

Review Report for NHESS-2023-154

1 Overall assessment

The paper titled "A systemic and comprehensive assessment of coastal hazard changes: method and application to France and its overseas territories" is an attempt to, as the title suggests, systemic (e.g, coast as a system) and comprehensive assessment of coastal hazard change (in the context of climate change). The paper goes long discussion about its method, then appears to pull observation from some available repositories (in France), pull climate projection from other studies and proposes to provide a systemic (or systematic?) and comprehensive assessment of coastal hazard changes. The final result boils down to a table of regions where qualitative/quantitative measurements from the above-mentioned data are put together, and a mixture of subjective and objective opinion is provided.

The objective of this paper is ambitious, and necessary in the context of the risk of multiple coastal hazards, and their unknown/uncertain evolution in the changing climate. I would like to thank the authors to take time to work on this topic. However, unfortunately, after reading the manuscript, I was left with a hollow impression. At the current condition of the manuscript, I do not recommend it's publication in NHESS, and my decision would be to **reject**.

2 Reasoning for the decision

Despite my negative decision, below I have tried to provide a relatively broad reasoning of my decision and some ways the work can be improved (in my opinion). I have also marked some smaller matter in the line-by-line comments. I hope it helps the authors to rethink about their approach, analysis, and presentation.

The first one is regarding the physics, and the referencing of the existing knowledge of the physical processes that constitute the hazard. There are countless profound claims regarding storm surge characteristics, tide-surge interactions, contribution of wave setup, link between shoreline and hazard and many more are written, but for which very little or often no reference are provided. For each region in France, for practically each component of hazard in question, there are many available literature that should be cited, but it was not the case. Particularly, the consideration of wave is very highlighted in this paper as a novelty. However, the well outdated (and overused) eqn. of $0.2 H_s$ [1] is too oversimplification of an important factor. One way-around would be to get the best assessment from available studies regarding the scaling, if not there are already existing literature that proposes alternative beach-slope dependent formulations (e.g., [2]). The non-linear interaction between various components - tide, surge, wave-setup are now well established (e.g, [3]) and needs to be well thought too. For the overseas areas of France, there are excellent paper exists that uses sophisticated modelling with thousands of cyclones to quantify hazards (e.g., [4, 5]) - they are needed to be consulted. In broader sense, much more effort must be given to harvest the existing knowledge, particularly over France, the case-study of this paper.

Secondly, The organisation of the paper is odd. The method section (section 2) is very long, with a lot of reasoning (which reads like a discussion rather than a method), and always referring to things in France - the study area - which is actually presented afterwards (section 3). It appears like, although I hope my guess is wrong, that the paper was first drafted for France, and then it was re-organised to present as a globally applicable method with an application to France. As such, if the Section 3 and Section 2 are switched, the text makes more sense.

Finally, for a paper this ambitious, no data analysis is done, most of the figures are off-the-shelves, and most of the results are table, which are not often compact, with repeated results. I was looking for a map that summarises these coastal hazards over France, but it was disappointing to not find one. One approach, that might be of interest for the further development of this paper, would be to do a consensus based assessment, where all the contributing factors listed in this paper are assessed based on existing literature. From there to find how consensus the results are - e.g., IPCC approach. Then, how this consensus differs from the results of the current study - which will potentially identify the research gaps in this line of study.

3 Line-by-Line comments

1. Abstract: It appears that "meteocean events" is the main character of your study. Please consider giving a brief definition of what a "meteocean event" is in the context of the study.
2. L12: Perhaps you meant "metocean" instead of "meteocean"? In the existing literature, I can only find reference to "metocean" which refers to the combined effect of the meteorologic and oceanographic conditions. If "meteocean" (as currently written in the manuscript) was the term you wanted to introduce, please consider introducing it in this line by incorporating briefly the definition to make its meaning clear (compared to "metocean").
3. L27: Please consider adding a few relevant references to the line "Recent research...".
4. L36: What does "very likely" refer to in this context? Same as IPCC terminology?
5. L40: Why ESL is not sufficient to describe the evolution of the coastal hazards? Please consider brief elaboration of the explanation to come, or provide relevant reference or cases where it was found not enough (e.g., Igitabel et al. 2021 that is cited in L44).
6. L46: Please consider adding a connecting line to indicate for which purpose we need to "First, it is necessary to...".
7. L122: Does "consequence" here mean the same as "impacts" as described in IPCC AR5 WG2 report?
8. L141: "The application of the proposed method..." for which purpose? It appears that something is missing from this line.
9. L142-144: This statement is interesting and thought-provoking, please elaborate.
10. L184: What would be the 3-maritime facades of France? Perhaps consider adding a bit more somewhere about the coastline of France.
11. L190: Pickering et al. 2012 - The impact of future sea-level rise on the European Shelf tides
12. L201: Is "meteo-oceanic" event the same as metocean/metoecean event?

