

Interactive comment on “Understanding epistemic uncertainty in large-scale coastal flood risk assessment for present and future climates” by Michalis I. Vousdoukas et al.

Anonymous Referee #1

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This is an interesting and timely manuscript that explores, in a quantitative manner, the different sources of uncertainty in large-scale coastal flood risk modelling for two case studies: a regional application for the Iberian Peninsula and a local case study in Faro, Portugal. The study concludes that uncertainty from ESL contributions, particularly the consideration of waves, exceeds the uncertainty introduced by the use of the GHG emission projections and climate models used in the analysis. Further, it reports that the information on coastal protection levels and elevation is similarly important.

The manuscript is very well written and the authors have done a very good job in clearly explaining the assumptions of the study, presenting the results and discussing their

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findings. I do feel that the ms could be clearer on some methodological descriptions (I have made some suggestions below), but this is not a major comment.

I certainly recommend the paper for publication – nevertheless I think that, before publication, the authors should consider addressing a series of points that I raise below. I hope that the authors find these comments useful for improving the manuscript.

1. I find that the use of what the authors call “bathtub approach” (i.e. the static approach that does not consider connectivity) is unnecessary (and in a way incorrect) and does not add much to the manuscript. Only very few studies have applied the bathtub approach without considering hydrological connectivity in the last 10 years (or longer), as it is not correct to assume that all pixels below a certain elevation would belong to the coastal flood plain, even if they are not connected to the ocean. This would, in some locations, lead to including to the floodplain some low-elevation inland areas that can be hundreds of kilometres away from the coast. I would therefore recommend the authors to remove this method (and the respective results) from the ms, or at least limit the distance from the coastline at which such areas (pixels) are included in the calculation of the flood extent. The term bathtubo includes the connectivity consideration and I would therefore find the Snh approach obsolete.

2. I understand the need for the coastal segmentation (pg. 3, line 14) – however, I am unsure as to how the authors have implemented it and specifically how they have defined the inland boundaries of the segments (perpendicular to the coast?); and how they have addressed the problem of “spill-over” of water between the segments. I would assume that this problem could substantially affect the results of the VI method as water does not stop at the inland boundaries but rather propagates to neighbouring segments. I suggest that the authors add some lines to the manuscript (or in the supplementary material) providing some additional information on this process.

3. The analysis presented in the manuscript is based on the LISCOAST framework. However, this framework is not described in the manuscript and the reference (which

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has been accepted for publication) is not yet available; some basic information on LISCOAST would therefore be useful to include in the main text or as supplementary material.

4. To address the assumption that all extreme events coincide with high tide the authors use a modulation factor. If I understand correctly, this factor only considers the spring-neap tide variability, thus not accounting for the actual variability of the tide during a storm. In the case of the VI method this could lead to substantial overestimation of the volume of water (particularly in the Atlantic coast of the Iberian peninsula) as it assumes that there is always high water. It would be useful to clearly mention and discuss this point.

5. If I understand correctly from Fig. 1b the tide gauge used for the Mediterranean coast of the Iberian Peninsula is not located in the Iberian Peninsula (seems to be in Africa, on Spanish territory) and may not be the most representative one for the Mediterranean coast as it is located next to the strait and could be affected by currents? Why didn't the authors use other tide gauges from e.g. Barcelona or Valencia? In the same figure, for the sake of completeness, it might also be useful to include in the caption that red dots represent tide gauges.

6. Based on the figures (e.g. fig.4) it seems to me that the highest differences between SRTM and Lidar appear along the barrier islands, mostly in areas that is actually water and where the two datasets do not perfectly overlap. In this context, it might well be that the reported bias and error are overestimated, as the water and the areas of overlap could (should?) be easily masked out. I am not necessarily suggesting that the authors should repeat the calculation but if what I am suggesting is correct, they should discuss this point in the manuscript as I assume that a comparison of the two DEMs should include masking out the water surfaces (while also ensuring that the extent of the two datasets is exactly the same, i.e. that they are co-registered and overlap “completely”).

7. Two minor comments about the figures: In figure 5 the default lines cannot be clearly

seen as they coincide with others. Also, figure A1 leaves the impression that the SRTM includes non-integer values (e.g. A1f). Might there be something wrong there, or have the authors performed some type of interpolation, or did they use one of the newer versions which include non-integer values? If the latter is correct, they should cite correctly which version they used. Also, the x-axis is missing numbering

8. A suggestion - I do not want to be pedantic but "large scale" is actually "small area" or local (because 1:10 scale is larger than 1:100). I am aware that the term is widely used in the context that the authors use it but I would suggest to change this to e.g. "broad scale", "global scale" or "large area" as suggested in some other journal.

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