



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



FDP (Cyclone) NOC Report Dated 30th October, 2019

Time of Issue: 1200 UTC

Synoptic features:

- The **Extremely Severe Cyclonic Storm (ESCS)** over westcentral & adjoining eastcentral & north Arabian Sea weakened into a Very Severe Cyclonic Storm at 00 UTVC of 30th October over westcentral and adjoining northwest Arabian. It moved west-southwestwards and lay centred at 0900 UTC of today, 30th October, 2019 over westcentral and adjoining northwest Arabian Sea near Latitude 19.3°N and Longitude 61.7°E, about 1170 km west-northwest of Mumbai (Maharashtra), 860 km east-northeast of Salalah (Oman) and 330 km east-southeast of Masirah (Oman). It is very likely to continue to move west-southwestwards across westcentral Arabian Sea during next 4 days. It is very likely to weaken into a Severe Cyclonic Storm by early hours of 31st October and into a Cyclonic Storm by forenoon of 31st October, 2019
- Yesterday's Well Marked Low pressure Area over Comorin area & adjoining equatorial Indian ocean concentrated into a Depression over Lakshadweep-Maldives areas & adjoining southeast Arabian Sea at 00 UTC of today, the 30th October. It moved northwestwards and intensified into intensified into a Deep Depression over Lakshadweep and adjoining southeast Arabian Sea and Maldives area and lay centered at 0900 UTC of today, 30th October, 2019 near Latitude 8.5°N and Longitude 74.5°E, about 490 km north-northeast of Male (Maldives), 150 km east-northeast of Minicoy (Lakshadweep), 300 km southeast of Kavaratti (Lakshadweep) and 270 km west of Thiruvananthapuram (Kerala). It is very likely to continue to move northwestwards across Lakshadweep Islands during next 36 hours and then emerge into eastcentral Arabian Sea. It is very likely to intensify into a Cyclonic Storm during next 12 hours.

Dynamical and thermodynamical features

Sea Surface Temperature (SST):

Sea Surface Temperature is around 27-28°C over the system area while to the north and to the south of the VSCS, it is warmer (29-30°C). SST is around 29-30°C over the area of deep depression and is decreasing in the forecast direction of movement.

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

Tropical Cyclone Heat Potential (TCHP):

Tropical Cyclone Heat Potential (TCHP) to the west of the VSCS over westcentral Arabian Sea is 20-40 kJ/cm² while to the east of the system center over eastcentral Arabian Sea, it is 50-80 kJ/cm².

TCHP is around 80-100 kJ/cm² over the area of DD and decreases in the forecast direction of movement of the system.

TCHP is 120-130 kJ/cm² over a small area in southwest BOB and 80-100 kJ/cm² over the rest of the BOB.

Relative Vorticity:

An area of cyclonic relative vorticity at 850 hPa of 250 X10⁻⁶s⁻¹ is seen to the south of the centre of the VSCS. Cyclonic relative vorticity at 850 hPa of 150 X10⁻⁶s⁻¹ is seen over the area of DD.

Low level Convergence:

Lower level convergence is about $10 \times 10^{-5} \text{s}^{-1}$ to the south of the VSCS.
Lower level convergence of about $20 \times 10^{-5} \text{s}^{-1}$ is seen over area of DD.

Upper level Divergence:

Upper level divergence of value $20 \times 10^{-5} \text{s}^{-1}$ is seen to the south of the VSCS centre and of value $30 \times 10^{-5} \text{s}^{-1}$ is seen over the area of DD.

Wind Shear:

Wind shear is moderate (15-20 knots) over the VSCS area. It is moderate to high (20-25 knots) over the area of the DD.

Wind shear is low to moderate over most parts of BOB and Andaman Sea.

Wind Shear Tendency:

The wind shear is increasing 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 15°N over the region of the DD.

Satellite observations based on INSAT imagery:

Arabian Sea:-

As per the satellite imagery at 0900 UTC OF 30TH October, 2019, the current intensity of the system is T 4.5/CI 5.5. associated broken low to medium clouds with embedded intense to very intense convection lies over westcentral and adjoining east central Arabian Sea between Lat 18.0°N to 23.0°N and Long 60.5°E to 64.5°E . The minimum CTT is minus 93°C .

As per the satellite imagery at 0900 UTC of 30TH October, 2019, the current intensity of the system over Lakshadweep area is T 2.0. Associated scattered low to medium clouds with embedded intense to very intense convection lies over Comorin and adjoining areas between Lat 5.5°N to 9.5°N and Long 72.5°E to 75.0°E . The minimum CTT is minus 93°C .

