Historical carbon cycle simulations in E3SMv1.1-BGC

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This presentation summarizes results from the E3SMv1.1-BGC coupled simulation campaign, which are described in a paper recently published in *JAMES*. The behavior of the land model is evaluated in a concentration-driven experiment over the historical period, by comparing the model with a broad range of observations and metrics.

The land model performs well on the ILAMB scorecard, generally out-performing its ancestor (CESM1-BGC) as well as a multi-model mean of CMIP5 models. The cumulative simulated historical carbon uptake of terrestrial ecosystems is in good agreement with existing inventories. The default model is compared with an alternative configuration to gain insight into structural uncertainties in representation of terrestrial biogeochemistry, for example, the impacts of nutrient stresses on soil biogeochemistry and plant growth.

The ocean biogeochemistry simulates less biomass and slightly lower anthropogenic carbon uptake than observational estimates support over the historical period. This is likely attributable to biases in ocean transport leading to widespread anoxia and undersupply of

nutrients to surface waters, issues that have been addressed in developments for the v2 model.

The strength of carbon-climate feedbacks in the model is quantified, including their evolution over the simulated historical period. The inclusion of nutrient limitations in the land biogeochemistry results in weaker carbon fertilization and carbon-climate feedbacks than exhibited by other Earth System Models that exclude those limitations.

The simulations documented in this paper have been published on ESGF and constitute a portion of the E3SM submissions to the CMIP6 and C4MIP.