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Water Stable Isotope Tracers in the Blautopf Catchment (Southern Germany) linked to a Mass Balance of Polyaromatic Hydrocarbons

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In a pollutant mass balance on the Blautopf Catchment ("Schwäbische Alb", Southern Germany), we observed retention by soils of more than 82% of the atmospherically deposited polyaromatic hydrocarbons in soils. Furthermore, the largest fluxes of the transported pollutants were detected in the Blautopf discharge during peak runoff such as after snowmelt events. To better understand the hydrology of the system, we studied the dynamics of water discharge of the catchment using stable isotopes (δ18O and δ2H) in precipitation, cave seepage and the Blautopf Spring. The latter is the only outlet of the system and represents the groundwater, which shows a highly variable discharge (0.3 to 32 m3 s-1) as expected for fast responsive karst systems. Isotopically, the rainfall showed a seasonal cycle with δ18O values between -2.6 and -22.6 permille during summer and winter, respectively. In contrast to this, the isotopic signals of the cave seepage water and the discharge seemed completely buffered and ranged around an average δ18O value of -10 permille. This value also closely matched the amount-weighted average of the precipitation. The isotopic similarity between cave seepage- and discharge water indicated that most of the mixing already occurred in the vadose zone that has up to 150 meters of thickness. The latter can be divided into the compartments soil, epikarst and rock matrix that all have good storage capacities. The method revealed new aspects about the flow paths and mixing of the infiltrated water and associated pollutants and helped constrain the risk to the local groundwater.