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Sources, transport, and mixing of particle-bound PAHs fluxes in the upper Neckar River basin

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Transport of many urban pollutants in rivers is coupled to transport of suspended particles. The degree of contamination of these suspended particles depends on the mixture of “polluted” urban and “clean” background particles. Recent results have shown that, in several meso-scale catchments studied in southwestern and eastern Germany, the loading of particles with polycyclic aromatic hydrocarbons (PAHs) was stable over time and characteristic for each catchment. The absence of significant long-term trends or pronounced changes of the catchment-specific loadings indicate that either input and output of PAHs into the stream networks are largely at steady state or that storage of PAHs in the sediments within the stream network are sufficient to smooth out larger fluctuations. Moreover, it was shown that the contamination of sediments and suspended particles with PAHs is proportional to the number of inhabitants per suspended sediment flux in a catchment.

These processes are being further studied at larger scale in the upper Neckar River basin (2300 km^2) in southwestern Germany. This basin, located between the mountain ranges of the Black Forest and the Swabian Alb, comprises sub-catchments that are diverse in terms of urban impact, geology (ranging from gypsum and limetstones to siliceous sandstones) and hydrology (dynamics driven either by summerly convective events or by winterly frontal systems and snow melt). Accordingly, quality and quantity of particles being released in the sub-catchments as potential vectors for hydrophobic pollutants differ; and so do the events that mobilize the particles. These settings enable the investigation of how particle-bound pollutant fluxes generated at the meso-scale are mixed and transported at larger scales when introduced into a higher order river. A prominent research question is whether varying contributions from contrasting sub-catchments lead to changing contamination patterns in the main stem or if the sediment storage in the river channel is large enough to smooth out those temporally varying inputs.

First results indicate that ratios of inhabitants and sediment fluxes hold as predictors for sediment quality also at this larger scale. A challenge for these predictions is the adequate determination of suspended sediment fluxes since measurements thereof are time- and cost-intensive. For this reason the use of erosion models is being tested by comparison of model results with measured particle fluxes in reference sub-catchments of the upper Neckar basin.