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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

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This paper presents a calibration methodology to yield more robust hydrological models, ie models that are less sensitive to data outliers/noise and therefore more amenable to extrapolation. The paper expands on another very similar paper by the same authors currently under review in HESSD.

The paper introduces a new algorithm that aims to be more efficient and yield more robust parameter sets than existing algorithms for robust parameter estimation (ROPE) based on Monte Carlo sampling. Case studies with a complex hydrological model are used to demonstrate the benefits of the new algorithm.

My two main comments relate to how results from the case studies demonstrate improved efficiency and robustness of the new algorithm.

1. Efficiency

As discussed on page 2377, the main rationale for developing the new algorithm (replacing Monte Carlo sampling with Particle Swarm Optimization PSO) is the need for computational efficiency. Hence, the focus here should be on a comparison of computational efficiency between the various versions of the ROPE algorithm. Such a comparison is done for the first synthetic case study, showing improved efficiency of the new algorithm. However, it would be more interesting and convincing to do this for the two real-world case studies. The synthetic case study is actually not that interesting and should perhaps be omitted.

2. Robustness

Using performance in validation as the main robustness criterion, the two real-world case studies show improved robustness with the new algorithm compared to the existing ROPE algorithm (figs. 6 and 14). However, the last case study shows very similar results between the new algorithm and PSO without deep parameter generation. This seems to suggest that deep generation, designed to increase robustness, is not that important in this case. This should be more extensively discussed; when is the new ROPE algorithm developed here expected to improve robustness above a method that does not perform deep parameter generation?

3. Other comments:

-Definition of the floodskill score is counter-intuitive, as one expects "skill" something

that is to be maximized, yet here it is minimized.

-The word “representative” in the title is quite vague; what is meant by a representative parameterization?

-Good parameter sets are defined by a threshold parameter tolf – how was its value determined? And how does it compare to the 10% best parameters criterion in the other ROPE algorithms? To what extent do these settings directly affect the spread in the derived parameter populations (comparing parameter histograms in figs 9 and 10)?

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