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The Interaction of Estuarine and Shelf Waters: A Model and Applications

Q.H. Zhang, G.S. Janowitz, and L.J. Pietrafesa

Department of Marine, Earth and Atmospheric Sciences, North Carolina State University, Raleigh, North Carolina 27695-8208

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ABSTRACT

An analytical model is developed to describe the steady flow in an estuary-shelf interaction region where the system is treated as a two layer density stratified flow. The motion is expanded in terms of the relative thickness of the vertical Ekman layer. The zero-order flow is geostrophic in each layer. Balancing of order-one quantities reduces the system to two vorticity equations relating the pressure field with the displacement of the interface and the bottom topography. An explicit solution is obtained for the case of linear offshore sloping bottom. The flow behavior of the estuarine plume depends on the vertical structure of the flow at the river mouth, the bottom slope and the ambient coastal flow. Under certain conditions, a front exists as an offshore boundary of the plume. These results are compared with observations for the Changjiang River Estuary (in China), and both the Chesapeake Bay and Savannah River estuaries in the United States.

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