Bay of Bengal & Andaman Sea:-

According to 0900 UTC satellite imagery, scattered low/medium clouds with embedded intense convection prevails over southwest and adjoining westcentral BOB.

Large scale features

M.J.O. Index:

MJO index is in Phase 4 with amplitude less than 1. It will continue in same phase with reduction in amplitude till 31st October and enter into Phase 5 with amplitude less than 1.

Storms and Depression over South China Sea/ South Indian Ocean: At 1200 UTC, Tropical Storm MATMO, located near $13.5\text{N } 110.1\text{E}$ approximately 183 NM southeast of DA NANG, VIETNAM,. It moved west-northwestwards with a speed of 09 knots over the past six hours. It is expected to continue to move in a west-northwestward direction and cross Vietnam around 1800 UTC and weaken thereafter.

NWP Input for FDP Cyclone based on 0000 UTC of today

IMD-GFS T-1534

- (i) Indicates :ESCS over west central AS on 30th, is seen to weaken into SCS 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: A Depression over Comorin and adjoining Maldives area on 30th and a SCS over Lakshadweep Islands on 31st. Moving northwestwards, it weakens into a CS over southeast AS and adjoining Lakshadweep area on 1st November, a DD over SE Arabian Sea on 2nd November and a D on 03rd, which becomes less marked by 7th near Oman coast.

IMD-GEFS

- (i) Indicates: SCS over westcentral AS on 31st, which becomes a DD over west-central AS off Oman coast on 1st November, weakens into WML over the same region and becomes less marked subsequently.
- (ii) Indicates: CS over Lakshadweep area on 31st October, which is seen to weaken into a WML on 02nd November and becomes less marked subsequently.

IMD-WRF

- (i) Indicates: VSCS over west-central AS on 30th October while moving in a west-southwestward direction weakens into and a SCS on 31st over WC Arabian Sea close to Oman coast, and into a DD over the same area by 01st November.
- (ii) Depression over Comorin and adjoining Maldives on 30th, becomes a DD over Maldives and adjoining Lakshadweep area off Kerala-Karnataka coasts on 31st October and a SCS over EC Arabian Sea on 01st November off Maharashtra coast.

NCMRWF-NCUM:

- (i) Indicates: ESCS/VSCS over west central AS on 30th October, SCS over west central AS close to Oman coast on 31st October, CS on 1st November close to Oman coast and a Depression off Oman coast on 2nd November, and becomes less marked thereafter.
- (ii) Indicates: Well marked low pressure area over southeast AS and adjoining Lakshadweep area on 30th, a CS on 31st over Lakshadweep area, over SE Arabian Sea on 01st November. It is seen to move in a west-northwest direction till 3rd November and becomes DD on 4th November over WC Arabian Sea, D on 5th off Oman coast.
- (iii) Shows formation of a WML over southeast BOB and adjoining Andaman Sea on 6th November which becomes a depression on 7th over eastcentral BoB, a CS over central parts of BoB on 8th, a VSCS off north Andhra Pradesh- south Odisha coasts on 9th.

NCMRWF-UM-Regional Model:

- (i) Indicates: SuCS/ ESCS over central and adjoining north AS on 29th and 30th October, which moves westwards.
- (ii) Indicates : LOPAR over IO to the south of Comorin area on 29th which becomes a WML on 31st and a D over Lakshadweep and adjoining SE Arabian Sea on 31st October and a CS 01st November over SE Arabian Sea.

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: WML over Lakshadweep and adjoining SE Arabian Sea on 30th, CS over SE Arabian Sea on 31st October and 01st November, which while moving in a west-northwest direction becomes SCS over EC Arabian Sea by 03th November, weakens into CS on 4th, DD on 5th close to Oman coast, WML on 5th, becomes less marked on 06th.
- (v) A LOPAR seen to form over Andaman Sea and adjoining BoB on 4th November which becomes a WML on 5th, DD/CS over EC BoB by 7th, SCS by 8th November, and a VSCS/ESCS off south Odisha coast on 9th November.

ECMWF:

(i) Indicates : ESCS/VSCS over west-central and adjoining north AS on 30th, CS over west-central AS off 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: D over Comorin and adjoining Lakshadweep area on 30th October, CS over south east AS on 31st October, SCS on 1st November, which is seen to move west-northwestwards to further intensify into a VSCS and into ESCS over westcentral AS by 04th November. It is seen to skirt Oman coast on 5th and 6th November and weakens thereafter over sea.

(iv) Another LOPAR is seen over north Andaman Sea and adjoining EC BoB on 05th, which becomes a D over EC BoB on 6th, DD/CS on 7th, and reach south Odisha- north Andhra Pradesh coasts by 9th.

