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Inverse modelling of multiple infiltration-outflow experiments

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Changes of (quasi)steady state water flow rates were observed in laboratory infiltration experiments done on columns of compacted sand and on two undisturbed soil columns of sandy loam and loamy sand cambisol soil. Infiltration-outflow experiments consisted of series of ponded infiltration runs with seepage face boundary condition at the lower end of columns. The initial water contents were different for each run. The results of the experiment done on an undisturbed soil column showed that the flux rates and water contents measured during quasi-steady state differ between infiltration runs. This finding contradicts the standard theory. The fluctuations of the water content during the steady state flow can be ascribed to the variations in volume of the entrapped air. The same behaviour was not observed in the sample of homogeneous sand. Computer tomography was used to characterize the structure of the undisturbed soil sample with focus on potential preferential flow pathways. In order to asses the changes between runs quantitatively, hydraulic characteristics were estimated for each infiltration run separately by inverse modelling. Experimental outflow data and tensiometric pressure head data were used as an input for inverse modelling. Numerical code based on dual permeability approach was coupled with parameter estimator. Result of the inverse modelling for each column is specific set of hydraulic properties for each infiltration run of particular soil column. Since we hypothesise that the steady state flow is affected by soil water content at the beginning of the infiltration run, we will study the relationships between initial moistures and hydraulic parameters values. Furthermore we will test if the above phenomena can be ascribed to hysteresis of hydraulic functions.