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Monitoring of event based mobilization of hydrophobic pollutants in rivers: Calibration of turbidity as a proxy for particle facilitated transport

Hermann Rügner (1), Marc Schwientek (1), Peter Grathwohl (1,2)

(1) Water & Earth System Science (WESS), c/o University of Tübingen, Tübingen, Germany (h.ruegner@uni-tuebingen.de), (2) Center for Applied Geoscience, University of Tübingen, Tübingen, Germany

Transport of many pollutants in rivers is coupled to transport of suspended particles which is typically enhanced during events such as floods, snow melts etc. As the amount of total suspended solids (TSS) in rivers can be monitored by turbidity measurements this may be used as a proxy for the total concentration of particle associated pollutants in rivers such as polycyclic aromatic hydrocarbons (PAHs), PCBs, etc. and several heavy metals. On-line turbidity measurements (e.g. by optical backscattering sensors) then allow for an assessment of particle and pollutant flux dynamics. In this study, pronounced flood and thus turbidity events were sampled at high temporal resolution in three contrasting catchments in Southwest Germany (Rivers Ammer, Goldersbach, Steinlach) as well as in the River Neckar. Samples were analyzed for turbidity, the total amount of PAH and total suspended solids (TSS) in water. Additionally, the grain size distributions of suspended solids were determined. Discharge and turbidity were measured on-line at gauging stations in three of the catchments. Results showed that turbidity and TSS were linearly correlated over an extended turbidity range up to 2000 NTU for the flood samples (i.e. independent on grain size). This also holds for total PAH concentrations which can be reasonably well predicted based on the turbidity measurements and TSS versus PAH relationships - even for very high turbidity or TSS values (> 2000 NTU or mg l-1, respectively). From these linear regressions concentrations of PAHs on suspended particles were obtained which varied by catchment. The values comprise a robust measure of the average sediment quality in a river network and may be correlated to the degree of urbanization represented by the number of inhabitants per total flux of suspended particles. Based on long-term on-line turbidity measurements mass flow rates of particle bound pollutants over time could be calculated. Results showed that by far the largest amount of pollutant loads occur at relative high turbidities > 100 NTU which are observed only during very short time periods. Therefore it is of particular importance not to miss these pronounced but rare events.