NCEP-GFS :

(i) Indicates : ESCS over westcentral AS on 30th, SCS over west-central AS on 31st October, DD over west-central AS off Oman coast on 1st November , D over west-central AS off Oman coast on 2nd November which becomes insignificant thereafter.

(ii) Indicates : WML over Comorin-Maldives - Lakshadweep areas on 30th, CS on 31st, which intensifies while moving in a northwest direction towards Oman coast till 8th and weakens thereafter.

ARP-Meteo France : NIL

Dynamical statistical models

IMD Genesis Potential Parameter (GPP):

(i) Significant zone of GPP seen over west-central AS on 30th, diminished on 31st October, reappears over west-central AS on 1st and 2nd November, which becomes less marked on 3rd November.

(ii) Another significant zone of GPP seen over Comorin and adjoining Maldives area on 30th, over Lakshadweep area, off Kerala coast on 31st October, over southeast AS on 1st November, which becomes insignificant on 3rd November over northern parts of 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) Environmental conditions indicate that total precipitable water imageries show continued reduction in warm air incursion and dry air incursion is taking place in the south and western sectors of the VSCS. Equatorward outflow is taking place in the upper tropospheric levels. All the environmental, dynamic and thermodynamic conditions indicate further weakening of the system while the system moves in a west-southwestward direction across west central Arabian Sea. Majority of numerical models agree with the above inference.

(B) The ridge over the area of DD runs roughly along 15^oN. The lower level convergence is about $20 \times 10^{-5} \text{S}^{-1}$ over the system centre and the upper level divergence is about $30 \times 10^{-5} \text{S}^{-1}$ over the system centre. the vertical wind shear is moderate to high (20-25 knots) over the system area. Sea surface temperature is around 29-30°C over the system area and is decreasing in the forecast direction . Tropical cyclone heat potential is around 80-100 KJ/CM² over the system area and decreases in the forecast direction of the system. As the system is lying in a favourable environment, it has intensified into a deep depression and is very likely to intensify into a cyclonic storm during next 12 hours while moving in a northwest direction. Most of the NWP models are in agreement with this observation.

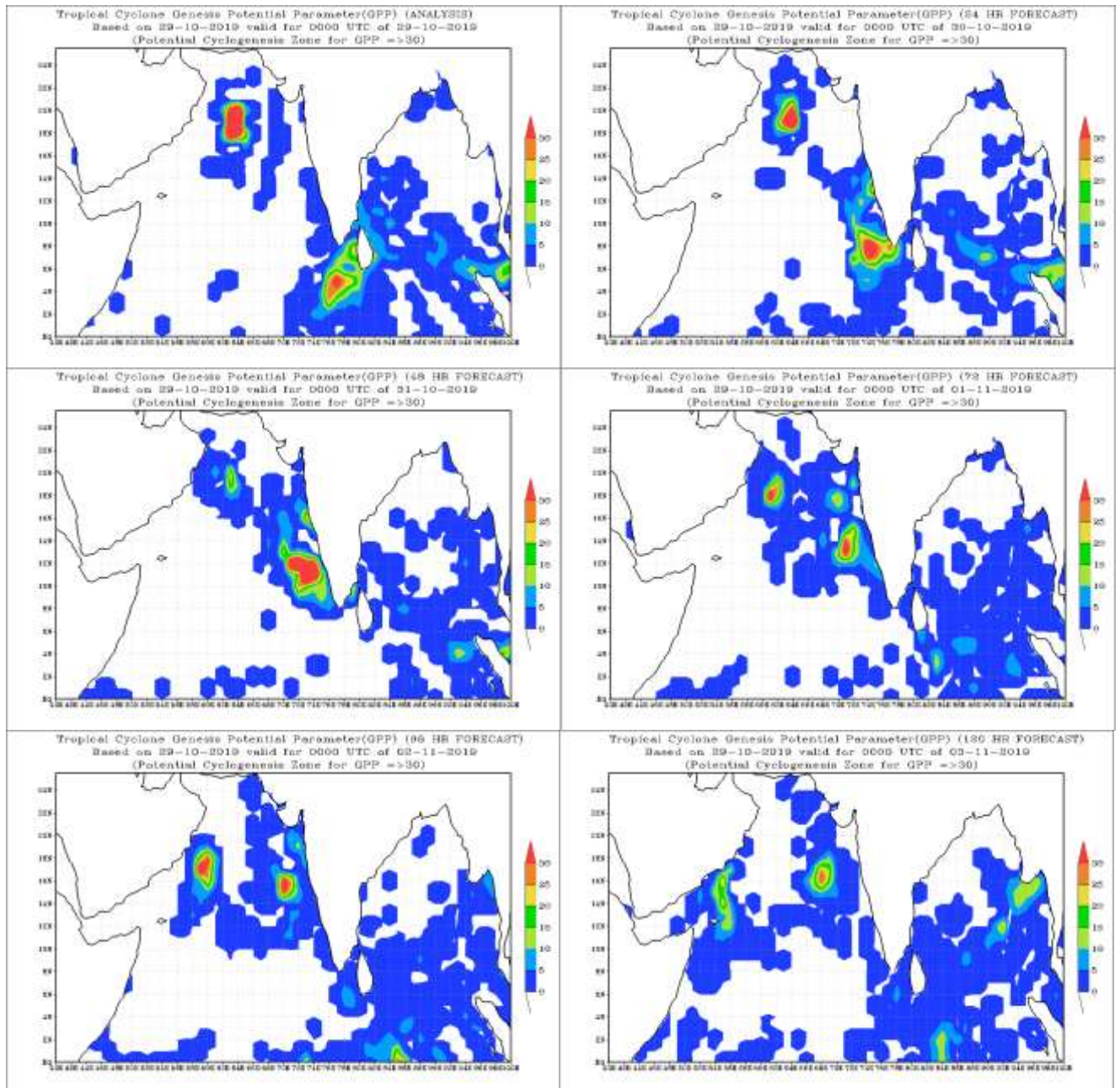
Probability of cyclogenesis over Bay of Bengal and Andaman Sea during next 120 hours:

