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.

Anonymous Referee #1

Comment 1

The paper by Mei Hou and colleagues is focused at the climate in five key regions: Asia, the Americas, Europe, the Mediterranean, Africa, and the polar regions at the time be-tween 7.5-7.0 cal ka BP. The authors analyzed 47 previously published paleoclimatic records and identified a cold episode around this time. They diagnosed a cooling in the polar regions, north-central Europe and in western North America, a weaker Asian and stronger South American summer monsoons and contrasting patterns of precipitation in the Mediterranean. This cooling occurred in the warm period of the mid Holocene and this adds additional interest to the analysis of its forcings. The cooling roughly coincides with IRD event between 7.5 and 7.3 cal ka BP (Bond et al., 2001) and with two(out of three) spikes of the solar irradiance around this time (Steinhilber et al., 2012).The authors explain the observed climate patterns by a combination of orbital forcing, deglaciation, volcanic eruptions, and solar activity. I believe that the paper is interesting and is an important contribution to the study of the Holocene climate.

We are grateful 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 2

However, I am missing a discussion with some previous papers concerning the same problem. The first one is Wanner H., Solomina O., Grosjean M., Ritz S.P. and Jetel M. 2011. Structure and origin of Holocene cold events. Quaternary Science Reviews, v 30, n 21-22,p. 3109-3123 doi:10.1016/j.quascirev.2011.07.010 These authors selected 46 temperature and 35 humidity sensitive time series proxies and identified six cold relapses during the last 10,000 years occurred around 8200, 6300, 4700, 2700, 1550 and 550 years BP. Thus, no cooling in the interval 7-7.5 cal ka BP was identified in this paper. I think it would be important to discuss this discrepancy, including the comparison of the time series used in both papers, the criteria of "cooling" etc.

Second one concerns the global glacier variations (Solomina O., Bradley R., Hodgson D., Ivy-Ochs S., Jomelli V., Mackintosh A., Nesje A., Owen L., Wanner H., Wiles G., Young N. 2015 Holocene glacier fluctuations. Quaternary Science Reviews Volume 111, 1 March 2015, Pages 9–34. doi:10.1016/j.quascirev.2014.11.018). Solomina et al., 2015 in their review of Holocene glacier variations identified two advances around 7.7 and between 7.1 and 6.5 ka. I would appreciate the author's opinion about this: which one was forced by the cooling that they are considering. Several curves (e.g. at the Figs 2, 3, 4) actually show two minima (or one but slightly outside the interval 7-7.5 cal ka BP). Is there a possibility that there were two events?

The second reviewer also inquiries the discrepancy between our suggested possible climate anomaly and its absence in the reconstruction by Wanner et al. (2011). Before answering his (her) question, we present an introduction about the difference in research methodology between us and reviewers. Please see detailed discussions in the response to the second reviewer. Here, we mainly discuss some basic problems.

Wanner et al. (2011) compiled 46 temperature and 35 humidity/precipitation time series to identify the Holocene cold events and found that 38 sites (47%) recorded the 8.2 ka event; if 11 ice cores are excluded, only 27 site (33%) registered 8.2 ka event. It is should be noted that the existence of 8.2ka event has been previously confirmed by the multiple duplicable 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 related to it 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". Such conjecture was supported by the reconstruction of other Holocene events by Wanner et al. (2011). For example, they did not identify 4.2ka event, the widely accepted marker event for the Middle-late Holocene boundary (Walker et al., 2012). In addition, their identified 6300 a BP and 4700 a BP event received less acceptance by the Holocene climate research community than their possible counterparts of 5500 a BP (Magny, 2003; Brooks, 2006) and 4.2kaBP (Walker et al., 2012; Wu and Liu, 2004).The identified 6300 a BP and 4700 a BP event should not be regarded as truth but as hypothesis, needing further variations. In this way, the absence of possible 7.5-7.0ka event in reconstruction by Wanner et al. (2011) should not be used to prove against its existence.

Compared with other continuous proxy records, discontinuous glacier records usually subject to the high dating uncertainties and ability to capture the exact variables (temperature or perception or both) of climate change. Both glacier advances around 7.7 and between 7.1 and 6.5 ka may be the related to the same climate anomaly around 7.0-7.5 ka BP, but they may also not, and there is also a possibility that there were two events. We may also give two examples here to illustrate the complexity of identifying the exact timing and duration of an event. Even the then high reproducibility by several multiple independent reconstructed ice-core records confirmed the existence of 8.2kaBP event, Alley and Ágústsdóttir (2005) found that the presumably reconstructed climate anomaly that was correlated to the 8.2kaBP event has estimated a duration ranging from 100 to 1000 yr or more. Similarly, in reviewing the Dark Age Cold Period, a period with precisely dated and highly-resolved proxy records, Helama et al., (2017) found that different reconstructions have different durations for the Dark Age Cold Period with a range more than several hundred years.

- ✓ *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.*
- ✓ *Brooks N. Cultural responses to aridity in the Middle Holocene and increased social complexity. Quaternary International, 2006, 151(1): 29–49.*
- ✓ *Helama, S., Jones, P. D., Briffa, K. R. Dark Ages Cold Period: A literature review and directions for future research. The Holocene, 2017, 27: 1600–1606.*
- ✓ *Magny, M., Haas, J.N. A major widespread climatic change around 5300 cal. Yr BP at the time of the Alpine Iceman. Journal of Quaternary Science, 2004, 19: 423–430.*
- ✓ *Walker M J C, Berkelhammer M, Björck S, et al. Formal subdivision of the Holocene Series/Epoch: a Discussion Paper by a Working Group of INTIMATE (Integration of ice-core, marine and terrestrial records) and the Subcommission on Quaternary Stratigraphy (International Commission on Stratigraphy). Journal of Quaternary Science, 2012, 27(7): 649–659.*
- ✓ *Wanner, H., Solomina, O., Grosjean, M., et al. Structure and origin of Holocene cold events. Quaternary Science Reviews, 2011, 30: 3109–3123.*
- ✓ *Wu, W., Liu, T. Possible role of the "Holocene Event 3" on the collapse of Neolithic cultures around the Central Plain of China. Quaternary International,2004, 117:153–166.*

Comment 3

When the authors refer to the glacial history they are citing Karlen, 1988 paper ("In north-central Europe, an IRD spike (Bond et al., 2001), widespread mountain glacial advances (Karlén, 1988), and higher lake levels537 (Magny, 2004) pointed to cold–wet climate conditions."). Although Karlén, 1988 is a very comprehensive review, but during the last 30 years a lot of new data (including new methods of dating!) appeared and I would recommend to update the reference and check the chronology of glacier fluctuations that the authors refer to.

We agree with you and will update the reference of Karlén (1988) and add two references by Nesje (2009) and Solomina et al., (2015) in the revised manuscript.

References to be added:

- ✓ *Nesje, A. Latest Pleistocene and Holocene alpine glacier fluctuations in Scandinavia. Quaternary Science Reviews, 2009, 28:2119–2136.*
- ✓ *Solomina O., N., Bradley, R., S., Hodgson, D. A., et al. Holocene glacier fluctuations. Quaternary Science Reviews, 2015, 111: 9–34.*

Comment 4

It would be interesting to analyze a little more in detail the records that have potentials for higher resolution. For instance, it was noticed that the "overcooling of SSTs to below 18℃ resulted in at least nine abrupt massive mortality events in reef corals (line 550-551)". Such analysis is important for the explanation of forcings: nine short events require another combination of forcings that one strong event of long duration.

Thanks for your suggestion. In the revised manuscript, we will add some information about those records with higher-resolution.

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