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GTP Seminar

MULTISCALE ASYMPTOTIC FORMALISMS FOR LANGMUIR CIRCULATION DYNAMICS ON OCEAN SUBMESOSCALES

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This session will be webcast and recorded http://www.fin.ucar.edu/it/mms/ml-live.htm

The ocean surface boundary layer (BL) is the site of vigorous, multiscale mixing events driven by an array of instability processes. On cross-wind scales commensurate with the mixed-layer depth, wind and surface-wave-driven Langmuir circulation (LC), characterized by an array of counter-rotating vortical structures elongated in the wind direction, has long been thought to dominate vertical transport and mixing. More recently, a spate of observational, numerical, and theoretical studies has demonstrated the profound impact of submesoscale flows, having lateral scales ranging from 1-10 km, on upper ocean mixing and restratification.

An important question is whether and how these two flow regimes interact. Here, multiscale asymptotic formalisms are derived to facilitate investigation of LC dynamics over time and horizontal length scales commensurate with those of internal waves, symmetric and mixed-layer baroclinic instabilities, and other submesoscale BL phenomena. Numerical simulations of the resulting asymptotically-reduced and multiscale PDEs reveal interesting coarse-scale phenomenology, including: a robust 2:1 spatial resonance that may be responsible for Y-junction formation in LC windrow patterns; a long-wavelength side-band instability of stratified LC; and a 40-fold intensification of submesoscale internal-wave vertical velocities induced by nonlinear interaction with fine-scale LC. More generally, the multiscale PDEs provide a useful framework for rapidly investigating disparate scale coupling between large Rossby number, strongly non-hydrostatic LC and rotationally influenced, largely hydrostatic submesoscale flows in the upper ocean.

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Mesa Laboratory, Main Seminar Room
Lecture at 11:00 am

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