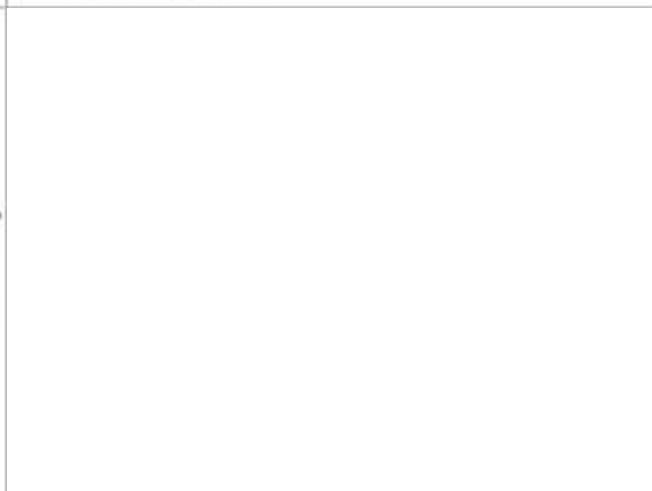
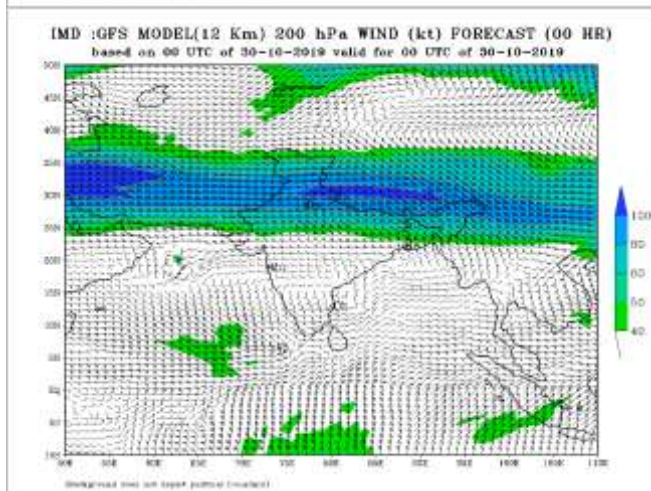
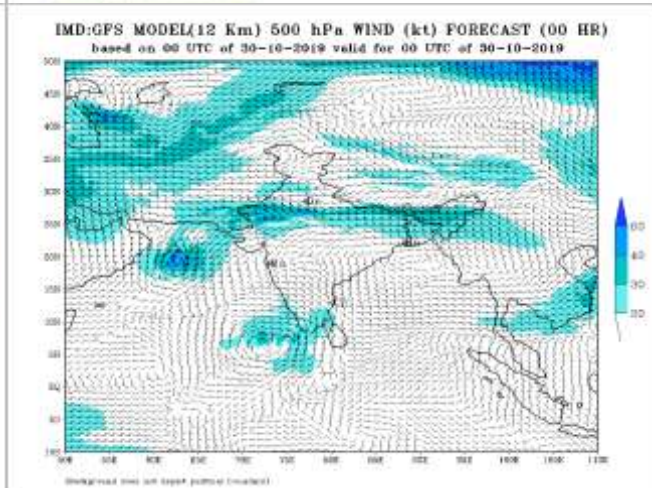
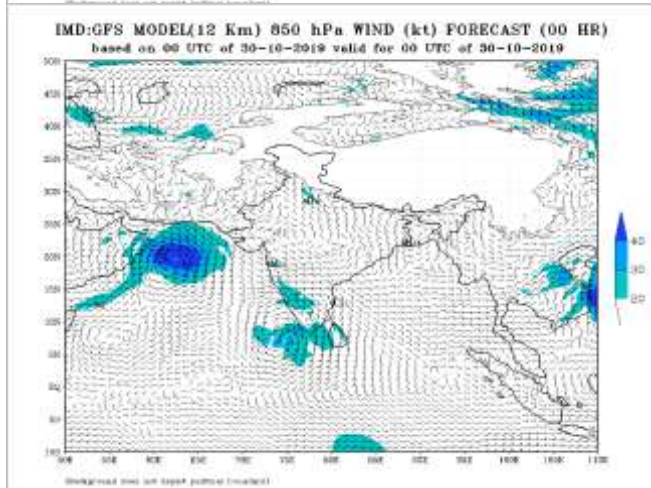
