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Interactive comment on "Glycerol dialkyl glycerol tetraether variations in the northern Chukchi Sea, Arctic Ocean, during the Holocene" *by* Yu-Hyeon Park et al.

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We would like to thank Dr. Naafs for reviewing our manuscript and significant comments and suggestions. We agree with most of your comments. According to your comments and suggestions, we will revise our manuscript.

Comment: I argee with the other reviewer that a more thorough discussion about the sources (including in situ production) and preservation of GDGTs is needed.

Reply: Thanks for reminding this point. In submitted manuscript, we overlooked the discussion on the sources and preservation of GDGTs. We will add more discussion on these points.

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Comment: The other major comment I have is that the authors should not use TEX86L as the GDGT community is moving away from using this index because of a range of different issues with this particular ratio. Instead, I suggest the authors to use the BAYSPAR calibration in addition to the regular TEX86 calibration -Tierney, J.E., Tingley, M.P., 2015. A TEX86 surface sediment database and extended Bayesian calibration. Scientific Data 2, 150029. -Tierney, J.E., Tingley, M.P., 2014. A Bayesian, spatially-varying calibration model for the TEX86 proxy. Geochimica et Cosmochimica Acta 127, 83-106. In addition, the authors need to (more thoroughly) discuss their results in context of the evidence that indicates that the application of TEX86 to reconstruct SSTs in the arctic ocean is problematic (see for example Ho, S.L., Mollenhauer, G., Fietz, S., Martínez-Garcia, A., Lamy, F., Rueda, G., Schipper, K., Méheust, M., Rosell-Melé, A., Stein, R., Tiedemann, R., 2014. Appraisal of TEX86 and thermometries in subpolar and polar regions. Geochimica et Cosmochimica Acta 131, 213-226.).

Reply: According to your comment, we will try to apply BAYSPAR calibration of TEX86..

Line 21-22: change to ": : :: : :but their application to sediments from the Artic Ocean is limited. Here we analyzed the GDGT distribution in three sediment cores: : :.."

Reply: We will change this part.

Line 24-25: Delete sentence

Reply: We will delete the sentence.

Line 26: introduce the BIT (branched over isoprenoidal tetraether) and CBT (cyclisation of branched tetraethers) indices

Reply: We will spell out the BIT and CBT.

Line 28: Not sure what "incomplete sea-level rise" means. Delete

Reply: We will delete them.

Line 31: add "a reduction in" after "controlled by"

Reply: We will add the words.

Line 63: Change to “Biomarker research, including the use of glycerol: : :: : :”

Reply: We will change it.

Line 80: Add reference to Schouten, S., Hopmans, E.C., Sinninghe Damsté, J.S., 2013. The organic geochemistry of glycerol dialkyl glycerol tetraether lipids: A review. Organic Geochemistry 54, 19-61. Reply: We will add it. Lines 92-104: Overall this paragraph is poorly structured and not complete. The authors need to spell out the different indices. Show how TEX86 is calculated, which GDGTs are used. Same for the other indices (BIT, MBT, etc). In addition, the use of all the different indices should be properly referenced here (not in section 2.3). So Schouten et al., 2002 for TEX86, etc. Lastly, the GDGT-0/Cren ratio should be introduced here (with proper reference). Also clearly explain that TEX86 and MI are based on archaeal isoGDGTs and MBT/CBT on bacterial brGDGTs.

Reply: We will spell out the names of indices, add the calculation formula of TEX86 and other parameters.

Line 92: replace “measured” with “the abundance of”

Reply: We will replace it.

Line 93: add “the” before “TEX86”

Reply: We will add it.

Line 96-98: delete part of sentence starting at “is based on (..) polar waters (Kim et al., 2010).

Reply: We will delete it.

Line 98: Change to “The MI can be used to indicate the contribution of anaerobic methanothrophs to the sedimentary GDGT pool (Zhang et al., 2011)”

Reply: We will change the sentence.

Line 113: delete “the” before “sea level”

Reply: We will delete it.

Line 113: replace “at the time of” with “during”

Reply: We will replace it.

Line 153: rephrase came out with slightly”

Reply: We will rephrase to “have”.

Line 169: delete “mixture of”

Reply: We will delete it.

Line 171: explain which solvents and how much were used to elute the different fractions. E.g. 5 ml of hexane for F1, etc

Reply: We will explain the solvent names and volumes.

Line 172: change to “Fraction 4, including the GDGTs,”

Reply: We will change to it.

