Response to Anonymous Referee #2

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.

Dear editor and authors of the manuscript "Wet/dry status change in global closed basins between the mid-Holocene and the Last Glacial Maximum and its implication for future projection", I have no ability to assess the use of lake sediment data due to my professional restriction, and propose my opinion about the model results. This work is encouraged to help future projection using the paleoclimate information. The Global model-data comparison over the orbital scale and short-scale is important to understand the difference in the local hydroclimate variations. The analysis is logical and fruitful. I was attracted by the idea of the manuscript, but still felt unsatisfied about the mechanism. Thus, I suggest that the manuscript should be accepted for publication after a minor revision.

Main comments:

1. The mechanism should be furtherly improved. e.g. the influence of the insolation is not derived from the current study. A regional difference and its reason should be emphasized in the abstract and the conclusion. e.g. the difference of the hydroclimate variation mechanisms in the Central Eurasia and other regions.

To address this, we will rewrite the abstract and conclusion and discuss more details in the revised version,

2. The reason for choosing the analysis period is obscure. It is hard to understand to compare a centennial and longer variation of glacial-interglacial cycle with a decadal variation (AD 2006-2015 and AD 2091-2100). Is it better to choose the period as long as possible, e.g. the entire 20th century and 21th century?

We agree that the rationality of comparison between different timescales is the basis of our study. Even the entire 20th century and 21th century still mismatch the MH variation. Here we just consider the E21 and L21 as specific climate status. We will address this in more details in the revised version.

3. The conclusion should be furtherly verified. It is challenging that a decadal variation in the late 21th century is attributed to the ENSO variability. The Pacific decadal oscillation or the Inter-decadal pacific oscillation may be more appropriate, if the analyzed period would be extended to the entire century.

Thanks for your suggestion. A new table was added in the supplement, containing pearson correlation coefficients between AI and monthly NAO, SOI, PDO and TPI. The PDO indeed show significant correlation, but not better than ENSO does. We will address this in more details in the revised version.

Specific Comments:

1. Page 1, line 17. The location of these basins should be provided, which is your contribution. e.g. There is an opposite significant AI-MEI relationship between in the Southern Africa and in the Central Eurasia.

Added as suggested.

2. Page 2, line 30. The abbreviation of the term ’wet get wetter dry get drier’ could be revised to ’DGDWGW’ according to the previous study [Hu et al., 2019].

Revised and cited.

3. Page 2, line 56. ’Zhan et al.,’

Done.

4. Page 3, line 73-75. How to know that the proxy should be indicative of moisture changes and its drive is climatic change’? Following the original descriptions?

Yes, only records verified in the original study were used.

5. Page 3, line 83. What does the ’direction’ mean? Is it a trend?

It means the positive or negative change of simulated effective precipitation from the LGM to MH. The sentence was rewritten to clarify it.

6. Pages 3-5. The table 1 should be changed with a Figure 1b to show model-data comparison.

Done.

7. Page 6, line 120. References of these experiments should be added.

Done.

8. Page 7, line 138-143. A new Figure 1b would be helpful to describe this part.

A new Figure 1b was added.

9. Page 7, line 153. The L21-PI difference is a future scenario not a modern warming.

Expression of modern warming was removed.

10. Page 8, line 174. Why to select the period 1979-2016? Is it better to choose the same period with the early 21th century (AD 2006-2015)?

To match the MEI data series (new version). Another reason is that historical observations used for CRU gridding are sparse or simply unavailable over many land areas during the first half of the 20th Century. The early 21th century (AD 2006-2015) is too short to capture the modern moisture trends.

11. Page 10, line 205. ’within’

Done.

12. Page 11, line 239. ’2091-2100’?

Done.

13. Page 11, line 242. the period (AD 1901-2100) was not analyzed in this study.

Removed.

14. Page 11, lines 244-254. If the period is extended to the entire 20th century and 21th century, this discussion may be related to the above mechanism about a centennial and longer variation of glacial-interglacial cycle.

Thanks for your suggestion. We will expand this part of discussion in the invised version.

