Multidisciplinary Simulation, Estimation, and Assimilation Systems
Seminar Series

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An Asymptotic Model for the Coupled Evolution of Near-Inertial Waves and Quasi-Geostrophic Flow

Abstract: Far from boundaries, oceanic motion is primarily a mix of two modes: nearly-balanced and slowly-evolving eddies and currents, and more rapidly oscillating internal waves with near-inertial and tidal frequency. Here, we present a three-component asymptotic model which isolates the coupled evolution of near-inertial waves and quasi-geostrophic flow from the Boussinesq equations. A principal implication of our “NIW-QG” model is that near-inertial waves — which may be externally forced by winds, tides, or flow-topography interaction — can extract energy from mesoscale or submesoscale quasi-geostrophic flows. A second and separate implication of the model is that this wave-flow interaction catalyzes a loss of near-inertial energy to freely propagating near-inertial second harmonic waves with twice the inertial frequency. The newly-produced harmonic waves both propagate rapidly to depth and transfer energy back to the near-inertial wavefield at very small vertical scales. The upshot of second harmonic generation is a two-step mechanism whereby quasi-geostrophic flow catalyzes a nonlinear transfer of near-inertial energy to the small scales of wave breaking and mixing.

Biography: Greg is working with William R. Young on theories for the interaction between oceanic near-inertial waves and nearly-balanced currents. Originally from Massachusetts, he obtained his Bachelor's and Master's degrees in Aerospace Engineering from the University of Michigan before making his way to the Mechanical and Aerospace Engineering Department at UCSD. In addition to his current focus on geophysical fluid dynamics, topics of former research include land-based locomotion, mixing, and low Reynolds number fluid dynamics.

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Host: Tom Peacock
http://web.mit.edu/endlab/index.html