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Interactive comment on "Reviews and syntheses: Greenhouse gas emissions in natural and agricultural lands in sub-Saharan Africa: synthesis of available data and suggestions for further studies" *by* D.-G. Kim et al.

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Dear Editor Professor Michael Weintraub,

We thank the two anonymous reviewers and Drs. Alberto Borges and Steven Bouillon for their constructive comments. We greatly appreciate the time they have spent considering the manuscript and for providing a series of suggestions that will enable us to produce a much stronger paper. We are very pleased to read that they believe the paper (in a revised form) will be a useful scientific contribution to the field of terrestrial

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greenhouse gas emissions (GHG) from sub-Saharan Africa (SSA). It is our intention to make these changes as completely as we can in order that we make the paper a go-to resource for all scientists working on soil GHG emissions in SSA and worldwide. Reviewers provided many constructive comments, all of which, in our opinion, will improve the paper. In order to clearly outline how we plan to address the comments we've grouped them into six main categories. We first summarise the comment and then indicate how we plan to address it.

1. Provide a synthesis of results in order to provide more insight into controls on soil GHG emission

Both reviewers remarked that the structure could be improved by moving away from a sequential summary of study findings. We will restructure the main body of text to better reflect controls on soil GHG emissions. In adopting this radically different structure we hope to be able to provide a much clearer synthesis of the available data and to identify the drivers of the variations in GHG emissions. This will enable us to make informed comments on the evidence in the literature for land use, edaphic and climatic effects on GHG emissions.

2. Undertake additional statistical analyses on the data – testing theoretically-derived hypotheses on the controls over soil GHG emissions

To facilitate greater insights into the underlying controls on GHG emissions we will undertake further statistical analysis of selected data from the literature (where the number and quality of studies permit). This can be done to test specific hypotheses about the controls on soil GHG emissions derived from the existing theory on drivers of GHG emissions. Examples might include quantifying the Q10 of respiration, correlation between soil GHG fluxes and environmental factors (e.g., rainfall, soil temperature and moisture, carbon and nitrogen, etc.), the effects of fertilizer application, or the N-saturation theory (as suggested by reviewer #1). This will then provide a guiding structure for the re-organisation/re-structuring of the discussion. Where the number

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of studies is insufficient to undertake further statistical analysis we will highlight as a research gap (see action point 3).

3. Identify the research gaps more clearly

To identify the different levels of understanding of the processes and controls on variations in GHG emissions we will produce a summary table highlighting the gaps in our knowledge. This will include geographical gaps (associated with some of the political and social issues raised by reviewer #2) as well as those associated with the main drivers of GHG emissions.

4. Provide an additional dimension to the discussion

As well as re-organising the discussion to focus on the theoretical insights into the data, we will also add another section that stresses why the data are important and how they can be utilised to inform sustainable (and climate smart) agriculture. We've already touched on this with yield-scaled data, but we can go further and elaborate several statements on the possible ways the data can be used and the difficult decisions that have to be made regarding how and why to manage land. Specifically we are interested in the potential trade-offs and compromises that may be involved in managing land for different purposes. Examples include reducing CO2 and CH4 emissions, or in managing land to store more C or produce more food.

5. More acknowledgement and evaluation of the research design and methods

Reviewer #1 raises the question of the different approaches taken by the studies reviewed in the manuscript. We have only included studies that were conducted in the field, excluding laboratory based results, but there are wide variations in chambers, sampling techniques, duration of data collection, replication and quality control. We like the idea of including a supplementary table where the methodological characteristics of each study are outlined. We have already included some information such as chamber type and sampling periods in the database we provided with the manuscript.

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This could then be used to make comments on how many studies reach the “gold standard” of replication, techniques, data quality (i.e. have they been diffusion corrected, adjusted to standard atmosphere, temperature and pressure) and those that fall short. This information can then be used to make clearer recommendations for future research.

6. Greenhouse gas emissions from African river basin and lake

Drs. Alberto Borges and Steven Bouillon suggested newly arrange greenhouse gas emissions from African rivers by the unit of river basin not country. Also they suggested adding greenhouse gas emissions from African lakes. We recognized the importance of their suggestions so we will revise text and Table S1 related to greenhouse gas emissions from African rivers. Also we will include greenhouse gas emissions data from African lakes in text and Table S1.

Interactive comment on Biogeosciences Discuss., 12, 16479, 2015.