Biogeosciences Discuss.,
https://doi.org/10.5194/bg-2019-507-AC2, 2020
© Author(s) 2020. This work is distributed under
the Creative Commons Attribution 4.0 License.

Biogeosciences
Discussions

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.

Jiantao Cao et al.

caojt19@tongji.edu.cn

Received and published: 13 March 2020

Response to "Interactive comment on 'Decoupling of water and air temperature in winter causes warm season bias of lacustrine brGDGTs temperature estimates'by Anonymous Referee #2" Anonymous Referee #2

Received and published: 2 March 2020

General comments

The mechanism of season bias of lake brGDGTs-derived temperature is not very clear, hence limit the application of brGDGTs index in lakes. The manuscript proposes a new

idea about this hot topic. They conclude that decoupling of water and air temperature in winter causes warm season bias of lacustrine brGDGTs temperature estimates. Therefore, I recommend this manuscript for publication in the journal after improvement.

Response: Thanks for the comments. We have made substantial improvements according to reviewers' suggestions. Besides, some improvements were made beyond those suggestions during our revision, including paper title rephrasing, reanalysis sedimentary dada instead of presenting mean brGDGT values (line 1, 22-24, 216-217, 224-225, 241-242, 244-246), and reorganization of discussion (line 258-259, 382-418, 426-433, 447-471). We think the manuscript has been greatly improved in logic.

Detailed comments

1/ Many pervious researchers suggested that soil calibrations could not be applicable to lake sediments for temperature reconstruction, if aquatic production of brGDGTs is predominant over soil input (e.g. many papers). It is no new, and not necessary to discuss too much in this point in your manuscript. And to focus on SPM.

Response: We agree. Some related sentences have been deleted and some related content has merged into the Section 4.1, as evidences of the in situ production of brGDGTs in the lakes. Please see Line 284-290 in the revision.

2/ Seasonality is a major feature for almost all organic proxies. For example, Lake Huguangyan (Hu et al., 2016; Chu et al., 2017). Lake limnology is most important, for example, Lake Huguangyan is a monomictic lake.

Response: We agree. Seasonality has been discussed in lines 421-444 in our manuscript and we are inclined to rule it out as a cause in our case. Lake Huguangyan has been used as a reference in many places in our paper. However, due to its location in the tropical area it is not the focus of our discussion. We give a special mention on proxy seasonality in the Lake Huguangyan. Moreover, we propose deep/bottom waters

might influence brGDGT temperature signal in the lake. Please see lines 445-471 in the revision.

3/ “Line 147-148: “There is no water column stratifification whether summer or winter”. You must revise this sentence. Based on the location and depth of the lake, it might be stratifified in summer. And figure 2 shows a little stratifification occurred in September (autumn).

Response: You are right. We changed these sentences. Please see lines 133-135 in the revision.

4/ Line 360-365: I don’t think the estimated temperature using the calibration of Dang et al. (2018) are close to the mean warm season AT in GH, even if the RMSE is being considered. It seems that the calibration of Russell et al. (2018) may be more suitable for your explanation, and you’d get more discuss about this point.

Response: You are right. We rephrase these sentences. Please see lines 309-315 in the revision.

5/ Line 450: The definition of warm season should be given earlier, and change “monthly temperature” to “average monthly temperature”.

Response: Done. The warm season is defined in the head of Section 4.2 ‘4.2 Lacustrine brGDGT-derived AT are warm season biased (average monthly temperature >0 °C)’. Please see line 300-301, 313 in the revision.

6/ Line 464-465: “For example, MBT/CBT-derived temperature correlated better with warm season AT than with annual mean AT in the tropical Lake Huguangyan, suggesting a warm season bias (Sun et al., 2011)”. To improve the discussion of seasonality in the paper, I recommend authors should detailed read the paper of Sun et al. (2011) carefully. And the author should see discussion about the seasonality of brGDGTs in Lake Huguangyan from Hu et al. (2016) and Chu et al. (2017). Seasonal biases may be due to seasonal brGDGTs production, and link to lake limnology and local climate.

