ABSTRACT OF THE DISSERTATION

A numerical, observational investigation of internal wave propagation in stably stratified shear flows

by

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The breaking of oceanic internal waves is an essential part of the deep-ocean mixing processes that contribute to the general circulation of the ocean, the exchange of heat and gases with the atmosphere, the distribution of nutrients and the dispersal of pollutants. It is essential to improve our understanding of how these waves evolve toward dissipation and the resultant mixing of momentum, heat, and materials in a realistic ocean environment. Specifically ray and numerical simulations and observations are used to examine the refraction of short internal-wave packets by background shear profiles to test the validity and explore the limitations of currently used models of short internal waves in the deep ocean. These Doppler-spreading models for the high wavenumber end of oceanic internal wave spectra though successful are far from well understood and ignore a number of significant physical processes, especially time-dependent effects in their parameterization of dissipation. An analysis of observational ocean data supports the simulation results which show a change in the propagation of short internal waves and their properties when time dependence in the background shear profile is taken into account. The results of our simulations and analysis are enough to show that these ignored physical effects and in particular the time dependence in the long-wave shear can make a significant difference to short-wave behavior and should be taken into account in the models.