13. L213-214: What kind of analysis? How about literature review?
14. L229: "maritime facade" is mentioned again here (directly translated from french façade maritime perhaps? it does not seem to exist in English), please elaborate what it means somewhere in the text.
15. L231: Please consider providing proper journal/article reference (which exists) instead of a generic website from noaa.
16. L234: Please consider adding a real example from published literature.
17. L247: "should" -> "expected to".
18. L250-252: How does these sentences fit to the current discussion of hazard? Please consider rewriting/revising/deleting.
19. L280: Why French coast was chosen to demonstrate the method?
20. Figure 2: Please consider a bit more elaborate caption and add reference to the figure if it is adapted from somewhere else.
21. Figure 2: Please consider putting different colour for so called "marine facade".
22. L280-300: I do not understand the objective of the paragraph regarding the GMSL projections. Neither in your equation of ESL (eq 3.) nor in the list presented in L270 there is GMSL present.
23. L304: Consider giving a 1-2 line summary of Vousdoukas et al. (2018) framework.
24. L305: Are these projections of waves and storm surges published already? Has there been any bias correction done to CMIP5 data?
25. L308-310: Where are these projection coming from? I do not see a reference here. Is it from CMIP 6 project?
26. Table 2: Please add lon,lat location of the tide gauges. Please also add another column with tidal range.
27. L322: In the "standard classification" are there more than 3 types? Please add a reference to standard classification, like Book of Pugh and Woodworth 2014.
28. Figure 3: The figure contains an incomplete description. The Mediterranean is missing, so is the other french islands. What is type of the data? How it was generated? Model? Altimetry? Tide gauges? Please provide further detail.
29. Table 3: Please consider combining Table 3 with Table 2.
30. L359: Please provide the link for ReefTEMPS and DYNALIT services.
31. L361: Why infragravity waves with $H_s \sim 1\text{m}$ can be superimposed on this set-up? Reference?
32. L363: "This information" -> which information? Which geo-morphological configuration?
33. Table 4-5: Are the results taken directly from Vousdoukas et al. (2018) or reanalyzed? It is not clear to me.

34. L380: Reference for this claim about Mediterranean? Or is it analyzed somewhere in this manuscript? It is not clear.
35. Why Table 5 and Table 7 is separated?
36. Same question as above for Table 4 and Table 6.
37. L405: Repeated, not needed.
38. Table 8: Please add relevant reference to another column. Since it is a "qualitative" assessment, without reference it does not hold enough validity. Adding reference to each cases will also add values to all the past regional studies that are done over these various regions. Same goes for related text, where there appears to be no references currently (L428-446). In addition, it is not clear how these subjective labels are provided - e.g., Very high, High etc.
39. Section 3.2.3: How these factors are taken into account? Any subjective or objective comparison?
40. Why Table 9 and 10 are separated? It seems the tide gauge stations are now aggregated. Why it is so?
41. It is not very clear how in Table 9 and 10, the "important" and "most important" labels are applied. Are they coming from assessment of available literature?
42. L614: I believe GMSL is not taken into account here as global sense, rather it was included into RSL. Is it?
43. L665: How the impact of sea level changes on human communities are evaluated in paper? I do not see it. I do not also see where the "anthropogenic structures" are considered, and how it was considered.

References

- [1] Jerome Aucan, Ron K. Hoeke, Curt D. Storlazzi, Justin Stopa, Moritz Wandres, and Ryan Lowe. Waves do not contribute to global sea-level rise. *Nature Climate Change*, 9(1):2–2, December 2018.
- [2] Sean Vitousek, Patrick L. Barnard, Charles H. Fletcher, Neil Frazer, Li Erikson, and Curt D. Storlazzi. Doubling of coastal flooding frequency within decades due to sea-level rise. *Scientific Reports*, 7(1), may 2017.
- [3] Déborah Idier, Xavier Bertin, Philip Thompson, and Mark D. Pickering. Interactions between mean sea level, tide, surge, waves and flooding: Mechanisms and contributions to sea level variations at the coast. *Surveys in Geophysics*, 40(6):1603–1630, jun 2019.
- [4] Y. Krien, B. Dudon, J. Roger, and N. Zahibo. Probabilistic hurricane-induced storm surge hazard assessment in guadeloupe, lesser antilles. *Natural Hazards and Earth System Science*, 15(8):1711–1720, aug 2015.
- [5] Yann Krien, Bernard Dudon, Jean Roger, Gael Arnaud, and Narcisse Zahibo. Assessing storm surge hazard and impact of sea level rise in the lesser antilles case study of martinique. *Natural Hazards and Earth System Sciences*, 17(9):1559–1571, sep 2017.