Response: Thanks for the comment. We misunderstood the results from the Lake Huguangyan and made changes accordingly. The sentence has been corrected as ‘The MBT/CBT-derived temperature in the Lake Huguangyan was thought to reflect mean annual AT (Hu et al., 2015, 2016); however, has recently been proposed to be winter/cool biased (Chu et al., 2017)’. Lake Huguangyan is located in the tropical region, which is not the focus of our discussion. Nonetheless, we give a special mention on proxy seasonality of Lake Huguangyan and other tropical lakes in second paragraph in Section 4.4. Please see line 455-463 in the revision.

7/ Please provide the component specific content of brGDGT as a Supplement.

Response: The brGDGT data had been showed in the data repository as journal recommends, please see https://figshare.com/s/a4f324247ecd9d1ac575.

8/ This manuscript is worth publish because something is new. But, authors should mention that the limited data in your manuscript, and more works are need to verify this question.

Response: Thanks for your suggestion. We add a sentence “Of course, considering limited data in this study, more investigations are needed to test our viewpoint in future studies.” at the end of discussion.

Interactive comment on Biogeosciences Discuss., https://doi.org/10.5194/bg-2019-507, 2020.

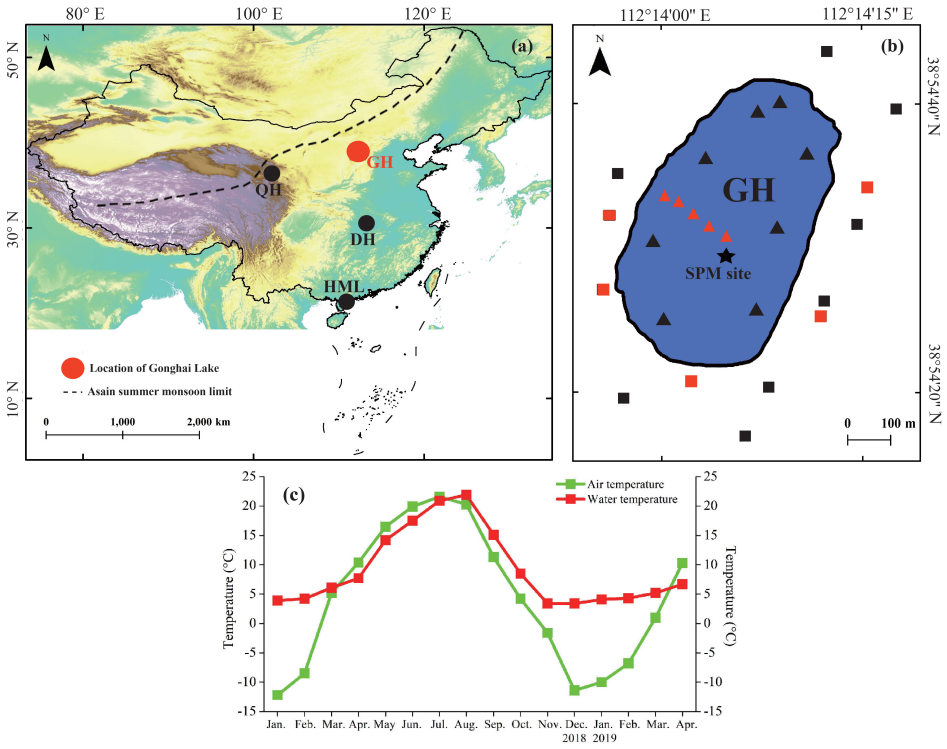
80° E
100° E
120° E
50° N
30° N
10° N
(a)
GH
QH
DH
HML
Location of Gonghai Lake
Asain summer monsoon limit
0
1,000
2,000 km
112°14'00" E
112°14'15" E
38°54'40" N
38°54'20" N
(b)
GH
SPM site
0
100 m
(c)
Air temperature
Water temperature
Temperature (°C)
Jan. Feb. Mar. Apr. May Jun. Jul. Aug. Sep. Oct. Nov. Dec. Jan. Feb. Mar. Apr.
2018 2019

Fig. 1.

