Weekly Seminar: Spring 2009

Date: Friday April 24

Time: 11:00 AM

Location: Maryland Hall 110

Speaker: *Peter Diamessis, Cornell University*

Title: *"Secondary instabilities and turbulence in high Reynolds number stratified wakes"*

Abstract

Laboratory and numerical studies of the idealized model of the stratified wake of a towed sphere have significantly enhanced our understanding of more complex oceanic/atmospheric flows where shear-driven turbulence competes against the stabilizing effect of ambient stratification. In this talk, results from highly parallel spectral multidomain large eddy simulations (LES) of stratified sphere wakes will be presented for a broad range of sphere-based Reynolds and Froude numbers.

Distinct modifications in wake structure and dynamics are observed as the Reynolds number, *Re* is varied by a factor of twenty. The non-equilibrium regime, where three-dimensional turbulence adjusts into a quasi-two-dimensional buoyancy dominated flow, lasts longer with increasing Reynolds number, *Re*. At *Re*=105, secondary Kelvin-Helmholtz instabilities and turbulence driven by the vertical shear of the large-scale quasi-horizontal motions are clearly observed for as late as Nt~100, where N is the stratification frequency. A -5/3 horizontal kinetic energy spectrum is obtained suggesting a horizontal Kolmogorov-like forward cascade at late times. In addition, significant vertical transport and mixing accompanies the secondary motions. The above findings motivate the reconsideration of the commonly perceived life-cycle of a stratified turbulent event and the possible reinterpretation of recent oceanographic observations.