Reply to Referee#2

We would like to thank the reviewer for their positive evaluation of the manuscript and for the useful comments and suggestions. Below we address the raised concerns. The reviewer's comments are shown in **bold** and our replies are given in blue. Additions to the original text are in green.

First, we applied the changes suggested in the Interactive Discussion CC1 'Citations for CAMS-GLOB-SOIL' by David Simpson. More specifically:

L.149-151: New references were added to the CAMS-BIO-SOILv2.4 inventory: (Simpson et al., 2023; Simpson and Segers, 2024). Also, we added Steinkamp and Lawrence (2011) and Yienger and Levy (1995) that replace Hudman et al. (2012).

Table 2: Reference to Darras et Simpson (2021) was replaced by Simpson et al. (2023).

Second, we add the following:

L.105: "A few other studies advocated for joint inversion and applied a similar approach (Souri et al., 2020, 2024; Wells et al., 2020)."

The authors conducted adjoint-based inverse modelling to update emissions of NOx and VOC over Africa for 2019 using a chemistry-transport model MAGRITTEv1.1 and TROPOMI HCHO and NO_2 retrievals. This is a robust study. Even though there are uncertainties associated with assumptions and methods in the approach, the authors conduct additional analyses (an ensemble of inversions) to evaluate and address these uncertainties. The updated emissions have also been evaluated using available observations. This study is important and informative given limited knowledge and observations of Africa NOx and VOC emissions. The manuscript is well written. I have no major concerns or comments on this manuscript. Below are only a few minor suggestions.

Please consider adding latitude and longitude to your map plots. For example, Line 393 says "decreases in soil emissions in the Northern Hemisphere". Without latitude and longitude, it's hard to visualise in Figure 11.

For the sake of clarity, we have emphasised the coordinate lines in Fig. 6. As figures already contain a substantial amount of information, we believe that including latitudes and longitudes would further reduce their readability.

Caption of Figure 17: Please change "Histogram of average soil NO flux measurements" to "Average soil NO flux".

Done.

I wonder if the author could add more discussion on the implication on MEGAN.

We add the Supplementary Section 7 containing the Table S2 referenced in the paragraph we add to the manuscript. We add the following to the manuscript:

L.689: "Our results point to a likely underestimation of basal isoprene emissions of the species in southern Africa and tropical western Africa, as also underscored by Marais et al. (2014). The STD inversion uses the MEGAN bottom-up inventory (Sect. 2.1.1 and Fig. 3), which relies on emission capacity maps derived from detailed ecoregion descriptions. These maps integrate information on species composition with species-specific emission factors. However, these maps bear uncertainties related to the species composition estimates and to the basal emission capacities that stem from several factors, including within-species, diurnal and seasonal variabilities, measurement and analysis errors, and differences between sun- and shade-adapted leaves. Despite these difficulties, a single value of the basal emission capacity is assigned for the entire canopy and the entire year, typically based on measurements in the summer for shade-adapted leaves. Based on the inversion results, the derived average isoprene emission capacity in regions 1 and 2 is relatively close to the a priori (Table S2), whereas the emission capacity for broadleaf forests is increased by about 20% (from 4,100 to 5,100 µg m^{-2} h^{-1}) and the emission capacity of savannas in region 4 is strongly enhanced after optimisation, from 2,500 µg m^{-2} h^{-1} to 6,000 µg m^{-2} h^{-1}. High emission rates in southern African woodlands, notably from *Diplorhynchus condylocarpon* and the Miombo Woodlands, were reported in Otter et al. (2003), in a region encompassing southern Angola and northern Mozambique (eastern Miombo woodlands), in line with our results."

Also, we add a paragraph in the conclusion section about future research direction:

L. 785: "Building on the work of Marais et al. (2014), future research could focus on deriving a map of emission potential developed for each ecosystem based on top-down isoprene emission estimates. With recent advances in satellite-based isoprene estimates, top-down inventories could be employed to assign MEGAN isoprene emission capacities in landscapes where data on species composition and species-specific emission factors are sparse."

Reference

Marais, E. A., Jacob, D. J., Guenther, A., Chance, K., Kurosu, T. P., Murphy, J. G., Reeves, C. E., and Pye, H. O. T.: Improved model of isoprene emissions in Africa using Ozone Monitoring Instrument (OMI) satellite observations of formaldehyde: implications for oxidants and particulate matter, Atmospheric Chem. Phys., 14, 7693–7703, https://doi.org/10.5194/acp-14-7693-2014, 2014.

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Yienger, J. J. and Levy, H.: Empirical model of global soil-biogenic NO_χ emissions, J. Geophys. Res. Atmospheres, 100, 11447–11464, https://doi.org/10.1029/95JD00370, 1995.