Abstract View

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The Frictional Nearshore Response to Forcing by Synoptic Scale Winds

Gary T. Mitchum and Allan J Clarke

Department of Oceanography and Geophysical Fluid Dynamics Institute, Florida State University, Tallahassee, FL 32306

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ABSTRACT

An analytic barotropic model was used to study the nearshore frictional response to synoptic-scale wind forcing. The results depend only on the region where the surface and bottom Ekman layers interact strongly and the water is consequently well mixed. Thus, the conclusions apply even to shelves where baroclinic effects are not negligible father offshore. The main findings are as follows.

(i) The "blocking" of the surface Ekman flux which drives the shelf flow is a consequence of the interaction of Ekwan layers in the nearshore region. The interaction transfers progressively more of the surface stress directly to bottom stress as the depth decreases. The consequent decrease in Ekman flux toward the shore creates an Ekman flux divergence which drives the interior flow.

(ii) The region over which the shelf is effectively forced is narrow. It extends, approximately, from where the depth divided by the Ekman layer *e*-folding scale is 0.2 to where it is 2.5.

(iii) Simple equations for pressure and the depth-averaged alongshore velocity component were developed for the region extending from the coast to where the depth h is about three times the Ekamn layer *3*-folding scale δ. these equations do not depend on the dynamics outside this region and are easily solved for arbitrary alongshore forcing.

(iv) A "coastal" boundary condition was derived for those models which analyze the offshore region where $h \geqslant 3\delta$. The appropriate condition is that the depth integrated flow perpendicular to the coast should vanish at the model coast $h=3\delta$. A simple formula connecting actual coast and model coast pressure is also given so that predictions at the model coast can be related to the easily obtained coastal tide gauge data.

(v) The equations for pressure and the alongshore velocity component were compared to a dataset on the West Florida Shelf. Although the data were somewhat limited, the comparison showed good agreement.

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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