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Effect of river boundary conditions on groundwater flow and solute transport during a flood event

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The dynamic of groundwater flow and the interactions between streams and aquifers can be highly influenced by extreme river stage fluctuations during floods. In groundwater models, extreme events represent a transient state in the boundary conditions which may affect groundwater flow and transport of solutes. The objective of this research is to understand the influence of the river boundary condition in the interaction between surface water and groundwater during a flood event considering a case study (Alz river, Germany). We used MODFLOW-2005 to develop a three-dimensional groundwater flow model. Additionally, MT3DMS and MODPATH were used to simulate dispersive and advective solute transport. Finally, we consider four hypothetical scenarios to evaluate the influence of the river stage and the riverbed conductance over groundwater flow and solute transport. The simulations show a large variability at different phases of the flood event in groundwater flow velocity that are driven by changes in the hydraulic gradient. The transport simulations showed that during flood events also break through curves are highly affected by the change in the river stage conditions, giving evidence that these extreme events should be properly considered to describe groundwater flow and transport processes accurately.