Abstract View

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Two-Layer Model of Summer Circulation on the Southeast U.S. Continental Shelf

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ABSTRACT

The summer circulation in the South Atlantic Bight is investigated using a two-layer finite element model. Simulations using a steady state mean summer wind field lead to the following conclusions. (i) the adjustment time of the shelf circulation to sudden changes in the wind varies between 12 to 24 hours; (ii) the main dynamical balances were geostrophic in the cross-shelf direction and with the Coriolis, pressure gradient, wind and bottom stresses all being significant in the alongshore momentum balance. Both findings agree with data analysis of Lee and Pletrafesa. This experiment produced an upwelling cell that matched well with the summer upwelling observed north of Cape Canaveral. Results of a second experiment using a 9-day real wind event compared reasonably well against observed coastal sea level, midshelf currents and an upwelling-downwelling event. Momentum balance results associated with the short adjustment time compared to the time scale of the wind forcing (4 to 12 days), indicate that quasi-steady state conditions are dominant with a dynamical balance similar to the arrested topographic wave model of Csanady. A third experiment where the model was forced with an alongshelf pressure gradient applied along the open offshore boundary, characteristic of the Gulf Stream, also produced an upwelling cell north of Cape Canaveral. These findings support the idea that Cape Canaveral upwelling is determined by the joint effect of wind and Gulf Stream intrusions over the shelf.

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