Abstract View

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Free, Stable Continental Shelf Waves in a Sheared, Barotropic Boundary Current

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ABSTRACT

The dispersion characteristics of stable, discrete, barotropic, continental shelf wave (CSW) modes propagating in a barotropic boundary current are strongly modified by the dynamical effects of nonuniform horizontal shear. For example, the CSW's propagate *cum sole* with no mean current, but their direction of propagation can be reversed by an opposing uniform mean current. In contrast, an opposing sheared mean current increases the tendency for *cum sole* propagation relative to an opposing uniform mean current, and produces a high-wavenumber cutoff, at least for modes higher than the first. If the sheared mean flow vanishes somewhere, the discrete CSW modes all propagate *cum sole* once again. For the mean current profiles considered, the high-frequency cutoff is lowered in the nonuniform shear case compared to the zero current case.

In a simple geometry motivated by the Florida Current and Florida Straits, southward CSW propagation can occur, in opposition to the Current, primarily because the cyclonic shear of the Current is similar in magnitude to the local Coriolis parameter. The short-period cutoff (zero group speed) for the first mode CSW is about 12 days; this CSW has a wavelength of about 190 km, corresponding to a southward phase speed of about 17 cm s^{-1}. Within the limitations of the model, the results indicate that the Florida Straits–Florida Current system can accumulate energy at time scales of 10–14 days, corresponding to those of atmospheric cold front forcing.