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Comment on nhess-2021-272

Anonymous Referee #1

Referee comment on "Developing a framework for the assessment of current and future flood risk in Venice, Italy" by Julius Schlumberger et al., Nat. Hazards Earth Syst. Sci. Discuss., https://doi.org/10.5194/nhess-2021-272-RC1, 2021

Review of nhess-2021-272, "Developing a framework for the assessment of current and future flood risk in Venice, Italy"

Summary:

This very interesting and meaningful manuscript aims at filling a research gap on the current limited information on direct flood damage and risk modelling of the historical city centre of Venice. To do so, the authors present a novel approach based on a risk assessment framework to provide an instrument potentially useful for decision-making in the scope of flood risk management in Venice. The article is generally well written and very informative, particularly the introduction which is very informative even for readers with little background on flood risk. I really appreciate the effort of the authors in providing such an interesting methodological framework while considering aspects that are relevant for the dynamics of the Lagoon and MOSE, such as the consideration of different management options for the lagoon inlets and water level scenarios. While I acknowledge the importance of such contribution and I appreciate the effort of the authors in integrating hydrodynamic flood modelling with flood damage modelling to better support decision-making and adaptation under the ever-growing pressure of floods, in particular in the context of Venice, I believe that the manuscript needs some improvements and clarifications that are required for achieving publication state. These improvements and modification, in my perspective, are also essential to ultimately render this work more significant. These are listed below.

Major Reviews:

- The author are using an interesting and complex combination of hydrodynamic models to simulate the flood hazard in Venice; yet, the authors are also only using water depth as the descriptor of flood damages in the case study area. One of the main advantages of hydrodynamic models is the capability of providing information pertaining to the duration and velocity of a flood event, which however are not considered in the damage modelling framework. As such, the value-added of utilising the nested hydrodynamic models is not clear in the current version of the manuscript, and seems to only be adding to the complexity of the proposed methodological framework. While the authors are already using a hydrodynamic model to simulate the dynamics from the Adriatic sea to the Lagoon of Venice (i.e. parent model), I would strongly suggest the authors to highlight the benefits of using the nested hydrodynamic models over a more simplistic bathtub approach for the studied application.

- In the same topic of the last point, it would be interesting to provide a table similar to Table 7 but comparing the results of the hydrostatic and the hydrodynamic models, in terms of R and RMSE.

- As Figure 6a shows an underestimation flood depth bias by the d3dfm model with respect to the bathtub approach, It would be interesting to include also the damage results from the bathtub flood model, if possible, so to provide a meta-model comparison. The same rational is valid for Tables 9 and 10.

- During recent MOSE activations, the Malamocco inlet was left open, while both Lido and Chioggia were closed, as this is the main inlet for commercial and industrial ships. While the scenario "lidoopen" is certainly very interesting and capable of providing much appreciated information to decision-makers and to the general public, it would be also interesting to consider, if possible, a more plausible and realistic scenario were the Malamocco inlet only is left open.

- In line 142, the authors mention that the d3dfm model "allows to account for additional processes like wave action or 1D flow of the sewage system". From the manuscript's text, these are not taken into consideration. In the specific case of Venice, it could be relevant to consider the effects of the sewage and drainage system when modelling high tide floods, as during high tide events water may come directly from underneath the city instead of overflowing from the canals. The non-consideration of such phenomena might lead to the underestimation of flooded areas, especially in a scenario such as Venice, where buildings are often attached to one another, leading to significant areas isolated from overland flow in the perspective of the hydrodynamic model. Indeed, this might be the case why Figure 6a shows that the hydrodynamic model underestimates flooding in the majority of cells with respect to the hydrostatic (bathtub) approach. Could the authors better explain why this option has not been included in the flood modelling framework?

- It is not clear from the text if the seven nested sub-models exchange information among themselves as boundary conditions or just with the parent model? Please better explain the nested setup.

- Regarding the altimetry data that has been used in this study, has the correction to the ZMPS datum been done within the work developed in this manuscript or is it a data that has been obtained as already published from other sources? If the correction to the reference ZMPS level has been done as part of the work developed in this manuscript, please add a methodological description on how this has been performed (I suggest adding it in the supplementary material if possible).

- The authors refer to "grid instabilities" in lines 298 and 299. Could the authors better explain what are those instabilities and how are they defined? Also, it is not clear if the whole Castello sub-model was affected or just part of it (14% of total, where total refers to the Castello sub-model or to Venice?). Please better explain.

Minor Reviews:

- Some of the graphics are difficult to read due to their low quality and/or small font size (e.g. Figure 9).

- I might be wrong, but Figure 8 may be out of scale on the y-axis for the variable F2 (risk taking IPS).

- Figure 9a, as a suggestion to improve the readability of the figure, it would be interesting to add some indications on when MOSE is activated and deactivated.

- Line 2-3, sentence "limited scientific knowledge of flood hazard and flood damage modelling of the old-town of Venice is available to support decisions to mitigate existing and future flood risk."; I would suggest to rephrase the sentence, as flood hazard information is available, including publicly-available flood maps and walking paths covering the historical city centre of Venice for different flood quotas. Instead, information about flood risk is definitely much less available.

- Some sentences are unclear and/or could be better structured (e.g. line 1, "Flooding has been a serious struggle to the old-town of Venice, its residents and cultural heritage and continues to be a challenge in the future."). Also, spelling is mixed

between British and American styles (e.h. behaviour vs. behavior; analyse vs. analyze). An in-depth proof-reading of the manuscript is recommended.

- Line 2 and line 51; is the term "existence-defining" correctly employed (particularly in the phrase of line 2)? Or should be "existence-defying"?

- Line 24; please correct the definition of exposure as, following the IPCC definition, it is not only related to human systems, but to the "inventory of elements in an area in which hazard events may occur". The next phrase on the manuscript highlights this, and the text should be consistent (i.e. "human health, environment, cultural heritage and economic activities").

- Line49: The phrase "Additionally, intangible damages to cultural heritage sites and their meaning for the cultural identity of the region and nation can be expected (Wang, 2015)" is not very informative and could either be removed or extended with some examples of intangible damages to cultural heritage sites.

- Please define all acronyms in the main text (e.g. ZMPS, IGM42, etc.).

- As a suggestion, the paragraph between lines 69 and 75 could be moved to the methods section.

- Please better explain the phrase in line 150 “All grid points inside a 4m buffer around each structure were used to derive an average water level”. Does this means that water level per building considers only the surrounding flooded pixels or all pixels? Please clarify?

- Unless supported by a reference or data, I would suggest renaming the "Expected IPS" scenario to something else that better fits with the assumptions and discussions, such as "Risk neural IPS".