

Interactive comment on “Water pH and temperature in Lake Biwa from MBT'/CBT indices during the last 282 000 years” by T. Ajioka et al.

Anonymous Referee #2

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Ajioka et al present a combined record of temperature and precipitation in Japan over the past 282 kyr based on GDGT distributions in a sediment core from Lake Biwa. With GDGT-based paleothermometry they have used a state-of-the-art method with a lot of potential. However, they do not meet the required level of discussion and interpretation that their record is worth. In my opinion, main flaws of this manuscript are 1) the very large uncertainties of the age model, which are in fact a lot larger than the trends and cycles that are being discussed, 2) the unpublished local MBT/CBT calibration that is used to derive the presented temperature and pH records and other people than the ones on the manuscript have no idea of, and 3) the sources of the GDGTs in the lake sediments are not well constrained. All other major comments are a result of these main points of criticism. I suggest that the authors wait until the local calibration is published, improve the age model, and extend the discussion/interpretation of the

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record before this paper should actually be considered for publication in *Climate of the Past* (or publication in general). I thus suggest to reject the paper in this state, with the encouragement to resubmit once the age model has been updated, the used calibration has been published, and the records are more thoroughly discussed.

Specific comments: Introduction (page and line numbers are based on the printer friendly version) -p1155, line 11-20: add references to proxy examples in line 11-13. Move the lines on GDGTs in lakes until after they have been introduced. Summarize the findings based on the mentioned proxy records from Lake Biwa so far and identify the open question. What is the aim of this research? - p1155, line 23: brGDGTs can not (yet) be attributed to Acidobacteria. So far, only one type (i.e. brGDGT-Ia) has been found in a few Acidobacteria cultures (Sinninghe Damste et al 2011, AEM). All other types are still orphan. -p1156, line 10-18: This calibration first need to be published before it can be used to actually reconstruct a paleotemperature record. Furthermore, I do not understand how different GDGT distributions in soils and lake sediments can have similar relations with environmental parameters? What is the influence of in situ GDGT production in the lake? And where in the lake are they being produced? - The different monsoon systems that influence Lake Biwa need more introduction, as does the actual research question. What hypothesis are you actually testing with the generated GDGT records?

Materials and methods - p1157, line 5: 118 rivers flow into the lake. Recent studies indicate that brGDGTs are also produced in rivers (e.g. Kim et al., 2012, GCA; Zell et al., 2013 L&O; De Jonge et al., 2014, GCA), and can influence the brGDGT signature stored in river fan sediments. I guess this potential fluvial contribution is/should be discussed in the Ajioka paper with the local calibration used here. ...? - p1157, line 20: It seems like the age model as published by Takemura et al. has been adjusted based on personal comments of Kitagawa. If so, please mention the changes made to the original age model, and how this influences the interpretation of associated records. - p1158, line 5: The age model of this core is not well enough constrained to perform

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the spectral analysis and subsequently draw conclusions from these analysis. The uncertainties are simply unacceptably large. -p1159, line 21-25: I find it unacceptable to use a calibration that has not yet been published. For anyone not on the paper it is now unclear what the calibration is based on and how these equations have been derived. Also, what are the calibration errors of MAT and pH? -p1159, line 26: what is the analytical accuracy based on?

Results - What is the pH from the soils in the lake catchment? These data are needed to constrain the sources of the brGDGTs in the lakes later on. -The BIT index and MI index are presented in this section, but are not further interpreted in the discussion section. If these data are not used in the paleoclimate discussion then exclude them from the paper.

Discussion -section 4.1: In this section I expected to find out what the CBT-derived pH signal would represent. Is it catchment soil pH, water pH, or sediment pH? Where in the lake (catchment) are they produced, and how do they influence brGDGT signal stored in the sedimentary record? Instead, the section is about controls on lake water pH, and except for in the title, GDGTs are nowhere mentioned in the section. - section 4.2: In the previous section the authors conclude that photosynthesis is the major factor controlling water pH in Lake Biwa. In this section, pH is used as a proxy for precipitation, whereas the link between photosynthesis and precipitation has nowhere been made. - p1162, line 6: replace ...delayed behind. ... By ...lags... - p1162, line 6-7: I don't think it is fair to do such kind of spectral analysis with an age model uncertainty that is larger than the cycles in the spectra that are being extracted from the record. -P1162, line 8-9: I do not share the observation that the CBT record varies similar in timing with the Tp record. For example, I see a clear offset between the records during the MIS5-MIS4 transition (>20kyr), and also the LGM appears to be later (~10kyr) in the CBT record than in the Tp record. As a consequence, the subsequent statement that East Asian summer temperature and summer precipitation varied in concert is not convincingly supported. The offset between temperature and precipitation is observed

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in practically all other records from East Asia, and can potentially be reassessed by directly comparing the CBT-derived pH (if proven that this truly represents precipitation) with the MBT/CBT-based temperature record. Since both records are based on the same set of molecules, lags and leads can be determined unrelated to age model (e.g. cf. Peterse et al., 2014, QSR). -p1163, line 3-4: what is the reason that the MBT/CBT proxy generates winter temperatures? Has this specific equation been calibrated on winter temperature? Or do they just happen to underestimate MAT? -p1163, line 13-14: eccentricity cycle of East Asian winter monsoon climate: please extend the discussion and support this statement with data from the literature. -p1163, line 17-18: please discuss the differences and similarities between the record of Kuwae et al and your record. Which one is more reliable?

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