

Thank you for your insightful comments, we have gone through and addressed them, providing our responses below.

Regards,

Further to your responses to the previous reviewer:

1) The reviewer made a case that you did not provide sufficient evidence for the statement that yield-scaled N₂O emissions are high in this region. You have now added some more information based on your dataset, and cited some studies on a more general level, but to substantiate your reasoning it would be good if you could compile your data for yield-scaled N₂O fluxes in a Table, and reference them against comparable studies. While this may corroborate the reasoning that yield-scaled emissions could potentially be improved by increased fertilizer use, the concluding statement in your abstract needs to be toned down considerably: even when assuming that water and nutrient management can reduce yield-scaled N₂O emissions in the studies smallholder farms in sub-Saharan Africa, it is misleading to state broadly that intensification of agricultural production can be a tool to 'mitigate' (sic!) the impact of African agriculture to climate change. (see also the next point)

We have added a small table (Table 4) showing measured yields, and yield-scaled emissions as well as some yields from other studies (we could not find any yield-scaled emission estimates from similar low-input, smallholder, east-African farming systems).

We have also toned down the concluding statement in our abstract (lines 36-38)

2) I follow your reasoning that your dataset does not permit any conclusions on the soil or ecosystem carbon (and thus the GHG) balance, and think that the way you frame your study in terms of soil GHG fluxes makes this sufficiently clear. It might nevertheless be good to point out more explicitly that your approach focuses on soil GHG fluxes and that for the obtaining the GHG balance of these ecosystems also photosynthetic C uptake and respiration of above-ground plant parts would need to be included (rather than stating the limitation of your approach to this end).

The text has been changed to explicitly mention that our methods include only soil CO₂ flux and that other information would be required to obtain the full GHG balance of the ecosystem (lines 461-463)

3) The discussion of methodological uncertainties requires some further elaboration. a) a change of air temperature in the chamber headspace not only leads to a (small) error in the flux calculations, but also changes the pressure in the chamber and suppresses soil GHG emissions; it furthermore increases soil temperatures and related microbial and root activity in the soil underneath the chamber; b) the build-up of high CO₂ concentrations in the chamber headspace may lead to an underestimation of soil CO₂ emissions.

Thank you, in the hopes of clarifying the methods we have added some elaboration regarding the increase in soil temperature, however I somehow disagree with the second point (b). The use of the non-linear model was done to estimate the slope (rate of change) at time 0. It was only when the fit for a non-linear model was poor that we used a linear model (which may provide a bias towards underestimating

soil CO₂ emissions when CO₂ starts accumulating in the headspace). The use of the non-linear model then, will provide an accurate estimate of emissions even when CO₂ accumulates in the headspace over time. A quick sampling of our flux measurements found that about 10% showed some form of CO₂ build-up (a plateauing of the concentrations), however, all of these had the flux calculated using the non-linear model, which would still accurately estimate the flux at T₀.

We do not expect the pressure in the chambers to have changed due to temperature changes because we used vented chambers. Also, given the 45 minute deployment time and the use of insulated, reflective chambers, soil temperatures would be unlikely to experience sufficient change (See Rochette, Philippe and Hutchinson, Gordon L., "Measurement of Soil Respiration in situ: Chamber Techniques" (2005). Publications from USDA-ARS / UNL Faculty. Paper 1379). We would like to stress that measurements were done under extreme logistic constraints and that to our knowledge a comparable dataset for Africa is not available at all. Despite limitations, this paper presents a radical improvement in available data for GHG fluxes from agricultural systems in Africa and sets a high water mark for the next generation of such studies.

4) Figures 2 and 3: I agree that adding error bars will probably overcharge the graphs, which are very busy anyhow. However, you can add information on the range (i.e. the minimum and maximum) of standard errors in the Figure captions, along with the respective number of observations and the dates when these occurred.

Figure 3 is a box and whisker plot, and uses the box to show the median, first and third quartiles, while the whiskers extend another 1.5*interquartile range (and the open circles indicate outliers). Perhaps you were just referring to Figure 2. We added two sentences explaining what the variability in SEM was for the 3 gases and when (and where) the highest variability occurred.

In addition, I request you make the following improvements:

5) Table 1: when showing data from this study please refer to „this study“ rather than „Pelster et al. 2016“ (note that Pelster et al. 2016 is in fact a different paper included in the references).

Thank you. This has been changed

6) Format Tables 2 and 3 according to the journal standard.

We assume that you were referring to the vertical lines in the tables. These have been removed

7) In Table 2: Indicate what SEM was based on and add „soil“ after „cumulative“. Correct English wording in footnote 1.

Perhaps you meant Table 3 because Table 2 has no “cumulative” in the title, so we changed the footnote a bit to clarify the point as well as adding the term “soil” after the word “cumulative”. Also added the n value to the different columns so the reader knows what the SEM was based on.

8) Fig. 2: Add a panel on soil temperature and include abbreviations used for all parameters in the panels as well as a reference to the study years in the Figure caption.

We have changed Fig. 2 to include a panel with the soil temperatures from the highlands and the lowlands. Abbreviations are also explained in the caption while the time frame for the study is also included.

9) Fig. 3: Explain (in the caption) the letters you have now included, and that the lack of letters implies that no significant differences were found.

Thank you for noticing this, we have now included an explanation of the letters (and the lack of letters).

10) Check the manuscript carefully for phrasing, which could be improved in some parts (e.g. l. 525-535); for clarity add „cumulative“ in l. 387, „overall“ in l. 389 and specify land classes in l. 465-466.

Fixed the wording in lines 525-535 and added the word “overall” in line 389.

Cumulative was already in line 387 (We couldn't find a place to put it in again).

Descriptions of land classes were added in lines 465-466.