

## ***Interactive comment on “Identification of hydrological model parameters for flood forecasting using data depth measures” by T. Krauß and J. Cullmann***

**Anonymous Referee #3**

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This paper presents a calibration methodology that aims to yield more robust hydrological models, ie models that are less sensitive to data outliers and therefore more amenable to extrapolation. The central assumption is that robust parameter sets are located near the geometric center (as measured by a depth function) of a cloud of well performing parameter sets. The method is based on earlier work by Bardossy and Singh (2008) – this paper contributes by further developing the computational algorithm and applying the method to a distributed hydrological model.

The work is potentially interesting, but several issues need to be addressed before

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publication is possible. My recommendation is to reject the paper and merge some of the results with another very similar paper by the same authors currently under review in HESSD.

Summary of issues:

1. The main problem is that the analyses and results presented in this paper do not convincingly show the benefits and improvements of the method.

-The first case study considers finding the global minimum of two synthetic test functions. As the authors state in the paper, the goal of their method is not finding a globally optimal parameter set, but rather identifying robust parameter sets that extrapolate well. Therefore, the case study appears to be an inappropriate test.

-The second case study considers identifying robust parameters sets of a distributed hydrological model. Here the new algorithm is compared to two existing optimization algorithms (GA, IPM). As the newly proposed algorithm extends the approach of Bardossy and Singh, it seems more appropriate to compare to their algorithm (in terms of improved model robustness and better validation performance). The choice of comparing to GA/IPM seems arbitrary and not entirely appropriate. Also, only three parameters are considered, which means the case study does not address the over-parameterization and robustness issues of distributed hydrological models.

2. Description of the methodological contributions needs to be improved:

-The GenDeep algorithm to generate geometrically deep parameter sets needs to be described in words (now only in algorithmic form on page 2435).

-The stopping criterion for the algorithm is based on performance on a control/validation data set – a crucial step is how to select this control data set, this is not discussed.

3. Other comments:

-Description of the Bayesian approach on page 2426 is a bit too un-nuanced in my

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opinion. Yes, subjective distributional assumptions need to be made, but doesn't the arbitrary 10%-criterion used here to select "good" parameter sets serve a similar purpose? An advantage of making explicit distributional assumptions is that these can be checked a posteriori.

-The literature review should make a link with other robust approaches (median regression, Bayesian inference with fat-tailed likelihoods etc)

-How sensitive are your results to the 10% criterion for selecting good parameter sets (algorithm 5.3 on page 2437)?

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