



Abstract View

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Normal Modes of the World Ocean. Part I. Design of a Finite-Element Barotropic Model

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ABSTRACT

The linearized primitive equations for a barotropic world ocean are discretized by means of first-order, piecewise-linear finite elements. Surface elevation and Stokes/Helmholtz velocity potentials are adopted as dependent variables. On any segment of the ocean boundary, specification of elevation and simple radiation are allowed as alternative conditions. The discretized mass and momentum equations are designed to make the finite-element solution satisfy global energy balance exactly. They also permit an arbitrary choice of axes at each node of the grid and thereby avoid the “pole” problem. The model is tested by applying it to a rotating rectangular basin and to a domain consisting of the Atlantic and Indian Oceans.

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