Comments on "Econometric Modelling for Estimating Direct Flood Damage to Firms: A Local-Scale Approach Using Post-Event Records in Italy" submitted by Ballocci et al.

1 General comments

5 This is an empirical study analysing the direct flood damage to building, stock and equipment in the business sector. The dataset covers five flood events in several regions of Italy. Regression models are calibrated, by considering dummy variables for the economic sectors to compensate for the relatively low number of observations (especially when disaggregated per sector and/or per direct damage component). The research question is important and timely. Overall, the methodology is sensible.

10 A challenging aspect of the study is the relatively limited sample size (given the number of cost components to be predicted for several sectors). This is a typical challenge in the field. Consequently, the predictive capacity of the regressions is limited, as correctly acknowledged by the Authors (Line 438: "considered unsatisfactory"); but it provides nonetheless valuable insights into the important features, the relative amounts of damage in different sectors and across cost components. My opinion, is that the paper is suitable for publication in this journal, provided the points below are addressed, but it would

15 become even more valuable if the text can be made more concise, by identifying a limited number of key take-home messages of the study, and rewriting the text more straight-to-the-point to convey these few key messages to the reader. Additional material can be moved to a Supplement.

The paper would also benefit from a bit more in-depth information on how data were collected and processed. Particularly, the step of attributing a single, representative value of water depth to (relatively large) business buildings needs to be

20 discussed with more attention.

2 Specific comments

- The Authors must make sure that they consistently adhere to a single term to refer to a given concept. If different words are used interchangeably to denote the same idea, it creates confusion for the reader. Examples are as follows:

25 - firms, enterprises …: if they all mean the same, choose one word and stick to it;
  - local-scale (title), micro-scale, micro-local (Abstract) …
  - "multiple regression model"

- L52: "The assessment of damage is important to evaluate actions from …" Is the model proposed by the Authors suitable for evaluating a wide range of risk reduction measures. It is important to discuss this point in Section 8, particularly in light of regression models which do not consider any hazard explanatory variable.

- L160-164: exactly how data was collected and how it was processed is key to the analysis. I recommend that a Supplement to the paper is created to provide more details on how data was collected and treated for each flood event.

- L170-174: exactly how water depth was estimated is crucial for the entire analysis. The Authors are asked to describe in detail how the hydrodynamic models were validated (which is their performance, and hence estimate the uncertainty on the water depths), and how water depth attribution to (large) buildings was performed. The latter point refers to how a single representative value of water depth was assigned to a particular building from the gridded results of a 2D model. Considering the highest water depth around the building, or the average, or other statistics can lead to substantially different results, especially for large buildings. How were the buildings incorporated in the 2D simulations (building block approach vs. building hole approach …)?

- I'm particularly sceptical of all the boxplots presented with a log-scale y-axis extending up to 10^5 €/m² (Figure 1 and later). This is motivated by the existence of a few outliers; but I believe that this representation leads to a bias in the visual inspection of the plots. I would recommend keeping one version of the boxplots as they are, and including a second version based on a linear-scale bounded by reasonable values (e.g., up to 5,000 €/m²). One version could remain in the main text, and the other one be moved to a Supplement.

- L265-267: this may be related to the technique used for water depth attribution to buildings from the 2D computations.

- L284-286: this is not clear. Please reformulate and be sure to use the right words. Is "proportional" correct?

- L299: what is meant with "some statistical measures". Be more specific. Which one is relevant here?

- L309 and Table 5: it is unclear how the results for model training and validation are displayed. Importantly, it is also not clear what is presented in Table 5 regarding the 10 folds … Does Table 5 display an average over the 10 folds, or something else? This is key to clarify.

- L310-315: it is unclear whether "damage" or "unitary damage" is considered. The text seems to lack rigor. Percentages are given; but it is not clear to what they refer (average value, median value …).

- L316-318: elaborate a bit more on whether this result is satisfactory or not.

- Table 7 could be moved to a Supplement, and replaced by a bar chart in the main text. The last row of Table 7 is not clear "Total average" …

- Paragraph starting in Line 365: the use of "initial value" is not clear and seems not rigorous.

- L375: this seems incorrect. It is a portion of the variance which is explained. Again, bi rigorous with the use of the words "damage" or "unitary damage".

- It is essential that the performance of each "final" model (Eqs. 11 to 13) is represented by means of a scatter plot (computed vs. observed values), and that the possible trends revealed by these plots (over- vs. under-estimations …) are briefly discussed.
- Lines 402 and following: it is not clear which are the "Italian models". Are there only two such models (Arrighi et al. and Molinari et al., 2020), or also others? Besides, make sure to avoid contradictions in the text: L469 it is stated that the new model applies to the "whole Italian territory". Then, also Florence? In that case, how does it compare with Arrighi et al.? It is probably better to tone down the statement "whole Italian territory" and emphasize the regions for which data were available and were used for calibrating the regressions.
- L410: discussion on relative vs. absolute errors is not clear. Please clarify.
- The main results need to be concisely summarized in the Conclusion.

3 Technical corrections

Overall, the text is reasonably well written. Here and there, sentences are odd, and weird formulations need to be corrected.

- L22-23: rephrase to improve clarity
- L23: is "vulnerable" the correct word? Data show that these are the highest values of damage. It is not proven that the reason for the higher damage is a higher vulnerability. The hazard may be higher.
- L60: existent
- Remove multiple occurrences of "in fact" throughout the text.
- Many references cited in the text are missing in the reference list.
- Table 2: bottom left cell should read 812 instead of 325.
- L221: same approach as
- In general, avoid repeating generally known information, such as a description of a boxplot (e.g., in caption of Figure 1).
- There are errors in the numbering of the equations.
- L293: "take unity values"
- L299: remove "caused"
- In figures like Figure 7, the exact meaning of the grey shaded area needs to be explained.
- L387. Reformulate "inadvisable".
- L391: remove "at the premises' location".
- L463. Delete the first sentence ("… results were predictable.").

A thorough review of the text for typos is necessary, as well as for improving English style. The items listed above are just examples of necessary improvements.