

*We thank editor for this response opportunity. We appreciate the reviewers' valuable suggestions and comments on our manuscript, which help us to clarify the inappropriate expressions, refine some confused ideas, and improve our manuscript significantly. We have made point-by-point responses according to your comments and suggestions. They are shown in black and the responses and actions taken are shown in blue.*

### ***Short Comment #3***

Hou et al. compiled 47 paleoclimatic records of temperature, precipitation, and sea level from around the world to search for evidence for a global climatic event around 7.5-7.0 ka BP. The authors discuss the evidence for the event in continental-scale regions around the world, and discuss various possible forcings (e.g. changes in solar irradiance triggering feedback loops or changes in deep water formation, a volcanic eruption, and meltwater pulses influencing AMOC). We find the overall ambition to be well placed, and the paper is well structured and generally well written.

*Thanks for your general positive comments on our manuscript. We are also aware of the limitations and problems of this manuscript, and we will refine this manuscript according to your and other reviewers' comments and suggestions.*

### ***Comment 1***

However, we strongly agree with referee #2: the design of the study is flawed. The paper begins with the conclusion that an event exists at 7.5-7.0 ka BP; the authors then select records that they contend show an event around that time. However, in many cases, there is little or no convincing evidence for an "event" within their chosen datasets. We have four primary concerns with the study.

*The study design flaw was also the main concern by the referee #2, and we have presented a detailed response. Please see our response to the same question.*

## **Comment 2**

The authors need to define what is meant by an “event” and then apply an objective test for its presence or absence. Ideally, the test would be quantitative (significantly different than random, e.g. the 8.2 ka study of Morrill et al., 2013), but a rigorous qualitative test would also work. To our eyes, only 11 out of the 47 records presented show a convincing event near 7.5-7.0 ka (i.e., Qinghai lake, Guliya ice core, Yellow Sea, Dajiuhu peat, Nordan’s pond bog, Kilimanjaro ice core, Padul Lake, Eastern Alps, mid-European high level scores, Laurentide ice sheet sea-level contribution, SE Sweden relative sea level). The others show fluctuations at 7.5-7.0 ka that are indistinguishable from any other 500-year-long period in the time series. After an objective test is implemented, a map showing the spatial distribution of the results of the test would help both the authors and the readers in interpreting the underlying climate dynamics.

*Thanks for the reviewer's suggestion. We agree with your suggestion and will delete some records that did not meet the criteria in the revised manuscript. For other proxy records, we think that due to the large uncertainty in proxy records, thus one can often have a choice in correlating possible anomalies across many records. In fact, such subjective methods to identify anomalies is adopted by some researchers (Mayewski et al., 2004; Alley and Ágústsdóttir, 2005; Rohling and Pälike, 2005), but we need a strict criterion for selecting proxy records.*

- ✓ *Alley R B, Ágústsdóttir A M. The 8k event: cause and consequences of a major Holocene abrupt climate change. *Quaternary Science Reviews*, 2005, 24(10–11): 1123–1149.*
- ✓ *Mayewski, P. A., Rohling, E. E., Stager, J. C., et al. Holocene climate variability, *Quaternary Research*, 2004, 62: 243–255.*
- ✓ *Rohling, E. J., Pälike, H. Centennial-scale climate cooling with a sudden cold event around 8,200 years ago. *Nature*, 2005, 432(21): 975–979.*

### **Comment 3**

The selection criteria for the records appear subjective, “We exclude those records that do not provide convincing evidence of an event across this interval [7.5-7.0 k BP]” (line113). It is unclear how 47 records were selected out of the thousands that exist globally. Critically, the authors must discuss the implications of why so few studies show an event during this interval. If only a small subset of global paleoclimate data show an event in this interval, what does that imply about the global nature of this event? Moreover, the current stated screening criteria do not appear to have been universally applied in the study. Some of the selected records do not appear to meet the criterion of “sampling resolution of better than 200 years” (line 119).

*As is argued in response to the referee #2, the aim of our manuscript is to present a hypothesis for a possible widespread climatic anomaly around 7.5-7.0 cal ka BP. Our hypothesis was put forward mainly based on three findings. First, widespread archaeological transformations occurred around 7.5-7.0 ka BP in China, which were characterized by widespread abandonment of settlements especially in the northern, northwestern, and northeastern environment-vulnerable areas, early-middle Neolithic transitions, southward retreat of rice cultivations in several temperate northern areas (Zhang et al., 1997; Lü and Zhang, 2008; Dong, 2013; Wang et al., 2014). Similar archaeological transformations such as the Mesolithic-Neolithic transition across southern Iberia and the final collapse of the Early Neolithic Linear Pottery culture across the central Europe also occurred at about the same time period (Gronenborn, 2010; Sánchez et al., 2012). These widespread archaeological transformations are strongly suggestive of a possible climate change cause. Second, there are some individual researchers that find some evidence of possible climate change around 7.5-7.0 cal ka BP, however, a synthesis of large number of proxy records is still lacking, which is needed. Third, we also examine the climate forcing responsible for the 7.5-7.0 cal ka BP event and found four potential mechanisms. On the base of these three findings, we intend to provide a hypothesis for the possible widespread climatic anomaly around 7.5-7.0 cal ka BP.*

*In this way, proxy record is just one foundation for establishment of this hypothesis.*

*Due to the high uncertainties in proxy records, we cannot prove the existence of 7.5-7.0 ka BP event climate anomaly based on a quantitative analysis recommended by referee #2.*

