Abstract View

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The Self-Propagating Quasi-Monopolar Vortex

Melvin E. Stern and Timour Radko

Oceanography Department, The Florida State University, Tallahassee, Florida

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ABSTRACT

If an azimuthally symmetric barotropic eddy on the f plane is subject to a relatively small amplitude disturbance of unit azimuthal wavenumber ($m = 1$), it can propagate very many diameters away from its origin, as shown by a weak nonlinear theory for a piecewise uniform vorticity eddy, and also for one with continuous vorticity inside a finite area. In the former case an initial value contour dynamical calculation shows that the analytical solution is realizable over long distances; the same is true in the latter case, as shown by spectral calculations using the full two-dimensional vorticity equation (with small dissipation). The oceanographic significance of this effect lies in the ability of *almost* symmetric eddies to self-propagate over large distances and collide with other eddies, currents, and continents; this produces important mixing effects, as illustrated herein. It is also shown how the analysis and the effect is generalizeable to a 1½-layer density model on the β plane.