Poster #9-20

A Multi-Hypothesis Modeling Approach to Study Sub-Canopy Carbon Balance

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The Functionally Assembled Terrestrial Ecosystem Simulator (FATES) simulates competition among age and size structured populations of multiple plant functional types. Competition is currently based on access to and use of light and water. Light competition occurs via a vertically structured canopy with an over-canopy that receives full sun at its top and a sub-canopy that, at its top, receives the light that penetrates the over-canopy. With the current set of assumptions within FATES, mortality rates appear to be high in the sub-canopy which affects FATES' ability to reproduce observed forest age and size structures. We assume that a proportion of these high mortality rates is caused by assumptions in how leaf scale photosynthesis and respiration are represented and parameterized within FATES and how those assumptions affect the carbon balance of leaves in the sub-canopy. To investigate the variability in leaf carbon balance at low light levels caused by process representation and parameterization we used the multi-assumption architecture and testbed (MAAT). MAAT automates the combination, generation, and execution of a model ensemble built with different representations of process. MAAT also incorporates a novel method to calculate a process representation sensitivity index. The process representation sensitivity index quantifies the variability in a model outcome caused by variability in process representation (including parameterization). MAAT and the process representation sensitivity index provides a flexible and rigorous framework for analyzing model sensitivity to process representation, parametric variability, and environmental variability. An initial assessment of the sensitivity of the modeled leaf carbon balance under low light and typical tropical forest environmental conditions will be presented. Processes investigated will include photosynthesis, respiration base rates, stomatal conductance, and the temperature response of biochemical rates.