Abstract View

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Numerical Treatment of Cross-Shelf Open Boundaries in a Barotropic Coastal Ocean Model

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ABSTRACT

Using a barotropic coastal ocean model with a straight coastline and uniform cross-shelf bottom slope, seven different cross-shelf open boundary conditions (four of which are applied in either implicit or explicit form) are compared in three numerical experiments. 1) A mound of water is allowed to collapse and radiate waves toward the open boundaries. 2) A uniform alongshelf wind stress is applied at zero time over the entire shelf and held constant for the duration of the experiment. 3) A uniform cross-shelf wind stress is applied at zero time over the entire shelf and held constant for the duration of the experiment.

The boundary condition which is most transparent to waves consists of a sponge at the outer edge of the model domain with an Orlanski radiation condition at the outer edge of the sponge. Several open boundary conditions perform adequately in the wind stress experiments, but the Orlanski radiation condition alone (without a sponge) appears to give the best total performance (of these tested) through all of the experiments. It is adequate at transmitting wave energy, and its response is entirely acceptable in the wind stress experiments.

The results suggest that a clamped open boundary is probably the worst choice of cross-shelf open boundary condition for barotropic coastal models. In fact, any open boundary condition which significantly restricts the cross-shelf open boundary should probably be avoided.

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