We thank the reviewer very much for reviewing our manuscript, for providing constructive criticism and useful suggestions. We respond to all comments below.

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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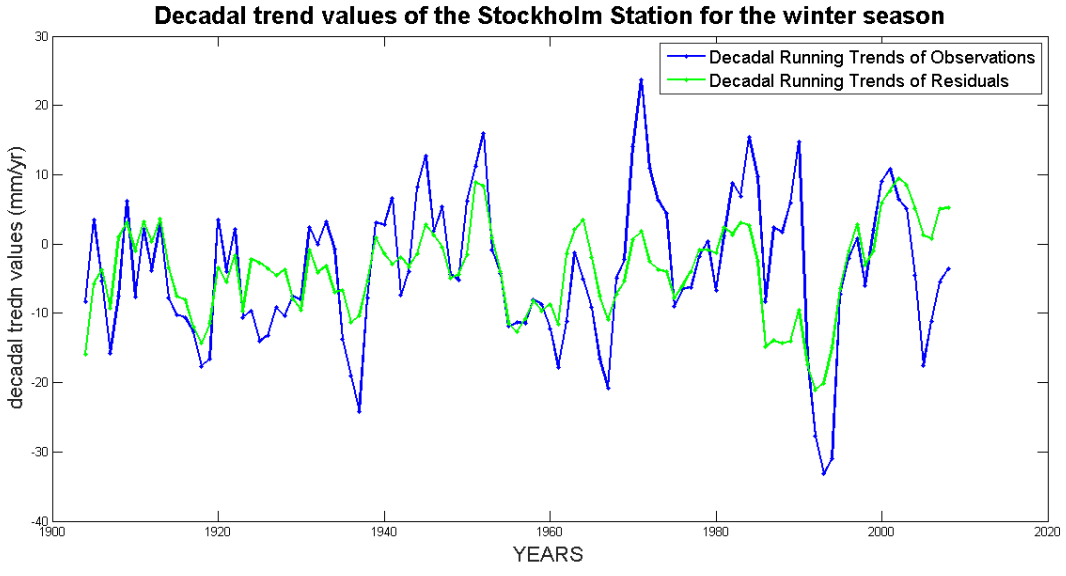
In the present study "Mechanisms of variability of decadal sea-level trends in the Baltic Sea over the 20th century" the authors use long tide gauge records and reconstructions of different climatic variables to study large-scale factors influencing trends in the Baltic Sea level. Regional sea level 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:

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?

We will clarify the text and comment on decadal SL trend variations, decadal SL residual trend variations.

In the following figure, we show the decadal running trends of observations (blue) and of residuals (green) for the Stockholm station in wintertime.



Here, we consider the Stockholm station for the wintertime over the period 1900-2012. The sea-level trend residuals explain 41% variance of sea-level trends. The maximum (minimum) value of sea-level trend residuals in this period is 9.5 (-21.1) mm/year.

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.

We indeed always use the same period of analysis.

For the analysis, we used PSMSL (www.psmsl.org) data sets. These data sets are quality controlled.

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.)

We will include a contour indicating the significant correlations.

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

We will expand the conclusion and focus more on implications of the results.

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

We will improve the quality of Figure presentations.

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.

We will rewrite the abstract according to this suggestion.

2.) Page 8, line 11 and Figure 5: Why are only 9 tide gauges considered and not the full 29?

We consider these tide gauges to be representative of the Baltic Sea, well distributed over the Baltic Sea region and have long records.

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.

We will move them to 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.

We will improve the quality of correlation scale based on the suggestion. We will plot only one colour bar next to the whole figure and expand the subfigures.

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.

We will reorder the positions of the subfigures based on the suggestion.

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.

We will modify the representation of the figures accordingly.

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

We will add explanation of colours and make the size of the titles larger.