Abstract View

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A Vertically Averaged Circulation Model Using Boundary-Fitted Coordinates

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ABSTRACT

A two-dimensional vertically averaged circulation model using boundary-fitted coordinates has been developed for predicting sea level and currants in estuarine and shelf waters. The basic idea of the approach is to use a set of coupled quasi-linear elliptic transformation equations to map the physical domain to a corresponding transformed plane such that all boundaries are coincident with coordinate lines and the transformed mesh is rectangular. The hydrodynamic equations are then solved by a multi-operation finite difference technique in the rectangular mesh transformed grid. Comparisons of the circulation model predictions for tidally forced flows in a wedge section with both flat and quadratic bottom topography, and in a flat channel with exponential variation in width, were in excellent agreement with corresponding analytic solutions. Simulation of steady-state wind-induced setup in a closed basin formed using elliptic cylindrical coordinates also was in excellent agreement with the analytic solution. Finally, the model was applied to predict the M_2 tidal circulation in the North Sea and accurately reproduced the well-known amphidromic systems present in this region.

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