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Surface water pesticide modelling for decision support in drinking water production

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The occurrence of pesticides and other contaminants in river systems may compromise the use of surface water for drinking water production. To reduce the cost of removal of pesticides from the raw water, drinking water companies can: search for other raw water sources, invest in water storage capacity to overcome periods with high pesticide concentrations (often related to the application period), or impose measures to reduce the emission of pesticides to surface water (i.e. sustainable application strategies or use restrictions).
To select the most appropriate water management options, the costs and effects of the aforementioned actions need to be evaluated. This evaluation requires knowledge on the concentrations and loads of pesticides at the point of drinking water abstraction, as well as insight in the contribution and the temporal variability of different sources or subbasins. In such a case, a modelling approach can assist in generating measurement-based datasets and to compare different scenarios for water management.

We illustrate how a modelling approach can provide decision support for water management related to drinking water abstraction from surface water in a catchment that suffers from elevated pesticide concentrations. The study area is a water production center (WPC) located in northwestern Belgium. The WPC abstracts raw water from the river IJzer or from a natural pond and its connected streams. The available quantities as well as the quality of the water vary throughout the year. The WPC uses a reservoir of 3 million m^3 to capture and store raw water to overcome periods with limited water availability and/or poor water quality. However, the pressure on water increases and in the future this buffering capacity might be no longer sufficient to fulfill the drinking water production demand.
A surface water quality model for the area is set up using InfoWorks RS. The model is applied to obtain insight in the concentrations and loads at the different points of drinking water abstraction (river IJzer and Blankaart pond), the contribution of the subbasins, and the seasonal dynamics. The model is also applied for scenario analysis related to water management and varying climatological conditions. Especially in summer, the availability of raw water of good quality for the WPC is limited. The discharge of the river IJzer is low and a minimum level is required for navigation, and the pond is part of a nature reserve where a minimum water level is imposed for conservation of aquatic habitats, and application of pesticides on the surrounding agricultural lands results in high pesticide concentrations (e.g. bentazon > 1μg/L).