Abstract View

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Effects of Near-Bottom Return Flows on Wind-Induced Currents

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ABSTRACT

Wind, currents, and surface waves have been measured in a circulating wind-wave tank. Conditions corresponding to both coast and ocean, with and without bottom return flows respectively, have been simulated. Spectra of currents were found to exhibit a −5/3 slope outside the frequency range of motions induced by dominant waves. For the coastal condition, the Reynolds stress decreases linearly with depth, and the turbulence energy decays with a z^{-1} trend, where z is the depth. Much of this results from the piling up of water at the downwind coast, with the vertical distribution of momentum significantly affected by return flows and the reverse pressure gradient. For the oceanic condition, the wind-induced drift currents are extended much further downward; a region of constant momentum flux prevails, and a uniform vertical distribution of turbulence energy was found. Below this surface region, the turbulence energy decays with a $z-2$ trend, possibly implying a dissipative mechanism.

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