Parameters of infiltration models as affected by the measurement technique and land use

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Infiltration is strongly affected by soil structure. The measurement technique and the land use are two soil structure-related attributes that are typically available in descriptions of infiltration experiments. We hypothesized that these attributes may be good predictors of the performance of different infiltration models, and of the parameter values in those models. The international soil infiltration database SWIG assembled in the Institute of Agrosphere in Jülich, Germany, was used as the data source. The database encompasses about 5000 experiments all over the world. Texture, measurement method and land use were known for all experiments, availability of organic carbon content, bulk density, saturated hydraulic conductivity (Ksat), pH, the electrical conductivity of saturated paste, and initial water content varied. Comparison of the performance of eight infiltration models showed that Horton and Mezencev models outperformed all others and that one of these two models could be preferred based on the infiltration measurement method. The machine learning method – regression trees – was applied to find the most influential predictors of parameters of Horton and Mezencev models. The measurement method, the textural class, and the land use were the most influential predictors in 80% of cases for both models. The measurement method was the most influential input in 40% of cases. The accuracy of parameter estimates increased when only the subset of measurements with the same method was used to estimate infiltration parameters. Land use, textural class, and organic carbon content dominated as the most influential predictors for the parameters of the Mezencev model, whereas land use, textural class, Ksat, and bulk density became most important in the case of the Horton model. Overall, estimates of the infiltration equation parameters can be more accurate if they have been developed for the same measurement method as in the task in hand. Land use category and the infiltration measurement method provide useful surrogate information about the soil structure effect on infiltration.