



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



FDP (Cyclone) NOC Report Dated 02nd December, 2019

Time of Issue: 1200 UTC

Synoptic features:

- The Well Marked Low pressure area over Southwest Arabian Sea and adjoining Equatorial Indian Ocean persists over the same region with associated cyclonic circulation extending upto mid tropospheric levels. It is very likely to concentrate into a Depression during next 12 hours and intensify gradually into a Cyclonic Storm during subsequent 48 hours. It is very likely to move west-northwestwards towards Somalia coast during next 72 hours.
- The Low Pressure Area over Lakshadweep Area and adjoining Southeast Arabian Sea persists with associated cyclonic circulation extending upto mid tropospheric levels. It is likely to become more marked during next 24 hours and concentrate into a Depression during subsequent 24 hours.

Dynamical and thermodynamical features

Sea Surface Temperature (SST):

Sea Surface Temperature is around 28-29°C over the system area in westcentral Arabian Sea which reduces to 27-28°C to the northwest direction. It increases to 28-30°C over eastcentral and southeast Arabian Sea.

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 over 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:

Cyclonic relative vorticity of value 150x10⁻⁵ s⁻¹ seen over the area of the WML over southwest Arabian Sea and adjoining equatorial Indian Ocean. Cyclonic relative vorticity of value 40-50x10⁻⁵ s⁻¹ seen over the area of the LOPAR over southeast Arabian Sea and adjoining Lakshadweep area.

Cyclonic relative vorticity of value 20-30x10⁻⁵ s⁻¹ seen over southwest BoB off Tamil Nadu- Sri Lanka coasts and also over the northeast BoB.

Low level Convergence:

Positive lower level convergence of value 10-15x10⁻⁵ s⁻¹ is seen over equatorial Indian Ocean to the south of southwest Arabian Sea where the WML lies and also over SE Arabian Sea and adjoining Lakshadweep LOPAR lies.

An area of positive lower level convergence of value 5-10x10⁻⁵ s⁻¹ is seen over equatorial Indian Ocean to the south of southwest BoB.

Upper level Divergence:

An area of positive upper level divergence of value 5-10x10⁻⁵ s⁻¹ is seen over southwest BoB and adjoining Gulf of Mannar and Comorin area.

Positive upper level divergence of value $30 \times 10^{-5} \text{ s}^{-1}$ is seen over west equatorial Indian Ocean to the south of southwest Arabian Sea in association with the WML; $20 \times 10^{-5} \text{ s}^{-1}$ is seen in association with the LOPAR over Southeast Arabian Sea and adjoining Lakshadweep area.

Wind Shear:

Wind shear is moderate to high over southwest Arabian Sea and low to moderate over southeast Arabian Sea.

Wind Shear Tendency:

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

It is negative or neutral over north and central 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 Arabian Sea.

Satellite observations based on INSAT imagery:

Arabian Sea:-

As per the satellite imagery at 0900 UTC of 2nd December, 2019, a vortex is seen over equatorial Indian Ocean and adjoining southwest Arabian Sea with intensity T 1.0. Associated broken low to medium clouds with embedded intense to very intense convection lies between latitude 4.0°N to 11°N and longitude 53°E to 60.5°E . Minimum Cloud Top Temperature (CTT) is minus 93 deg C.

Broken low/med clouds with embedded intense to very intense convection is seen over southeast Arabian Sea and adjoining Lakshadweep area between latitude 8.0°N to 13.0°N long 71.0°E to 75.5°E in association with the LLC over the area.

Bay of Bengal & Andaman Sea:

According to 0900 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 with increasing amplitude 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 depression over equatorial Indian Ocean and adjoining southwest Arabian Sea, which becomes a CS on 05th December and moving in a west-northwest direction it is seen off Somali coast on 6th and weakens by 00 UTC of 7th.
- (ii) The low pressure area over Lakshadweep area and adjoining southeast Arabian Sea, is seen to persists over the same region till 5th December without any intensification.

IMD-GEFS:

- (i) Indicates depression over equatorial IO and adjoining southwest Arabian Sea (AS) which becomes a CS on 03rd December. Moving west-northwestwards, it weakens into a low off Somali coast on 6th and becomes less marked thereafter.
- (ii) Other LOPAR over Lakshadweep area and adjoining southeast Arabian Sea moving in a north-northeastwards becomes insignificant on 5th December.

IMD-WRF:

- (i) The LOPAR forms over Lakshadweep area and adjoining southeast Arabian Sea becomes less marked by 04th.

- (i) **NCMRWF-NCUM:** The depression on 02nd December over southwest Arabian Sea and adjoining equatorial Indian Ocean, becomes a CS on 3rd and a VSCS by 00 UTC of 6th very close to Somali coast. It crosses extreme north coast of Somali on 6th and weakens thereafter.
- (ii) This model is not indicating a second system over SE Arabian Sea.

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

NEPS Model: The depression over SW Arabian Sea and adjoining equatorial Indian Ocean becomes a CS on 3rd. Moving northwestwards, it intensifies into a Severe Cyclonic Storm on 5th and reaches very close to north Somali Coast and crosses extreme northern parts on 6th. This model is not indicating a second system over SE Arabian Sea.

ECMWF:

- (i) The depression over equatorial Indian Ocean and adjoining southwest Arabian Sea becomes a CS on 03rd December and moves nearly westwards to cross Somali coast around 8° N latitude during 0600-1200 UTC of 06th December.
- (ii) The other LOPAR over southeast Arabian Sea, does not show any significant intensification.

NCEP-GFS:

- (iii) The depression on 02nd December over southwest Arabian Sea and adjoining equatorial Indian Ocean, moves northwestwards and reach very close to Somali coast by 5th December. It crosses extreme north coast of Somali on 6th and weakens thereafter.
- (iv) This model is another LOPAR over SE Arabian Sea. It is seen moving nearly northwards without significant intensification and becomes less marked by 6th.

ARP-Meteo France :

- (i) A well marked low pressure area is seen over equatorial Indian Ocean and adjoining southwest Arabian Sea on 02nd December which becomes a CS on 03rd December and is seen to move northwestwards with gradual intensification.
- (ii) Another LOPAR is seen over Lakshadweep area which becomes less marked by 04th December.

Dynamical statistical models

IMD Genesis Potential Parameter (GPP):

An area of significant zone of GPP is seen over southwest Arabian Sea is seen to move westwards slowly and becomes insignificant by 07th December off Somali coast. Another significant GPP zone is to develop over southeast Arabian Sea and adjoining Lakshadweep on 03rd December. 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 well marked low pressure area/ depression over equatorial Indian Ocean and adjoining southwest Arabian Sea in the analysis field. Most of them except NCEP GFS is forecasting the system to further intensify into a Cyclonic Storm on 3rd. NCEP GFS is not showing this intensification. NCUM& NEPS models are indicating further intensification of the system to a SCS/ VSCS. All the models are

forecasting the system to move in a north-northwestward to northwestward direction and reach north Somali coast by 0000 UTC of 06th December.

Considering the environmental condition, the system is lying over a moderately favourable environment. The intensification of the WML needs to be closely monitored.

Most of the models except NCUM and NEPS are indicating another low pressure area over Lakshadweep and adjoining southeast Arabian Sea. Majority of models are indicating that the system is not intensifying further.

Any 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
Moderate	High	High	High	High

Advisory: No IOP area for the next 5 days













