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Suitability Mapping for Subsurface Floodwater Storage Schemes

Lea Augustin and Thomas Baumann

Technical University of Munich, Germany; TUM School of Engineering and Design, Department of Civil and Engineering

Co-management strategies for floods and droughts offer a promising solution for dealing with two extremes that are increasingly close in time and space. Techniques originally developed for drought prevention, such as managed groundwater recharge (MAR), could use floods as a source of water (Flood-MAR) to simultaneously protect against flooding.

The project Smart-SWS aims to develop this concept further by capturing the flood waves in a river and infiltrating them into aquifers nearby. Subsurface storage is created through geotechnical measures in the aquifer. This storage could secure the seasonal water supply while protecting downstream settlements from flooding.

The main attributes of Smart-SWS sites mirror the overall objective: On the one hand, potential sites for such a system are located in areas that are regularly flooded and, at the same time, have problems with groundwater scarcity. In order to infiltrate large volumes of water into the aquifer and store this water for extended periods, the characteristics of the aquifer, the surface, and the water source must be taken into account to assess the suitability of these sites.

In this work, we have identified suitable sites for such an underground flood storage system by applying a GIS-based multi-criteria decision analysis (MCDA). The workflow for the suitability mapping is based on publicly available data and implemented in Python. The results are shown for the administrative district of Swabia in Bavaria, Germany, where approximately 35% of the study area was identified as having varying degrees of suitability. The robustness of the MCDA is validated with a sensitivity analysis, and the results are checked against expert opinions based on field data.