

Answer to Referee report #1

We thank the referee for valuable comments and suggestions. In particular, we appreciate the efforts of the referee to polish the language of our manuscript. Our answers are given below. The original referee comment is repeated in **bold**, changes in the manuscript text are printed in *italics*.

Overall comments

This is a very nice paper describing a well-executed solid piece of research that exploits a very new highly innovative set of observations, compares them to a state-of-the art atmospheric chemistry modeling system, and draws useful conclusions that have the potential to improve the accuracy of such models in future. I believe this paper is in very good shape and happily recommend it for publication in ACP once a few minor comments of mine (mostly related to wording) are considered (along with those of other reviewers, naturally). The standard of the presentation is excellent and the description of the work is laudably clear and well constructed.

We thank the referee for this encouraging judgement.

Minor comments

Line 10: Suggest: "...pollutants likely originate from..."

Done.

Line 12: Suggest: "...In comparisons to results of the CAMS..." (think "simulations" disrupts the flow and is not needed).

Agreed.

Line 14: Suggest you delete "too".

Agreed.

Line 16: Move "discussed" to after "gases"

Done.

Line 23: "their" is a vague antecedent. Does it refer to Africa, South America, etc., or to the increase in biomass burning, or to the UTLS. Also the "too" (end of the line) is out of place as the preceding sentence does not talk about any "increase" just the ongoing importance of the UTLS. I suggest you re think these two sentences a bit.

We rephrased the second part of this sentence: *Due to increasing biomass burning activities in Africa, South America and Australia (Torres et al., 2010, Abram et al., 2021), the potential influence of biomass burning trace gases on climate may increase over time.*

Line 29: Suggest: "Typical biomass burning trace gases have different atmospheric lifetimes and atmospheric sinks. Further, they may have additional non-pyrogenic

sources."

Thank you for this excellent suggestion.

Line 36: Suggest: "Atmospheric model simulation of such pollution trace gases is challenging:"

Agreed.

Line 42: Suggest "to simulate" -> "the accurate simulation of", then "due to" -> "during".

Done.

Line 43: Suggest: "processes, which" -> "processes that".

Done.

Line 44: Delete comma after gases, change "like" to "such as". Change "For example" to "As an example" (the latter somehow feels better as the example refers to more than just the preceding sentence).

Thanks.

Line 38: Delete "Then" (and capitalize "The" as a result, naturally).

We think this was related to line 58. We changed it as suggested on this line.

Table 2: Would be good to specify whether the estimated error is random/precision-like or systematic/accuracy-like, or some combination of the two.

We changed the table caption to: [...] *estimated errors (combination of random and systematic errors)*.

Line 105: "this" -> "that"

Done.

Line 106: "estimate the" -> "estimates of the"

Done.

Figure 1 (and 2): I find the colored background (land/sea) in panel a distracting. I'm usually in favor of such things, but I think in this case there is simply too much else going on. I suggest you revert to a simple outlines as in Figure 3, or perhaps just shade the continents in pale grey.

We agree with the referee and changed the map background for both figures.

Figure 1, also: I find the green contour particularly hard to spot (compared to the others). Perhaps, for this one, you could put a thicker white contour underneath it to make it stand out (or perhaps used a dashed green/white line for the counter, but that might make it stand out too much).

We increased all white counter lines in width and changed the line style to dashed lines for all colored boxes. We applied those changes to Figs. 4-5, too.

Figure 1/2: I imagine you considered this, but it might be preferable to use the same color bar ranges between the two plots. They're not that different (in some cases they're already identical), and it might make for easier comparisons. On the other hand, if your feeling is that it mutes the enhancements in Figure 1 too much, I'm fine if you opt to keep

things as they are.

We agree that the differences in the color bars have been very small and, in fact, the enhancements in Fig.1 are still well visible with the color bar ranges of Fig. 2 applied. **Line 153: Suggest you add a comma between "correlated" and "pointing"**

Done.

Line 183: Suggest: "and their horizontal evolution is presented in Fig. 3"

Agreed.

Line 183/184: Suggest you swap "PAN" and "surface"

Done.

Line 184: Suggest "of" -> "from"

Done.

Line 186: My only semi-substantive point here. I'd avoid "origin". To me the "origin" is the place where the air masses left the surface, which is not constrained to lie along the trajectories. Rather I'd say "the point at which the air masses were injected into the UTLS", "or reached UTLS altitudes" or something like that.

We agree with the referee and we now avoid the word "origin" throughout the manuscript, unless "origin" is used in a rather vague way (e.g.: "indicate the origin").

Line 206/207: Suggest: "...also illustrate enhancements in this region."

Agreed.

Line 230: Delete "correlation", change "is" to "are"

"Correlation" deleted as suggested. In our opinion, "is" refers to "the majority" and should be singular (and not plural "are" as suggested). But we are no native speakers – so we may be wrong, and in case of publication in ACP, copy editing will fix it.

Line 233: Suggest "simulated too low" be changed to "underestimated" (even though you have "underestimation" in the next line, I think this is still preferable.

Agreed.

Line 237: Suggest: "to reproduce" -> "in reproducing"

Done.

Line 238: Suggest you insert "well" before "represented" (feel some word if needed, I'm fine with "fairly well" if you prefer)

Done.

Line 240: "In the" -> "The", "it is illustrated" -> "illustrate". Move "overall" to after "concentrations" on the next line.

Done.

Line 245: "accordingly" -> "in accordance"

Done.

Line 265: "large" -> "strong", "of" -> "with a"

Done.

Line 267: "too low" -> "smaller". Add commas before and after "below 200 pptv"

Done.

Line 268: "of" -> "in"

Done.

Line 285: "to reproduce" -> "in reproducing"

Agreed.

Line 287: "have" -> "be due to"

Done.

Line 288: Perhaps add "a priori" or something after "estimate", to indicate that you're not talking about the composition measured by GLORIA, but rather in the immediate vicinity of the fires.

Thank you for this suggestion.

Line 291: Suggest "high" -> "much"

Done.

Line 291/292: Move "overall" to after "concentrations"

Done.

Line 295: Move "discussed" to after "flights". Change "above" to "over"

Done.

Line 296: Change "discussed" to "multiple".

Done.

Line 300: suggest "retrieval" -> "measurements" (it's not just the retrieval that's doing well)

Agreed.

Line 302: "illustrated" -> "illustrate"

Done.

Line 303: "While during" -> "Although on",

Done.

Line 305: Delete "have"

Done.

Line 306: Delete the comma after "week" and change "have been" to "were"

Done.

Line 307-308: Suggest: "... which only were observed in some of the places where peaks in other measured pollution trace gases were found."

Agreed.

Line 327: Suggest "... are reproduced well overall..."

Done.

Line 328: "also" -> "the"

Done.

Line 329: "are able" -> "enable CAMS to"

Done.

Line 321: Change "should" to "could" and move "for these species" to just before "could"

Done.

References: Do you really need both the doi and Copernicus URLs? (More of a question for the copy-editor).

For previous publications in ACP, this was requested during the typesetting process. We suggest to leave the references as they are, if not requested otherwise by the copy-editor.