Abstract View

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Some Three-Dimensional Characteristics of Low-Frequency Current Fluctuations near the Oregon Coast

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ABSTRACT

An analysis is presented of the low-frequency fluctuations [$\omega<0.6$ cycle per day (cpd)] of the currents near the Oregon coast, based on the 1972 and 1973 measurements from moored current meters in CUE-1 and CUE-2. Let u and v denote the eastward (approximately onshore) and northward (approximately alongshore) components of the currents. The mean alongshore velocity v has the structure of a baroclinic coastal jet, whose maximum speed occurs near the surface at a distance of about 15–20 km from the shore, whereas the fluctuating part of v has the structure of a roughly barotropic coastal jet whose maximum occurs very near (<4 km) the shore. The standard deviation of v is approximately depth-independent whereas that of u decreases with depth. As one approaches the coast, the standard deviation of u decreases whereas that of v rises steeply, consistent with the behavior expected of coastally trapped wave motion. A scatter plot of the velocity fluctuations in a hodograph plane indicates that the fluctuations roughly follow the direction of the local isobaths. The Reynolds stresses in an east-north coordinate system therefore change sign because of the change of direction of the isobaths in the region. The v fluctuations seem to be mutually better correlated than the u fluctuations throughout the region, suggesting that the u components may be affected by "turbulence." By finding the time lag corresponding to maximum correlation between stations separated alongshore, the velocity fluctuations have been found to propagate northward approximately nondispersively at a mean velocity of about 500 km day^{-1} during 1972 and 120 km day^{-1} during 1973. A method for performing the empirical orthogonal decomposition for two-dimensional vector time series has been formulated and applied to the velocity field over the continental shelf.

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