



SPOTPY: A python tool for sensitivity and uncertainty analysis of environmental models

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Sensitivity analysis (SA), parameter calibration and uncertainty analysis (UA) remains necessary for most users of models in environmental science and beyond. A comprehensive range of different methods for SA and UA are available and new methods are still coming up. These methods differ in their underlying philosophy, how parameters are treated and model performances are propagated. There is overall little guidance about the benefits of a specific method. Consequently, the users' choice for a specific parameter estimation method becomes more dependent on its availability than its performance.

We developed SPOTPY (Statistical Parameter Optimization Tool), an open source Python package containing a comprehensive set of methods typically used to calibrate, analyze and optimize parameters for almost any environmental model. SPOTPY currently contains 12 widely used algorithms for SA and UA, 17 objective functions, 17 likelihood functions, 23 hydrological signature functions and can sample from 11 parameter distributions. SPOTPY has a model-independent structure and can be run in parallel from a workstation to large computation clusters using the Message Passing Interface (MPI) for single and multi-objective calibration.

As SPOTPY becomes more and more widely used and comprises contributions from different working groups, we plan to give an overview about the latest advances. We will demonstrate the use of SPOTPY with an open source hydrological model (CMF) and show results, where the choice of different Bayesian parameter optimization methods leads to conflicting results. Our case study further shows the benefit of having one package at hand that includes number of well performing parameter search methods, since not every parameter estimation problem can be solved properly with every algorithm or every objective function.