Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., author comment AC1
https://doi.org/10.5194/acp-2020-1302-AC1, 2021

Reply on RC1

Peng Wang et al.

Author comment on "Unexpected enhancement of ozone exposure and health risks during National Day in China" by Peng Wang et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1302-AC1, 2021

Comments Response

Journal: Atmospheric Chemistry and Physics

Manuscript ID: acp-2020-1302

Title: "Unexpected enhancement of ozone exposure and health risks during National Day in China"

Dear Referee #1,

We appreciate your comments to help improve the manuscript and tried our best to address your comments. The detailed responses and related changes are shown in below. Our response is in blue and the modifications in the manuscript are in red. All figures are included in the attached PDF file.

General:

The manuscript presents a topical research, i.e. to understand the elevated O3 issue in China due to the holiday impact. This study reported that the drastically rising MDA8 O3 were observed during the CNDH with the increasing rate up to 120% even in some pristine regions, which also induced 33% additional deaths through China. It was shown that increased precursor emissions and regional transport were corresponding to the O3 elevation. This is the first comprehensive study to investigate O3 pollution during CNDH at national level and could provide useful suggestion for the policy makers. The manuscript is easy to follow and fit to the scope of ACP very well. I have some minor comments below for the authors to address.

Response: Thanks for the recognition of our study. Below is the response to each specific comment.

Minor comments:

Line 90~91: Could the author explain more for the IPR and PA tools in the CMAQ model?

Response: The IPR (integrated process rate analysis) and IRR (integrated reaction rate analysis) are all defined as the PA (process analysis) in the CMAQ model (https://www.cmascenter.org/cmaq/science_documentation/pdf/ch16.pdf+&cd=1&hl=zh-CN&ct=clnk). PA aims to provide quantitative information on the process of the chemical reactions and other atmospheric processes that are being simulated, illustrating how the CMAQ model calculated its predictions. The IPR analysis quantifies the relative contributions of individual atmospheric physical and chemical processes in the CMAQ model.

Changes in manuscript: (lines 95-100) In the CMAQ model, the IPR and integrated reaction rate analysis (IRR) were all defined as the PA. PA aims to provide quantitative information on the process of the chemical reactions and other atmospheric processes that are being simulated, illustrating how the CMAQ model calculated its predictions. The IPR was used to determine the relative contributions of individual atmospheric physical and chemical processes in the CMAQ model.

Line 135~136: as readers may not be familiar with West China, please add a reference to show that West China has less anthropogenic impacts.

Response: Thanks for the comments. We've added a related reference to show the less anthropogenic impact of West China.

Changes in manuscript: (lines 141-142) Negligible MDA8 O_3 increase in West China is consistent with vast rural areas and less anthropogenic impacts (Wang et al., 2017).

Line 147~148: it should be mentioned that MDA8 O3 in Shanghai during the CNDH slightly decreased compared with that before CNDH.

Response: We have checked the observation data and confirm that the MDA8 O_3 in Shanghai increased from 58.3 ppb to 63.2 ppb during the CNDH (Table S3). The reviewer may refer to the graphical abstract, which shows decreased total daily mortality in Shanghai but not decreased O_3 levels. The model simulation slightly underestimates the observed O_3 levels in Shanghai during the CNDH, which causes the decreased total daily mortality. We have re-arraged the related content to better clarify this point in Line 273-274.

Changes in manuscript: (lines 273-274) Except for Shanghai (in which O_3 is slightly underestimated), the other eight key cities increased their total daily mortality rates from PRE-CNDH to CNDH.

Line 188: could the author explain more about meteorology impacts such as the variation of the temperature on the O3 during the CNDH?

Response: Thanks for the comment. We've added more analysis of the meteorology impacts in section 3.3.

Changes in manuscript: (line 218-224) Regional transport is also a significant contributor to enhanced MDA8 O_3 during CNDH. As shown in Fig. S5, the lower temperature is predicted during the CNDH compared to the PRE-CNDH. In PRD, the average temperature drops from 25 °C to 23 °C, leading to a lower O_3 level in previous studies (Fu et al., 2015;Bloomer et al., 2009;Pusede et al., 2015). Meanwhile, the increasing wind speed is predicted in the PRD, which is able to facilitate regional transport. The higher O_3 production rates that are calculated by the PA process directly in the CMAQ model (increase rate up to ~150%) are predicted mainly in the urban regions (the NCP,

YRD, and PRD) in China (Fig. S7).

Line 195: Could the author discuss how will the coefficients from the AMAP be applied in the emission inventory?

Response: In the future study, we consider using the real-time coefficients from the AMAP to adjust the traffic emissions. First, an average emission adjustment factor from AMAP will be applied in the simulation during the CNDH to investigate the impacts on O_3 throughout China. And then, a daily or even hourly adjustment factor (if possible) will be applied in the transport emission. In addition, the localized real-time traffic flow data will be considered (if available) as well as the coefficients from AMAP, aiming to reflect the emission variations during the CNDH on a regional scale. By including the localized real-time data, we will be capable of conducting a more compressive study of the emission changes of the traffic sector during the CNDH.

Line 228: please label the key cities in the PRD in the Figure 4

Response: We have labeled the key cities (GZ: Guangzhou, SZ: Shenzhen, and ZH: Zhuhai) in the revised Figure 5 (Also shown in the figure below R1-1).

Please also note the supplement to this comment:
https://acp.copernicus.org/preprints/acp-2020-1302/acp-2020-1302-AC1-supplement.pdf