

CGD SEMINAR



DATE: Tuesday 22 October, 2019

TIME: 11 am – 12 pm

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

TITLE: “Synoptic-scale Weather imprints on Upper-Ocean Physics and Phytoplankton Blooms in the Southern Ocean”

SPEAKER: Magdalena Carranza, NCAR

ABSTRACT:

Synoptic-scale weather systems inject variability in the upper ocean on timescales of a few days that resonate with phytoplankton growth timescales, and over spatial scales of ~1000 km. Weather systems are expected to modify upper ocean mixing and stratification, potentially impacting on phytoplankton bloom development through changes in nutrient supply, light availability and grazing rates. Here, we use a coarse resolution (1°) ocean-sea-ice model with biogeochemistry (from the Community Earth System Model, CESM) forced with reanalysis winds to demonstrate how weather systems, both atmospheric cyclones and anticyclones, create horizontal structure in the upper ocean, and by modifying upper ocean physics, shape phytoplankton distributions over large spatial scales (~1000 km). Taking a Lagrangian approach, we identify and track weather systems in atmospheric Sea Level Pressure fields for the Southern Hemisphere, and construct composite maps of upper ocean properties on weather-centric coordinates. Atmospheric cyclonic systems (i.e., storms), linked to high winds and cloudy conditions, are associated with deeper mixed layers and upwelling, and enhance surface chlorophyll concentrations in summer but reduce them in winter. On the other hand, atmospheric anticyclones linked to clear skies and calm wind conditions, exhibit shallower mixed layers and down welling that induce higher surface chlorophyll in winter but lower in summer. The bio-physical response to synoptic-scale weather systems is consistent with Fe-light collimation principles and impacts on phytoplankton growth rates. A Fe budget analyses for the Southern Ocean points to the importance of vertical mixing as the dominant Fe supply mechanism to the surface ocean on these short-temporal scales (days). We further explore driving mechanisms of the patterns observed and quantify this weather-driven modulation of upper ocean bio-physical properties by means of tracer budget analyses for areas impacted by storms and anticyclones. As atmospheric cyclones and anticyclones populate different regions of the Southern Ocean, weather-scale phenomena can potentially have rectified effects on longer-term mean biogeochemical fields.

Live webcast: <http://ucarconnect.ucar.edu/live>

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