Geophysical Research Abstracts,
Vol. 11, EGU2009-5711, 2009
EGU General Assembly 2009

Extratropical Rossby waves in the presence of buoyancy mixing

O. Marchal

Woods Hole Oceanographic Institution, Woods Hole, United States (omarchal@whoi.edu)

Rossby waves are long-period oscillations in the ocean and atmosphere, whose restoring mechanism is provided by the meridional variation of the Coriolis parameter. These waves constitute the predominant way in which the ocean adjusts on long time scales (year to decade) to large-scale perturbations in the atmosphere. Here the standard theory of oceanic Rossby waves at the middle latitudes is extended to include the influence of buoyancy mixing in the form of density diffusion. The search for wave solutions in a vertically bounded medium subject to horizontal (vertical) diffusion leads to an eigenvalue problem of second (fourth) order. For each case, approximate solutions are obtained for arbitrary density stratification by using WKB theory. It is found that, in the presence of horizontal or vertical diffusion, the dispersion relation of adiabatic theory is modified to include a negative imaginary part, i.e., the baroclinic normal modes are damped. The decay rate of these modes increases with horizontal or vertical diffusivity, mode number, and wave number. It is concluded from observational estimates that horizontal (vertical) mixing could (not) significantly contribute to the spin-down of the first baroclinic mode in the ocean.