

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2022-47

Anonymous Referee #2

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-RC2>, 2022

Dear Editor,

Now I can inform you about the paper titled "Recent significant decline of strong carbon peat accumulation rates in the tropical Andes related to climate change and glacier retreat" by Romina Llanos et al.

In this work, four-peat cores from high-Andean *Distichia* cushion-plant peatlands close to tropical glacial were radiocarbon-dated to estimate the C accumulation rates. The paper would potentially contribute to paleoenvironmental data since they are scarce. However, the data interpretation is highly speculative. For this reason and those explained below, I suggest rejecting the manuscript.

This work does not present hypotheses: The authors state that the retreat of the glaciers could have affected the rate of C accumulation due to temperature change from the 1970s, but this effect could have impacted both sites where the carbon accumulate were lower in the southern sites than the northern ones (only 6 km away and similar elevation, nothing is said about how far or glacial description). As the authors state, the increase in temperature could have impacted the primary production rates and decomposition rates. However, neither of these were measured; therefore, it is difficult to sustain that the temperature change was the primary driver because both sites received a similar impact (Figure 8 shows a similar average), and other factors such as topography and drainage conditions, other potential factors mentioned were not measured either or described properly. In general, this paper is highly speculative, and it lacks rugosity with many imprecise sentences and often confusing ones (see below).

Other important and minor details

Abstract

L.15-17 "...Here, we point out the important role of Andean peatlands on carbon accumulation rates (CAR), one of the highest in the world, and the impact of climate on carbon storage over the last 65 years, using four peat cores". From the sentence above it is not clear what is the highest in the world, the Andean peatlands in general, or your study using four-peat cores?

- 19 "For both peatlands": Never mention before the two peatlands sites.
- 25 Where did depth accumulation rates reach up to? What is CE?
- L.20 Annual mean temperature cannot be responsible; only humans are responsible for something.
- L.25 The authors indicate a decrease in CAR during the study period may be due to a decrease in meltwater by the retreat of the glaciers and the increase in temperature (the last tested); however, an increase in temperature is not the only factor even when you do not mention if there was a type of control to confirm your findings. For comparison you have to be sure that the primary productivity was similar 50-60 years ago.

Introduction

- 38 say: ...researches, ...must say: researches, however,..
- L.76-103 move this section to M&M. The authors need to clearly describe the differences between APA-1 and APA-2 in the results section, as the calibrated age from APA-1 and APA-2 are compared.

M&M

I generally miss the statistical analysis for setting the differences of CAR and depths.

- L.105 says: between 29 and 35 cm-long, it must say: intervals layers between 2 and 31 cm depth.
- L.105-107 The authors need to clarify how they named the samples in Table 1. In M&M,

there is no clear description.

- L. 114 says: accelerator mass spectroscopy, it must say: accelerator mass spectrometry. This mistake comes from another article, Xing et al. (2015) that used the same terminology.
- L. 127 says C stable isotope. It must say. The natural abundance of stable isotope...
- L. 131-132 Even though you are citing a source, please give the equation and units of each variable. How were C accumulation rates calculated? It is not straightforward and familiar for all readers. By the way, Lähteenoja et al., 2009 and Cooper et al., 2015 are not listed in the reference.
- L.133 says: strong. It must say: significant and positive (or negative) ...
- L.136-137 says: ...can be used to estimate relative paleotemperature changes recorded in Andean *Distichia* peat, as they mentioned. It must say: can be used to estimate relative paleotemperature changes recorded in Andean *Distichia* peat during the growth season (See Skrzypek et al. 2011).
- L. 138-139 Please expand the explanation about the resolution used because I understand that NCP-NCAR uses $5^{\circ} \times 5$ pixel. I know you cite Kalnay et al., 1996; however, the last reference is not in the list of references.

Results

- 146-147 The authors say "...an abrupt change occurred at the end of the 1970s when the rates visibly decreased"... Compared with? APA-2 ? I see such abrupt change from Fig 2 if I only compare APA-2 with APA-1.
- L161. "Mean TOC content..." Figure 3: Neither the text tells us if these results average the three depths or only the upper part? The authors refer to supplementary information to prompt the reader to seek information, but this must be carried over to the main text.
- L.174 The authors say, "...CAR varied depending on age and elevation" however, the elevation of these sites is similar (see sites description).
- L. 184. It is hard to see differences without statistical analysis. The variability is so high.
- L193. I do not see the difference for APA-2, even when it was the site that present lower CAR.

Discussion

- L.197 The authors introduce Fig 6 for tropical versus boreal and temperate climate; however tropical high latitude presents an enormous error bar, invalidating the comparison. Please remove this Figure from the Discussion.
- L. 234-235 "...The author says: ...differences found in CAR (Fig. 4) ...were related to the different drainage area surfaces, much more prominent for APA-1 than for APA-2. These differences must be described in the site descriptions first and later discussed.
- L 237. Again other differences that were not described "...specific topographic factors,..."
- L.239-240 "...Although there is a similar downward trend in the CAR at both sites after the early 1980s,..." I do not see the difference in APA-1 in Fig. 2.

- L. 256. Move Fig. 7 to the results section.
- L.255-260 What about photosynthesis. The increase in CO₂ must have a consequence?
- L.280-285. Ok, here photosynthesis is discussed.
- L.283 "...The strong gradients in $\delta^{13}\text{C}$..." Insist I do not see this gradient in APA-2 having a similar temperature.
- 286 Figure 8 should be the first figure that the authors must show in the result section.
- L. 292 Say: "showed a good relationship especially in trends". It must say: showed a good relationship"
- L. 291-294 "...this comparison is difficult because the NCEP data ... because we do not know precisely what time period each peat sample corresponds to", this sentence is not clear.
- L. 296 "between 1.9 and 2°C" is different than "from 1.9 and 2°C" what do you mean?

Conclusions

- L 307-311 Sentences are more summary than conclusions.
- L. 314-316. "...This decline in C accumulation was mainly related to the temperature rise which increases the organic matter degradation rate..."

The lower CAR probably comes from a lower primary biomass production in APA-2, which was not measured neither discussed. This may have shed light on the input, prevented speculation such as high decomposition rate, and reduced water supply from glacier retreats. The hypothesis that the temperature causes the differences been CARs in my view has not been demonstrated.