

## Overall Assessment

The manuscript addresses a highly relevant topic for the natural hazards and coastal risk community. It makes use of data-driven metamodels as an effort to support operational early warnings for marine flooding. The comparison of analog (M1) and meta-model approaches (M2, M3) is scientifically interesting and potentially valuable for researchers and coastal managers. Furthermore, the study is generally well structured and the outcomes are sufficiently described.

However, in its current form, the manuscript requires further clarifications and editing improvements before considering publication. My main concerns arise from the following aspects:

(1) The authors refer to “overflowing” processes, but the widely accepted term of wave run-up is not introduced or discussed. This aspect should be clarified and integrated into the terminology of the manuscript.

(2) Several aspects of the modeling strategy require clearer justifications, including a brief presentation of the constructed pseudo-historical events. In particular, the construction of pseudo-historical events should be better described, including the ranges of forcing parameters. Furthermore,

(3) The extraction of the surge level (SPM) parameter took place at the location of the buoy located offshore (at 50 m depth) and not at the tide gauge located at the nearshore.

(4) M3 method should be more clearly framed as a refinement or extension of M2, mainly improving the spatial reconstruction of flood depths rather than the prediction of flood extent or impact category.

(5) The inclusion of 1000-year return period storm scenarios raise concerns, given the limited observational basis and uncertainties of the hydrodynamic parameters, and thus should be reconsidered.

(6) Use of terminology, technical specifications and text editing.

Once these issues are adequately addressed, I believe that the study could be a meaningful contribution to the coastal hazards literature. For this purpose, detailed commentary is provided to the authors.

## Detailed Comments

### Page 2

**Line 12:** Think that this chapter should be renamed to “Mehodology.”

**Line 13:** This sub-chapter could be renames to “Study Area”

**Lines 27-28:** Modify from “*High Performance Computing, reduced process complexity with generalized overflowing, models or empirical formula, statistical analysis of pre-calculated flooding scenarios*” to “(1) *High Performance Computing (HPC)*; (2) *reduced process complexity with generalized overflowing, models or empirical formulas*; and (3) *statistical analysis of pre-calculated flooding scenarios*”.

**Lines 29-30:** Rephrase from “*Now....guide these technical choices. It is about linking top-down and bottom-up...*” to “*Nowadays....guide through these technical choices. . It is about linking bottom-up*”.

**Line 31:** Exclude “*finally*”.

### Page 3

**Lines 3-4 and Line 32:** Use of the widely acknowledged term of “*Total Water Level (TWL)*” instead of “*total sea levels*”. Replace also elsewhere in the document.

**Lines 5-6:** This sentence shall be replaced/modified to make more sense to the reader “*If databases are often used to work by analogy*”.

**Line 9:** Add a comma or “and to” before (2).

**Lines 12-13 and Line 20:** References listed here shall be updated. There is significant work achieved in this sector since 2020.

**Line 15:** Replace “*it can predict*” with “*they can predict*”.

**Line 22:** Rephrase from “*...forcing conditions and flood maps*” to “*...forcing conditions and the generation of flood maps*”.

**Line 23:** Add a space before “s” (seconds).

**Line 24:** Rephrase from “*The objective is then to investigate*” to “*The objective of this work is to investigate*”.

**Line 27:** Replace “*...with needs of crisis managers*” with “*...according to the needs of crisis managers*”.

#### Page 4

**Lines 1-5:** It is not clear who applied these simulations and if this is an on-line available database. Please justify.

**Line 6:** Rephrase “*In the following*” with “*In the following chapters*” or something relevant.

**Lines 6-11:** Replace “Sect.” with “Section”.

**Line 22:** “NGF”, the abbreviation is not defined.

#### Page 5

**Figure 1A:** The depth scale is not well defined and shows just the 0 and 10 m values. Also, areas close to the shoreline appear to have depth values that are close to 10 m, while offshore values (close to the buoy) appear to have depths close to 0 m (instead of 50 m, as stated later at the text). Suspect that the depth scale here is wrong, please check this aspect carefully. Also, suggest including the north symbol.

