**Project number:** A24  
**Postdoctoral Researcher:** Natalie Schröder  
**Title:** Modeling of soil-root interactions

**Description of individual research project and research results achieved to date**

Water transfer through plants is a passive process, driven by the water potential gradient between the soil and the atmosphere. Beyond the ground surface, the water uptake by plant roots is, thus, highly impacted by the spatial distribution of the water potential in the soil and in the root, and by the root system architecture (RSA). The spatial distribution and the magnitude of the uptake will also depend on the spatial distribution of the root radial and of the soil conductivities. In addition, the distribution of salts and nutrients around the plant roots are affected by the velocity field and solute accumulation in the root-zone, as well as solute uptake by the plant roots, are depending again on local root-soil interaction along the RSA.

Most of currently available experimental devices do not allow an accurate measurement of soil and root variables locally, which make predictions water and solute processes in coupled soil-root systems very difficult to realize. Numerical models are able to account for the three-dimensional distributions of RSA and soil properties and are therefore helpful to understand interactions in the groundwater-soil-plant-atmosphere system. In this project, a high resolution root-soil model is developed on plant-scale, using the framework Dumux. The model combines biological, chemical and physical processes in soil, roots, and at root-soil interfaces and is used to investigate effects of soil heterogeneity on water uptake, combination of water uptake and solute transport, and salt precipitation in the root zone. The model is now able to simulate water flow, solute transport and root growth.

The project work is likely to be continued by the current NUPUS-Masterstudent Katharina Heck within a new doctoral thesis.