# Numerical investigation of ocean mixed layer in response to moving cyclone of different eye radii

A.A.Deo, D.W.Ganer and P.S.Salvekar

Indian Institute of Tropical Meteorology, Pune 411 008, India
E-mail : aad@tropmet.ernet.in

## Introduction

Present work deals with the sensitivity studies of the upper mixed layer response to an idealized Indian Ocean cyclone having different eye radii using simple ocean model. In the earlier studies the surface circulation and mixed layer depth (MLD) variation as well as temperature change has been studied in response to moving cyclones in the Indian Ocean [1,2,3,4]. The model used in this study is a simple 1½ layer reduced gravity ocean model over the tropical Indian Ocean (35°E-115°E, 30°S-25°N) with one active layer overlying a deep motionless inactive layer[3]. The initial thermocline is assumed to be 50 m deep and the gravity wave speed is 1 m/s. The initial temperature in the mixed and bottom layer are considered as 29 °C and 23 °C.

## Numerical experiments and discussion of results

The horizontal resolution of the model is 1/8° x 1/8°. The model cyclone assumes a symmetric rankine vortex having radius 400 km and maximum winds 20 m/s. The radius of eye wall is taken as 55 km for control experiment and is changed to 42 km and 28 km in the sensitivity study. Such vortex is allowed to move along northward track in the Bay of Bengal in four days. The track considered is from the initial position of (90E, 6N) to (90E,14N). The model is integrated for four days (considered life span of the cyclone), from the initial condition of rest. The variations in the upper layer thickness (ULT) and temperature from the initial conditions are studied.

Figure 1 shows temperature change of mixed layer from the initial temperature of 29 °C (left panel) and upper layer thickness deviation (ULTD) from initial value of 50 m (right Panel), on the third day for different values of eye radius. The ULTD shows that as the radius of eye decreases, the maximum upwelling and downwelling decreases. For example at the point (91 E, 11N) near the track the time series of ULTD (Figure 2a) shows the values of maximum upwelling as 12m, 11m and 10m, for eye radius 55m, 42m and 28m respectively. Model temperature field shows increase in maximum cooling and decrease in maximum warming as the eye radius decreases. This is clearly seen from figure 2b, which shows the times series of temperature change at the point (91 E, 11N) near the track.

## References:

1. Behera S.K, Deo A.A, and Salvekar P.S., 1998: Investigation of mixed layer response to Bay of Bengal cyclone using a simple ocean model. Meteorol. Atmos. Phys.,65, 77-91.
2. Chang S.W. & Anthes R.A., 1978: Numerical simulation of the ocean's nonlinear baroclinic response to translating hurricanes. J. Phys. Oceano., 13, 468-480
3. Deo A.A, Salvekar P.S and Behera S.K,2001: Oceanic response to cyclone moving in different directions over Indian Seas using IRG model. Mausam, 52, 163-174.
4. Price J.F., 1981: Upper ocean response to a hurricane. J. Phys. Oceano., 11,153-175.

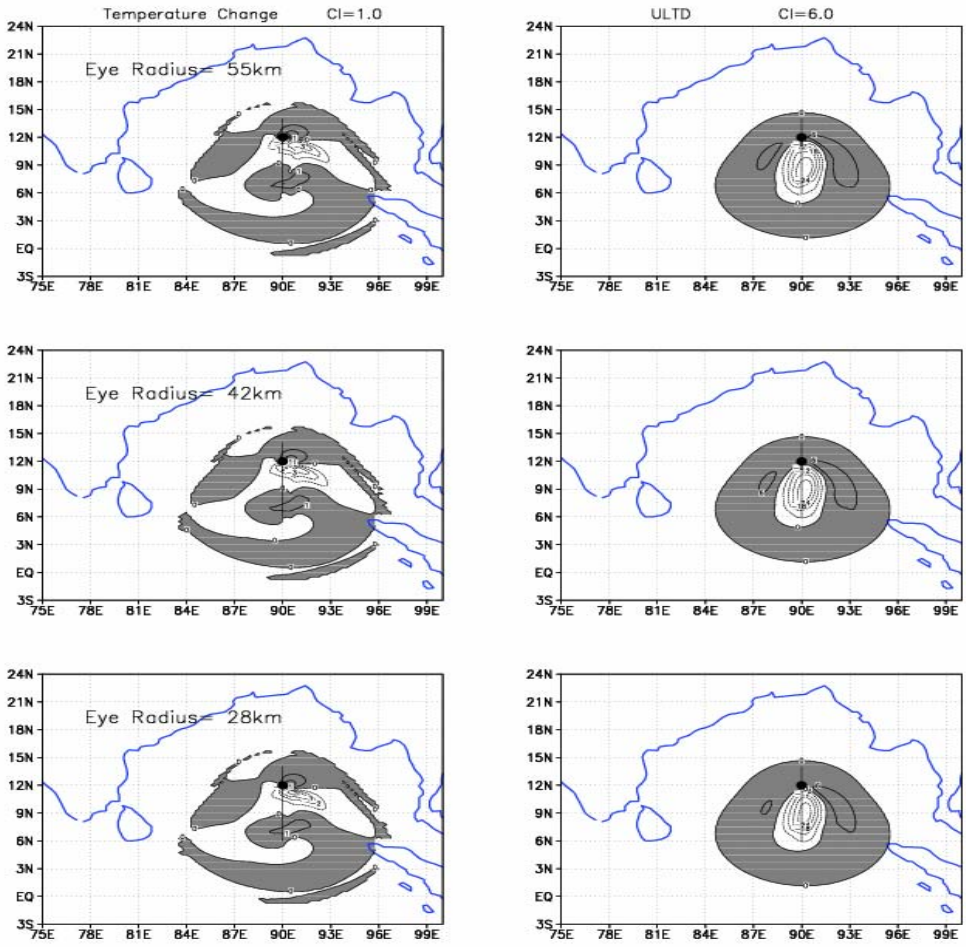


**Fig. 1 Model ULTD and temperature change on the third day For different eye radii**

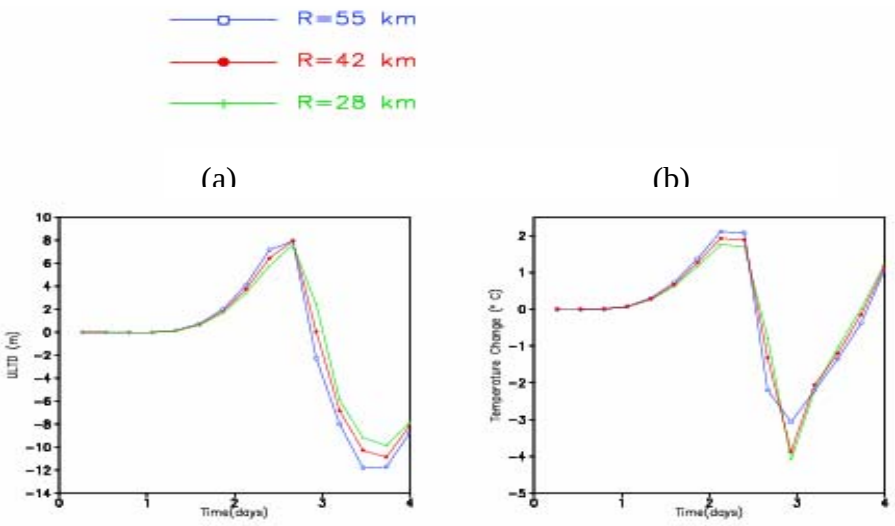


**Fig.2 Time series of (a) ULTD and (b) Temperature change at point (91E, 11N), for dfferent eye radii**