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Biogeosciences Discussions

Interactive comment on "Modern calibration of *Poa flabellata* (Tussac grass) as a new paleoclimate proxy in the South Atlantic" *by* Dulcinea V. Groff et al.

Anonymous Referee #1

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Overall, this is a really nice dataset that has a lot of promise for enhancing our understanding of paleoclimate in the southern hemisphere. I have several minor comments and a few major comments below. There is a lot of analysis into explaining the variation in the isotopes, how that's controlled by plant physiology, but not much discussion and explanation of how these isotope signals will be used to reconstruct paleoclimate, especially in context of applying this to a peat core (through time). Providing a roadmap for how changes in d13C and d18O will be interpreted would be useful and weather this is qualitative or can it be pushed further to be quantitative? There is the suggestion that this is going to really help us understand climate dynamics, but then there is not discussion of how. Is this going to provide temperature or relative humidity or both

(there is not clear indication of which and both are correlated with the isotopes) and how to you disentangle any changes in source water d18O through time?

Some discussion of how to do this for paleoclimate also needs to focus on how this study shows nicely that the leaves are recording a seasonal signal. So, when you go down core, how are you going to deal with this? Are you going to focus on a large sampling of leaves from each horizon (age?) with the expectation that you are sampling both seasons or is it going to be a single multiple leaf measurement to approximate an annual signal? Some thought into this is needed as the data analysis and presentation may need to be added to or adapted for paleo work. I'd like to see a clearer connection between this nice modern calibration data and how to use it for the past.

Maybe these comments don't seem fair (the focus is rally on the modern calibration), but the title, abstract, intro, and conclusion suggest this is a new great paleoclimate proxy. My guess is the authors will be applying this to a peat core in the future. It would be nice if the framework is put forth here. If that can't be done, then I think the paleoclimate proxy significance and mention needs to be removed throughout.

Line 28: "trends in southern hemisphere climate dynamics" – is that consistent with what you can actually do with this proxy? Or is it something more specific?

Lines 43-46: Awkward sentence with semicolon connecting two separate statements.

Line 56: Is it really called a "bog"? That's not confusing... It's hard to reconcile this description with the one line 70 and "pedestal" which is in the caption for Figure 2. Maybe some annotation on the figure or more description would be useful. I'd like to have a clear idea how this is going to develop over time in a peatland and how this plants growth habit is going to translate into a vertical succession (or some crazy patchwork of different ages in a peat core).

Line 57: Something wrong with new sentence that starts here and sentence seems incomplete too.

Line 56-57: Either they use precip or the precip wets all that organic matter and then there is evaporative enrichment b/c it is exposed to wind/sun.

Line 70: Maybe start a new paragraph here or have a better transition?

Line 71 and below: check the order in which isotopes are first described. Here delta symbols are used first but aren't defined, next sentence doesn't use delta symbols (carbon isotopes), and then defined on line 90-91. I think this comes up a few other places and would be worth cleaning up.

Lines 92-93: Improving "westerly wind dynamics" is different than what's mentioned elsewhere. What is it that this new proxy can solve and make it consistent throughout.

Line 100: Could the km hr-1 also be reported here and later for reference? Not to many readers will think about wind speed in m/s.

Line 170-172: How are temperature and humidity related? Based on the figure, they look highly correlated. If they are, then how do you disentangle their effects from the cellulose d13C and d18O as they are both strongly related? I didn't see any multiple regression analysis reported below either.

Line 186: is west, NW, and SW 79%? That's missing from the sentence. Reporting 21% for the last source and not saying anything about the other 3 directions is reads strangely and compared to the prior sentence.

Line 206-207: I think you need to be really careful presenting this here and then in the discussion below. With this data, maybe the other factors have a stronger control than precipitation d18O, but at least at some level, precip d18O must be important. So, when applying this down core (through Holocene), if there are changes in d18O, they must change the cellulose d18O (and then it's probably modified by the other factors you report here). I think this is critical to point out for those who will use this in paleo applications. More on this below.

Section 3.4: there's no mention here of the relationships between the isotopes and

temp and humidity but these are in the discussion, figures and tables. This would be a good place to describe the relationships of to both environmental factors.

Line 237: What negative correlation? Not in the results or the figures. VPD is not discussed prior to this.

Line 242-244: Is this consistent with the "low" humidity of the Falklands of >70%?

Lines 283-288: Relating plant tissue d18O (or dD) to precipitation is always a challenge. Even if you had leaf water or soil (pedestal?) water, it would still be complicated, but maybe give some insight. Many studies try to relate d18O of the plant back to precipitation, but here, it's clear that other factors modify this. But, at the most basic level, d18O precip is setting source water and then maybe there is mixing with other sources (ground water, dew, etc), but that is then modified by temp/humidity, etc. I think some discussion here is needed to highlight that this is much more complicated than indicated for the reader. If one tries to do this down core, changes in d18Oprecip must at some level matter for the d18O of plant source water and ultimately the d18O cellulose. Also, getting into event precip (as mentioned) could be interesting, but it might be more informative to pull into this discussion when the leaves/cellulose are being made. Can you say anything about this with the data in hand?

Overall, the discussion is lacking a clear description of how the d13C and d18O would be used to interpret paleoclimate. Is it a temperature signal, a humidity signal, a source of precipitation signal? Or is it all of the above? How will a down core record be interpreted? Is there any way to put some uncertainty into this? How are you going to disentangle the multiple correlations between the isotopes themselves and the relationships with temp and humidity?

Figure 1: It would be nice here or elsewhere to have the wind diagrams and the precip source isotopes provided. I don't know what the figure limitations are for this journal, so maybe that's not possible. But, it sure would be nice to have a bit more of the great data collected here summarized in the main article figures.

Figure 2: It would be nice if the interpretive strategy figure here was where that data is reported. The peat core is interesting, but not really discussed. It would be nice if it was to put into an interpretive strategy that could be used for downcore paleo reconstructions.

Figure 3: VSMOW on 3a, but VSMOW and VPDB missing on 3b. For the LMWL reported here, can you report the r or R2, p-value, and n?

Figure 4, VSMOW and VPDB needed

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