

“Distribution of tetraether lipids in agricultural soils – differentiation between paddy and upland management” by C. Mueller-Niggemann et al.

[Response to the comments by anonymous reviewer #3](#)

The presented paper describe the occurrence of tetraether lipids in agricultural soils from various locations in the tropical and subtropical area. Despite the article is well presented, it is difficult to understand which is the motivation behind this research. The argument is novel, but it seems only to report the data about tetraether lipids without giving any exhaustive explanation about which are the implications and the importance of their occurrence in soil. Which is the relevance of the study? I think it can be relevant, but it should be made clear. The research questions as well as the findings of the study should be improved. I think the article needs major revisions so to better explain the importance of this study. The lack of data is not a research question. The discussion should indicate clearly the relevance of the findings from this study, not only indicate that now there are more data concerning this topic. Which are the implications related to a different content of GDGT in soils? Which are the implication also for other types of environments? and of managements?

With the aim to emphasize the direction of and motivation for our research more convincingly, a point raised by the 3rd reviewer in a manner comparable to the 2nd reviewer, we will add the following information:

Microbial presence and activity in soil ecosystems is dependent on natural factors, in particular climate and organic substrate and on anthropogenic influences in agro-ecosystems. In the latter human activities will control microbial to variable degrees depending on type and intensity of management practices, e.g. crop type, irrigation, fertilization, soil aeration by tilling, and various other effects. Rice paddies, represent an agro-ecosystem, where human influence is most pronounced due to episodic flooding. This leads to rapidly fluctuating redox and pH-regimes and favors microbial communities able to cope with such environmental stress. To cover a range of natural ecosystem properties we analyzed a variety of paddy agro-ecosystems from tropical to subtropical climate settings and soil substrates. To identify anthropogenically induced ecosystem properties, reflected in the respective microbial community structures, we in parallel studied adjacent upland fields, showing identical natural ecosystem properties but differing management practices. Management practices exert a major control on the duration and frequency of anoxic-oxic cycles, dependent one whether 1, 2, or 3 rice growth period per annum occurred. The question whether natural or human-induced variation in ecosystem properties dominate the microbial community association was addressed in this study, based on the distribution of GDGT biomarkers derived from archaea vs. bacteria and relative distribution of archaeal GDGTs, which are interpreted towards a preferential methanogenic euryarchaeal or ammonium-oxidizing thaumarchaeal life style. From the literature a wide range of biomarker proxies based on GDGT distributions is available that are used to infer soil pH and air temperature in upland soils. In this study we determined these GDGT-palaeoproxies in upland soil, comparable to previously generate data sets and compared those to (episodically) subaquatic soils, which are yet unexplored with respect to their GDGT distributions.

Below are reported some specific comments:

Page 16712 line 10: What does ANME-1 means? Please give the full name and then the acronim.

Reply: ANME refers to anaerobic methanotrophic archaea. This was already indicated in the submitted manuscript. ANME-1 is one of the three clusters that have been defined based on 16S rRNA gene sequences.

Page 16714 line 4: remove e.g. Alternatively rephrase the sentence to indicate some parameters, other than to soil moisture, affecting Eh.

Reply: We will add a further sentence to make clear that beside by soil moisture Eh is also affected by other parameters. As individual microorganisms are adapted to specific Eh conditions, an increase in e.g. soil moisture is accompanied by a decrease in Eh because of the consumption of oxygen by microbes (Husson, 2013).

Page 16714 line 20-29: here you should state clearly which are the motivation of your research and the scientific questions you want to address. Also the global implication should be made clear. The lack of data concerning the topic is not enough for conducting a reaserch.

Although we do not agree with the statement that a lack of data (and thus knowledge) does not warrant research, but rather assume the opposite, we will add more research questions as pointed out in the comment to the general statement, presented above.

Page 16715 line 8. I am not sure if the Italian site can be considered in this study as representative of a subtropical location. Which kind of climtic subdivision it was used to identify the sites?

Reply: We disagree, because after Köppen climate classification both Italian sites are located in a humid subtropical climate zone.

Page 616715 line 24: Please be clearer. Are you referring to the dike chronosequence in CIXI for this composite sample? Or in general to all the sites? Which was on average the area covered by each field? You state that seven samples were representative for the complete field but you should specify the area covered by the fields.

Reply: This passage deals with the description of soil samples from the Cixi chronosequence that has been previously studied in detail, in particular addressing the question of sample representativeness by Mueller-Niggemann et al. (2012). We will add information on the area covered by each field to the final manuscript.

Page 16716 line 13: have you analysed the three composte samples for each site? Please specify the number of samples you analysed in each area.

Reply: Only for the Cixi chronosequence, we had composite samples available. Those were measured individually. For all other sites we analysed between 1-10 samples as listed in Table 1.

Page 16718 line 18: Why percentage symbol in reporting pH values? It is not the correct way to report pH values. Remove the % symbol.

Reply: We accidentally added the % symbol to the pH values. This will be removed in the final manuscript.

Page 16718 line 22: you mean comprised between 20 and 80? it is not clear

Reply: We will provide a more specific description: "The brGDGT/iGDGT ratio was >80 in Indonesian paddy soils (Jasinga), varied between 20–80 in forest and bushland soils, and was as low as 1.9 in the remaining soils (Supplement, Fig. S1)."

Page 16719 line 3: report first the full name than the acronim in brackets

Reply: We will now first report the full name and then the acronym.

Figure 1: Pay attention that in Italy the blue zone is exactly covering all the Alpine area, where climate is not “subtropical”.

Reply: We are thankful for the reviewer’s comment and will redraw the area affected by subtropical conditions in Italy (Fig. 1).

Figure 2: what does numbers in the gap means?

Reply: The meaning of numbers was designated in the figure caption: “Numbers in all plots indicate samples listed in Table S1.” We left the numbers in the figures, so that the reader can easily figure out which samples do not follow the trend. In addition we will add information to the different symbols representing outliers: “The symbols (circle or asterisk) denote outliers that are more than 1.5 (or 3) box lengths from one hinge of the box.”

References

Husson, O.: Redox potential (Eh) and pH as drivers of soil/plant/microorganism systems: a transdisciplinary overview pointing to integrative opportunities for agronomy, *Plant and Soil*, 362, 389–417, 2013.

Mueller-Niggemann, C., Bannert, A., Schloter, M., Lehndorff, E. and Schwark, L.: Intra-versus inter-site macroscale variation in biogeochemical properties along a paddy soil chronosequence, *Biogeosciences*, 9, 1237–1251, 2012.