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## Reducing the risk for contamination of river bank filtration systems using inverse modelling and anthropogenic traces

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Many drinking water systems worldwide are based on river bank filtration. From a quantitative point of view river bank filtration systems are highly reliable because of the high permeability of alluvial aquifers linked to high production rates. However, there might be an increased risk of contamination because of the short residence time between the river and the production well, especially during flood events.

Flood events change the river-aquifer hydraulic interactions and may increase infiltration rates (e.g., due to an increased hydraulic head, larger river infiltration widths, or erosion of a siltation layer). This leads to changes in groundwater flow paths and production wells might abstract water with a shorter residence time and lower quality. Groundwater quality may degrade during flood events due to the presence of undesirable chemicals (e.g., wastes water treatment plant overflow) and the occurrence of faecal indicator bacteria such as *E. Coli*.

Groundwater modelling can assist in developing strategies to protect river bank filtration from such undesired contamination by predicting optimal operation conditions. The key impediment of this approach is significant uncertainties in subsurface properties and the associated uncertainties of the groundwater flow paths. To reduce uncertainties in model predictions, anthropogenic tracers including the MRI contrast agent gadolinium and artificial sweeteners were used in this study. They revealed sources and flow patterns, and have been used to derive mixing ratios representing different temporal and spatial scales. Including anthropogenic tracers into the objective function of the calibration process also lead to more accurate estimation of groundwater flow paths. This was critical to predict the best water works operation strategy during flood events.