Biogeosciences Discussions

Biogeosciences Discuss., referee comment RC1
https://doi.org/10.5194/bg-2022-50-RC1, 2022


# Comment on bg-2022-50

Anonymous Referee #1

Referee comment on "Excess radiation exacerbates drought stress impacts on canopy conductance along aridity gradients" by Jing Wang and Xuefa Wen, Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-50-RC1, 2022

I enjoyed reading this succinct and interesting paper on the variations in the oxygen isotope composition of dry grasslands in China. In my opinion the key novel finding of this study is that leaf oxygen isotopic enrichment above source water (D18O) in multi-species grasslands consistently increases with aridity in three distant plateaus with contrasting dry climates. This is quite an impressive database on the oxygen isotopic composition of multiple grass species exposed to different climates, and the results are interesting, novel and compelling. However, I have several important suggestions for further improvement, which I hope the authors will find useful and reasonable.

- I think this paper would greatly benefit from the inclusion of a more open, thorough and detailed description of the raw bulk leaf d18O, LA and SLA data obtained in the different regions, including additional figures depicting this basic information. Readers interested in the oxygen isotope composition of plants in general will surely want to see the raw leaf d18O data, as well as more detailed data on the d18O composition of rainfall water in the different regions (amount-weighed annual averages, range of values, etc). These data were used to estimate D18Oenrichment in the different sampling sites, so it is important to report these basic raw data as well. I would also like to see the averages, ranges of values, standard deviations, etc of the leaf d18O, SLA and LA values of the different grass species sampled in each region, as well as a listing of grass species names in each plateau. The detailed species listing could be included as Supporting Information material, but it is still important to provide this basic information for each plateau/climate region separately. Ideally, all this important descriptive information could be synthesized in 1 or 2 additional figures (or tables) that should be provided at the beginning of the Results section. Also, please briefly comment in the Discussion how your leaf d18O and D18Oenrichment range of values compares to other datasets previously published in the literature, especially for arid and semiarid grasslands (in both China and elsewhere across world dryland ecosystems).
- The paper would also benefit from a more open acknowledgement that rainwater d18O is only a (reasonable) proxy of topsoil water d18O, which is the real source of water used by most grass species. Evaporative isotopic enrichment of soil water in upper soil

layers during prolonged rainless periods in dryland ecosystems usually results in heavy enrichment in the 18O in the remaining soil water used by plants. Longer rainless periods and heavier evaporative enrichment of soil water in the drier sites along the aridity gradient could be also contributing to the reported patterns, but this questions is not addressed in the paper. I would appreciate the inclusion of a few sentences in the Discussion to address this caveat of the study. Despite this criticism, I admit that the approach used by the authors to estimate D18Oenrichment is legitimate, in the absence of data on culm water isotopic composition in each species (which I am assuming is not available). However, the readers should be aware that interspecific differences in rooting and water acquisition depth and phenology among coexisting grass species can lead to substantial differences in the isotopic composition of their water sources, which cannot be detected with the approach used in the present study (even though they will certainly affect the real d18O and D18Ovalues of the different species). This should also be mentioned and discussed in the paper.

- Important data are missing from the M&M section, including the elevation/altitude, mean annual rainfall d18O, mean annual VPD, and LMA, LA (average, range of values) of the 3 different plateaus. This important information could be provided by adding additional panels to Figure 1. Please also add an additional panel for mean annual temperature (the one shown is for mean summer temperature). In panel f, please enhance the scale and resolution of the Y axis, as some of the drier sites in the Tibetan Plateau appear to have extremely low precipitation values that are hard to interpret in the graph.
- I would recommend the authors to discuss the influence of temperature on leaf d18O and D18Oenrichment data much more in depth, according to earlier findings of Brent Helliker and collaborators, which I think are very relevant here (Helliker & Richter 2008 Nature, Song et al.,2011 New Phytologist).
- L83-90: Some of the references cited in this section may not be very adequate if they refer to the d18O of tree rings, which is a more complicated process influenced by other factors (post-photosinthetic and photosynthate transport processes, ligning synthesis, etc). I would recommend to cite here only papers dealing specifically with the d18O and/or D18Oenrichment of bulk leaves, which is the topic of the present paper (e.g. see Ramirez et al 2009 Plant Cell Environ or the work by Margaret Barbour, Regina Hirl or Cabrera-Bosquet and Araus). Also, some of the references cited in this section appear to be missing from the References section (Levesque, Keitel?).
- Lines 266-274: this section dealing with the relationships between SLA and leaf oxygen isotopes is very confusing and hard to interpret. Please try to better clarify the nature of this relationship in the different plateaus, preferably illustrating it with some additional graphs (1/D18Oenrichment vs SLA plots?). To the best of my knowledge, this relationship was first examined in depth by Prieto et al 2018 (Functional Ecology) in dry grassland species, so it would be interesting to compare and discuss the patterns encountered in both studies.
- L226: "and viceversa" is confusing and hard to interpret, please elaborate and explain what you mean here.
- L269-270: I don't understand the term "high heat capacity" used in this sentence, please clarify.
- L16: this sentence is confusing and difficult to understand, please rephrase and clarify what you mean here.
- L51: I think this sentence is inaccurate, as it is indeed possible to measure the leaf gas exchange rates of whole canopies using the appropriate methods (e.g. see Liberati et al 2021 Global Change Biology).
- L78-79: Please rephrase and clarify your second hypothesis, it is difficult to understand.