

## ***Interactive comment on “Cushion bog plant community responses to passive warming in southern Patagonia” by Verónica Pancotto et al.***

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Received and published: 21 February 2021

General comments:

Climate warming has been frequently reported to occur under future climate change scenarios; therefore, it is very important and interesting to evaluate the impacts of it on various ecosystems – specifically those with significant accumulations of peat following a long-term carbon sink functioning since Holocene. One of the most important carbon sink ecosystems with peat accumulation is peatland – could be various kinds. Thus, this study of investigating carbon flux responses to expected warming in a cushion bog is important and interesting and may help advise ecosystem management and related policy development. This manuscript merits consideration for publication once

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the reviewer's comments are appropriately addressed to improve the quality of this rigorous research.

Specific comments: The abstract section is quite comprehensive and written with great clarity and brevity. The reader can feel the weakness of the study at line 6 where passive warming is shown to be only 0.4-0.7 with a very small  $n=3$ . No SD or SE is provided. For example, the uncertainty may be larger than the warming itself, and then what would be the strength of this study – not sure. But let me see ahead in the results. Additionally, it is amazing to find that small temperature increases of 0.4-0.7 switched the system to a large increase in respiration and/or 55-85% decreases in CO<sub>2</sub>-C sequestration (sink to source).

Line 43-45: It is noticeable that authors referred to old experimental warming research works conducted in 1997 and 2009 with chambers, and more recent works are ignored here (One of the references is a review (Aronson and McNulty, 2009), not an experiment; however, it works well here). For example, Lyons et al. 2020 (Journal of Vegetation Science), Strack et al. 2019 (Ecohydrology), Yang et al. 2017 (Atmospheric Environment), Munir et al. 2017 (Ecohydrology). Also, the last paragraph of this manuscript describes how the chamber used in this study works, while this should be a separate comprehensive paragraph with more and recent reviews in the methods section.

Line 113: Again, more recent references could be added here for readers to gain knowledge breadth.

Line 114: I am worried about how authors adjusted the volume of the chamber when the chamber was placed on the collar with protruding vascular vegetation which certainly occupied some volume of the chamber headspace and should be adjusted while applying  $PV=nRT$  in the respective excel column/empirical modelling – not just the coverage. Did authors adjust the transmittance in their chamber flux calculations? Additionally, this experiment used open side chambers for passive warming – what

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happened to rainfall or precipitation inputs compared to the control plots is not even briefly mentioned. Mention clearly if the chamber was open on top as well.

Line 122: describe IRGA (make, model, location).

Line 143-146: I appreciate that the authors used linear regression; an increase in CO<sub>2</sub> concentration in the chamber headspace should be linear if the chamber volume is large and is corrected for inside temperature and pressure following ideal gas law. I see the measurement chamber size is very small (0.12 m<sup>2</sup> basal area x 0.4 m height) compared to the contemporary research works that used passive warming with open top or side chamber – I know measurement time is somewhat smaller in this research. Also, covering the in-situ soil and vegetation has been frequently reported to manipulate the spontaneous CO<sub>2</sub> fluxes across the soil-vegetation-air continuum (Hanson et al., 1993; Davidson et al., 2002; Denmead and Reicosky, 2003; Kutzbach et al., 2007) – did authors made any adjustments to mitigate these effects or interferences?

I think the statistical analysis section is missing – I need to know what design of experiment authors used, did they applied repeated measures with a mixed model or what statistical analysis techniques were used.

Line 187: SD?

Line 194: what is p<0.1?

Fig. 3: axes labels are very small fonts.

Fig. 7. Why can't the y-axis have the label "ecosystem respiration" instead to let the reader know what flux is this?

Fig. 9. It is unusual to see different flux measurement units used for CO<sub>2</sub> measurement in a single experiment.

Discussion: Line 295 onwards: how did researchers exclude the effect of rainfall or precipitation – since rainfall is from the top, not sides. How did rainfall enter the exper-

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imental chamber area? If the top was also open, then why it was not described here. I feel the authors need to describe the warming chamber in more detail in the setup of the experiment section. The authors have included a full paragraph on the wind direction effect. Please add a wind direction diagram, for example, the wind rose in the methods section to substantiate your arguments in the discussion section. Adding this figure may substantially strengthen the authors' arguments. I know wind may not be in a single direction like northerly but could take other directions as well with varying speeds during a year.

Line 355: space.

I notice authors keep switching between CO<sub>2</sub> and CO<sub>2</sub>-C, please be consistent.

Line 398: please provide the temperature range here in brackets.

Line 404: replace treatment plots with warmed plots.

Line 412-413: replace "the A. pumila cushions where temperature conditions were manipulated" with "warmed A. pumila cushions".

Line 416: please do not mix manipulated warming and weather temperatures – be clear in conclusions. As authors used here >18°C, they can use the passive warming values as well to help the reader a take-home message with exact passive warming and their calculated or modelled effects on GPP and Respiration.

Authors may want to provide passive warming average temperatures during study years/seasons at various plots in a separate table.

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Interactive comment on Biogeosciences Discuss., <https://doi.org/10.5194/bg-2020-440>, 2020.

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