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Interactive comment on "Quantification of southwest China rainfall during the 8.2 ka BP event with response to North Atlantic cooling" *by* Y. Liu and C. Hu

Y. Liu and C. Hu

yhliu@cug.edu.cn

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Reviewer #2

Major comments:

1. Line 16: "decreased by âĹij350 mm" This difference is calculated from a short-lived wet period occurring right before the 8.2 ka event. Rather, a longer-term average of pre-8.2ka conditions should be used to calculate this anomaly.

Response

If calculated from a longer-term average, between the average value before the event

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and the average value during the event, the difference would be ∼140 mm, which is similar to the difference shown in Hu et al.(2008). Since the record resolution of Hu et al.(2008) is ∼100 yr, which is difficult to show the abrupt decrease when the 8.2 kyr event occurred, we therefore prefer to take the advantage of the high resolution of this record to show the abrupt change.

2. Since the publication of the Hu et al. (2008) paper, several other papers have been published showing that the relationship between δ18O and precipitation amount is more complicated than assumed by the authors for their reconstruction. More consideration and discussion of these other results is needed, please see Liu et al. 2014 Quaternary Science Reviews 83: 115-128 and references cited therein.

Response

We do agree that the interpretation of Chinese stalagmite δ18O is complex, and more discussion shown as follows will be added in the manuscript.

Many processes contribute to Chinese stalagmite δ18O, such as moisture source and pathway, local condensation and evaporation or even different types of precipitation (Dayem et al., 2010). A recent millennial climate simulation suggests that the Chinese stalagmite δ18O record is an indicator of intensity of the East Asian summer monsoon in terms of the monsoon wind and the accompanying rainfall in northern China, but not related to the rainfall change in southeastern China (Liu et al., 2014).

Since stalagmite δ18O records from South China are more complex, modern monitoring data from both Dongge and Heshang might be helpful to assess the difference method adopted in this paper. Unfortunately there is no published monitoring data from Dongge, but there are three separate monthly drip-water δ18O records from Liangfeng Cave (26°16'N, 108°03'E, close to Dongge Cave) from April 2011 to April 2013(Zeng et al., 2015). To avoid the effect of evaporation, we selected the lowest δ18O value from each month from Liangfeng to calculate the drip-water δ18O difference between Liangfeng and HS4 collection site after the whole HS4 monthly drip-water δ18O record was positively offset by 2 months to allow for the effect of the aquifer above Heshang cave(Johnson et al., 2006). Correlation analysis suggest that there may be a weak positive correlation(R=0.33) between the monthly drip-water Dδ18O and the average monthly rainfall from 6 sites mentioned in Hu et al. (2008a). Since stalagmite δ18O derives from cave drip-water δ18O, in some degree this weak correlation between the cave drip-water Dδ18O and the local rainfall amount suggests that stalagmite Dδ18O between two caves located along the same moisture transport pathway could reflect the local rainfall.

3. Lines 87-88: Was this wiggle matching always within the analytical error of the U-Th dates?

Response

Yes. From the chronology table of stalagmite DA (Cheng et al., 2009), the errors of the chronology of DA during 8.2 kyr period is from 31-yr to 94-yr with an average of ~60-yr. Since the difference between adjusted and original chronology of DA is from 2-yr to 70-yr with an average of ~40-yr, we are sure that the wiggle of DA is always within the analytical uncertainty of its U-Th dates.

4. Lines 114-117: A perhaps even larger source of error that could create negative values is the chronological uncertainty, given that two records with uncertain chronologies are being differenced. Wiggle matching will not eliminate this uncertainty, nor is even the best approach since it is subjective. Chronological error should be tracked in the reconstruction process.

