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Discussions

Interactive comment on "Stem and soil nitrous oxide fluxes from rainforest and cacao agroforest on highly weathered soils in the Congo Basin" *by* Najeeb Al-Amin Iddris et al.

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Quantifying the exchange of powerful trace gases is important if we are to fully understand biosphere atmosphere exchange contributions to national inventories when there are international efforts to avert damaging climate change (e.g. the Paris Agreement climats target). This involves a need to understand the contribution of natural ecosystems to the atmospheric radiative balance as well as the effect of any changes to those ecosystems e.g. through land use change. In this paper, the authors tackle both the need for new measurements of N2O from tree stems, while also placing this within the context of land use change. While it is seemingly obvious to make measurements from

tree stems, there have been remarkably few such measurements and the field has only taken off in the last 5-10 years. Until this point, stem surface exchange has been neglected from studies of net ecosystem exchange of powerful trace gases. The authors also make the first tree stem flux measurements of N2O exchange in Africa. They report the important discovery that both natural forest trees and plantation cacao trees are important contributors of N2O to the atmosphere forming a substantial contribution of total ecosystem emissions. They further scale these measurements to the whole Congo region, which further demonstrates the importance of tree stems in unfertilised natural and agricultural forestry ecosystems in influencing net emissions. For these reasons I recommend full publication in Biogeosciences. The manuscript is very well written and the methods are robust and meticulously detailed so are able to be replicated by others with ease. The tables and figures are informative and are straightforward to interpret providing a wealth of stem flux and additional supporting information. My main comment on the study is concerned with the position of flux measurement chambers which are mainly at breast height and above. I understand that some of the natural forest trees are buttressed, making it difficult for deployment of a uniform chamber design lower down the tree stem but this does present a potential reason for the lower fluxes they observed relative to the only other tropical forest N2O fluxes reported. The authors do acknowledge that there are other studies demonstrating larger fluxes from trees at the tree base and they do discuss their own measurements in this context but I feel they could do more to discuss how, given this, their measurements may represent a conservative estimate of total tree stem fluxes and stem fluxes could be even larger. This doesn't diminish the study in any way (we're still in the relatively early stages of tree stem flux measurements with, as yet, no standard approaches emerging) but it would place a lower bound on emissions from these forests and plantations pointing to the need for further study. A simple line that addresses this point in the 'Implications' section or at a relevant point in the discussion would suffice.

Reply: We appreciate the reviewer's comments highlighting both the novelty of the dataset that we present, and the timeliness of our manuscript. We also agree with the

reviewer that our stem N2O measurements may be conservative, considering that we could only measure stem fluxes at 1.3 m stem height and above, due to the presence of buttresses on many of our measured trees. We have incorporated his suggestion by adding it to our proposed revision for questions #5 and 6 above.

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