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Using hillslope-scale groundwater model to bridge the gap between basin inputs and river concentrations. The case of nitrates in Brittany (France).

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Over the past decades, intensive agriculture has altered surface water and groundwater resources quality. Nutrient surplus increased nitrate concentrations in groundwater and rivers resulting in eutrophication or drinking water risk having ecosystem, sanitary and economic repercussions. Legislations led to a reduction of agricultural inputs of nitrogen since 1990's followed by a decrease of nitrate concentrations in rivers, but still difficult to predict and evaluate. Indeed, the incomplete knowledge of the spatial variability of climate and nitrogen inputs, cumulated to the unknown groundwater heterogeneity, leads to hydrological and biogeochemical processes difficult to model. This study deals with the long-term variations (~decades) of nitrate concentrations in three rivers (~30 km² catchment) located in Brittany. Thus, we focus on groundwater modelling because they constitute the bigger hydrological reservoir. We developed a parsimonious equivalent hillslope-scale groundwater model. The model parameterization, which controls hydrological functioning such as mean groundwater residence times, young water contribution to the river or denitrification, relies on long-term monitored streamflow and nitrate river concentrations. In addition, dissolved CFC were sampled in the catchments. Finally, we found that uncertainty on simulated nitrate river concentrations is low. The physically-based model also brings information on temporal and spatial variability of groundwater residence times highlighting the relative importance of young (1-5 yr) and old waters (~decades) for nitrate river concentrations. Moreover, calibrated models show similar trends looking at two fictive input scenarios from 2015 to 2050.