**Title**:

Climate-carbon-nutrient feedbacks under a future climate change scenario in the E3SM v1.1 model with coupled biogeochemistry

**Authorship:**

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**Abstract:**

Following on the publication of detailed analyses for the E3SM v1.1 model with coupled biogeochemical cycles over the historical period (Burrows et al. 2020), we explore here the behavior of this coupled system under the SSP585 scenario for future anthropogenic forcing of the climate system. We focus here on climate-carbon-nutrient feedbacks within the terrestrial system. Our most important result is that the strength of the CO2 fertilization effect for the land biosphere declines over the period from the present through year 2100, while the loss of carbon in the land biosphere due to warming increases over that same period. The decline in fertilization effect is on the order of 50%, while the increase in carbon loss due to warming is on the order of 300%. Both of these predicted dynamics tend to reduce the effectiveness of land ecosystems as natural sinks for anthropogenic CO2 released to the atmosphere. The changes are predicted to be global in extent, but with a stronger quantitative impact in tropical regions. We explore several different mechanisms that might be responsible for these dynamics, including acceleration of the rate of increase in atmospheric CO2 concentration under SSP585, changes in water availability, and progressive nutrient limitation.