



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



**FDP (Cyclone) NOC Report Dated 06<sup>th</sup> November, 2019**

**Time of Issue: 1200 UTC**

**Synoptic features:**

- The Very severe cyclonic storm (ESCS) MAHA (Pronounced as M'maha) over westcentral and adjoining eastcentral Arabian Sea moved nearly eastwards and weakened into a **Severe Cyclonic Storm (SCS)** over the same area at 0000 UTC of 6<sup>th</sup>. It lay centered at 0900 UTC of today, the 06<sup>th</sup> November, 2019 over eastcentral & adjoining northeast Arabian Sea near latitude 19.6°N and longitude 67.1°E, about 350 km west-southwest of Porbandar (Gujarat), 370 km west-southwest of Veraval (Gujarat) and 420 km west-southwest of Diu. It is very likely to move nearly eastwards, weaken into a Cyclonic Storm during next 12 hours. Thereafter it is likely to move east-northeastwards, weaken further into a Deep Depression by morning of tomorrow, the 7<sup>th</sup> November over northeast and adjoining eastcentral Arabian Sea. It is very likely to skirt Saurashtra coast and lie centered about 40 kilometers south of Diu around noon of 7<sup>th</sup> November as a deep depression. Continuing to move east-northeastwards, it would further weaken into a depression by tomorrow evening.
- The Depression over eastcentral and adjoining southeast BoB and adjoining Andaman sea intensified into a **Deep Depression** over eastcentral and adjoining southeast BoB remained practically stationary and lay centred at 0900 UTC of today, the 6<sup>th</sup> November 2019, over eastcentral & adjoining southeast Bay of Bengal, near Lat.13.4°N and Long. 89.3°E, about 390 km west-northwest of Maya Bandar (Andaman Islands), about 810 km south-southeast of Paradip (Odisha), 920 km south-southeast of Sagar Islands (West Bengal) and 960 km south-southwest of Khepupara (Bangladesh) . It is very likely to intensify into a Cyclonic Storm during next 12 hours and into a Severe Cyclonic Storm during the subsequent 24 hours. It is very likely to move northwestwards for some time and then north-northwestwards towards West Bengal and Bangladesh coasts.

**Dynamical and thermodynamical features**

**Sea Surface Temperature (SST):**

Sea Surface Temperature is around 26-28°C over the area of SCS Maha but increases to 28-30°C along the forecast track.

SST is 28 - 30°C over most parts of the BOB with higher values over central BoB.

**Tropical Cyclone Heat Potential (TCHP):**

Tropical Cyclone Heat Potential (TCHP) is 20-40 kJ/cm<sup>2</sup> over the system area and also in most parts of central Arabian Sea and north Arabian sea. There is a narrow strip of value 50-70 kJ/cm<sup>2</sup> off west coast of India. It is around 80-100 kJ/cm<sup>2</sup> over south Arabian Sea.

TCHP is 100-120 kJ/cm<sup>2</sup> over a small area in southwest BOB and is 80-100 kJ/cm<sup>2</sup> over the rest of the BOB.

**Relative Vorticity:**

Cyclonic relative vorticity at 850 hPa of value 100-120 X10<sup>-6</sup>s<sup>-1</sup> is seen over EC BoB.

Cyclonic relative vorticity at 850 hPa of value 150 X10<sup>-6</sup>s<sup>-1</sup> is seen to the south of the centre of SCS Maha.

**Low level Convergence:**

An area of lower level convergence about 5-10 x 10<sup>-5</sup>s<sup>-1</sup> is seen over EC and adjoining SE BoB.

Lower level convergence of about 10 x 10<sup>-5</sup>s<sup>-1</sup> to the east of the centre of SCS Maha.

**Upper level Divergence:**

Upper level divergence of value 10-20x10<sup>-5</sup> s<sup>-1</sup> is seen over EC and adjoining SE BoB.

Upper level divergence of value 10 x10<sup>-5</sup> s<sup>-1</sup> is around the centre of SCS Maha.

**Wind Shear:**

Wind shear is high over north Arabian Sea and adjoining central Arabian Sea. It is low to moderate over the rest AS.

Wind shear is low to moderate over north Andaman Sea. It is high elsewhere.

**Wind Shear Tendency:**

The wind shear tendency is positive over most parts of BoB except north Andaman Sea where it is negative or neutral.

It is positive over most parts of Arabian Sea except for southwest Arabian Sea where it is positive.

**Upper tropospheric ridge:**

The upper tropospheric ridge at 200 hPa runs roughly along 13°N over the Arabian Sea region and is around 15°N over BoB.

