REVIEW REPLY

Anonymous Referee #2

The paper addresses flood loss estimation in Northern Italy, trying to highlight possibilities and limitations. By using flood damages recorded after the flood of the Secchia river in 2014, the authors (i) derive uni- and multi-variable damage models for the study area and compare them with models from the literature (ii) evaluate the transferability of such models to similar contexts and finally (iii) explore the relationship between damage to buildings and damage to contents for the available dataset.

The paper is in the scope of the journal and of interest for the research community working on flood risk; although "local" in the analyses, its results can be generalised to other contexts as well.

The paper is well organised, data are properly described, as well as methods, although some minor integrations/specifications are required with respect to the latter. Likewise, there are some minor imprecisions to be corrected in the whole text. The discussion of results can be improved with respect to some aspects (see below).

In general, the paper is a little bit long. Some suggestions are provided in the following on parts that can be neglected or shortened; nonetheless, the paper can take advantage of an English review aimed at simplifying articulated and (repetitive) sentence.

The positive review and all specific remarks of Anonymous Referee #2, particularly the suggestions for a modification of the revised manuscript structure, are gratefully acknowledged and we will definitely take them into account, in order to reach a better presentation of our analysis.

Major criticisms

Section 1

- The Introduction is too long. I would shorten the first paragraphs on the importance of flood losses and omit the discussion on aleatory and epistemic uncertainty (the following part on specific uncertainties related to damage models is more interesting for the paper).

We will review and shorten the introduction, according to these suggestions.

- Section 1.1 should be re-organised by first declaring the objectives of the research and then the tools/methods. The present form is totally clear only after reading the whole paper.

Thank you for the advice, we will definitely follow it in the revised manuscript.

Section 3.1

- The discussion on the difference between declared and refunded damage can be shortened in my opinion, by neglecting details.

Ok, we will take this comment into consideration, although a compromise is needed with the request of Anonymous Referee #1, who asks for a more detailed explanation of this part.

- I agree on the use of declared data (instead of refunded damages) but it is not clear whether implemented damage data above 15.000 euros were verified or not. If this is the case, data below 15.000 euros are less reliable and authors should take this aspect into account in the analysis.

This part will be better clarified in the revised manuscript, in order to keep in consideration both Reviewers' comments.

- I do not agree with the use of OMI data for the assessment of buildings value that, as stated by the authors in the Conclusions, "are more an expression of the overall economic well-being of a specific area" rather than of the real value of the buildings. (Re)construction costs are more suitable to the objective in my opinion.

We used the OMI values because they are one of the few reliable economic data that are available freely and homogeneously at a national level for provisional. Also, the use of these economic values is still deem to be informative for ex-ante damage estimation for planning activities. Moreover, reconstruction and restoration costs were not available when we started the analysis and the compilation of the dataset. Nevertheless, we will acknowledge this possibility in the revised manuscript.

Section 4.1

- The description of the damage models can be shortened by referring to available literature and leaving only the significant information for the paper (i.e. how models have been implemented).

Ok, thanks. We will shorten this description in the revised manuscript.

- Authors implement models developed to be applied at the micro-scale (e.g. MCM, Flemo-PS) and models developed to be applied at the meso-scale (e.g. Rhine Atlas, JRCs). I guess whether damage estimation (i.e. models' performance) is influenced by the different levels of knowledge/detail of input variables required by the models vs. available data. Did authors explore this aspect?

This aspect will be better discussed in the revised manuscript. We believe that this fact explains the differences among the performance of the models and the similar performances of the models at different scales. We will also take this opportunity to better strengthen the need for a more informed and rational selection of the damage model, which seldom appears to be the case in common practice, i.e. the level of detail of each input variable required by each model is always overlooked or neglected.

Section 4.1.1

- How authors converted the absolute curves of MCM in relative curves? MCM curves were developed in 2005 while the flood occurred in 2014; Did authors apply a discount rate to estimated damage? Why authors chose to convert absolute curves by mean of the average economic building value in the study area rather than by using different values for the different OMI zones? I would adopt this second option as MCM is a "micro" scale damage model.

Thanks, we will consider the possibility to apply the MCM curve as suggested.

Section 4.2

- Which is the formulation of SEMP?

There is no formulation of the SEMP curve, because it comes out from the interpolation of the median damage values for each class (i.e. bin) of 25 cm water depth. We will better clarify this in the text that present the procedure to develop the model.

Section 5.1

- From figures 7, 8, 9, it seems that uni-variable local models always estimate a relative damage around 0.1 (independently of the value of the dependent variable). Did authors notice that? How it can be justified?

We sincerely thank the Reviewer because his/her comment enabled us to identify a limitation of the previous study. Locally derived models consider an intercept different from zero, which we do not consider anymore to be realistic and representative of the buildings in the study area (i.e. additional direct verification enabled us to see that only a few affected buildings have a basement, whereas the norm is not to have any underground level for the impacted buildings). We are already working at the development of more robust empirical models, that have intercept equal to zero and we will present these models in the revised manuscript.

- How authors justify the bad performance of SVM in estimating the total absolute damage?

Thanks for this comment, which helped us realizing that the caption is rather misleading (and will be adjusted). We believe that the difference -and poorer performance- is associated with the fact that SVM is identified for relative damages and not for actual absolute damages in monetary terms. We will better investigate this aspect in the revised manuscript.

- With regard to existing models, I expect that models with the best performance underestimate the total damage (as citizens tend to overestimate damage during declaration). In fact, four of the six best models underestimate. Can authors comment on that?

The Reviewer raises a very interesting consideration which we will incorporate in the discussion section of the revised manuscript. Thanks.

Section 5.2

- This section could be rewritten and improved to better explain the significance of results. Finding correspondence between authors' considerations and figures/tables is not straightforward at present.

- There is no correspondence between Figure 11 and its description in the text. Check also models acronym. Correspondence between test and figures is often lacking.

Thank you for these suggestions, this part will be improved following both observations.

Section 5.3

- The link between the performance in estimating damage to buildings and damage to contents is not so evident to me. Why SMV that is the one with the best performance in estimating damage to buildings is quite bad in estimating damage to contents?

We believe that the reason is that the regression curve for contents damages is derived starting from the structural damages to buildings and this relationship is not so strong itself. We will examine more in depth the explanation of these results, performing additional analyses if needed, and adding discussion of this aspect to the revised manuscript.

Conclusions

- The transferability of local models stated in the last part of the section should be better discussed previously in the paper. Two/three sentences highlighting this point can make conclusions more robust

Thank you for the advice. We will improve the revised manuscript accordingly.

NB

Pay attention to be consistent in terminology. Authors use damage to "contents" and "content" interchangeably. I guess they are typos. The same can be state for model acronyms (e.g. SMV sometimes becomes MV).

We will pay attention to the typos in the revised manuscript.

Specific minor comments (which can increase the readability and clarity of the paper)

Section 1

Pg. 2 line 17 "flood risk is the combination of hazard (i.e. the probability of a flood event with a certain intensity to occur in a specific area and in a specific time period) and consequences, providing for instance information on the vulnerability, i.e. the type and number of elements affected by a given flood

event, and how well they are able to resist” □ from this statement, I understand that consequences and vulnerability are the same “concept”, please rephrase

Ok, thanks. We will improve this description.