Abstract View

Volume 15, Issue 1 (January 1985)

Journal of Physical Oceanography
Article: pp. 33–45 | Abstract | PDF (902K)

On Wavenumber Estimates for Forced Continental Shelf Waves

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(Manuscript received September 30, 1983, in final form October 2, 1984)

DOI: 10.1175/1520-0485(1985)015<0033:OWEFFC>2.0.CO;2

ABSTRACT

We derive expressions that predict the variations of Cartesian, rotary and elliptical properties of free and forced barotropic continental shelf waves as functions of alongshore and cross-shore location. Bottom friction is shown to significantly complicate these expressions. Particular attention is given to the spatial variability in the phases of forced waves as functions of the wavenumber of the forcing and the corresponding free wave mode. Consideration of the alongshore and across-shelf structure predicted by the theory indicates that, for a given frequency, the relative merits of Cartesian or rotary Fourier analysis of data depends on the location of the observation stations in the across shelf direction and on the geometry of the continental shelf and slope. The specific case of observed, diurnal period (K_1) continental shelf waves off Vancouver Island is used to illustrate how the free and forced shelf wave models lead to different interpretations for the wavelengths of the free wave component. The results demonstrate the nontrivial nature of the forced problem and emphasize the need for accurate resolution of the wavenumber of the driving mechanism.