

Interactive comment on “What have we missed when studying the impact of aerosols on surface ozone via changing photolysis rates?” by Jinhui Gao et al.

Anonymous Referee #1

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In this manuscript, the authors examined the effects of aerosols on surface ozone via affecting the photolysis rates over CEC China. They focused on the discrepancy between the decrease of the ozone net production and the smaller magnitude of the ozone reduction at the surface, which have been reported in previous studies. The modeling results suggest that weakened ozone photochemistry led to a significant reduction in ozone net chemical production, which occurred not only at the surface but also within the lowest several hundred meters in the planetary boundary layer. Meanwhile, the authors highlighted that vertical mixing played an important role and partly counteracting the significant decrease in ozone net production at the surface. The ozone apportionment results highlighted more significant impacts on ozone from local

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and adjacent regions, suggesting that while controlling the concentration of aerosols, simultaneously controlling ozone precursors from local and adjacent source regions is an effective way to suppress the increase in surface ozone over CEC at present.

The figures in the manuscript and supplement information are with high quality and well presented. The analysis is sound, but some details need to be revised before the manuscript being published.

The comments are listed below:

1. In model validation (section 3.1), the authors compare the simulated $J[\text{NO}_2]$ with the observations. In addition to $J[\text{NO}_2]$, $J[\text{O}_3\text{D}]$ is also important in affecting the ozone photochemical production. Comparison on $J[\text{O}_3\text{D}]$ will show more sufficient evidence to demonstrating the well model performance in simulating photolysis rates. If the authors have the observations of $J[\text{O}_3\text{D}]$, please add the comparison of $J[\text{O}_3\text{D}]$.

2. The authors showed that $J[\text{NO}_2]$ was enhanced at altitude above 1.3km which is due to the enhancement of light caused by the light-scattering effect of aerosols. Discussions on the compositions of the aerosols and their effects on $J[\text{NO}_2]$ over this place are necessary. Please add them in the manuscript.

Technical correction: 1. Line 99, add a comma after “combustion” 2. Line 135, add a comma after “episodes” 3. Variables in Table2 need to be added with units. 4. Caption of figure 6 needs to be update. “CASE1” and “CASE2” should be replaced by “Exp1” and “Exp2”.

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