



## **Tracing aquifer-surface water and aquifer-aquifer interactions using a multi-tracer approach**

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Conserving a good groundwater quality is a major challenge because of its importance as a reservoir for drinking water. Influxes from surface water, especially input of nitrate, can deteriorate groundwater quality. The objective of our project was to i) investigate aquifer-surface water interactions and ii) trace aquifer-aquifer interactions concerning the separation between three porous aquifers.

The investigation area is located in Bavaria, Southern Germany and contains three aquifers A-C (quaternary sediment) that were described as three separated flow systems to date. Two rivers 1 -2 drain the investigation area. The sampling campaign (Apr-Oct 2012) included three sampling locations along the streams, six wells in aquifer A and three wells each in aquifers B and C. The water samples were analyzed for concentration of anions (Cl<sup>-</sup>, SO<sub>4</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup>), cations (Na<sup>+</sup>, K<sup>+</sup>, Mg<sup>2+</sup>, Ca<sup>2+</sup>), electrical conductivity, water temperature, pH, oxygen and stable isotopes of water (<sup>18</sup>O, <sup>2</sup>H), which were used as environmental tracers. Our results showed that only one out of three groundwater wells close to river 1 indicated river water infiltration into the groundwater due to elevated concentration of sulfate and depleted concentration of calcium and magnesium compared to the rest of the aquifer. The water chemistry of all other groundwater wells at river 1 and all sites at river 2 did not show any similarity with river water. By that, we assume that no river water infiltrated into groundwater but we cannot exclude groundwater infiltration into the rivers. Contrary to prior knowledge assumptions, aquifer-aquifer interaction took place in all three monitored aquifers. The results of stable isotopes of water and ions indicated that aquifers B and C are constantly connected to aquifer A at certain sites. The monitoring of groundwater and river water sites in the investigation area points to a heterogeneous groundwater flow regime particularly in aquifer A. Regarding the conservation of a good groundwater quality, in all observed sites the level of nitrate concentration is below 10 mg/L and constant over time.