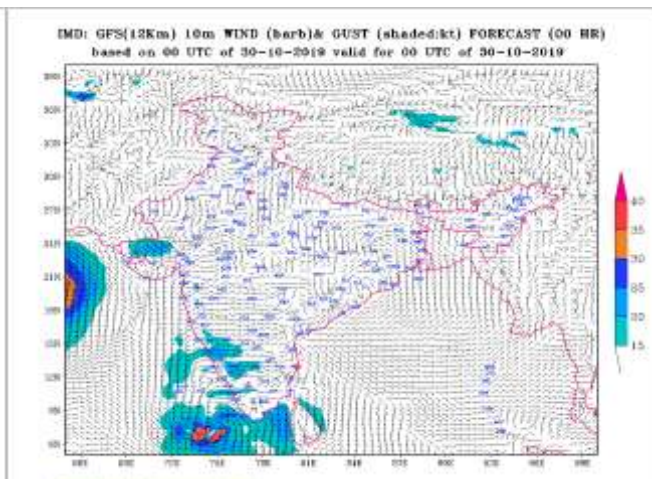
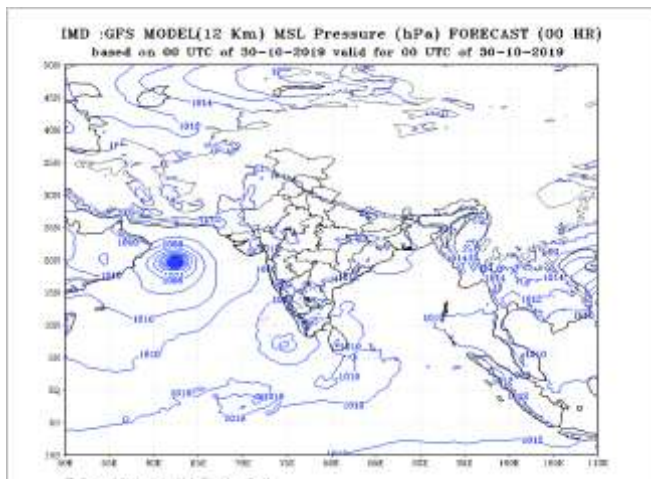
24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
Nil	Nil	Nil	Nil	Nil

