Datenassimilation für ungesättigte Strömung
(Data assimilation for unsaturated flow)

Model predictions of water flow in the environment are important for many fields of applications, ranging from weather forecast over flood and drought prediction to managing of groundwater resources. If systems on larger length scales are considered, it could be beneficial to describe the flow in different compartments in a coupled manner. The unsaturated zone is an important part in such model systems, as the division of rainfall into surface and subsurface flow is strongly influenced by this compartment. It is the link between surface and subsurface flow and couples two compartments with very different process time scales.

The integration of observations into the model in an optimal way (data assimilation) is essential for model predictions. Often, observations, such as remote sensing data or observations from permanently installed sensors, are integrated continuously in a sequential manner. In particular when large, coupled models are considered, there are many open questions concerning the handling of the unsaturated zone in such a large scale data assimilation framework. The unsaturated zone might have to be modeled with large grid cells, which could have length scales of hundreds of meters. The Richards equation, which describes flow in the unsaturated zone, is established and tested for much smaller length scales. Storage models, on the other hand, might not necessarily include variables needed for estimation of water fluxes in-between compartments, such as soil moisture profiles. Also, model parameters are mostly unknown. At the same time, soil is heterogeneously structured. For this reason, strong model errors have to be expected in an unsaturated zone model. In the unsaturated zone, soil moisture observations from sensors with small observation volume are often used for data assimilation. Under natural forcing conditions (in contrast to, for example, forced infiltration in a measurement campaign), such observations are not very sensitive to the model parameters.

In the presentation, data assimilation methods for the unsaturated zone related to these open questions will be discussed. Different ways to compensate for model errors and parameter uncertainty will be compared. It is concluded that when making predictions, it is in many cases beneficial to use simple models and at the same time to use measures to compensate for the simplifications, rather than to attempt to use models with optimized parameters and complex parameterization.