Geophysical Research Abstracts
Vol. 18, EGU2016-14545, 2016
EGU General Assembly 2016

The influence of mass movements on flow dynamics in carbonatic conglomerates in the Western Sattnitz, Carinthia (Austria)

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The Turiawald plateau (about 6 km^2) in the Western Sattnitz (Carinthia, Austria) is built up by massive carbonatic conglomerates with a thickness up to 200 m which are underlain by Miocene fine clastic sediments that act as an aquiclude and slightly incline towards NW. Nearly no overland flow occurs and most of the infiltrating water flows towards three captured major springs, the Roach spring, Pleier spring, and Hojoutz spring. Their catchments are characterized by highly differing in the occurrence of mass movements.
The Roach spring drains about 75% of the plateau and is located in the west of the plateau and is influenced by a large-scale mass movement. The Pleier spring drains an area situated at the northern escarpment of the plateau influenced by smaller mass movements and rockfalls. The Hojoutz spring is supposed to be unaffected by mass movements as the water is collected in a gallery with a length of 110 m. This gallery was driven below the Turiawald plateau at the contact between the conglomerates and the aquiclude. Discharge (water level), water temperature and electrical conductivity data were continuously measured at these springs over a period of approximately three years. Additionally, air temperature and precipitation measurements are provided by a weather station located on top of the plateau.
The recession analyses result three drainage components for each spring (first runoff, middle flow, and base flow). The Roach spring shows high discharge variability and the highest recession coefficients with a base flow coefficient of about 0.01 1/d. That is almost as high as the fast flow component of the other two springs. In addition, the discharge responses to groundwater recharge after several days. The water temperature seasonally ranges between 7.9 and 8.2 °C with a time shift of 4 to 6 months to the air temperature. The Pleier spring is characterized by a response to precipitation events after a few hours which can be extended up to nearly one day. The recession coefficients are much lower than the ones of the Roach spring and the base flow is about 0.004 1/d. The water temperature seasonally varies between 7.2 to 8.0 °C and shows a time shift of about 2 months to the air temperature.
The Hojoutz spring has the lowest discharge variability and the slowest recession with a base flow coefficient of about 0.0036 1/d. The seasonal water temperature variation ranges from 7.68 to 7.72 °C with a time shift of 2 to 4 months to the air temperature.
It can be concluded that the mass movements cause additional aquifer components affecting massively the flow dynamics of the Pleier spring and, especially, the Roach spring. The mass movement material causes a longer retention of the water and a delayed response of the discharge to recharge pulses. But the springs show a shallower water circulation and thus a higher vulnerability due to pollution from the surface.