**Lines 8-20:** Wave run-up is not mentioned here, a crucial component. Suggest revising this entire section, making the distinctions between wave-wind-river components of coastal flooding clearer to the reader. Suggest providing a distinction between - marine (waves, wind) and - riverine flooding. In alliance with the terminology used in your text.

**Line 19:** Rephrase from “*in particular in*” to “*particularly at*”.

#### Page 6

**Line 5:** “*surge conditions*”. I suspect that you refer to SPM (surge skewness) here. However, how is it possible to extract this parameter from a buoy located at 50 m depth? As surge involves the meteorological contribution to sea level (tide in this case), wouldn't it be safer to estimate this value by using the tide gauge data instead?

**Line 9:** Describe SPM abbreviation before using it (skew surge peak method). Please define also its calculation (is it the difference between max. sea level and max. tidal level?)

**Line 12:** Rephrase from “*peak period  $T_p$ , wave directions  $D_p$  and winds  $D_u$* ” to “*peak period -  $T_p$ , wave direction -  $D_p$  and wind direction -  $D_u$* ”

**Lines 19-20:** Why is SPM (surge level) extracted at the location of the buoy (50 m) and not at the location of the tide gauge? As I see it the proper methodology would be to extract the tide

level (T) at 50 m depth and use this value in conjunction with the sea level measured close to the shore (tide gauge) for estimating surge skewness.

**Line 28:** Correct “*then*” to “*the*”

**Line 30:** Be consistent for the term “pseudo-historical”. Add the quotations “” also in line 21.

**Lines 29-30:** Here you state that “*storms (Fabien, Klaus and Domingos) occurred at low tide coefficients*”. Previously, In line 26 you state that “*Table 1 shows the characteristics of the monitored 8 storms during high tide*”. By checking your table it seems that indeed Klaus, Fabien and Domingos occurred during low tidal level. Please correct this paragraph accordingly.

**Lines 30-31, and Lines 1-2, p. 6:** It is not clear how these pseudo-historical events have been created. You mention that you used the high tide of the synthetic events to construct 80 pseudo-events, but what is the range of the forcing parameters you used for this treatment and which concept was used ? Also, the *Pseudo\_StormName\_TideLevel(NGF)* is not shown or mentioned elsewhere in the manuscript.

## **Page 7**

**Line 2:** Add full name in italic “*Pseudo\_StormName\_TideLevel(NGF)*”.

Line 8:

**Lines 9-10:** Need to be more descriptive on the modeling strategy you used here. Did you use the output of WW3 from Copernicus Marine Service, coupled with the UHAINA model to simulate hydrodynamics, or did you use the WW3 model itself. This should be clearly stated within the text. Also, why UHAINA model is selected amongst others found in the relevant literature. Are there any advantages compared to the usage of other well known hydrodynamic models for which some of your storms have been successfully validated in the past. Specifically, Xynthia is a well-known event that has been previously validated by several models (e.g. Xbeach).

**Line 11:** Be more specific to your grid resolution. Suggest to refer to the specific range of your grid resolution in meters (offshore, nearshore and land).

**Lines 14-16:** English check of this sentence.

## **Page 8**

**Figure 3:** Suggest using a different color than the already used one for showing the box (red) to indicate the land limits of your grid.

**Lines 8-9:** Suggest to rephrase from “*consideration of temporality*“ to “*temporal resolution*”.

**Lines 9-12:** Be clear of the temporal resolution of the synthetic (is it hourly) and the historical, pseudo-events (what’s the resolution you used here and how did you reconstruct the bulk parameters).

**Line 18:** Replace “*Concerning*” with “*Regarding*”.

**Line 19:** Remove “*also*”.

**Lines 22-24:** Check the use of english here and rephrase this sentence.

### **Page 9**

**Line 5:** Suggest being careful here when referring to “*more than millennial*” events, concerning the span of data coverage.