Response

Yes, we do agree that the chronological error should be tracked in the reconstruction process. We tested this by shifting the DA δ18O data set by moving 50-yr forward and backward respectively as shown in revised Figure 2. After the shifting, though it does increase the uncertainty of the Dδ18O with a maximum error of 0.76‰ the

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general variation trends are similar, suggesting the difference method is valid in this case. However, the error produced by chronology uncertainty should be taken into consideration. Therefore the cumulative error of the reconstructed Dδ18O sequence should increases to 0.53‰

The relevant correction will be done in the manuscript.

5. How was a one-year resolution record created from a 2.5 year resolution record? Linear interpolation? A better approach would be to create records of equivalent >=2.5 year resolution.

Response

We rechecked the δ18O records of DA from Cheng et al.(2009), and the resolution varies from 1-yr to 8-yr with an average of ~3.5yr. That means even if we create an HS4 δ18O records with a 2.5-yr or 3.5-yr resolution, it is still difficult to be equivalent to DA. Therefore, annual interpolation is perhaps the best way to make the two δ18O sequences comparable.

6. The analysis of Yichang precipitation and Greenland temperature is not useful to the paper. It is unsurprising that the correlation of rainfall in China to temperature during the 8.2 ka event (perhaps the largest climate event of the Holocene) is larger than for interannual variations today calculated from two noisy station records. Regarding the calculated slopes of precipitation change per Greenland temperature change from the modern data, are these slopes shown to be significantly different than zero using a statistical test? This analysis is problematic in many regards, does not provide insight into "abrupt climate prediction under warming conditions" and should not appear in the paper.

Response

We will delete the discussion section about the analysis of Yichang precipitation and Greenland temperature.

Minor comments: 1. Line 32-33: The statement “experiencing a warming period similar to that of today” is debatable. There are important ways in which the early Holocene was different from today (e.g., melting of the Laurentide Ice Sheet, lower atmospheric carbon dioxide levels, etc).

Response

We will delete this sentence.

2. Line 165-166: “highest annual rainfall of 350 mm/yr” This should read “maximum decline in annual rainfall of 350 mm/yr”

Response

This will be corrected.

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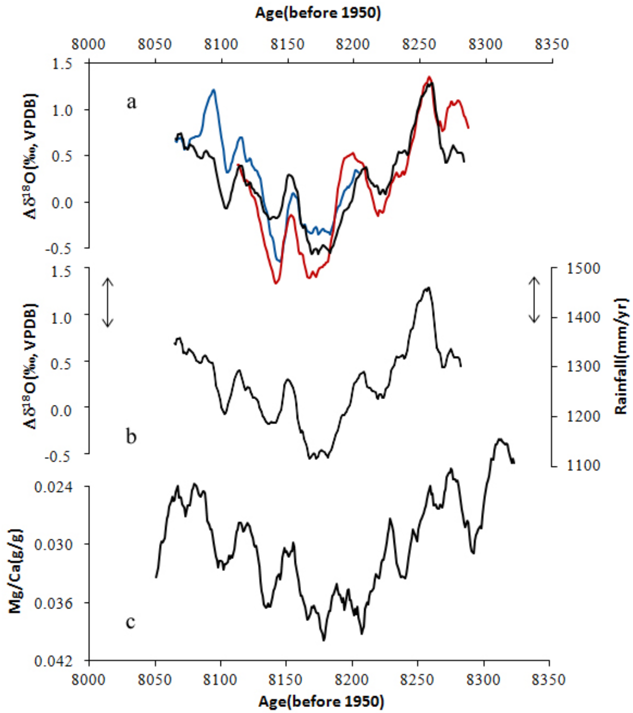

Figure 2. 10-yr moving average records during the 8.2 ka BP period. a) $\Delta\delta^{18}O$ records between HS4 and DA with unchanged chronology(black), 50-yr moving forward (blue) and 50-yr moving backward(red); b) $\Delta\delta^{18}O$ records between HS4 and DA and reconstructed annual rainfall in southwest China with their accumulative error bars ; c) Mg/Ca ratios of HS4 shown on inverted scales, which reveals a similar trend to the rainfall sequence increasing the confidence of the quantization of the reconstructed record.

Fig. 1.

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