



Searching for an optimized single criteria matching multiple objectives with automatic calibration of hydrological models

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Single or multiple objective functions are essential for automatic calibration of hydrological models, which serves as evaluation criteria for model performance. In most previous studies, there is a general opinion that every single objective function cannot match all of the important characteristics of the hydrograph, and thus multi-objective calibration as one possible solution has attracted much attention. In this study, however, we defined a new objective function based on exponential function of the absolute error between the observed and simulated variable, investigated the possibility of substituting trade-offs of calibrating hydrograph on multi-objectives with that on the exponent values, and demonstrated that single objective calibration also have the potential to simultaneously address multi-response modes. This new objective function was applied to 196 model parameter estimation experiment (MOPEX) basins across the eastern United States. 8 representative basins among them were selected for comparative study between this new objective and Nash-Sutcliffe efficiency (NSE) and that between single objective calibration and multi-objective calibration with four widely used objectives focusing on peak flows, low flows, water balance and flashiness respectively. The results show that single objection calibration with proposed objective function can achieve a better simulation compared to NSE for most basins, as well as balance high flow part and low flow part to be comparable to multi-objective calibration.