Abstract View

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On the Structure of Transient Upwelling Events

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ABSTRACT

Nearshore transcends, following the development of transient coastal upwelling, characteristically show “intermediate” density fluid occupying the immediate nearshore band. Large cross-shore particle excursions during the development of upwelling may be inferred from be-fore and after transects, and the movement of surface layers seaward, intermediate density fluid shoreward through a distance of the order of kilometers, and the bottom layers also shoreward by a 1esser amount. Some inevitable vertical Mixing together with the large cross-shore displacements results in efficient cross-shore mass exchange.

The main dynamical features of similar events may be investigated by means of three-layer models. Linear theory is conveniently discussed first, the conclusions of which are easily generalized to multilayer models, Finite-amplitude (i.e., “full”) upwelling is then considered using a potential-vorticity conserving impulsive model. The results show that the wind “peels” off the surface layer over which the wind stress is effectively distributed. Thus the next lightest layer becomes exposed to the atmosphere. The lower layers generally respond in the barotropic mode, becoming “equally stretched” on the removal of the surface layer, except within a distance of the order of the baroclinic radius of deformation from the pycnocline outcropping. The maximum velocity of the jet associated with the pycnocline outcropping is limited to an effective densimetric velocity. Cross-shore displacements behave similarly in the model and the observed cases.