Response to referee 1's Comments

Thank you for your time and helpful comments. Reviewer's comments are written in gray and our responses are in black.

The authors responded thoroughly to my comments on their earlier draft and improved the paper. I think the addition of Section 4 (strategies for improving O_3 simulations) is a good one; can you include some discussion of Ox in this section as well? After addressing this, I recommend publication.

→ We added analysis of Ox with surface observations in China and South Korea in Section 4 and Supporting Information. The metrices and bar figures of Ox were added to Supporting Information (**Table S14-S17, Figure S16 and S17)**. Please refer to Figure R1 and R2 for the analysis. We added the new paragraphs to the revised manuscript. Additionally, we have made slight adjustments to the numbers in Table S14-S17, in the range of 1-2%, to account for missing observations. We have made minor language edits to incorporate the opinions of co-authors.

For regions (Figure R1 or Figure S16):

The biases of O_X typically follow O_3 biases across cases in all regions except NCP, YRD, PRD, and NOC, which experience high NO_X conditions. Refer to Supporting Information Figure S16 for analysis of O_X along with O_3 across various regions. In these specific regions, a substantial reduction in NO_X levels (as in C4 and C7) resulted in an increase in O_3 bias, while there was a decrease in O_X.

For cities (Figure R2 or Figure S17)

The biases of O_X generally follow O_3 biases in Chengdu and Chongqing, where the simulated O_3 initially exhibits a notably high positive bias (50-60%), attributable to high VOC. Refer to Supporting Information Figure S17 for an analysis of O_x and O_3 across cases and cities. In contrast, for other cities experiencing high NO_X conditions with positive NO_2 biases, a

reduction in NO_X levels (as in C4 and C7) led to a decrease in O_X (and its bias for most cities). However, there was a simultaneous increase in O_3 and its bias, attributed to the NO_x-saturated regime (Figure S17).

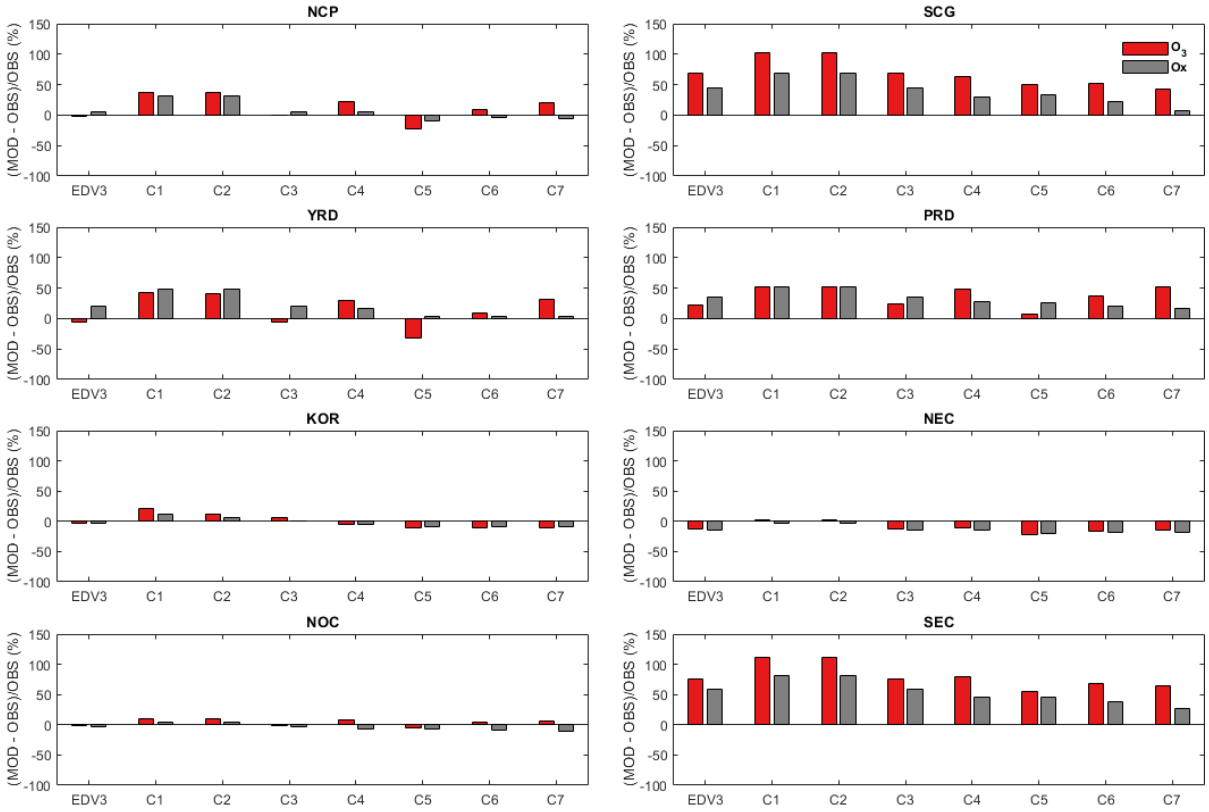

Figure R1. Same as **Figure 14** except that NO_2 is changed to O_X (= NO_2 + O_3).

