

DOI: 10.5194/egusphere-2022-935
Version: June 2, 2023
Title: The acceleration of sea-level rise along the coast of the Netherlands started in the 1960s
Authors: Iris Keizer, D. Le Bars, C. de Valk, A. Jüling, R. van de Wal, and S. Drijfhout

Point by point reply to reviewer #2

We Thank the reviewer for their additional comments on the manuscript and address these points below. All comments have been implemented and contribute to the quality of the manuscript.

Summary

This is my second review of the paper. I want to Thank the authors' work and effort answering my recommendations to the first version of the manuscript, which I believe helped to improve the paper. Authors answered to my main comments. First, they included an Appendix with the tide gauge's individual SLR rates, giving a clear explanation of why they decided to use the six tide gauges average through the paper. In addition, at the end of section five, they discuss the differences in the SLR rates obtained from the individual tide gauges when compared to their average, giving the reader the complete information to ponder the paper's results. Second, authors expanded the information related to the nodal effect on sea-level in an Appendix, what I believe also helps to explain some paper's details which might be important to some particular readers. Finally, Appendix C in my view presents a stronger case of the possible drivers of low frequency wind-driven sea level variations in the Netherland's coasts, found in this research. Therefore, I have no main comments on the new version of the paper. However, I present some specific comments and minor recommendations to the authors for them to consider include into the final version of the paper.

Specific Comments and Minor Recommendations

- *L50. Appendixes are named as "Appendix" and as "App." (L123). Please use the same naming. Besides, verify Appendixes are organized in the same order as they are mentioned in the main text.*

Thank you, we implemented this suggestion.

- *L56. ... meridional surface wind velocities ...*

Thank you, we implemented this suggestion.

- *L109. Tables are named as "Tbl." and as "Table" (L149). Please use the same naming for tables and figures.*

Thank you, we implemented this suggestion.

- *L127. . . . nodal tide and wind effects.*

Thank you, we implemented this suggestion.

- *Table 1 legend. Third line. “. . . predictive variables for wind effects.”. Use the same lower case Phi symbol, as in the formulas.*

Thank you, we implemented this suggestion.

- *Figure 2 legend. First line. “. . . with three sea level time series obtained from the Generalised . . . ”.*

Thank you, we implemented this suggestion.

- *L220. . . . (1988) with . . .*

Thank you, we implemented this suggestion.

- *Figure 3 legend. Last row. (d) Detrended and smoothed time series shown in (a).*

Thank you, we implemented this suggestion.

- *Table 2. Please mention this table in the results section. Table 2 is only mentioned in the Conclusions section of the main text (L333).*

In Section 4.3 on Rates of Sea Level Rise, we have added references to Table 2. Firstly, in the first sentence (line 227), where we mention that the rates of sea level rise obtained from each of the four models are shown in Fig. 4, and the average rates over different periods are provided in Table 2. Secondly, in line 239, we present the specific rates of sea level rise for the model TrNtW over different periods, accompanied by references to both Fig. 4 and Table 2.

- *L258. Calafat and Chambers (2013) and Steffebauer et al. (2002).*

Thank you, we implemented this suggestion.

- *L298. In this version is (App. A).*

Thank you, we implemented this suggestion.

- *L330. Fig. 4.*

Thank you, we implemented this suggestion.

- *L333-L335. Consider moving this sentence to the Discussion section as this is not a conclusion from the paper.*

We moved the sentence to the discussion section. As it didn't fit into any of the existing paragraphs, it is added as a new paragraph with some context.

