Abstract View

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Laboratory Experiments on the Merging of Nonlinear Anticyclonic Eddies

Doron Nof

Department of Oceanography and The Geophysical Fluid Dynamics Institute, The Florida State University, Tallahassee, Florida 32306

Leslie M. Simon

Department of Oceanography, The Florida State University, Tallahassee, Florida 32306

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ABSTRACT

The mutual interaction of two isolated lenslike eddies is examined with the aid of a laboratory experiment on a rotating table. The isolated anticyclonic eddies are formed by withdrawing two cylinders containing a mixture of Freon (with a density of 1.53 gm cm^{-3}), and silicone oil (with a density of 0.853 gm cm^{-3}). The cylinders are embedded in water, and the collapse of the mixture forces two identical lenslike eddies (with an anticyclonic circulation) on the bottom of the tank. Initially, the lenslike eddies are completely separated from each other so that one vortex does not “know” about the presence of the other.

Due to small bottom friction, the vortices spin down slowly so that after some time their edges meet and they touch each other, forming a “figure 8” structure. After this happens there is a rapid (i.e., within 20 revolutions) interleaving of the two eddies. Arms are extended from one vortex to the other and the vortices become one unit consisting of two main lenses. As the interaction continues, the two lenses become less distinct and, ultimately, a single lenslike vortex is formed.

A total of about 20 experiments were performed and all showed that merging takes place after the eddies touch each other. Experiments with vortices whose densities are not identical were also performed and these also resulted in vortices that merged. The experiments suggest that the *potential vorticity of the eddies is altered during their interaction* and that no external source of energy is needed for the merging.

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Headquarters: 45 Beacon Street Boston, MA 02108-3693
DC Office: 1120 G Street, NW, Suite 800 Washington DC, 20005-3826
amsinfo@ametsoc.org Phone: 617-227-2425 Fax: 617-742-8718
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