Abstract View

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A Numerical Model for Low-Frequency Equatorial Dynamics

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ABSTRACT

A fast, efficient numerical procedure for modeling the linear low-frequency motions on an equatorial beta plane is developed. The model is capable of simulating the seasonal and interannual variability in realistically shaped ocean basins forced by realistic winds. The timestep allowed is the order of days rather than hours as allowed by more conventional schemes. The numerical method is designed around the special characteristics of low-frequency equatorial waves. A crucial element is the formulation of proper boundary conditions, including those for a partial boundary such as the western end of the Gulf of Guinea.

The response of an Atlantic-shaped basin to a periodic wind is compared with the analytic results of Cane and Sarachik for a meridionally unbounded ocean. The response along the equator is essentially the same. A narrow boundary layer forms along the Guinea coast, too narrow to be a single coastally trapped wave: it is the sum of many modes. The near lack of phase variation along the coast and the smallness of the phase difference between the equator and the coast are additional contrasts to the results for an initial value problem studied by Moore and others. The implication is that the annually recurring upwelling in the Gulf of Guinea cannot be adequately modeled as the response to an impulsively applied wind stress.