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:

1. The authors present another search algorithm to solve multiple objective problems. In the literature there is already many of such algorithms. Why would this algorithm be better than the existing state-of-the art? The authors do not show this in the paper. This is crucial to warrant publication.

We included further high-dimensional test cases that show the advantages of the proposed MO-PSO-GA search strategy with respect to other single-strategy multi-objective optimisation approaches. Furthermore it helps to improve the performance of the existing advanced multi-method strategy AMALGAM.

Referrring to the depth based sampling we show that the deep parameter vectors provide are more robust in terms of transferability. Thus, they show a better performance with tighter variation intervals on the validation data. The deep parameter vectors provide a better representation of the (theoretical) Pareto fronts for other time periods and flood events respectively. Furthermore we compare the depth based sampling with a simple cutoff strategy based on subjective threshold values and explain the advantages of this approach.

2. Multimethod seach has been done before, but not with data depths. For this paper to be acceptable the authors need to show that their approach is superior. If they cannot show this, then what is the purpose of the work. Yet, another algorithm that can do the job.

Each multi-method search is as intelligent as the sum of its components. There are multi-method search strategies, e.g. AMALGAM that apply several approved search strategies. It is hard to outperform all these strategies by a hybrid search strategy based on PSO and an additional GA based operator for many problems. In our opinion it is nonetheless important to continue the development of further advanced single or hybrid multi-objective search strategies.

We showed that the developed MO-PSO-GA can both outperform other single-strategy search strategies and help to improve existing advanced multi-method search approaches. That is why we integrated the developed approach into the existing AMALGAM framework in order to achieve an optimal effectivity and efficiency for the estimation of the Pareto-optimal set.

Furthermore the multi-objective optimisation is just one component of the presented approach. The main thrust of this paper is the depth based sampling. We integrated further case studies focussing on this approach.

3. The synthetic case studies are very simple. Very low dimensionality of the parameter space. This does not inspire confidence that the method also works in the presence of 10 + parameters. I suggest to include a few case studies with at least 30 parameters. Many of them are available in the literature!! Thus, high-dimensionality needs to be confronted. The case studies are too simple.

We agree to you. Therefore, we integrated many more complex test problems with up to 30 parameters. The selected set of test problems is oriented to the one used in the first presentation of the AMALGAM approach.

4. The authors elude to the AMALGAM approach of Vrugt et al., and this methodology (published in 2007) has very similar ideas as adopted herein. The authors should much better reflect this.

We refer to our answer for question 5.

5. It would be necessary to include the AMALGAM results for the same studies. My experience suggests that the results of the new code will not outperform existing methods such as AMALGAM. Thus, why develop all this stuff if the codes are already available and better?

We applied the AMALGAM framework for all test problems in this paper. Consider that we tremendously extended the set of test problems with respect to the first manuscript. Furthermore we compared our developed hybrid MO-PSO-GA search strategy with other single multi-optimisation search strategies that are part of the AMALGAM framework. MO-PSO-GA is able to outperform existing strategies for the

given test problems. Nonetheless a simple hybrid search strategy cannot outperform the strengths of all approved search strategies in the AMALGAM framework at once. That is why we integrated our hybrid search strategy into the AMALGAM framework as an additional search strategy. We show that the modified version of AMALGAM extended by our search strategy has a clearly improved performance in terms of effectivity and efficiency for most of the given test problems.

6. The only novel element of this work is the data depth approach integrated into multiobjective algorithms. This is the main thrust of the paper. Not the algorithm.

We absoluetly agree to you on this issue. The depth based sampling in combination with multi-objective optimisation is the key concept of this paper. Unfortunately we did not highlight this in the first version. Therefore we re-edited the paper and put a stronger focus on the depth based sampling. According to other reviewer comments we removed the section dealing with multi-objective optimisation and included a set of test problems that show the advantages of the data depth approach. These test problems are based on the test problems that are used for the study of the different multi-objective optimisation algorithms include uncertainty.

Kind regards,

Thomas Krauße, Johannes Cullmann, Philipp Saile and Gerd Schmitz