Abstract View

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Coastal Upwelling on a β-Plane

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ABSTRACT

The β effect is found to produce a poleward undercurrent in a wind-driven model of an eastern ocean circulation. The model is on an *x*, *z* plane and longshore derivatives of the velocity field are neglected. The nonlinear two-layer model is time-dependent and is solved numerically. Beta is found to exhibit little effect on the vertical mass transport, but exerts a dominant influence on the longshore flow by inducing a north-south sea surface slope.

For an equatorward wind stress and flat bottom topography, the model predicts upwelling adjacent to the coast with a mean vertical velocity of 10^{-2} to 10^{-2} cm sec^{-1} and an *e*-folding width of about 15 km. The longshore flow is characterized by an equatorward surface jet and a poleward undercurrent. Outside the upwelling zone the longshore flow is weak. The offshore flow in the upper layer is slightly weaker than that predicted by Ekman drift. The compensating onshore flow in the lower layer is balanced by the north-south sea surface slope.

Positive wind stress curl in the coastal upwelling zone tends to diminish the surface jet and to enhance the poleward undercurrent. Bottom topography is shown to modify the dynamics and a secondary upwelling zone is found over the continental slope.

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