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Classification and hydrogeological similarity in regional scale groundwater assessment and regionalization

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A new approach is proposed for the assessment of groundwater systems (quantity and quality) on the regional scale as an analogue to the concepts of Catchment Classification and Hydrologic Similarity developed in surface water hydrology within the framework of PUB (Predictions in Ungauged Basins). While groundwater models rely primarily on local data which is not always available for all parts of large river basins, the proposed approach strives to statistically derive relevant information for unobserved areas, making use of existing information from observed locations. The proposed approach is based on the hypothesis that similar groundwater systems respond similarly to similar impacts. At its core is the classification of (i) static hydrogeological structures, (ii) dynamic inputs to the groundwater system, and (iii) dynamic groundwater system responses, as well as the systematic use of the dependencies of system responses on explanatory variables. Classification of static and dynamic system features combined with information about known system properties and their dependencies provide insight into system behaviour that cannot be directly derived through the analysis of unclassified data. The methodology allows (i) the prediction of missing data values, (ii) the determination of dominant processes, and (iii) the analysis of cause and effect relationships related to environmental change. It combines classical methods of multivariate analysis and novel methods (e.g., Copula) with expert hydrogeological knowledge.
This contribution presents the main ideas underlying the approach, discusses the state of the art, and presents preliminary results. The advantages of combining regional modelling with regionalization and classification concepts will be discussed.
The main objectives of the paper are to show how a concept which is already well-established in surface hydrology might be extended to subsurface hydrogeology and to discuss options for better integration of groundwater systems into catchment hydrology.