Abstract View

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A Two-Dimensional Model of Inertial Oscillations Generated by a Propagating Wind Field

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ABSTRACT

A linear, two-dimensional, continuously stratified, viscous model has been developed to study the inertial oscillations generated by a propagating wind field. The model, an extension of that of Kundu and Thomson, includes the presence of a coast and superposition due to distributed forcing. These two effects generate a large subsurface oscillation, provided the wind spectrum has energy near the inertial frequency. The presence of the coast causes an additional blue shift of the frequency, and a downward flux from the surface-coast corner. The superposition of responses with random phases does not cancel out but initially increases the rms amplitude as $(\text{time})^{1/2}$. The model spectra have a blue shift that increases with depth and can also contain secondary peaks at higher frequencies if the speed of propagation is not too large. For a given propagation speed the blue shift, and hence the downward flux from the surface, is larger in the deep ocean where the gravity wave speeds c_n are larger. A calculation in the open ocean with a thermocline shows a decrease of the inertial oscillations with depth, and a clear upward phase and downward energy propagation. Although the model subsurface oscillations are large enough to explain the observations, they are too highly correlated in the vertical and horizontal directions. It is suggested that the variations perpendicular to the direction of propagation, and the β-effect, should be included in the model in order to explain the incoherence of the observed oscillations.

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