



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



FDP (Cyclone) NOC Report Dated 28th October, 2019

Time of Issue: 1200 UTC

Synoptic features:

- The **Super Cyclonic Storm (SuCS)** 'KYARR' over east-central Arabian Sea (AS) further moved west-northwestwards and lay centred at 0300 UTC of today, the 28th October, 2019 near latitude 18.2°N and longitude 65.0°E over eastcentral Arabian Sea. It continued to move west-northwestwards and lay over east-central and adjoining west-central AS, near latitude 18.4°N and longitude 64.5°E about 880 km west-southwest of Mumbai (Maharashtra), 1110 km east-northeast of Salalah (Oman) and 640 km east-southeast of Masirah (Oman). It is very likely to move west-northwestwards till 30th October re-curve west-southwestwards thereafter and move towards Gulf of Aden off south Oman-Yemen coasts during subsequent 3 days. It is very likely to maintain the intensity of a Super Cyclonic Storm till the morning hours of 29th October and weaken gradually thereafter.
- Yesterday's trough of low at mean sea level over southwest Bay of Bengal off Sri Lanka coast organized into a Low pressure area over equatorial Indian Ocean (IO) off south Sri Lanka coast at 0300 UTC of today. It persists over the same region. The system is likely to become more marked over Comorin area & neighbourhood during next 24 hours and concentrate into a depression over southeast Arabian Sea & adjoining Lakshadweep-Maldives areas during the subsequent 48 hours.

Dynamical and thermodynamical features

Sea Surface Temperature (SST):

SST is 26-27°C over a pocket of west-central AS, 27-28°C over west-central and adjoining southwest AS surrounding this area and 29-30°C over rest AS.

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

Tropical Cyclone Heat Potential (TCHP):

TCHP is 110-120 kJ/cm² over west equatorial IO, 100 – 110 kJ/cm² over southeast and southwest AS off Somalia coast. It is < 40 kJ/cm² over entire north, west-central and adjoining southwest AS and along Oman-Yemen and north Somalia coasts.

TCHP is 120-130 kJ/cm² over 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 300 X10⁻⁶s⁻¹ is seen over around the centre of the SuCS.

Cyclonic relative vorticity at 850 hPa 25 - 50 X10⁻⁶s⁻¹ over east equatorial Indian Ocean (IO), off south Sri Lanka.

Low level Convergence:

Lower level convergence is about 40 x 10⁻⁵s⁻¹ over the southwest sector of the SuCS.

Lower level convergence of about 05-10 x 10⁻⁵s⁻¹ is seen over southwest BOB.

Upper level Divergence:

A zone of upper level divergence of $20 - 30 \times 10^{-5} \text{ s}^{-1}$ is seen over the eastern sector of the SuCS and $05 - 10 \times 10^{-5} \text{ s}^{-1}$ over southern parts of southeast AS and $05 \times 10^{-5} \text{ s}^{-1}$ over northwest AS.

Upper level divergence of $05 - 10 \times 10^{-5} \text{ s}^{-1}$ is seen over Comorin area and adjoining equatorial IO.

Wind Shear:

Wind shear is 05-10 knots over central AS, and increases to the north as well as to the south. Wind shear is 05 knots over entire BOB and Andaman Sea.

Wind Shear Tendency:

The wind shear is in decreasing tendency over southwest & east-central AS, increasing over southwest AS and neutral over the rest of AS.

It is decreasing over most parts of the BOB and Andaman Sea.

Upper tropospheric ridge:

The upper tropospheric ridge at 200 hPa runs roughly along 20°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 $18.4\text{N}/64.5 \text{ E}$ with intensity T 6.5. Eye pattern prevails with ragged eye seen in visible imagery with temperature of $+17.0^\circ\text{C}$. Diameter of the 'eye' is about 44 km. Associated broken low / medium clouds with embedded intense to very intense convection prevails over east-central AS between Lat 16.5N to 20.0N and Long 62.0E to 66.5E (minimum CTT is minus 93 deg C).

In association with the Lobar over equatorial IO off south Sri Lanka coast, scattered low / Medium clouds with embedded moderate to intense convection prevails over the region.

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 and west-central BOB and Gulf of Martaban and moderate to intense convection over southern parts of east-central BOB and Andaman Sea.

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

MJO index is in Phase 3 (eastern Indian Ocean) with amplitude less 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 central AS on 28th, SuCS over west central AS on 29th, Extremely Severe Cyclonic Storm (ESCS) over west central AS on 30th, VSCS over west-central AS on 31st October & 1st November, SCS over west-central AS on 2nd November and less marked on 3rd November.

- (ii) Indicates: Lopar over equatorial IO and adjoining Maldives area on 30th October, Severe Cyclonic Storm (SCS) over southeast AS to the west of Lakshadweep area on 31st October, Very SCS (VSCS) over southeast AS on 1st November, SCS over southeast and adjoining east-central AS on 2nd, SCS over central AS on 3rd, VSCS over west-central AS off south Oman coast on 4th, VSCS over south Oman – Yemen coasts on 5th November.

IMD-GEFS

- (i) Indicates: SuCS over central AS on 28th & 29th, VSCS over west-central AS on 30th, SCS over west-central AS off Oman coast on 31st October, weakens into a CS and D respectively over the same region on 1st & 2nd November.
- (ii) Indicates: Lopar over equatorial IO and adjoining Comorin area on 29th October, Lopar over equatorial IO and adjoining Maldives area on 30th October, Lopar over southeast AS and adjoining Lakshadweep area on 31st October, Depression (D) over the same region on 1st November and Well Marked Lopar (WML) over southeast and adjoining east-central AS on 2nd November.

