



Lang-term solute transport and geochemical equilibria in a Triassic catchment cross section

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A significant part of south-western German landscape is formed of a sequence of Triassic sandstones, lime stones and clays. In this densely populated and industrialized area, safety of water resources represents a major issue. Especially the long-term responses of subsurface-surface water systems and their quality, on influences of aerial pollution, agricultural and geogenic influences are not well understood on the catchment scale. The goal of this study is to investigate factors that influence the geochemical interactions between subsurface water and adjacent rivers. A computer model was constructed comprising a 2-D 1500 m x 150 m vertical cross-section of Triassic layers, quaternary gravel aquifer subject to subsurface water flow and solute transport towards the Neckar river. Geochemical interactions include intra-aqueous kinetic reaction of oxygen and soil organic matter as well as kinetics of carbonate dissolution/precipitation. This model section was chosen to provide an efficient insight to the principal processes and timescales affecting catchment geochemistry. The numerical simulator MIN3P was chosen, a finite volume program for variably saturated subsurface flow, which offers a highly flexible structure for definition of geochemical interactions.

Results show that subsurface water residence times range from years to many centuries. Different zones are to be expected with respect to the development of mineral equilibria such as open or closed system carbonate dissolution. Short-term responses to daily averaged changes in precipitation, however, are visible to some extent in the shallower and near-river parts of the flow system as well as in solute loads. This can most likely be explained by directional changes in flow paths. The extent of reducing zones is controlled by the presence of organic rich layers (i.e. peat deposits), the dissolution kinetics of aquifer organic matter and the subsequent mixing with oxygenated water by hydrodynamic dispersion. The modelling approach appears promising to achieve better understanding of large scale subsurface hydrogeochemical interactions.