Responses to Reviewer #1

Below, the reviewer comments are given in *italics*, and our responses in blue plain text.

I have gone through the revised version and, while I appreciate the changes made and the corresponding responses provided by the authors, I find this work is still confusing in some parts. My major concern in the first review was the choice of the probability function for the marginal distributions of sea level and waves, which has been defined as an exponential function. I argued that it may not be the best one for extremes. The authors have responded that the extreme analysis is not the purpose of this work, but in fact, they extrapolate their statistics to values of low probabilities, thus discussing extreme events. This is evident from (some examples):

We have modified the manuscript to concentrate more on the part of the distribution which is not strongly affected by the extrapolation (generally from 100 down to 0.1 events/year). See more detailed responses below.

- Second conclusion in section 5: "This underlines the importance of accounting for the dependence between the variables when calculating the probabilities of high total water levels e.g. for flooding risk estimates"

We reworded this to read: "As the total water level values rarer than 0.1 events/year are also likely underestimated, the dependence between the variables should be accounted for when calculating the probabilities of high total water levels e.g. for flooding risk estimates."

- page 19, line 1: exceedance frequency of 0.01 events/yr

We replaced this with a discussion about less extreme values in the distribution, on frequency interval 100-0.1 events/year.

- page 18, line 5: "Our results obtained from 4-year time series can only be considered a methodological analysis on the applicability of different methods for obtaining exceedance frequencies of high total water levels"

We removed this sentence and instead say just: "Our results obtained from 4-year time series do not provide any flooding risk estimates for practical applications."

- page 13, lines 5 to 10

We replaced the results on extremes with results concerning the part of the distribution which is not so strongly dependent on the choice of the extrapolation function (from 100 down to 0.1 events/year).

- section 3.3: discussions about the tails of the bivariate distributions

This section discusses the differences in the copula-based distributions in general; e.g. the Cramér-von Mises statistics. We reworded the section to clarify that the results here are not relying on the extreme tails of the distributions.

- Figures 6 and 7: extrapolation to very low probability values

We changed the figure axes to remove the lowest extrapolations.

- Etc.

Also, in page 9, l. 14-15: this sentence seems to be in contradiction with the manuscript central idea and with the conclusion stated in the last 2 lines of page 18.

We changed the discussion. Instead of the extremes, we now discuss the underestimation of the total water levels in the frequency interval 100-0.1 events/year, which are more soundly based on the observed distributions and not dependent on the extrapolation function.

So, after reading the manuscript again, my interpretation remains similar. The authors are fitting an exponential function to the entire time series, which provides a good fit because values around the mean dominate. But this does not mean that the same distribution can be used to infer the statistics of the tail of the distribution. Ideally, one should use a combination of two different distributions for different parts of the histogram. Or at least, perform two separate analyses for the mean and extreme regimes. An alternative, which is perhaps less demanding, is to discuss this point in the manuscript and make it explicit when describing the method.

The reviewer's suggestion here seems to be in fact what we have done in the analysis. We used three separate functions for different parts of the distribution: for frequencies above 44 h/yr (the mean regime, 0.5-99.5 %), the empirical distribution function was used. The exponential functions were fitted to the frequencies below 44 h/yr (either CDF for the low tail of the distribution, or CCDF for the high tail.) We clarified the manuscript to point this out:

"We used the empirical frequency distributions for exceedance frequencies between the 0.5 and 99.5 percentiles, which correspond to a frequency of 44 h yr^{-1} in the tail of the CDF/CCDF. We chose to extrapolate the high (low) tails of the distribution by fitting two-parameter exponential functions $F = e^{-\lambda(x - x0)}$ to the CCDFs (CDFs) below this frequency, following e.g Leijala et al. (2018). This method was applied consistently to the sea level, significant wave height (only high tail), and total water level data. The PDFs were obtained by numerically differentiating the CDFs. As our main focus in this study is not on the extrapolated extreme ends of the distribution, we left more detailed considerations of the extrapolation function out and considered the simple exponential function sufficient for our purposes."

In section 3.3, I understand that the authors have included a number of Copula functions to respond to another reviewer's request. However, some of them are clearly not suitable, so what is the purpose of showing the results that do not fit the data? In my opinion it would be enough to mention that 9 have been tested and only a subset of the best fits is shown.

We agree that it would be possible to show only the best fitting copulas. However, on our opinion, it is better to show explicitly how the different copulas behave. This provides the reader an opportunity to see the difference between suitable and not suitable copulas, not just rely on our subjective assessment.