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# A Multistart Kalman Filter-Based Method for Model Calibration

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The determination of the parameters for hydrologic models has been the subject of a large number of studies during the last three decades. A multitude of methods have been developed for this purpose. These methods suffer from the drawback of the assumption that the mismatch between model simulations and observations is caused exclusively by errors in the parameter values, while uncertainties in the observations, the model structure, the parameter values, and the forcing data are neglected. Further, an objective function is optimized by these methods, which can lead to parameter values that result in a good model performance under certain (e.g. low flow) conditions, but not under other (e.g. high flow) conditions. The objective of this paper is to demonstrate a calibration algorithm which takes into account uncertainty in the parameter values, the model structure, the forcing data, and the observations, and which leads to a good model performance under all boundary conditions. Fur this purpose the Extended Kalman Filter (EKF) has been used in a Monte-Carlo approach, strongly increasing the chance that a global optimal parameter set is obtained instead of a local optimum. The method has been applied to a rainfall-runoff model for the Zwalm catchment in Belgium, using both a one-year and a two-year calibration period. For both calibration periods a similar model performance, although with quite different parameter sets, has been obtained. It has also been found that the EKF can bypass local optima in the determination of the final parameter values. The best initial parameter sets do not lead to the best final parameter values. To apply the method only three parameters need to be specified, more specifically the number of starting points, the number of iterations per starting point, and one parameter used to initialize the model error covariance matrix. For this reason, the method could be a simple alternative to more complex methods if model parameters have to be determined when time and/or computational power are limited.