

Near-term predictions of ocean biogeochemistry in the Community Earth System Model

Authors: Nicole S. Lovenduski, Stephen G. Yeager, Riley X. Brady, Kristen M. Krumhardt

The pressing need for societally-relevant information about the climate system in the near-future (the coming years to decades) has generated extensive research in the field of decadal climate prediction. Here, we explore the potential to make predictions of near-term ocean biogeochemistry using the Community Earth System Model Decadal Prediction Large Ensemble (CESM-DPLE). CESM-DPLE initiates 40 decade-long forecasts of the coupled Earth system each year from 1954 to 2017. Each forecast is initialized slightly differently, but all forecasts are subject to a common set of historical external forcings. The benefit(s) of forecast initialization are explored by comparing the ensemble mean forecast with that generated by the uninitialized CESM Large Ensemble. Our results suggest the potential to predict the evolution of biogeochemically important quantities such as air-sea CO₂ flux, phytoplankton primary productivity, and surface ocean pH variations several years in advance. The production and analysis of decadal ocean biogeochemical predictions has the potential to serve society and advance scientific research in this field. Those designing ocean biogeochemical observational programs can benefit from a robust quantification of regional predictability.