LETKF-ROMS: An improved predictability system for the Indian Ocean

Arya Paul, Balaji B., Biswamoy Paul, D. S. Banerjee, Sivareddy S.
aryapaul@incois.gov.in **(corresponding author)**

A high-resolution ocean circulation model for the Indian Ocean (IO) using Regional Ocean Modeling System (ROMS) is operational at Indian National Centre for Ocean Information Services (INCOIS) which provides ocean state forecasts for the Bay of Bengal (BoB) and the Arabian Sea (AS) to the Indian Ocean rim countries. To provide an improved estimate of ocean state, a variant of Ensemble Kalman Filter (EnKF), *viz*., the Local Ensemble Transform Kalman Filter (LETKF) has been developed and interfaced with the present basin-wide operational ROMS. This system assimilates in-situ temperature and salinity profiles and satellite track data of sea-surface temperature (SST). The ensemble members of the assimilation system are initialized with different parameters like diffusion and viscosity coefficients and are subjected to an ensemble of atmospheric fluxes. In addition, one half of the ensemble members respond to K profile parameterization mixing scheme while the other half is subjected to Mellor–Yamada mixing scheme. This strategy aids in arresting the filter divergence which has always been a challenging task. The assimilated system simulates the ocean state better than the present operational ROMS. Improvements permeate to deeper ocean depths with better correlation and reduced root-mean-squared deviation (RMSD) with respect to observations particularly in the northern Indian Ocean which is data rich in density. Analysis shows domain averaged RMSD reduction of about 0.2–0.4 °C in sea surface temperature and 2–4 cm in sea level anomaly. The assimilated system also manages to significantly improve the thickness of the temperature inversion layers and the duration of its occurrence in northern Bay of Bengal. The most profound improvements are seen in currents, with an error reduction of 15 cm/s in zonal currents of central Bay of Bengal.