Poster# 80

Seasonal Fluxes in the Contribution of Stored Water to the Transpiration Stream: Testing a Hydraulic Transport Model Against Measurements

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In vascular plants, transpiration (E) is often limited by the rate at which water can be transported from the soil to the leaf. Declines in water pressure in soil and plant tissue reduce the transport rate, while water stored within plant tissues modulates plant water pressure, and therefore augments E. Stored water has been estimated to contribute 5–35% of E, depending on plant size, environmental conditions, and plant hydraulic traits. Because E is linked to carbon uptake and photosynthesis, as well as plant growth and mortality, Earth System Model (ESM) development has focused on integration with models of plant hydraulic transport and water storage. However, of these hydraulically-enabled ESMs, none has been tested against measurements in tropical forest trees, where seasonality of water availability combined with high trait diversity may produce divergent patterns of stored water use and E. We measured E and stored water use for five tree species during wet and dry seasons in a seasonally dry tropical forest in Panama. We also measured parameters required for hydraulic transport models to estimate E and stored water use, including water pressure and hydraulic traits. With these datasets, we tested the ability of the hydraulically-enabled Functionally Assembled Terrestrial Ecosystem Simulator coupled to the Community Land Model (FATES-CLM) to predict E, stored water use, and midday leaf and stem water pressure for a set of trees with diverse traits and under varying environmental conditions. Initial analyses of the measurements show that the contribution of stored water to E varied among individuals and seasons, ranging ~5–20% of daily E. Likewise, the direction and magnitude of seasonal change in daily E varied among trees. These observations will be tested against model outputs with a particular focus capturing how variation in hydraulic traits leads to variation in E and stored water use.