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

As per the satellite imagery at 0900 UTC of 06<sup>th</sup> November, 2019, the current intensity of the system (SCS Maha) is T 2.5/3.0. Associated scattered low to medium clouds with embedded intense to very intense convection lies over eastcentral and adjoining north Arabian Sea between Lat 18.8<sup>0</sup>N to 22.0<sup>0</sup>N and Long 66.2<sup>0</sup>E to 69.0<sup>0</sup>E. The minimum CTT is minus 87<sup>0</sup>C.

**Bay of Bengal & Andaman Sea:-**

According to 0900 UTC satellite imagery, the vortex lay centered within half degree of 13.1<sup>0</sup>N/89.5<sup>0</sup>E with intensity T2.0. Associated broken low/medium clouds with embedded intense to very intense convection lies over eastcentral and adjoining southeast BoB between Lat 10.7<sup>0</sup>N to 17.8<sup>0</sup>N and Long 87.0<sup>0</sup>E to 91.5<sup>0</sup>E. The minimum CTT is minus 93<sup>0</sup>C.

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

MJO index is in Phase 5 with amplitude more than 1. It is likely to enter into phase 6 from tomorrow and remain there for next 2 days and move to phase 7 thereafter.

**Storms and Depression over South China Sea/ South Indian Ocean:**

- a) At 0600 UTC on 06 Nov 2019, Super Typhoon "Halong" was located near 21.2°N 150.6°E, approximately 260 NM southwest of Minami Tori Shima.. Maximum sustained surface winds were estimated at 145 knots. It is expected to move north-northeastwards and further intensify to 155 knots till 1800 UTC of 06<sup>th</sup> November and is likely to move northeastwards thereafter with gradual weakening.
- b) The Tropical Storm "NAKRI" is located at 0600 UTC of 06<sup>th</sup> near 13.2°N 116.4°E, approximately 281nm west-southwest of Manila, Philippines. It is expected that the system is likely to move nearly westwards with marginal intensification and cross Vietnam coast around 13.2<sup>0</sup> N by 1800 UTC on 11<sup>th</sup> November as a cyclonic storm.

**NWP Input for FDP Cyclone based on 0000 UTC of today****IMD-GFS T-1534**

- (i) The VSCS over west central Arabian Sea on 6<sup>th</sup> November moves in a northeast direction with gradual weakening is seen as a SCS on 7<sup>th</sup> and a depression on 8<sup>th</sup> over south Gujarat- north Maharashtra coasts in the morning of 8<sup>th</sup> . It becomes less marked thereafter.
- (ii) The depression on 6<sup>th</sup> over EC BoB while moving in a north-northwest direction becomes a VSCS/ ESCS 8<sup>th</sup>- 9<sup>th</sup>. Further it moves in a north-northeast direction and is seen off Bangladsh coast on 10<sup>th</sup> and crosses coast in the early hours of 11<sup>th</sup>.

**IMD-GEFS**

- (i) SCS over eastcentral Arabian Sea on 06<sup>th</sup> November is seen to move in a east-northeastward direction with gradual weakening to reach close to south Gujarat coast as a depression on 7<sup>th</sup>, which becomes less marked thereafter.
- (ii) The over EC BoB on 7<sup>th</sup> November, which intensifies further while moving northwestwards to reach Odisha –West Bengal coasts on 9<sup>th</sup>. It is seen to recurve northeastwards with gradual weakening thereafter.

#### **IMD-WRF**

- (i) The SCS over EC Arabian Sea on 6<sup>th</sup> November moves in a nearly eastward direction and weaken slightly and is seen as a CS on 7<sup>th</sup> and 8<sup>th</sup> over EC Arabian Sea off south Gujarat coast. It is seen as a depression on 9<sup>th</sup> off Maharashtra coast.
- (ii) The deep depression/ CS over eastcentral BoB on 6<sup>th</sup> while moving in a northwest direction intensifies and is seen as a ESCS on 9<sup>th</sup> over WC BoB off Odisha coast.

#### **NCMRWF-NCUM:**

- (i) Indicates: The CS over WC Arabian Sea on 6<sup>th</sup> November is seen to move in a nearly eastward direction with gradual weakening and is seen as a depression on 8<sup>th</sup> over northern parts of eastcentral Arabian sea close to south Gujarat coast. It is seen to weaken further over sea without making landfall.
- (ii) The WML over eastcentral BOB on 6<sup>th</sup> November becomes a depression on 7<sup>th</sup> over eastcentral BoB and a CS on 8<sup>th</sup>. Thereafter it is seen to move in a north-northeastward direction and further intensify to reach Bangladesh coast as a ESCS on 10<sup>th</sup> November and cross coast in the same night.

#### **NCMRWF-UM-Regional Model:**

- (i) The CS over central Arabian sea is seen to move east-northeastwards with gradual weakening and is seen to cross south Gujrat coast as a very weak system on 8<sup>th</sup>.
- (ii) The LOPAR over EC BoB becomes a Depression on 6<sup>th</sup> and a CS on 7<sup>th</sup>. It is seen to intensify further while moving in a northwest direction.

