Title: Evaluating ELM-SPRUCE Using Carbon Isotope Measurements

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Project Abstract: Peatland ecosystems store about one third of global soil carbon(C) and play an important role in the global C cycle. Yet, the representation of peatland responses to global changes in Earth System Models (ESMs) remains a challenge due to the complex interactions between climate, hydrology, plant physiology, allocation, turnover and soil biogeochemistry. The development of Earth Land Model (ELM)-SPRUCE allows us to explore these complex interactions by taking advantage of the comprehensive measurements at SPRUCE sites. ELM-SPRUCE has been evaluated and improved by using field observed carbon, nitrogen, and phosphorus pools and fluxes. Measurements of carbon isotopes (^{13}C and ^{14}C) provide additional opportunity for model evaluation. The goal of this study is to evaluate the performance of ELM-SPRUCE against carbon isotope measurements at the SPRUCE site and identify the areas for further model improvement. We first evaluate model simulated soil $\Delta^{14}C$ vertical profile against baseline measurements. Our results suggest that the model captures the shape of the measured $\Delta^{14}C$ vertical profile very well, except for the surface layer where model simulated $\Delta^{14}C$ is more negative than measurements. This could be due to the inaccurate representation of vertical movement of soil organic matter. We also take advantage of the unique isotope signal of the added CO_2 in elevated CO_2 plots to evaluate the representation of allocation and turnover in the model. Preliminary results show that the model is able to capture the observed $\Delta^{14}C$ of vegetation in elevated CO2 plots. Detailed evaluation of tissue turnover is underway.