Reply to anonymous referee #1

We thank the anonymous referee #1 for his comments and questions on our manuscript. Below we have provided point to point responses to each referee comment/ question (in italic).

A very basic comment to a general point of the reviewer´s criticism is provided here as an introduction to our reply. The well-intended suggestions to include more parameters for determination of physical, chemical or biological properties are one key element in the criticism of the anonymous reviewer and also of reviewer G. Wiesenberg. We fully agree with the reviewers that analyzing more parameters will significantly improve understanding of soil heterogeneity and as such is highly desirable but obviously, time and budget limitation prevented us from including more parameters. We have tried to keep the selection of biogeochemical parameters used for our assessment of paddy soil heterogeneity as broad as possible, including highly reactive and more conservative properties. We furthermore attempted to include some of those parameters that are frequently used in other biogeochemical studies without claiming to cover all aspects of soil biogeochemistry. It is our hope that this approach will be appreciated by the readers.

Although the soil/mineralogical properties and variations therein have been described in other papers, I think that they should be (partly) included in this paper to explain the biogeochemical differences. Basic parameters such as soil pH, moisture, grain-size, clay mineralogy etc. can have profound effects on the transformation and preservation of organic matter.

The basic soil parameters described in the paper by Jahn et al. (2012) and Wissing et al. (2011) were determined on other field samples and never in pentuplicate but rather in triplicate or by single measurement. Therefore, this data cannot be included in our statistical study.

What is the composition of the TLE along the chronosequence? The reason of only focusing on n-alkanes, which represent generally a very small fraction of the total lipids in soils is not clear, alkanols, fatty acids, terpenoids etc. are source specific as well. n-alkanes can be easily oxidized to form 2-methylalkanones even in wet soils (see e.g. Jansen et al., Org. Geochem 40 (2009) 61–69). Thus their 'stability' is not that trivial.

As mentioned in the introductory paragraph, we had to make a selection of which parameters to analyze. Inclusion of all different lipid fractions in a pentuplicate field sampling programme with 10 sites investigated was not feasible (> 200 analysis, if only alkenones, alkanols, and n-carboxylic acids are included) due to time and budget constraints. If we would have included these lipid class analyses in our programme we would have had to leave out other determinations.
It is absolutely correct that n-alkanes can be diagenetically altered or that other lipid classes upon diagenetic alteration may generate soil n-alkanes. The main scope of this study was not the investigation of diagenetic transformation reactions in soils but limited to the assessment of paddy soil heterogeneity. It is not evident from the n-alkane distributions that selective oxidation of alkanes occurred within a single field to a relevant extent and as such altering the n-alkane distribution pattern. If this process

occurred, it affected all 5 sites per field in the same manner and as such did not increase paddy soil biogeochemical heterogeneity.

References

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Wissing, L., Koelbl, A., Vogelsang, V., Fu, J-R., Cao, Z-H., and Koegel-Knabner, I.: Organic carbon accumulation in a 2000-year chronosequence of paddy soil evolution, Catena, doi:10.1016/j.catena.2011.07.007, 2011.