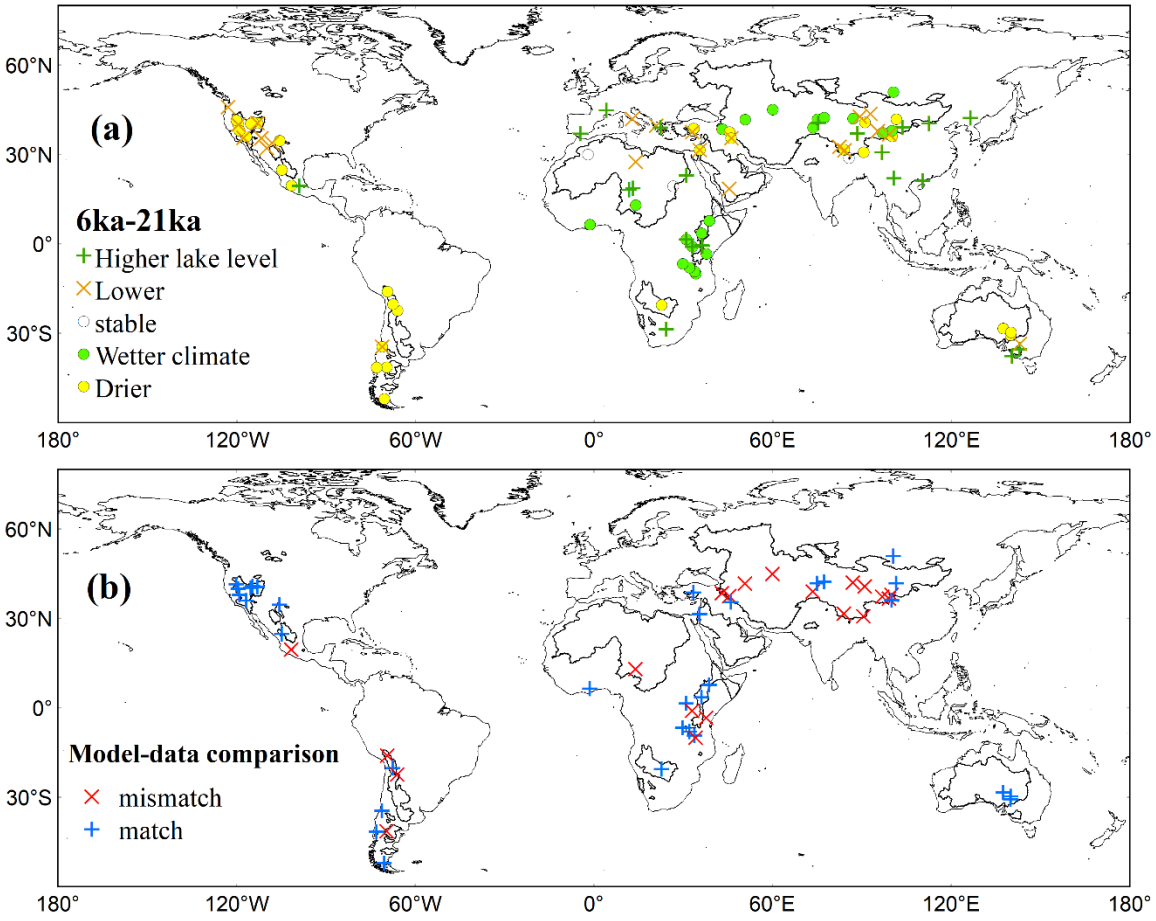

Figure 1. Wet/dry status change between the LGM and MH from lake records (a) and comparison with the simulated effective precipitation from PMIP3/CMIP5 multi-models (b).

Table S2. Pearson correlation coefficients between AI and monthly NAO, SOI, PDO and TPI during 1979-2016. The bold numbers mean that correlation coefficients are statistically significant at 5% level. SAM-South America, NAM-North America, SAF-Southern Africa, EAF-Eastern Africa, NAF-Northern Africa and Arabian peninsula, CEA-Central Eurasia, AUS-Australia, ALL-Global closed basins.

