REPLY TO REFEREE #2 CHRIS JONES

We warmly thank Chris Jones for his very thoughtful and precious Referee comments and for the fact that the Referee acknowledges the manuscript content.
Below we provide answers to the comments posted by Chris Jones.

"I have a few minor comments which may help presentation, but recommend publication once these are addressed."

Thank you, we will ensure that all the comments are addressed.

"My main comment is that due to its length, I think there may be a cleaner way to summarize and finish the paper. When I got to figure 10 (and also fig 11) I thought "this is a nice synthesis plot" (i.e. it feels like a really good place to finish and summarize everything you've found), but then the paper goes back into more details and uncertainties – I was then left not knowing whether to believe figures 10 and 11 any more…. It would be nice maybe to have the discussion of uncertainties first, and then finish with a clear synthesis figure like 10/11 which shows your final best estimates."

We agree that the paper should be shortened after figures 10 and 11 and will ensure that the discussion about uncertainties is before these figures.

Minor comments

- "You note that land use CO_2 emissions have the greatest uncertainty. It is worth noting that this is true globally and in fact land-use CO_2 are the most uncertain of all GHGs (at least when expressed as CO_2e) according to IPCC."

We will reframe that point and refer to IPCC reports.

- "For N_2O, you note the difference between bottom-up and top-down estimates. I'm curious how this compares with the global situation – is this similarly affected by the potential contribution of natural sources? Or is this just a problem for Africa (and if so why?)."

According to Deng et al. (2022), the global situation from inversions for main emitters is similarly affected by the potential contribution of natural sources as well, which is difficult to estimate / separate.

We copied below Fig. 11 from Deng et al. (2022) showing that even when removing 'intact / non managed lands' from inversions, in many countries, especially tropical countries, the inversions give a systematically much higher anthropogenic emission of N_2O than inventories, suggesting that there are

either missing anthropogenic sources or some 'natural' sources (e.g. conservation areas) in managed lands being underestimated by inventories. We will highlight this point in the revised manuscript.

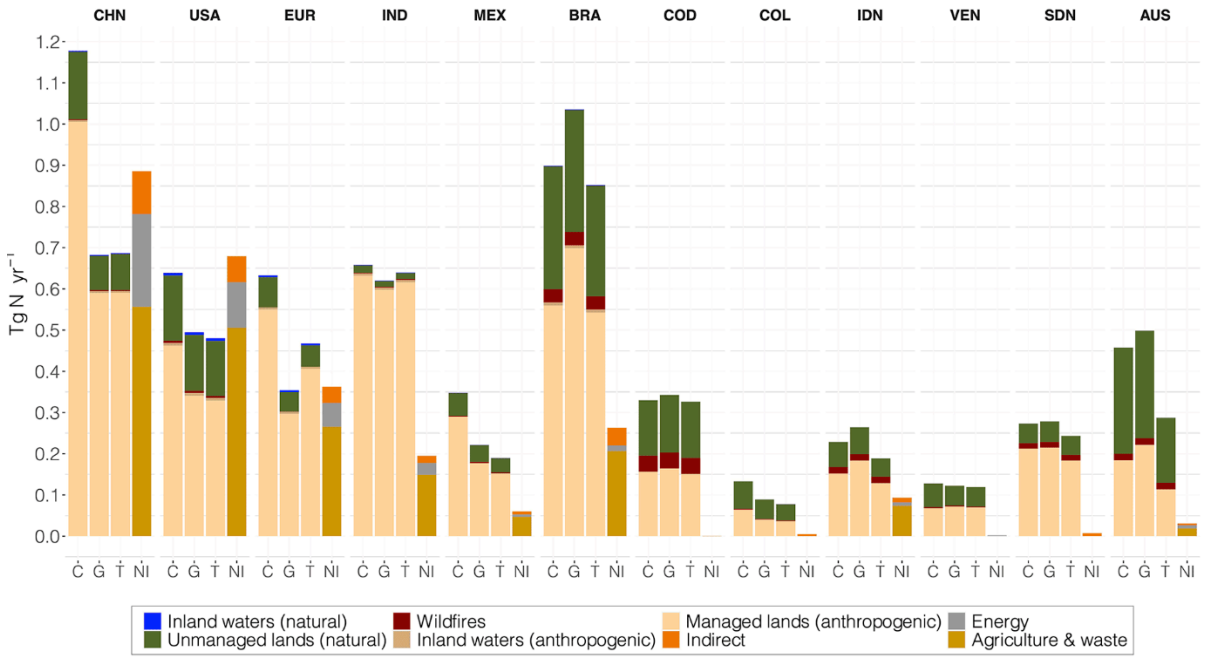

Figure 11 from Deng et al. ESSD 2022

- "Given the importance of this uncertainty – could the paper recommend which estimate to use? Do you believe the top-down or bottom-up ones are better? At the moment it just leaves the reader to see two very different possible answers…."

Thanks, it is a tricky point, we will add a more detailed paragraph about it based on our reply to the comment above.

- "Table 1: why do you list all 3 N_2O inversions as different lines here, but for CO_2 you just have "GCB ensemble" (which is itself multiple models)?"

We will suppress the listing of all 3 N_2O inversions and refer them to the N_2O budget paper.

- "Line 291 – Pongratz is a good reference here for the issues of "loss of sink capacity". https://esd.copernicus.org/articles/5/177/2014/esd-5-177-2014.pdf"

Thanks, we will add reference to Pongratz and her mathematical definition of loss of additional sink capacity" (LASC) as detailed p. 180 of her paper as:

"LASC $=\delta(Em - Ep)^3$

"CO_2 fluxes in response to environmental changes on managed land as compared to potential natural vegetation. Historically, the potential natural vegetation would have provided a foregone sink as compared to human land use."

- "Line 339 – why do you use GWP100 numbers from AR4 (16 years old?) – can you update these to AR6?"

We used AR4 because many African countries have been following 2006 IPCC guidelines referring to AR4 GWP. 2019 refinement to IPCC guidelines do not recommend any specific metrics, therefore we are not following IPCC guidelines used by countries. We have explained this point and given the coefficients to use to change AR4 to AR6 GWP values in the revised manuscript.