Geophysical Research Abstracts, Vol. 8, 08565, 2006
SRef-ID: 1607-7962/gra/EGU06-A-08565

Shelf-slope exchanges induced by baroclinic instability near submarine canyons

A. Jordi (1),J. M. Klinck (2),G. Basterretxea (1),A. Orfila (1) and J. Tintoré (1)
(1) IMEDEA (CSIC-UIB), Spain (vieaajb@uib.es)
(2)Center for Coastal Physical Oceanography, Old Dominion

The dynamics associated with the propagation of meanders along a density front and their interaction with submarine canyons are simulated and analyzed with a fine-resolution three-dimensional primitive equation coastal ocean model. Simulations consider flow in an alongshore density front over two bottom topographies: an idealized straight shelf and a shelf incised by a canyon. The stationary circulation over the idealized shelf exhibits a geostrophic balance. But the canyon topography breaks this balance leading to large cross-shore and vertical motions in its vicinity. A second set of simulations consider the effect of a small perturbation superimposed on the frontal circulation which develops growing meanders. The perturbation over the shelf grows rapidly by baroclinic instability into a steepened backward breaking wave, characterized by significant cross-shore and vertical motions in the upper levels. In contrast, the canyon topography slows the growth of the meanders; although cross-shore and vertical motions are intensified near the canyon topography over most of the water column. Finally, we use model results to determine the shelf-slope exchanges based on two methodologies. The first methodology computes the water transported across the shelf break while the second accounts for cross-shore and vertical displacements. The application of both methodologies shows that not all water transported across the shelf break is effectively exchanged between the shelf and the open ocean. However, cross-shore and vertical motions are enhanced by the interaction between the unstable front and submarine canyon leading to a large exchange between shelf and open ocean waters.