Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC1
https://doi.org/10.5194/acp-2020-1251-RC1, 2021

Comment on acp-2020-1251

Anonymous Referee #1

Referee comment on "Contrasting chemical environments in summertime for atmospheric ozone across major Chinese industrial regions: the effectiveness of emission control strategies" by Zhenze Liu et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1251-RC1, 2021

In this study the UKCA chemistry-climate model is enhanced by incorporating reactive VOC tracers into the UKCA gas-phase chemistry scheme in order to better represent urban and regional-scale O3 photochemistry, and then applied to quantify the differences in chemical environment for surface O3 for six major industrial regions across China in summer 2016. This study is well organized and clearly written on an interesting topic – how to effectively control tropospheric ozone pollution in China. Here are some specific comments:

- Six cities are chosen because they are located in the heavily populated regions with high emissions, but their climate is different, for example, Chongqing is often cloudy and foggy, and especially hot and muggy in summer. The amount of sunshine in Chongqing is poor, and the only months when the sunshine hours exceed 40% (but they still remain below 50%) are July and August; while Beijing has strange weather—extreme hot and cold temperatures, and high humidity to no humidity. It has glorious sunshine year-round and is hot and rainy in summer, especially in July and August. In the study impacts of meteorological conditions on local O3 production rates are not discussed, and model results are not evaluated against observed meteorological parameters.
- Figure 3 shows that the model overestimates O3 systematically in Chongqing, and observed low concentrations (<35 ppb) are not reproduced. As statistical indicators are limited and independent in this study, high correlation coefficient r does not indicate that the modeled concentrations in Chongqing are acceptable, because seasonal averaged diurnal variations in O3 over high emission areas are quite easy to be simulated. Beside the explanation in lines 165-169, would the meteorological fields be attributable? From Figure 4, we can also find that NO2 in Chongqing is not reproduced well, and daytime NO2 is underestimated at all sites. How would the underestimation of daytime NO2 impact on O3 production sensitivity? Bye the way, O3 and NO2 from the surface monitoring networks of China are usually recorded in the unit of μg/m3, how are they converted to ppb?
- Tropospheric O3 concentrations are functions of the chain lengths of NOx and HOx radical catalytic cycles, and ozone production rates depend on not only NOx and VOCs

concentrations, but also actinic flux and temperature. The conclusion of O3 production across all regions except Chongqing being VOC limited needs to studies for different weather conditions.

- Generally model simulated O3 production rates are quite sensitive to the chemical mechanism beside other model inputs. As stated in lines 101-105, VOCs such as alkenes and aromatics are abundant in industrial areas of China, but why is ethene not incorporated into the UKCA gas-phase chemistry scheme?