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Formulations of transport in catchment-scale conceptual models

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Standard conceptual hydrological models can rarely accommodate stream tracer dynamics at the catchment scale. They rely on the generation of runoff through the propagation of a pressure wave and do not account for the actual advective movement of particles. Over the last years different model frameworks have been developed to account for this shortcoming. The difference between the frameworks lies in whether they are based on mixing coefficients or storage age selection functions. Both methods have shown their ability to capture the stream chemistry response. It is however not clear how these distinct approaches compare to each other and to reality. The object of this research is to provide clarification in this matter.
To achieve this, the hydrological and stream water chemistry response for a set of contrasting research catchments is modelled, using both the mixing coefficient and the storage age selection approach. The results are analysed using the concept of transit times, where information on the fluxes and states in all model components is used to generate distributions that describe the age structure of water. By comparing the distributions generated by both methods and by evaluating the overall model performances, more insight is gained on how mixing occurs at the catchment scale. This contributes to the understanding of the integrated system dynamics of catchments, which is relevant for the development of good water quality models that accurately describe the integrated response of a hydrological system.