# Abstract View

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# On the Possibilities of Coastal, Mid-Shelf, and Shelf Break Upwelling

**Y. Hsueh and Hsien-wang Ou**

*Department of Oceanography, Florida State University, Tallahassee 32306*

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ABSTRACT

The steady-state circulation on a continental shelf under the combined influence of a wind stress, a surface density distribution, and a longshore current over the shelf break is investigated in a linear, β-plane model that allows a longshore pressure gradient. The problem is quasi-two-dimensional and lends itself readily to a standard boundary-layer analysis. For the range of parameters considered, the hydrostatic Lineykin layer allows a vertical mass transport into the surface Ekman layer to compensate for the one-sided divergence created by the wind stress at the coast and is, therefore, primarily responsible for coastal upwelling. An equatorward longshore current over the shelf break, on the other hand, contributes to a shelf break upwelling due to the Sverdrup relation. There is, in this case, also a possibility for a poleward undercurrent over the continental shelf. When the equatorward longshore velocity at the shelf break bottom is sufficiently large, however, the poleward undercurrent may not exist at all, and the whole shelf water may move equatorward. The resulting onsho're transport in the bottom Ekman layer then causes upward motion in the Stewartson $E^{1/2}$ layer, and allows for an appearance of coastal upwelling in the presence of upwelling at the continental shelf break. The interior density anomaly in the model is always diffusive and admits an upwelling circulation beneath sharp surface contrasts with a shoreward gradient. While such contrasts in surface density anomaly can, and do, occur at mid-shelf points, the intensity of upwelling generally remains the greatest in the coastal boundary layer.

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Headquarters: 45 Beacon Street Boston, MA 02108-3693
DC Office: 1120 G Street, NW, Suite 800 Washington DC, 20005-3826
amsinfo@ametsoc.org Phone: 617-227-2425 Fax: 617-742-8718
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