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Assessment of water balance simulations for large-scale weighing lysimeters

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Field lysimeter studies represent a suitable tool for the determination of water balance components in the soil-plant-atmosphere continuum. Various problems indeed exist in the data surveyed in lysimeter studies, e.g. microclimatic effects, side-wall flow effects or disturbing effects of measurements. But up to now lysimeter studies are the most precise tool to simulate field conditions and therefore are used to evaluate water transport models.
A challenge of soil water transport modelling is the assessment of various uncertainties resulting from input data, from parameterisation of soil hydraulic characteristics and from estimation of sink terms like plant water uptake and soil evaporation. The objective of this study is to evaluate different modelling approaches for the estimation of soil hydraulic characteristics and evapotranspiration. Datasets from a lysimeter study in South-Germany with rotative crop vegetations and from Middle-Germany with grass surface were used to perform this analysis.
The pedotransfer functions that were used to estimate parameters for the representation of soil water retention and hydraulic conductivity curves have shown to be appropriate for water flow simulations. Although the simulated annual percolation amount is not very sensitive to the applied soil hydraulic characteristics and boundary conditions, the diurnal percolation dynamics are highly sensitive to the soil hydraulic characteristics.
The Penman, Penman–Monteith and Haude approach were used to calculate the actual evapotranspiration in the present study. The results show a strong dependence of simulated percolation on the used potential evpotranspiration (ETp) model. Depending on ETp model choice the simulated percolation amounts vary between 52% and 126% of the measured amounts.