



Application of Sentinel-1 soil moisture information for improving groundwater simulations

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To support robust water management, water managers should have access to up-to-date information about their water system. For example, Dutch regional water authorities are interested in temporally and spatially distributed groundwater level information. The Netherlands Hydrological Model LHM is often used for retrieving such information on several spatial scales in the Netherlands (De Lange et al., 2014). LHM is a physically-based distributed integrated hydrological model for simulating surface water, unsaturated zone and saturated zone dynamics. However, a validation of saturated zone simulations shows that, on a local to regional scale, deviations occur between observations and simulations of groundwater levels.

The availability of high-resolution remotely sensed hydrological information has led to new possibilities for hydrological model improvements. Assimilating soil moisture information can improve both unsaturated and saturated zone simulations (Camporese et al., 2009; Zhang et al., 2016). Recently, a fine-resolution surface soil moisture product based on the freely available Sentinel-1 imagery has been developed. We use this new soil moisture information in combination with an Ensemble Kalman Filter to improve groundwater simulations of the LHM and to develop an accurate system for real-time groundwater simulations and forecasts. The open-source data assimilation framework OpenDA is used to implement the filter technique. The Twente region in the Netherlands serves as a case study. The availability of in-situ soil moisture and groundwater level measurement networks enables validation of the results.

The results of this study show the potential of using high-resolution Sentinel-1 satellite imagery for water management. Water managers can use this knowledge to improve forecasts of groundwater levels and to estimate effects of control measures. Furthermore, water managers can use the results to explore the use of soil moisture information for water management.

References

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