Abstract View

Volume 19, Issue 11 (November 1989)

Journal of Physical Oceanography
Article: pp. 1716–1729 | Abstract | PDF (1.06M)

Implications for Ocean Mixing of Internal Wave Scattering off Irregular Topography

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(Manuscript received April 11, 1989, in final form June 8, 1989)

DOI: 10.1175/1520-0485(1989)019<1716:IFOMOI>2.0.CO;2

ABSTRACT

Earlier work has suggested that internal wave reflection off sloping bottoms may cause significant diapycnal mixing in the deep ocean, and may also represent an important sink of internal wave energy. Most theories have been limited, however, by the representation of the bottom as an infinite plane slope. In this paper, the scattering of internal waves off irregular topography is studied for a few idealized bottom shapes. We pay special attention to the critical case, which occurs when the bottom slope dh/dx locally matches the wave ray slope s. Analytical solutions for bottom shapes such that $dh/dx = s$ at a single point are discussed for both locally convex and concave topography, and are compared with the results of specular reflection theory. They lead to the important conclusion that one is more likely to observe energy enhancement at the critical frequency above locally convex rather than concave topography. This suggests that energy dissipation rates associated with the breaking of internal waves may also be higher above locally convex topography. We also note that, for locally convex topography, rapid variations of the reflected wavefield with height above the bottom can be explained by purely geometric effects, and need not be a consequence of nonlinear interactions.