Biogeosciences Discussions

Biogeosciences Discuss., author comment AC1
https://doi.org/10.5194/bg-2022-101-AC1, 2022

Reply on RC1

Margaret Capooci and Rodrigo Vargas

Author 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-AC1, 2022

Comment: In general, the study presents useful contribution in our understanding of trace gas fluxes from saltmarsh ecosystem. I believe that manuscript is well-written and fits well in the frame of the basic requirement for Biogeosciences Discussion.

Response: We thank the reviewer for their kind comments and support on the manuscript.

Comment: Please find below some specific recommendations which may be useful.

Introduction: This section covers the background information nicely.

Response: Thank you!

Comment: Line 65: I suggest finding some recent references.

Response: We will add the following reference from 2014:

Brimblecombe, P.: The Global Sulfur Cycle, in: Treatise on Geochemistry, vol. 10, edited by: Holland, H.D. and Turekian, K.K., Elsevier Science, 559-591, http://dx.doi.org/10.1016/B978-0-08-095975-7.00814-7, 2014

Comment: Lines 92-98: Please provide references.

Response: We will add examples of automated measurements in salt marshes on line 93:

Diefenderfer, H.L., Cullinan, V.I., Borde, A.B., Gunn, C.M., Thom, R.M.: High-frequency greenhouse gas flux measurement system detects winter storm surge effects on salt marsh, Glob. Chang. Biol., 24, 5961-5971, http://doi.wiley.com/10.1111/gcb.14430, 2018.

Capooci, M., Vargas, R.: Diel and seasonal patterns of soil CO_2 efflux in a temperate tidal

marsh, Sci. Total Environ., 802, https://doi.org/10.1016/j.scitotenv.2021.149715, 2022.

The challenges in installing instruments in tidal salt marshes listed in lines 93-95 are based on our own experiences installing this type of equipment in tidal salt marshes as there have been very limited published examples.

Methods:

Comment: Line 134: How the position of the collars was selected to best represent the study area? What was the extent of the sampled area/total area?

Response: The location of the collars was defined by several constraints. One, our power source for the autochambers and the greenhouse gas analyzers was line power via outlets interspersed throughout an access point in a boardwalk. Therefore, we were constrained to locations ~15 m away from the outlets due to the length of the tubing connecting the autochambers to the analyzers. This is a known limitation using the LI-8100 multiplexer and most of any autochambers using fixed tubbing lengths for their analyzers. Two, St. Jones Reserve is a protected wetland. Therefore, we designed this experiment to minimize impact to the ecosystem and follow approved guidelines of the State of Delaware. These state guidelines constrained our experiment to areas near the available outlet and the access point in a boardwalk

With that being said, collars are located in a short Spartina area, which comprises of ~66% of the vegetated cover in the marsh (Vázquez-Lule and Vargas, 2021; as mentioned in line 124). Each collar covered an area of ~314 cm^2 for a total of ~1,884 cm^2. While we acknowledge that fluxes are heterogenous across the landscape, average CO_2 fluxes throughout the campaigns were similar to those measured in prior studies covering a larger spatial extent of this wetland (Capooci and Vargas, 2022; Seyfferth et al., 2020; Hill et al 2022).

References

Hill, A. C., and R. Vargas. 2022. Methane and carbon dioxide fluxes in a temperate tidal salt marsh: Comparisons between plot and ecosystem measurements. Journal of geophysical research. Biogeosciences 127. http://doi.org/10.1029/2022JG006943

Capooci, M. and Vargas, R.: Diel and seasonal patterns of soil CO2 efflux in a temperate tidal marsh, Sci. Total Environ., 802, https://doi.org/10.1016/j.scitotenv.2021.149715, 2022.

Seyfferth, A. L., Bothfeld, F., Vargas, R., Stuckey, J. W., Wang, J., Kearns, K., Michael, H. A., Guimond, J., Yu, X., and Sparks, D. L.: Spatial and temporal heterogeneity of geochemical controls on carbon cycling in a tidal salt marsh, Geochim. Cosmochim. Acta, 282, 1–18, https://doi.org/10.1016/j.gca.2020.05.013, 2020.

