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Tracing the spatial propagation of river inlet water into an agricultural polder area using anthropogenic gadolinium

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The inlet of diverted river water into agricultural areas or nature reserves is a frequently applied management strategy to prevent fresh water shortage. However, the inlet water might have negative consequences for water quality and ecology in the receiving water bodies. This study aimed to obtain a spatial image of the inlet water propagation into a hydrological complex polder area in The Netherlands. We used anthropogenic gadolinium (Gd-anomaly) as a tracer for diverted water from the Rhine river. A clear reduction in the river water contribution was found from very dry conditions on 5 August 2010 to very wet conditions on 22 October. Despite the large inlet water impact on 5 August, the diverted river water did not propagate up into the small agricultural headwater ditches. Gadolinium proved to be an effective tracer for diverted river water in a polder system. We applied our results to upgrade the interpretation of water quality monitoring data and to validate our integrated nutrient transport models.