

## ***Interactive comment on “An atmosphere-wave regional coupled model: improving predictions of wave heights and surface winds in the Southern North Sea” by Kathrin Wahle et al.***

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Authors: Thank you for the review of our manuscript. We appreciate the constructive comments and will revise the manuscript in accordance with the reviewer’s comments.

R#2: Manuscript “An atmosphere-wave regional coupled model: improving predictions of wave heights and surface winds in the Southern North Sea by Kathrin Wahle et al. evaluates the effect of model coupling on the accuracy of modelled wave field in coastal areas. Model coupling especially for short-term forecasting purposes is a very topical issue and it is nice to see that the progress includes also coastal modelling. However, the authors state in several places that coupling of atmosphere and wave models is not novel in itself and that coupled models have been run operationally in many forecasting

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centres for decades. A reader would expect more detailed analysis of the effects of coupling on the coastal modelling, which is the novelty of this paper. Also, the analysis of the results should be done more carefully. In several places there are statements that are not entirely supported by the Figures presented (cf. specific comments). The paper is fairly well structured, but the formulations and language require some further attention. I also recommend that the language is checked by a native speaker.

Authors: We agree. The manuscript has been revised and the analyses of the model results were more precisely presented. Deeper discussion and more information are provided of the role of two-way coupling on the coastal model results. Following the similar comments of the Reviewer #1 this Section has been re-organized (see also the answers to Reviewer #1 comments about that).

R#2: The revised manuscript has been carefully checked by a native speaker, typos and errors in English language have been corrected.

R#2: Some specific comments: Section 1. Introduction: This section could be better structured and written. Explicit statements of what the authors are studying in this paper could be put in one place, preferably at the end of this section. Also the references to previous studies should be better formulated. Now it seems just a list of different coupled models presented in earlier studies. Please highlight their connection to the present study.

Authors: We agree with the comments and the suggested revisions have been done. The introduction part has been re-organized following this suggestion. Earlier works have been better formulated and new references added. The discussion on what we are studying in this manuscript, stressing on the novelty compared to the early studies is given now in one paragraph.

R#2: Section 2.3: Please give a short description of how the coupling was done, not just a reference to article by Ho-Hagemann et al.

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Authors: The suggested revision has been done in Section 2 of the revised manuscript.

R#2: Section 2.4, line 206: Here should probably be a reference to Fig. 1c, not 1b

Authors: We apologize for the mistake and refer now to the correct figure.

R#2: Section 3.1, line 221: "reasons explained above" - Should it be "due to earlier explained reasons" and please give a reference to the section, where this explanation is given or explain it here.

Authors: The text has been modified and we provided clearer statements.

R#2: Section 3.1: Did you compare the altimeter data against the Waveriders? How good is the accuracy of the altimeter data in the North Sea? And how was the match-up done between altimeter data and model data (distance in space and time, averaging, etc.)?

Authors: We agree that additional information is needed. In the revised manuscript we included a new sub-section (now Section 3.1) dealing with comparisons of altimeter data against in-situ measurements. Analyses and new figures demonstrating these comparisons have been also included in the revised version. We also included a discussion about the match-up of altimeter and model data in our study.

R#2: What is the number of matched model-measured pairs for each altimeter and buoy?

Authors: For the altimeter data these numbers are given in Table1 (about 7000 for each of them). For the buoys there are about 4000 matched pairs. These numbers have been also now given in Sections 3.2 and 3.3, correspondingly, of the revised manuscript.

R#2: Section 3.1, line 239-240: "In both cases measured and modelled wave heights are in good agreement" - is this really so? There seems to be quite big differences between the modelled and measured values along the track. Please be more precise.

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Authors: The suggested revisions have been done. The validation results have been more precisely discussed in Section 3.2 and additional arguments and explanations presented.

R#2: Section 3.1, line 245-246: “the two-way coupled model results are closer to the measurements” - This is true for latitudes 54-55 and 57-58, but around latitude 56, the one-way coupled model seems to be closer to measurements. More detailed analysis is required.

Authors: We agree with the comment about the discussion of the comparisons with the measurements. More detailed analyses have been added in Section 3.2 about the spatial (latitudinal) distribution of the satellite data and model simulations. Critical discussion on the results has been included.

R#2: Fig. 3: Why not use the same altimeter track to compare the performance on low-wind and storm conditions?

Authors: The choice of tracks to compare the performance (Figure 5 and Figure 6 in the revised manuscript), also following the comments of the reviewer #1, has been discussed in Section 3.2 in the revised manuscript.

R#2: Section 3.1, lines 266-267: “Throughout the period WAM-NS-1wc shows the highest significant wave height” - This is true for Helgoland, but not for Westerland, where WAM-GB-1wc occasionally has higher values.

Authors: We agree with the comment and this has been added in the revised manuscript. Additional analyses are provided making now the description in Section 2 more precisely.

R#2: Section 3.1, lines 283-284 and Fig. 4d: What actually happens on December 5th in the Westerland in WAM-GB-1wc. Why is it behaving completely differently from the other setups? Nothing in the wind field seems to be supporting this kind of behaviour.

Authors: We apologize for the mistake, which we made while plotting WAM-GB-1wc

run (blue line in Fig.4). The figure has been plotted correctly (Figure 7 in the revised manuscript).

R#2: Figure 4: Would it be possible to mark the locations of the wave buoys to figures 4a and 4b. Although their locations are shown in Fig. 1, it would be easier for the reader to evaluate the model performance, if the locations would also be marked here.

Authors: Following the Reviewer #1 suggestions, the organization of the figures has been changed in the revised manuscript. The different sub-plots have been split into separate figures. The patterns in the new Figures were made larger. Additionally, the quality of the individual figures has been improved. Some of them have been re-ordered following the logics in the text. Figure 4 a,b is Figure 8 and Fig. 4c,d – Fig. 7.

R#2: Figure 8: Please use scales that show the whole range of the presented values of the chosen periods. Authors: As described in the text the wave age is calculated as the quotient of phase and friction velocity it gets very high values by calm weather conditions when the wind speed is very low. Therefore, we introduced a wave age limit in the plots making the time variability and the ranges clearer. Additional information and description on the wave age plots has been added in Section 4.

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