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Comment on acp-2021-44

Anonymous Referee #2

Referee comment on "Development of ozone reactivity scales for volatile organic compounds in a Chinese megacity" by Yingnan Zhang et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-44-RC2, 2021

In this paper, Carter's method and local data of Guangzhou were applied to construct new MIR, MOR and EBIR scenarios under observation and emission methods through a box model equipped with MCMv3.3.1 mechanism. At the same time, the MIR-characteristics of VOCs are described and analyzed. The application of recent research results to achieve migration is meaningful and has universality in application. At the same time, the research needs to carry out data processing for each VOC, and the workload is heavy, which is worthy of recognition. After review, it is considered that the article still needs to address the following concerns:

- For the box model, the observation based method adopted by the author to constrain the concentration of both NO₂ and NO at the same time, which made the O₃ concentration largely fixed by the ratio of NO₂/NO. In this case, could the impact of VOCs on O₃ be reasonably reflected?
- The running step of the box model is 1h, is it too sparse for the total integral period of 10h? In the paper, it may be necessary to include the graphs or tables of O₃ concentration changes in the two observation-based and emission models within 10 hours.
- The MIR table of VOCs species is suggested to refer to the article published by Carter in 2007, which is arranged in the order of commonly used alkanes, olefins and aromatic hydrocarbons.
- Fig. 5a is one of the most important conclusions of the whole paper, which is used to compare the MIR-values of the article and the MIR-values in the literature. Compared with the logarithmic axis, the comparison results of the conventional axis are more convincing. At the same time, scatter plots similar to the size order in Fig. 5b should be reduced, because the deviation of MIR order in a considerable number of VOCs species is large, and R² is of little significance. This paper needs to further prove the validity of the calculated MIR in Guangzhou, so it can be used to replace the MIR from US (mainly Carter's publication) for Guangzhou.
- In Table2a, why change the simulation time to 3 days? 10h can describe the period of time during which VOCs receive light and undergo photolysis reaction cycle in real day, and the situation of 3 days lacks practical significance. However, for the MIR scenario and MOR scenario, there were differences in RMA slope changes in the 3-day

simulation, and some R^2 were too small. It needs to be clarified.