Comments responses

Journal: Atmospheric Chemistry and Physics

Manuscript ID: acp-2022-577

Title: "Aggravated Air Pollution and Health Burden due to Traffic Congestion in Urban China"

Dear Referee #1,

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

Referee #1

Comments: This study focused on the impacts of traffic congestion on air quality and the associated health burden in urban areas in China. In addition, the authors also developed a new temporal-allocation approach in transportation emission to improve the current emission inventory by using the real-time congestion data. The manuscript is well written and organized, but some minor points should be improved before the publication.

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

1. In section 2.1, the authors used the ECF value only from the gasoline vehicles. Can the authors briefly discuss the uncertainties of this method since the diesel vehicles is also an important contributor to the transportation emission?

Response: Thanks for your comment. This method may slightly underestimate the vehicle emissions. Diesel vehicle is an important contributor to NO_x emission in the transportation sector (Sun et al., 2018), and our method may underestimate the NO_x emissions and the concentrations of air pollutants. However, in urban areas of China, the population of diesel vehicles is relatively small (< 5%) (Sun et al., 2019) due to emission control policies. For example, in Beijing, the registration of light diesel vehicles has been banned since 2003 (Zhang et al., 2014; Wu et al., 2017). Gasoline vehicle is the dominant contributor to the air quality in urban areas.

Changes in manuscript (lines 126-128): Our method may slightly underestimate the transportation emissions since diesel vehicle was an important contributor to NO_x emissions (Sun et al., 2018), which would be improved in the future.

2. In section 2.2, the authors mentioned that the CMAQ model was with "updated SOA formation mechanism". What are the improvements of this model?

Response: Thanks for your suggestion. An improved SAPRC-11(S11) photochemical mechanism was incorporated into this model to treat isoprene oxidation and additional SOA formation pathways. The surface uptake of dicarbonyls and isoprene epoxides, as well as predictions of glyoxal and methylglyoxal are considered in the SOA modul. We have made corresponding modifications to introduce the SOA improvements of this model.

Changes in manuscript (lines 131-133): The mechanism incorporated a more explicit description of isoprene oxidation chemistry and isoprene SOA formation pathways. The surface uptake of dicarbonyls and isoprene epoxides, glyoxal, and methylglyoxal SOA formation pathways were all considered in the model.

3. Can the authors add the WRF scheme set-up to provide more details of the meteorology simulations?

Response: The WRF scheme set-up details are added in the supplemental information (Table S2).

Changes in SI:

Table S2. The WRF model set-up.

.

Physical mechanism	Scheme
mp_physics	Thompson
ra_lw_physics	RRTM
ra_sw_physics	Goddard short wave
sf_surface_physics	Unified Noah
bl_pbl_physics	YSU
cu_physics	Grell-Freitas ensemble scheme

4. The study was conducted in the 2020 when the COVID-19 happened across China. If possible, could the author simply discuss/compare the congestion impacts during the COVID-19 period and normal year (such as 2019)?

Response: Thanks for the comment. More obvious impacts on air quality due to traffic congestion should be found in the normal year. During the COVID-19 lockdown, on-road emissions decreased significantly due to the reduced anthropogenic activities (Zheng et al., 2021). The drastic decreases in both traffic flow (~70%) and NOx emissions (~ 40%) were reported during the COVID-19 lockdown, which may even eliminate traffic congestion.

Changes in manuscript (lines 241-244): Our simulation was conducted in 2020, covering the COVID-19 lockdown period. During the lockdown, a drastic decrease was reported in traffic flow (~70%), which

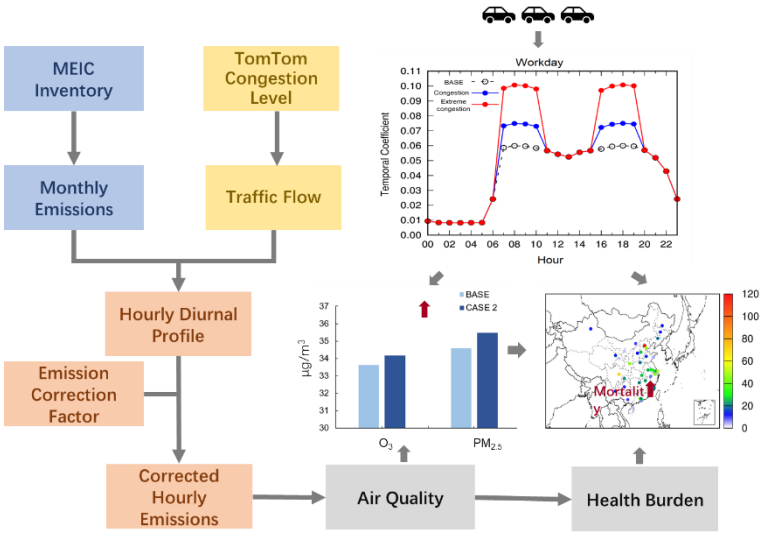
may even eliminate the traffic congestion and its impacts on air quality(Huang et al., 2020a; Zheng et al., 2021b). More remarkable changes in air quality associated the traffic congestion are expected during the normal year.

5. The manuscript mentioned that the population data is from China's Seventh Census. Please explain more how to use/adjust the population data.

Response: Thanks for the comment. We used total population data for 2008 as the baseline and adjust the data to 2020 according to the population change rates in each province from China's Seventh Census (http://www.stats.gov.cn/tjsj/tjgb/rkpcgb/).

6. Please improve the graphic abstract such as adding the unit of the histogram figure and deleting "(a)" in the regional plot.

Response: Thanks for the comment. We have improved the graphic abstract accordingly.



Reference

Sun, S., Zhao, G., Wang, T., Jin, J., Wang, P., Lin, Y., Li, H., Ying, Q., and Mao, H.: Past and future trends of vehicle emissions in Tianjin, China, from 2000 to 2030, Atmospheric Environment, 209, 182-191, https://doi.org/10.1016/j.atmosenv.2019.04.016, 2019.

Sun, W., Shao, M., Granier, C., Liu, Y., Ye, C. S., and Zheng, J. Y.: Long-Term Trends of Anthropogenic SO2, NOx, CO, and NMVOCs Emissions in China, Earth's Future, 6, 1112-1133, https://doi.org/10.1029/2018EF000822, 2018.

Wu, Y., Zhang, S., Hao, J., Liu, H., Wu, X., Hu, J., Walsh, M. P., Wallington, T. J., Zhang, K. M., and Stevanovic, S.: On-road vehicle emissions and their control in China: A review and outlook, Science of the Total Environment, 574, 332-349, 2017.

Zhang, S., Wu, Y., Wu, X., Li, M., Ge, Y., Liang, B., Xu, Y., Zhou, Y., Liu, H., and Fu, L.: Historic and future trends of vehicle emissions in Beijing, 1998–2020: A policy assessment for the most stringent vehicle emission control program in China, Atmospheric Environment, 89, 216-229, 2014.

Zheng, B., Zhang, Q., Geng, G., Chen, C., Shi, Q., Cui, M., Lei, Y., and He, K.: Changes in China's anthropogenic emissions and air quality during the COVID-19 pandemic in 2020, Earth Syst. Sci. Data, 13, 2895-2907, 10.5194/essd-13-2895-2021, 2021.