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COUPLING WATER FLOW AND SOLUTE TRANSPORT IN A CATCHMENT SCALE HYDROLOGICAL MODEL

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Summary. A physically-based distributed hydrological model simulating complex surface - subsurface flow and transport interactions is presented. The subsurface component is modeled by the three-dimensional Richards equation for flow and the classical advection-dispersion-reaction equation for transport, solved using finite element/finite volume techniques. The surface model is based on a path-based (rill flow) diffusion wave equation for both flow and transport, solved using a Muskingum-Cunge scheme. The path-based paradigm, together with Leopold and Maddock scaling relations for hydraulic parameterization, allow the same surface model to be used for both overland and channel dynamics. A novel approach for resolution of the interactions of water across the land surface, based on a boundary condition switching algorithm, is extended to the solute flux exchanges. The use of a high resolution finite volume scheme for the advective component of subsurface transport introduces minimal numerical diffusion even in the absence of physical dispersion.