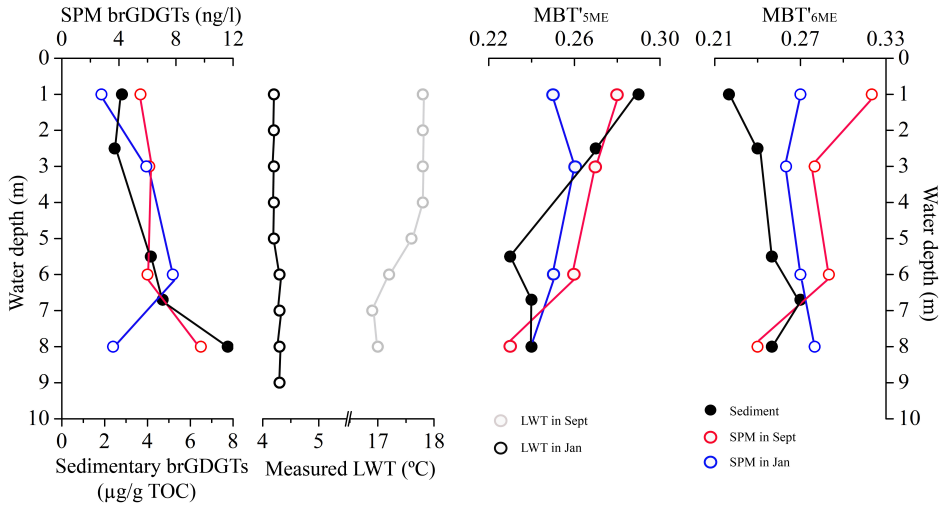
SPM brGDGTs (ng/l)
MBT'5ME
MBT'6ME
Water depth (m)
Sedimentary brGDGTs (μg/g TOC)
Measured LWT (°C)
LWT in Sept
LWT in Jan
Sediment
SPM in Sept
SPM in Jan

Fig. 2.

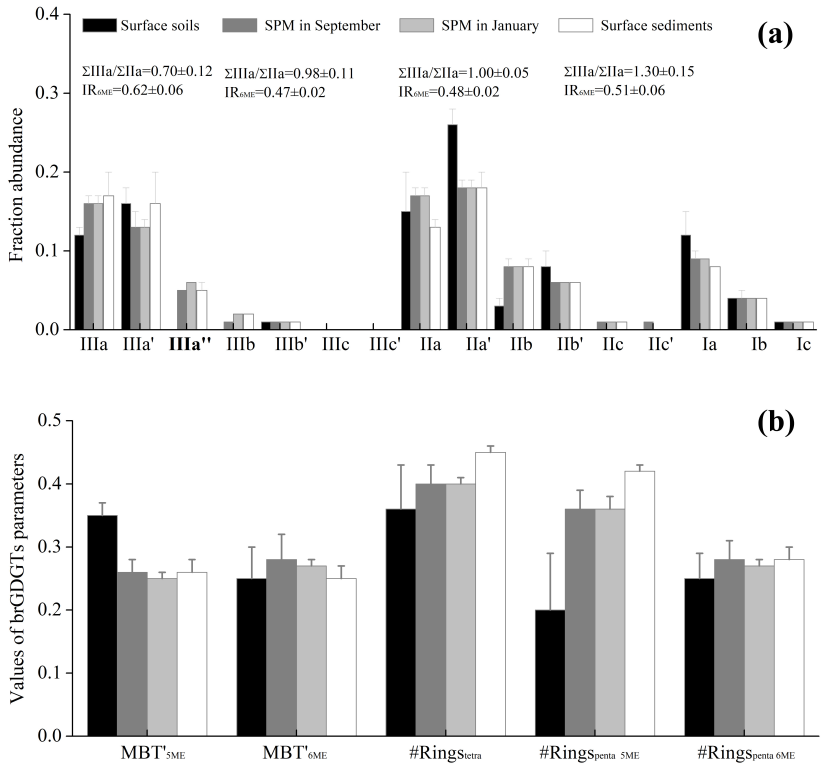
(a)
Surface soils
SPM in September
SPM in January
Surface sediments
ΣIIIa/ΣIIa=0.70±0.12
IR6ME=0.62±0.06
ΣIIIa/ΣIIa=0.98±0.11
IR6ME=0.47±0.02
ΣIIIa/ΣIIa=1.00±0.05
IR6ME=0.48±0.02
ΣIIIa/ΣIIa=1.30±0.15
IR6ME=0.51±0.06
Fraction abundance
0.0
0.1
0.2
0.3
0.4
IIIa
IIIa'
IIIa''
IIIb
IIIb'
IIIc
IIIc'
IIa
IIa'
IIb
IIb'
IIc
IIc'
Ia
Ib
Ic
(b)
Values of brGDGTs parameters
0.0
0.1
0.2
0.3
0.4
0.5
MBT'5ME
MBT'6ME
#Ringstetra
#Ringspenta 5ME
#Ringspenta 6ME

Fig. 3.

