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## Reviewer 1

### Introductory Response

Dear Reviewer,

We sincerely thank you for your constructive feedback and the positive remarks regarding the writing, methodology, and interpretation of our manuscript. We are encouraged by your recognition of the importance of our work in exploring the uncertainties and improving the accuracy within the National Oceanic and Atmospheric Administration (NOAA) Office of Water Prediction (OWP) flood inundation map (FIM) framework.

We understand the significance of the issues you have highlighted and are fully committed to addressing these to further enhance the quality and impact of our manuscript. Our primary objective remains to explore and elucidate the effects of digital elevation model (DEM) source and resolution on FIM extents, thereby contributing valuable insights toward improving the accuracy and reliability of the OWP Height Above Nearest Drainage (HAND) FIM framework for operational forecasting.

We will address each of the issues you have highlighted in the subsequent sections of our response letter, providing clarifications and making necessary revisions as suggested. We appreciate the opportunity to enhance our manuscript through this revision and are committed to making all requisite amendments to meet the high standards of Hydrology and Earth System Sciences (HESS).

Thank you once again for your insightful feedback.

Warm regards,

Corresponding Author

### Major Issues

**Reviewer Point P 1.1** — Consider extending the analysis for 30 and 90 meter (m) resolutions - these are the most common DEM resolution for many national and global DEMs.

**Reply:** We appreciate your suggestion to extend the analysis to include coarser resolutions, as these are commonly encountered in many national and global scale DEMs. Additionally, we believe that this extension can provide valuable insights into answering at what point the coarsening of resolutions begins to affect the quality of HAND based FIMs significantly.

In acknowledgment of this valuable input, we have conducted additional analyses and expanded our discussion in Section 3.3 to encompass these additional spatial resolutions. The outcomes of this extended analysis have been encapsulated in a newly introduced Table 5, which illustrates how the quality of FIM begins to degrade at very coarse resolutions.

These amendments aim to provide a broader understanding of how different DEM resolutions impact the FIM quality, aligning with other resolutions utilized in national and global scale DEMs. We trust that this inclusion enriches our manuscript and addresses the concern adeptly.

**Reviewer Point P 1.2** — Figure 4. A very busy map that makes it hard to read - consider aggregating the key classes into 4-5 major land use/land cover (LULC) classes.

**Reply:** Thank you for your constructive suggestion to simplify Figure 4 by aggregating key classes into fewer major LULC categories. In response to your feedback, we have revised the figure by reducing it to the high-level National Land Cover Database (NLCD) LULCs classes, which has indeed made the figure less crowded and more comprehensible.

The revised figure now predominantly presents four main land use/land cover classes: forest, wetland, open-water, and pasture/crops, providing a clearer visual representation. Some high-level indication of anthropogenic development is also provided by this new symbology. We believe that this revision provides a more straightforward visualization while retaining the essential information for understanding the land cover distribution across the site.

We trust that this amendment addresses your concern effectively and enhances the clarity and readability of Figure 4 in our manuscript.

**Reviewer Point P 1.3** — Section 3.1 and Figure 6: I found it hard to understand what is the actual/overall improvement in HAND-FIM predictions using 3-Dimensional Elevation Program (3DEP). The authors should provide summary statistics in a table and/or additional plots (e.g. PDF, Box Violine).

**Reply:** We appreciate your valuable feedback regarding the presentation of the improvement in HAND-FIM predictions using 3DEP in Section 3.1 and Figure 6. We understand the significance of clearly conveying the actual improvement to elucidate the broader impact of our study.

While the original Figure 6 aimed to explicitly depict the difference in metric values, we acknowledge your suggestion for a more comprehensive presentation of the summary statistics. To address this, we have included summary metrics within a new table—Table 5, which presents the mean catchment scale metric values across various DEM sources and spatial resolutions, while aggregating across flood magnitudes. Also, we removed the differences as to focus on the distribution of the metrics values in Figure 6 and not repeat information.

We trust these amendments will provide a clearer and more thorough understanding of the improvements achieved through the use of 3DEP, thereby addressing the concerns you raised.

