Coupled Water and Solute Transport in Plant-Soil Systems

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Local rhizosphere conditions are an important control on plant performance but are in turn affected by plant uptake and rhizodeposition processes. We are building capabilities to better understand plant-soil interactions, including modelling tools that address the spatiotemporal hydrobiogeochemistry in the rhizosphere. We report on a plant-soil ecosystem model of *Brachypodium distachyon*, a genomics model bioenergy grass. In this case, a growing root system architecture, controlled in part by photosynthate production and allocation, is explicitly embedded in the representation of the belowground model domain. Diurnal cycles of water and nutrient uptake are simulated resulting in local depletion around individual roots. Without sufficient replenishment, limiting water and/or nutrient availability feed back to plant performance via transpiration, photosynthesis, and stomatal conductance. We are particularly interested in the impact of drought on the exchange of water and nutrients in the local soil-root environment. The elucidation of the controlling processes and their interactions will contribute to a better basis for modelling plant water and nutrient cycling in larger scale models (e.g., Earth System Models).