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Transit time distributions to assess present and future contamination risk of karst aquifers over Europe and the Mediterranean

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Karst develops through the dissolution of carbonate rock. Karst groundwater in Europe is a major source of fresh water contributing up to half of the total drinking water supply in some countries. Climate model projections suggest that in the next 100 years, karst regions will experience a strong increase in temperature and a serious decrease of precipitation - especially in the Mediterranean region. Previous work showed that the karstic preferential recharge processes result in enhanced recharge rates and future climate sensitivity. But as there is fast water flow form the surface to the aquifer, there is also an enhanced risk of groundwater contamination.
In this study we will assess the contamination risk of karst aquifers over Europe and the Mediterranean using simulated transit time distributions. Using a new type of semi-distributed model that considers the spatial heterogeneity of the karst system by distribution functions we simulated a range of spatially variable pathways of karstic groundwater recharge. The model is driven by the bias-corrected 5 GCMs of the ISI-MIP project (RCP8.5). Transit time distributions are calculated by virtual tracer experiments. These are repeated several times in the present (1991-2010) and the future (2080-2099). We can show that regions with larger fractions of preferential recharge show higher risks of contamination and that spatial patterns of contamination risk change towards the future.