Answers to the reviewers of “The impact of intertidal areas on the carbonate system of the southern North Sea” by Fabian Schwichtenberg, Johannes Pätsch, Michael Ernst Böttcher, Helmuth Thomas, Vera Winde, Kay-Christian Emeis.

The authors thank the reviewers for their comments to improve the BGD-manuscript.

In the following we list all reviewer comments (blue, italic) and give answers (black).

## *Anonymous Referee #1*

*I went through the responses to both reviewers’ comments and the revised manuscript version. I believe they have well addressed most of my earlier comments. The structure has much improved, the aim of the manuscript has become clearer, and the TA budget and TA/DIC ratios are better explained.*

*A few minor comments I still have:*
*- The abstract could still benefit from a concluding statement*

We introduced the following sentence at the end of the abstract: “Despite of the scarcity of high-resolution field data it is shown that anaerobic degradation in the Wadden Sea is one of the main contributors of elevated summer TA values in the southern North Sea.”

*- I don’t fully understand your description on L. 158-162. On L.158 you mention “pelagic and benthic degradation and remineralisation” If I understand your description well, this is only aerobic (since on L.160-161 you write: “Benthic denitrification and other anaerobic processes have no impact on pelagic TA concentrations in this model version”. However, “the remineralisation products ammonium and phosphate”(L.162) can also come from anaerobic decomposition of organic matter. Please clarify in your text.*

You are right, this may be confusing: We write now: “In this model version benthic denitrification has no impact on pelagic TA concentrations. Other benthic anaerobic processes are not considered. Only the carbonate ions from benthic calcite dilution increase pelagic TA concentrations. Aerobic remineralisation releases ammonium and phosphate, which enter the pelagic system across the benthic-pelagic interface and alter the pelagic TA concentration.”

*- L.169: “above” where exactly? Add a reference to the corresponding section. I believe they are only discussed afterwards, equation (2) is presented much later in the text.*

Yes, “above” stems from the original text. We write now “For scenario B we used the same model configuration as for scenario A and additionally implemented Wadden Sea export rates of TA and DIC as described in section 2.3.1.”

*- L.220-225 are a great addition and very helpful but an actual definition (in words) of effective river input is still lacking. I suggest to add that around the introduction of eq. 1.*

We augmented the first sentence of this section, and write now: “In order to analyse the net effect on concentrations in the sea due to river input, the effective river input ($Riv_{eff}$ [Gmol $yr^{-1}$]) is introduced:”

*- It might make sense to swap the order of 2.3.1 and 2.3.2, or at least refer to 2.3.2 on L.252*

After equation (2) we reference now to 2.3.2: “Differences in measured concentrations in the Wadden Sea during rising and falling water levels, as decribed in section 2.3.2, were temporally interpolated and summarized as wad_sta [mmol $m^{-3}$].”

## *Anonymous Referee #2*

*Technical corrections:*
*Note that TA is a equivalent, rather than a concentration.*

We have chosen to apply SI units or direct derivatives in our study. As such the unit attributed to alkalinity is the one of a concentration. Accordingly, we have chosen to attribute concentration to alkalinity.

*Lines 128-129, "It is applied to several regional sea areas worldwide", references?*

We added corresponding references.

*Lines 569-571, Note that oxidation of iron will reduce TA, and nitrification of ammonium consumes TA without changes in DIC.*

You are right, oxidation of iron reduces TA. We changed the text accordingly: “ .. by oxidation of iron (consuming TA) ..”