Geophysical Research Abstracts
Vol. 21, EGU2019-13594, 2019
EGU General Assembly 2019


# Interpreting breakthrough curves using dual-continuum approach

Michal Dohnal (1), Jana Votrubova (1), Martina Sobotkova (1), Jaromir Dusek (1), Horst H. Gerke (2), Tomas Vogel (1), and Michal Snehota (1)

(1) Czech Technical University in Prague, Prague, Czech Republic (michal.dohnal@cvut.cz), (2) Leibniz Centre for Agricultural Landscape Research (ZALF), Hydropedology Working Group, Müncheberg, Germany

Numerical models based on the dual-continuum approach have become useful tools for predicting flow and transport in structured soils with significant preferential flow effects. These models conceptualize the soil by two mutually communicating flow domains – the soil matrix and the preferential flow domain. The water flow is described by a set of two Richards' equations; the solute transport by a dual set of advection-dispersion equations. Simple first-order approximations define the exchange of water and solute transport between the two domains. A simple first-order mass exchange is assumed to describe the water and solute transfer between the two flow domains.

Several replicates of breakthrough curves of conservative bromide tracer were determined on undisturbed soil columns of heterogeneous soil. Breakthrough curves of bromide tracer were determined for undisturbed soil columns of two heterogeneous soil. The soils were coarse sandy loam from the experimental sites Liz, Korkusova Hut (Bohemian Forest, Czech Republic), and Tomsovka (Jizera Mountains, Czech Republic); the soils are classified as a Cambisol or Cryptopodzol. Breakthrough curves showed a rapid appearance of the tracer in leachate and prolonged tailing typical characteristics of preferential transport.

Decline of flow rate between repeated experimental runs, caused by entrapped air phase within the soil column, was approximated by the decrease of volumetric proportion of preferential pathways. The modeling results indicate a key role of the correct determination of preferential flow domain volume and interdomain water and mass transfer on the prediction of the tracer concentration in the effluent. Furthermore, the values of mass transfer between the flow domains among the experimental runs showed great variability.

The research was supported by the Czech Science Foundation Project No. 17-00630J.