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Ecosystem Modeling along the Western Bay of Bengal

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Abstract : Modeling on coupled physical and biogeochemical processes of coastal waters is vital to identify the primary production status under different natural and anthropogenic conditions. About 7, 500 km length of Indian coastline is occupied with number of semi enclosed coastal bodies such as estuaries, inlets, bays, lagoons, and other near shore, offshore shelf waters, etc. This coastline is also rich in wide varieties of ecosystem flora and fauna. Directly/indirectly extensive domestic and industrial sewage enter into these coastal water bodies affecting the ecosystem character and create environment problems such as water quality degradation, hypoxia, anoxia, harmful algal blooms, etc. lead to decline in fishery and other related biological production. The present study is focused on the southeast coast of India, starting from Pulicat to Gulf of Mannar, which is rich in marine diversity such as lagoon, mangrove and coral ecosystem. Three dimensional Massachusetts Institute of Technology general circulation model (MITgcm) along with Darwin biogeochemical module is configured for the western Bay of Bengal (BoB) to study the biogeochemistry over this region. The biogeochemical module resolves the cycling of carbon, phosphorous, nitrogen, silica, iron and oxygen through inorganic, living, dissolved and particulate organic phases. The model domain extends from 4°N-16.5°N and 77°E-86°E with a horizontal resolution of 1 km. The bathymetry is derived from General Bathymetric Chart of the Oceans (GEBCO), which has a resolution of 30 sec. The model is initialized by using the temperature, salinity filed from the World Ocean Atlas (WOA2013) of National Oceanographic Data Centre with a resolution of 0.25°. The model is forced by the surface wind stress from ASCAT and the photosynthetically active radiation from the MODIS-Aqua satellite. Seasonal climatology of nutrients (phosphate, nitrate and silicate) for the southwest BoB region are prepared using available National Institute of Oceanography (NIO) in-situ data sets and compared with the WOA2013 seasonal climatology data. The model simulations with the two different initial conditions viz., WOA2013 and the generated NIO climatology, showed evident changes in the concentration and the evolution of the nutrients in the study region. It is observed that the availability of nutrients is more in NIO data compared to WOA in the model domain. The model simulated primary productivity is compared with the spatially distributed satellite derived chlorophyll data and at various locations with the in-situ data. The seasonal variability of the model simulated primary productivity is also studied.

Keywords : Bay of Bengal, Massachusetts Institute of Technology general circulation model, MITgcm, biogeochemistry, primary productivity
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