

Biogeosciences Discuss., referee comment RC3
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Comment on bg-2022-47

Anonymous Referee #3

Referee comment on "Recent significant decline of strong carbon peat accumulation rates in tropical Andes related to climate change and glacier retreat" by Romina Llanos et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-47-RC3>, 2022

The authors present an interesting study on the impact of climate change on Andean peatlands carbon storage. Given the importance of peatlands for the global carbon cycle and climate, I believe this paper is of interest to the readership of this journal. Although the methodology is not particularly novel, the Andean peatlands appear poorly studied (after a quick search on web of science) and any good evidence of climate change impact on this ecosystem would be worth being published.

I have some major comments on the methodology and interpretation of the data that led to certain conclusions and some minor comments to help improve the manuscript overall.

- I have some concerns about the derivation of accumulation rates and carbon accumulation rates and the logic behind these estimations. First, how is the accumulation rate obtained? This is not presented. Second, why is the CAR computed directly from the accumulation rate? Is the assumption behind this step that carbon moves only top to bottom? I am not able to determine because this methodology is only briefly mentioned here. But if this is the case, what about carbon released from the roots? Could not plant release carbon directly at depth as root exudates? We just need more details and discussion of the assumptions to better evaluate conclusions originating from this approach.

- The authors somewhat try to infer the evolution of soil carbon over time as a result of the balance between inputs (from plants) and outputs (decomposition). Is there any estimate of how plant productivity changed over time? Although only from year 2000, MODIS from NASA could help.

- Most importantly, I believe the authors should considerably improve their discussion of the methodology, give more context about these peatlands, and elaborate more on their research question.

Minor comments:

- There are some issues with the abstract. First, in line 16 the authors introduce carbon accumulation rates (CAR), but then the following line they quantify accumulation rates. From reading the rest of the paper these two quantities are different and have different units. From the abstract it seems they are the same quantity, and it is measured in cm per year. Second, there is no reason to mention APA1 and APA2 here, because a reader does not know what they are at this point. Third, the sentence in lines 20-23 on *Distichia muscoides* does not seem to fit here. This seems a preliminary information that could be mentioned earlier, if necessary. In summary, I would simplify the abstract and keep only information and conclusions that are needed to invite a reader to look at the entire paper.

- Give at least a brief description of the age-depth model.

- Rather than just a simple map, Figure 1 could be used to introduce also trends in temperature and other relevant preliminary information about the sites (e.g., what is presented in fig. 7).

- Line 174. replace "that" with "than".

- Line 242. Maybe topographic "*location*" is better than "*conditions*".

- Lines 276-285. Could you rephrase this whole paragraph?