Climate of the Past Discussions

Clim. Past Discuss., referee comment RC1
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Comment on cp-2022-92

Anonymous Referee #1

Referee comment on "Climate transition over the past two centuries revealed by lake Ebinur in Xinjiang, northwest China" by Xiaotong Wei et al., Clim. Past Discuss., https://doi.org/10.5194/cp-2022-92-RC1, 2022

The manuscript by Wei et al. tries to use a sediment core from lake Ebinur in northwest China for paleoenvironmental reconstruction of the past ~200 years. For this purpose, the authors dated the record with ^{210}Pb only, as ^{137}Cs showed no activity. This was successful back to AD 1944 at 17.5 cm sediment depth while for the lower part a linear extrapolation was applied. Unfortunately, the authors do not provide any information how this was done. In my opinion this cannot be done as i) we usually have less compacted sediments in the upper part of sediment cores with a high sedimentation rate and ii) there is a change in lithology which the authors use for their environmental reconstruction. In addition to that, the authors give a basal age for the record of AD 1816. Such a precision seems to be impossible with a well dated record but for sure with such an approach. As there is still some Pb activity in the lower part of the dated record, the authors might want to continue measurements either to extent the chronology or to prove that there is no activity anymore.

For environmental reconstruction the authors used several methods. While some of the parameters might indeed be interpreted in the way it was done some can certainly not (especially the spectrophotometer data) and others miss explanation or evidence. I will try to explain that in the detailed comments below.

Although I am not a native speaker, I do have the feeling that the text also needs some language corrections, which might make it easier to read and understand.

Detailer comments:

- Line 29: 1819 --> This is an unrealistic age
- 73-74: tree-ring δD record from Kenya demonstrates that extreme drought in East Africa in the early 1920s --> What is the relation to China / this study?

- 138-139: The climate is generally characterized by warm-dry summers and cold wet winters --> If you can talk about wet conditions in this setting at all, this is not consistent with Fig. 2
- 195-197: The dry samples were weighed before and after carbonate removal, and the actual TOC values were obtained by converting the measured TOC values using the ratio of the mass before and after treatment. --> Why would you weigh them after carbonate removal? Is there some information missing?
- 220: using a linear extrapolation method --> I don't know how this was done but I am sure that this cannot be done (see explanation above)
- 230-231: correlation coefficient (r2) --> This is not a correlation coefficient and needs more explanations
- 233: with over 60 % of the C value above 50 μm --> This needs more explanations
- 239: Thus, the sedimentary sequence can be divided into two units. --> How exactly did you determine the boundary of the units? This is very important as this is one of your major findings when this happened. According to some parameters the boundary could also be further downcore
- 240: Fig. 4b and c need more explanations
- 266-269: Correspondingly, the contents of TOC (0.25-0.34, mean 0.30) and TIC (1.91-2.95, mean 2.50) also showed strong fluctuations (Figs. 5m, 5n), which may have been influenced by strong wind activity during the cold period. --> How? What is the mechanism behind that?
- 270-271: In general, the ultrafine component (the grain size fraction of < 1 μm) is associated with pedogenesis and can be used as indicator of regional climate change --> this needs more explanation
- 272-274: In this unit, the proportion of ultrafine component is the highest in the whole sequence (1.7 %-10.2 %, mean 5.0 %), revealing the strongest pedogenesis in the study area --> This would imply that no soils have been present before modern soil formation and that soils formed are immediately removed. Have you considered soil erosion as one mechanism? This should be discussed
- 274-277: It is generally believed that pedogenesis is related to temperature and humidity (Sun et al., 2011). However, the temperature was lower and the wind speed was higher during 1816-1920 AD, so we considered that the strong pedogenesis during this period might be related to the high humidity. --> This is a lot of speculation. Especially if the comment above is considered
- 281-284: a* is usually affected by red minerals (e.g., hematite and goethite) and is thought to be associated with oxidation of sediments in arid region (Ji et al., 2005; Jiang et al., 2007). The high a* value (mean 0.76) in this unit indicates that more water vapor enhanced the oxidation during the cold period (Fig. 5l), thus providing more red minerals for the lake. --> Colors can react on various processes especially if you use dried samples. This is a lot of speculation and needs to be verified by further (mineralogical) analyses.
- 285-286: L* values within arid lakes are considered to reflect variations in the carbonate, and high L* values denote more carbonate content --> This can be the case – but it is certainly not the case here. In this case there should be a correlation between L* and TIC which is a much better carbonate indicator – which is not the case. In addition to that, why would you use an indirect indicator for carbonates if you have a direct one?
- 287-291: The L* value in this unit fluctuates between 73.2-76.1, with an average of 74.6 (Fig. 5k), which may be related to the changes of the lake water body. The cooling leads to weakening of evaporation and transpiration, and together with more water vapor from the westerlies (Guo et al., 2022), resulting in more water in the lake and more carbonate content. --> Wouldn't you normally expect a higher carbonate content in more evaporative instead of less evaporative conditions? This needs more discussion
- 296: 816-1876 --> It is impossible to be this precise
- 305: a stable variation with slight fluctuations --> What is that?
- 308: EM2 --> Why are you putting so much emphasis on EM2? EM1 explains much

