Abstract View

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Anticyclonic Lenses in Large-Scale Strain and Shear

Barry R. Ruddick

Department of Oceanography, Dalhousie University, Halifax, N.S., B3H4JI Canada

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ABSTRACT

A three-layer model is used to study the effects of pure strain flow and simple shearing flow on isolated, anticyclonic, baroclinic vortices such as Mediterranean salt lenses. Exact steady solutions are found representing elliptical vortices with uniform interior vorticity. These solutions become increasingly elliptical with increasing strain or shear, with the major axis always 45° clockwise from the principal (outflow) axis of the strain field. This is shown to be necessary so that the mean flow not exchange energy with the lens. At some Critical value of strain or shear, these solutions cease to exist. The results suggest that for a lens of a given Rossby number, there is a maximum large-scale strain beyond which the lens must undergo drastic changes in order to survive.

The geostrophic adjustment of an infinitely long strip aligned with a simple shearing flow is also investigated. It is found that the shear modifies the distance of outward adjustment, but not the profile of the adjusted region. The strong flow and vorticity near the edge, and the assumed infinite length, allow the strip to persist in environmental slim as strong as f, the Coriolis parameter.