Clim. Past Discuss., 10, C2125–C2131, 2014
www.clim-past-discuss.net/10/C2125/2014/

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Interactive comment on "Variability of summer humidity during the past 800 years on the eastern Tibetan Plateau inferred from δ^{18}O of tree-ring cellulose" *by* J. Wernicke et al.

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Received and published: 23 December 2014

[cp]copernicus

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23 December 2014

Reply to interactive comment on “Variability of summer humidity during the past 800 years on the eastern Tibetan Plateau inferred from δ^{18}O of tree-ring cellulose” by J. Wernicke et al.

[reply] Dear anonymous referee # 2,

Thank you very much for your additional comments and your feedback on the comments of anonymous referee 1. Moreover, we like to thank you for your general support of publishing our δ^{18}O tree-ring cellulose based relative humidity reconstruction. On December 16th we already submitted a revised version of our manuscript (see supplement of Author Comment C2098), according to the concerns raised by referee 1. Therewith we might have already discussed most of the critical aspects of your review. We appreciate to reply on your comments and questions in detail within this letter. Attached to this reply letter you will find a revised version of the manuscript with additional information highlighted in cyan. Furthermore a detailed *graph about the single segment lengths is attached to the reply letter (see supplementary figure 1). Doing so, we hope that we satisfactorily responded to all critical points. If you have any further requests or questions, do not hesitate to contact us immediately.*

With kind regards,

Jakob Wernicke

Anonymous Referee 2

Received and published: 19 December 2014

Dear editor and authors of the manuscript "Variability of summer humidity during the past 800 years on the eastern Tibetan Plateau inferred from 18O of tree-ring cellulose", I fully agree with referee 1 on the importance of the reconstruction, the strong data and also all general and specific comments which were raised. I therefore have only very few additional comments and I do recommend publication of the manuscript after these minor revisions. Even though the study focusses on d18O as a climate proxy, it would be interesting to read more about the ring-width data. It is mentioned in the text (line 125) that tree-ring growth is limited by temperature and spring precipitation, but as I understand it, this conclusion is derived from trees different from the ones used in the present study? In any case, I think a brief description and discussion about the climate sensitivity of ring-width data would be helpful. Please also provide information about the segment length of the five trees (it is hard to see that in figure 2) and whether the youngest part of each tree has been omitted (juvenile effect).

[reply] Our chronology comprises of samples collected from the Lhamcoka E site in 1996, identical with the ring-width data published by Bräuning *(*2006*, p.373). These samples are neither affected by human chopping activities nor by LIA glacier advances. The trees from site E are the only ones of the entire Lhamcoka site (A-E), who show a significant positive correlation with precipitation during spring. Thus,* Bräuning *(*2006*) summarized: "...dry and cold winters..." reduce the annual growth of Juniper at that site. Therefore, temperature and spring precipitation are the limiting factors for tree-ring growth exactly for the trees we used within our stable oxygen isotope analysis. We will implement a short discussion of the tree-ring width data in the revised manuscript.*

- *Segment length will be added to the revised version. The cores have a mean length of 633 years with the single segment lengths of 801, 697, 668, 528, and 469 years (see supplementary figure 1).*
- *We sustained the youngest parts of our chronology in order to achieve a maximum age. That is of course only feasible, if we can exclude the so called "juvenile" affect which would result in a systematic decline of oxygen isotope values during the approximately first 100 years after germination (*Esper et al. *(*2010*);* Treydte et al. *(*2006*)). We aligned our stable isotope data to the cambial age of the trees (see supplementary figure 1) and found no declining trends within the first decades or century that might be attributed to a so called "juvenile effect". Hence, we used the entire segment length for our reconstruction.*

Line 140: Is it possible to quantify the amount (ratio) of snow? According to figure 1, temperatures are below zero during December and January. I'm not sure if the numbers in the climate diagram are readable in the printed version (too small?). It is known from a number of studies that snow can have a large effect on the isotope ratio in tree rings since the highly depleted melt water gets incorporated in the tree, with some temporal offset (depending on soil properties).

*[reply] We re-sized the climate diagram of Figure 1 to ensure clear readability of all numbers in the printed version. We are furthermore aware that snow derived melt water might contribute to the source water in high altitude ecosystems (*Treydte et al.*, 2006). That of course affects the source water δ^{18}O composition and might, perhaps with some delay, influence the δ^{18}O values in tree-ring cellulose. This is especially the case in climate regions, where winter precipitation contributes to a major part to the annual precipitation amount (e.g. regions dominated by the Westelies). Nevertheless, the eastern TP derives the vast majority of its annual precipitation during the summer monsoon season, while the winter precipitation contribution is minor due to the prevailance of dry continental air mass and a strong westerly influence (*Wang and Ding *(2006); *Webster et al. *(1998)). Therewith, snow accumulation mostly occurs during the summer monsoon season, leading also to the so called "summer accumulation type glaciers" in that region (*Mölg et al.*, 2012). Additionally, solid precipitation at the study site only occurs during the months with temperatures below the freezing point. According to the adiabatic temperature lapse rate, respective conditions may occur during October to April (see climate diagram). However, these winter months contribute only by 13% to the total precipitation of the entire year. Thus, the influence of solid precipitation is likely to have only a minor influence on the δ^{18}O values of the source water and stable oxygen isotope ratios of the tree-ring cellulose.*

Line 156: Can you specify whether one core or two cores per tree were used?

[reply] Two cores per tree were sampled in order to enhance the chance to detect

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missing rings. From the two cores the longest sample was selected.

Line 167: Please provide the reproducibility for d18O mass spectrometer analysis.

[reply] The standard deviation for the repeated analysis of an internal standard (IAEA 601 cellulose standard) was better than 0.25‰. We added this information in the revised manuscript.

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