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Climate of the Past Discussions

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 #1

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Ajioka et al. generated a 282 000-year record of water pH and temperature in Lake Biwa. Their interpret water pH as a proxy for summer precipitation in central Japon and propose synchronous variation with air temperature, in contradiction with previous studies. They also propose that East Asian summer monsoon precipitation was governed by Northern Hemisphere summer insolation on orbital timescales, similar to the interpretation proposed with oxygen isotopes in stalagmite, although extremely debated. Finally, they suggests that the temperature variation reflected winter monsoon variability.

General comments: The new records (MBT and CBT) generated by the authors are interesting and could potentially bring new insight concerning the timing of Asian monsoon at the orbital scale, a very debated topic. However, the interpretations of the

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records and conclusions are quite speculative because 1) the calibration used in the manuscript to convert the CBT and MBT records to pH and MAAT is unpublished (Ajioka et al., submitted) whereas previous calibration (Tierney et al., 2010) differed from that of the global soil set and 2) the age models used in this study are not published (Kitagawa, personal communication 2014 and Takemura, personal communication 2014) and contain too large errors to address the timing of the records discussed in details in the manuscript.

I am therefore sorry to say that I recommend rejection of the paper. The authors must published their calibration study first (Ajioka et al., submitted) and the age models of the two cores (or furnish all the data used for the age model in this paper) before the manuscript can be considered for publication in Climate of the past. I furnish more explanations in the "specific comments" section below.

Specific comments:

1) Introduction, first paragraph. The debate concerning the timing of the Indo-asian monsoon is not detailed enough. There is a lot of records showing a different timing and with different hypothesis that must be explained and reviewed in details (see for examples Morley and Heusser, 1997; Reichart et al., 1998; Sun et al., 2006; Clemens et al., 2008; Cheng et al., 2009; Ziegler et al., 2010; Caley et al., 2011; An et al., 2011; Caley et al., 2013).

2) The calibration used by the authors is unpublished for the MBT and CBT. This is mentioned as Ajioka et al. 2014 in the introduction whereas the references is Ajioka et al. submitted. As mentioned by the authors, this calibration is in contradiction with previous results: "Tierney et al. (2010) noted that the correlation between MBT/CBT from sediments and MAAT for 46 lakes in East Africa differed from that of the global soil set and proposed a calibration applicable in lake environments. Ajioka et al. (2014) investigated the distribution of GDGTsin soils and rive and lake sediments in the Lake Biwa drainage basin and showed that the distribution of branched GDGTs in the lake

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sediments was different from that in the catchment soils, suggesting in situ production of branched GDGTs in the lake. They also found, in contrast to the conclusion of Tierney et al. (2010), that the relationships 15 among soil pH, MAAT, and MBT0/CBT in soils are not different from those of lake water pH, temperature, and MBT0/CBT in lake sediments, implying that the soil calibration is applicable without modification to the study of lake sediments to obtain lake water temperature and pH." Therefore, the calibration must be accepted before it can be used in this study.

3) The age models used in the study are unpublished (Kitagawa, personal communication 2014 and Takemura, personal communication 2014), and this is not acceptable given the importance of such results for the interpretation of records. Furthermore, the proposed age models contain very large errors. It is clearly visible on Figure 3 that the age model have errors of 25-50 ka!! between 50-150ka and errors of around 100 ka!! between 150-300ka. These errors are clearly more important that a complete precession cycle (23ka). Therefore the timing and forcing of the records interpreted in the manuscript could be completely wrong. As an example, the comparison between the insolation and the CBT-pH on figure 7 is far to be clear. Some of the maximum peaks of the CBT are phase with max insolation (200ka and 100 ka), some are in antiphase with max insolation (270ka, 150ka and 60ka) and others are various delayed. This is probably due to the significant uncertainties with the age model.

4) Discussion 4.1 The authors conclude "that that photosynthesis in the lake water is the major factor controlling water pH in Lake Biwa". In the abstract they mention that "Because water pH in Lake Biwa is determined by phosphorus input driven by precipitation, the record of water pH should indicate changes in summer precipitation in central Japan." Does the input of phosphorus is responsible of the photosynthesis changes? Insolation changes (light) could also affect photosynthesis without relationship with monsoon input.

5) Discussion 4.2 The spectral analyses are not sufficiently explained. What is the coherency and the limit of the 95% c.i for the coherency? Only the spectral density is

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shown. Similarly, the results of cross correlation analyses are not shown and the error bars are not indicated. What is the record used for the cross correlation (the precession index? The insolation?...). The authors also indicate : “The strong precession signal agrees with that postulated by the hypothesis that the monsoon is regulated by insolation variation at low latitudes (Kutzbach, 1981).” However, based on the Fig. 5, the precession signal is weak in comparison to the obliquity signal. This is different to what is observed in East asian d18O speleothem records.

The authors indicate that: “our new record of CBT-based pH was synchronized with the Tp record, implying synchronous variation of precipitation and temperature”. However they do not furnish any explanation for the different timing observed between the Cryptomeria record and their CBT-record (figure 6).

Interactive comment on Clim. Past Discuss., 10, 1153, 2014.

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