Abstract View

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Observations on the Vertical Polarization and Energy Flux of Near-Inertial Waves

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ABSTRACT

Vertical profiles of horizontal ocean currents are used to study the vertical structure and temporal behavior of internal waves in the ocean, particularly those near the local inertial frequency. The polarization, or direction in which the horizontal velocity vector of an internal wave rotates with depth, is an important feature of the vertical structure, since it provides information on the direction and magnitude of the vertical wave energy flux. Analysis of a time series of profiles at one location over smooth topography shows that the observed wave polarization and phase propagation in the vertical are consistent, at least within the limits of the observational technique that was employed, with the linear dispersion relation for internal waves. The fact that the waves are polarized in the clockwise sense with increasing pressure shows that they have a net downward energy flux. A spectral decomposition of the profiles into clockwise and anti-clockwise components provides an estimate of 0.2–0.4 erg cm^{-2} s^{-1} (0.2–0.4 × 10^{-3} J m^{-2} s^{-1}) for this net downward energy flux and gives an estimate of bottom reflection coefficients for these waves as a function of vertical wavenumber. The horizontal kinetic energy spectrum as a function of stretched vertical wavenumber and the dropped, lagged, rotary coherence between profiles separated in time are compared with predictions based on a model derived by Garrett and Munk (1975). Within the expected error there is good agreement between the data and the model. Some profiles obtained over a region of rough bottom topography indicate that the rough bottom may be acting as an energy source for the near-inertial waves.

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