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Objective use of hard and soft hydrological information in parameter estimation in ungauged basins

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We present a calibration framework based on the generalised likelihood uncertainty estimation (GLUE) that can be used to condition model parameter distributions in sparsely gauged river basins, where processes have to be modelled in the presence of data which are uncertain, intermittent, collected at the wrong time scale or often non-concomitant. While model residual based information may not be available in ungauged cases, we propose to calibrate a given hydrological model by using signatures derived from any available observation. Limits of acceptability of the above signatures are derived from interannual variability and user perception. The essence of the framework is that the objectively defined limits of acceptability reduce the subjectivity of classical application of GLUE considerably. First, hard information with objectively quantified limits of acceptability is introduced in GLUE. This results in an intermediate parameter distribution, which can be used to reduce the sampling limits and to assess which additional information would further constrain model parameters. Soft information may then be introduced, which is here considered as complementary information which is less effective in driving parameter calibration. In an application of the framework in the Luangwa catchment in Zambia, three information signatures are retrieved from an old discharge time series and used to condition model parameter distributions of a conceptual model. Two calibration attempts with two significantly different satellite rainfall estimates show a consistent and considerable reduction in parameter uncertainty.