



## **The impact of groundwater recharge on the propagation of groundwater droughts in southwestern Germany**

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The recharge of groundwater resources, which is an important source for drinking water supply in southwestern Germany, is affected by droughts. In order to manage groundwater resources sustainably, knowledge about groundwater recharge, especially under drought conditions, is indispensable. We investigate and compare groundwater recharge and groundwater levels during droughts in southwestern Germany with regard to their quantification, propagation and persistence. In particular, we investigate how groundwater recharge patterns change during droughts and how this affects groundwater levels. In addition, we investigate regional similarities of groundwater recharge patterns. Therefore, we compare measured groundwater levels with the model results of groundwater recharge of the spatial version of the hydrological model TRAIN. Groundwater droughts are detected with the help of a groundwater drought indicator and evaluated with regard to their spatial distribution. The incipient (modelled) groundwater recharge is displayed with heat map diagrams, which show the temporal anomalies of the incipient time. The dependency between groundwater recharge and groundwater drought is carried out by cross correlation analysis. We were able to show that the onset of the autumnal groundwater recharge in drought years is distinctly delayed. Another interesting finding is the spatial organization, where the model results show the strongest characteristic for the Upper Rhine Valley. According to our investigations, not only the time of onset of groundwater recharge in autumn, but also the extent of groundwater recharge in the following winter influences the propagation and persistence of a groundwater drought. Our findings will enable better decision-making processes for a sustainable water and aquifer management within the context of climate change.