Scale-dependent impacts of natural and anthropogenic drivers on groundwater level dynamics – analysis of shallow coastal aquifers using deep learning

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Groundwater level dynamics are very sensitive to groundwater withdrawal, but their effects and magnitude – especially in combination with natural fluctuations – must be often estimated due to missing or inaccurate information of all local pumping activities in an area. This study examines the potential of deep learning applications at large spatial scales to estimate the parts of local withdrawal activities and natural impacts – meteorological and environmental – on groundwater level dynamics. We will use big data elements from a newly constructed global groundwater database in a single long-term short-term memory (LSTM) model to examine scale-dependent impacts. The data used in the model consists of continuous groundwater level observations and catchment attributes – spatially heterogeneous but temporally static catchment attributes (e.g. topography) and continuous observations of the meteorological forcing (e.g. precipitation) – from several hundred catchments of shallow coastal aquifers of different continents. Our approach is to use only freely accessible data sources covering the global scale as catchment attributes. We will test how relationships between groundwater level dynamics and catchment attributes, at different scales, can improve interpretability of groundwater level simulations using deep learning techniques.