

Interactive comment on “Synergy of the westerly winds and monsoons in lake evolution of global closed basins since the Last Glacial Maximum” by Yu Li and Yuxin Zhang

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We thank very much for reviewer's comments concerning our manuscript. We use bold font to highlight reviewer's comments and use normal font to mark our reply.

General comments The study presents an interesting way of separate the influence of westerlies and monsoon on mid-latitude closed basins by complementing paleoclimates records and climate models. However, minor changes should be made before final publication.

1. Most of the work and its conclusions are applicable to the Northern Hemisphere (NH); in my opinion this should be represented in the title of the work.

Thank you very much for your suggestion. Our study regarded global closed basins as study area and explored synergy of the westerly winds and monsoons in lake evolution since the LGM. However, most closed basins are located in the Northern Hemisphere so that most of the work and conclusions are concentrated there. We will supplement the relevant conclusions of Southern Hemisphere in the revised version.

2. In Material and Methods section, authors consider three periods (LGM, MH and PI); however, in most of the analyses only LGM and Holocene are studied, having only a few mentions about the late Holocene or PI period.

Thank you very much for your suggestion. We will supplement the analyses of climate characteristic in the PI period in the revised version.

3. I am little confused, in P7, L144 said “Whereas, effective moisture increases since the LGM over the global Tropics”. However, one the main conclusions of this work is that monsoon areas were characterized by dry conditions during the LGM (and late Holocene), and humid conditions during the early-mid Holocene. Please could you explain that?

Yes, of course. Based on the time series of the effective moisture change in the monsoon dominated closed basins

of the Northern Hemisphere, we draw a conclusion that humid climate prevails in the early-mid Holocene and relative dry climate appears in the LGM and late Holocene. However, according to the trend analysis of continuous simulation in effective moisture change, effective moisture increases since the LGM over the global Tropics. Trend analysis is used to judge whether the fluctuation of the time series is mainly rising or falling. Even effective moisture is relatively low in the LGM and late Holocene, and relatively high in the early-mid Holocene, the fluctuation of effective moisture is dominated by rising trend.

4. Figure 2: What are the dark areas in the map? Letters (a) and (b) are missing.

Thank you for pointing this out, the dark areas are global closed basins. And we will supplement the caption and Letters (a) and (b) of Figure 2 in the revised version.

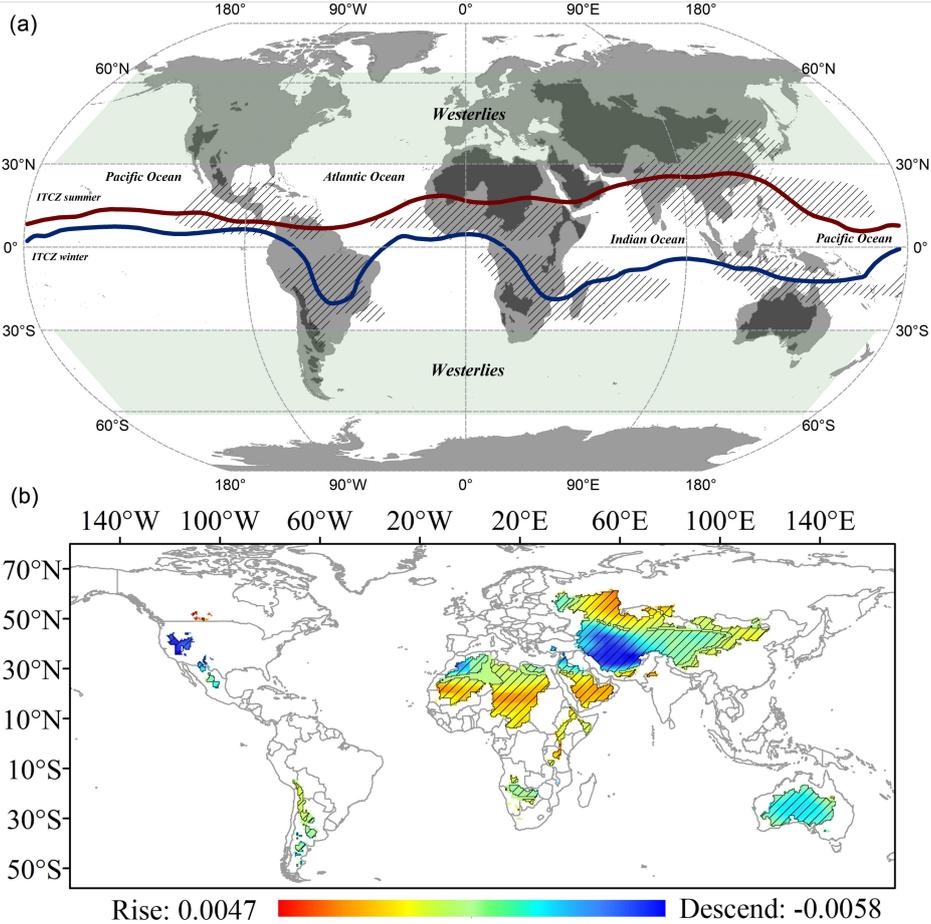


Figure 2. (a) Distribution of global closed basins and circulation system: The dark areas are global closed basins; summer and winter are in accordance with the Northern Hemisphere; the shadows present the six monsoon areas according to Wang (2009), and (b) Trend analysis of continuous simulation in water balance change: The shadows

indicate that the trends are statistically significant at 5% level.

