



Using stable isotopes to understand water flow paths and ages in complex urban catchments

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The need to understand how urbanization impacts the hydrological cycle and creates a complex, hybrid system of artificial and natural flow paths is an increasing focus of research. A key question is how routing processes are affected by preferential flow of urban runoff into storm drains and infiltration trenches, and how this affects catchment travel time distributions of water and groundwater recharge. Isotopic tracers are commonly used in hydrology in order to identify dominant runoff sources, track flows paths and estimate water ages. However, isotope studies in urban areas are surprisingly scarce. Here, we address this research gap by using stable isotopes for a preliminary investigation of the effects of urbanization on the stream flow generation and groundwater discharge in the Panke catchment (230 km²) in the northern part of Berlin. The Panke is highly urbanised, with the built areas occupying 30% of the catchment, and a waste water treatment plant (WWTP) for around 700,000 people. Daily isotope samples of precipitation and streamflow were collected through the transition period from summer (dry) to winter (wet) conditions. In addition, spatially synoptic surveys in summer and winter gathered samples from throughout the catchment surface water drainage network and numerous groundwater wells. The natural hydrology of the catchment is groundwater-dominated, with isotopes indicating that an aquifer of glacial sands and gravel still providing the main source of runoff in the catchment headwaters, upstream of Berlin. Increasingly downstream, urban impacts become more dominant, especially during high flows when urban storm drains are active. In addition, the isotopic imprint of discharge from a WWTP dominates baseflow composition in the lower catchment. This preliminary work will be extended throughout 2020 and ultimately seek to inform models to quantify how the travel time distributions of the catchment have changed due to urban drainage, and how both impermeable surfaces and urban green space affect the spatial distribution of groundwater recharge.