Earth System Dynamics Discussions

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Comment on esd-2021-6

Anonymous Referee #1

Referee 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-RC1, 2021

This manuscript is a summary of part of the outputs of a recent regional assessment report in the Baltic Sea. In particular, it focusses on a compilation of results on sea level changes and coastal morphology features in the region. Despite its aim being a review paper, I find the description of the sea level and coastline changes too generic and sometimes superficial. I recognise that there is a good number of references included that will point the reader towards detailed results. However, I believe that a manuscript must be self-consistent and not limited to a broad description or summary of earlier works. In my opinion, this manuscript must be extended to include at least the major results it describes. After reading the main body of the manuscript, I still have no clue about the magnitude of the sea level variability, its regional distribution or the values of sea level extremes as measured by tide gauges and how well these are captured by hydrodynamic models, to mention some examples. Some insights into wind-wave distributions would also be welcome. I am giving some specific suggestions below, although probably the authors can add or change some of them based on their knowledge and their identification of the major issues to be highlighted.

- In sections on mean sea level and extreme sea levels I have found the description rather superficial, despite the number of references included. I believe that it should at least show the results that are being described and discussed. For example, I think some maps are needed to 1) represent spatial patterns of mean sea level changes (trends, for example) and 2) show the magnitude of the extremes, their spatial distribution and possibly the changes. Additionally, also it could be included 3) maps with impacts of NAO, as these are mentioned several times. Likewise, in section on erosion, again, little information is provided on the observed changes in coastal morphology and on erosion/accretion rates (or patterns).
- Lines 84-85: “About 75%...”. Where does the other 25% come from? Probably not

volume change. Later, from section 2.1.2 seems that this difference can be attributed to westerlies, but I would say that these are also exchanges with the North Sea. Please clarify.

- Line 246: An additional reference that could be added here is Dangendorf et al (2019) https://doi.org/10.1038/s41558-019-0531-8. Acceleration in GMSL has been detected since the early 1970s and remains nearly constant. The method uses a sea level reconstruction based on tide gauge data and knowledge on regional drivers.
- Lines 255-257: this is very unlikely to occur, given that the conditions will not be the same during the 21st century. If Baltic sea level is largely driven by North Atlantic sea level, it will also follow it in the future.
- Paragraph 294-303: I miss here a quantitative description of the intensity (height) of the storm surges.
- Line 336 (and in many other places throughout the manuscript): many local names are used. It would be useful for the reader to include a map with their location.
- Lines 356-357: "higher extremes …" because of reduced friction at the bottom
- Lines 362-363: since many stations show a decreased in relative mean sea level, the trends in sea level extremes are also negative (see e.g. Marcos an Woodworth 2017, doi:10.1002/2017JC013065).
- Line 374: I am surprised that 5 mm/yr in significant wave height is really significant. Or even it can be measured.
- Line 387: "wind-induced extremes" is written, but these are induced by wind and atmospheric pressure, right?
- Lines 403-407: "Relative sea level….". I think this sentence is a bit vague. Also, it should go into the previous section as it refers to mean sea level.
- Lines 454-461: In my view this part of the text is very general and applies to any sedimentary coast. Can it be rewritten focusing on the Baltic Sea?
- Section 3.3: It seems to me that these knowledge gaps in this section will be extremely difficult to address without high resolution (o<1km) model outputs of the forcing that causes coastline changes. In my view, the first step to understand past changes requires a deeper knowledge of the driving mechanisms. This should go before evaluating future changes in forcing variables.

Minor errors and typos:

- Lines 68, 79: remove commas.
- Line 275: remove "in combination"
- Line 333: remove "still"
- Line 713: "considerable efforts… changes" in mean and extreme sea level.