

## ***Interactive comment on “What do we do with model simulation crashes? Recommendations for global sensitivity analysis of earth and environmental systems models” by Razi Sheikholeslami et al.***

### **Anonymous Referee #1**

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With great interest I have read and reviewed the manuscript “What do we do with model simulation crashes? Recommendations for global sensitivity analysis of earth and environmental systems models” by Sheikholeslami et al. In general, the paper presents a novel and interesting approach to deal with the issue of model crashes when applying global sensitivity analysis. Although this new idea looks promising, additional investigations and explanations are necessary before this paper can be published. In the next sections general, major and minor comments and suggestions are provided that should allow the authors to improve their manuscript.

C1

General To improve the validity of this novel idea and allow it to be applied in a more general context, more investigation is required by

\* Applying this for different SA techniques (e.g. a variance based techniques, as one of the proposed approaches might influence the variance of the output) (in particular on the HBV example with different ratios of the number of crashes)

\* Apply the k-NN technique instead or next to the simple NN, as the former seems to be more powerful

\* Apply a convergence analysis on the SA results. It appears to me that the proposed approach only slows down the convergence of the results (so an evolution of the SA-statistics for both the simulations without crashes and the simulations with suggested crashes should be performed. Possible approaches can be found in (Sarrazin et al., 2016) or (Nossent et al., 2011))

\* Different sampling techniques (as the density of the samples might have an influence on the results) (e.g. on p13, L33 one could argue that this statement should be supported by applying different strategies next to “STAR”)

\* Adding information on the computation time of the different steps

Major

\* p2, L27: In most cases, the samples for GSA are independent. This is important in the interpretation of your proposed strategy, so you should clearly mention this in the text.

\* p4, L22: In many cases of GSA, it is not necessary to re-run the entire experiment, but just a limited number of runs. This is important to put this into perspective.

\* p10, L11: What about parameter “CO”? It is influential, but you don’t talk about that one.

\* p12, L18: I have the impression that you went into detail too much on these causes of

C2

crashes of this model, whereas your main focus should be on the SA. The part starting on p13, L10 can be maintained as it is an interesting addition to this topic.

\* p13, L26: Is this valid for both single NN and k-NN? Specify this.

\* p25, fig 7: Could you provide some additional figures of this type in annex? Although this is arbitrarily chosen, this would support the results.

Minor

\* p1, L28: Should it be "Dynamical Earth Systems Models" or "Dynamical Earth System Models"?

\* p2, L29: Remove either "that" or "how"

\* p3, L21: Replace "is" by "are"

\* p3, L24: Add "the" before "parameter space"

\* p4, L24: Replace "the" by "a"

\* p5, L21: It would be either "a computationally simple method" or "computationally simplest method"

\* p6, L18: Add "a" before "response"

\* p6, L20: Add a comma after "In the literature"

\* p6, L22: Add "the" before "RBF"

\* p8, L7: Add "a" before "highly"

\* p8, L8: Add "a" before "minimum"

\* p8, L15: Add "a" or "the" before "maximum"

\* p8, L16: Add "the" before "output"

\* p8, L16: Add "a" before "minimum"

C3

\* p8, L24 (and others): All superscript numbers seem to be written as normal numbers

\* p8, L26: "of which" should go before "10"

\* p8, L29: The last sentence seems to have an odd structure

\* p9, L20: Add "the" before "STAR-VARS"

\* p9, L25: Add "the" before "GSA"

\* p9, L30: I would suggest to move "when there are no crashes" between the brackets on the previous line ("after 9100 function evaluations").

\* p10, L7: Add "the" before "parameter space"

\* p10, L7: Remove the "s" from "ratios"

\* p10, L10: Reformulate this sentence

\* p11, L1: Add "the" before "Four" and before "water"

\* p11, L10: Replace "with" by "between these"

\* p11, L12: Add "a" before "vegetation"

\* p11, L13: Add "the" before "soil"

\* p11, L21: Reformulate "As shown"

\* p11, L23: Add an "s" to "order"

\* p11, L29: Remove the "7"

\* p13, L30: Replace "depends" by "depending"

\* p14, L1: Which feature? Reformulate this sentence

\* p14, L6: Replace "are" by "should be"

\* p14, L7: Add an "s" to "problem"

C4

- \* p14, L25: Remove the “s” from “involves”
- \* p14, L31: “The efficiency of our proposed simulation based strategies was shown. . .”
- \* p14, L30: This is a very long, complex sentence.
- \* p15, L11: “causing” instead of “casing”
- \* p15, L18: “understanding” instead of “understand”
- \* p23 caption: Remove “C0” from the list of “moderately influential parameters”

Ref

Nossent, Elsen and Bauwens. Sobol’ sensitivity analysis of a complex environmental model, *Environmental Modelling & Software*, 26 (12), 2011

Sarrazin, Pianosi and Wagener. Global Sensitivity Analysis of environmental models: convergence and validation. *Environmental Modelling & Software*, 79, 2016

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Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2019-17>, 2019.