Abstract View

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On the Mixed Stability Program for Quasi-Geostrophic Ocean Currents

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ABSTRACT

A simple, two-layer, quasi-geostrophic model is used to investigate the stability of baroclinic currents confined to a finite length scale L in a basin of considerably larger dimension ($4L$). The current distributions studied are typical of oceanic boundary currents and of certain oceanic and atmospheric eddies. The sharp shear zone which couples the relativity broad interior portion of the current to the resting ocean makes it possible for instabilities to arise which can get their energy either from the available potential energy of the tilted interface or from the basic zonal kinetic energy of the current. In a two-layer inviscid ocean of density contrast $\Delta\rho$ on an f-plane, and with a flat bottom, the two parameters governing the stability of a given current are the internal Froude number $F=\rho f^2 L^2 (g\Delta\rho H)^{-1}$ and the layer depth ratio $\delta=H_{top}/H_{bottom}$. The stability calculations show that these finite-width currents can be stable for intermediate values of F if δ is small enough. For moderate δ (0.2 to 1.0) the current distributions studied are unstable for all values F. The growth rates for the instabilities are given.