Geophysical Research Abstracts
Vol. 18, EGU2016-13920, 2016
EGU General Assembly 2016

Modeling stable isotope and organic carbon in hillslope stormflow

Jaromir Dusek (1), Tomas Vogel (1), Michal Dohnal (1), Anne Marx (2), Jakub Jankovec (1), Martin Sanda (1), Jana Votrubova (1), Johannes A.C. Barth (2), and Milena Cislerova (1)

(1) Czech Technical University in Prague, Faculty of Civil Engineering, Dept. of Hydraulics and Hydrology, Prague, Czech Republic (dusek@mat.fsv.cvut.cz), (2) Friedrich-Alexander-University Erlangen-Nuremberg, GeoZentrum Nordbayern, Dept. of Geography and Geosciences, Erlangen, Germany

Reliable prediction of water movement and fluxes of dissolved substances (such as stable isotopes and organic carbon) at both the hillslope and the catchment scales remains a challenge due to complex boundary conditions and soil spatial heterogeneity. In addition, microbially mediated transformations of dissolved organic carbon (DOC) are known to affect balance of DOC in soils, hence the transformations need to be included in a conceptual model of a DOC transport. So far, only few studies utilized stable isotope information in modeling and even fewer linked dissolved carbon fluxes to mixing and/or transport models. In this study, stormflow dynamics of oxygen-18 isotope and dissolved organic carbon was analyzed using a physically based modeling approach. One-dimensional dual-continuum vertical flow and transport model, based on Richards and advection-dispersion equations, was used to simulate the subsurface transport processes in a forest soil during several observed rainfall-runoff episodes. The transport of heat in the soil profile was described by conduction-advection equation. Water flow and transport of solutes and heat were assumed to take place in two mutually communicating porous domains, the soil matrix and the network of preferential pathways. The rate of microbial transformations of DOC was assumed to depend on soil water content and soil temperature. Oxygen-18 and dissolved organic carbon concentrations were observed in soil pore water, hillslope stormflow (collected in the experimental hillslope trench), and stream discharge (at the catchment outlet). The modeling was used to analyze the transformation of input solute signals into output hillslope signals observed in the trench stormflow. Signatures of oxygen-18 isotope in hillslope stormflow as well as isotope concentration in soil pore water were predicted reasonably well. Due to complex nature of microbial transformations, prediction of DOC rate and transport was associated with a high uncertainty.