Ocean Science

Discussions

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Interactive comment on "Extreme Sea Levels in the Baltic Sea under Climate Change Scenarios. Part 1: Model Validation and Sensitivity" *by* Christian Dieterich et al.

Anonymous Referee #2

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General comments

This study aims to validate the simulations of regional coupled circulation model by testing its extreme sea level outputs for the Baltic Sea region. For the downscaling of global model and of reanalysis outcomes, regional coupled model RCA4-NEMO is used. Results indicate that regional coupled model estimates on extreme sea levels are representing the observations on the stations, in general, well.

I think this paper focuses on very crucial topic for Baltic Sea, since the mechanisms driving mean sea level variability and extreme sea level variability are not well established for different regions of the Baltic Sea. Overall, the paper is well designed and

C1

addresses a key topic of the Baltic Sea.

However, I think, there are some issues needed to be clarified in terms of content and writing style of the paper. In that sense, I tried to contribute to increase the quality of the paper by pointing some lines which can be found below. Hopefully it will be useful for authors in order to make the paper more reader friendly and clarified. (I think paper needs to be proofread by an external person. Given the case that there is a research gap on modelling MSL and ESL, this paper will be read by different authors in near future. Therefore, it would be very efficient to make this paper reader friendly)

First of all, the novelty of paper is not well written. Could authors please clearly write down why is this study important? (in Abstract and Introduction)

Secondly, the paper is a little bit hard to read. I have an impression that paper is written much quicker than it should be. Therefore, text is not distilled enough to easily follow the line of paper's story. For instance, first sentence of the abstract is already confusing. It basically claims that regional climate change scenarios are validated in the recent past. One may ask: how can you validate scenarios by comparing them with the recent past of extreme sea levels? I would try to formulate the first sentence in a way to avoid this complexity. It may be formulated like: We analyzed a regional climate model with respect to variability of recent extreme sea levels in the Baltic Sea. (if this sentence is true, it is much easier to read).

OR

'We investigated the variability of mean and extreme sea levels under different climate scenarios by using a regional coupled model for the Baltic Sea.' (Since the paper indeed also analyzes mean sea level variability)

Technical corrections

P1L3 (Page1Line23): Sentence:'. . .have been downscaled'. Is it dynamically or statistically downscaled? Please put it in front of the word 'downscaled'.

C2

P1L4: Sentence 'Validation of 100-year....' Is also complicated to read. Do authors mean: 'Along the Swedish coast, simulations indicate a significant coherency of the model comparing to the estimations based on ESL observations, except for the sea level stations on the west coast, in terms of 100-year return periods of ESLs'?

P1L5: Sentence reads: 'The ensemble mean 100-year return levels turns out to be the best estimator with biases less than 10 cm.' I did not understand this sentence. Because up-to-now, this study only analyzes 100-year return levels. Or there are other return level periods that are analyzed in this study? If yes, which return periods?

P1L6: Sentence starts with: 'The ensemble spread..'. This sentence is redundant. It should be removed from the abstract.

P1L10: Please update the sentence starting in this line in this way: 'Some regions like Skagerrak, Gulf of Finland...'.

P1L14: which observational records? Tide gauges?

Authors use sometimes term 'sea level' in the text. Please make it clear whether you mention about 'mean sea level' or 'extreme sea level'.

I did not understand the sentence in P1L23: 'That has lead to harbours falling dry with economic impact on local societies.'. Do authors mean 'This relative fall of mean sea level rise along the harbours caused economic damages for local societies.'? Order of sentences in the paragraph is also confusing. Because authors first mention about increasing risk of being flooded, then say that indeed relative sea level is falling. It is hard to understand the logic behind it. Connections between paragraphs are also a bit weak. First paragraph can be put just before the paragraph starts with Analyses of ESLs by Weisse et al. (P3L1).

What does 100-year return level mean? I could not see any explanation about it. This is a concept which should be briefly explained in this paper.

P2L7 Please revise 'has coordinated to an ensemble' to 'has coordinated to an ensem-

ble mean'

P2L9 again add 'mean' to next to the word 'ensemble'

P2L13 Sentence starts at this line does not mention about the region. Where will be the magnitude of GIA and GMSL effects same in terms of relative sea level rise?

Can authors briefly explain the methods that they applied in this study at the end of introduction? (before P4L3).

P4L3: First two sentences of this paragraph should be placed earlier in the introduction section where the authors explain the novelty of this study.

P4L10: Which paper? Please put the reference. And please also write the principle conclusion of that paper, if it is needed to understand the scope of this paper.

P5L12 please cite the paper at the end of the sentence.

P8L11: Why Landsort is chosen, not Stockholm?

P8L18: Authors mention that modeled and observed sea surface for the period 1970-1999 is compared in Fig 1. You have observations only along the coasts. But interpretation of comparison covers the inner side of the Baltic Sea. Please explain which kind of assumption you did. Also show where is Skagerrak Where is Kattegat Where is Bothnian Bay? Please put them on the figure.

P15L1: What is a,b,c in Figure 5?

P16L2: Sentence: 'In the Baltic sea the impact on ESLs is negligible'. What is the subject of this sentence? I did not understand the sentence. This sentence is also a good sample representing the common mistakes in terms of writing style through whole paper. Writing part needs more attention than authors gave for this paper.

P23L7; It is mentioned that SLR,tides. Storm surges and wind waves increase the 100-year return levels more than SLR alone over the German Bight. I understand that

authors would like to show the importance of including high frequency variations in sea level, but German Bight is not in the Baltic Sea. For example, as far as I know, tides do not play an important role in driving sea level variability in the Baltic Sea. In that sense, please try to cite a study which has analysed high frequency sea level in the Baltic Sea. Or say why German Bight is representative for the Baltic Sea.

P23L25. Again the same issue. The sentence 'Similar for the ocean-only models'. Where is the subject of the sentence? I understand what authors mean, but they did not write exactly what they would like to say.

P23L35. I think sentence should start with 'Observation based' not 'Observationally based.' In Discussion section, it is mentioned that a second part of the study discusses the sea level projections. I could not understand what is the point of putting this information here. Because it is not further discussed and also study is not properly cited.

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