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Numerical Simulation of Wind-Driven Flow through the Bering Strait

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ABSTRACT

A two-dimensional, vertically averaged hydrodynamic model has bean applied to predict the wind-forced circulation in the Bering and Chukchi seas. A simulation of the steady state flows induced by a 10^{-6} sea surface slope between the North Pacific and Arctic means gives a northward transport of 1.97 Sv (Sv ≡ 10^6 m^3 s^{-1}) with 67% and 33% of the flow passing through the Anadyr and Shpanberg straits, respectively. The transport and velocities in the straits scale linearly with the imposed slope. A wind field derived from the Fleet Numerical Oceanographic Center (FNOC) model and validated with available observations was used as input to perform simulations for February 1982. Comparison of model predictions to current and sea elevation observations in the Shpanberg and Bering straits and Chukchi Sea (from Aagaard et al.) are generally in good agreement (R = 0.78). A sensitivity study investigating the influence of open boundary-condition specification, model grid size, bottom friction coefficient and wind-forcing representation showed that the wind is the most important parameter. The model, however, normally undeterpredicts the wind-driven response. Correlation of model-predicted transports with mean current speed and wind speed are in reasonable agreement with the data and have correlations of 0.75 or higher. The transport wind speed correlation is approximately a factor of two higher than earlier estimates, but varies substantially depending on the simulation period. Simulations show that the latitudinal and longitudinal momentum balances are essentially geostrophic and the area between St. Lawrence Island to Cape Lisburne responds essentially as a unit to wind forcing at periods of 2.5 days and longer.

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