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Predicting herbicide and biocide concentrations in rivers across Switzerland

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Pesticide concentrations vary strongly in space and time. Accordingly, intensive sampling is required to achieve a reliable quantification of pesticide pollution. As this requires substantial resources, loads and concentration ranges in many small and medium streams remain unknown.

Here, we propose partially filling the information gap for herbicides and biocides by using a modelling approach that predicts stream concentrations without site-specific calibration simply based on generally available data like land use, discharge and nation-wide consumption data. The simple, conceptual model distinguishes herbicide losses from agricultural fields, private gardens and biocide losses from buildings (facades, roofs). The herbicide model is driven by river discharge and the applied herbicide mass; the biocide model requires precipitation and the footprint area of urban areas containing the biocide. The model approach allows for modelling concentrations across multiple catchments at the daily, or shorter, time scale and for small to medium-sized catchments (1 – 100 km2).

Four high resolution sampling campaigns in the Swiss Plateau were used to calibrate the model parameters for six model compounds: atrazine, metolachlor, terbuthylazine, terbutryn, diuron and mecoprop. Five additional sampled catchments across Switzerland were used to directly compare the predicted to the measured concentrations.

Analysis of the first results reveals a reasonable simulation of the concentration dynamics for specific rainfall events and across the seasons. Predicted concentration ranges are reasonable even without site-specific calibration. This indicates the transferability of the calibrated model directly to other areas. However, the results also demonstrate systematic biases in that the highest measured peaks were not attained by the model. Probable causes for these deviations are conceptual model limitations and input uncertainty (pesticide use intensity, local precipitation, etc.). Accordingly, the model will be conceptually improved. This presentation will present the model simulations and compare the performance of the original and the modified model versions. Finally, the model will be applied across approximately 50% of the catchments in the Swiss Plateau, where necessary input data is available and where the model concept can be reasonably applied.