Session: C19 Poster: T115B

Indian Ocean simulations in latest Modular Ocean Model with open boundary configuration

Hasibur Rahaman†; Matthew Harrison; Stephen Griffies
† INCOIS,Ministry of Earth Sciences,Government of India, India
Leading author: rahman@incois.gov.in

The Indian Ocean exhibits strong variability on spatial scales ranging from less than 10 to thousands of kilometers and from sub-monthly to decade time scales. Much of this variability is forced by winds which are strongly influenced by the monsoon. We adopt a multi-model approach using MOM4p1 at CM2.1 global resolution and a regional model with 25 km resolution in the horizontal and less than 1 meter vertical resolution near the ocean surface to understand the upper ocean variability on seasonal and inter-annual time scale. Although present day ocean general circulation model could simulate the Indian Ocean mixed layer temperature with reasonable accuracy, the salinity simulations from the existing regional and global model for the Indian Ocean suffer large errors. In this study we have made an attempt to simulate the upper ocean salinity and temperature variability over north Indian Ocean. In its first kind, nested high resolution (horizontal and vertical) regional model have been developed for this purpose. The global spunup simulates the seasonal cycle of temperature, salinity, current and mixed layer depth quite realistically with climatological CORE-II normal year forcing. The seasonal climatology made from the inter-annual simulations using CORE-II inter-annual forcing show that the model SST could produce the seasonal variability very close to observations with a mean bias of ~0.5oC in global simulations. This bias reduces considerably in the regional model solutions and could be attributed due to the higher resolution. Significant improvement in the mixed layer depth (MLD) on seasonal time scale could also be attributed due to the high vertical and spatial resolution in the regional model. The surface salinity shows low positive bias ~ 0.2-0.3 psu on seasonal time scale over entire basin. Over Bay of Bengal it is ~ 0.5 psu. The subsurface salt show good match with observations over Bay of Bengal. The incursion of low salinity BoB water to the south-eastern Arabian Sea show good agreement both in time and space. The seasonal river runoff solutions show better agreement in surface and subsurface as compared to global and regional solutions with annual river runoff solution. The surface circulation show very good agreement with the observations. East India Coast Current (EICC) and West India Coastal Current (WICC) captured the spatial and temporal variations close to observed values. The vertical structure of EICC and WICC show very narrow ~ 100-150 km width with a core at the surface and gradually extend up to 200 m. The strength of EICC is modulated by the topography and salinity. The major seasonal signature revealed in sea level anomaly (SLA) over north Indian Ocean (NIO) are the westward propagating Rossby wave along the equator, central Arabian Sea and Bay of Bengal (BoB); eastward propagating equatorial and coastally trapped Kelvin wave. The observed planetary wave motions (Kelvin and Rossby waves) on SLA over north Indian Ocean are simulated with very good agreement especially in the regional solutions. Earlier studies have pointed out that the good understanding of BoB seasonal variability is the first step to understand the Bay's inter-annual variability. Hence our models better representation of circulation and sea level variability will have great significance for the understanding of the inter-annual and intraseasonal variability of NIO especially BoB.