**Applying the ELM Microbial-explicit Soil Biogeochemical Model to Analyze Carbon Responses to Whole Soil Profile Warming**

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**Project Abstract**: Soil organic carbon is the largest actively cycling component of global terrestrial carbon and is vulnerable to climate changes, such as warming. Therefore, it is desirable to accurately assess how this large carbon pool responds to increasing temperature. Here we use a comprehensive microbe and mineral-surface explicit soil biogeochemical model integrated in the E3SM land model (ELM) to simulate soil carbon dynamics in a warming environment. To calibrate and evaluate the model, we apply field observations from one of the few on-going whole soil profile warming experiments, the LBNL TES SFA Warming Experiment at the Blodgett Experiment Forest in the Sierra Nevada Mountains, California. Three plots at this temperate conifer forest have been warmed by 4℃ for over 4 years to 1m depth, and soil fluxes and stocks are been monitored and compared to adjacent control plots. We conduct both ambient and heated simulations using CRU climate forcing corrected with site weather station data. Observed depth-resolved soil temperature and soil moisture are imposed for the heated simulation. We will present modeling results in comparison to the field observation results at this warming site from 2014 to 2018, for both control and heated plots. The model accurately represents observed soil surface $CO_2$ fluxes, soil carbon stocks and microbial biomass. Heated simulations capture the observed increase in soil $CO_2$ fluxes and decrease in carbon stocks compared to controls. Soil respiration from the heated simulations are over 20% higher than the control simulations each year, especially for wet winters and springs. This pattern indicates that seasonal variation of soil moisture and temperature affect soil carbon dynamics and the magnitude of the warming effect. Comparing the inter-annual soil flux responses, we find slightly higher soil surface fluxes at the beginning of the warming period. During this period, the soil microbial community may have been reorganizing, pointing to a possibility of an acclimation trend in the longer term. Finally, we find that heating caused soil carbon losses in the sub-soil, emphasizing the importance of carbon stored in deeper soils under warming climate.