IMD-WRF

- (i) Indicates: SuCS over central AS on 28th, ESCS over west-central AS on 29th & 30th October.
- (ii) Lopar over equatorial IO and adjoining Maldives on 30th October and DD over the same region on 31st October.

NCMRWF-NCUM:

- (i) Indicates: VSCS over central AS on 28th. VSCS over west-central and adjoining east-central AS on 29th, VSCS over west central AS on 30th & 31st October, SCS over southern parts of west central AS on 1st November (an apparent Fujiwarah effect), SCS over southwest and adjoining west-central AS on 2nd, CS over southwest AS off north Somalia coast on 3rd and becomes less marked on 4th November.
- (ii) Indicates: Trough of low over equatorial IO and adjoining Comorin area on 29th, Lopar over Comorin – Maldives area on 30th, D over southeast AS and adjoining Lakshadweep area on 31st October, D over southeast AS off Karnataka coast on 1st November, D over east-central AS on 2nd November, D over east-central and adjoining west-central AS on 3rd and WML over central AS on 4th November.
- (iii) Shows formation of a WML over southeast BOB and adjoining Andaman Sea on 7th November.

NCMRWF-UM-Regional Model:

- (i) Indicates: SuCS over central AS on 28th, SuCS over west-central and adjoining east-central AS on 29th, SuCS over west-central AS on 30th October, moves further westwards on 31st October..
- (ii) Indicates : Lopar over equatorial IO and adjoining southwest BOB off south Sri Lanka coast on 28th, Lopar over equatorial IO and adjoining Comorin area on 29th, D over Maldives Comorin area on 30th, CS over Lakshadweep area on 31st October.

NEPS Model:

- (i) Indicates : SuCS over east-central AS on 28th, SuCS over west-central and adjoining east-central AS on 29th, ESCS over west-central AS on 30th, ESCS over west-central AS off Oman coast on 31st October, ESCS over west-central AS off south Oman coast on 1st November, VSCS over west-central and adjoining southwest AS on 2nd, SCS over Gulf of Aden off Somalia coast on 3rd, moves further westwards over Gulf of Aden as a CS on 4th November.
- (ii) Indicates: Lopar over east equatorial IO off south Sri Lanka on 28th, WML over Comorin area on 29th, Lopar over Lakshadweep area on 30th, CS over east-central AS off north Kerala – Karnataka coasts on 31st October, CS over east-central AS off Karnataka coast on 1st November, CS over east-central AS on 2nd, DD over east-central and adjoining west-central AS on 3rd and D over central AS on 4th November,

ECMWF:

- (i) Indicates : ESCS over east-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: 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 west central AS on 29th, ESCS over central AS on 29th, SCS over west-central AS on 30th, SCS over west-central AS on 31st October, CS over west-central AS on 1st November , D over west-central AS off Oman coast on 2nd, Lopar over Gulf of Aden off Yemen coast on 3rd and less marked on 4th November.
- (ii) Indicates : Lopar over Comorin area on 29th, Lopar over Maldives - Lakshadweep area on 30th, Lopar over Lakshadweep area on 31st October, Lopar over east-central AS on 1st & 2nd November, Lopar over central AS on 3rd November and less marked on 4th November.
- (iii) D over south China Sea on 29th, CS over south China Sea approaching Thailand on 30th, after crossing, lies as D over Thailand on 31st October.

ARP-Meteo France :

- (i) Indicates: SuCS over east-central AS on 28th, SuCS over west-central AS on 29th, SuCS over central AS on 29th & 30th October, ESCS over west-central AS on 31st October.
- (ii) Indicates: Trough of low over equatorial IO off south Sri Lanka coast on 28th, Lopar over Comorin area on 29th, D over Maldives - Comorin area on 30th, DD / CS over east-central AS and adjoining Lakshadweep area on 31st October.

Dynamical statistical models

IMD Genesis Potential Parameter (GPP):

- (i) Significant zone of GPP seen over central AS on 28th, west-central and adjoining east-central AS on 29th, west-central AS on 30th, over the same region but diminished areal extension on 31st October, less marked on 1st November, over west-central AS off Oman coast on 2nd and insignificant on 3rd November.
- (ii) Significant zone of GPP seen over equatorial IO to the south of Sri Lanka on 28th, equatorial IO to the south of Comorin area on 29th, equatorial IO and adjoining Maldives area on 30th, over Lakshadweep area (circular) on 31st October, over southeast & adjoining east-central AS on 1st November, insignificant on 2nd. An area over Gulf of Aden off Somalia coast on 4th November.

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:

- Model forecasts on track of the SuCS 'KYARR' over central Arabian Sea show better consensus from today's 00 UTC runs. Majority of them show, west-northwestward movement for some more time and then re-curving west-southwestwards with gradual weakening upto 30th October and rapid weakening thereafter.
- The MJO lies in the phase 3 with amplitude less than 1. It likely to transit to Phase-4 with diminishing amplitude in a couple of days. The phase of MJO along with the prevailing Positive Indian Ocean Dipole and overall sea surface temperature > 29°C 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.
- Majority of the models suggest further intensification of the present Low pressure area over Equatorial IO off south Sri Lanka coast over southeast Arabian Sea on either 30th / 31st October. However, there is wide divergence in the further track and intensity predictions.
- It is also likely that the vorticity advection from south China Sea westwards could lead to the formation of a low pressure area over north Andaman Sea around 2nd / 3rd November. Its further intensification prospects need to be monitored.

Advisory: IOP for South Tamil Nadu, Kerala and Lakshadweep for next 3 days.











