Abstract View

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The Steady-State Barotropic Response of the Gulf of Maine and Adjacent Regions to Surface Wind Stress

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ABSTRACT

The response of the Gulf of Maine region to steady, spatially uniform wind stress is examined using a linearized numerical model, with the influence of the strong tidal currents in the region included in the bottom stress formulation. The sensitivity of the model results to various idealizations is investigated including the assumption of linearity, the bottom steam formulation, cross-shelf structure in the (large-scale) alongshelf wind stress and the cross-shelf boundary conditions. The model solutions for the Gulf are found to be sensitive to the "backward" boundary condition on the Scotian Shelf, but not to the "forward" boundary condition in the Middle Atlantic Bight. For alongshelf stress, the former is estimated using Csanady's "arrested topographic wave" model and observed coastal sea level gains at Halifax.

The model has a spinup time of about one day, comparable to previous estimates for the region. The alongshelf component of wind stress is generally much more effective than the cross-shelf component in driving currents and sea level changes in the model. The predicted large-scale circulation features and coastal sea level changes compare favorably with those observed, and there is reasonable agreement between predicted and observed currents off southwestern Nova Scotia for alongshelf stress. The dynamics of the model response are discussed in terms of the arrested topographic wave model and Ekman dynamics and using the momentum balances at some current meter observation sites.