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Integrated assessment of river water quality in contrasting catchments: Impact of urbanization on particle bound pollutant fluxes

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Water quality in rivers typically depends on the degree of urbanization or the population density in a catchment. Transport of many pollutants in rivers is coupled to transport of suspended particles, potentially dominated by storm water overflows and mobilization of legacy contamination of sediments. Concentration of pollutants strongly sorbed to suspended particles cannot be diluted by water directly, but depends on the mixture of "polluted" urban and "clean" background particles. In the current study, the total concentration of polycyclic aromatic hydrocarbons (PAHs), the amount of total suspended solids (TSS) and turbidity were measured on a monthly basis in water samples from 5 neighbouring catchments with contrasting land use in Southwest Germany over 1.5 years. In addition, single flood events with large changes in turbidity were sampled at high temporal resolution. Linear correlations of turbidity and TSS where obtained over all catchments investigated. From linear regressions of turbidity vs. total PAH concentrations in water, robust mean concentrations of PAHs on suspended particles could be obtained, which were distinct for each catchment depending on urban influence. PAH concentrations on suspended particles were stable over a large turbidity range (up to 900 NTU) confirmed by samples taken during flood events. No pronounced effects due to changing particle size or origin have been observed for the catchments investigated (< 150 squared km). Regression of total concentrations of PAHs in water samples vs. turbidity thus comprises a robust measure of the average sediment quality in a given catchment and this correlates to the degree of urbanization represented by the number of inhabitants per total flux of suspended particles. The findings are very promising for other particle-bound contaminant fluxes (PCBs, phosphorus, etc.) and in terms of on-line monitoring of turbidity as a proxy for pollution.