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Vorticity Waves over Strong Topography

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ABSTRACT

Analytical solutions are found for topographic waves propagating over step bottom slopes in a two-layer infinite channel. From the inviscid unforced long-wave equation for a two-layer fluid on an f -plane, it is shown, under the assumption of a relatively thin upper layer, that barotropic waves force a baroclinic response through topographic coupling, resulting in surface intensified motion. Solutions are found with and without the small slope approximation. It is shown that the small slope approximation underestimates the frequency of low-frequency topographic waves, even when the slope is small. The theory is compared with observations from the Strait of Georgia and with a numerical model of the St. Lawrence estuary.

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