Abstract View

Volume 12, Issue 8 (August 1982)

Journal of Physical Oceanography
Article: pp. 862–879 | Abstract | PDF (1.36M)

Eastern Boundary Currents and Coastal Upwelling

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(Manuscript received January 5, 1982, in final form April 28, 1982)

DOI: 10.1175/1520-0485(1982)012<0862:EBCACU>2.0.CO;2

ABSTRACT

The adjustment of the eastern coastal zone of an inviscid ocean with vertical walls to a change in wind conditions occurs in two stages. After the propagation of a Kelvin wave across the forced region in a time T_k which is of the order of a day or two, the coastal upwelling zone is temporarily in equilibrium with the wind. Further adjustment occurs after a time T_R, which is of the order of a few mouths, when westward Rossby dispersion of the coastal jet becomes important. These time scales define three frequency ranges that characterize the response to fluctuating winds with period P. 1) At high frequencies ($P \lesssim T_k$) short Kelvin waves can destroy coherence between the forcing and response, alonshore coherence of oceanic variables is small, and the spectrum of the response is red even if that of the forcing is white. The offshore wale of the response is the radius of deformation. Poleward phase propagation at Kelvin wave speed *c* in unforced regions and at speed 2*c* in the forced region is prominent in this frequency range and at an lower frequencies. 2) At intermediate frequencies ($T_k \ll P\ T_R$) long Kelvin waves from the boundary of the forced region establish an equilibrium response so that the ocean and atmosphere are practically in phase, but Kelvin waves excited by remote winds could destroy this coherence. Alongshore correlations are high and the spectrum of the response is much less red than at higher frequencies. The offshore male exceeds the radius of deformation and increases with decreasing frequency. 3) At low frequencies ($P \gtrsim T_R$) the offshore scale is the distance Rossby waves travel in time *P*. A complex system of northward and southward currents appears near the eastern boundary of the basin. It is proposed that the California Current system is generated in this manner.

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