Abstract View

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A Numerical Study of Nonfrictional Decay of Mesoscale Eddies

D.C. Smith IV

Mesoscale Air–Sea Interaction Group, Florida State University, Tallahassee 32306

R.O. Reid

Department of Oceanography, Texas A&M University, College Station 77843

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ABSTRACT

The decay of mesoscale eddies can be attributed to either frictional dissipation of kinetic energy through viscous effects or through dispersive spreading of the different constituent Rossby wave components at their own characteristic wave speeds. Several previous investigations of eddy decay have examined the role of variable friction in the spindown process. In addition to frictional results, these studies have shown that nonlinear advective processes can stabilize the vortex against dispersive effects. The quantification of this relation between nonlinear stabilization and beta dispersion is the primary focus of this paper.

Results are obtained using a finite difference “equivalent barotropic” numerical model with a fixed biharmonic friction formulation. Variable parameters in the study are vortex size and strength. Initial conditions are in the form of a Gaussian height field in gradient balance. Nonfrictional vortex decay is parameterized in terms of lateral spreading. This spreading is determined by the rate of increase of the second radial moment weighted by potential energy density. Estimates are made for the time required for this length to double in magnitude. Moments based on other weightings are also investigated.