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Particle-Associated Contaminant Transport in Rivers during High Discharge Events

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The pressure on natural water resources and aquatic ecosystems will increase in the future, particularly in urban areas, as a result of climate change and population and economic growth. Rapid rates of urbanization may lead to an increase in impervious surfaces, resulting in higher runoff volumes and pollutant loads. While wastewater treatment technology made significant progress over time, it is reported that a significant part of runoff is still discharged directly into rivers. Besides dissolved compounds, many toxic compounds are associated with natural and anthropogenic particles and some small particles themselves have to be considered pollutants such as microplastics (MP) and tire wear particles (TWP).

In the scope of this study, suspended river sediments are examined towards type and amount of transported anthropogenic particles as well as for the contaminant loading with organic pollutants such as per- and polyfluoroalkyl substances (PFAS) and polycyclic aromatic hydrocarbons (PAH). The overall aim of the study is to identify correlations between the different classes of contaminants (i.e., MP, TWP, PFAS, PAH) and physio-chemical parameters (e.g., total suspended solids (TSS), turbidity, total organic carbon (TOC)) or catchment-specific properties such as land use and geology, as well as event- and/or seasonal related features (e.g., rain intensity, 1st flush effects).

The samples are collected during high discharge events in rivers with contrasting catchments regarding land use and geology in southwest Germany. PFAS analysis includes the monitoring of 40 different PFAS and the direct total oxidizable precursor (dTOP) assay to investigate the levels of precursor compounds that are not included in the target analysis. Preliminary results suggest a predominant transport of long-chain PFAS precursors on suspended sediments in rivers compared to targeted PFAS. Microscopic analyses of the collected particles after standard filtration, chemical treatment, and separation steps imply amounts of MP and TWP in the range of 0.1‰ of the total suspended sediment mass.