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A Three-dimensional Baroclinic Hydrodynamic Model for Singapore Region

Haihua Xu (1), Pavel Tkalich (1), Sandric Leong (1), and Nicholas Patrikalakis (2)

(1) National University of Singapore, TMSI, Singapore, Singapore (tmspt@nus.edu.sg), (2) Massachusetts Institute of Technology, USA (nmp@mit.edu)

The hydrodynamics of Singapore's coastal water is driven by interactions of tides from Indian and Pacific Ocean, and influenced by the seasonal monsoon and the local wind. To study interplay of the phenomena, a three-dimensional hydrodynamic model for Singapore region is set using baroclinic Semi-implicit Eulerian-Lagrangian Finite-Element model (SELFE) (Zhang and Baptista, 2008). In horizontal direction, the area is discretized by a triangular mesh having varying size from 50m near the Singapore coastlines to 1.5km at the edge of the domain, totaling about 290K elements. Vertically the computational domain is discretized into 10 sigma-layers having finer resolution near the free surface and coarser toward the bottom. Implicit scheme in SELFE allow for a relative large computational time step 20 sec. The harmonic tidal elevation, monthly averaged climatology of sea water temperature and salinity, and 6-hourly wind force and solar radiations are applied at the boundaries of the domain. The model is run for 14 days to cover transition of neap-spring-neap cycle during Southwest monsoon (Aug 2013). The computed tidal elevations are compared with the measurements at the tidal stations, whereas three-dimensional velocity, temperature and salinity fields are compared with the ADCP measurement at the Johor Strait. The computed values agree well with the observations, indication that the model is fitted to simulate the complex hydrodynamics in Singapore region.