Internal Tides Near Steep Topographies

by

Sydney Glass Sroka

Submitted to the Department of Mechanical Engineering
in partial fulfillment of the requirements for the degree of

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Abstract

The primary contributions of this thesis include the first stages of development of a 2D, finite-volume, non-hydrostatic, σ-coordinate code and beginning to apply the Dynamically Orthogonal field equations to study the sensitivity of internal tides to perturbations in the density field. First, we ensure that the 2D Finite Volume (2DFV) code that we use can accurately capture non-hydrostatic internal tides since these dynamics have not yet been carefully evaluated for accuracy in this framework. We find that, for low-aspect ratio topographies, the z-coordinate mesh in the 2DFV code produces numerical artifacts near the bathymetry. To ameliorate these staircasing effects, and to develop the framework towards a moving mesh with free-surface dynamics, we have begun to implement a non-hydrostatic σ-coordinate framework which significantly improves the representation of the internal tides for low-aspect ratio topographies. Finally we investigate the applicability of stochastic density perturbations in an internal tide field. We utilize the Dynamically Orthogonal field equations for this investigation because they achieve substantial model order reduction over ensemble Monte-Carlo methods.

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