Abstract View

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River-Forced Estuarine Plumes

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ABSTRACT

The development, maintenance, and dissipation of river-forced estuarine plumes with and without seaward sloping bottom are studied by use of a three-dimensional, primitive-equation model. Inside the estuary, discussion is focused on how the Coriolis force induces lateral asymmetries in the circulation. Four physical processes dictate the transient as well as the quasi-steady circulation in moderately stratified estuaries: 1) upper-layer convergence during the transient spinup phase, 2) upward entrainment leading to the two-layer steady circulation pattern, 3) upward stretching of the lower-layer vortex during the spindown period, and 4) in the presence of a seaward bottom slope, the left-bounded tendency of the landward undercurrent for all phases of development. Deviations from the laterally averaged circulation pattern caused by these processes are discussed. Over the shelf, various types of plumes are defined according to the visual appearance of the surface salinity field. The four types of plumes, namely, the supercritical, subcritical, diffusive-supercritical, and diffusive-subcritical are classified by an empirical Froude number and another dimensionless parameter indicating the amount of dissipation acting on density currents.