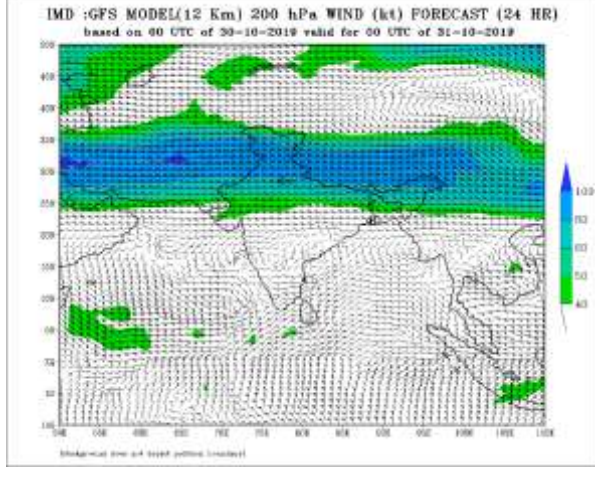
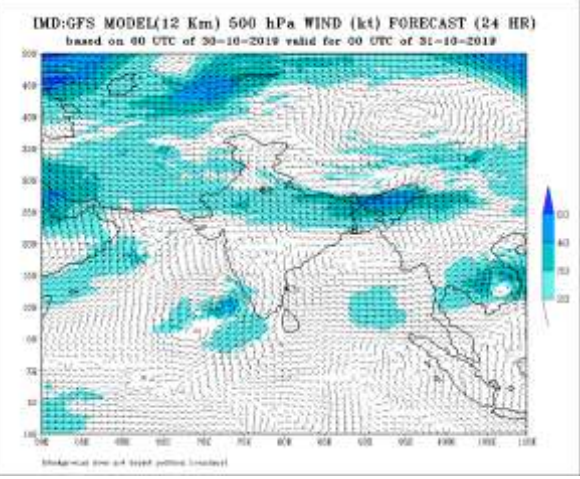
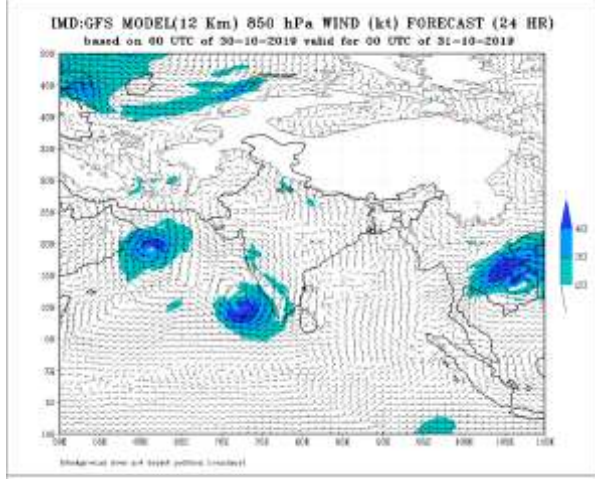
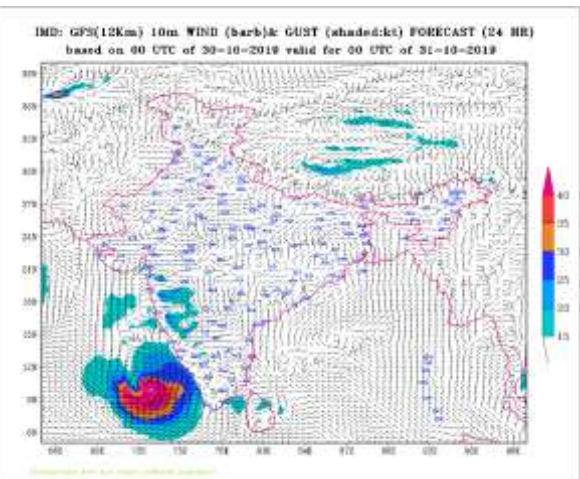
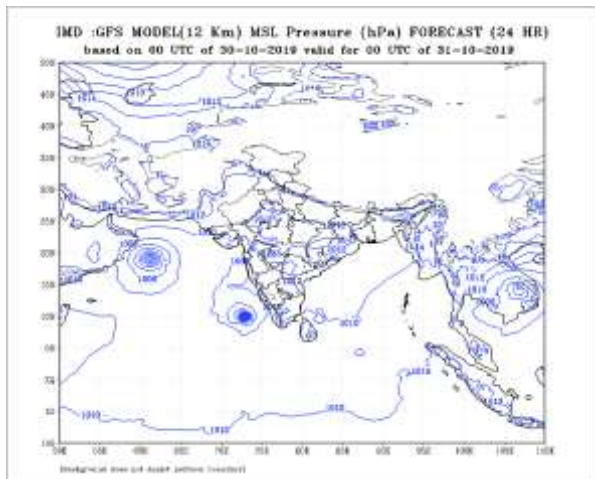
Probability of cyclogenesis over Arabian Sea during next 120 hours:

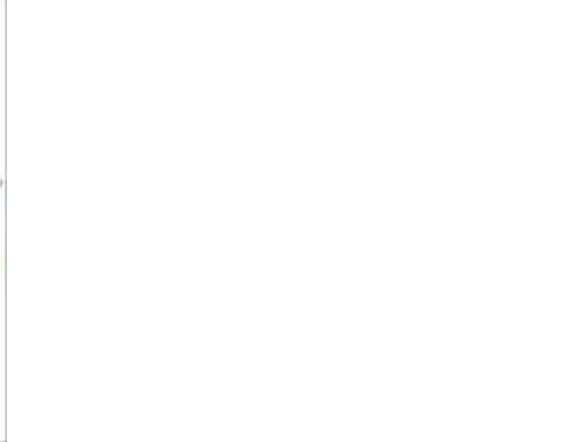
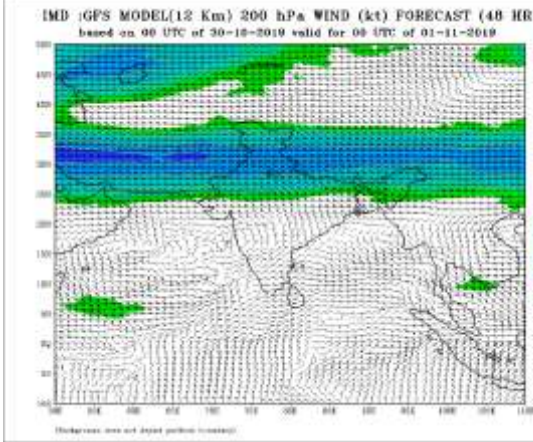
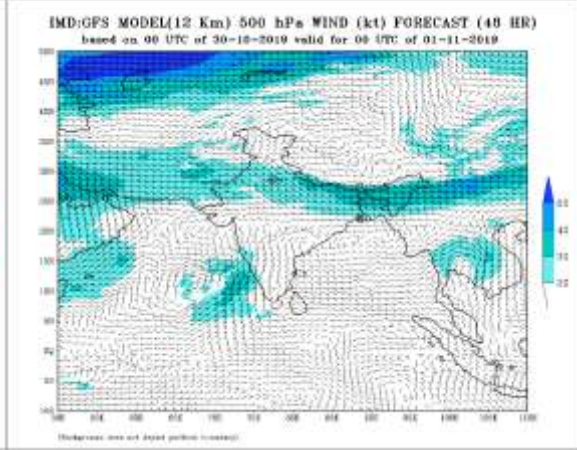
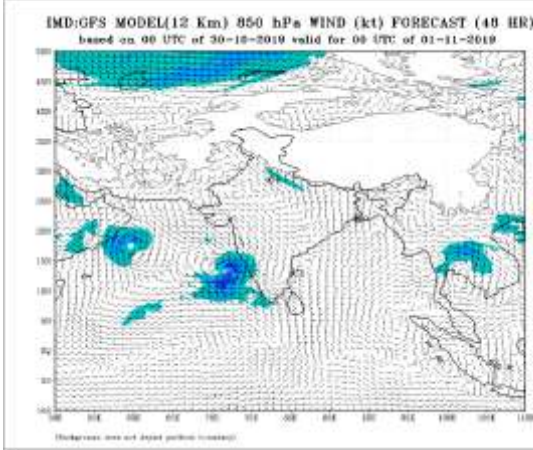
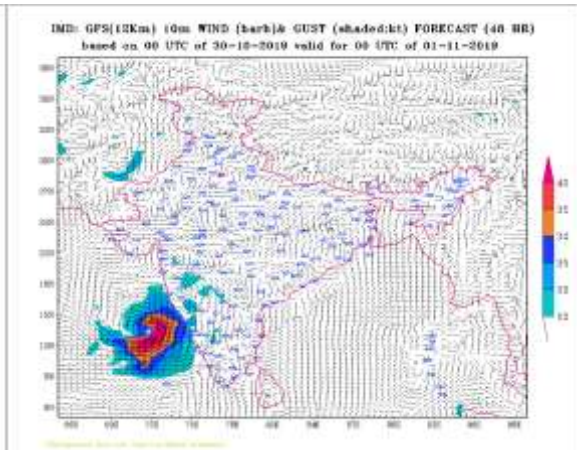
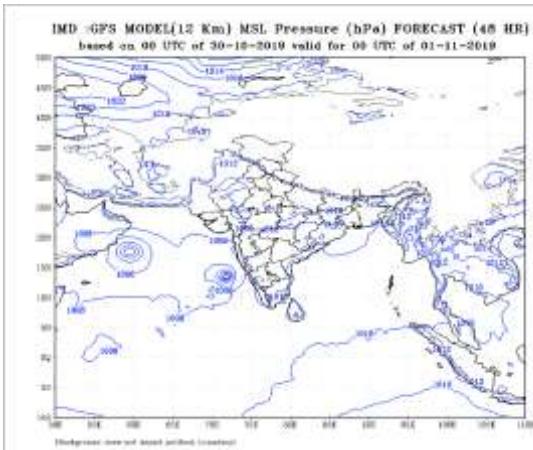
24 HOURS	24-48 HOURS	48-72 HOURS	72-96 HOURS	96-120 HOURS
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Advisory: IOP for South Tamil Nadu, Kerala and Lakshadweep during 30-31 October 2019.