		1	2	3	4	5	6	7	8	9	10	11	12
NAO	ALL	0.25	-0.03	0.15	-0.03	-0.02	-0.02	-0.09	0.10	-0.03	0.19	0.06	0.12
	SAM	-0.15	0.00	0.05	-0.02	0.11	0.00	0.02	-0.07	**-0.34**	0.08	0.14	0.10
	NAM	0.01	-0.08	-0.11	0.10	0.11	0.07	0.09	0.10	-0.17	0.18	0.18	0.45
	SAF	-0.09	-0.17	0.08	0.17	0.13	**-0.36**	-0.11	-0.25	0.01	-0.18	-0.06	-0.07
	EAF	0.19	0.12	**0.41**	-0.04	-0.10	-0.06	-0.07	0.11	0.30	0.29	-0.03	0.03
	NAF	0.06	-0.05	0.15	0.05	-0.04	-0.12	0.06	-0.08	0.18	-0.11	-0.02	0.04
	CEA	**0.37**	-0.05	-0.08	-0.16	-0.04	0.14	-0.04	0.18	-0.12	0.05	0.01	0.02
	AUS	-0.17	0.04	-0.06	0.26	-0.08	-0.20	-0.03	-0.08	-0.13	-0.03	0.09	0.13
SOI	ALL	**-0.35**	**-0.35**	**-0.42**	**-0.48**	-0.07	0.16	0.01	0.07	-0.03	0.21	0.12	-0.08
	SAM	-0.17	0.02	-0.10	-0.24	-0.32	-0.22	-0.27	-0.06	-0.16	-0.15	-0.05	-0.25
	NAM	-0.01	-0.09	-0.06	-0.03	-0.17	-0.19	-0.24	-0.13	-0.12	-0.15	-0.07	0.03
	SAF	-0.06	-0.01	-0.15	-0.01	-0.07	0.08	-0.01	-0.05	0.07	0.17	0.14	0.10
	EAF	-0.22	**-0.34**	**-0.35**	-0.15	0.16	0.21	0.14	0.03	0.01	0.22	-0.01	0.08
	NAF	-0.17	-0.13	0.07	-0.15	0.22	0.07	0.02	-0.02	0.18	0.15	0.05	0.09
	CEA	-0.26	-0.30	**-0.37**	**-0.53**	-0.23	0.01	-0.08	0.03	-0.14	-0.01	-0.01	-0.23
	AUS	0.19	**0.39**	0.27	0.13	0.07	-0.14	-0.08	0.01	0.09	0.11	0.21	0.04
PDO	ALL	-0.10	-0.06	-0.07	0.06	0.08	0.16	0.19	0.29	0.31	0.30	**0.33**	**0.34**
	SAM	-0.19	-0.17	-0.13	-0.12	-0.07	-0.04	0.01	0.12	0.15	0.15	0.14	0.06
	NAM	**0.51**	**0.57**	**0.56**	**0.48**	**0.39**	0.29	0.19	0.13	0.08	0.06	0.05	0.07
	SAF	**-0.60**	**-0.63**	**-0.61**	**-0.56**	**-0.49**	**-0.43**	**-0.33**	-0.22	-0.13	-0.07	0.00	0.03
	EAF	-0.09	-0.09	-0.11	-0.03	0.01	0.08	0.05	0.06	0.13	0.14	0.19	0.23
	NAF	0.15	0.10	0.07	0.11	0.05	0.00	-0.03	-0.02	0.02	0.07	0.13	0.10
	CEA	0.08	0.14	0.14	0.27	0.29	**0.37**	**0.42**	**0.48**	**0.41**	**0.37**	**0.34**	**0.37**
	AUS	0.06	0.09	0.08	0.00	-0.09	-0.19	-0.24	-0.26	-0.28	**-0.32**	**-0.34**	**-0.34**
TPI	ALL	-0.10	-0.06	-0.07	0.06	0.08	0.16	0.19	0.29	0.31	0.30	**0.33**	**0.34**
	SAM	-0.19	-0.17	-0.13	-0.12	-0.07	-0.04	0.01	0.12	0.15	0.15	0.14	0.06
	NAM	**0.51**	**0.57**	**0.56**	**0.48**	**0.39**	0.29	0.19	0.13	0.08	0.06	0.05	0.07
	SAF	**-0.60**	**-0.63**	**-0.61**	**-0.56**	**-0.49**	**-0.43**	**-0.33**	-0.22	-0.13	-0.07	0.00	0.03
	EAF	-0.09	-0.09	-0.11	-0.03	0.01	0.08	0.05	0.06	0.13	0.14	0.19	0.23
	NAF	0.15	0.10	0.07	0.11	0.05	0.00	-0.03	-0.02	0.02	0.07	0.13	0.10
	CEA	0.08	0.14	0.14	0.27	0.29	**0.37**	**0.42**	**0.48**	**0.41**	**0.37**	**0.34**	**0.37**
	AUS	0.06	0.09	0.08	0.00	-0.09	-0.19	-0.24	-0.26	-0.28	**-0.32**	**-0.34**	**-0.34**