

Spatial and temporal patterns of micropollutants in streams and effluent of 24 WWTPs across Switzerland

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Treated municipal wastewater is an important source of micropollutants entering the environment. Micropollutants are a diverse range of chemicals of which concentrations vary strongly in space and time. To better quantitatively understand the spatio-temporal patterns of micropollutants in streams, we compared upstream and downstream locations at 24 wastewater treatment plants (WWTPs) across the Swiss Plateau and Jura regions. Each site represents the most upstream treatment plant in the corresponding catchment.

In 2013, a broad analytical screening was applied to samples collected at 12 sites during winter (January) and summer conditions (June). Based in these results, the bi-monthly samples obtained in 2014 at 12 additional sites were analysed for a group of approximately 60 selected organic micropollutants.

The screening results demonstrate that generally, pharmaceuticals, artificial sweeteners and corrosion inhibitors make up the largest share of the organic micropollutants in wastewater. Pesticides including biocides and plant protection products are also regularly found, but at lower concentrations. The opposite holds true for the concentration variability: pesticides vary the most across time and space, while pharmaceuticals exhibit more stable concentrations. Heavy metals fluctuate to a similar degree as pharmaceuticals.

Principal component analyses suggest that pesticide and pharmaceutical levels at both upstream locations and in the wastewater vary independently of each other. At the upstream locations, the pesticide levels increased with the proportion of arable land in the watershed, whilst decreasing with greater cover of pasture and forest. Interestingly, the same patterns hold true for the composition of wastewater when considering land use in the catchments of the WWTPs. This suggests that pesticide-intensive agricultural crops not only impact surface water quality via diffuse pollution but also increase levels of pesticides in wastewater discharged to the streams. As a consequence, catchment land uses and effluent composition appear to be inextricably bound.