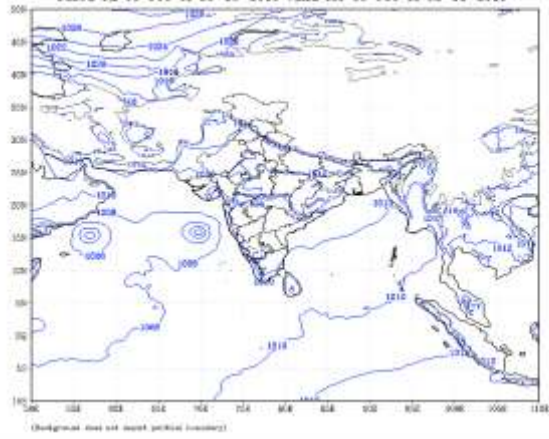




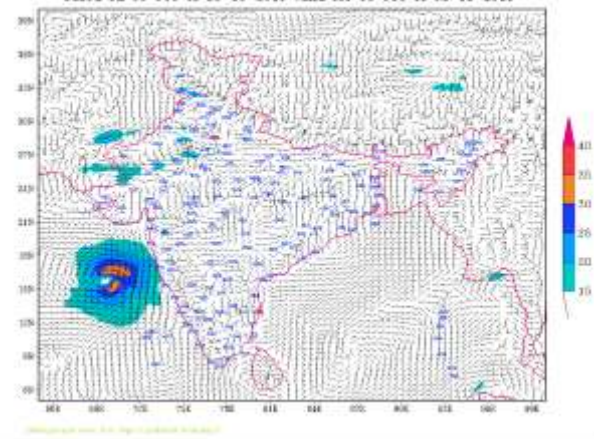




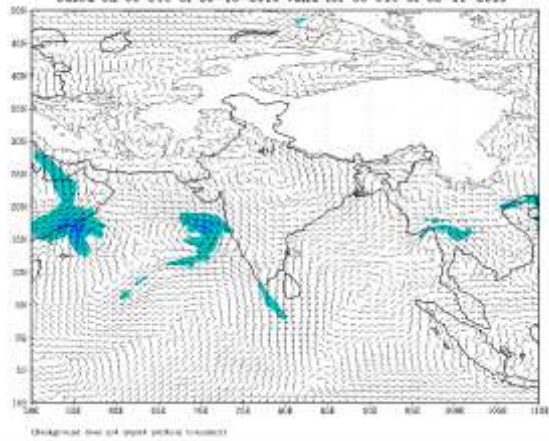
IMD :GFS MODEL(12 Km) MSL Pressure (hPa) FORECAST (72 HR)
based on 00 UTC of 30-10-2019 valid for 00 UTC of 02-11-2019



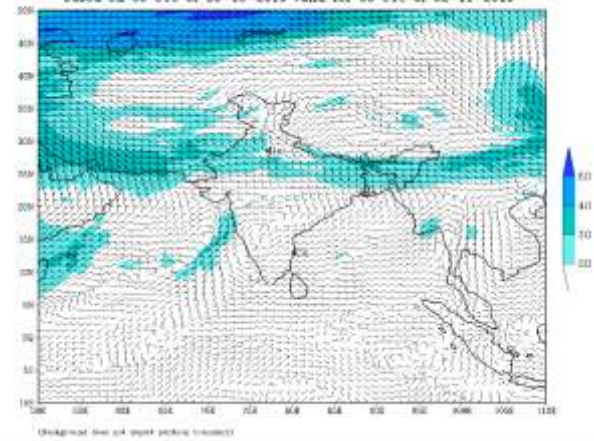
IMD: GFS(12Km) 10m WIND (barb)& GUST (shaded:kt) FORECAST (72 HR)
based on 00 UTC of 30-10-2019 valid for 00 UTC of 02-11-2019



IMD:GFS MODEL(12 Km) 850 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 30-10-2019 valid for 00 UTC of 02-11-2019



IMD:GFS MODEL(12 Km) 500 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 30-10-2019 valid for 00 UTC of 02-11-2019



IMD :GFS MODEL(12 Km) 200 hPa WIND (kt) FORECAST (72 HR)
based on 00 UTC of 30-10-2019 valid for 00 UTC of 02-11-2019

