Poster #108

Carbon–Nutrient Economy of the Rhizosphere: Improving Biogeochemical Prediction and Scaling Feedbacks From Ecosystem to Regional Scales

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This project is developing plant-soil-microbial dynamics in large-scale terrestrial biosphere models, with particular emphasis on nutrient cycling and uptake (nitrogen and phosphorus), root exudation and priming, mycorrhizal interactions, and controls on the carbon cost of nutrient uptake. The model developments within the cutting-edge Fixation & Uptake of Nitrogen (FUN) model in the Community Land Model (CLM) are tested against data from six forests across the US that vary in mycorrhizal association, parent material, and climate; links to the ACME Land Model (ALM) will be explored. Measurements include assays of inorganic and organic nutrient uptake using quantum dots and isotopic tracers, estimates of carbon C of roots, exudates, and mycorrhizae using ingrowth cores, in-situ root incubations, and minirhizotrons coupled to base measurements of stand level C, N, and P budgets, and meteorology. A remote sensing framework is used to scale between the field measurements and the model resolution. The key science questions we seek to address, focusing primarily on temperate forests, include:

- How do belowground processes affect the spatial and temporal patterns of forest C sequestration, C–N–P cycling, and vegetation response?
- How does the C cost for plant N and P acquisition control productivity and vary between sites/regions with high versus low nutrient quality?
- To what degree does inclusion of mycorrhizae increase the ability of Earth System Models to predict land–atmosphere C fluxes across spatial and temporal scales?

The project started in the Fall of 2016, and the project team has been establishing both the experimental plots and baseline measurements, as well as the modeling and analysis structure.