

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2022-101

Nathan McTigue (Referee)

Referee comment on "Trace gas fluxes from tidal salt marsh soils: implications for carbon–sulfur biogeochemistry" by Margaret Capooci and Rodrigo Vargas, Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-101-RC2>, 2022

This is a pioneering study that compares traditional discrete low-tide gas (CO₂, CH₄, N₂O, CS₂, DMS) flux measurements from a salt marsh against continuous, high-temporal frequency measurements. The novel approach to measuring high-frequency, continuous (72-hour) fluxes of gases is capable of capturing episodic, pulse emissions that might otherwise evade discrete, low tide measurements. High-temporal flux measurements of CO₂ did not differ from discrete measurements demonstrating that daily mean low tide measurements capture the variability of this process sufficiently, whereas the episodic spikes of the other gas fluxes (CH₄, N₂O, CS₂, DMS) that were captured by high-temporal measurements were missed by discrete measurements. There was also a strong relationship between temperature and CO₂ and CH₄ fluxes. However, precautions should be taken when using daily mean low tide (discrete) values to calculate annual flux budgets or warming potentials due to differences in flux ranges despite the mean values between the two approaches generally agreeing. Overall, this study is very thorough and the sound results are presented in very clear writing.

Below are comments/questions that may improve the clarity of the manuscript text and figures, along with requests for more methodological details.

L45: add "can potentially" after also. Carbon storage rates have a vast range and many factors will impact the long-term storage potential.

L65-72: please specify the affect these compounds have on the climate, i.e., cooling or warming effects

L82-87: it is my understanding that disentangling gas fluxes during high tide are difficult since the effluxing gases are mixing/dissolving into the flood tide waters. Perhaps this

should also be mentioned here. How were gas fluxes measured when the collars were underwater from the flood tide?

L128-133: this text reveals that the gas fluxes are measured over ~four days; this makes the use of the word "continuous" in the introduction misleading. I understand that continuous over four days is still different than discrete low tide measurements, but this should be clarified in the Introduction that this study utilizes a continuous, *multi-day* measurements. Perhaps it's my own bias, but to me continuous implies year-round.

L135-137: could benthic microalgae be present on the sediment surface? Were gas chambers darkened to prevent photosynthesis? Were plant stems trimmed down to the sediment surface or pulled out completely? Could remaining plant structure in the sediment act as "straws" or conduits of gas exchange? If plants were completely removed (i.e., pulled out or cut to below the surface), was the sediment surface disturbed?

L140: what was the volume of a chamber? Did this warrant an internal fan to homogenize gases while measuring?

L155-158: The description of the QAQC is a bit too brief. There seems to be a lot of steps packed into this sentence. It would help the reader to have each step in a sentence, at least, with more description. I recognize that every step of QAQC cannot be divulged in detail, but the current state of this sentence is far from reproducible.

L216: salinity should be reported as unitless

Figure 2: the text reporting mean, UCI, and LCI is too small. Please enlarge. Define UCI and LCI in the figure caption.

Figure 4: is it possible to produce higher resolution figures so the density curves do not look pixelated? The grey color is not included in the legend or described in the caption. It needs to be. I assume this is where overlap occurs. If so, it appears the N₂O fluxes are completely and perfectly overlapped, which was not mentioned in the text.

Figure 5: if I understand this correctly, this plot compares the continuous measurement (over 72 hours) to the discrete measurement (one hour before and after low tide). If so, the time frames should be mentioned in the figure caption and/or text to remind the reader how exactly the comparison is made.

L366-368: it may be useful to mention the findings of McTigue et al. 2021 (doi: 10.3389/fmars.2021.661442) that demonstrate the relationship between CO₂ production and temperature is a function of the activation energy required to breakdown salt marsh sediment organic matter.

L387: "pore water" should be one word, as is used throughout the rest of the manuscript

L568: remove the comma after "temporal"