Abstract View

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The Birth and Evolution of Eastward-Propagating Modons

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ABSTRACT

This paper addresses the tendency for an eastward-propagating modon to form from a mesoscale eddy which has an inclined vertical axis and different senses of rotation in the upper and deep oceans. This scenario, which has been observed in nature (McCartney *et al*., 1978; Savehenko *et al*., 1978), is modeled in a two-layer ocean by placing a cyclonic eddy in the upper ocean, and an anticyclonic eddy in the deep ocean; these two eddies have centers which are horizontally separated. Inferences about the tendency for modongenesis are made from analytical quasigeostrophic calculations and numerical primitive equation computations. Numerical experiments have been performed using radial velocity distributions $\propto r \exp(-r^2/2L^2)$ in each layer. These results not only corroborate the analytical early-time inferences but expand the parameter range for which modongenesis occurs.

If the upper wean vortex is cyclonic and lies due north of the deep ocean anticyclonic gyre, modongenesis occurs when the vortex centers are separated by $\lesssim(1.5{-}2.0)L$. But if the deep wean anticyclonic vortex is due north of the cyclonic one, modongenesis ensues when the separation is $\lesssim L/3$. The maximum separation at which modongenesis can occur varies continuously between these two extremes as the line of vortex centers is rotated from one configuration to the other. The modons so formed possess a barotropic core (Latichey and Reznik, 1976), and support superposed barotropic and baroclinic vortices (Stern, 1975; Flierl *et al*., 1980), the propagation speeds, length scales and strengths of the resulting modons are examined in the light of these steady state theories.