# Data Selection for Parameter Estimation Robust to Changing Climatic Conditions

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Hydrological models are commonly used for water resource management and making predictions under climate change. Parameters of these models usually depend on the input data. Under climate change, parameter values estimated from the historical record and existing model structures may prove inadequate to simulate the desired output for future conditions. This results in a need to develop methods for improving the robustness of parameter estimation to these changing climatic conditions. In this study, a stress testing approach was used for parameter estimation - identifying specific historically observed transitions between conditions that a model predicts poorly, and using this to inform improvements in the model. Four methods were examined to investigate the relationship between data and estimated parameters: 1) sensitivity analysis for independent time periods using Morris and Sobol2002 methods, 2) time-varying sensitivity analysis using Morris, 3) estimation of predictive uncertainty across periods using Generalised Likelihood Uncertainty Estimation (GLUE), 4) estimation of parameter uncertainty across periods using GLUE. The study was carried out on the Cotter River and Queanbeyan River catchments in the Australian Capital Territory, Australia. All work was undertaken with the hydromad R package (http://hydromad.catchment.org/). The results provided important datasets, i.e. periods where the model predictive uncertainty poorly covers the observations, periods where the most important parameters are very different or periods with different feasible parameter estimates, that could be tested to develop new hydrological models for making predictions under climate change. Sensitivity of mean flow to model parameters was evaluated using Morris and Sobol2002 method for initial 1000 days of Cotter data using GR4J model which gave similar results. 2-D probability distribution of two feasible parameters of CWI model i.e. f and tw in different time periods (1974-1976 & 1980-1982) on Queanbeyan dataset was done. It was observed that the data was less overlapping meaning that these time periods are useful for testing models that make predictions under climate change.

Keywords: Parameter estimation, Hydrological modelling, Sensitivity analysis, Uncertainty estimation

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