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Process-based characterisation of flow and recharge properties in karst aquifers by combined analysis of hydraulic and physico-chemical spring responses

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Karst aquifers represent important water resources. This is mainly due to their large catchment areas and high regional transmissivity. The characterisation of recharge as well as flow and transport properties is vital for their efficient exploitation and the allocation of well protection zones. The aim of the presented work is to assess important parameters of recharge into and flow through karst aquifers. For this purpose hydraulic and physico-chemical spring responses were analysed in a large scale karst aquifer (Gallusquelle, Germany) over an observation period of two years.

Spring responses after recharge events can be distingushed between simple responses after rainfall events and complex responses after snowmelts. The shape of infiltration functions were derived from the spring hydrograph by a detailed analysis of the shape of hydrographs. Further information on the infiltration function was derived from the temporal variability turbidity in spring water. Infiltration times are reflected by characteristic changes in electrical conductivity and temperature in spring discharge. The amount of infiltration was estimated from climatic data using a soil water balance model.

Informations on the conduit system were obtained by an approach proposed by Williams (1983), using water volumes discharged after rain as well as snowmelt events to estimate conduit volumes. The resulting conduit volumes were translated into conduit diameters and compared with the results from tracer tests in boreholes and sink-

holes. The comparison shows that diameter estimates by rainfalls are in good agreement with diameter estimates by tracer tests.

Williams, P.W. (1983): The role of the subcutaneous zone in karst hydrology. Journal of Hydrology 61, 45-67.