

# CGD SEMINAR



**DATE:** Thursday, 16 February 2017

**TIME:** 1:30 p.m.

**LOCATION:** NCAR, 1850 Table Mesa Drive  
Mesa Lab, Main Seminar Room

**TITLE:** Exploring mesoscale-to-submesoscale Earth system dynamics in the upper ocean: How unsteady winds fuel phytoplankton growth at ocean fronts

**SPEAKER:** Dan Whitt, NCAR / CGD

## **ABSTRACT:**

By storing and transporting water (mass), energy and biogeochemical constituents, ocean physics plays an essential role in Earth system dynamics across scales. For example, ocean nutrient transport to the sunlit euphotic layer is crucial for marine primary productivity, which accounts for about half of all carbon fixation on Earth and fuels the trophic base of marine ecosystems. Marine primary productivity is driven by photosynthesizing phytoplankton, which exhibit significant mesoscale (10 to 100 km, days to weeks) and submesoscale (0.1 to 10km, hours to days) variability. However, phytoplankton variability on these scales arises from coupled physical and biogeochemical dynamics that are unresolved by current global Earth system models and poorly understood. In this talk, I will present results from a process study that builds understanding of the coupled physical and biogeochemical dynamics that result in mesoscale-to-submesoscale phytoplankton variability. The analysis focuses on understanding why phytoplankton are more concentrated at mesoscale and submesoscale fronts, where horizontal density gradients are sharp and currents are swift. In particular, mathematical and numerical models are used to obtain new perspectives on: 1) how unsteady winds modify vertical velocities and turbulent mixing at fronts, and 2) how wind-driven changes in vertical nutrient transport enhance phytoplankton growth at fronts. The results, which highlight the potential significance of coupled physical and biogeochemical dynamics at the oceanic mesoscale and submesoscale, motivate future development of multi-scale Earth system models. I will conclude by discussing some ways forward in this regard.