 31-10-2019