

Response to the questions of reviewer one

First of all I would like to again thank the referee for his/her thoughtful comments, time and interest in the manuscript. I have put the referees comments in italics and my answers are given in plain text.

This new version of the manuscript has been improved from the original one and the author has considered most of my comments. I still have a couple of items I would like to see in the final version. Otherwise, the list of minor comments can be found below.

General Comments:

The author discussed in the method section (lines 131-136) about the fact that change in extremes is not accounted for i.e. by 2150, the model considers extremes will follow the same statistics as present time. I think it's an important point and the author point out if such data were existing, they could be plugged into the model.

I think it would be good to restate this point / discuss it in the conclusion as a caveat.

A discussion has been added on L319-324

I still find the figure font quite small, and I still believe having a twin axis with return period in addition of frequencies would be useful for a reader. Especially as the tool is intended for decision makers; a return period is more likely something perceived by the potential users compared to a frequency.

In this update I have redrawn all figures using practically the largest font I could fit within the panels.

Regarding the twin y-axes, I was unclear in the first response. It is not just a preference of mine to use planning period probability instead of yearly probability or both. It is, in fact impossible to translate planning period probability into a unique return period in these plots. In other words, these plots cannot be made with a twin y-axis showing yearly probability (1/ return period) and planning period probability for three different planning periods simultaneously. I will try to give a more detailed explanation in the following.

Firstly, the CDFs from which the return period (1/yearly probability) could be determined for the mean and mean + extreme panels are time dependent. That is, the return period of seeing say a 2 m sea level today at Ringhals is perhaps 10000 years, while the same sea level might have a return period of perhaps 5 years in 2150. The planning period probability is fixed during a planning period, while the yearly probability is not. Therefore there is no one to one

correspondence between planning period probability and yearly probability, so a single extra y-axis cannot do the translation.

Secondly, even for the extreme only panel, which has a stationary distribution there is no one to one correspondence between planning period probability and yearly probability. In fact, in this case, it is the return level i.e. sea level above the mean that has a one to one correspondence with return period (like in Fig. 1b). That, is it would be more natural with double x-axes than double y-axes in this case. This can also be seen by noting that for every x-value in the extreme only panel there are three y-values, one for each planning period length. Therefore, one would need three different y-axes or a double x-axis in this case. However, the double x-axis would be very hard to fit, and it would not work in the other panels because of the non-stationary distributions.

In conclusion, I agree that it would be informative for planners if planning period probabilities could be translated into yearly probabilities, but I don't believe it is possible in those figures. In Hieronymus & Kalén (2022) we did calculate the yearly probability of the extreme component of joint (mean+extreme) sea level maximum with a fixed 1/10000 planning period probability. This I think is a useful diagnostic, but it relies on first freezing the planning period probability, so it would not work in the figures shown here. Ultimately, I believe that thinking in terms of return period is only useful for processes that are stationary or close to stationary, so for sea level I would advocate moving away from them.

Minor Comments:

line 36: "This is of course a great hindrance", maybe "barrier" or "Obstacle" instead of "hindrance"; this is just a suggestion

I have now changed to obstacle.

Line 66-68: "the first paper..." and later "second paper"; Citations are missing. Which papers? also I would suggest using "study" or "work" instead of paper

Citations are added and the word paper is changed to study.

Line 70: maybe itemise the new features?

They are now itemized.

There are a multitude of figure reference with the ")" I would remove it. E.g. instead of "Fig.1b)" just write "Fig. 1b" etc - all the references to figure 1 basically.

I have redone the referencing according to the reviewers suggestion.

In Figure 1, the location of b) is not great. Top left corner would be better.

The b) is moved to the top left corner.

Line 108. This sentence is not needed. This has already been explained few times. "Each such one armed bandit implies that there is a random process in operation when going from one module to the next."

It is now removed.

Around line 150, maybe add a number to each module in figure 1 so you can refer it in text. The sentence would be more fluid. For example: "in the third and forth module from the left in Fig.1 " could be simplified to "in the third and fourth moduleS"

Numbers have been added to the modules in Fig. 1a and the sentence has been rewritten according to the reviewers suggestion.

Line 156: "ascribed" maybe "attributed" instead – again just a suggestion.

I changed to attributed.

Line 233: "it is plain to see that both the mean and the mean + extreme panel of the plot are dominated by this scenario at frequencies lower than approximately 10 3 ." not fully sure it is that obvious without comparing to the simulation without the low confidence scenarios.

The plain to see part has been removed.

Line 281-282: The upper panels show the relative density of the mean and extreme sea level contributions to the joint sea level maxima. Reverse to match how they appear in figure (left is extreme and right mean).

I have switched extreme and mean.

Line 286: "does give" maybe just "give"

I switched to just give.

Line 308: "examples by (Hieronymus, 2021; Hieronymus and Kalén, 2022)."
Remove parenthesis.

It have been removed.

Line 314: "The list of possible new applications is very long." replace "very long" by "extensive"

it now says extensive.

Line 320: "find the the inverse" remove one "the"

one the has been removed.