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Interactive Comment

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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Dear Reviewer,

we greatly appreciate your thoughtful comments that helped improve the manuscript.

We trust that all of your comments have been addressed accordingly in a revised manuscript. Thank you very much for your effort. In the following, we give a point-by-point reply to your comments:

>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 compar- ison of computational efficiency between the various versions of the ROPE algorithm. Such a comparison >is done for the first synthetic case study, showing improved effi- ciency 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.

According to your and the editor's comment we omitted the synthetic case study. The computational efficiency of a calibration algorithm is highly depend on the number of model runs required in order to obtain a stable solution. We inserted a brief discussion on this issue (refer to page 14 and 17) to both case studies. The PSO based algorithm requires a tremendously smaller number of model runs while providing better results.

>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?

The deep parameter sampling cannot generate parameter vectors with higher model

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performance. However it can remove parameters with bad model performance from the previously (by PSO-GA_u) estimated set. The ROPE-PSO results therefore cannot outperform the PSO-GA_u results in terms of the best achieved model performance. However it can remove outliers and improve the mean performance. Refer to Figure 17 in the new manuscript. This issue is also discussed while presenting these results (page 21). Consider that the results slightly changed because we redefined the Flood-Skill criterion according to your advice (see below)

>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.

We agree to your comment. Therefore redefined the FloodSkill score and repeated the calibration with the new defined criterion.

>The word "representative" in the title is quite vague; what is meant by a representative parameterization?

In this context the word representative is related to the term robust and transferable. Thus, a representative parameterisation leads to a model that corresponds to a sufficient performance on all or most validation time periods the model was calibrated for. Within the scope of this paper that means that a representative model shows a sufficient model performance on the various flood events in the validation set.

>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)?

The uncertainty tolerance is estimated according to a method given in the paper of Bardossy and Singh (2008). We briefly introduced this method and also inserted a discussion on this issue. The 10% criterion in the AROPE is just a criterion for every Monte Carlo iteration. However in the stopping criterion the tolerance is also consid-

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ered (Figure 5 in the new manuscript).

Kind regards,

Johannes Cullmann and Thomas Krauße

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

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