Abstract View

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Trapping of Waves by a Constant Slope internal Interface in a Two-Layer Ocean

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ABSTRACT

It is well known that “edge” and “continental shelf” waves can be trapped by a constant slope nearshore bottom; in a two-layer ocean of great constant depth, a *constant* slope *internal* interface, as well as the associated geostrophic current, can do the same.

The perturbation equation governing the waves which propagate along the contours of the interface (or along the streamlines of the geostrophic current) is similar to the one that governs the ordinary barotropic edge- and shelf-waves over a plane sloping bottom. However, the boundary conditions on the two sides of the current strip associated with the sloping interface involve the fitting of 1) the elevations of the surface and of the interface and 2) the transverse velocities, with those of “Kelvin-type” waves (with exponential profiles) outside the current strip. The basic current within the strip is taken into account in the fitting. We did not find any solution for a front, when the mean interface intersects the surface; but we found some for a mean interface sloping from one level on one side to a different one on the other side. Analytical solutions for these conditions seem to be beyond reach; but a numerical approach in a number of cases involving *stable* waves shows that such waves do exist, either second-class waves ($|\sigma|<f$) or first-class waves ($|\sigma|<f$). In those cases, the second-class waves propagate cyclonically with respect to the shallower side of the interface, provided the reference for propagation speed is an observer *driven by the basic current* (“right-bounded” waves), this shows similarity with continental shelf waves.

The method used is applicable to a parallel-wall strait or when a vertical shore exists on one side of the basic current.

At the time when satellite infrared images reveal so many areas on the ocean surface where wavy surface fronts are seen to exist, this kind of investigation may prove useful.

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