



EGUsphere, referee comment RC1
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Comment on egusphere-2022-1204

Anonymous Referee #1

Referee comment on "Sensitivity analysis of erosion on the landward slope of an earthen flood defense located in southern France submitted to wave overtopping" by Clément Houdard et al., EGU sphere, <https://doi.org/10.5194/egusphere-2022-1204-RC1>, 2022

▪ **Summary**

In this paper, Lutringer et al., 2022 suggested a new method to estimate erosion on the landward slope of an earthen dike submitted to wave overtopping in considering uncertainties. This approach considers the potential compound effects from waves and sea-level height in using the copula method and links it to the wave overtopping and erosion. To calculate the related uncertainties, a sensitivity analysis based on the Sobol index is done which also permits to assess the importance of the drivers carrying uncertainties. This is a case study located on the site: Salin-de-Giraud, Camargue (France).

▪ **General comment**

I find this paper very interesting. The proposed method to assess such processes in considering uncertainties and highlighting the importance of each physical driver is innovative and relevant. However, there are some concerning aspects that the authors should address before this paper can be considered for publication in NHESS. I will list them here, together with some minor/technical corrections.

▪ **Specific comment**

- **Article structure**

I find it confusing to follow the general structure of the paper. Both the data, methods and results are overlapping and should be clearly separated. To me, a discussion section is missing where limitations within this study could be presented.

- **Introduction**

When expressing some aspects of Climate Change and looking into future scenarios, it is important to express the related uncertainty the scientific community addresses as expressed in the IPCC (lines 16-18 for example, how likely is this "increase in storm intensity" in this region?). Some text clarification is needed (line 45 for example: what is an "and" return period ").

- **Data**

It is not clearly expressed which type of data we are referring to, is-it reanalysis data? Modelled data? In-situ observations data? Also, some references about it would be appreciated if possible. Also, the water level data is said to be taken "quite far off the actual place", it is hard both to understand how far it is (maybe adding it on the map of Figure 2 can help) but also and mainly, a justification on the possibility to use such data far from the site location is needed (literature, sea-level analysis, ...).

- **Bivariate Joint Distribution**

It is not clearly written how the "extremes" are identified, it looks like some Peaks over threshold method has been used but it is hard to know, and, if so, we do not know how such threshold value has been chosen. Also, 2 sets of coupled data (V_i , W_i) should be identified if either the peak values V_i is chosen on the sea-level dataset OR the wave dataset, clarification is needed. Concerning the GEV fit, it is hard to know which block length is chosen to apply such distribution and literature would be appreciated. It seems that no correlation-test is made on the 2 sets before applying the copula method as commonly proposed in the literature. Also, recent literature highlighted the need of testing different copula as it is often case dependent. Here, the choice of the copula approach (type of scenario) is not explained and the choice of the Gumbel copula is motivated by "Brummer et al. (2016)" (line 114) which studies a copula approach on flood peaks and river discharge in Switzerland, far from being a coastal region where dynamics can be quite different. Moreover, this paper does not conclude on which copula is best to use in

general but stipulates that it is case specific and investigates the choice of the approach which "has a significant influence on the outcome of the design variable quantiles".

- **Technical correction**

I would specify that this analysis is based on a specific site in the title.

Figure 1 should be part of the section 2, not of the introduction. Also, the figures are not always well presented. For example, the colorbar in Fig. 1 does not present any units. It would be interesting and relevant, I think, to highlight the location of the site and the sea-level tide gauge on figure 2. Using "a" and "b" instead of "bottom" or "top" would, I think, help the reader.

The manuscript needs *in-depth proofreading*, some sentence constructs are hard to follow, and there are few typos throughout the paper (I provide some examples below, but the list is not exhaustive).

Title: "wave overtoppings" should be "wave overtopping"

Line 20: it should be "quite" not "quiet"

Line 77: To clarify the text, I would replace "(see Figure 2)" by "(Figure 2)" or even "(fig. 2)"

Line 81: I think the sentence could be simpler: "The water level, noted N, is then extracted..." could be "The water level (N) is extracted..."

Line 94: "part 3.1" should be "part2.1"

Line 352: I think there is a "0" missing in the number of points proposed and those sentences are hard to understand as it is not clearly written that we are talking about computational time (if I understood correctly the goal of this sentence).

Legend Fig. 10: it should be "at", not "a" and there is a "the" missing before "landward slope"