We are grateful to the referee for his/her time and energy in providing helpful comments and guidance that have improved the manuscript. In this document, we describe how we have addressed the reviewer's comments. Referee comments are shown in black and author responses are shown in blue text.

Reviewer#1

Well written paper showing vegetation feedback of fire-enhanced O_3 based on modelling approaches. The results are supported by showing O_3 vegetation feedback with and without fire. I would recommend to slightly change the Introduction so that the reader would be able to follow the text more fluently and the paragraphs will follow each other more logically.

➔ Thank you for your positive evaluations. All the questions and concerns have been carefully answered. We have adjusted the sequence of paragraphs in the Introduction section, so that the readers can follow the text more fluently.

Here are some more detailed comments:

1. line 23: fire is not a source of ozone. Please rewrite it in a manner that it produces precursors of O_3. Moreover, the sentence has double meaning - it is a fire and O_3, which causes damage to vegetation and reduces stomatal conductance.

Response: We revised this sentence to avoid confusions: "Fire is an important source of ozone (O_3) precursors. The formation of surface O_3 can cause damages to vegetation and reduce stomatal conductance." (Lines 23-24)

2. line 70-71: here you write the same as in line 49-50.

Response: The original sentence "Emissions from biomass burning generate a large amount of O_3 precursors" on lines 70-71 has been removed in the revised paper.

3. line 79: cite the three papers here.

Response: We added a recent paper by Zhu et al. (2021) in the revised paper. All the

four studies have been cited as suggested. (Lines 67-68)

4. line 88-90: when the O_3 is enhanced, one would expect higher deposition velocity. Could you explain why in that case it is the opposite?

Response: Vegetation acts as a major sink through stomatal uptake of O_3. Observations show that surface O_3 damages will decrease both plant photosynthesis and stomatal conductance. Therefore, the higher surface O_3 results in lower stomatal conductance, leading to smaller dry deposition velocity. Such O_3-vegetation feedback has been revealed in previous studies and is further clarified as follows: "Simulations showed that surface O_3 could be enhanced … through comparable effects from biogeochemical (decreased dry deposition and increased isoprene emissions) and biogeophysical (changes in meteorological variables following reduced transpiration rate) feedbacks from O_3-vegetation interactions." (Lines 70-74)

5. line 103-105: how do the influence the sources and sinks? I think it influence more sinks. Now it seems as the reduces LAI would be a source of O_3, when it is just reducing sink of O_3. Moreover, there is a new review about O_3 effect on vegetation, which you might consider to include here. 10.3390/atmos12010082

Response: Vegetation stomatal conductance and LAI influence dry deposition of O_3. LAI also influences the emissions of BVOC, which is an important O_3 precursor. The new review article has been cited in lines 46-47. "Tropospheric ozone (O_3) is a toxic air pollutant with detrimental effects on vegetation (Yue and Unger, 2014; Juráň et al., 2021)"

6. line 203-204: is that true? One would expect oxidation of the compounds and sedimentation of particles before reaching PBL

Response: We agree with your comment. Most of fire emissions and oxidations occur below the PBL. We clarified as follows: "In GC-YIBs, all biomass burning emissions occur in the atmospheric boundary layer. Such configuration might slightly overestimate regional O_3 formation as observations suggested ~20% of fire plumes

reached the height above the boundary layer (Val Martin et al., 2010) and consequently enhanced surface O_3 level at the downwind regions (Jaffe and Wigder, 2012)." (Lines 214-219)

7. line 256-258: is the mean annual or is the mean from 2005-2012, which is longer time that annual.

Response: It is the mean [O_3] during 2005-2012. "global mean annual" has been modified as "global mean" in the revised paper. (Lines 274-275)

8. line 381: I think you just hypothesize, that it is due to reduced stomatal conductance. There is no model feedback showing this nor your measurement.

Response: This conclusion is not a hypothesis. First, many observations have shown that O_3 can cause damages to stomatal conductance (Yue et al., 2016). Second, our simulations show that O_3-induced reductions in stomatal conductance result in enhanced surface O_3 (Fig. S3a) due to reduced dry deposition velocity (Fig. S4) (Related descriptions in Lines 326-332). Third, such O_3-vegetation feedback has been revealed and supported by other modeling studies (Sadiq et al., 2017; Zhou et al., 2018; Gong et al., 2020; Zhu et al., 2021).

9. Fig 6: explain abbreviations AMZ, CAF, SAS as in Fig. 3

Response: We modified the figure caption as follows: "The blue, red, and green bars in (a) represent the O_3-vegetation feedback in Eastern U.S. (EUS), Eastern China (ECH), Western Europe (WUR), respectively. The blue, red, and green bars in (b) represent the O_3-vegetation feedback in Amazon (AMZ), Central Africa (CAF), and Southern Asia (SAS), respectively." (Lines 718-721)

References

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