

Regularized calibration of a distributed hydrological model using available information about watershed properties and signature measures

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Abstract Physically-based distributed models are increasingly being used to predict the behaviour of hydrological processes in data-sparse regions. However, a model is a simplified representation of the real system and some form of calibration cannot be avoided. Because distributed models have large numbers of parameters to be specified, the resulting parameter estimation problem becomes ill conditioned. In this study we investigate a calibration approach that uses: (a) a simple form of spatial regularization (using scalar multipliers) to reduce the dimension of the calibration problem, and (b) signature measures targeting specific behavioural response of a watershed system to guide the parameter search towards a more “hydrologically consistent” set of parameters. Signature measures are applied as “regularization constraints”, in an approach that is functionally similar to “Tikhonov regularization”, and which results in a better-conditioned optimization problem compared to the benchmark case. The approach is demonstrated for the Blue River Basin in Oklahoma, USA.

Key words regularization; multicriteria optimization; parameter estimation; distributed hydrological model