



Abstract View

[Volume 10, Issue 10 \(October 1980\)](#)

Journal of Physical Oceanography

Article: pp. 1574–1583 | [Abstract](#) | [PDF \(680K\)](#)

A Model and Observations of Time-Dependent Upwelling over the Mid-Shelf and Slope

G.S. Janowitz and L.J. Pietrafesa

Department of Marine Science and Engineering, North Carolina State University, Raleigh 27650

(Manuscript received January 28, 1980, in final form July 17, 1980)

DOI: 10.1175/1520-0485(1980)010<1574:AMAOOT>2.0.CO;2

ABSTRACT

A simple model of time-dependent quasi-geostrophic upwelling over an outer continental shelf and slope region is considered with the velocity assumed independent of the alongshore coordinate. The flow is at rest and stably stratified when a uniform alongshore wind stress τ is applied. Initially, the onshore flow in the water column balances the offshore top Ekman volume flux. As time progresses the bottom Ekman layer supplies increasingly more of the required onshore flux and the onshore flow in the interior of the water column decreases. The shallower water spins up first leading to both a coastal jet and an upward bulge in the isopycnal surfaces which propagates offshore with a speed equal to $0.012(\tau/\rho)^{1/2}/h_x$, where h_x is the local slope. At the shelf break, if

$h_{xx} h/h_x^2 > 2$ another upward bulge of the isopycnal surfaces will develop at the

onset of upwelling favorable winds and will be of greater amplitude than the propagating bulge. The theory is generalized to include the effects of a time-dependent wind stress and those of a specified time-dependent alongshore pressure gradient. The velocity induced by the deformation of the density field is then calculated. Comparisons of theory with moored meter data collected in Onslow Bay, North Carolina are made during upwelling favorable summertime wind conditions.

Options:

- [Create Reference](#)
- [Email this Article](#)
- [Add to MyArchive](#)
- [Search AMS Glossary](#)

Search CrossRef for:

- [Articles Citing This Article](#)

Search Google Scholar for:

- [G.S. Janowitz](#)
- [L.J. Pietrafesa](#)



© 2008 American Meteorological Society [Privacy Policy and Disclaimer](#)

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

[Allen Press, Inc.](#) assists in the online publication of *AMS* journals.