Anonymous Referee #1

This work present the results of the field measurement of air pollution during 2019 Spring Festival. Spring Festival is a special period to investigate the impact of emission reduction on air quality. The topic itself is very interesting. The authors provide very interesting data. However, there's major defect for the current manuscript. The authors compared the variation of various air pollutants, and gave the conclusion that the reduction of "Sharply reduced sulfur dioxide (SO2) and nitrogen dioxide (NO2) concentrations during the festival holiday resulted in an unexpected increase in the surface ozone (O3) concentration", and further promote the secondary formation. These conclusions are astonishing and new, but the authors did not provide enough convincing evidence. Besides, considering the quality of ACP, I will not recommand the publication of this manuscript.

Response: While we appreciate the critical comment of the review, it'd be much more helpful if the reviewer could have provided a more informative and insightful comment so that we know more about his/her concern. For any scientific research, a finding of "astonishing and new" should not be the reason for rejection.

In this study, we investigated the impact of emission reductions on the concentrations of several trace gases and their further impact on aerosol formation during the special period of the 2019 Spring Festival. It is clear that emission reductions could efficiently reduce primary pollutants (SO_2, NO_x, BC, etc.). The time series of O_x (O_3+NO_2) added in Fig. 2 depicts a weak decrease of O_x from the POL period to the BG period, suggesting that the possible appeared O_3-titration made [O_3] increase during the BG period. Simultaneously, the mass concentrations of secondary inorganics decreased but their reduction percentages were much lower than those of primary pollutants. With the further analysis of SOR, NOR, and their relationships with ambient RH and ALWC, we concluded that the enhancement of aqueous chemical reactions oxidized by the dissolved O_3 maybe the main reason causing the enhanced secondary inorganic aerosol (SIA) formation, especially for sulfate.

In recent years, the annual average $PM_{2.5}$ concentration has decreased rapidly in China, benefitting from the implementation of many emission reduction measures taken by the Chinese government. However, the mass fraction of inorganics increased by more than 10 % during these years (H. Li et al., 2019; Y. Wang et al., 2019), implying the formation enhancement of secondary inorganic aerosols (SIA), which partly counteracted the decrease in $PM_{2.5}$. Xie et al. (2020) found that the aerosol pH level increased as $PM_{2.5}$ decreased in urban Beijing because of the increased mass ratio of nitrate to sulfate. They also stated that the major chemical processes during haze events and the control target should be re-evaluated to obtain the most effective control strategy. As one possible consequence of the increased aerosol pH, the dissolved O_3 in particles may play a more important role in SIA formation, especially for sulfate (Seinfeld and Pandis, 2016). Our study provides sound evidence for this.

Other recent studies have also suggested that the role of O_3 on SIA formation cannot be neglected. For example, Fang et al. (2019) found that relative humidity (RH) and O_3 concentration were two important prerequisites for sulfate formation, based on a year-long set of field measurements made in Beijing. They found a rapid rise in the SOR at the RH threshold of ~ 45% or an O_3 concentration threshold of ~35 ppb, similar to what we found in our study. As another example, Huang et al. (2020) investigated air quality during the COVID-19 lockdown using comprehensive measurements and modeling with a focus on China. They also found that a large reduction in emissions could enhance the concentration of O_3 in winter in the Beijing-Tianjin-Hebei (BTH) region, promoting SIA formation through the enhancement of nocturnal aqueous chemical reactions during the COVID-19 lockdown.

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