*We take the quantitative analysis by Morrill et al. (2005) as an example to illustrate the reconstructed effects. They selected previously-published records from 52 sites using objective criteria for detecting the 8.2 ka event. Among these selected proxy records, 21 sites (40%) recorded the 8.2 ka event. If we exclude the 5 ice cores that register the 8.2 ka event, only 16 (31%) records from other paleoclimatic archives record the 8.2 ka event. It should be noted that the existence of 8.2ka event has been previously confirmed mainly by the multiple ice core records with large spatial scale climate singles (such as windblown sea salt, continental dust, and trapped-bubble records of concentrations of trace gases) (Alley et al., 1997; Alley and Ágústsdóttir, 2005). Such verification in combination with its great significance in dealing with global warming and understanding cultural transformations would necessarily enhance the publications of proxy records that registered the 8.2 ka event. As a result this would further increase the occurrence probability in the inductive reconstruction method with “big data”. If we adopt similar quantitative analysis, we will find much less occurrence probability of our suggested 7.5-7.0 ka BP climate anomaly.*

*For detailed discussion, please see our response to the referee#1 and referee #2.*

- ✓ *Alley, R. B., Ágústsdóttir, A. M. The 8k event: cause and consequences of a major Holocene abrupt climate change. *Quaternary Science Reviews*, 2005, 24(10-11): 1123–1149.*
- ✓ *Alley, R. B., Mayewski, P. A., Sowers, T., et al. Holocene climatic instability: A prominent, widespread event 8200 yr ago. *Geology*, 1997, 25(6): 483-486.*
- ✓ *Dong, G. Neolithic cultural evolution and its environmental driving force in Gansu-Qinghai region problems and perspectives. *Marine Geology & Quaternary Geology*, 2013, 33: 67–75, (in Chinese).*
- ✓ *Gronenborn, D. Climate, crises and the neolithisation of Central Europe between IRD-events 6 and 4, in: *The Spread of the Neolithic to Central Europe*, edited by:*

Gronenborn, D. and Petrasch, J. Verlag des Romisch-Germanischen Zentralmuseums, Mainz, 2010, 61–80.

- ✓ Lü H., Zhang, J. Neolithic cultural evolution and Holocene climate change in the Guanzhong Basin, Shanxi, China. *Quaternary Sciences*, 2008, 28: 1050–1060 (in Chinese).
- ✓ Morrill, C., Jacobsen, R. M. How widespread were climate anomalies 8200 years ago? *Geophysical Research Letters*, 2005, 32: L 19701. doi:10.1029/2005GL023536.
- ✓ Sánchez, M. C., Espejo, F. J. J., Vallejo, M. D. S., et al. The Mesolithic-Neolithic transition in southern Iberia. *Quaternary Research*, 2012, 77: 221–234.
- ✓ Wang, C., Lu, H., Zhang, J., et al. Prehistoric demographic fluctuations in China inferred from radiocarbon data and their linkage with climate change over the past 50000 years. *Quaternary Science Reviews*, 2014, 98: 45–59.
- ✓ Zhang, L., Fang, X., Ren, G., et al. Environmental changes in the north China farming-grazing transitional zone. *Earth Science Frontier*, 1997, 4:127–136, (in Chinese).

### **Comment 3**

Finally, the regional treatment of records was variable. For example, only three records for North America were included. One potential avenue for strengthening the study would be to focus on one region or one climate feature instead of reaching for a global conclusion on a shaky foundation. The sentence “Therefore, in some cases, we have followed the authors’ original interpretations of paleoclimate records and have not made any corrections” (line 137) is concerning. It is unclear whether some interpretations should be considered suspect or whether the authors did make any corrections. Moreover, any corrections made should be clearly articulated and changes to the original interpretation need a solid scientific justification.

*We agree with and appreciate the reviewer's two suggestions. For the first, our inconsistency in regional treatment of proxy records is mainly due to the uneven geographical distribution of proxy records that could be used to detect the 7.5-7.0 ka BP.*

*For the second, we agree with you that our uncritical acceptance of the original interpretation by the selected proxy records is inappropriate and thus has no solid scientific justification, and we will check these original reconstructions in the revised manuscript.*

#### ***Comment 4***

Finally, the study is framed as providing insight into future abrupt climate change, but other motivations may be more convincing. Understanding Holocene climate variability and the climate dynamics associated with certain forcings are important, and certainly motivate this study and others like it.

*We agree with your comments and we will seriously consider your suggestions in the revised manuscript.*

#### ***Minor***

Additionally, the language used throughout the paper is often strong (e.g., lines: 532, 630, 738) and inconsistent with the uncertainty apparent throughout the manuscript.

*We agree with you that our language is too strong, which is inconsistent with our study aim. Our aim is to provide hypothesis for a possible widespread climate anomaly around 7.5-7.0kaBP. It is just a hypothesis rather than reality that needs further verifications. Thanks for pointing out our inappropriate expressions and we will make modifications of language.*

We suggest standardizing the figures' visual style (at present there are many varied styles for presenting each time series), providing more details in the captions, and checking the data. For example, the eastern Alps temperature anomaly shows a curious horizontal bump around 7.6 ka BP that would suggest an age reversal.

*Thanks for your suggestion, and we will carefully check these figures in the revised manuscript.*

For these reasons, we feel like the paper is not suitable for publication until the

short-comings described above are addressed, which requires extensive changes. Regardless, we wish the authors well in their future research.

*We appreciate your valuable suggestions and comments on our manuscript, which will help us to clarify the inappropriate expressions, refine some confused ideas, and improve our manuscript. We hope that we have addressed all the questions.*

*We appreciate your concertation of our response. We hope that we have addressed all the questions by the reviewers.*

*Thank you very much for your time and considerations,*

*Sincerely,*

*Corresponding Author*

*Wenxiang Wu*