<u>Review #2</u>

Main comment

The authors provide important insights into soil carbon variability based on the biogeochemical characterisation of the study site. The results are interesting and valuable for the 'blue carbon community' and emphasise the thorough investigations needed to assess carbon stocks in tidal marsh habitats accurately. Some clarifications would benefit the manuscript.

- Most blue carbon stock and sequestration rate studies focus on Total Organic Carbon concentrations. The manuscript focuses on total soil carbon (assuming this is the term the authors use for both organic and inorganic components). Organic and inorganic carbon fractions in soil can react differently under redox conditions. It's important to make this distinction.

We thank the reviewer for this comment. The reviewer is correct in their assumption that we report soil C as Total soil C, and that we did not separate soil C into organic vs inorganic. In a revised version of the manuscript we will clarify that we report Total Soil C, and to make the comment that inorganic and organic are two separate pools of C that react differently under variable redox conditions, but we only measure total C in this study. We will highlight this limitation in our study.

- There seems to be some confusion regarding the terminology relating to carbon stocks vs concentrations. The methodology section covers soil C % calculations. However, the core stock calculations are missing and are only mentioned in section 4.4. If other data is used from previous publications to calculate soil carbon stocks, this should be detailed in the methodology.

We thank the reviewer for this comment and agree there should be a clearer explanation of soil C stock calculations in the methods. We do mention that other values (bulk density) were used from a previous study (Line 513) to calculate soil C stock, but we agree this information should also be mentioned in the methods near the soil % calculations and will include it in a revised version of the manuscript.

- The statistical methods chosen in the manuscript need more clarification, perhaps in the supplementary materials. Were the assumptions of equal variance and normality met before proceeding with ANOVA? What criteria were used for the subset of predictors in the stepwise regression model? Why was the stepwise regression model chosen over partial least squares regression?

Assumptions of ANOVA were met by assessing for normality with QQ plots and we transformed the data to achieve normality when necessary (Fe^{2+}, S^{2-}, DOC, and Total Fe). Equal variance was tested to ensure homogeneity in variance between subgroups with a

Levene's test. In the revised version, we will include this information as well as the criteria used for the stepwise regression model predictors.

- In the conclusion sections of the manuscript, the authors make sampling recommendations for carbon stock assessments. It would be useful to briefly compare with existing sampling guidance e.g., Howard et al., 2014 and Bansal et al., 2023. These guidance documents recommend sampling based on marsh zonations and at the time of highest plant biomass (late summer). Given that most guidance documents aim to provide sampling for quantification of long-term TOC carbon pools, perhaps it's better to emphasise the importance of sampling from multiple locations within the marsh, rather than seasonal sampling.

We thank the reviewer for this comment and agree that reviewing our recommendations alongside other recommendations would make this article more useful and meaningful. We will add a discussion to the end of section 4.4, when discussing soil carbon storage rates and stocks and further discuss our recommendations for accounting for this ecosystem scale variability rather than seasonal sampling.

Other comments

Please check the manuscript for consistency with abbreviations e.g., 12 cm vs 12cm vs 12-cm.

We thank the reviewer for this comment. In a revised version of the manuscript, we will ensure that we are consistent with abbreviations and units.