- *Appendix A. I find the difference between the nodal tide from the GAMs models and the equilibrium tide too large. For clarity, please mention or give a reference to the method used to obtain the equilibrium tide from the individual tide gauge records. In my view, to accurately assess the equilibrium tide, the nodal cycle has to be calculated in each of the most important lunar tidal constituents (e.g. <https://doi.org/10.1016/j.csr.2009.10.006>). To assess the nodal effect on sea level, these constituents' nodal cycles (amplitude and phase) should be added. I understand that such calculations are probably out of the scope of the paper. However, a reference to the method used to compute the equilibrium tide I think is needed as in my view, the nodal cycle obtained from the GAMs somehow is a novel method to assess the nodal cycle effect in long annual sea level records.*

We have addressed your valuable comment by incorporating the reference for the estimation of the equilibrium tide to Section Appendix A: Nodal Effects on Sea Level. The equilibrium tide computation in our study follows the approach outlined in Woodworth, 2012 (<https://doi.org/10.2112/JCOASTRES-D-11A-00023.1>). This method was also utilized in the budget calculations conducted by Frederikse et al. (<https://doi.org/10.1002/2016GL070750>).

- *Please verify colors in Fig. A1(a) and its legend. Besides, I found legend in Fig. A1(b) confusing. Consider a different legend (e.g. OSL-TrW; OSL-Nt-TrW; OSL-ET-TrW; OSL-Et; OSL for observed sea level). The last spectra is not mentioned in the legend.*

After reviewing the colors and legend of Figure A1, we have made adjustments to enhance clarity. Specifically, we have modified the appearance of the TrNtPd line by making it a broken line, thereby improving the visibility of the plot. Furthermore, we have updated the legend of A1(b) to clearly indicate when the residual is plotted and which signal is represented. Additionally, we have included a statement in the caption of Figure A1 mentioning that the spectrum of the equilibrium tide (Et) is plotted.

- *In the appendix text the spectra from "Et" is not mentioned but it is shown in Fig A1(b). I do not understand why the "Et" residual spectra has low energy in the nodal period, while the "TrEtW" residual spectra has much more energy in this period.*

To provide a clearer explanation, we have refined the text of Appendix A by incorporating the following lines: "Due to the use of the multitaper method, the spectrum of Et does not manifest as a single peak at 18.613 years; rather, it appears as a broad peak centered around that period due to the windowing effect. As anticipated, in the vicinity of the equilibrium tide period, the residuals of TrW retain the majority of the energy since this model does not encompass the nodal tide, thereby leaving the nodal tide signal in the residuals. Conversely, when the equilibrium tide is incorporated into the model ($TrEtW$), the nodal tide signal should no longer persist in the residuals, resulting in a reduced power in the spectrum around the equilibrium tide period. We observe that indeed less power remains around this period, and the power removed is equivalent to the power of the equilibrium tide (Et). However, a substantial amount of energy remains compared to the utilization of $TrNtW$. This outcome underscores our decision to employ a statistical estimation for the nodal tide."

- *L356 – 357. Please rephrase the sentence. I understand that the $TrNtW$ and $TrEtW$ models use the trend and wind as predictive variables, but they differ because the former uses the nodal tide obtained from the GAMs, while the latter uses the equilibrium tide. However, this is not what the sentence indicates.*

We have added an explanatory sentence to clarify the context: "The reconstructed sea level is obtained for three models: TrW , which includes the sea-level trend and zonal and meridional wind but excludes the nodal tide; $TrNtW$, which includes the sea-level trend, zonal and meridional wind, and the nodal tide estimated using a particular method; and $TrEtW$, which employs the same predictive variables as TrW but corrects the sea level data using the equilibrium tide. By comparing the results of $TrEtW$ and $TrNtW$, which differ only in their method of obtaining the nodal tide, we can examine the impact of the chosen method on the resulting nodal tide estimation."

- *Appendix B. Consider including in Figure B1, the SLR obtained from the six tide gauge average using the $TrNtW$ model, as shown in Figure 4e and f (orange line). This would be useful to the reader to observe individual tide gauge sea level rate differences from the average. In Figure B1 legend, second line, replace $TrNtZw$ for $TrNtW$.*

Thank you, excellent suggestion, we included the average to the plots.