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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "An important mechanism of regional $O_3$ transport for summer smog over the Yangtze River Delta in East China" *by* Jun Hu et al.

**Anonymous Referee #4**

Received and published: 24 August 2018

Comment:

The authors presented their efforts in applying observations and model simulation to analyze a severe O3 pollution case in China. This is an important and interesting topic considering the adverse health effect of O3. The materials are reasonably organized, and the unique horizontal transport and vertical mixing mechanisms were reported. Therefore I would recommend this manuscript to be published if the following concerns can be properly addressed.

Major comment:

(1). Please consider rephrase the whole manuscript for English editing with help from



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native speaker. There are a lot grammar errors, confusing lengthy sentences, and improper wordings. Some are pointed out in the minor comments. The current shape is not acceptable for scientific journal publication.

(2). The unique transport and vertical mixing mechanism shall be discussed with more in-depth analysis, including: first, background introduction is necessary to briefly describe the general condition of O3 and meteorology over the study domain, thus the findings from examining the extreme event can be highlighted. For example, multi-year data of local O3 observations (or satellite products) could be used to demonstrate the frequency, seasonality, and spatial distribution of O3 smog in YRD. Climate data (e.g., observation from NCDC or China Meteorology Agency) could also be used to describe the general PBL condition in YRD; Second, discussion about the transport shall be improved with more solid demonstrations, many of the current statements were roughly made without sufficient proofs. For example, section2 promotes the hypothesis that the extreme O3 event was due to regional transport, yet no discussion was made to exclude the potential impact from local emission or photochemical production; Third, the most important one, the driving forces of the unique transport and mixing processes were not discussed at all. The authors spent a lot efforts to describe the severe O3 case and how it was accumulated though regional transport, but paid little attention to the causes. For example, in Fig.4(a), why O3 in 0-0.5km was depleted after 20:00, but remained high in 0.5-1km? The near surface layer NO might be responsible for titration but no demonstrate was made; Does the residual layer present in all seasons, and does it always host O3 or other atmospheric pollutants? The southeast wind shown in this study seems closely related with East Asia summer monsoon, thus does it also carry excessive O3 from the ocean into inland YRD? Fundamental questions such as what make the high O3 concentration in residual layer remained unsolved. These are the key findings that shall be reported in a journal publication.

Minor comment:

(1). P2-L27: Spell “NO” before use it.

(2). P3-L64: change word “incomprehensively”

(3). P3-L68: This manuscript has no in-depth discussion of the “climate change of Asian summer monsoon” or its impact on O3, I would suggest remove this sentence or add the related discussion

(4). A brief introduction of the typical O3 concentration urban areas of China would be necessary, to clarify if the high O3 in YRD is an area-dependent condition or a national wide issue.

(5). Table 1 & Figure 1: Are there multiple sites or is there only one site for each city? Please also provide the web source or reference for the observation data

(6). P4-L85: Why wind speed is collected at 10m but temperature and relative humidity are collected at 2m? For evaluation purpose, WRF can output wind speed at both 10m & 2m, and NCDC has observation data for both too.

(7). P4-L95-97: Do you try to compare Temperature & O3 between western (NJ) and eastern YRD? Local emissions would be another factor determining O3, the conclusion made in line#95-96 was made without solid demonstration.

(8). P4-L95: “The O3 concentrations over NJ of the western YRD were much higher . . .” this is not professional scientific writing, please describe it with exact numbers.

(9). P5-L99: “Surface air temperature and solar radiation, deeply affect photochemical production.” Please rewrite this sentence or remove it, these are unnecessary common sense for journal publication.

(10). P5-L101: “exhibited” shall be “showed” ?

(11). P5-L102-105: Please rewrite this lengthy sentence, either break it into a few short ones or rephrase.

(12). P5-L103: “NJ of the western YRD” this term has been used several times in the manuscript, I would recommend simply using “NJ” or “the western part of YRD”.

(13). Fig.2 & Table2: Why the data from other sites were not shown?

(14). P5-L108: Unnecessary, in addition to local production and transport, what else can result in high O3?

(15). P5-L110: “it is estimated that the daily mean surface NO2 concentrations varied slightly during August 24 and 25 ”. Analysis of NO2 is important and necessary to be included as it supports your conclusion.

(16). P6-L130: Latest MEIC updates the emission to 2015, if the 2012 emission was not projected to 2016, it’s better to rerun the simulation with latest emission inputs.

(17). P6-L134: Incorrect grammar, it shall be “Simulated wind speed, air temperature, relative humidity, and O3 concentrations are compared with observations . . . ”

(18). Section3.2: More evaluation statistics, such as normalized mean bias and root mean square error shall be applied to demonstrate model performance. Fig.3 cannot tell the absolute values of simulation bias. P6-L120-125 listed details of model configuration but no reason was given to clarify why these options were selected. It’s also necessary to briefly compare the simulation performance with other published WRF-Chem applications over YRD region.

(19). P7-L145: “Analysis on” shall be “Analyzing” or “Analysis of”

(20). P7-L153: It’s necessary to include a brief introduction of the climatology in NJ area before using “heat wave”.

(21). Fig.4: Need a clear definition of “eastern” and “western” if you are showing sub-domain averages in the figure.

(22). P7-L165: Please rewrite this lengthy and confusing sentence.

(23). P8-L175: Please change the word “questionable”, check it in the dictionary before using it.

(24). Fig.5: No prominent changes of O3 or wind stream are shown, why use 4 sub-panels?

(25). Fig.6 cross sections are drawn along the red line in Fig.1. If the observation along this track is not discussed, I would recommend to make cross-sectional figures along the travel path in Fig.5.

(26). P9-L201: Please specify how “vertical mixing” is calculated, if it is directly output by WRF-Chem, a bar chart would be better for Fig.7 to present the contributions from all processes.

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