

## ***Interactive comment on “Impacts of meteorology and emissions on surface ozone increases over Central Eastern China between 2003 and 2015” by Lei Sun et al.***

### **Anonymous Referee #2**

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This manuscript aims to quantify the contributions of emission changes and meteorological conditions on surface ozone changes over Central Eastern China between July 2003 and 2015. An ensemble of simulations using the GEOS-Chem model were conducted to diagnose the impacts of meteorology, anthropogenic and natural emissions. The results show comparable and spatially different contributions from emissions and meteorology on surface ozone changes between the two months, and further point out the importance of chemical production and pollution transport on surface ozone over Central Eastern China. The manuscript is generally well written and fits the scope of ACP. The results are valuable for better understanding the ozone pollution over Eastern China. I recommend publish on ACP but after the following

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comments being addressed.

### **Main Comments**

1) This study focused on surface ozone changes between July 2003 and July 2015, yet it is not clear why the two particular years (2003 and 2015) were selected. Why not analyze other years, for example, 2014, as the Chinese anthropogenic emissions in the model were based on 2014? Were meteorological conditions in the two years distinctly different from each other, in order to emphasize the impact of meteorology as analysed in this study? Please clarify.

2) Since only two months were analyzed in the study, it needs to be careful with the interpretation of the surface ozone changes between the two periods. The manuscript described the ozone changes mainly as a increasing trend and compared it with previous trend observations, e.g., the paragraphs in Sect. 3.1 and Sect. 3.2 (Page 8). It should be well noted here that surface ozone changes between July 2003 and 2015 may largely reflect ozone inter-annual variability, not a trend.

### **Specific Comments**

1) Page 7, Line 4:

“but with the 2004 observations for the other four sites”. Do you mean there was no observations available for the other four sites in 2003?

2) Page 7, Line 17:

Please describe more how non-urban sites were selected in this study. Based on the population density or any other information? Did the authors select one site for each city?

3) Page 8, Line 28

“This result is very different from the trends over the US, where summertime daytime

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O3 increased over the past decades is contrast to the night-time decrease in all seasons (Yan et al., 2018a).” Yan et al. (2018a) showed that US summertime daytime O3 decreased and nighttime O3 increased in the past decade. Please check.

4) Page 10, Line 8

Please provide values of air temperature and relative humidity over CEC on Figure S7. Seen from this Figure, it seems air temperature in July 2015 was higher than that in July 2003.

5) Page 10, Line 15:

What is “gradient analysis”? Please clarify.

6) Page 12, Figure 6:

I suggest add a figure in the Supplement showing the spatial distribution of changes in anthropogenic NMVOCs and NO<sub>x</sub> emissions between 2003 and 2015. This can provide helpful information to better interpret their resulting changes in surface O<sub>3</sub> as shown in Figure 6.

7) Page 13, Line 4-8:

“minus value” should be “negative value”. In “15E03M (-1232 Gg mon-1)”, where did “-1232” come from? Table 4 shows “-1100”

8) Page 13, Line 27:

“we find that the absolute value of O<sub>3</sub> transport flux increased by 395 Gg mon-1 (2015-2003)”. This sentence is misleading. The absolute value of O<sub>3</sub> transport flux actually decreased in 2015 relative to 2003 due to less export in 2015. Please clarify.

9) Page 14, Line 2:

“Asia nested model” should be “Asian nested model”.

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10) Page 14, Line 14:

The statement “The transport pattern in July 2015 tends to enhance O<sub>3</sub> levels over the central part of CEC” needs some explanation. Is that because the meteorological conditions in July 2015 favoured pollution accumulation and reduced O<sub>3</sub> export over CEC and thus enhanced O<sub>3</sub> levels there?

11) In the supplement, Figure S6 and S7:

The meteorological fields should be based on “MERRA-2” instead of “the GEOS-Chem results”.

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