#### **NEPS Model:**

- (i) The SCS over WC Arabian Sea on 06<sup>th</sup> November seen to move in an east-northeast direction and weaken gradually and is seen close south Gujarat coast on 8<sup>th</sup> and 9<sup>th</sup> as a depression. It further weakens and becomes less marked subsequently.
- (ii) The depression over EC BoB on 6<sup>th</sup> becomes a CS on 7<sup>th</sup>, and a ESCS on 9<sup>th</sup> November while moving north-northeastwards which crosses West Bengal- Bangladesh coasts on 10<sup>th</sup>.

#### **ECMWF:**

- (i) The CS over eastcentral and adjoining westcentral and north Arabian Sea on 6<sup>th</sup> moves nearly eastwards and weaken into a depression over EC and adjoining NE Arabian Sea off Saurashtra coast on 8<sup>th</sup> and becomes a LOPAR on 9<sup>th</sup>.
- (iv) The DD over EC BoB on 6<sup>th</sup> intensifies into a CS on 7<sup>th</sup> and an SCS on 8<sup>th</sup>. Moving in a northwest direction it is seen off Odisha coast as a SCS on 11<sup>th</sup>. It weakens thereafter after making landfall on 12<sup>th</sup> as a CS.

#### **NCEP-GFS:**

- (i) Indicates: The CS over WC Arabian Sea on 6<sup>th</sup> and starts moving towards east-northeast direction with gradual weakening and is seen close to south Gujrat coast as a depression on 7<sup>th</sup> to 9<sup>th</sup> November which is seen to become less marked subsequently.
- (ii) The DD over EC BoB on 6<sup>th</sup> November becomes a CS on 7<sup>th</sup> and a SCS on 8<sup>th</sup> over central BoB. It is seen to move north-northwestwards and then north-northeastwards. It is seen off Bangladesh- West Bengal coasts on 10<sup>th</sup> SCS and is seen to weaken thereafter and becomes less marked on 13<sup>th</sup> over northeast BoB.

#### **ARP-Meteo France : NIL**

#### **Dynamical statistical models**

#### **IMD Genesis Potential Parameter (GPP):**

- (i) The significant zone of GPP seen over east-central AS on 06<sup>th</sup> November becomes insignificant on 7<sup>th</sup> November.
- (ii) Another significant zone of GPP seen over EC BoB on 6<sup>th</sup> November, is seen to move in north-northwest direction till 10<sup>th</sup> to reach north BoB off Bangladesh coast becomes insignificant on 11<sup>th</sup>.

**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](http://www.rsmcnewdelhi.imd.gov.in/NWP_CYC/Analysis.htm) or

[http://www.rsmcnewdelhi.imd.gov.in/NWP\\_CYC/<HH> hrs.htm](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)** The low level relative vorticity is about  $150 \times 10^{-5} \text{ sec}^{-1}$  to the south of system centre of SCS Maha. The lower level convergence is about  $10 \times 10^{-5} \text{ s}^{-1}$  in south west sector and the upper level divergence is about  $10 \times 10^{-5} \text{ s}^{-1}$  around the system center. The vertical wind shear is 25-30 knots over the system area and 25-30 knots along the forecast track. Sea surface temperature is between 24-26°C to the southwest of the system center and tropical cyclone heat potential of 20-40 kJ/cm<sup>2</sup> is around the system center. The system is moving east-northeastwards under the influence of mid-latitude westerlies. Also the system has weakened under the influence of unfavourable vertical wind shear environment. Since this condition is very likely to continue along the forecast track, further weakening is anticipated during next 36 hours. Majority of the numerical models are in agreement with the above analysis.
- B)** The low level relative vorticity is about  $150 \times 10^{-5} \text{ sec}^{-1}$  to the south of the centre of the Deep Depression. The lower level convergence is about  $20 \times 10^{-5} \text{ s}^{-1}$  around the system centre and the upper level divergence is about  $10 \times 10^{-5} \text{ s}^{-1}$  to the southwest of the system center. The vertical wind shear is 15-20 knots over the system area and it is 20-25 kt along the forecast track. The ridge runs roughly along 15°N to the north of the system area. Tropical cyclone heat potential of 80-110 kJ/cm<sup>2</sup> around the system center. Sea surface temperature (SST) is between 28-30°C around the system. The moderate vertical wind shear and high SST over ocean is supporting the gradual intensification of the system. During the past 09 hours, the system remained nearly stationary, as there is no well defined steering flow for this shallow system in its current location. It is likely to move northwestwards, as it further intensifies and thereafter due to weak steering flow the system will move slowly north-northwestwards. Majority of the NWP models are in agreement with the above analysis.

**Advisory: IOP for South Gujarat coast on 6<sup>th</sup> and 7<sup>th</sup> November 2019.**





















