



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



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

Time of Issue: 1200 UTC

Synoptic features:

- The trough in easterlies between 0.9 km & 1.5 km above mean sea level over southwest Bay of Bengal off Srilanka and Tamilnadu coasts now seen as a cyclonic circulation between 0.9 km & 1.5 km above mean sea level over Comorin area & neighbourhood.
- A low pressure area has formed over Equatorial Indian Ocean and adjoining Southwest Arabian Sea at 0000 UTC of 30th November. The associated cyclonic circulation extends upto 5.8 km above mean sea level tilting southwestwards with height. It is likely to move west-northwestwards and become more marked during next 48 hours.
- Another low pressure area is likely to form over Southeast Arabian Sea & adjoining Lakshadweep area during next 24 hours and it is likely to become more marked during subsequent 24 hours.

Dynamical and thermodynamical features

Sea Surface Temperature (SST):

Sea Surface Temperature is around 26-28°C over westcentral Arabian Sea and north Arabian Sea and western parts of southwest Arabian Sea. It increases to 28-30°C over eastcentral and southeast Arabian Sea. There is a very small pocket of values around 25°C over northeast AS.

SST is around 26-28 °C over most parts of north BoB and adjoining WC BoB. It is between 28 - 30°C over rest BoB with higher values over eastcentral and south BoB.

Tropical Cyclone Heat Potential (TCHP):

Tropical Cyclone Heat Potential (TCHP) is 20-50 kJ/cm² over north Arabian Sea, westcentral, adjoining eastcentral and western parts of southwest Arabian Sea. Over southeast Arabian Sea it is of value 80-100 kJ/cm². There are areas of values more than 100 kJ/cm² southeast Arabian Sea, off Kerala coast & Lakshadweep area and also over equatorial Indian Ocean.

TCHP is around 30-50 kJ/cm² over north BoB and adjoining westcentral BoB. It is around 80-90 kJ/cm² over rest of the BOB.

Relative Vorticity:

Areas of cyclonic relative vorticity of value 50-60x10⁻⁵ s⁻¹ seen over southwest BoB off Tamil Nadu coast and also over Comorin and adjoin Maldives area. rather anti-cyclonic vorticity prevails over major parts of the BoB.

Cyclonic relative vorticity of value 50-70x10⁻⁵ s⁻¹ seen over equatorial Indian Ocean to the south of southwest Arabian Sea.

Low level Convergence:

An area of positive lower level convergence of value 20x10⁻⁵ s⁻¹ is seen over southwest BoB and another area of value 30x10⁻⁵ s⁻¹ is seen over Comorin Area.

Positive lower level convergence of value 30-40x10⁻⁵ s⁻¹ is seen over equatorial Indian Ocean to the south of southwest Arabian Sea where the LOPAR lies.

Upper level Divergence:

An area of positive upper level divergence of value 5-10x10⁻⁵ s⁻¹ is seen over southwest BoB and adjoining equatorial Indian Ocean.

Positive upper level divergence of value 40x10⁻⁵ s⁻¹ is seen over west equatorial Indian Ocean to the south of southwest Arabian Sea in association with the LOPAR.

Wind Shear:

Wind shear is high over north, central and southwest BoB and low to moderate over southeast BoB.

Wind shear is high over most parts of Arabian Sea except for a small area over southwest Arabian Sea and over Comorin- Maldives area, where it is low to moderate.

Wind Shear Tendency:

The wind shear tendency is negative or neutral over entire BoB.

It is negative or neutral over north Arabian Sea and also over western parts of southwest Arabian Sea. It is positive over the rest area.

Upper tropospheric ridge:

The upper tropospheric ridge at 200 hPa runs roughly along 12°N over BoB and roughly along 11°N over Arabian Sea.

Satellite observations based on INSAT imagery:**Arabian Sea:-**

As per the satellite imagery at 0600 UTC of 30th November, 2019, broken low to medium clouds with embedded intense to very intense convection lies over equatorial Indian Ocean and adjoining southwest Arabian Sea between latitude 3.0°N to 12°N and longitude 52°E to 60°E in association with the low level circulation (LLC) over the area.

Bay of Bengal & Andaman Sea:

According to 0600 UTC satellite imagery, scattered low/medium clouds with embedded intense to very intense convection lies over southwest BoB.

Large scale features**M.J.O. Index:**

MJO index is in Phase 1 with amplitude near to 1. It is likely to remain in the same phase for next 3-4 days and move to Phase -2 thereafter.

