Geophysical Research Abstracts
Vol. 16, EGU2014-10655-2, 2014
EGU General Assembly 2014

Identification of soil hydraulic properties over the full moisture range by inverse modeling of evaporation experiments

Sascha C. Iden, Efstathios Diamantopoulos, Benedikt Scharnagl, and Wolfgang Durner

Technische Universität Braunschweig, Institut für Geoökologie, Abteilung Bodenkunde und Bodenphysik, Braunschweig, Germany

Semi-arid regions represent a significant portion of earth's surface. Reliable quantification of the soil water balance in these regions plays a key role for estimating ground water recharge and a proper management of water use. However, modeling of soil water movement in relatively dry soils and the accurate prediction of the evaporative fluxes to the atmosphere and the deep drainage to the groundwater, pose considerable challenges. Simulation of these processes relies on a proper conceptual model for water flow and an adequate parameterization of the soil hydraulic properties. While the experimental characterization of soil water retention in dry soils has made significant progress, for instance by the introduction and more widespread use of the dewpoint method, the measurement of unsaturated hydraulic conductivity in medium to dry soils remains a challenge. In dry soils, the determination of hydraulic conductivity is difficult, because the measurement of the water potential gradient is not trivial.

The aim of this study was to identify soil hydraulic properties by inverse modeling, with a particular focus on the medium to dry moisture range. We conducted evaporation experiments on large soil columns under laboratory conditions. An extended instrumentation using tensiometres and relative humidity sensors enabled us to monitor water potential in the columns from full wetness to air dryness. We found that the unsaturated hydraulic conductivity functions which lead to a good match between model-predicted and observed flux and potential data differed markedly from those obtained from traditional conceptual models of hydraulic conductivity. For validation purposes, we tested the predictive capabilities of the identified hydraulic functions under boundary conditions which were different from those used for parameter identification, and found them to be good predictors of system behavior.