Geophysical Research Abstracts
Vol. 17, EGU2015-2394, 2015
EGU General Assembly 2015

On how to avoid input and structural uncertainties corrupt the inference of hydrological parameters using a Bayesian framework

Mario R. Hernández (1) and Félix Francés (2)

(1) Research Institute of Water and Environmental Engineering (IIAMA), Universitat Politècnica de València, Valencia, Spain (maherlo@hma.upv.es), (2) Research Institute of Water and Environmental Engineering (IIAMA), Universitat Politècnica de València, Valencia, Spain (ffrances@hma.upv.es)

One phase of the hydrological models implementation process, significantly contributing to the hydrological predictions uncertainty, is the calibration phase in which values of the unknown model parameters are tuned by optimizing an objective function. An unsuitable error model (e.g. Standard Least Squares or SLS) introduces noise into the estimation of the parameters. The main sources of this noise are the input errors and the hydrological model structural deficiencies. Thus, the biased calibrated parameters cause the divergence model phenomenon, where the errors variance of the (spatially and temporally) forecasted flows far exceeds the errors variance in the fitting period, and provoke the loss of part or all of the physical meaning of the modeled processes. In other words, yielding a calibrated hydrological model which works well, but not for the right reasons. Besides, an unsuitable error model yields a non-reliable predictive uncertainty assessment.

Hence, with the aim of prevent all these undesirable effects, this research focuses on the Bayesian joint inference (BJI) of both the hydrological and error model parameters, considering a general additive (GA) error model that allows for correlation, non-stationarity (in variance and bias) and non-normality of model residuals. As hydrological model, it has been used a conceptual distributed model called TETIS, with a particular split structure of the effective model parameters. Bayesian inference has been performed with the aid of a Markov Chain Monte Carlo (MCMC) algorithm called Dream-ZS. MCMC algorithm quantifies the uncertainty of the hydrological and error model parameters by getting the joint posterior probability distribution, conditioned on the observed flows. The BJI methodology is a very powerful and reliable tool, but it must be used correctly this is, if non-stationarity in errors variance and bias is modeled, the Total Laws must be taken into account.

The results of this research show that the application of BJI with a GA error model outperforms the hydrological parameters robustness (diminishing the divergence model phenomenon) and improves the reliability of the streamflow predictive distribution, in respect of the results of a bad error model as SLS. Finally, the most likely prediction in a validation period, for both BJI+GA and SLS error models shows a similar performance.