SESSION: (B6) Frontiers in earth system prediction

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A change in the forecast: Ocean biogeochemistry over the next decade

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Observations collected over the past few decades and projections from climate models suggest that anthropogenic climate change has influenced and will continue to alter ocean biogeochemistry. Superimposed on the background of long-term changes in ocean biogeochemistry is natural variability in the physical and biogeochemical system that manifests on timescales of years to decades. While there has been considerable research in the field of decadal climate prediction of the physical oceanographic system, decadal predictability of ocean biogeochemistry remains relatively unexplored.

Here, we explore the predictability and predictive skill of ocean biogeochemistry generated by the Community Earth System Model Decadal Prediction System (CESM-DP), with a particular focus on ocean carbon uptake and marine plankton productivity. Our promising first results indicate regional predictability in these quantities on interannual to decadal timescales. Standard anomaly correlation analysis of CESM-DP retrospective forecasts reveals significant predictability in ocean carbon uptake in the California Current, eastern subtropical south Pacific, and North Atlantic basins on forecast lead times of 1-6 years. Mean square skill score statistics suggests that model initialization engenders predictability of carbon uptake in these regions. For marine productivity, the Atlantic basin, western boundary current regions, and eastern boundary upwelling systems have particularly long-lasting predictive skill that derives from initialization. Our findings suggest potentially important implications for the development of carbon dioxide emission and fisheries management strategies.