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Extending amulti-scale parameter regionalization (MPR) method by introducing parameter constrained optimization and flexible transfer functions

Daniel Klotz, Mathew Herrnegger, and Karsten Schulz

Institute of Water Resource Management, Hydrology and Hydraulic Engineering (IWHW), University of Natural Resources and Life Sciences (BOKU) Vienna, Austria

A multi-scale parameter-estimation method, as presented by Samaniego et al. (2010), is implemented and extended for the conceptual hydrological model COSERO. COSERO is a HBV-type model that is specialized for alpine-environments, but has been applied over a wide range of basins all over the world (see: Kling et al., 2014 for an overview). Within the methodology available small-scale information (DEM, soil texture, land cover, etc.) is used to estimate the coarse-scale model parameters by applying a set of transfer-functions (TFs) and subsequent averaging methods, whereby only TF hyper-parameters are optimized against available observations (e.g. runoff data).
The parameter regionalisation approach was extended in order to allow for a more meta-heuristical handling of the transfer-functions. The two main novelties are:
1. An explicit introduction of constrains into parameter estimation scheme:
The constraint scheme replaces invalid parts of the transfer-function-solution space with valid solutions. It is inspired by applications in evolutionary algorithms and related to the combination of learning and evolution. This allows the consideration of physical and numerical constraints as well as the incorporation of a priori modeller-experience into the parameter estimation.
2. Spline-based transfer-functions:
Spline-based functions enable arbitrary forms of transfer-functions: This is of importance since in many cases the general relationship between sub-grid information and parameters are known, but not the form of the transfer-function itself.
The contribution presents the results and experiences with the adopted method and the introduced extensions. Simulation are performed for the pre-alpine/alpine Traisen catchment in Lower Austria.

References:
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