General Response

We thank the editor and reviewers for their constructive comment, careful reading and constructive feedback. We have carefully revised the manuscript and addressed each point. Below is a detailed, point-by-point response.

Response to Editor Comments

We have reviewed the manuscript thoroughly and made the suggested minor corrections to improve clarity, including, clarifying figures, adjusting wording.

We understand this decision of Referee#2 and have not added new discussion on pCO_2 dynamics, in accordance with the editor's guidance.

Report #1:

We are pleased that the reviewer finds our study valuable and acknowledges the improvements in the revised manuscript. We have addressed major and minor comments, focusing on figure clarity, discussion balance, and simplifying geographical language.

Overall comment: The reviewer recommends clarifying figures and figure texts, better supporting riverine influence in discussion (or emphasizing tidal pumping if preferred), and simplifying geographical language to improve readability.

1. Figures das been revised for clarity, including improved labels and captions to better tie them to the text (see Figures 4–6).
2. We added information on tidal pumping and streamlined the discussion of riverine influence to better align with the Introduction and Conclusions. The Study side section were updated with additional information on sluices and rivers to provide context for riverine and tidal influences.
3. Geographical island names were minimized. This should improve readability for international readers while preserving scientific clarity. We also added information to the map (sluice).

Into/result: We expanded the Study site section to include sluice locations, operation frequency, and information on the Weser and Ems rivers. We clarified seasonal river flows (including low summer flows).

202: Additional information was added to the section study side and the discussion.

235/fig. 3: The figure description has been updated, symbols enlarged, and the text clarified to improve readability and interpretation. Additionally, sections 3.3 and 3.4 were swapped in the manuscript to better highlight TA production, ensuring that the discussion of TA and DIC dynamics follows a logical and clear progression.

Fig. 3 see above

272: Added a sentence explaining the use of the 200 µmol/kg TA-DIC limit.

Fig. 5 Added statistical support (linear regression, p-values) to confirm significant trends in TA excess. Scatterplots were changed to boxplots for clarity (now section 3.3 and Fig. 4).

Fig. 6: Potential misinterpretation of this figure. This likely arises from the previous, less detailed description. Not all seasons are represented in the figure; only the difference between March and May (ΔMarch-May) is shown. The seasonal difference was calculated for each station based on nitrate (ΔNO_3^-) and silicic acid (ΔSiO_2) concentrations. To improve clarity, the legend and figure description

have been updated to explicitly indicate that the data represent March–May differences. Slopes are now labeled as C:N and C:Si to clearly indicate that these are the calculated ratios from our dataset.

405: We added additional information in the discussion regarding tidal driven fluxes.

Minor comments:

Fig. 1: We added the sluice location and station CAR_S_076 to ensure clarity. Since the river is not the main driver of changes in TA and DIC, we did not include it in detail.

2.3 Discrete samples: CO2SYS constants were all added

168: We rephrased the wording and updated the equations to improve readability and ensure they reflect the correct formulation

Lines 142, 168, 174, 184, 239, 267, 275, 286, 329, 341: Wording clarified, equations updated, TA/DIC sections rewritten, ranges added, and additional information included where needed.

Fig. 4: Regression added to the figure.

Report#2:

pCO_2 data integration: We acknowledge this point. While continuous pCO_2 data were collected, it was not the focus of the current study. In accordance with the editor's guidance, no additional discussion on pCO_2 has been added, as the manuscript already provides a dense and focused analysis of TA and DIC dynamics.

- **Changes in Manuscript:** Lines X–Y: Added clarification on scope and rationale for focusing on TA/DIC.

Minor corrections (units, equations, definitions):

- All minor corrections suggested in the annotated PDF have been implemented, including:
    - Correcting units throughout the manuscript.
    - Updating equations where necessary.
    - Clarifying definitions for key parameters.
- **Changes in Manuscript:** Units, equations, and definitions corrected per suggestions.