Abstract View

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On the Detection of Continental Shelf Waves

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ABSTRACT

Given equal amounts of kinetic energy near the coast, different shelf wave modes (at the same frequency) have different magnitudes of sea-level oscillations—the magnitudes decrease with increasing mode number. Hence, an intrinsic bias for the lowest mode is present when using sea-level data for shelf wave detection.

Shelf waves have many modal-dependent structures in their cross-shelf dimension, which can be used to accurately identify the excited modes in the current fluctuations. In addition to rotary spectral analysis, a new technique that involves fitting (at a particular frequency of interest) the theoretical current ellipses of various barotropic shelf wave modes to the observed current ellipses at stations spread across the continental shelf, is introduced. This technique shows how the current energy is distributed among the modes.

These techniques are illustrated using Oregon shelf data from the summer of 1973. The cross-shelf fitting shows that at frequencies below 0.45 cycles day^{-1}, the current fluctuations on the Oregon shelf were completely dominated by the second mode. Furthermore, the observed alongshore phase speed also agreed very closely with the theoretical value for the second mode shelf wave. This is the clearest shelf wave identification achieved to date.