Continuous noble gas analysis to estimate artificial groundwater recharge for drinking water production

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During a 27 days groundwater pumping test in a drinking water production area, we continuously measured dissolved (noble) gas concentrations to determine groundwater origin. Additionally, we took water samples for laboratory based noble gas analysis for ^{3}H-^{3}He groundwater dating.

At the study site in northern Switzerland groundwater is artificially recharged by infiltrating water from the river Rhine on an excavated system of channels and ponds into the underlying aquifer.

Groundwater modelling let us assume that intensive pumping of a drinking water well leads to an inflow of older (e.g., ^{4}He-rich') water from the underlying fractured rocks. These fractured systems are suspected to hydraulically connect nearby old landfill sites with drinking water wells. Therefore, contaminants from the waste disposal sites can enter the drinking water production by intensive pumping for a longer period of time. During the experiment, only water from a single well was continuously abstracted while other wells in the direct vicinity of the pumped well were not operated. The pumped well is known to lie above a highly fracture zone.

First results show that the water of the pumped well has a higher share of old water compared to neighbouring wells. However, this mixing ratio does not significantly change for the duration of the pumping test. Hence, intensive pumping does not increase the inflow of deep and potentially contaminated groundwater.

Our study examples how continuous (noble) gas analysis in the field can contribute to an improved water management in artificially recharged groundwaters.