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Performance of two predictive uncertainty estimation approaches for conceptual Rainfall-Runoff Model: Bayesian Joint Inference and Hydrologic Uncertainty Post-processing

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It is noticeably important to emphasize the role of uncertainty particularly when the model forecasts are used to support decision-making and water management. This research compares two approaches for the evaluation of the predictive uncertainty in hydrological modeling. First approach is the Bayesian Joint Inference of hydrological and error models. Second approach is carried out through the Model Conditional Processor using the Truncated Normal Distribution in the transformed space. This comparison is focused on the predictive distribution reliability. The case study is applied to two basins included in the Model Parameter Estimation Experiment (MOPEX). These two basins, which have different hydrological complexity, are the French Broad River (North Carolina) and the Guadalupe River (Texas). The results indicate that generally, both approaches are able to provide similar predictive performances. However, the differences between them can arise in basins with complex hydrology (e.g. ephemeral basins). This is because obtained results with Bayesian Joint Inference are strongly dependent on the suitability of the hypothesized error model. Similarly, the results in the case of the Model Conditional Processor are mainly influenced by the selected model of tails or even by the selected full probability distribution model of the data in the real space, and by the definition of the Truncated Normal Distribution in the transformed space. In summary, the different hypotheses that the modeler choose on each of the two approaches are the main cause of the different results. This research also explores a proper combination of both methodologies which could be useful to achieve less biased hydrological parameter estimation. For this approach, firstly the predictive distribution is obtained through the Model Conditional Processor. Secondly, this predictive distribution is used to derive the corresponding additive error model which is employed for the hydrological parameter estimation with the Bayesian Joint Inference methodology.