CASTS TALKS

Special Program in Applied Mathematics and Applied Mechanics

Modeling of tidally driven circulation and exchange in the Dongsha Atoll

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Water exchange between open ocean and lagoon in an atoll is crucial to its coral reef ecosystems. It is essential to understand which path dominates the exchange. To investigate tidally driven water exchange, circulation around Dongsha Atoll is modeled with ROMS. Initial flow fields are acquired from HYCOM global analysis. Boundary conditions are a combination of HYCOM low frequency climatology variation and TPXO8 tidal fluctuation. Surface wind stresses, heat, and salt fluxes are extracted from ECMWF ERA-Interim. Validation of the model is carried out by comparing the model results with in-situ data. The model results show asynchronous exchange pattern at reef-flat, south channel, and north channel. The main outflow path is reef-flat, and the main inflow path is south channel. Inflow and outflow are roughly balanced at north channel. The water exchange is driven by difference of sea level between open ocean and lagoon, and the asynchronous pattern is due to spatially inhomogeneous distribution of tidal amplitude and phase. When tidal waves propagate southwestward passing Dongsha Atoll, they induce about 1-5 cm spatially inhomogeneous sea level difference. In addition, background mean flow could enhance the exchange rate.

