

## ***Interactive comment on “Late Pleistocene to Holocene climate and limnological changes at Lake Karakul (Pamir Mountains, Tajikistan)” by Liv Heinecke et al.***

**Anonymous Referee #2**

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The manuscript of Heinecke et al. was prepared and written very well in general. It is expressive that there is a large amount of data produced in this work, and they were applied clearly to support scientific interpretations and to understand climate and hydrological changes in Central Asia. The discussion and conclusions are generally consistent, which are important to understand past climate change in arid central Asia and its connections with the Asian monsoon and the Westerlies. My general recommendation is that this manuscript could be accepted in this journal but after minor revision.

The detailed comments are as followed.

- 1) It is necessary to improve the quality of Figures and corresponding captions. In  
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particular, for Figure 2 and 3. Apparently, Figure 2 and corresponding section is too simple. Please provide more details in the figure and corresponding descriptions in the section 4.1. For Fig.3, I would suggest to split it into two figures instead of Fig3.A and B then the reader can see more clearly. Please remove the EM.res. scores from Fig.3A for it does not provide any meaningful information. I strongly suggest to plot paleoenvironmental indicators along geochemical and sedimentary parameters so that the reader will get a straightforward appreciation of the record and the interpretation instead of searching difficultly in the text. Please note that there are PCA axis 1 scores and PCA axis 2 scores both in the Fig3.A and B, apparently, they are different but it is confusing and misleading somehow. Please distinct them. Similarly, the zones in two figures are different. I could not follow why they are different and the real question is why there is a mismatch between the so-claimed external and internal processes. The sub-zones should be displayed in the figure, such as Pre-LGM, LGM, late glacial, early and middle Holocene. For Fig.4 the captions of A and B are obviously reversed. For Fig.5, the legend should be placed at a better position so that the plots of A and B would have same size.

- 2) The PCA internal axis 2 is interpreted to represent lake level change, but why this is not consistent with the main grain-size data. Normally, for the sediments they tend to be finer when lake level become higher and vice versa. In figure 3, particularly in the zone 3, there is a trend of fining of grain size but a decreasing of lake level.

- 3) What is the difference between the two periods: pre-LGM and after 6.6 ka, if both periods are dominated by the westerlies, why the geochemical and sedimentary parameters are so different. This could lead to the question on the hypothesis that the interplay between westerlies and Asian monsoon. Why the two atmospheric circulations are always competitive but not cooperative?

- 4) As viewed from oxygen and carbon isotopes, there are no significant variations since late glacial to 2 ka. It is hard to tell how the studying area was impacted by the Asian monsoon and to what extent. So the question is which parameter is relatively good

indicator of monsoon or the westerlies.

5) The general trend of Br is increasing but the TOC is decreasing in the zone 3, could they both be treated as the indicator for productivity?

6) It is pity that the results of this manuscript have not been compared with other paleoclimate records in the surrounding and those from different climate and geographic backgrounds. It would be helpful in understanding the general picture of past climate change globally and regionally if the record is compared to the records during the same time intervals.

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