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Generation and Propagation of Downwelling Fronts

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ABSTRACT

The dynamics of downwelling fronts observed along the steep and elongated southern shore of Lake Ontario are investigated by considering the nonlinear response to surface forcing of one-layer and two-layer fluids on a rotating, semi-infinite plane. Analytical and numerical solutions for idealized situations exhibit typical characteristics of the observed fronts such as offshore propagation and periodic recurrence with near-inertial periods. A numerical simulation of an actual downwelling episode in Lake Ontario shows that this type of model reproduces the observed behavior of the thermocline as well as the associated oscillatory currents. It is concluded that the fronts are to be visualized as internal surges associated with the oscillatory rather than the quasi-geostrophic response of a lake to wind.

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