Earth System Dynamics Discussions

Earth Syst. Dynam. Discuss., author comment AC1
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Reply on RC1

Ralf Weisse et al.

Author comment on "Sea level dynamics and coastal erosion in the Baltic Sea region" by Ralf Weisse et al., Earth Syst. Dynam. Discuss., https://doi.org/10.5194/esd-2021-6-AC1, 2021

We thank Referee #1 for the constructive comments that have helped us to clarify and improve some points in our manuscript. In the following, we show how we will address the individual issues raised by the reviewer in the revised manuscript.

In the first paragraph of the review, the referee states that parts of the manuscript are "too generic and sometimes superficial". While the reviewer acknowledges that "a good number of references" is "included that will point the reader towards detailed results" he/she argues that the "manuscript must be extended to include at last the major results". In the original manuscript, we intentionally preferred general assessments rather than specific numbers that are available from the referenced literature. The latter typically vary depending on, for example, the periods considered, the methods used, etc. However, we acknowledge the point that this might appear too generic. To address the issue we will revise the manuscript by including more specific results and numbers from the referenced literature, specifically on the magnitude of sea level variability, its regional distribution, and the values of sea level extremes as measured by tide gauges and derived from models.

In the first bullet point, the referee provides several specific suggestions related to the same point. These will be accounted for as follows:

- We will include a map illustrating the spatial distribution of mean sea level changes
- Similarly, a map for extremes will be added.
- We will further add a figure illustrating the relation between Baltic Sea level and the large-scale atmospheric circulation.
- Also, a map of measured coastline changes for the Baltic Sea will be included.

The specific points raised by the referee will be addressed as follows:

- Lines 84-85: We agree that this is misleading. In the referenced publication, it means that if we refer to the external trend; that is at the entrance of the Baltic Sea (1.6 mm/year) as "100%", then local values may deviate by as much as 25% caused by redistribution within the Baltic Sea. We will reformulate this part to make this clear and explicit.
- Line 246: We will add the additional reference suggested by the referee.
- Line 255-257: We agree that this misleading. The acceleration referenced only refers to the observational period. We will revise the manuscript and clarify that the contribution

is only small if we assume that it does not change in the future. The latter appears unlikely if ice sheets (in particular Antarctica) melt more rapidly in the future.

- Line 294-303: Storm surge heights will be included in the discussion.
- Line 336 (and in many other places throughout the manuscript): A map with local names will be included.
- Lines 356-357: Will be added as suggested.
- Lines 362-363: We agree. The point is not fully/correctly addressed in the original manuscript. Corresponding statements and discussions will be included. We will also add the suggested reference and remove the one presently used in the manuscript because the latter is a summary of the reference suggested by the referee.
- Line 374: The authors of the referenced study tested the "ability" of the classic methods for extracting the trend of 0.5 mm/yr (using linear regression and the Mann-Kendall method) against the presence of normally distributed random error with a standard deviation of 0.5 m. Both methods indicated the presence of the trend. For the actual data, the linear regression method revealed statistically significant increases in basin-wide significant wave heights for 1993-2015 (typically 20,000-40,000 snapshots of wave fields each year) whereas the Mann-Kendall method did not. The total change was about 12 cm that is about 10% of the overall significant wave height. We will clarify this point in the revised manuscript.
- Line 387: Pressure will be added.
- Lines 403-407: We partly agree. Strictly and as suggested by the reviewer, the point belongs to the previous section. However, it is needed here for understanding and contextualization, as changes in the mean will affect the extremes. To address the point, we suggest moving it to the previous section but also restating it here and making it clearer that changes in the extremes depend on changes in the mean.
- Lines 454-461: The comment is true, but we think restating these concepts is essential for contextualization of the Baltic Sea specifics. To address the point we will rewrite the paragraph with a somewhat stronger focus on the Baltic Sea and clearer links to the following paragraphs.
- Section 3.3: We agree but think that the various types of missing data need to be filled concurrently, as we say at the end of the section. However, we also recognize that the model output of drivers (in the case of the Baltic coast, this is primarily waves) is important, and indeed some efforts are on the way, running wave models at a resolution suggested by the reviewer. We will provide some additional sentences to that effect in a revised manuscript. However, it does not negate any of the statements made so far in section 3.3.

Minor errors and typos will be corrected as suggested.