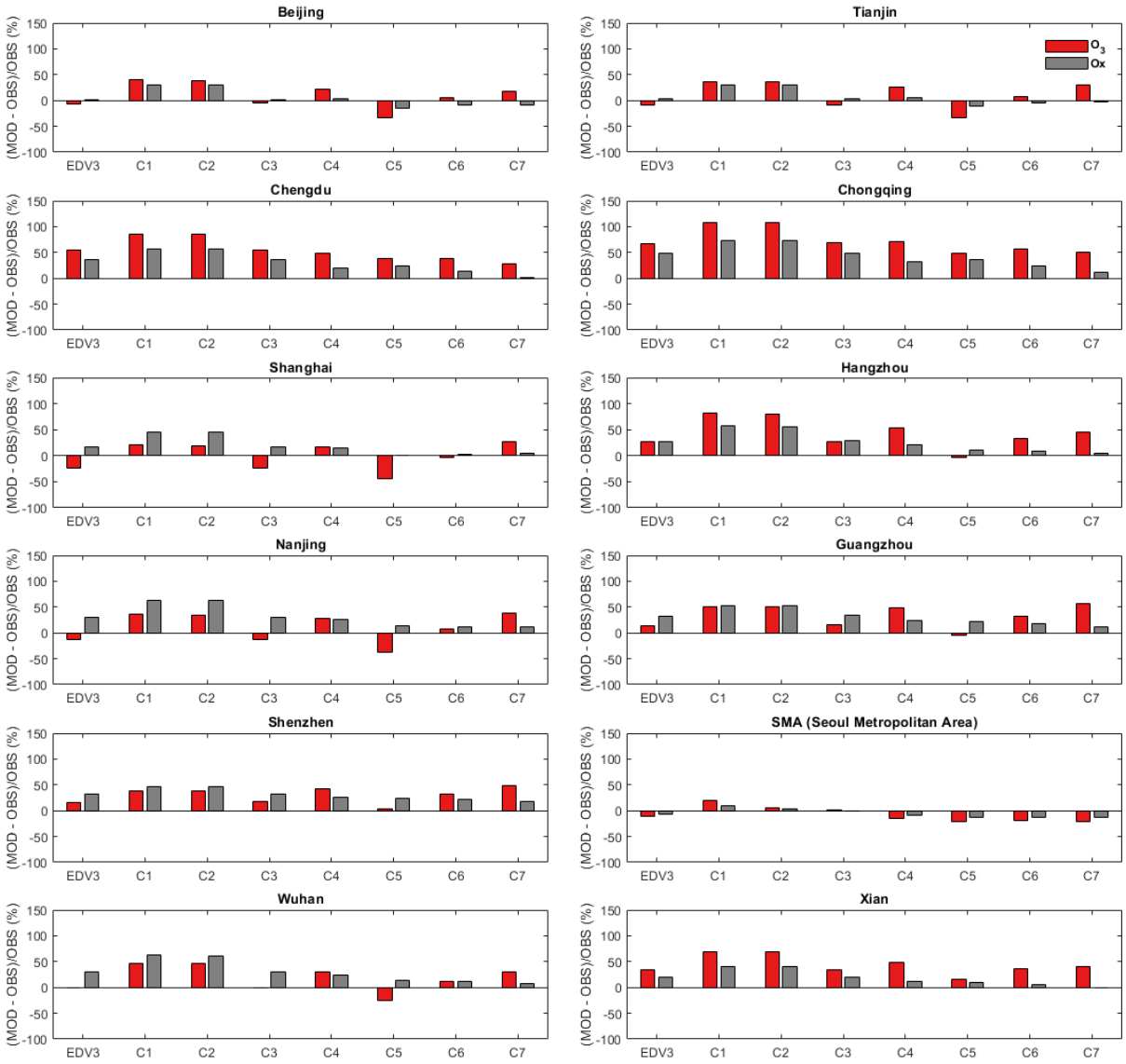

Figure R2. Same as **Figure 15** except that NO_2 is changed to Ox (= NO_2 + O_3).