

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2021-85

Anonymous Referee #2

Referee comment on "Reviews and syntheses: Enhancing research and monitoring of land-to-atmosphere greenhouse gases exchange in developing countries" by Dong-Gill Kim et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2021-85-RC2>, 2021

General comments:

The paper "Reviews and syntheses: Enhancing research and monitoring of land-to-atmosphere greenhouse gases exchange in developing countries" provides further insight into addressing the key knowledge gaps regarding the accurate quantification of carbon stocks and greenhouse gas dynamics in developing countries. While this is a valid topic, in relation to the lack of research infrastructure in these regions, this has already been addressed in several other recent publications that approach this issue from multiple cross-domain perspectives. The novelty in this paper is not just the identification of gaps and priorities (as this has been documented elsewhere), but it is how this can be addressed. In this paper, the potential solutions are presented through the description of how a focus on the application, or potential application of AT&A approaches can be used to enhance our understanding in these areas. The manuscript in its current form represents a "think-piece" or discussion paper rather than a standard scientific paper and presents a very general overview of the background requirements and application of AT&A approaches rather than the "review and synthesis" as indicated in the title. Further details are required in many parts to provide insight into the technological developments and how these can really be implemented and utilised by the variety of stakeholders who would find this information useful. I also agree with R1 in that the paper does not just deal with greenhouse gas exchange and could be revised to better represent the information presented.

Specific comments:

- Lines 37/38: Expansion of GHG research not only required in developing countries to reduce uncertainty, this is also required in some systems in more developed areas also.
- Line 44: GHG research is conducted extensively across the globe it is the spatial representative nature of the sites/networks that requires attention.
- Line 49: Do the authors mean that where measurements are being made they meet the standardised protocols of networks elsewhere and it is the spatial aspect that requires attention?
- Line 53: recognition of GHG sources, useful to link this to methods used to develop national inventories and the need for data to inform this. This would also align with the IPCC reporting approaches described in the C stock section.
- Lines 54/55: Provide further details on topics described to expand on the research that has been undertaken using the AT&A approach, its utility and relevance here.
- Line 77: Define abbreviations before wider use.
- Line 81/82: What are the “quickly-developing, highly advanced instruments using relevant technologies” and does this influence the measurements made across the distribution of sites detailed (developed/developing nations)?
- The authors have compiled the literature to provide summary statistics from studies that address the key C stocks, GHG emissions and land use (predominantly land use change and the agricultural sector). Would it be worth including a section on the information available from the application of potential mitigation strategies to reduce GHG emissions from the land use sector (there is some literature on this for Africa)?
- Section 2.5. Is it also worth making the point that in many cases we don’t have adequate data to effectively use biogeochemical models at the site-scale to better understand fluxes and potential impacts of management or climate? Also have any ML or RS approaches been trialled/ground-truthed using/against sites/datasets in Africa?
- Line 215: 80 published studies?
- Line 215-219: valid point but securing long-term funding to maintain the study sites/measurement infrastructure is a problem globally.
- Section 3.3. Possible to link the measurements infrastructure and variables derived to the systems that can inform strategies to deal with the issues faced?
- Section 4.1. Why does this only refer to forest systems?
- Section 4.4/4.5: Further details are required to really provide critical insight, e.g. how RS derived GHG data can be used in practice or the developments and application of the “deep-learning playground” are required.
- Section 5.6. What about addressing the combination of accuracy, time and cost in the recognition of the AT&A use in Africa?
- Section 6.1. Have the outputs from the researchers who have implemented the AT&A approach been fully described, discussed and evaluated here?
- Section 6.2. The recommendations are very general e.g. the technological aspects, if this is really to be used to stimulate new research and fill knowledge gaps further details are needed throughout.