

## ***Interactive comment on “Mechanisms of variability of decadal sea-level trends in the Baltic Sea over the 20th century” by Sitar Karabil et al.***

### **Anonymous Referee #2**

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In the present study “Mechanisms of variability of decadal sea-level trends in the Baltic Sea over the 20th century” the authors use long tide gauge records and reconstructions of different climatic variables to study large-scale factors influencing trends in the Baltic Sea level. Regional sea level trends can deviate strongly from global trends and therefore it is of great importance to understand the factors influencing sea level trends at regional scales. Thus, the present study could give valuable new insights into the factors influencing regional sea-level trends in the Baltic Sea. However, I have some concerns regarding this manuscript and I would recommend a major revision before the study could be published in Earth System Dynamics. I will list my concerns and comments below.

Major comments:

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A) The authors present an interesting approach by filtering the direct influence of the atmospheric forcing on the sea level trends and only looking at the residuals. However, they do not show how relevant these residuals are. On page 8, 1st paragraph they only mention that for their regression model they use the first 5 principal components of the SLP trends that explain around 80% of the variance of SLP trends. But how large are the residuals of the regression analysis for the sea level trends? And how much of the variance of the sea level trends do these residuals explain?

B) The data sets used all cover different time periods. From the figures and the text it is not always clear which time period is used for which analysis. For consistency it would be best to use the common time period from 1901-2012 for all analysis except for the SSHA reconstructions and the NCEP/NCAR precipitation reconstruction, where it should be clearly indicated that only shorter time series are used. Further, I am missing a discussion of the quality of the data sets and possible problems with the data sets especially during the first decades.

C) A lot of the analyses are based on correlations, which in some cases are quite small. However, it is not shown if these correlations are significant. I would suggest to only plot the significant correlations in shading and the rest just as contours. (See also my comments on the figures below.)

D) The conclusion section is quite short and I am missing a discussion of the results and their implications.

E) The presentation of the figures should be improved. (See below for detailed comments.)

Further comments:

1.) The abstract should be rewritten to be more concise. For example, most of the 2nd paragraph could be cut and instead a stronger focus should be on the results.

2.) Page 8, line 11 and Figure 5: Why are only 9 tide gauges considered and not the

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full 29?

3.) Page 8, line 31: The results are not very surprising since this was the aim of the approach, but the figures do not really add any new information. Therefore, I would only put them in the supplementary material.

4.) Figures 3, 4, 5, 6, 7, 8, and 9: The colour bar is not very well chosen. It is difficult to distinguish the colours for correlations between 0.6 and 1.0 and -0.5 and -1.0. I would suggest to only plot the significant correlations in colour and otherwise just the contours for example. And then to use a better separated colour scheme for the higher correlations. Further, in the multi-panel figures I would only plot one colour bar next to the whole figure and not individually for each panel. Instead I would make the subfigures larger.

5.) Figures 4, 5, 8, 9, 10: The positioning of the subfigures is a bit confusing. I would suggest to put Stockholm in the left column and Warnemünde in the right column and then arrange by season from top to bottom.

6.) Figure 4: I would crop the figures to focus on the Baltic Sea region since the correlations over the Atlantic are not discussed anyway.

7.) Figure 10: The titles are way too small and the colours are not explained.

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