

Authors Response to the comments of two anonymous reviewer **RC1** on the manuscript *egusphere-2025-5715*

„An ensemble of regional wind wave scenarios for the North Sea and the Baltic Sea: a revisit“ by Nikolaus Groll and Iris Grabemann

We would like to thank reviewer #1 for the comments, which helped us to improve the manuscript. The reviewer's comments are shown in blue below. The author's response will appear below each comment, and any suggested changes to the text will be in orange and italics. The referred line numbers correspond to the line numbers in the original submitted manuscript.

1. General comments:

The scientific methods and assumptions are clearly outlined, and the experiments and calculations are well described. It would be helpful to mention the sources of the regional climate model data, e.g. where the data was provided/downloaded from. This would facilitate reproduction by fellow scientists.

We agree with the reviewer that making the regional atmospheric model data available would be beneficial. However, due to the age of many of the simulations, the original high-resolution data are no longer available.

2. Specific comments:

The changes in significant wave height are analysed and discussed. Changes in wave periods and directions are not analysed or discussed, even though these can also have important implications, e.g. for coastal erosion and flooding. The limitation of the study to significant wave height should be clearer outlined, e.g. in the title or introduction.

In the revised manuscript, we are more precise by adding the term 'significant wave height' and changing the term 'wave conditions' to 'significant wave height'. We also stated that other wave parameters, such as period and direction, are important but are not discussed in this study.

L41: Revisiting the work of Grabemann et al. (2015) in the North Sea and Groll et al. (2017) in the Baltic Sea, this study evaluates *changes in the significant wave height based on* an updated and expanded ensemble of regional wave climate projections.

L47: By extending the limited number of regional wave projections, the greater ensemble allows to be subdivided into larger sub-ensembles of high- and low-emission scenarios. *This enables a more detailed analysis of the effects of emissions on the significance of wave height.*

L51: Applying a unified analysis method across all scenarios provides a robust basis for interpreting projected changes in *significant wave height* conditions in both the North Sea and the Baltic Sea. *Although changes in other wave parameters, such as period and direction, can have a significant impact on coastal erosion and protection, this study focuses on changes in significant wave height.*

L57: By combining CMIP3 and CMIP5-based projections into one ensemble, the analysis provides a better estimate on the range of uncertainty in future *significant wave height* conditions for the North Sea and Baltic Sea.

The authors show that patterns of change may diverge depending on the statistical variable under consideration. The implications of climate change signals could be discussed in the 'Discussion' section. For example, a relative change in the ensemble median or the 99th percentile, or the maximum and with the same magnitude can have different implications.

We added a paragraph to point out that the same relative changes, could have different implications on the median or extreme significant wave height.

L 275: Median SWH increases are more concentrated in the northern Baltic and are of a similar magnitude. *Even if the relative changes in median or extreme SWH are comparable, it should be noted that the absolute values differ and depending on the region. These values range from approximately +/-10 cm for the median, -20 cm to +50 cm for the 99th percentile, and up to +1 m for the yearly maximum SWH (see Appendix for more details). Depending on the region and application, these differences could impact sediment transport, coastal erosion, coastal protection infrastructure, and offshore planning and safety in different ways.*

3. Technical corrections:

L134: Replace the plural 'areas' with the singular.

We corrected areas to *area*

L279: the word 'is' is missing before 'evident'.

We added *is* before evident

NOTE:

While working on the revised version of the manuscript to address the reviewers' comments, we found inconsistencies in the calculation of the 30-year running means for some ensemble members (e5cc_a1b_1, e5cc_a1b_2, e5cc_b1_1 and e5cc_b1_2) at location GBI. Consistent calculations of the time series of 30-year running means for these four ensemble members led to slight changes in the ensemble medians for high and low emission scenarios. While the overall conclusion remains the same, the description of Figure 4 in the submitted manuscript has been adapted as follows:

L204: Although neither exhibits a consistent upward trend throughout the 21st century, both ensemble medians show an increase towards the end. *The high-emission sub-ensemble also showed a statistically significant increase in the middle of the simulation period, demonstrating a rise of over 8%. Both ensembles showed an increase of around 5% towards the end of the simulation period, but only the increase for the high-emission sub-ensemble was statistically significant.*

L207: The median for the high-emission sub-ensemble again shows a larger and statistically significant increase of *more than* 5 % by the end of the century.

L211: By contrast, the sub-ensemble for low-emission scenarios exhibits *no significant changes*, suggesting that changes in the 99th percentile SWH at GBI are less robust.

L215: Neither the median SWH *for the high- and low-emission sub-ensembles, nor the maximum and 99th percentile SWH for the low-emission sub-ensembles*, shows statistically significant changes, implying that any trends are either too small to detect or are masked by substantial internal ensemble variability.

L288: The time series analysis for the location in the German Bight shows, that the high-emission scenarios exhibit stronger and more consistent increases over time than low-emission scenarios. ~~-, although statistically significant trends are primarily confined to the 99th percentile.~~