Abstract View

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Topographic Coupling of Surface and Internal Kelvin Waves

Shenn-Yu Chao

Research and Data Systems, Inc., Lanham, MD 20801

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ABSTRACT

An analytical method is developed to compute the diffraction of a barotropic Kelvin wave by a localized topographic irregularity on an otherwise flat-bottom ocean with an arbitrary vertical stratification. The bump topography is assumed to be small in height compared to the water depth of the flat-bottom ocean. It is found that all baroclinic mode Kelvin waves will be generated downstream of the bump, with the first baroclinic mode having the largest amplitude. At subinertial frequencies ($\omega<f$) localized disturbances are also generated with higher vertical modes trapped nearer to the bump. At superinertial frequencies ($\omega>f$) cylindrical Poincard waves with certain anisotropy are generated at ($x = x_0$, $y = 0$) and ($x = -x_0$, $y = 0$), where (x_0,0) is the center of the bump topography, and the y axis is the coastline. The Poincaré waves favor the lowest few modes, with the baroclinic modes having stronger tendencies to be directionally anisotropic. The baroclinic Poincaré waves radiating offshore from the bump topography could contribute to the internal wave field in the open ocean and provide an alternative mechanism to dissipate the barotropic tides. Order-of-magnitude estimates show that an energy flux of ~ 0.09 W per centimeter coastline could be converted from the M2 tide in the eastern Pacific.

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