Abstract View

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Mechanisms for Lateral Exchange with Oceanic Convectio

Keith Alverson

Physics Department, University of Toronto, Toronto, Ontario, Canada

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ABSTRACT

Competing influences of baroclinic instability and ambient mean flow in the shutdown of convection in the ocean are studied using a primitive equation model. A mean flow over isolated bottom topography is one way to generate convection on the horizontal scales seen in the ocean. Modeling of this process suggests that the convective deepening is arrested when horizontal fluxes of heat due to the mean flow balance surface cooling. The topographically trapped convective chimney is not prone to baroclinic instability because the mean flow advects anomalies away from the chimney faster than they can grow locally. This behavior is unlike that seen in model chimneys forced by isolated, circular shaped, cooling regions in which baroclinic eddies provide the horizontal fluxes of heat required to shut down convection.

In order to elucidate the suppression of baroclinic instability by the presence of an ambient mean flow, a series of experiments is carried out with a circular cooling region used to parameterize the preconditioning effect of the topography. For small mean fl generated reproduce the robust baroclinic instability seen in previous studies. In this case, the final d the convection is determined by the horizontal fluxes due to baroclinic eddies. For large mean flows is suppressed, and the mean flow provides the horizontal fluxes that determine the final depth of ver topographic preconditioning experiments. Some possible implications for the parameterization of co general circulation models are discussed.