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Enhancing calibration and uncertainty analysis in rainfall-runoff modelling through multi-objective optimization

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Uncertainty analysis is known as a crucially important step in the calibration phase of hydrologic models. A variety of techniques have been suggested to quantify uncertainties in hydrological modeling ranging from simple Monte Carlo approaches to more complex Bayesian methods. The Bayesian statistical approaches are fairly complex but theoretically robust. Due to the fact that the statistical assumptions in these methods might not be met in complex hydrological modeling experiments, a variety of simpler informal methods have been alternatively proposed for calibration and uncertainty analysis studies. Our study aims at enhancing uncertainty assessment obtained from both formal and informal methods using Multi-Objective Optimization (MOO) and the concept of Pareto dominance. In the Bayesian approach, MOO is employed to find approximate posterior distributions of model parameters. Moreover, MOO is also applied to informal uncertainty analysis approaches for improving the sampling efficiency and the quality of predictive capacity. The preliminary results demonstrate that implementation of MOO in formal and informal uncertainty analysis methodologies would serve well to improve their usefulness.