

CGD SEMINAR



DATE: Tuesday, 30 May 2017

TIME: 11 a.m.

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

TITLE: Effects of mesoscale turbulence on
carbon export: a global perspective

SPEAKER: Cheryl Harrison, NCAR/CGD

ABSTRACT:

Carbon export from the surface to the deep ocean is a primary control on global carbon budgets and therefore a critical component of the Earth system. Export is mediated by the lower trophic levels of marine ecosystems that exhibit large sensitivity to physical dynamics. This is potentially problematic, however, for the coarse resolution Earth system models commonly used for climate projections, which do not explicitly simulate ocean mesoscale circulation, as these scales exert a large control on transport of nutrients and biota. We evaluate the role of mesoscale circulation in modulating export production by comparing global ocean simulations conducted at 1° and 0.1° horizontal resolution. Our analysis demonstrates that resolving the mesoscale produces a small reduction in globally-integrated export production over the 5-year model run ($<2\%$); however, the impact on local export production can be large ($\pm 50\%$), with compensating effects in different basins. Improved representation of coastal jets that block off-shelf transport leads to lower export production in the eddy-resolving model in regions, such as the Patagonian Basin, where continental-shelf-derived nutrients fuel production. Further, mesoscale circulation restricts the spatial area of production in these coastal regions, further reducing production and export. In mode water formation regions of the Southern Ocean, deeper winter mixed layers at high resolution drive stronger nutrient entrainment and enhanced export production. In energetic regions with seasonal blooms, such as the Subantarctic and North Pacific, internally-generated mesoscale variability in circulation drives substantial interannual variation in local export production. These results suggest that biogeochemical tracer dynamics show different sensitivities to transport biases than temperature and salinity, which should be considered in the formulation and validation of physical parameterizations. Efforts to compare observations with models should account for large variability in space and time reflected in discrete sampling plans.

Live webcast: <http://www.fin.ucar.edu/it/mms/ml-live.htm>

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