

egosphere-2025-2914

“Quantifying the farmed kelp atmospheric CO₂ uptake through localized air-sea flux in the Northern Gulf of Alaska”

Haag et al.

Author’s response

We thank the editor for their encouraging and constructive comments on the manuscript. Specific concerns are addressed in detail below.

Comments from Editor:

Line 21: the language here is biased, please adjust. The CO₂ sink is described as being actively strengthened by the farm, while the CO₂ source is implicitly described as being circumstantial (“experienced outflux”), not necessarily driven by the farm.

We have changed the language to make both farms more active and therefore remove bias. The farm experiencing outflux is now described as: “one farm reversed the natural sink by releasing carbon over the deployment period.”

On lines 267-268, both the CO₂ source and the sink are described as being actively caused by the kelp farms. The main take-home message seems to be that kelp farms are not always sinks of CO₂ from the atmosphere as one might expect, but they can also act as CO₂ sources. However, only CO₂ uptake and not release is mentioned in the title, which could also be viewed as a continuation of the biased language mentioned in my point above. If you agree with my summary of the take-home message above, please adapt the title to better reflect it. (Both comments above: I do not mean to imply that the authors have used biased language deliberately or that there is any ill intent!)

We have changed the title to “Quantifying farmed kelp atmospheric CO₂ uptake and release through localized air-sea flux measurements in the Northern Gulf of Alaska” to remove the biased language. We appreciate this note as the title has remained the same throughout the entire project and was never revisited as the story developed.

Additionally the title needs another word (e.g. “measurements”) after “localized air-sea flux” to make proper sense.

We have added the word “measurements.”

Line 109: please clarify whether the CRM used to calibrate the DIC measurements or as a check on some other calibration.

We have tried to clarify by saying that the CRM was used to “create a standard curve with which to calibrate the instrument as it may drift over time.” Before analysis, we input within the analyzer the expected values associated with the CRM, so it is the instrument that is making the standard curve and applying corrections to the samples. A CRM is measured at the beginning, end, and at intervals between samples to ensure that there isn’t any drift occurring.

Line 111: please mention how the TA instrument was calibrated.

We did not calibrate the TA instrument. We measured a CRM throughout the analysis and used the difference between what was measured versus expected to calculate the uncertainty across all samples. Therefore, at the beginning of a day of analysis, spare seawater was analyzed multiple times until the instrument has stabilized to ensure that the instrument was ready. We have added “using a CRM to later calculate sample uncertainty” to the text.

Line 160: the statement that water mass properties are altered only by mixing is true only in the interior ocean. In the surface, evaporation/precipitation and air-sea heat fluxes also modify salinity and temperature. Indeed one could argue that ‘water mass’ is not an appropriate term to describe this surface layer variability. Please rephrase.

We have added the additional processes mentioned here, with the caveat that at such small scale they are likely not to influence the water mass passing from the outside to the inside mooring: “, or processes such as evaporation/precipitation and air-sea heat fluxes that should be negligible at small scales such as the distance between moorings.”

Line 421: one of the reviewers made a comment I believe is relevant to this point – asking how growing kelp can net release DIC. Your answer provided in the response is okay (“aging kelp became a strong net source of DIC relative to early stages of kelp growth”), but I think that it would be helpful to also provide a brief sentence on it in the manuscript (probably including the Xiong et al. citation), because it is still confusing to the reader as currently written.

We have included this in the introduction in lines 40-42 when first discussing the idea of using kelp as carbon credits: “and aging kelp can become a strong net source of dissolved inorganic carbon relative to early stages of kelp, thus restricting the length of time a farm can actively drawdown atmospheric CO₂ (Xiong et al. 2024).”

Finally, the manuscript needs careful copy-editing. Some examples that I noticed can be found below but please check through everything again.

In the abstract, ‘seawater CO₂’ should be ‘seawater pCO₂’ or ‘seawater fCO₂’, as appropriate (several times).

We have changed seawater CO₂ to seawater pCO₂ in the abstract.

Line 21: “flux” needs a direction (presumably “influx”?) and a from where (“influx from the atmosphere”?)

We have changed “flux” to “influx” to indicate that the Windy Bay farm is strengthening the natural influx of carbon from atmosphere to ocean.

Line 44: citation(s) needed.

We have added this citation: Bednaršek, N., Pelletier, G., Beck, M. W., Feely, R. A., Siegrist, Z., Kiefer, D., Davis, J., Peabody, B.: Predictable patterns within the kelp forest can indirectly create temporary refugia from ocean acidification. *Sci. of the Tot. Env.*, 945, 174065, doi: [10.1016/j.scitotenv.2024.174065](https://doi.org/10.1016/j.scitotenv.2024.174065), 2024.

Line 44: “a local refugia” => “local refugia” or “a local refugium”
Changed to “local refugia.”

Line 100: TM should be superscript or the TM symbol? (after Science First)
TM has been made superscript.

Line 113: “electrode specific” => “electrode-specific”
Change made.

Line 123: where did the errors for the constants come from? Needs citation.
We have added the Orr et al. 2018 citation and have rearranged the order of the sources of error to make it clear that the CO2Sys constants are associated with that citation.

Line 133: please provide the equation for the TA-S relationship.
We have included the Evans et al. equation in the text and cited Equation A1 from the appendix for the new relationship we estimated for Kalsin Bay.

Line 206: “within site” => “within-site”
Change made.

Line 214: “indicate” => “indicated”
Change made.

Line 217: unclosed parenthesis.
Second parenthesis added.

Line 347: “have” => “has”
Change made.

Line 349: the added “also” doesn’t seem to make sense here
“Also” has been removed.

Line 393: “respectfully” => “respectively”
Change made.

Line 359: “observed 12 January” => “observed on 12 January”
“On” added.

Line 364: remove comma after “(2014)”
Comma removed.

Line 366: clarify which study is being referred to by “this study”
We have changed “this study” to “our study” to indicate this one.