

## ***Interactive comment on “Impacts of aerosol direct effects on tropospheric ozone through changes in atmospheric dynamics and photolysis rates” by Jia Xing et al.***

**Anonymous Referee #1**

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This paper uses WRF-CMAQ simulations to examine the sensitivity of surface ozone in China to aerosol effects on PBL dynamics and photolysis rates, pointing out that aerosol reductions may have inadvertent effects on ozone that need to be considered in air quality management. The simulations appear to have been done carefully and the results are of some moderate interest, but the presentation is very difficult to wade through because of laborious analyses of model results that are of little interest and because of postage-stamp figures that seem like core dumps of obscure information. Also, it appears that the authors did not examine (or mention, unless I missed it) the aerosol effect on ozone through heterogeneous chemistry but I would expect this effect to be at least as large as the effects from dynamics and photolysis. Not accounting for

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the effect of aerosols on heterogeneous chemistry (for example through N<sub>2</sub>O<sub>5</sub> hydrolysis) compromises in my opinion the policy-relevant conclusions about the sensitivity of ozone to aerosol reductions. Overall I rate this paper as marginally acceptable in ACP (it would be in my opinion in the bottom third of papers) and then only if the presentation is greatly improved through shortened text and a better selection of figures.

Additional specific comments:

1. Page 2: what meteorological data assimilation is done in the WRF simulation and how would it affect the sensitivity of dynamics to aerosols?
2. Page 4: the authors present as established fact that ADE increases boundary layer stability. I'm not necessarily disputing that but a few references would be helpful.
3. Page 5, line 8: the authors find that aerosols decrease photolysis rates in winter but increase them in summer, and it's not clear why there is this seasonal difference. I suppose indeed that scattering aerosol could increase photolysis rates in summer, but then why not in winter? Line 11 further seems to contradict the statement on line 8 by saying that photolysis rates decrease in summer.
4. Figures 3-6 seem like core dumps. I didn't see a colorbar legend for figures 5-6.
5. Page 6: I don't understand why  $\Delta$ dynamics decreases ozone deposition velocity in summer. During the daytime the ozone deposition velocity should be more limited by the surface resistance.
6. Page 9, line 1: summary states that aerosol effects improve the ozone simulation but I didn't see this demonstrated in the text.
7. Page 9: the summary presents as a punch line that one should decrease NO<sub>x</sub> emissions to improve both ozone and PM but this is hardly an original result.

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