Poster #1-41

Modeling Nitrogen and Phosphorus Cycling Dynamics and the Interactions with Carbon Cycling in Peatland Ecosystems

Xiaojuan Yang[1*], Dan Ricciuto[1], Xiaoying Shi[1], Paul J. Hanson[1], Colleen Iversen[1], Rich Norby[1], Natalie Griffiths[1], Peter Thornton[1], David Weston[1], Steve Sebestyen[2], Terri Jicha[3], Kirsten Hofmockel[4], Avni Malhotra[1], Joanne Childs[1], Randy Kolka[2], and Scott Bridgham[5]

[1]Environmental Sciences Division and Climate Change Science Institute, Oak Ridge, TN
[2]USDA Forest Service, Northern Research Station, Grand Rapids, MN
[3]USEPA Environmental Effects Research Laboratory, Duluth, MN
[4]Environmental Molecular Sciences Laboratory, Richland, WA
[5]University of Oregon, Eugene, OR

Contact: yangx2@ornl.gov

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Although only covering 2-3% of land's surface, peatland ecosystems store about one third of global soil carbon(C) and are currently considered as sinks for atmospheric CO_2. It is crucial to have a predictive understanding of how this C-rich ecosystem responds to changes in temperature and atmospheric CO_2. One of the key characteristics of peatland ecosystems is the low input of nutrients such as nitrogen (N) and phosphorus (P), particularly in bogs that receive all of their nutrients from precipitation. Primary production in peatlands has been found to be limited by N availability or P availability, or co-limited by both N and P. Despite the important role of N and P in controlling productivity and ecosystem function, limited attention has been paid to investigating the N and P cycling dynamics and how they affect C cycling in peatland ecosystems, particularly in the context of environmental changes. A recent focus of SPRUCE (Spruce and Peatland Responses Under Changing Environments) has been on nutrient cycle, in particular N and P. Comprehensive measurements of major N and P reservoirs and related processes have been conducted for both pre-treatment condition and with treatment. Here we try to integrate these empirical data with a modeling approach aiming to develop a predictive understanding of N and P cycling in peatland bogs in response to environmental changes and how the responses affect C cycling. We use the ELMv1- SPRUCE, which is developed based on the most recent ELM v1 and ELM v0-SPRUCE. Compared to ELMv0-SPRUCE, ELMv1- SPRUCE includes an improved representation of nitrogen cycle and a prognostic phosphorus cycle. The questions we are trying to address include: (1) can the model reproduce the N and P budget from the field measurements; (2) what processes in the model needs to be improved (either process representation or parameterization) or added based on the measurements; (3) what other measurements are needed to better inform model representation; and (4) How do the model simulated responses to warming and elevated CO_2 differ from the experiment and why? The ultimate goal of this study is to improve the representation of N and P cycling processes and C-N-P interactions in ELM-SPRUCE, while the modeling efforts can also help guide the most-needed measurements in the field.