Geophysical Research Abstracts
Vol. 20, EGU2018-5046, 2018
EGU General Assembly 2018

Estimating soil hydraulic properties using field data and inverse modeling

Thalita Oliveira and Quirijn de Jong van Lier
University of São Paulo, Center for Nuclear Energy in Agriculture, Soil Physics Laboratory, Brazil (tcolivei@hotmail.com)

Physical modeling soil water flow by the Richards equation relies on unsaturated hydraulic property functions, water retention and hydraulic conductivity. The most common method to determine water retention is by establishing a hydrostatic equilibrium at a defined pressure head using a pressure plate extractor or hanging water column. Alternatively, in recent decades, inverse modeling techniques have been used to estimate soil hydraulic properties, with the advantage of using time-scale data under natural boundary conditions. In this study, we evaluated the performance of soil hydraulic property determination using inverse modeling of measured water content data in a field plot. We also compared the performance of soil hydraulic properties obtained by pressure plate extractor in simulate field water content. The study was conducted in Piracicaba/Brazil in a 312 m^2 area. The soil was a Nitisol with 55% clay, and hydraulic properties were assumed to be defined by the K-θ-h relation described by the Van Genuchten-Mualem model. Hydraulic parameters (θ_s, θ_r, α, n, K_{sat} and λ) were obtained for two depths (0.00-0.10 and 0.30-0.40 m) using the Hydrus 1-D model by inverse modeling of field water content data (IM). As several field water contents were lower than the θ_r obtained from pressure plate determinations, we also applied inverse modeling to only field water contents higher than θ_r (IM$_w$). As third alternative, pressure plate data for θ_s, θ_r, α and n were used whereas only K_{sat} and λ were obtained by inverse modeling (PPE). Prediction performance was evaluated by the Root Mean Square Error (RMSE) and Akaike Information Criterion (AIC). Soil hydraulic property determination using inverse modeling of all parameters (IM and IM$_w$) resulted in sets of hydraulic parameters that better simulated water content over time with the lowest values of RMSE and AIC, whereas PPE showed higher values, overestimating water content over time. IM resulted in better predictions of water content when compared to IM$_w$, although both parameter sets resulted in an overestimation. From this, IM gave the best set of hydraulic parameters to describe the soil hydraulic properties. Concluding, these results suggest that the use of lab-determined retention curves in Richards equation based models may lead to prediction errors; inverse modeling appears to make predictions more reliable.