more of the variation

- 310-311: This is probably duo to the decrease of the temperature gradient --> Between what?
- 313-314: the contents of TOC (0.25-0.32) and TIC (2.17-2.63) showed very slight fluctuations except for the top two points --> How do you interpret this?
- 316: revealing weaker pedogenesis --> Or transport?
- 316-319: The obvious decrease of a* value (mean 0.51) indicates the weakening of oxidation (Fig. 5l), which may be caused by reduced water vapor from westerly circulation and enhanced evaporation due to the increase in temperature. --> This is pure speculation as colors can be influenced by various factors
- 319-321: the relatively high L* value (mean 75.3) may be associated with an increase in summer glacial meltwater into the lake as a result of warming --> This needs to be explained
- However, the increase of L* value since 1955 AD may be related to the dramatic shrinkage of lake Ebinur by human activity --> How? This needs to be explained
- 324-326: unit 2 can be further divided into two sub-units according to the variation of all proxies: unit 2-a (24-16 cm, 1920-1955 AD) and unit 2-b (16-0 cm, 1955-2019 AD) (Figs. 5a-5n). --> Sorry, but I cannot see that. On what is it based?
- 330-334: The Y value of Sahu's formula is usually used to recognize the eolian environment, which is mainly determined by mean grain size, standard deviation, skewness, and kurtosis (Sahu, 1964). The Y values of all samples range from -19.5 to -7.6, lower than the threshold value of -2.74 (Fig. 7), supporting their windblown origin (Jiang et al., 2017b, 2022; Wei et al., 2021). --> This needs to go to the Results and Interpretation chapter
- 344-352: End-member simulations of all 96 grain size data show that there are two end member components in lake Ebinur sediments: 345 EM1 (~ 5.9 μm) and EM2 (~ 24.1 μm) (Fig. 4a). This is consistent with previous studies (Pye, 1987; Jiang et al., 2014; Wei et al., 2021), i.e., the fine particles (EM1) are transported by long distance high-altitude suspension and represent background deposition, while the coarse particles (EM2) are transported by short distance low-altitude and represent local and regional deposition. In addition, the EM2 component (~ 24.1 μm) shows a similar modal distribution with aeolian dust samples collected from the Ebinur drainage area (15-26 μm) (Ma et al., 2016), further supporting the possible transport mechanism model proposed by us. --> This also needs to go to the Results and Interpretation chapter
- 372-373: These two events (E1, E2) may be related to local strong wind events within the age error --> If you consider the error you should provide the error in your study. When did the local wins events occur? Can you integrate the wind data in Fig. 8?
- 389-391: These results are consistent with the cold-wet and warm-dry climate combinations revealed by Chen et al. (2010, 2015) in arid central Asia. --> No! There is an offset
- 391-393: Moreover, the lake Ebinur sedimentary record reveals that a climate transition around 1920 AD, the same as the reconstructed temperature records in China (Yang et al., 2002; Ge et al., 2013) --> No! This is a slow transition – not a shift as you are arguing
- 415-420: Fig. 9 --> If you want to compare this to your data, this should be included in Fig. 8

Considering all these weaknesses, which are sometimes not easy to overcome, I am afraid, but I have to recommend to reject this manuscript.