5. Figures 3 and 4: Improve figure caption, is not totally representative of the figure.

Thank you very much for your suggestion. We will improve figure caption of Figures 3 and 4.

Figure 3. (a) Spatial distribution feature of EOF1, (b) Spatial distribution feature of EOF2, (c) PCA1 and PCA2 of simulated water balance change since the LGM, and (d) Comparison between stalagmite records and summer insolation: Stalagmite records come from Dykoski et al. (2005) and Wang et al. (2008), summer insolation comes from Berger (1978).

Figure 4. Comparison between simulated water balance change and reconstructed moisture index in the mid-latitude closed basins of the Northern Hemisphere during the Holocene. Triangles indicate locations of paleoclimate records (Table 3).

6. In P9, L177 text indicate that a moisture index was reconstructed from early Holocene to late Holocene. However, in methodology that fact is not totally explained.

Thank you very much for your suggestion. We will clarify this in the revised version.

Specific comments 1. Figure 3: For reduce unnecessary information on Figure 3, only include latitude at one side of the map.

Thank you very much for your suggestion. We will modify the Figure 3 in the revised version.

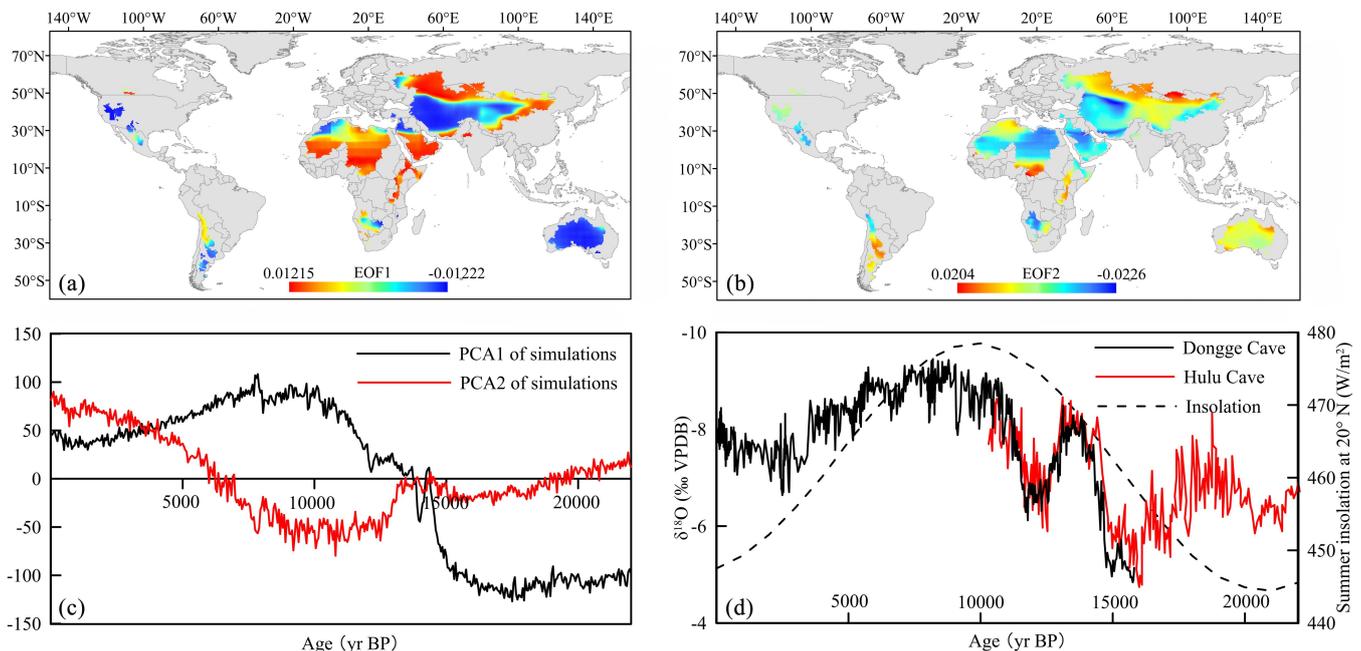


Figure 3. (a) Spatial distribution feature of EOF1, (b) Spatial distribution feature of EOF2, (c) PCA1 and PCA2 of simulated water balance change since the LGM, and (d) Comparison between stalagmite records and summer insolation: Stalagmite records come from Dykoski et al. (2005) and Wang et al. (2008), summer insolation comes from Berger (1978).

2. Figure caption on figure 6: I think that letters “(a)”, “(b)” and “(c)” must go at the beginning of each description.

Thank you very much for your suggestion. We will modify figure caption on Figure 6.

