Geophysical Research Abstracts,
Vol. 10, EGU2008-A-01503, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-01503
EGU General Assembly 2008

Adjustment of a fluid layer to surface buoyancy forcing on the β-plane: An overlooked problem

O. Marchal (1), A. Colin de Verdière (2), and P. Winsor (1)

(1) Woods Hole Oceanographic Institution, Massachusetts, USA (omarchal@whoi.edu / Fax: +1 508 457 2187 / Phone: +1 508 289 3374), (2) Laboratoire de Physique des Océans, Université de Bretagne Occidentale, France

Recent studies used scaling arguments for the thermocline and numerical solutions of the equations of motion to show that the *equilibrium* response of the meridional overturning circulation (MOC) to surface buoyancy forcing in a one-hemisphere basin depends qualitatively on the representation of vertical mixing: if the postulated vertical diffusivity (κ_v) is constant (a common assumption), the strength of the MOC decreases with decreasing equator-to-pole density contrast at the surface ($\Delta\rho$), whereas if κ_v depends on vertical density stratification (at least an equally plausible assumption), the MOC increases with decreasing $\Delta\rho$. Here we will extend earlier work by discussing the *time-dependent* response of the circulation to surface buoyancy forcing for different representations of κ_v. Our attention will be focused on the adjustment of a fluid layer to meridional buoyancy forcing on the β-plane via the radiation of long baroclinic Rossby waves. First, quasi-geostrophic theory will be used to derive the dispersion relation and baroclinic modes of these waves for different representations of κ_v. Second, numerical solutions of the equations of motion for small Rossby number will be presented to illustrate the characteristics of wave propagation for these different mixing representations. Attempts will be made to relate theory to the numerical results. The simplified dynamical and geometrical frameworks employed here should be useful to understand the time-dependent response of the circulation to buoyancy forcing in more complete models.