

Comparing the induced mean flow for internal and surface gravity wave packets

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Abstract

Although the leading-order motion of waves is periodic – in other words backwards and forwards – many types of waves including those driven by gravity induce a mean flow as a higher-order effect. Because they transport energy, momentum and other tracers, wave-induced mean flows have important consequences for climate, environment, air traffic, fisheries, offshore oil and other industries. I compare and contrast existing and new results for the Stokes drift and associated return flow for surface gravity wave packets on an unstratified fluid to new results for the Stokes drift and its "return flow" for Boussinesq internal gravity wave packets on a linearly stratified fluid. I do so by exploring a perturbation expansion in two small parameters, the steepness and the bandwidth of the packet, and provide numerical and experimental validation.