Abstract View

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The Stability of Ocean Currents in Eddy-Resolving General Circulation Models

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ABSTRACT

The stability of currents generated in an oceanic eddy-resolving general circulation model EGCM (Holland, 1978) is investigated by solving the eigenvalue problem associated with the finite-difference quasi-geostrophic vorticity equations which govern the flow. In general, both barotropically and baroclinically unstable waves are shown to exist for instantaneous currents found in the EGCM. Although these simulated flows are not always quasi-steady in the sense required by the theory and are themselves modified by the presence of the finite-amplitude eddies, many characteristics of the eddy field and its interaction with the time-mean circulation can nevertheless be deduced by the linear stability analysis.

In particular, these investigations show that linear stability considerations correctly identify regions of instability in the ocean circulation model and accurately predict the low-order statistical features of the eddy field such as wavelength, period and phase speed. The effects of weakly unstable regions which are masked by global diagnostic techniques can be studied with the local stability model. The linear stability analysis also predicts, with some success, higher order statistics such as the sign and structure of intra-eddy energy fluxes that are important indicators of the dynamics of the unstable regions.