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Massbalance and integrated modelling of urban micropollutants

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The urban aquatic environment is increasingly polluted by low concentrated but high eco-toxic compounds as pharmaceuticals, fragrances and endocrine disruptors. These so-called xenobiotics are emitted into the surface and subsurface waters by outlets of waste water treatment plants and/or by seeping processes of waste water. This contamination could have a long-time impact on the urban ecosystem and on the human health.

Within an interdisciplinary project on risk assessment of water pollution, we work on the identification of water and substance fluxes in urban areas. The objective is an integrated modelling tool for the description of transport of substances in the urban environment. Transport processes of interest are in the surface water zone, in the groundwater zone and in the groundwater – surface water – interaction zone.

In a first assumption we used a flow model concept with in- and output and surface water transport represented by the city of Halle, Germany, and the river Saale. The river Saale acts as surface water system collecting lateral inputs along the city traverse. Using indicators for impacts on water resources such as Bisphenol A and t-Nonylphenol, Carbamacepine, Galaxolide and Tonalide,^{34}S-sulphate and^{15}N-nitrate, and Gadolinium, investigations of the pathways and the behaviour of the substances in the environment have been carried out. In the city of Halle/Saale, concentration magnitudes of μg/L were found in rivers and in groundwater. A balance of water and substance fluxes in the rivers was built up for the city as a whole. The calculation of the loads shows increasing values of all investigated xenobiotics over the distance of the city passage. Solely Bisphenol A stagnates along the passage through the city.

The understanding of the interaction between groundwater and surface water is important to quantify the exchange of substances between the two hydrological compartments. In order to investigate this, a transient hydrodynamic river reach model of the Saale River and a groundwater flow model of the area connected to the reach were built up and coupled. In a first estimation the inter-compartmental transport of an indicator substance exfiltrated during a flooding event from the Saale River into the groundwater was simulated.