Abstract View

Volume 10, Issue 8 (August 1980)

Journal of Physical Oceanography
Article: pp. 1187–1199 | Abstract | PDF (880K)

Diffraction of Continental Shelf Waves by Irregular Alongshore Geometry

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(Manuscript received July 17, 1979, in final form May 5, 1980)

DOI: 10.1175/1520-0485(1980)010<1187:DOCSWB>2.0.CO;2

ABSTRACT

Diffraction of continental shelf waves by irregular alongshore geometry, such as ridges, canyons and bumps, is examined. The full barotropic, shelf-wave equation is treated, and the solutions include forward and back scattering, and a description of the near-field circulation around the topographic feature.

Reflection of long waves by the convergence/divergence of depth contours is small. On the other hand, velocity amplitude of the transmitted wave can become much larger (smaller) than the incident amplitude, in the case of convergence (divergence). Back scattering becomes important, when the incident wave approaches critical frequency (zero group speed). Above critical frequency, the incident long wave is totally reflected as a short wave.

Wave diffraction by ridges or canyons leads to both forward and back scattering. Local amplitude amplification occurs near the depth convergence zone. The amplitude amplification is more intense when higher modes are excited. The reflected short wave is also likely to be trapped immediately upstream of the ridge or canyon, due to bottom dissipation. Consequently, strong localized disturbances will be generated near the ridge or canyon.

The results suggest that topographic irregularities on the continental shelf are the energy sink of long waves. Through diffraction, the large-scale, predominantly alongshore motion transforms to the intense, small-scale, cross-shore motion in the vicinity of sharp depth convergence.

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