Boulder Fluid Dynamics Seminar Series

Tuesday, March 4, 2014
3:30pm-4:30pm (refreshments at 3:15pm)
Bechtel Collaboratory in the Discovery Learning Center (DLC)
University of Colorado at Boulder

Ocean submesoscale mixing: Combining theory and observations

Hezi Gildor, *The Hebrew University*

High Frequency radars for surface current measurements enable us to reconstruct quasi-synoptic maps of ocean surface velocity field, over large areas and at high spatial (100s of meter) and temporal (30 min) resolutions. These surface current observations allow the computation of Lagrangian trajectories of many virtual particles. Based on these trajectories, one can compute various measures for mixing and identified Lagrangian Coherent Structures.

I will demonstrate, using surface current measurements by High Frequency radar, the existence of temporary submesoscale barriers to mixing, which has important implications for a wide range of predictions. We were also able to verify the existence of these barriers using aerial-photographs. Using a non-stationary Lagrangian stochastic model, I will present a method for estimating the upper bound of the horizontal eddy diffusivity based on the existence of such barriers. Last, by introducing weak vertical motion associated with diurnal convection into the horizontal, time-periodic double-gyre toy model, I will show that the weak vertical motion simplifies the chaotic surface mixing pattern for a wide range of parameters.

Roughness in simple problems

John Mersch, Thomas Hauser, and John Pellegrino
University of Colorado, Boulder

This work is very much “in progress” and is motivated by experimental results for mass transfer phenomena occurring at 10-100 nm length scales in cm scale milieus. Mass transfer membranes have been created with regular surface patterns that influence the deposition of colloidal species (10-1000 nm diameter). Our modeling work focuses on elucidating the role of fluid dynamics on these deposition effects (versus surface energy/adhesion). We are currently using CFD to compute the energy dissipation occurring at the surface of the patterns versus the angle of fluid "attack", to determine whether or not these correlate with the experimentally-observed variations in the particle deposition. Our overarching goal is the development of a hybrid, multiscale, multiphysics solver to engineer nanoscale roughness specific for industrial applications.