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Biogeosciences Discussions

Interactive comment on "Impact of land use and soil properties on soil methane flux response to biochar addition" *by* Weiwei Cong et al.

Anonymous Referee #2

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The paper presents a meta-analysis investigating the impacts of biochar addition to soils on methane fluxes. It is generally well written and has accessed a wide range of data. However, I have some major concerns that should be addressed before this manuscript should be considered for publication.

The paper repeatedly mis-interprets the Hedge's d metric. For example, in the abstract "soils with higher SOC content, C/N, and circumneutral pH exhibited higher CH4 emission with biochar addition." It is not possible to conclude this from the metric used. Hedge's d is a probabilistic metric. If it is a positive number it says that there is an increased probability that the auxiliary variable being investigated leads to increased emissions or reduced oxidation of methane. It says nothing about absolute changes in emissions and so it is not possible to draw the conclusions that the authors have done.

The manuscript needs to be re-worked to make sure this issue is clear and to avoid over interpretation of the results.

You have not explained how you are able to present absolute CH4 flux values, from across a range of studies that undoubtedly used different units of measurement. How have you standardised to get mg C kg soil-1 d-1? You also need to make clear which of the studies used in your meta-analysis were included in this figure, and which excluded, as it seems unlikely all would have reported with units that could be converted to the units you have used.

I have only very limited experience of linear additive models. However, I have doubts over their application with probabilistic measures such as Hedge's d. Can they really be applied like this? Hedge's d cannot be used as an absolute value – relative comparisons can only be made between each sub-categories in each individual analysis. I suggest that further comment from an independent reviewer with expertise on linear additive models is needed before this work can be considered for publication. The formatting of the manuscript still requires some work. For example, the majority of the text presented in Section 3.2 and its sub-sections is discussion rather than results.

The first line of the abstract is not objective. Biochar has also been shown to reduce crop yields and to increase greenhouse gas emissions under some conditions. This should be acknowledged.

Page 3, line 8 – You have not shown that biochar has the capacity to alter soil redox conditions or microbial activities over the short term, let alone the long term. Nor is It clear what biochar's recalcitrance has to do with either of these potential impacts.

Page 4, line 18 – but you used Hedge's d, which is not probabilistic metric and not a quantitative metric. So you have not conducted a "quantitative" meta-analysis, despite often interpreting your findings as such.

Page 6, line 17-20 – Biederman and Harpole, 2013 is another meta-analysis. They do

not include any new data. Please include a reference that has shown that the transfer function presented in Line 19 is actually effective and robust at converting pH[H2O] to pH[CaCl2]

Page 7, line 19 –Hedge's d does not allow you to determine the change in soil methane flux. It shows you the probability that fluxes increased or decreased for a given auxiliary variable. Page 8 Line 14 – 15 – Again, Hedge's d does not indicate increase or decrease, only the relative probability of an increase or decrease.

Page 9 – Line 1. How have you measured skewdness? What value did your analysis give? Why is this information not reported?

Line 14 – 16. This is methods, not results and so should be removed from here. But here you state that you provide an "accurate view of the quantitative relationship". But you have probabilistic data, not quantitative data, so this cannot be correct!

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