To be submitted to the poster session at the 2023 E3SM Spring Meeting II

Overview of the BGCv2 land-atmosphere simulation campaign

Sha Feng[1], Susannah Burrows[1], Daniel Ricciuto[2], Jon Wolfe[3], Wuyin Lin[4], Balwinder Singh[1], Chengzhu (Jill) Zhang[5], Ryan Forsyth[5], Bryce Harrop[1], Jennifer Holm[6], Qing Zhu[6], Nicole Jeffery[3], Ben Bond-Lamberty[1]

[1]PNNL; [2]ORNL; [3]LANL; [4]BNL; [5]LLNL; [6]LBL

The spatial gradients of atmospheric CO_2 concentrations have significant implications for their radiative effects on climate and their biogeophysical effects on land and ocean ecosystems. However, current climate simulations often simplify CO_2 concentrations as geographically uniform, leading to discrepancies in the simulated radiative and biogeophysical impacts of CO_2. To address scientific inquiries regarding the coupling of land and atmospheric CO_2 at a reduced computational cost, we have developed a land-atmosphere-interaction-focused configuration (BGC%LNDATM) within the E3SM biogeochemistry (BGC) model. This new configuration incorporates prognostic CO_2, which accounts for its radiative properties in the atmosphere, as well as active land BGC and the simulation of land-atmosphere CO_2 fluxes. By utilizing prescribed oceanic CO_2 fluxes and sea surface temperature (SST), we have substantially reduced computational requirements, allowing the configuration to serve as a valuable testbed for exploring the interactions between land BGC and atmospheric processes. As part of the E3SM BGCv2 simulation campaign, two compsets (1850_ and 20TR_) have been updated in version 2.1.0-beta.2 and used to conduct a 500-year spin-up simulation and a historical simulation spanning from 1870 to 2014, respectively. In this poster, we will provide a detailed description of the new BGC land-atmosphere-interaction-focused configuration, along with an evaluation of coupled BGC transient historical run. Additionally, we will offer an overview of the BGCv2 science studies that aim to address two key questions: (1) What is the impact of wildfire CO2 emissions and post-fire regrowth on the regional and global atmospheric CO2 growth rate and seasonal amplitude? (2) How does the parameterization of convection influence the terrestrial ecosystem? This configuration will continue to support the E3SM phase 3 Human-Earth-System (HES) science studies, further advancing our understanding of land-atmosphere interactions in the context of the Earth's climate system.