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Barotropic Rossby Waves in a Zonal Current: Effects of Lateral Viscosity

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ABSTRACT

The behavior of a barotropic Rossby wave in a zonal current is studied theoretically using a beta-plane ocean of constant depth in which the current depends only on latitude. The wave may be reflected or absorbed, depending on whether the relative frequency as detected in the moving water increases or decreases, respectively, as the wave penetrates into the current. An eastward-flowing current can reflect a Rossby wave with little transfer of zonal momentum or energy to the current, even in the presence of lateral viscosity. It does transfer meridional momentum. A westward-flowing current can absorb a Rossby wave, receiving all the wave momentum and much of its energy. Near the absorption velocity there is a balance between viscous diffusion and advection of vorticity, and relative accelerators are insignificant.

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