

Review for EGUSphere – 2025 – 5050 manuscript

Marine carbonate system variability from tidal to seasonal timescales at the interface between the North Sea and Wadden Sea

Ourradi Y., et al.

General comments

This work is solid and worth publishing. The authors have performed a thorough analysis of the available dataset and are proposing data analysis techniques that are not commonly used for coastal or marine carbonate system chemistry, but their use is robust and provides the means to reveal the complex carbonate chemistry dynamics and potential driving mechanisms in the study area. Worth commenting that the authors advocate the need, importance and significance of long term high frequency measurements and observation programmes as a cornerstone to study how complex marine ecosystems behave and respond to multiple stressors.

The main drawback of the study is that it focuses on observations and data from a single location, from which assumptions on carbonate chemistry and carbon fluxes dynamics of a larger area are inferred. Moreover, the justification on how representative the sampling location is for the entire area (Wadden Sea) is rather thin.

Besides that, there are some minor points in a few sections that can be clarified and maybe phrased in a simpler way so that it's even easier for the reader to follow.

Some specific comments on the sections are mentioned below.

Introduction

Comprehensive and solid, setting the scene for what will be presented later.

Line 54: how accurate is “accurately”? Can the definition introduced by (Newton et al., 2015) be used in coastal carbonate chemistry?

Materials and Methods

The section is well written and clear. There are, however, 2 points, that might not sound constructive as to an extent the authors will not be able to resolve them easily, however they are worth mentioning. Any further elaboration and explanation from the author might strengthen the document.

The accuracy of the Temperature sensor (± 0.2 °C) is not the best and not ideal when used in carbonate chemistry and/or air – sea CO₂ fluxes. On a similar note, the use of a bucket for collecting samples that will be analysed for DIC and pH.

Both points mentioned above can introduce errors. The temperature accuracy can be accounted for when evaluating error and uncertainty estimation, however the use of a bucket might give an error that will not be possible to characterize and account for. Saying that the statistical analysis

and comparisons that are presented do give confidence that any introduced errors are more than likely minimal/non significant, however these points “stick out”.

Additional remarks.

Section 2.1: As already mentioned in the general comments section, how representative is the sampling location for the Wadden Sea when one investigates carbonate system dynamics and biogeochemical patterns?

Data Quality

Line 379: The authors mention: “... using different statistical metrics, including...”. Are there more techniques/metrics? More than likely not so might need to rephrase and be specific.

Is this work following the methodology and equations presented in Nondal et al., 2009? If so to which extent? It’s also not clear where the results are presented (e.g. is it table 2?).

Line 415: Does the term “positively” suggest “strong” or “similar” comparison or it also has a “positive” (i.e. increasing) direction? Might need to rephrase

Line 459: How much is slightly? Same in lines 466 and 467 were the terms “minimal” and “substantial” are used. Can the authors provide numbers for them? In general, it might increase the clarity if such generic terms are not used (subject to editorial team as well).

Section 4.1.2. Valid assumptions, which would have been even stronger if supported by oxygen data/information. Again apologies for not being very constructive, but having DO information would have provided a better picture for NCP and respiration. Surprised also that the nutrient data are not mentioned here rather in the following section(?)

Figure 7; Some errors in the caption e.g. May is used instead of March, June instead of summer, etc. Please make consistent with Figure labels.

Section 4.2.3. Nice work and Figure 9 has a very interesting approach!

Suggested references mentioned in the review

Newton J.A., Feely R. A., Jewett E. B., Williamson P. & Mathis J., 2015. Global Ocean Acidification Observing Network: Requirements and Governance Plan. Second Edition, GOA-ON, http://www.goa-on.org/docs/GOA-ON_plan_print.pdf.