Interactive comment on “Decoupling of water and air temperature in winter causes warm season bias of lacustrine brGDGTs temperature estimates” by Jiantao Cao et al.

Anonymous Referee #1

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The authors of this manuscript examine the brGDGT distributions in the water column and surface sediments of the Lake Gonghai and its catchment. They address a critical issue for brGDGT studies which is the warm season bias of brGDGT-derived temperatures obtained in lakes. They propose a new very interesting mechanism to explain this bias implying the decoupling of air and lake water temperature during the cold season due to ice formation. This finding will be useful for the community and is worthy to be published. However, some improvements can be made before publication.

Main comments 1. The new separation method of the 5 and 6-Me isomers should be mentioned in the introduction. 2. A figure with the different forms of brGDGTs could be
3. Why don’t you use recent regional soil calibrations for China as the one of Wang et al., 2016 for your soil samples? 4. The conclusion is incomplete, you could add that soil temperature reconstructions reflect the MAAT and I think that it is important to mention that brGDGT distributions in the water column change with seasons while brGDGT productivity does not seem to significantly change. This allows you to propose an alternative explanation to warm season bias in brGDGT-derived temperature that is currently mainly considered as linked with changing brGDGT productivity. 5. The manuscript should be carefully checked for grammar and language issues.

Abstract

I17 mean annual

I18 There are too many ‘and’.

I29 I think that the use of ‘believe’ should be avoided and the sentence should be rewritten. Suggestion: we think that lacustrine brGDGTs actually reflect the mean annual LWT (…).

Introduction

I42 The abbreviations MBT and CBT should be defined.

I46 Some references could be added in particular, recent ones using the new separation method.

I53 Suggestion: brGDGTs could be produced in situ in lake environments and differ significantly from soil derived brGDGTs (…)

I106 ‘composition distribution of brGDGTs’ sounds odd to me, I suggest you to change it in the entire manuscript and replace it by ‘brGDGT distribution’.

I107 and further discuss …

Materials and methods
Mention ‘N’ and ‘E’ for latitude and longitude.

concentrated

146 combination of

146 and 150 ‘DCM’ and ‘MeOH’ could be used for dichloromethane and methanol defining the acronym at the first appearance.

157 Mention what are ‘A’ and ‘B’.

167 Remove the ‘;’ after(2)

169 The authors could mention Martin et al., 2019 who modified the initial definition of the IIIa/IIa ratio proposed by Xiao et al., 2016.

170 A word is missing as well as a punctuation mark.

177 Add a figure in appendix describing the different brGDGT structures and refer to it here.

Results

206 typical for in situ produced lacustrine (…)

Discussion

221 This title is not very clear, maybe ‘Different sources of brGDGTs in the Gonghai Lake’ or ‘In situ production of brGDGTs in the Gonghai Lake’.

226 and/or surface sediments. I would not mention brGDGT concentrations as a discriminant factor between soils and in situ production, differences of concentrations, alone, would not be a proof of the occurrence of in situ production as several other parameters could be involved.

227 comparison of brGDGT distribution

232 was similar to that of SPM … from that of soils
The $\Sigma\text{IIIa}/\Sigma\text{IIa}$ values in sediments and SPM were significantly higher than in catchment soils.

It does not appear very clearly that #Ringstetra were higher in sediments than in soils, a statistical test would be appreciated.

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I270-258 in globally distributed lakes? You should provide the reader with the analytical error associated with the MBT indices in the method section for a better evaluation of the changes discussed here.

You should add a reference to Fig. 2. You should at least mention that the deepest SPM shows an opposite trend which seems to indicate that at this depth, temperature is not the only parameter controlling brGDGT distributions.

seasonal temperature changes? previously

The phrasing sounds odd to me. Suggestion: suggest that both . . . could respond to temperature changes.

African ; the phrasing is not very clear here.

I suppose that 0.3 corresponds to the difference of the mean temperatures obtained for September and July? You could specify it.

remove the '.' after (16).

multi-seasonal

previously

could also be
The shallow water depth of the lake

The sentence is not very clear and too long, you should maybe cut it into two sentences.

Terrestrial inputs are almost not discussed, could they have a role in seasonal changes of brGDGTs?

Be coherent with the notation of $\Sigma_{IIIa}/\Sigma_{IIa}$.

You should mention here or in the previous paragraphs that SPM samples also reflect temperatures close to warm season AT.

You could add a reference to the table 1. Is it 13.2 or 13.5?

Correlated significantly

are thought to . . .

You say in situ production is thought to be the main source of brGDGTs in many lakes so why do you only consider six lakes in fig 5? What about the others?

Rephrase

You should also mention that brGDGT distribution in water column seems to change seasonally in agreement with temperature, what you discussed in the 4.3 section.

Rephrase

Most of stratified lakes . . .

Can you add a reference?

universal

compatible with the mechanism that we propose here
Use cold season rather than ‘winter’.

Conclusion

from that in soils

indicating that lacustrine brGDGTs are mainly produced in situ . . .

in surface sediments of Lake Gonghai

water-air decoupling in Lake Gonghai

Figure 1

(a) northern limit ? (b) For the latitude replace ‘E’ by N

Figure 3

fractional abundance Maybe specify: water column (SPM).

Use degree of cyclisation rather than ‘cyclisation ratio’.

Figure 4

soil calibration.

Figure 5

A comma missing before Lake Donghu. Mention the number of the equation used.

Table 1

For b et c, mention the number of the equation used.

Table 3

Mention the number of the equation used.