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Urban tracers for the characterization of particle transport processes in an agricultural catchment

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Well-established relations between concentrations of total suspended solids (TSS) and the hydrophobic polycyclic aromatic hydrocarbons (PAHs) in bulk water samples make PAH ideal tracers to understand water and solid transport in catchments during high discharge events. In the study presented here, we trace particle-bound PAH concentrations in the Ammer River, Germany (annual mean discharge of 0.87 $m^3 s^{-1}$), during a rain event to deepen knowledge on particle origin and hydrological processes in the catchment. High-resolution temporal monitoring of discharge, TSS, particle characteristics, and PAHs was conducted over the course of an event at two sampling sites at the Ammer River. The sampling sites are located in the upper catchment and ~ 8km downstream of the upper sampling site at the outlet of the gauged catchment (134 km^2), while the downstream sampling sites integrates inflowing water from tributaries and a wastewater treatment plant. High PAH particle loading demonstrates that particles in the river originate mainly from urban areas, introduced into the stream via combined sewer systems located in the upper catchment. These particles dominate the suspended particle flux over the temporal course of the event. Despite the integral suspended particle flux being nearly constant in between both sampling sites, particle quality changes which is represented by a decreased integral PAH flux and an increasing proportion of particulate organic carbon in the suspended particles. Decrease of PAH particle loading in the downstream direction suggest dilution by 'cleaner' particles from either un- or less contaminated or possibly leached sediments entering into the river. This shows that particle exchange between suspended and river bed sediments is more pronounced in downstream direction, demonstrating that sediment mobilisation plays a role for the overall particle flux. These results suggest that the catchment response of the Ammer River regarding the particle flux during rainfall is mainly dominated by the combined sewer system though particle exchange processes are also relevant. Urban tracers are hence helpful for understanding solid transport in catchments.