

Analysis of the surface water/groundwater interaction using the gas tracers during a dynamic test: a case of induced infiltration from the river in the piedmont area

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Abstract

We discuss a study that aimed to understand the genesis and inflow conditions of abstracted water by intake with induced infiltration located at a mountain river. A simple approach based on a combination of two research techniques was used: two-component water mixing modelling and studies of the variability of concentrations of environmental tracers in a dynamic test. This approach is versatile, easy to apply and modify, and can be good method for controlling surface/groundwater interactions. We used the gas tracers because gas exchange and dissolution of gases in infiltrating rainwater gives it a unique gas signature that is largely retained in groundwater. We focus on understanding river/aquifer interactions at the scale of reach of an intake. To understand these issues, a two-day field hydrogeological experiment based on a pumping test of increasing intensity was conducted. At each pumping stage, groundwater and river samples were collected to determine the concentration of noble gases, CFCs, SF₆, stable isotope content, and chemical composition of the water. The study results indicate a short pressure propagation time between the intake and the river, which results in inflow of water already at low water abstract by the intake. Despite limited river water inflow, there was a continuous hydraulic contact river/aquifer, largely independent of changes in pumping intensity. As pumping intensity increased, the river/aquifer hydraulic system tended towards stabilised conditions of mixing and inflow to the intake. In general, a small proportion of river water (up to 26%) was found in the exchange flux between the river and groundwater.

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