Abstract View

Volume 9, Issue 5 (September 1979)

Journal of Physical Oceanography
Article: pp. 975–991 | Abstract | PDF (1.17M)

Topographically Induced Changes in the Structure of an Inertial Coastal Jet: Application to the Agulhas Current

A.E. Gill

Department of Applied Mathematics and Theoretical Physics, University of Cambridge, England

E.H. Schumann

National Research Institute for Oceanology, Congella, South Africa

(Manuscript received May 9, 1978, in final form February 7, 1979)

DOI: 10.1175/1520-0485(1979)009<0975:TICITS>2.0.CO;2

ABSTRACT

Calculations are made of the changes in the structure of an inertial current which can be induced by slow changes in the topography of the continental shelf and slope along which it flows. The particular case of a uniform potential vorticity current over a shelf of uniform slope shows that smooth transitions from subcritical to supercritical flow can occur at a minimum in the shelf width. Long-wave disturbances travel away from such a point. Upstream there is a tendency for a countercurrent to occur at the coast, while downstream there is a tendency for cold water to outcrop on the inshore side of a front. Both these features occur along the path of the Agulhas Current.

A method developed for calculating the speed of long-wave disturbances in a flow with a given potential vorticity distribution is applied to sections of the Agulhas Current about 150 km apart. In this distance the shelf width is reduced, and a calculation using a current model with two active layers shows the second mode is very close to critical at Port Edward. This result supports the notion that shelf topography can hydraulically control an inertia] boundary current.