Geophysical Research Abstracts
Vol. 18, EGU2016-8282-2, 2016
EGU General Assembly 2016

Determination of groundwater travel time in a karst aquifer by stable water isotopes, Tanour and Rasoun spring (Jordan)

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Key words: karst aquifers, stable isotopes, water travel time, Jordan.

Tanour and Rasoun karst springs are located about 75 kilometers northwest of the city of Amman in Jordan. The aquifer is composed of Upper Cretaceous limestone that exhibits a moderate to high degree of karstification. The two springs represent the main drinking water resources for the surrounding villages. The yearly water production is about 1,135,000 m^3/yr for Tanour spring and 125,350 m^3/yr for Rasoun spring (MWI 2015). Due to contamination from microbiological pollution (leakage of wastewater from septic tanks) or infiltration of wastewater from local olive presses, drinking water supply from the two springs is frequently interrupted.

From November 2014 through March 2015, spring water samples were collected from Tanour and Rasoun spring for the analysis of stable hydrogen and oxygen isotopes to investigate spring response to precipitation and snowmelt events.

Both Tanour and Rasoun spring show a fast response to precipitation and snowmelt events, implying short water travel times. Based on the variation of δ^{18}O and δ^{2}H in spring discharge, the average maximum water travel time is in the order of 8 days for Tanour spring and 6 days for Rasoun spring. Due to fast water travel times, Tanour and Rasoun spring can be considered as highly vulnerable to pollutants.

δ^{18}O and δ^{2}H values of Tanour and Rasoun springs parallel other monitored parameter like water temperature, turbidity, electrical conductivity and spring discharge. In addition, a high turbidity peak was monitored in Tanour spring during a pollution event from olive mills wastewater (Hamdan et al., 2016; Hamdan, in prep.). The fast response in both Tanour and Rasoun springs to precipitation events requires monitoring potential sources of pollution within the catchment area.

References:

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