Nat. Hazards Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/nhess-2020-344-AC2, 2021

Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Simulating historical flood events at the continental-scale: observational validation of a large-scale hydrodynamic model" *by* Oliver E. J. Wing et al.

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Received and published: 4 January 2021

This paper evaluates a continental-scale flood hazard framework by comparing the simulations with the underlying hydrodynamic model with high water marks (HWM), reconstructed flood extents and insurance claim-based estimates of affected buildings of 9 actual flooding events in the U.S. If hazard frameworks are to be trusted in reproducing correct hazard layers (inundation depth/extent for a given return period), they should be able to reproduce actual flooding events with sufficient accuracy. So, this study produces a much-needed example of performing such an evaluation. The authors are applauded for their efforts. The results are encouraging: given the errors in

HWMs, the results are not that much worse in reproducing flood levels as reach-scale hydrodynamic models. Also, flood extent is reproduced with similar accuracy as reach-scale hydrodynamic models, although it was also shown that flood extent is not very discriminative between model configurations and model parameterizations. The paper is very well written and nicely concise and should be published without much delay. I only have a small number of comments:

RESPONSE: The authors are very thankful for Marc Bierkens' review and are thrilled by his positive comments. Responses to his points are made below:

The most important one is the additional error that would occur if the framework would be used to estimate future inundation hazards. In that case, one cannot rely on gauged upstream water levels. Instead, input should come from hydrological models. A discussion on the errors that could be expected in that case is advised in light of the usefulness of large-scale hazard frameworks.

RESPONSE: This is an excellent point and we will be sure to discuss this in the revision. Not only would the use of runoff models permit exploration of future hazard, a number of the issues related to gauge density that we identify in the paper would also be ameliorated. We must also point out the loss of (present-day) accuracy induced by such an approach, however, and future research should certainly explore the impact of this.

Line 54 "convergence of skill". Please rephrase, as it is not clear what is meant here.

RESPONSE: Of course. We will make this clearer in the revision. It is meant to mean the quality of local and larger scale models is beginning to become equivalent.

Equation (1): this is commonly referred to as the "mean absolute error" and is a measure of uncertainty akin to the RMSE, but less sensitive to outliers.

RESPONSE: That's right. We'll make reference to its common reference in the revision.

Line 161: this link does not work

RESPONSE: Seems like the address has changed since preprint publication. The new one is now https://www.fema.gov/about/openfema/data-sets

Equation (4): should this not be 1 – Eq. (4)?

RESPONSE: Thanks for spotting this, you're absolutely right.

Line 220: the realism of HWM observations is observed by comparing it with physically realistic water levels along a reach. However, is this not a scale issue? Could local obstructions (even temporary such as debris) not have been responsible for deviating HWMs? In this case, there is not an error in the observations, but rather one has observations that has picked up local details not accounted for in the models.

RESPONSE: This is an excellent point. Alongside other comments, including those from Francesco, this suggestion will make for a much richer and more informative discussion.

Line 346: underestimates -> underestimated.

RESPONSE: Thanks. We will amend.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2020-344, 2020.