Poster #9-8

Multi-assumption Modeling and MCMC Parameter Estimation for Testing Hypotheses of the Drivers of Seasonality in *Sphagnum* Gross Primary Production

Abigail Johnson[1], Anthony P. Walker[1*], Ming Ye[2], Dan Lu[1], Dave Weston[1], and Paul J. Hanson[1]

[1] Environmental Sciences Division and Climate Change Science Institute, Oak Ridge National Laboratory, Oak Ridge, TN;
[2] Florida State University, Tallahassee FL

Contact: walkerap@ornl.gov

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Multi-assumption modeling methods allow flexible generation of many alternative models that vary in the way that processes are represented. This allows quantitative investigation of competing mechanistic hypotheses with a fuller accounting of uncertainty in parameter values and uncertainty in mechanistic understanding of the other processes in the context of ecological systems. Evaluation of alternative models must be done on a level playing field. To level the field, parameters for each alternative hypothesis should be estimated using observed datasets. In this study we develop and use advanced MCMC algorithms within the Multi-Assumption Architecture and Testbed (MAAT) to estimate parameters for alternative hypotheses (models) of drivers of the seasonality in *Sphagnum* photosynthesis. Hypotheses were investigated that describe physiological temperature responses, interactions of structure with water table height, and physiological phenology of photosynthetic traits. Parameters for these competing hypotheses were estimated against data collected using LiCOR 8100 chambers at the SPRUCE experiment sited in the S1-bog at the Marcell Experimental Forest. The optimized models (hypotheses) were then evaluated against a validation dataset from the same site collected in different years. The primary research question addressed was: what are the drivers of seasonality in Sphagnum GPP the primary entry point of carbon into the carbon rich peatlands of northern bogs?

MCMC based parameter estimation, optimized the fit of each hypothesis to the training data in the context of uncertainty in parameters and process representation. From this level playing field, alternative hypotheses could be used to make predictions of the seasonal dynamics in Sphagnum gross primary production (GPP) using environmental data from the evaluation dataset. Using AIC based goodness-of-fit of predictions to the empirically modeled GPP in these years, the best and most parsimonious hypotheses to describe seasonality in *Sphagnum* GPP were identified.