

Response to Cody Routson

We very much thank the reviewer for taking the time to review our manuscript. The comments and suggestions are of tremendous assistance to improve the quality of our manuscript. The point-by-point responses are listed below.

Zhang et al., present a nice new compilation of existing Holocene and glacial hydroclimate records, which is accompanied by an interesting analysis. They compare proxy hydroclimate records, proxy lake level records, and PMIP simulations between the last glacial maximum, mid-Holocene, and future warming. Generally the analyses are straight forward and I think worthwhile of publication. However, before I can adequately evaluate the study design and associated conclusions, much work needs to be done to clarify the writing. The manuscript would substantially improve by having a native English speaker edit the sentences and overall structure. Many of the sentences are incomplete, difficult to follow, or entirely nonsense. I would also highly recommend reading and implementing the writing principals outlined by Joshua Schimel in his book “Writing Science” published in 2012. Below is my preliminary review, which was conducted rapidly and remains incomplete until the overall presentation and writing is improved.

1. The introduction is meandering and hard to follow. Make sure each sentence doing work, frame the knowledge gap, and keep the story moving forward in a logical sequence.

We revised and streamlined the introduction to improve readability.

2. Line 62. This gets to the point of the study, but should also include the LGM. Something along the lines of “...pattern of changes during the LGM, mid-Holocene and modern warm period...” Also there is only one modern warm period so it should be singular in this sentence.

The sentence was rewritten as suggested.

3. Line 71: This sentence is difficult for me to follow. Please re-write. Or remove?

Removed.

4. Line 72: Is there a sampling resolution criteria?

The dating control level rather than sampling resolution criteria was used here. Given the lack of continuous lake records dating back to the LGM (usually with depositional hiatuses), it's hard to make a resolution limit.

5. Line 76: I appreciate a description of the COHMAP dating scheme, however it is difficult to follow as written. Please clarify. Use multiple sentences if needed.

Clarified using multiple sentences.

6. Line 79. It took me some time to figure out what what you are trying to communicate here. The finding of 52 sites and Table 1 are results, and should be moved down into the beginning of the results section. Then, on line 79, a new paragraph should

be started with rewording the sentence to something along the lines of: “We then compared our new compilation of proxy records to 50...”

A new Figure 1b (model-data comparison based on Table 1) was added, and Table 1 was moved into Supplement. On original line 79, a new paragraph was started with rewording the sentence as suggested.

7. Line 82-84: Sentence structure, please clarify. Use multiple sentences as necessary.

Clarified using multiple sentences.

8. Line 107: Replace “involved” with “used”

Done.

9. Line 127: This sentence doesn’t make sense.

The paragraph was reorganized and revised to make it clearer.

10. Line 138: Please show the data (a graph or otherwise) to support the statement in this paragraph.

A new Figure 1b was added.

11. Line 145: I’m not following the argument in this paragraph. What two global warming processes? Was this described somewhere in the methods? E21 and L21? Please clarify.

Two global warming processes here mean the two periods of LGM-MH and PI-L21. This kind of expression is proved to be inappropriate and have been revised in whole manuscript. We now believe this paragraph is unnecessary and should be removed.

12. Line 151 and Figure 2: Please justify the comparison between warming from the LGM to MH versus PI to future warming. This should be done in the methods and then discussed in the discussion. There are very important mechanistic differences between mid-Holocene and future warming. Mid-Holocene warming was driven by changes in primarily summertime insolation whereas future warming is driven by greenhouse forcing. Some impacts are comparable, but differences in forcing mechanisms need addressed. It appears that you try to do some of this in the discussion, but it needs to be developed/clarified.

Yes, we agree that the rationality of comparison between different timescales is the basis of our study. We will address this in more details in the revised version.

13. Figure 2 and 3 captions. Please indicate why the maps have extreme missing data coverage. The significant regions are shown by the gridding...CRU has data over the regions which show no data...

Thanks for reminding me. The maps only show changes in global closed basins, and we have clarified it in captions.

14. Line 193: Please point the reader to the correlations (Table 4) before discussing them.

Done.

15. Line 241: Please point toward something to justify the statement that winter precipitation will play a dominant roll in future hydroclimate changes.

It is based on results from monthly precipitation changes of L21-E21 (Table 2).

16. Line 256: Please remove the word “comprehensive”.

Done.

17. Line 266: The conclusion that moisture changes in closed basins are resilient to warming needs justified...Large increases in temperature alone will dramatically increase evaporation and decrease effective moisture (e.g. lake level) under RCP 8.5 scenarios.

It's more resilient than previous thought, especially compared to alarming declines in water storage in recent years. We will expand the discussion on this in the revised version.

18. Data availability: Please make your compilation of 52 hydroclimate records available in addition to data that were already available.

OK, a new statement was added.

19. In general, make sure statements are accompanied by the data that support them (Figures, tables or otherwise).

We had an overall check and revised.