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Discussions

Interactive comment on "Reducing uncertainty bounds of two-dimensional hydrodynamic model output by constraining model roughness" *by* Punit Kumar Bhola et al.

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Authors: We sincerely appreciate the positive feedback from the reviewer. First of all, we would like to highlight few important changes in the revised manuscript based on other reviewers comments 1. The title has been updated to "Reducing uncertainties in flood inundation outputs of a two-dimensional hydrodynamic model by constraining roughness" 2. A digital elevation model and floodmap has been added for discussion 3. Conclusion has been updated

The followings are our point-by-point responses to the reviewer's quotes

C1

Guy J.-P. Schumann: This paper describes a case study of constraining the model roughness parameter as a means to reduce the overall uncertainty in 2D inundation models. In general, the paper is well written and, as so many papers around this topic that now start to become quite dated, is an interesting read and debates a very important topic: quite straightforward uncertainty reduction methods are available and should be used and applied much more in practice. Although, this argument was made a lot quite some years ago, I kind of welcome this paper, as it refreshes this important point.

Authors: We also second the opinion of the reviewer that the argument of uncertainty reduction is outdated, especially in operational-use. We hope that we have addressed all the comments satisfactorily in the revised manuscript, which improves the quality of this paper.

Guy J.-P. Schumann: Here are some points that I feel need to be addressed before publication: In my mind Keith Beven and Florian Pappenberger wrote two of the best papers on this topic, both in 2006 so 13 (or more) years ago, namely: Beven: https://www.sciencedirect.com/science/article/pii/S002216940500332X Pappenberger: https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2005WR004820 While the latter is cited by the authors, the former is not I believe and I think it should because I think it would be very useful in this presented study if the authors put their work in context of those two papers and build a justification around them to state why their presented case study is needed and what makes it different to existing literature, which, although now dated, is substantially large, especially the the 10 years 1998-2009. Without such a "putting in context", this paper only really refreshes this very well known problem. It is my opinion, that with such a justification, the paper could be published subject to "minor/moderate" revisions but without it, I think it is unclear what new message is presented here.

Authors: We thank the reviewer for this suggestion, The reference Beven (2006) has been added in the review in the revised manuscript. Page 2: Line 24-29.

"However, effective roughness identified for one flood event might not hold true for another (Romanowicz and Beven, 2003), and a range of parameters should be defined where equifinality can be observed. Beven (2006) argued that the prior selected for the range of parameters should potentially cover all the accepted or behavioural models (modeller types 2 or 3). In HD models, selecting such a prior distribution for model parameter introduces the issue of too wide bounds."

In addition, the novelty or the research gap has been clearly addressed in the revised version. Page 3: Line 6-8.

"These methods, although widely used in research, are not employed in operational practice, and a straightforward approach is needed to reduce the bounds. Furthermore, there is a need to ensure efficiency in searching model parameter spaces for behavioural models (Beven, 2006)."

Guy J.-P. Schumann: Also, the authors need to clarify why they did not consider other sources of uncertainty in their model, such as discharge or downstream boundary condition or indeed topography? Why only roughness? Also, they should explain why they decided to do 1000 simulations and how this number was decided?

Authors: A justification is given in the revised manuscript behind 1000 simulations on Page 5: Line 14-17.

"For the study, we have performed 1000 simulations based on uniformly distributed parameter sets for five land use classes. The sample size does contain enough samples of different behavioural models and the estimate was based on the recommendation in the literature (Aronica et al., 1998; Romanowicz and Beven, 2003) as well as the computational resources available."

In addition, more information is provided as to why other sources were not considered in this paper, Page 2: Line 5-7

"In the case of hindcasting a flood event based on measured discharges or water levels

as the input boundary conditions and a fine-resolution elevation, roughness remains the main source of uncertainty in HD models; hence we focus this study on roughness uncertainty."