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My long-term goal is to understand mixing processes near topography, especially those resulting from the tidal flow, and to quantify and parameterize this mixing in global and coastal numerical prediction models. This study focuses on one aspect of tidal mixing: that close to the shelf break.

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Tidal Mixing at the Shelf Break

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LONG-TERM GOALS

My long-term goal is to understand mixing processes near topography, especially those resulting from the tidal flow, and to quantify and parameterize this mixing in global and coastal numerical prediction models. This study focuses on one aspect of tidal mixing: that close to the shelf break.

OBJECTIVES

This project aims to understand mixing processes initiated near the shelf break by the motion of the tides over the shelf break topography, with a focus on the mixing off-shore of the shelf-break.

Specific questions to be examined include:

a) How much energy is converted from the barotropic tidal flow into baroclinic motion, and how much of the baroclinic energy is dissipated and/or used for mixing near the shelf-break, as compared with the fraction of energy radiated away as internal tides?

b) What factors of the topography, stratification and flow determine the width of the internal tide beam generated at the shelf-break?

c) Under what conditions, particularly of topographic slope and curvature, is an internal hydraulic jump created offshore of the shelf-break?

d) When there is transient hydraulic control at the shelf-break, where does the mixing occur - primarily as overturning in an internal hydraulic jump, or as shear instability?

e) How are the flow and mixing modified by changes in stratification and three-dimensional topographic features?

APPROACH

I will perform 2 and 3-dimensional numerical simulations using the nonhydrostatic MIT ocean model, configured for small domains with continental shelf-break topography. Topography and stratification will be imposed to match that of regions of recent observations of tidally driven mixing near the shelf-break, e.g. Monterey Canyon and Hawaii. Barotropic tides are forced through a sinusoidal body force, with tidal ellipses prescribed from observations.

WORK COMPLETED

This project is a new start begun late in FY03. Several exploratory 2D calculations with idealized topography have been carried out, examining the sensitivity of barotropic-to-baroclinic energy conversion and mixing to barotropic forcing amplitude and topographic height.

RESULTS

As a new start begun late in FY03, results are still preliminary.

IMPACT/APPLICATIONS

None.

RELATED PROJECTS

This work draws on observational data collected as part of previous (e.g. LIWI) and ongoing (e.g. HOME) field programs.