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# Bayesian total error analysis for hydrologic models: perspectives for regionalisation

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Calibration and prediction in conceptual rainfall-runoff (CRR) modelling is affected by the sampling and measurement uncertainty in the forcing/response data and by the structural error of the model conceptualisation. These errors significantly affect parameter estimates, so that the regionalisation of CRR model parameters can be confounded by biases in the calibrated parameters and unreliable assessment of parameter uncertainty. The Bayesian Total Error Analysis methodology (BATEA) provides the opportunity to directly and comprehensively address these sources of uncertainty. BATEA is built on Bayesian hierarchical methods, constructing explicit error models for forcing/response data and structural errors. This communication provides a general presentation of such error models, and describes the way parameters are inferred using Markov Chain Monte Carlo (MCMC) methods for sampling from the posterior distribution. The potential of BATEA for enhancing parameter regionalisation is then explored using a case study on the Horton catchment (1920 km2) in Northern New South Wales, Australia. The methodology used was to calibrate the CRR model LogSPM using four different rainfall time series. It was found that the BATEA parameter estimates for the different rainfall time series were acceptably consistent with each other. At the contrary, parameters estimated with a standard least square (SLS) approach were found to be very sensitive to the rainfall series used as input of the CRR model. Similar conclusions were found when using an alternative CRR model, GR4J. These results illustrate the benefit of explicitly accounting for uncertainties arising during the calibration process: BATEA estimates are indeed less dependent on errors affecting input data, and are therefore more likely to be linked to some intrinsic properties of the catchment. This is a necessary (unfortunately, not sufficient) condition for

regionalisation to occur.