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Georeferenced model simulations efficiently support targeted monitoring

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The European Water Framework Directive (WFD) demands the good ecological and chemical status of surface waters. To meet the definition of good chemical status of the WFD surface water concentrations of priority pollutants must not exceed established environmental quality standards (EQS). Surveillance of the concentrations of numerous chemical pollutants in whole river basins by monitoring is laborious and time-consuming. Moreover, measured data do often not allow for immediate source apportionment which is a prerequisite for defining promising reduction strategies to be implemented within the programme of measures. In this context, spatially explicit model approaches are highly advantageous because they provide a direct link between local point emissions (e.g. treated wastewater) or diffuse non-point emissions (e.g. agricultural runoff) and resulting surface water concentrations. Scenario analyses with such models allow for a priori investigation of potential positive effects of reduction measures such as optimization of wastewater treatment.

The geo-referenced model GREAT-ER (Geography-referenced Regional Exposure Assessment Tool for European Rivers) has been designed to calculate spatially resolved averaged concentrations for different flow conditions (e.g. mean or low flow) based on emission estimations for local point source emissions such as treated effluents from wastewater treatment plants. The methodology was applied to selected pharmaceuticals (diclofenac, sotalol, metoprolol, carbamazepin) in the Main river basin in Germany (approx. 27,290 km^2). Average concentrations of the compounds were calculated for each river reach in the whole catchment. Simulation results were evaluated by comparison with available data from orienting monitoring and used to develop an optimal monitoring strategy for the assessment of water quality regarding micropollutants at the catchment scale.