

Response to Referee #1

The authors wish to thank Reviewer #1 for the comments, which greatly contribute to an improvement of the paper.

In the following, we address the issues raised by the reviewer:

Q1.1: Lines 217-219, model spin-up is an adjustment process that the model that moves from an initial state of unusual conditions to an equilibrium state. It is usually applied under conditions with surface emissions. The authors' claim here is thus inappropriate. I suggest removing these sentences.

A1.1: Thanks a lot for the advice. The reviewer is correct saying that the description about the spin-up process here is inappropriate. We have removed these sentences in the revised manuscript. Please see the corrections in lines 240-243 of the revised manuscript.

Q1.2: Line 298, I feel a little confused here. In a previous context (c.f. line 266), the authors already stated that (R158) is responsible for the discrepancy of the results between CB6r2 and CB6r3. But here they stated that (R158) is “possibly” the major reason, which is confusing. Please rephrase the sentence here.

A1.2: Yes, the description here is inappropriate. However, in the revised manuscript, this part has been deleted due to the update of the computational results. Still, many thanks for pointing it out.

Q1.3: Line 303, (R26) is not an HNO₃ related reaction. Instead, it is an important NO₃ radical forming reaction, which plays an important role in the nighttime polluted atmosphere. Please rephrase it here.

A1.3: Thanks. We rephrased the sentences here. Please see lines 328-330 in page 11 of the revised manuscript.

Q1.4: Line 339, the estimation of ozone by CB6r3 would also be largely different from CB6r3 and CB6r2, isn't it? Please clarify it here.

A1.4: According to the results of the sensitivity analysis, under a different temperature condition, ozone predicted by CB6r3 would be substantially different from those predicted by CB6r1 and CB6r2, which is similar to the conclusion obtained from the sensitivity analysis of NO_x. We thus added more explanation here for clarify; please see lines 411-414 in page 13 of the revised manuscript.

Q1.5: Line 398, there is a redundant “of” in the sentence.

A1.5: Fixed. Thanks.

Q1.6: Line 413, from the response of ozone to the change of emissions in their study, it seems that the scenarios the authors investigated are in VOC-excess conditions so

that the increase of VOC tends to decrease ozone. I thus doubt that whether their conclusions are also valid under NO_x-excess conditions or not. The authors should provide a discussion (at least a brief one) on the limitations of their conclusions obtained in this paper.

A1.6: We agree with the opinion of the reviewer that the conclusions achieved in this manuscript are mostly valid under conditions that are focused on in this box model study. Whether these conclusions are still valid under different conditions or not needs further investigations. Therefore, according to the suggestion of the reviewer, we added a context stating the limitations of this study. Please see lines 660-662 in page 21 of the revised manuscript.

Q1.7: Code and data availability. It is always better to upload the source code as well as the data of the results to some website so that they can be shared with the scientific community. Only stating “the data can be acquired upon request” here is not enough from my point of view.

A1.7: Thanks. According to the reviewer’s suggestion, we uploaded our files including the source code of the model and the data for the computational results to a webpage, so that the readers can download and share them. Please see the “Code and data availability” section in page 21 of the revised manuscript for the address of the webpage and the password to download these files.

Q1.8: The appendix table in the manuscript is misplaced. Please modify it.

A1.8: We have adjusted the location of the table in the revised manuscript. Thanks.

Q1.9: The manuscript is reasonably well written, but I would like to remind the authors that there are still a few sentences that can be improved significantly.

A1.9: We revised our manuscript again and corrected many inappropriate statements in the paper. Please see the words and sentences marked in red throughout the revised manuscript.