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Interactive comment on "Survival of the Qaidam Mega-Lake System under Mid-Pliocene Climates and its Restoration under Future Climates" *by* Dieter Scherer

Anonymous Referee #2

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The author carried out a study about the survival of the Qaidam mega-lake system in Pliocene by analyzing the modern water balance of the basin. The author finds that the water balance of Qaidam basin is nearly zero under present climate condition and believes that Qaidam basin may switch from negative to positive in the near future. Although the story is quite interesting, there is a lack of robust evidence. In particular, the time scale of data used in the analysis is so different from a geological epoch, and therefore their connection is reluctant. I do not know how robust this linear speculation between the current and past lake conditions could be. As far as my knowledge, there are several fundamental flaws.

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1. Line 32, lake evaporation is missing in the equation. Lake evaporation is very different from land evaporation. Although it is very small in modern time because the lake area is small (only ∼1000 km2), it can be much large when the lake area is hundred times (∼120, 000 km2) in Pliocene. Moreover, it is hard to derive the water balance in such a case from current HAR data, considering very different effects of a large lake area that is not included in HAR data. Lake evaporation is neither considered in the remaining discussion. For example, in line 227-231, the author did not consider the impact of lake evaporation. In fact, when the lake continues to increase, lake evaporation increases and an equilibrium between input and output will be reached. Therefore, lake water level would not rise by 400 m over the basin within only 10 ka, even there is a positive long-term mean annual water balance.

2. Line 166-174, as the author said, both lake area and lake number in the Qaidam basin have increased from the last two decades. The groundwater in the Qaidam basin was recharged between 2003 and 2012 due to changes in terrestrial water storage of 20.6 km3 at rate of 8 mm/a. These studies indicate that there should be considerable positive water balance during the last two decades in Qaidam basin, which contrasts with the main conclusion of the study, which shows the water balance of the basin is almost zero (Line 174).

3. L194-197: “the estimated changes in precipitation due to changes in air temperature would be 52 to 105 mm/a. . .The mean change in water balance as inferred from the changes in air temperature would lead to a positive mean annual water balance of 49 mm/a.” I cannot believe this derivation. The positive water balance is too big, because most of precipitation would be lost through evaporation in such a dry environment.

4. The main conclusion of the study is ‘near-future climates not much different from present conditions could cause rising lake levels and expanding lake areas, and may result in restoration of the Qaidam mega-lake system over geological time scales’ (line12-14). Although I am not a paleo-climatologist, I guess the formation of mega-lake system over geological time scales might have underwent special climate condi-

tions (e.g. different scales of lake-air interaction, different land cover condition), and this speculation is quite uncertain. Even current climate yields positive mass balance, this positive balance would be lost soon due to the increase of lake evaporation when lake expands.

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