Response to Reviewers' Comments

Dear Editor,

Thank you very much for your efforts in reviewing our submission. We have carefully revised the manuscript. Attached are the detailed point-by-point responses to the review comments. For clarity, the reviewer's comments are listed below in *black italics*, while our responses and changes in the manuscript are highlighted in blue and red, respectively.

Best regards,
Guy Brasseur and co-authors

Line 501: NO4+ is not a compound. Please check which aerosol compound you are referring to here.

Author's reply: Sorry for the mistake. We changed it to NH_4^+.

The abstract must be 250 words or less, as per ACP author guidelines. Please reduce and make sure that it follows the formula found here: https://www.atmospheric-chemistry-and-physics.net/policies/guidelines_for_authors.html

Author's reply: We have condensed the abstract and show it below (236 words).

Despite substantial reductions in anthropogenic emissions, ozone (O_3) pollution remains a severe environmental problem in urban China. These reductions affect ozone formation by altering the levels of O_3 precursors, intermediates and the oxidation capacity of the atmosphere. However, the underlying mechanisms driving O_3 changes are still not fully understood. Here, we employ a regional chemical transport model to quantify the ozone changes due to a specified emission reduction (50%) for winter and summer conditions of 2018. Our results indicate that reduction in nitrogen oxide (NO_x) emissions increase surface O_3 concentrations by 15%−33% on average across China in winter and by up to 17% in the volatile organic compounds (VOCs)-limited areas during summer. These ozone increases are associated with a reduced NO_x-titration effect and higher levels of OH radical. Reducing the NO_x emission significantly decreases the concentration of particulate nitrate, which enhances ozone formation through increased HO_2 radical levels due to reduced aerosol uptake and diminished aerosol extinction. Additionally, an enhanced atmospheric oxidative capacity, driven by larger contributions from the photolysis of OVOCs and OH-related reactions, also favors urban ozone formation. With additional reductions in anthropogenic VOCs emissions, increases in summertime ozone (VOC-limited areas) can be offset by the reduced production of radicals from VOCs oxidations. To effectively mitigate ozone pollution, a simultaneous reduction in the emission of NO_x and specific VOCs species should be applied, especially regarding alkenes, aromatics, and unsaturated OVOCs, including methanol and ethanol.

Also, please review the conclusion section through the same link and provide a brief comparison and context with previous studies and caveats and limitations.

Author's reply: We modified the final paragraph of our conclusion to meet the requirements.

Overall, in urban areas, the reduction in the surface ozone levels requires a reduction in the emissions of anthropogenic VOCs. These results are consistent with the studies of W. Wang et al (2023) and Liu et al., (2023), who stated that the priority to control ozone pollution in China should be to reduce the emissions of VOCs. Our study assumes a uniform 50% reduction in the emissions of all primary VOCs. Future work should

therefore determine which of these VOCs should be reduced as a priority to determine the most effective ozone control strategy. Our results suggest that reducing emissions of alkenes, aromatics, and unsaturated VOCs, especially methanol and ethanol, should be a priority. To develop efficient mitigation strategies that reduce AVOC emissions, more detailed investigations are needed into the reactivity of individual VOCs and their potential impact on urban ozone formation.