Hydrogeophysical survey in the St. Ilgener valley revealing subsurface structure and groundwater pathways

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The Hochschwab massif is a major karst system in eastern Austria, providing water supply from its springs at the northern margin to the city of Vienna. The St. Ilgen aquifer, located at the southern margin of the Hochschwab massif, contributing water to the Central Water Supply Hochschwab South (ZWHS), is a roughly 200 m thick sediment body that is mainly sourced by surface and subsurface recharge from the Trawiestal. There are groundwater monitoring wells and precipitation measurement stations. The localized basin fill is known from earlier geophysical and hydrogeological studies, as well as from boreholes, and it largely consists of alternating layers of gravels, sands and clays. However, the detailed structure of the aquifer sediments and preferential groundwater pathways are still largely unknown due to the lack of spatiotemporal subsurface information. In this study, we applied electrical resistivity tomography and ground penetrating radar in order to determine the depth of the bedrock (“Werfener Schichten”) and to identify the water table in the Bodenbauer – St. Ilgener Tal area. Electrical resistivity tomography (ERT) data were collected from two ~400-meter-long profiles, oriented parallel with (P1) and perpendicular to (P2) the valley axis in the upper part of the St. Ilgener valley in dipole-dipole and pole-dipole modes. P1 reveals a mostly horizontal, highly conductive formation at depths between 15 and 60 meters, which we attribute to be the representation of the aquifer. The water bearing zone could also be detected as suggested by the high conductive zone in the intersecting cross-profile P2 with a matching water table depth of ~20 m and a saturated sediment thickness of 40–50 m. However, in its southwestern extension, P2 shows a depth shift of the water-saturated zone with a possible water table depth at ~70 m. The water-saturated sediment zone extends over a thickness of 50–60 m and is covered by a remarkably high-resistivity layer (> 1,000 Ohm.m) in the central part of the profile. Both P1 and P2 are unlikely to reach the bedrock. The preliminary ERT results indicate that the St. Ilgener valley aquifer system comprises a complex and heterogeneous internal structure with three postulated compartments. The hydraulic communication between the water-saturated zones in the central part of the St. Ilgener valley is tentative and must be clarified by additional investigations, such as time-lapse measurements.