Abstract View

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Generation of Coastal Inertial Oscillations by Time-Varying Wind

Pijush K. Kundu

Nova University, Oceanographic Center, Dania, FL 33004

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ABSTRACT

The excitation of coastal inertial oscillations by a rapidly varying wind is investigated. It is shown that the mean-square response to a completely random forcing is $\phi^{-2} \propto \int \phi_\delta^2 dt$, where ϕ_δ is the response to impulsive forcing and the integral is over the record length. The rms response therefore initially increases with time as $t^{½}$, and reaches stationarity in the decay scale for ϕ_δ. As in the random-walk problem, the $t^{½}$ increase is a result of the superposition of uncorrelated steps. Continuous random forcing preferentially increases subsurface amplitudes, since the energy flux from the coast-surface corner causes a surface decay and a subsurface growth of ϕ_δ.

With assumed parameters, a step-input wind forcing of 1 dyn cm^{-2} generates inertial oscillations of 4 cm s^{-1} in the surface layer and 0.7–1.5 cm s^{-1} below. With a random wind in the range (−0.5, 0.5) dyn cm^{-2}, the surface values increase to 8–11 cm s^{-1} and the subsurface values to 3–7 cm s^{-1}. With an observed wind-forcing the surface and subsurface amplitudes are 10–17 cm s^{-1} and 5–9 cm s^{-1}, respectively. Compared to the step-input wind, the oscillations due to a randomly varying wind are less coherent in the vertical and more intermittent in time.

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Headquarters: 45 Beacon Street Boston, MA 02108-3693
DC Office: 1120 G Street, NW, Suite 800 Washington DC, 20005-3826
amsinfo@ametsoc.org Phone: 617-227-2425 Fax: 617-742-8718
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