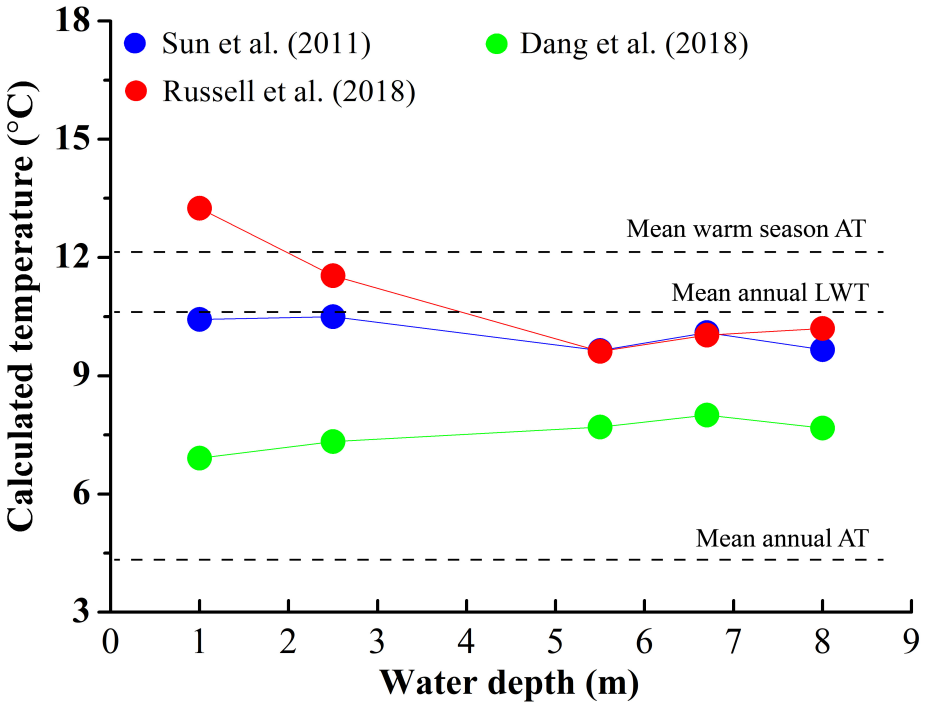
Sun et al. (2011)
Dang et al. (2018)
Russell et al. (2018)
Mean warm season AT
Mean annual LWT
Mean annual AT
Calculated temperature (°C)
3
6
9
12
15
18
0
1
2
3
4
5
6
7
8
9
Water depth (m)

Fig. 4.

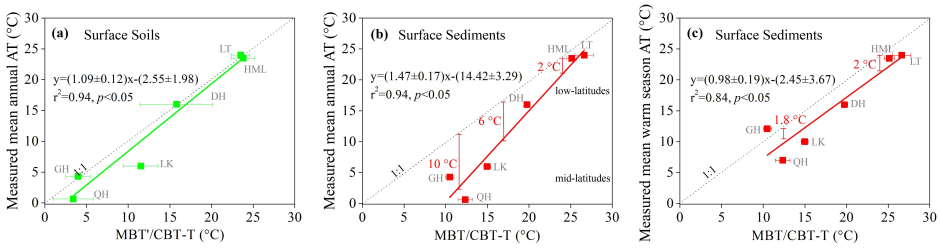
(a) Surface Soils
y=(1.09±0.12)x-(2.55±1.98)
r²=0.94, p<0.05
LT
HML
DH
GH
LK
QH
1:1
Measured mean annual AT (°C)
MBT'/CBT-T (°C)
(b) Surface Sediments
y=(1.47±0.17)x-(14.42±3.29)
r²=0.94, p<0.05
HML
LT
2 °C
DH
6 °C
low-latitudes
10 °C
GH
LK
QH
mid-latitudes
1:1
Measured mean annual AT (°C)
MBT/CBT-T (°C)
(c) Surface Sediments
y=(0.98±0.19)x-(2.45±3.67)
r²=0.84, p<0.05
HML
LT
2.5 °C
DH
1.8 °C
GH
LK
QH
1:1
Measured mean warm season AT (°C)
MBT/CBT-T (°C)

Fig. 5.