Abstract View

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Anomalous Behavior of Internal Gravity Waves Near Bermuda

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ABSTRACT

0bservations of vertical profiles of horizontal velocity made around the island of Bermuda during the FAME experiment reveal anomalies in the internal wave field associated with the island bathymetry. Compared to similar data taken at open-ocean sites, the near-Bermuda data exhibit lower horizontal kinetic energy levels, especially in the near inertial frequency band. Also, whereas the open ocean data consistently show the dominance of clockwise over anticlockwise polarized (with depth) energy, implying a near surface energy source, the Bermuda profiles frequently consist of mostly anticlockwise polarized energy. The near island internal wave field possesses a significant inshore over alongshore shear anisotropy, which, together with the anticlockwise polarization, might signify energy generation at the sea bottom with subsequent propagation upward radially away from the island. No relation is found between the amount of shear anisotropy and the energy level of the wave field. The shear anisotropy and temperature finestructure appear to be related to horizontal shear of the time-mean current and proximity to the island.

During the period when a large-scale eddy was impinging on the island, significant coherence was observed between vertical gradients of temperature and velocity components in the wavelength band 30–50 m. The phase between temperature and velocity variations was consistent with nearshore internal wave generation followed by upward and outward propagation. The observed coherence and phase are compared to that expected from a horizontally anisotropic, vertically asymmetric internal wave field. It is found that such a wave field can account for the observed temperature finestructure by internal wave distortion of the time-mean vertical temperature gradient. In contrast, horizontal advection by internal waves of a time-mean horizontal temperature gradient produces insignificant temperature finestructure. The narrow band coherence presumably results from scale-dependent generation or propagation.

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