Abstract View

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The Influence of Bottom Topography on Baroclinic Transports

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ABSTRACT

A new and reduced set of governing equations is proposed for the modeling of baroclinic motions in a two-layer system with variable bottom topography. The reduction of the equations, which eliminates all barotropic is based on the assumption of almost vertically compensated transports. The resulting equations differ somewhat from those obtained with a rigid-lid approximation. The limitations are topography variability only on horizontal scales greater than the wavelength and wavelengths shorter than the barotropic radius of deformation. These are not critical in many problems. Numerical solutions to the reduced equations are shown to be close to those obtained from the primitive equations, in one- and two-dimensional cases. In view of their relative simplicity, the new governing equations have also been applied to the analytical study of coastal upwelling in the presence of variable topography. It is shown then that the presence of a canyon enhances coastal upwelling.

The success of the reduced equations proposed here resides in the fact, if there are no externally forced barotropic motions, those formed by the interaction of baroclinic motions over variable topography are negligible. Because of the elimination of all barotropic motions, including barotropic planetary waves and barotropic shelf waves, it is concluded that the reduced equations will be best applied to near-shore regions, fjords, small lakes and seas.