

We sincerely thank the reviewers for their valuable comments and suggestions. We have carefully addressed all points raised. Below, we provide detailed point-by-point responses to each of the reviewers' comments.

Reviewer #1

Question: Fig. 1 caption and elsewhere, the biogenic VOC is a source of CO but presented as emissions. I would rephrase this throughout the manuscript.

Answer: "Emission" has been replaced with "source" in parts related to biogenic VOCs. This change affects the captions of Fig. 1, Fig. 4, Fig. 10, and Fig. S1, as well as the corresponding discussion in the text. Thank the reviewer for pointing out this issue!

Question: L.132-133: For an overview, could you also present the numbers from oxidation of CH₄ (presented in Fig S1) as well as the loss?

Answer: A comparison of CO sources and sink with those from Zheng et al. 2019 and bottom-up inventories (CEDs-CMIP6, CEDs-CMIP7, GFED5) was added in the revised version.

“The annual global sources are 536.3 Tg yr⁻¹ from anthropogenic emissions, 312.5 Tg yr⁻¹ from biomass burning, 623.2 Tg yr⁻¹ from the oxidation of biogenic VOCs, 922.5 Tg yr⁻¹ from the oxidation of CH₄, with a total sink (through the reaction with OH radicals) of approximately 2395.0 Tg yr⁻¹ in a priori inventories in this work. For comparison, Zheng et al. (2019) reported inversion-based global CO budget estimates for 2005-2017 of approximately 700 Tg yr⁻¹ for anthropogenic emissions, 500 Tg yr⁻¹ for biomass burning, 300 Tg yr⁻¹ for biogenic VOC oxidation, and 900 Tg yr⁻¹ for CH₄ oxidation, with a total sink of approximately 2600 Tg yr⁻¹. Regarding anthropogenic emissions, the CEDs-CMIP6 inventory estimates an average of 607.6 Tg yr⁻¹ for 2003-2014, while the updated CEDs-CMIP7 inventory yields lower values, averaging 480.2 Tg yr⁻¹ over 2003-2023. For biomass burning, the GFED5 inventory estimates an average of 518.3 Tg yr⁻¹ for 2003-2022”.

Question: Data availability: add CEDs-CMIP6, CEDs-CMIP7 here as well as GFED5. Also good if you can add links to the observational dataset used.

Answer: We have added links for data availability, including observational data (WDCGG surface observations, HIPPO and ATom aircraft observations) and emission data (GFED5, CEDs, and Zheng et al. 2019).

Reviewer #2

I noticed a few very minor grammatical errors in the supplementary figures which should be fixed:

Question: Supplementary figure 1: Fossil fuel not fule

Answer: Changed.

Question: Supplementary figure 4 and 5: Boreal Asia not Boreal_Asia

Answer: Changed.

Question: If possible, I would also request that in line 132-133, the budget terms from Zheng et al. 2019 (and any others the authors have read) are added as a comparison for the emission sources and oxidation of biogenic VOCs where this is available.

Answer: A comparison of CO sources and sink with those from Zheng et al. 2019 and bottom-up inventories (CEDS-CMIP6, CEDS-CMIP7, GFED5) was added in the revised version. Thank the reviewer for this suggestion!

“The annual global sources are 536.3 Tg yr⁻¹ from anthropogenic emissions, 312.5 Tg yr⁻¹ from biomass burning, 623.2 Tg yr⁻¹ from the oxidation of biogenic VOCs, 922.5 Tg yr⁻¹ from the oxidation of CH₄, with a total sink (through the reaction with OH radicals) of approximately 2395.0 Tg yr⁻¹ in a priori inventories in this work. For comparison, Zheng et al. (2019) reported inversion-based global CO budget estimates for 2005-2017 of approximately 700 Tg yr⁻¹ for anthropogenic emissions, 500 Tg yr⁻¹ for biomass burning, 300 Tg yr⁻¹ for biogenic VOC oxidation, and 900 Tg yr⁻¹ for CH₄ oxidation, with a total sink of approximately 2600 Tg yr⁻¹. Regarding anthropogenic emissions, the CEDS-CMIP6 inventory estimates an average of 607.6 Tg yr⁻¹ for 2003-2014, while the updated CEDS-CMIP7 inventory yields lower values, averaging 480.2 Tg yr⁻¹ over 2003-2023. For biomass burning, the GFED5 inventory estimates an average of 518.3 Tg yr⁻¹ for 2003-2022”.