

## ***Interactive comment on “Comparison of Surface Ozone Simulation among Selected Regional Models in MICS-Asia III – Effect of Chemistry and Vertical Transport for the Causes of Difference –” by Hajime Akimoto et al.***

**Anonymous Referee #2**

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This paper discussed O<sub>3</sub> simulations using CMAQ 5.0.2, CMAQ 4.7.1 and NAQM. The main focuses of this study is to investigate the possible reasons of model bias in reproducing the O<sub>3</sub> concentrations in Beijing and Tokyo. The topic is interesting and scientifically sound. I have a few minor comments:

1). The employed horizontal resolution is 45 km for all the models, and the highest height and number of vertical layers are 45 km and 40 layers for the CMAQ models and 20 km and 20 layers for the NAQM so that the vertical resolution in the troposphere is about the same.

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The top height of 45 km sounds really high. What is the top pressure of the CMAQ model?

2). Line 105: CMAQ v.4.7.1 and v.5.0.2 included AERO6 There was no AERO6 mechanism in CMAQ v4.7.1. 3). The quality of the figures might be improved: 1) Figure 2: It should be better if the labels were added inside each plot. For example, O<sub>3</sub> in April, O<sub>3</sub> in July, NO in April, NO in July can be added on the top corner of each panel 4) Line 197 A morning peaks (grammar issue) 5) Line 237: Figures 5 (a)-(d) show the net chemical production of O<sub>3</sub> in Beijing and Tokyo in April and July calculated in this study. More details need to be described. For example, how did the authors calculate the net chemical production? Did the authors add some diagnostic equations or use some internal diagnostic packages to get the net chemical production? Did the authors calculate the production in each grid and did average of all the grids at the end? 6) observational Typo: observational 7) Line 250-253: The authors tried to explain the overestimation in Fig. 2b and Fig. 3b for NAQM. The peak in Fig. 5b,d seems to support the overestimation. However, I feel the evidence is not strong. In Fig. 5d, the net reaction is negative, I am not sure how the negative production contributes to the ozone overestimation. In addition, the morning peak is obvious in Fig. 5a,c as well, why is there no overestimation in Fig. 2a and Fig. 3a if the early morning peak may result in the over shooting of ozone? 8) Line 257-259 In April, net chemical production of O<sub>3</sub> is in general negative for all the models both in Beijing and Tokyo except for CMAQ 4.7.1 around midday and NAQM in early morning showing slight positive values. I feel the descriptions are not accurate. In April (Fig. 5a,c), both CMAQ5.0.2 and CMAQ 4.7.1 shows substantial positive net chemical production of O<sub>3</sub> in Tokyo. Please double check the statement. 9) Line 348-350: Since the chemical mechanisms of CMAQ 5.0.2 and CMAQ 4.7.1 are the same, the difference in the model performance must be ascribed to the difference in transport processes.

The authors concluded that the chemical mechanism of CMAQ 5.0.2 and CMAQ 4.7.1 are the same, then why is there large differences in the O<sub>3</sub> chemical production based

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on Fig. 5? The section of “Comparison of Chemical Mechanism Sub-Modules” mainly compared the mechanism between SAPRC99 (CMAQ 5.0.2 and CMAQ 4.7.1) and CBM-Z (in NAQM), but discussed relatively little about the chemical production differences between CMAQ 5.0.2 and CMAQ 4.7.1 (Fig. 5). Any explanations? 10) Fig. 2b: there is a line with yellow line, which should be the red line. Please double check. 11) Line 382: course should be coarse 12) Line 383: “it would not enough” should be “it would not be enough”

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