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SEHR-ECHO v1.0: a Spatially Explicit Hydrologic Response model for ecohydrologic applications

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Abstract. This paper presents the Spatially Explicit Hydrologic Response (SEHR) model developed at the Laboratory of Ecohydrology of the Ecole Polytechnique Fédérale de Lausanne for the simulation of hydrological processes at the catchment scale. The key concept of the model is the formulation of water transport by geomorphologic travel time distributions through gravity-driven transitions among geomorphic states: the mobilization of water (and possibly dissolved solutes) is simulated at the subcatchment scale and the resulting responses are convolved with the travel paths distribution within the river network to obtain the hydrologic response at the catchment outlet. The model thus breaks down the complexity of the hydrologic response into an explicit geomorphological combination of dominant spatial patterns of precipitation input and of hydrologic process controls. Nonstationarity and nonlinearity effects are tackled through soil moisture dynamics in the active soil layer. We present here the basic model set-up for precipitation–runoff simulation and a detailed discussion of its parameter estimation and of its performance for the Dischma River (Switzerland), a snow-dominated catchment with a small glacier cover.

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