Vázquez-Lule, A. and Vargas, R.: Biophysical drivers of net ecosystem and methane exchange across phenological phases in a tidal salt marsh, Agric. For. Meteorol., 300, https://doi.org/10.1016/j.agrformet.2020.108309, 2021.

Comment: Lines 135-137: Please describe how the disturbance to the soil was addressed while removing vegetation? Was all vegetation removed?

Response: Vegetation was removed by carefully clipping the base of the stem where it met the soil surface. All vegetation within each collar was carefully clipped prior to each campaign. We confirmed that vegetation clipping had minimal to no impact on fluxes, as seen with a lack of anomalous fluxes during the beginning of each campaign (Fig. 2). We will clarify the fact that vegetation was clipped in lines 135-137.

Comment: Line 192-195: It seems to me that you have subsamples within the same area that presents the risk of pseudo replication. I suggest providing some more details about that.

Response: We clarified that the experimental design was limited by the technique of how automated chambers work. Arguably, manual soil flux measurements (i.e., with survey chambers) can cover a larger area but have limited replication in time (e.g., Vargas et al 2011). Automated chambers have the advantage of improving our information of temporal variability, but they are limited in spatial coverage. This technique is limited by how long the tubing connecting a multiplexer can extend to where an autochamber is located (usually ~15m). Having multiple systems to connect autochambers in distant places across a wetland has very high costs and will require providing electrical power in different ways. Consequently, most studies using automated chambers only use one multiplexer with multiple autochambers extending to a limited area (Barba et al 2018). That said, our results show the large spatial and temporal variability of these soil fluxes regardless of the spatial constraint of the autochambers. We will add a brief discussion on this topic in a revised version of the manuscript.

References

Barba, J., A. Cueva, M. Bahn, G. A. Barron-Gafford, B. Bond-Lamberty, P. J. Hanson, A.Jaimes, L. Kulmala, J. Pumpanen, R. L. Scott, G. Wohlfahrt, and R. Vargas. 2018. Comparing ecosystem and soil respiration: Review and key challenges of tower-based and soil measurements. Agricultural and Forest Meteorology 249:434–443.

Vargas, R., M. S. Carbone, M. Reichstein, and D. D. Baldocchi. 2011. Frontiers and challenges in soil respiration research: from measurements to model-data integration. Biogeochemistry 102:1–13.

Results

Comment: Line 334: I could not see Table 2 mentioned in the text

Response: Thank you for finding this mistake. We will include a reference to Table 2 in line 304.

Discussions:

Comment: Line 380-383: Is this generalisation for temperate wetlands?

Response: This pattern has been reported in northern, temperate, and subtropical wetlands by Turetsky et al. (2014) in a synthesis of CH_4 emissions from 71 wetlands. We will include this reference in line 382.

Reference

Turetsky, M.R., Kotowska, A., Bubier, J., Dise, N.B., Crill, P., Hornibrook, E.R.C., Minkkinen, K., Moore, T.R., Myers-Smith, I.H., Nykänen, H., Olefeldt, D., Rinne, J., Saarino, S., Shurpali, N., Tuittila, E-S., Waddington, J.M., White, J.R., Wickland, K.P., Wilmking, M.: A synthesis of methane emissions from 71 northern, temperate, and subtropical wetlands. Glob. Chang. Biol., 20, 2183-2197, https://doi.org/10.1111/gcb.12580, 2014.

Comment: Line 385-387: Reference needed

Response: The following reference will be included in line 386.

Zhang, Y., Ding, W.: Diel methane emissions in stands of Spartina alterniflora and Suaeda salsa from a coastal salt marsh. Aquat. Bot., 95, 262-267, https://doi.org/10.1016/j.aquabot.2011.08.005, 2011.

Comment: Line 401: Reference needed

Response: The references for the studies that have high-frequency data, but include plants within their scope are included in the following sentences on lines 403-407 in the discussion of the various diel patterns that have been found in coasted vegetated ecosystems. We will rephrase this sentence to clarify the message.

Comment: Conclusion: Well done. Very interesting read.

Response: Thank you very much!