**Reviewer Point P 1.4** — Section 3.2 and Figure 7: this was the most unclear section of the manuscript. The results did not make much sense to me and the figure was hard to read/understand. The authors should re-think how to present and analyze the results. They may want to consider removing this section altogether

**Reply:** Thanks for pointing out some of the opportunities to improve the regression analysis results. We understand this analysis technique can appear unclear. To better align with established practices for conveying multivariate regression analysis, we included a new table-Table 3 in order to convey the slopes and their levels of significance better showing the catchment scale metrics and how they relate to various explanatory variables. We hope that this table better aligns with traditional practices in reporting and offers our audience an easier time in understanding the meaning of this analysis.

**Reviewer Point P 1.5** — Section 3.3 and Figure 8: I don't recall that the authors explained how these distributions were calculated. Similar to section 3.1, summary (overall) statistics of the FIM accuracy metrics should be reported.

**Reply:** We appreciate your insightful observation regarding the clarification of the distributions calculation in Figure 8, and the request for overall summary statistics of the FIM accuracy metrics.

In the initial manuscript, the calculation of distributions using Gaussian kernel density estimation (KDE) was briefly mentioned on lines 417-419 of Section 3.3. To address your concern, we have revised these lines to provide a more detailed explanation of the Gaussian KDE methodology employed, along with appropriate references to ensure a comprehensive understanding for the readers.

Furthermore, in alignment with your suggestion and similar to the amendment made in your previous Point P 1.3, we have included overall summary statistics of the FIM accuracy metrics in the newly introduced Table 5. This table aims to provide a clear and concise summary of the metrics, facilitating a better understanding of the accuracy improvements.

We trust that these revisions aptly address your comments and enhance the clarity and completeness of our manuscript in the discussed sections.

**Reviewer Point P 1.6** — Figure 9 and relevant text: report the computer hardware that was used.

**Reply:** We thank the reviewer for bringing to our attention the importance of reporting the computer hardware used in our analyses, as this information is crucial for the reproducibility and comprehension of the computational benchmarks presented.

In response to your valuable comment, we have now included a detailed description of the computer hardware and the operating system utilized for computing these benchmarks in both the caption of Figure 9 and the corresponding text section. This addition will provide readers with a clearer understanding of the computational environment in which our analyses were conducted.

We trust that this amendment adequately addresses your concern and enhances the transparency and reproducibility of our work.

## Minor Issues

**Reviewer Point P 1.7** — Line 35: ‘...scales [often] requires’

**Reply:** Addressed.

**Reviewer Point P 1.8** — Line 109: ‘omb’ ?

**Reply:** We appreciate your keen observation regarding the unclear citation on line 109. The issue arose from how BibTeX renders citations with institutional authors. We have now rectified this problem by ensuring that the full institution name, Office of Management and Budget, is accurately cited in the text. This amendment will eliminate any confusion and enhance the clarity of the citation.

**Reviewer Point P 1.9** — Line 168: ‘due to the (...’

**Reply:** Thank you for bringing to our attention the incomplete statement on line 168. We have reviewed and revised the sentence to convey and complete the intended meaning better. We trust this revision addresses your concern and enhances the clarity of the manuscript.

**Reviewer Point P 1.10** — Line 183: ‘?’

**Reply:** This question mark was introduced by BibTex due to a repeated citation reference. This repeated entry has been removed and the question mark has disappeared. Thank you for your careful attention to detail.

**Reviewer Point P 1.11** — Line 256: '(of DEMs ,...'; '(, WBM)...

**Reply:** Another issue related to BibTex rendering of institutions. Thank you for your close oversight. This issue has been addressed.

**Reviewer Point P 1.12** — Line 257: '(, MRLC)'

**Reply:** Related to previous point P 1.11. This is now addressed.

**Reviewer Point P 1.13** — Line 373: 'we used investigate...'

**Reply:** The sentence has been rephrased for clarity and grammatical correctness.

**Reviewer Point P 1.14** — Line 400: 'two-way interactions' - do you mean cross-correlation?

**Reply:** Thank you for bringing up this point. In line 400, when we mention "two-way interactions," we are referring to interaction terms within the regression model, where the combined effect of two explanatory variables on the response variable is examined. This is common terminology in regression analysis to denote interactions between different predictor variables. The term "cross-correlation" generally pertains to the relationship between two separate series of data, which is not the focus in our regression analysis.

To ensure clarity and avoid any confusion, we will add a brief explanation of the "two-way interactions" in the text surrounding line 400.

We appreciate your vigilance in ensuring clarity and precision in our manuscript.

## References