Figure 6. (a) Simulated water balance change between westerly dominated regions and monsoon regions in the Asian closed basin since the LGM, (b) General climate changing patterns during the Holocene in monsoon Asia and westerly Central Asia come from Chen et al. (2006), and (c) Extracted westerly dominated regions and monsoon regions in the Asian closed basins.

3. P4, L93, 96 and 100: It must be Equation (1) instead of Eq (2).

Thank you very much for your careful examination of the manuscript. We will modify this in the revised version.

4. P4, L101: It must be Equation (2) instead of Eq. (3).

Thank you very much for your careful examination of the manuscript. We will modify this in the revised version.

5. P13, L231: Text is confusing: “Major trend of moisture conditions revealed by the (. . .) is a gradual decrease since the early Holocene, and reaches the wettest status between 8 and 6 kyr in the East Asian monsoon region”. It describes a decrease in moisture but ends with wettest conditions. Please reword the sentence in order to avoid confusion.

Thank you very much for your suggestion. We will reword this sentence.

Technical corrections P2, L50: “Simulate” instead of “simulating”. Include (precipitation minus evaporation) after P-E.

Thank you very much for your careful examination of the manuscript. We will modify this.

P2, L51: delete space before Pre-Industrial.

Thank you very much for your careful examination of the manuscript. We will delete space before Pre-Industrial.

P2, L51-58: The sentence is too long, needs to be rephrased.

Thank you very much for your suggestion. We will reword this sentence.

P2, L53: “which” instead of “where”.

Thank you very much for your careful examination of the manuscript. We will modify this.

P2, L57: add a “s” at the end of monsoon (= monsoons).

Thank you very much for your careful examination of the manuscript. We will modify this.

P2, L58: “Last” instead of “last” (capital letter).

Thank you very much for your careful examination of the manuscript. We will modify this.

P2, L58-61: I think that the phrase “(..) according to records of Quaternary ice sheets, low-mid latitudes summer insolation and winter insolation, $\delta^{18}O$ of Greenland ice core, etc.” could be summarized.

Thank you very much for your suggestion. We will reword this sentence.

P3, L67: delete space before 3 in CCSM3.

Thank you very much for your careful examination of the manuscript. We will modify this.

P3, L69: delete space before 4 in CCSM4.

Thank you very much for your careful examination of the manuscript. We will modify this.

P3, L84: Hostetler and Bartlein (1990)’s model.

Thank you very much for your careful examination of the manuscript. We will modify this.

P4, L90: Add parenthesis to the referenced cited (= Morrill (2004) and Li and Morrill (2010)).

Thank you very much for your careful examination of the manuscript. We will modify this.

P4, L94: Add a space after AB.

Thank you very much for your careful examination of the manuscript. We will modify this.

P4, L95: Add space before parenthesis “lake(m year⁻¹)”.

Thank you very much for your careful examination of the manuscript. We will modify this.

P4, L104: Add parenthesis to the referenced cited (= Li and Morrill (2010)). Replace Eq. (2) by (1) and (3) by

(2).

Thank you very much for your careful examination of the manuscript. We will modify this.

P4, L108: Delete “and” and replace phrase “and lake status information sorted by latitudes are shown in T able 2” by “Lake status information sorted by latitudes are shown in T able 2”.

Thank you very much for your careful examination of the manuscript. We will modify this.

P6, Fig. 1: In figure caption replace “mm/year” by “mm year⁻¹”.

Thank you very much for your careful examination of the manuscript. We will modify this.

P7, L138: Replace “that lakes with” by “in which lakes with” or “where lakes with”. It is not clear to me if Qinghai Lake, Hala Lake and Zhabuye are examples of lake with relative high-level during MH or PI.

P7, L139: “and Zhabuye Lake. . .”

Thank you very much for your careful examination of the manuscript. We will reword this sentence.

P9, Fig. 3: In figure caption add “, respectively.” After “Wang et al. (2008)”.

Thank you very much for your careful examination of the manuscript. We will reword this figure caption.

P10, L185: Add “that” before “a humid climate”.

Thank you very much for your careful examination of the manuscript. We will modify this.

P10, L186: Delete “And” at the beginning of the phrase.

Thank you very much for your careful examination of the manuscript. We will modify this.

P10, L187: Delete “the” before “paleoclimate modelling”.

Thank you very much for your careful examination of the manuscript. We will modify this.

P10, L188: Text is confusing, needs rewording “. . .resulting in the loss of lake water reduces and the high lake level sustains.”

Thank you very much for your suggestion. We will reword this sentence.

P10, L190: replace “to increase” by “increasing”.

Thank you very much for your careful examination of the manuscript. We will modify this.

P11, L201: include “and late Holocene” after “prevailed in the early Holocene”. **Line 232:** The phrase could be written as “The longest and highest-resolution drill core from Lake Qinghai (An et al. 2012) indicate that summer monsoon record generally(. . .).”

Thank you very much for your suggestion. We will reword this sentence.

P14, L255: Change sentence by “In these regions, winter precipitation accounts for a large proportion of annual precipitation (Li et al., 2008)”.

Thank you very much for your careful examination of the manuscript. We will modify this.