INSTITUTIONEN FÖR GEOVETENSKAPER

Towards prediction in ungauged aquifers
Methods for comparative regional analysis

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ABSTRACT

Hydrogeological investigations and in particular groundwater resource assessments are strongly reliant on understanding the factors controlling groundwater level dynamics. However, historical records of measured groundwater levels are often scarce and unevenly distributed in space and time. This irregularity of measurements, combined with hydrogeological systems with heterogeneous properties and unclear inputs and driving processes, leads to the need for systematic methods for prediction of groundwater in poorly-observed (ungauged) groundwater systems. In this thesis, methods of comparative regional analysis are presented to estimate groundwater level dynamics at ungauged sites based on similarity of groundwater system response and climatic and non-climatic characteristics. In order to carry out comparative regional analysis, methods were developed and compared for measuring similarity of groundwater system response based on entire (Paper I) and on features (Paper II) of groundwater levels time series. The relationship between similar groundwater response and groundwater system characteristics are evaluated further by identifying groups of similar sites using similarity-based classification (Paper I-III). Finally, climatic and physiographic system characteristics are identified that can be linked to groundwater dynamics aided by regression analysis and conceptual models (Paper IV). They can therefore serve as a basis for prediction in ungauged aquifers (Paper V).

The thesis presents novel methods for regional analysis of groundwater resources that can be used to link groundwater dynamics to groundwater system characteristics. It demonstrates the strong potential of the presented methods and ways forward for prediction of groundwater dynamics in ungauged aquifers.

Keywords: Groundwater, Prediction in ungauged aquifers, Comparative hydrogeology, Similarity, Groundwater hydrographs, Groundwater dynamics, Groundwater dynamics features, Time series clustering, Groundwater climate interaction, Classification, Regression, Groundwater storage, Groundwater resources management.