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Modeling subsurface fluxes of dissolved organic carbon at the hillslope scale

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Reliable quantitative prediction of water movement and fluxes of dissolved organic carbon (DOC) at both hillslope and catchment scales remains a challenge due to complex boundary conditions and soil spatial heterogeneity. In this study, a one-dimensional dual-continuum vertical flow and transport model was used to analyze subsurface transport processes in a forest hillslope soil over a period of 2.5 years. Among the processes determining the DOC distribution in the soil profile the microbially mediated transformations of DOC, dependent on soil moisture and soil temperature conditions, were considered. To quantify uncertainty associated with the model parameterization, Monte Carlo analysis was performed. The model was applied to describe the transformation of DOC source into output signal observed in the hillslope stormflow. Despite the complex nature of microbial transformations that caused uncertainty in model parameters and subsequent prediction of DOC transport, the simulated temporal patterns of DOC concentration in stormflow showed similar behavior to that reflected in the observed DOC fluxes. Due to preferential flow, the hillslope DOC export was higher than the amounts that are usually found in the available literature.