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Geospatial Analysis of Tidally Driven Flow in Mississippi Sound, U.S.A.

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We are simulating tidal flow in Mississippi Bight using an adaptive, barotropic, finite-volume model, Gerris, which solves the Boussinesq, incompressible, hydrostatic equations on a Cartesian reference frame. We are examining the impact of refinement and bottom friction on tidal flow in the sound and adjoining continental shelf. Our effort includes the influence of in-phase and out-of-phase forcing on the open boundaries as well as the transformation of the tidal wave as it propagates through the region. The model predicts the largest water elevation amplitudes in the western bays. The predicted semi-diurnal amplitude M2 varies from 3 to 10 cm and the diurnal K1 ranges from 14 to 30 cm. The results are evaluated using co-tidal plots of K1, O1, M2, and S2 constituents by comparison to published data from measurements at 24 tide gauges (Seim et al. 1987). The model is in agreement with the estimates from observations where the gauges were located. The tidal predictions of phase are within 5-10 degrees. The predicted residual currents show that, for the diurnal tides, there is a net flow into the Mississippi Sound in the east, as well as along the shoreline of the barrier islands. The inflow and outflow converge in the tidal inlets and generate sets of residual eddies. Some inlets contain anticyclonic eddies. Some display pairs of counter-rotating eddies while others present anticyclonic pairs (inside and outside the inlet). We are investigating the relationship between eddy development and tidal constituent. The model is also forced by combined tides to examine variations in the tidal flow over the spring-neap tidal cycle and evaluated using combined tidal heights from the IHO tidal database.