Abstract View

Volume 5, Issue 4 (October 1975)

Journal of Physical Oceanography
Article: pp. 683–704 | Abstract | PDF (1.52M)

Modal Decomposition of the Velocity Field near the Oregon Coast

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(Manuscript received December 9, 1974, in final form May 7, 1975)

DOI: 10.1175/1520-0485(1975)005<0683:MDOTVF>2.0.CO;2

ABSTRACT

The low-frequency [ω<0.5 cycle per day (cpd)] current fluctuations at four depths in 100 m of water have been investigated for two stations on the continental shelf off the coast of Oregon. One station, DB-7, was maintained during the summer of 1972 as part of the Coastal Upwelling Experiment-1 (CUE-I), and the other station, Carnation, was maintained during the summer of 1973 as part of CUE-II. A decomposition of the north-south (almost alongshore) v and the east-west (onshore-offshore) u components of the current has been performed in terms of two types of modal structures in the vertical direction: (i) dynamic modes determined by the separable solutions of the appropriate equations of motion, and (ii) empirical orthogonal modes which are the eigenvectors of the correlation matrix and depend only on the statistics of the data. For the alongshore currents, the standard deviation of the dynamic barotropic mode is found to be twice as large as that of the first baroclinic mode. The barotropic part is found to be correlated with the north-south component of the wind stress τw and the sea level, whereas the first mode baroclinic part is found to be correlated with the temperature fluctuations. The first empirical eigenmode accounts for about 91% of the energy and is fairly depth-independent, whereas the second empirical eigenmode accounts for about 7% of the energy and resembles the first dynamic baroclinic mode. Spectral analysis shows high mutal coherence between the barotropic modes for the u and v components and the wind stress nr at the frequencies 0.06 cpd in 1973 and 0.14 cpd in 1972. Results from a theoretical model show that the observed values of the phase relations at these frequencies are consistent with a resonant condition between the wind stress and forced, long, barotropic continental shelf waves.

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