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 a low pressure area over equatorial Indian Ocean and adjoining southwest Arabian Sea on 30th November, which becomes well marked low on 01st December. It further weakens from 02nd and becomes less marked by 05th.
- (ii) It also indicates another low pressure area on 01st December over Lakshadweep area and adjoining southeast Arabian Sea, which concentrates into a depression on 02nd, and a CS on 03rd. Moving north-northwestwards, it further intensifies and crosses south Gujarat coast on 6th December.

IMD-GEFS:

- (i) Indicates a Low Pressure area (LOPAR) over equatorial IO and adjoining southwest Arabian Sea (AS) on 30th November which becomes less marked on 02nd December.
- (ii) Another LOPAR forms over Lakshadweep area and adjoining southeast Arabian Sea on 01st December. Moving north-northeastwards it intensifies into a CS and crosses south Gujarat coast in the night of 5th December.

IMD-WRF:

- (i) Indicate a Low Pressure area over north equatorial Indian Ocean and adjoining southwest Arabian sea on 30th November which becomes a WML/ D by 03rd December.
- (ii) Another LOPAR forms over Lakshadweep area and adjoining southeast Arabian Sea on 01st December and is seen to persist over the same area without much intensification.

NCMRWF-NCUM: Indicates a low pressure area over equatorial Indian Ocean and adjoining southwest Arabian Sea on 30th November, which becomes a depression on 3rd December southwest Arabian Sea. Moving west-northeastwards it crosses north Somali coast on 7th and weakens thereafter. Its twin system over south Indian Ocean also is seen to intensify to a Very Severe system while moving in a south-southwestward direction.

This model does not indicate development of the second LOPAR over southeast Arabian Sea.

NCMRWF-UM-Regional Model: Indicates development of no low pressure system for the next 3 days.

NEPS Model: Indicates a low pressure area over equatorial Indian Ocean and adjoining southwest Arabian Sea on 30th November, which becomes a depression on 4th and a CS on 5th over southwest Arabian Sea. Moving west-northwestwards to cross north Somali coast on 7th and weakens thereafter. Its twin system over south Indian Ocean also is seen to intensify while moving in a south-southwestward direction, becoming a depression on 02nd and a CS on 3rd December and intensifies further thereafter.

ECMWF:

- (i) Indicates a low pressure area over equatorial Indian Ocean and adjoining southwest Arabian Sea on 30th November which becomes a depression on 01st December and persists over same area till 5th December. It becomes unimportant by 6th December.
- (ii) On 02nd December another LOPAR forms over southeast Arabian Sea, which becomes a depression during 03-04 December. It becomes less marked on 6th.

NCEP-GFS:

- (i) Indicates a low pressure area on 30th November, which becomes a depression on 03rd December over southwest Arabian Sea and adjoining equatorial Indian Ocean, close to Somali coast. It starts weakening from 5th December and becomes less marked on 6th.
- (ii) Another LOPAR is seen to form on 2nd December over southeast Arabian Sea which becomes a depression on 3rd and moves in a northwest direction. It is seen to become less marked on 07th December.

ARP-Meteo France :

- (i) A low pressure area is seen over equatorial Indian Ocean and adjoining southwest Arabian Sea on 30th November. It becomes a WML/ D on 01st December and persists till 03rd December.
- (ii) Another LOPAR form over Lakshadweep area on 01st December and it becomes WML/D on 02nd December and a CS on 03rd December.

Dynamical statistical models

IMD Genesis Potential Parameter (GPP):

An area of significant zone of GPP is seen over southwest Arabian Sea on 30th November which is seen to move westwards slowly and becomes insignificant by 07th December off Somali coast. Another significant GPP zone is to develop over southeast BoB and adjoining equatorial Indian Ocean on 30th November over Comorin area. It moves in a north-northwest direction and becomes less marked on 05th December.

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:

Amongst the NWP models considered, most of them are indicating a low pressure area over equatorial Indian Ocean and adjoining southwest Arabian Sea. Among these, ECMWF, NCEP GFS and NCUM& NEPS are indicating further intensification of the system to a depression. However, there is large variation in the day of formation of depression. It varies from 01st to 04th December. Except for NCUM and NEPS, no other model is indicating the system to further intensify into a CS.

The intensification of the LOPAR over equatorial Indian Ocean and adjoining southwest Arabian sea needs to be monitored.

Most of the models except NCUM and NEPS are indicating development of another low pressure area over Lakshadweep and adjoining southeast Arabian Sea. Majority of models are indicating the system to further intensify into a depression on 03rd/ 04th December over southeast Arabian Sea. Amongst the models considered only IMD GFS and its ensemble model are forecasting the system to intensify further into a CS and move nearly northward direction.

The development and possible intensification of the LOPAR over Lakshadweep area and adjoining southeast Arabian sea needs to be closely monitored.

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
Nil	Nil	Low	High	High

Advisory: No IOP area for the next 5 days