**Lines 13-14:** This sentence is not clear, please rephrase “*It induces that strong storm events are simulated with more tide levels than moderate ones ...*”. Guess you mean “higher levels”.

**Lines 15-18:** How did you conclude to 220 and 32 simulation parameters for learning and testing/validation? This should be clear in the text. What are the combinations used (ranges). Believe that these modeling scenarios should be submitted as a supplementary material accompanying this manuscript.

### **Page 10**

**Lines 2-5:** This should be moved to Lines 15-18, p.8. Also, check the use of english of the first sentence.

**Line 6:** Remove “although”.

**Lines 20-22:** Check the use of english in this sentence (rephrase also problematics).

### **Page 11**

**Line 1:** Again, I strongly disagree the inclusion of storm scenarios with a 1000-year return period. Do you feel confident to include such a scenario on the basis of your hydrodynamic forcing, based on the studied storm events? How do you justify it.

**Lines 12-13:** 30 cm and 50 cm range of SSHmax doesn't sound logical. Think you refer to the range of differences amongst SSHmax. Please clarify and rephrase appropriately.

**Lines 13-15:** Check the use of english.

**Lines 16-21:** Check the use of english.

## **Page 12**

**Lines 1-6:** Check the use of english.

**Lines 9-10:** Max. water height is defined as Hmax. This could create confusion with sea level height. Suggest to rename this parameter to "flood depth". Also, as Hmax is commonly used to describe the max. wave height, this can create confusion for the reader.

**Line 11:** Rephrase from "*Let us define*" to "*This is defined as*" or something relevant.

**Line 21-23:** Check the use of english. A better description is needed here. Suggest to revise the entire 3.1.1 section, considering also the next comment.

## **Page 13**

**Lines 3-6:** This is an interesting finding, how is this justified, is this be supported by relevant works? I'd suggest to enhance this paragraph.

**Line 23:** Exclude "etc."

**Lines 10-13:** Suggest to revise this sentence to be more understandable to the reader.

## **Page 14**

**Line 21:** Provide the full name for RF.

## **Page 15**

**Lines 2-6:** Be consistent with the equations format, according to the journal specs. Numbering needs to be revised for all equations.

**Line 15:** Capitalize "*hmax*".

**Line 20:** “(in M2 and thus M3)” – This is a point where you can state that M3 is used to improve M2.

### **Page 16**

**Figure 8:** Need to revise the legends shown on (A) and (B) for consistency. Also, suggest to revise the figure’s caption to be more understandable to the reader. Indicate also the relevant areas shown on the map of the lagoon on panel B. The use of an arrow could be more indicative.

\* **Entire Section 3.1:** M3 is actually used for the improvement of M2 approach. This can be confusing for the reader. Think that this could be to represent visually through a diagram, showing also the main processes involved in M1, M2 and how M3 is nested in M2.

### **Page 17**

**Figure 9:** As Figure 8.

**Lines 6-7:** Check the use of english.

**Lines 7-9:** Use either (1), (2), (3) or i); ii; iii); as previously done in the text.

### **Page 18**

**Figure 10:** From the results, it is evident that Pseudo\_Klaus\_2.0 (Audence) error is reduced by 25%. However, rest of the “Preudo” cases (and the points) are not significantly affected. This should be highlighted in the text (before line 5).

Lines 8-9: In Figures 11 and 12 there are areas +

### **Page 21**

**Figure 13:** \_CAT panel (upper). As M2 and M3 share the same predictions, the results duplicated for M3 can be excluded, and instead rename the panel for “M2” as “M2-M3”.

**Page 22**

**Line 2:** Here you make use of the entire word “*Section*” instead of “*Sect.*” Suggest to keep it as it is and revise rest of the manuscript accordingly, where needed.

**Line 3:** Make use of “*Table*” instead of “*Tab.*”.

**Page 23**

**Lines 10-18.** Considering the time passed since submission, if there is any update of the outcome of the works stated here, this could be mentioned or/and used for a comparative analysis.