Poster #9-9

The Responses of Nitrogen and Phosphorus Cycling Dynamics to Warming and the Feedbacks to Carbon Cycling in Peatland Ecosystems

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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 or P availability, or co-limited by both N and P. It was found that nutrient availability increased with warming in the SPRUCE warming plots. The increased nutrient availability could stimulate plant growth and lead to the indirect fertilization effect. Whether or not the peatland ecosystem carbon (C) storage will increase with warming depends on the balance between the nutrient induced indirect fertilization effect and carbon loss due to warming and drying. Here we try to explore this question through model-data integration using ELMv1-SPRUCE. We first use the pre-treatment observational data to evaluate model performance. Based on the observational data, we improve model representation and parameterization of several key processes, including soil carbon accumulation at depth and nutrient leaching. We then use the model to examine how the N and P cycling dynamics respond to warming and how the nutrient responses affect carbon cycle responses. We compare the model simulated responses with the experimental data from SPRUCE. The goal of this study is to better understand how C-nutrient interactions affect the peatland ecosystem responses to warming and to improve our predictive capability for the C-rich ecosystems in a warmer world. The model-data integration exercise will also help guide the most-needed measurements in the field.