Peer-review of NHESS article: *Mapping current and future flood exposure using a 5-metre flood model and climate change projections*

**Questions for consideration:**

1. Does the paper address relevant scientific and/or technical questions within the scope of NHESS? Yes
2. Does the paper present new data and/or novel concepts, ideas, tools, methods or results? Uncertain - reasoning explained below
3. Are these up to international standards? Yes
4. Are the scientific methods and assumptions valid and outlined clearly? No - Need more details on the modeling that produced the dataset used
5. Are the results sufficient to support the interpretations and the conclusions? Unclear, explained below
6. Does the author reach substantial conclusions? Unclear, explained below
7. Is the description of the data used, the methods used, the experiments and calculations made, and the results obtained sufficiently complete and accurate to allow their reproduction by fellow scientists (traceability of results)? Again, would like more details on the modeling methods. But the methods the authors used were clear and reproducible.
8. Does the title clearly and unambiguously reflect the contents of the paper? Yes
9. Does the abstract provide a concise, complete and unambiguous summary of the work done and the results obtained? Yes
10. Are the title and the abstract pertinent, and easy to understand to a wide and diversified audience? Yes
11. Are mathematical formulae, symbols, abbreviations and units correctly defined and used? If the formulae, symbols or abbreviations are numerous, are there tables or appendixes listing them? Yes
12. Is the size, quality and readability of each figure adequate to the type and quantity of data presented? Yes
13. Does the author give proper credit to previous and/or related work, and does he/she indicate clearly his/her own contribution? Yes
14. Are the number and quality of the references appropriate? Would like to see a more detailed review of more papers - explained further below
15. Are the references accessible by fellow scientists? Yes
16. Is the overall presentation well structured, clear and easy to understand by a wide and general audience? Yes
17. Is the length of the paper adequate, too long or too short? Appropriate length
18. Is there any part of the paper (title, abstract, main text, formulae, symbols, figures and their captions, tables, list of references, appendixes) that needs to be clarified, reduced, added, combined, or eliminated? Figures 1 and 2 could be merged
19. Is the technical language precise and understandable by fellow scientists? Yes

20. Is the English language of good quality, fluent, simple and easy to read and understand by a wide and diversified audience? Yes
21. Is the amount and quality of supplementary material (if any) appropriate? N/A

**General comments:**

- Novelty uncertain - In the review, different modeling approaches are described (e.g., physical, physically-based, and empirical), but there is no review on the current state of physically-based modeling which is the modeling method used. A review on physically-based approaches and their applications is needed to demonstrate the need for and novelty of this work. Similar datasets exist from First Street Foundation and Fathom. Comparing this dataset to existing ones can provide further context of this work.
- Modeling details - The description of the modeling methods was very general. More details are needed to understand how the dataset used was produced, especially for pluvial modeling since pluvial was the driving mechanism in the results.
- Include more return periods in analysis - There were several return periods listed that the data was available for, but results were only reported for the 100-year event. Consider comparing the driving flood mechanism across multiple return periods as this could yield interesting and innovative results.
- Paper is very well-written and organized. It is clear and easy to read.

**Line-specific comments:**

Pg. 2, line 35 - The IPCC citation is not included in the reference list and not in alphabetical order

Pg. 2, line 40 - change anticipating to anticipate

Pg. 4, line 106 - Section is not numbered

Pg. 4, line 142 - Is citation reference to the 2022a or 2022b reference?

Pg. 5, line 154 - The review of Canadian flow mapping throughput history and different initiatives provides nice context.

Figure 1 - Consider condensing Figures 1 and 2. Could add a fourth panel to Figure 2 that shows the inundation including all flood mechanisms for the 100-yr event and eliminating Figure 1.

Pg. 6, line 176 - use of the ‘coverage observed’ - this could be confusing for readers since this isn’t referring to a historical, observed event. Consider changing the language to ‘coverage modeled’ or ‘observed from modeling.’

Pg. 6, line 177 - The use of low to high scale. Figure 2 includes depth ranges instead of qualitative scale. Could the flood depths scale be used for Figure 1?

Pg. 6, line 184 - Figure 2 captions says its mapping the 100-yr event not the 1,500-year RP.

Pg. 8, line 198 - “infiltration coefficient” - I would like to see more details on how this was calculated and applied. Was it assumed to be the same across the study site, or did it vary based on land use or % imperviousness or some other method?

Pg. 8, line 210 - Include more detail on these “change factors” - how are they developed and applied.

Pg. 8, line 216 - Again, more detail on “change factors.” Were the change factors for the hydrographs calculated differently than the change factors for the rainfall?

Page 12, line 283 - make “elevation” plural

Page 12, line 285 - Was there consideration of making additional thresholds for measuring the severity of building exposure? Could include an additional threshold equivalent to the height of a first floor since the flood depths exceed 6 meters in some scenarios.

Page 12, line 292 - “combination of flood types” - Does this mean a building was flooded by both or all three flood types? Add a brief clarification as to how this was determined.

Page 12, line 292 - Change “combination” to “multiple” because the modeling considered the flood mechanism separately, and did not implement compound modeling where the mechanisms are included simultaneously in the model. Combination might imply flood mechanisms occurring at the same time and be misleading.

Page 13, line 300 - Results show pluvial is the driving mechanism of flood exposure. Why do you suppose that is? Consider adding this to the discussion.

Page 13, line 306 - Mention the role of “infrastructures and waterways.” Does the model consider stormwater infrastructure?

Figure 4 - Is the middle map of a different location? Why not use the same location for the pluvial flood mechanism as well?

Pg. 19, line 32 - Word choice of the word “greater.” Consider changing the first instance to “larger amounts of water” and the second instance to “further exposure” to add clarity.

Figure 5 - Consider splitting the classification of “continued exposure” into two groups: “continued exposure” and “worsened exposure” based on a building going from moderate to

severe exposure. This could add more information to the figure to show not only where new exposure occurred but also where it was made worse by climate change.

Page 20, line 41 - What model assumptions are being referred to? Be specific.
Page 20, line 43 - “two of the three assets.” The sentence before mentions 14 buildings, so not sure where three assets are coming from.

Page 20, line 46 - the small pockets of disjointed water causing changes. Perhaps this is an opportune place to discuss the role of model uncertainty on the output since the only input that was changed was increasing rainfalls based on climate change.

Page 21, lines 54-56 - can add that pluvial flooding was the driving mechanism, so excluding this in flood mapping could result in harmful consequences

Page 21, line 61 - Provide more detail on the approaches' scalability.

Page 21, line 62 - Why is there greater uncertainty in the pluvial flood estimation?

Page 22, line 83 - make ‘building’ plural

Page 22, line 84 - Add clarity to wording. Buildings are not a source of exposure, but an increase in development leads to a greater density and number of buildings that can be exposed to flooding.

Page 22, line 85 - Again, buildings are not a source of flooding, but they increase the number of assets that can be exposed.

Page 22, lines 95-96 - Sentence is unclear.

Page 22, line 98: Validation is discussed, but what about the roles of uncertainty of and sensitivity analysis on the dataset and the results?

Page 24, line 161 - Reference is in the reference list but not cited in the manuscript

Page 27, line 236 - Reference is in the reference list but not cited in the manuscript