Abstract View

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Steady Coastal Circulation Due to Oceanic Alongshore Pressure Gradients

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ABSTRACT

A depth-averaged barotropic model is used to investigate the steady response of the coastal ocean to alongshore pressure gradients imposed by the deep ocean. Solution indicate that the dimensionless continental margin width δ is the appropriate parameter determining the effectiveness of the transmission of the alongshore pressure field from ocean to coast. For linear depth profiles having depth $h = h_0 + h_1 x$ the abyssal plane at $x=l\delta=(fk/r)^{1/2}(h_1 l^2/2)^{1/2}$ where f is the Coriolis parameter, r is the linear friction coefficient for alongshore flow and k is the wavenumber of the alongshore pressure perturbation. For parabolic depth profiles having $h=h_0+h_2x^2$ to $x=l$, $\delta=(3fk/2r)^{1/3}(h_2 l^3/3)^{1/3}$. On narrow continental margins with $\delta \ll 1$, oceanic pressure fields are almost completely transmitted to the coast causing substantial near-coastal currents, while on wide continental margins with $\delta \gg 1$ the near coastal ocean is unaffected by the oceanic pressure field. In general, the oceanic pressure field drives a strong circulation at the outer slope, and this circulation weakens toward the coast. This contrasts with the coastal circulation resulting from an alongshore wind stress, which is strongest at the coast and weakens with distance offshore.