Overview

The paper “The Alkalinity Blue Carbon Pump: Tidal pumping drives long-term CO_2 sequestration as alkalinity in salt marshes” measured carbon fluxes in a small saltmarsh in France. It includes seasonal time series during low tide, mixing models, open incubations and sediment cores. The dataset is very comprehensive, the manuscript well-structured and figures informative. However, there are some mythological issues that need to be resolved before publication.

General comments

Reading the abstract, I assumed you measured pyrite and aerobic respiration. Only say “driven by” if you measured the driver, if not add “potentially” or remove. The abstract (also the results and discussion) should focus on the strengths of the paper: seasonal changes and biogeochemical drivers, rather than the weak points (ecosystem scale fluxes).

The introduction is quite broad. It could be more tailored to the study, clearly defining specific knowledge gaps. The last paraph should include a summary how research questions were addressed.

Calculating daily fluxes based on only ebb tide, using a freshwater endmember from a different water body and ocean endmember from a mid-tide saltmarsh water sample seems problematic. I suggest presenting results for high tide and freshwater endmembers and a mixing model with exclusively ebbtide data (add a figure showing fluxes per month for both). Then emphasize limitations and what each approach represents. Giving total fluxes per hour/ low tide seems more appropriate than daily fluxes.

Using open and static incubations to quantify process that are driven by tidal pumping in deep anoxic layers likely underestimates TA and DIC fluxes.

Expand sections in results and discussion about seasonal trends and biogeochemical drivers of TA and DIC (title suggest these are your focus). E.g. add some regressions of concentrations or ebbtide delta values. Largely reduce and summarise sections about outwelling and fluxes (remove Fig 8).

Comments by line

L16 Ta fluxes driven by aerobic respiration?

L19 How much higher?

L161 And DIC?

L222-229: On the maps it lokes like the creek and the North Canal are not connected. Are there some small canals connecting them or how can you justify applying a mixing model with endmembers from a different water body?

L283 This section is not central to your overall story and could be presented as a supplementary table (and text) instead. These values are only relevant for the mixing models.

Fig 3. Delta TA, DIC and DOC continue to increase until 240. This suggests that the maximum delta concertations have not yet been reached potentially underestimating tidal fluxes.

L353-361 The mudflats are likely also TA sources. Using a mid-tide sample as ocean endmember seems wrong to me and explains the extremely low carbon fluxes (e.g. 5 DIC mmol/m2/d) versus other saltmarsh sites with typically > 100 mmol/m2/d. I would present results for high tide and freshwater

endmembers and a mixing model with exclusively ebbtide data. Then emphasize limitations and what each approach represents.

Fig 4. Also show nutrients and DO.

Fig 6. Use delta only from ebb tide data.

L772 Subscript.