CGD SEMINAR

DATE: Tuesday, 18 October, 2011
TIME: 3:30 p.m.
LOCATION: Mesa Lab, Main Seminar Room
NCAR, 1850 Table Mesa Drive
SPEAKER: Leif Thomas, Stanford University
TITLE: Reduction of the usable wind-work on the ocean circulation by forced symmetric instability

ABSTRACT:
Winds aligned with geostrophic currents input energy into the ocean circulation. For currents associated with ocean fronts, winds of this orientation (i.e., down-front winds) reduce the potential vorticity in the mixed layer, making the flow susceptible to symmetric instability (SI). SI is a submesoscale shear instability that draws its energy from geostrophic currents with vertical shear. High-resolution numerical simulations are used to demonstrate how forced SI driven by down-front winds extracts energy from the geostrophic flow at a rate proportional to the Ekman buoyancy flux, the dot product of the Ekman transport and the surface buoyancy gradient. The kinetic energy (KE) going into SI is converted to 3D turbulence through a secondary shear instability and ultimately dissipated at small scales. Thus under the conditions where winds input KE to the circulation, some of the KE of the geostrophic currents that make up the circulation is dissipated by this mechanism. The net result of this submesoscale sink of KE is to reduce the usable wind-work, i.e., the wind-induced rate of KE increase, by an amount that depends on the wind-stress and the change in geostrophic velocity across the mixed layer. Integrated over the world’s oceans, it is estimated that 5-15% of the total wind-work on the circulation could be dissipated at fronts by this mechanism.

* Refreshments are served before seminar. *
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