

Biogeosciences Discuss., referee comment RC1
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Comment on bg-2022-143

Anonymous Referee #1

Referee comment on "Metabolic alkalinity release from large port facilities (Hamburg, Germany) and impact on coastal carbon storage" by Mona Norbisrath et al.,
Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-143-RC1>, 2022

General Comments

This well written and thorough manuscript describes the biogeochemical processes occurring in the Elbe river estuary and links these to anthropogenic influences. The modelled biogeochemical cycles are well considered and describe a large source of TA within the estuary. This TA source is described as being caused by the dissolution of CaCO₃ sediments which is assumed to be driven by the increased organic matter and N loading of the estuary. Biogeochemical processes are explored in detail, although much of this is hypothetical discussion.

One weakness of the study is that all biogeochemical processes are estimated from dissolved concentrations rather than from other field observations, for example benthic sediment incubations or water profiles. The estimation of biogeochemical processes within estuaries is complex due to the dynamic interactions occurring over tidal cycles (salt wedge and tidal movements influencing benthic sediment interactions), diel cycles (changes in benthic O₂ caused by respiration/photosynthesis), seasonal cycles influencing metabolism rates, and all influenced by different riverine flow rates. While I agree that the processes identified here are likely occurring within the estuary, the accuracy of the predictions (e.g. that 90% of TA is due to CaCO₃ dissolution) may have a high level of inaccuracy and may have high temporal variability. It is useful to use modelled results, however it is important to highlight the uncertainties and assumptions associated with them in all sections of the manuscript.

Other Comments

L17 – wording - 'resulting in maximum'

L60 – I suggest separating the two research questions for clarity. I also note that the 2nd research question doesn't receive much attention in the abstract or conclusion.

L65 – Provide more detail on 'surface water samples'.

L139 – What is the source of wind speed measurement DWD? If wind speed was not measured in situ then where was the data source and at what resolution was the data collected as wind speed can greatly influence flux estimates and this uncertainty should be clarified.

L157 – Provide details of box volume measurements and fill time estimates. Errors associated with both volume and fill time should be incorporated into the mass balance calculations. E.g. errors in the generic river width, depth etc. in Table 1.

L176 – Outer boundary conditions measured two months later. Is this an issue? Please justify.

L190 – The sentence is vague and poorly structured. Clarify the term 'imported' and clarify the link between PIC and CaCO₃ dissolution.

L308 – This section contains the most clear findings of the paper but seems hidden within the manuscript.

Table 3. Errors of species in the first half of the table seem optimistically low. Are all cumulative errors considered? Errors of samples, box volumes, flow rates, fluxes...etc.

L437 – replace 'vanishing' with a more appropriate term.

L442-L447 – This speculation reads as discussion not conclusions

END OF COMMENTS