SESSION: (B6) Frontiers in earth system prediction

(B6-05)

Predicting ocean oxygen: capabilities and potential

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Advanced prediction of ocean biogeochemistry fields has the potential to provide actionable information for marine conservation and fisheries managers. We present results from recent decadal prediction experiments conducted with the Community Earth System Model (CESM)—the first instance of such experiments with this model that include ocean biogeochemistry. We demonstrate that advanced prediction at multi-annual forecast lead times is possible for key quantities such as net primary productivity and interior dissolved oxygen concentrations. In this presentation, we focus on dissolved oxygen predictability and discuss the mechanisms enabling advanced prediction of anomalies. The results suggest that dissolved oxygen concentrations in thermocline depth ranges, for instance, have substantial predictability with forecast lead times of several years over much of the global ocean. Comparisons with uninitialized forecasts demonstrate that predictability can be attributed to initialization in many regions. Prediction is enabled in some cases by initializing anomalies within mode and intermediate water formations; forecast skill arises as the model transports anomalies in the interior. We consider predictability in both a perfect model sense and with direct comparison to available observations. In addition to demonstrating existing capabilities with CESM, we highlight key issues with the oxygen simulation that are common to coarse resolution models and speculate on defining requirements for successful oxygen prediction more generally.