Line 172: not clear what “treated according to procedure: : :” means. Explain and ex-pand

Reply: All right. We will describe the procedures as Yamamoto and Polyak (2009) did.

Line 175-177: was the LC-MS operated in SIM mode? State what m/z’s were scanned for.

Reply: Ions were detected in the full scan mode (m/z 500-1500).

Line 180-181: how are these standard deviations calculated? Also state the calibration errors here (which are much larger).

Reply: The SD was average value of duplicate analysis for five F4 fractions. Calibration errors of TEX86 and TEX86L are ïĆś5.2 °C and ïĆś4.0 °C, respectively (Kim et al., 2010).

Line 167-185: How did you quantify the GDGTs? I assume using a C46 std. Did you calculate response factors? Explain this in this section.

Reply: Yes, we used C46 std. and calculated response factors. GDGTs were quantified by comparing the summed peak area in the (M + H)+ and the isotopic (M + H + 1)+ ion to the peak area of internal standard. We will add the explanation.

Line 188-189: delete sentence

Reply: We will delete it.

Line 193-195: “fraction abundances of isoprenoidal GDGTs”, is vague. Be more specific. For example; “The relative abundance of crenarchaeol increases, etc”

Reply: We will describe more specifically.

Line 201: replace “to” with “at”

Reply: We will change it.

Line 204: delete “show a”

Reply: We will delete them.

Line 208-209: Delete sentence.

Reply: We will delete the sentence.

Line 212: add “those reported in” before “surface sediments”

Reply: We will add them.

Line 228-229: Sentence not clear. Rephrase.

Reply: We will rephrase to “BIT values were lower in the early deglacial and older sediments than in the later deglacial and early Holocene sediments, but somewhat higher than in late Holocene sediments.”

Line 230: introduce this ratio in the method section. In addition, in figure 5 you call it cald/cren ratio. Change this to GDGT-0/cren (consistent with the appendix)

Reply: Thanks for check in detail. We will change all to GDGT-0/Cren ratio and explain this ratio in the method section.

Line 244: delete “s” in “occur”

Reply: We will delete it.

Line 257: delete “fast”

Reply: We will delete it.

Line 258: I do not think Figure 6 shows the increase in GDGTs from 9-8 ka. Change to figure 5

Reply: Thanks. Figure 6 should be changed to Figure 5.

Line 262: change to “: : :.was driven by an increase in bioproduction of (thaum)archaeota with the: : :”

Reply: We will change to them.

Line 267: add “,” after “(Fig. 5)”

Reply: We will add it.

Line 274: How does this offset work? How does this result in a lag of a few kyr? Expand

Reply: Millennial-scale gradual decrease in sea ice at a certain location probably increased IP25 production first, and then increased GDGT production in a longer sea-

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sonally open ocean condition. We suppose that this gradual change induced a lag of a few kyr.

Line: 289: “characterize” is misspelled

Reply: We will correct it.

Line 325: add “the” before “GDGT”

Reply: We will add it.

Line 331: add GDGT-0

Reply: We will add it.

Line 334-341: Acknowledge that most of the variation in the TEX86 records is within the calibration error

Reply: The variation is smaller than the calibration error but is larger than analytical errors. We suppose that the TEX86 variation may not indicate the water temperature directly but reflect some environmental condition, which is worthy of being described.

Line 357-359: ending with the note that more research is needed is not good as it gives the idea that you didn’t accomplish much. Delete and end with a clear statement that highlights the overall result of the study

Reply: We will delete the sentences. We will consider this statement after trying to use a Bayesian calibration method.

References: Some times a journal name is abbreviated and sometimes a DOI is given. Follow journal guidelines and be consistent.

Reply: We will revise them.

Table 1: not sure this table is needed. This information can easily be described (and partly already is) in the material/method section

Reply: We will delete Table 1. The information will be described in the material/method section.

Figure 2: this appears to be a copy of the figure from Park et al., 2014. If no new information is provided here, delete figure and refer to original manuscript in the text.

Reply: We will delete Figure 2.

Figure 6: Is this figure really needed? Does it show anything that is not seen in figure 5? In addition, I am not sure I understand the meaning of the dotted line. Does the data from Park et al. 2014 indicate that surface samples from > 75oN have high CBT values and all plot above the dashed line? If so, I think instead of showing a dashed line, the authors should show the raw data from Park et al., 2014 in this figure with a clear distinction between samples from > 75°N.

Reply: We prefer to show this figure to indicate the characteristics of branched GDGTs in different sites and ages. We will add more explanation of the line. We will also consider to add the raw data in the figure.

Thank you very much again for all of your comments.

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