UP 15: Bodenkunde und Kryosphäre

Time: Friday 10:00–10:45 Location: G/gHS

UP 15.1 Fri 10:00 G/gHS

Soil Hydrology - Simultaneous Estimation of States, Parameters and Boundary Condition with Ensemble Kalman Filter — •Hannes Helmut Bauser, Stefan Jaumann, and Kurt Roth — Institute of Environmental Physics, Heidelberg University, Heidelberg

The Ensemble Kalman Filter (EnKF) is widely used in hydrologic modeling to estimate states and parameters incorporating uncertainties in measurements and all model components. In soil hydrologic modeling, especially the experimental determination of evaporation faces large uncertainties which are relayed to the formulation of the upper boundary condition of the model.

Thus, we expand the EnKF to additionally estimate the upper boundary condition by augmenting the state vector. Lacking a formulation of the forward model of the boundary condition, highly uncertain measurements are implemented as the forward model.

Additionally, the EnKF is applied iteratively allowing the update of the boundary condition to be dampened in case of a strongly non linear relationship of the boundary condition to the measurements.

The proposed new method is successfully tested on a synthetic 1D data set of subsurface water content measurements, imitating a Time Domain Reflectometry (TDR) measurement time-series. The results indicate that this modified EnKF is capable of estimating the upper boundary condition well, as long as a low temporal resolution is sufficient.

UP 15.2 Fri 10:15 G/gHS

Solute transport in heterogeneous layered porous media with stationary water flow — •Lisa Feustel and Kurt Roth — Institut für Umweltpysik, Heidelberg University, Germany

We present the results of tracer experiments in heterogeneous layered porous media realized in a quasi-two-dimensional Hele-Shaw cell. A flux depending pathway of the tracer pulse around structures of low conductivity is observed. Different possibilities to analyze experiments based on optical images are evaluated. It is shown, that the behavior of a tracer pulse and especially its pathway can generally be reproduced by a simulation, based on a numerical solution of the Richards equation and the convection-dispersion- equation. Material parameters are chosen on the basis of some simple geometric estimations and experimental observations. On the basis of a number of simulations solute transport in heterogeneous media is further analyzed. The heterogeneous structure of the porous medium is found to dominantly influence the shape and pathway during transport of a tracer pulse.

UP 15.3 Fri 10:30 G/gHS

Glacial-interglacial variability change: a view beyond ice cores — •Kira Rehfeld[1], Sze Ling Ho[1], Thomas Münch[1,2], and Thomas Laepple[1] — [1]Helmholtz Junior Research Group ECUS, Alfred-Wegener-Institut für Polar und Meeresforschung, Potsdam, Germany — [2]Department of Physics, Universität Potsdam, Germany

The last glacial period was characterized by a highly variable climate, including abrupt changes such as Heinrich- and Dansgaard-Oeschger events. By contrast, the warm Holocene time period was relatively stable. This variability change is often discussed based on data from polar ice cores, particularly from Greenland. Here, we contrast the polar ice core based variability change with the variability change as recorded by a global compilation of marine and terrestrial proxy records.

Accounting for uneven sampling in time and space, we develop an understanding of proxy signal-to-noise ratios which allows insight into proxy-specific biases concerning the recording of climate variability. Our results suggest that the oxygen isotopic composition of Greenland ice cores may not have reliably recorded Holocene temperature variability.

Globally, we find climate at the glacial maximum five times more variable than during the Holocene. This variability is expressed in particular by the polar ice cores: We find a stronger polar amplification of climate variability during the Glacial than during the warm Holocene. Our results indicate that the view of an extremely variable Glacial contrasting with a quiet Holocene may underestimate the actual variability of the present warm Interglacial.