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Evaluating the ocean biogeochemical components of earth system models using atmospheric potential oxygen (APO)

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Atmospheric potential oxygen (APO $\sim$ O_2/N2 + 1.1 CO_2) is an atmospheric tracer that varies seasonally mainly due to air-sea exchanges of oxygen. The observed seasonal cycles in APO provide a new benchmark for ocean biogeochemistry models. They offer evaluation metrics complementary to more traditional ocean color products by providing information on deep ventilation processes unavailable from satellite data alone. Further, many ocean biogeochemical changes expected in the future, such as responses to warming and stratification, are also highly relevant on seasonal time scales. Thus, challenging models against known seasonal variations in APO can aid in the development of credible predictions of future change. Here, the observed seasonal cycles in APO at a range of mid to high latitude surface monitoring sites will be compared to those inferred from atmospheric transport model simulations forced by the air-sea O_2 fluxes from a range of CMIP5 models. Results from both historical and future RCP8.5 scenarios will be presented and the relevance of the APO metric to carbon cycle processes such as net oceanic CO_2 uptake will be discussed.