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Hydrology and Earth System Sciences Discussions

Interactive comment on "

Towards a more representative parametrisation of hydrological models via synthesizing the strengths of particle swarm optimisation and robust parameter estimation" *by* T. Krauße and J. Cullmann

Anonymous Referee #1

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The paper presents the further development of the concept of the data depth used by Bardossy and Singh (2008) for identification of robust model parameters (named by them ROPE). This development concerns using particle swarm optimization algorithm (PSO) instead of (slower) Monte Carlo sampling. The paper presents several tests

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of this method (named ROPE-PSO) on a WaSIM model, which is more complex and much more computationally intensive than HBV (the model used by Bardossy and Singh). The paper is quite well written and well structured and will be interesting to the readers of HESS. It can be published provided some issues outlined below are addressed.

The authors often refer to their own (submitted) paper by (Krausse and Cullman 2011) but the readers cannot read it – so the material which is important for the considered paper should be presented here.

AROPE method should be introduced, at least briefly. Introduce relative peakflow deviation (rPD)

PSO and other randomized search methods were not designed as uncertainty analysis methods. This means that the vectors generated do not necessarily follow cover the space well and/or follow the prior distributions - which is done by standard MC procedures. The objective of PSO and similar methods (like GA, ant colony optimization, adaptive cluster covering, SCE-UA, AMALGAM, etc.) is to quickly move towards the global optimum, so that the parameter space will not be thoroughly explored. There have been studies reported when such methods were indeed used for uncertainty analysis as well, but there is of course no surprise they are more economical since they are not geared towards exploration of parameter space. I would suggest providing some brief discussion on this issue, or at least mentioning this. I would also suggest to provide references to the methods of "economical" uncertainty analysis (sampling) that are combining ideas of on random search methods and MCMC Metropolis algorithm (SCEM-UA, DREAM, etc) – see papers by Vrugt and co-authors.

I am not sure the test functions used really represent the reality of response surfaces (error functions) characteristic of hydrologic models which often have large flat areas and a number of local minima. Rosenbrok is of course a smooth single extremum function. Rastigin function, on the other hand, is a function with many dozens of local

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minima with close values which are on a rectangular grid, but with extremely high variability. The authors are invited to provide some evidence that the considered functions resemble the real ones characteristic of the considered calibration problems.

There is a notion of validation (or testing) the calibrated model. The authors use a very close term “transferability”. It is suggested to explain the relation between the two.

Editorial comments:

PP 2375-2376 – there is certain repetition. It is advisable to restructure the text to avoid it. P 2378, L11: change ‘by means’ to ‘in terms’. P 2396 L 11: change ‘from’ to ‘to’

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 8, 2373, 2011.