Dear editors and four reviewers:

Thank you all for your review and comments concerning our manuscript entitled "An important mechanism of regional O_3 transport for summer smog over the Yangtze River Delta in East China" (Manuscript ID: acp-2018-479). Those comments are all valuable and very helpful for revising and improving manuscript. We have studied comments carefully and have accordingly made the revisions. Revised parts are highlighted with Track Changes in the revised manuscript. In the following we quoted each review question in the square brackets and added our response after each paragraph.

For Referee #3:

Many thanks for your encouraging comments. We have revised the manuscript accordingly. Furthermore, following the suggestion of reviewer #4, we have rerun the simulation with the latest **MEIC** emission inventories of 2015 and analyzed the updated simulation over YRD in the revised manuscript, although there are small differences of O_3 simulation over the YRD region between MEIC emissions 2012 and 2015. All the revisions have been highlighted with Track Changes in the revised manuscript. The point-by-point responses to the reviewer's comments are as follows:

General comments:

1. "*This manuscript, using chemistry transport model WRF-Chem results to investigate one of typical summer ozone episodes observed in the Yangtze River Delta Region (YRD) in Eastern China. The model results was validated by meteorological and air quality observational data. The specific ozone episode was characterized by the nocturnal ozone transport over the residual layer (RL) and the daytime vertical mixing process. The decoupled RL holds the ozone produced from daytime and redistribute ozone concentration there due to large-scale circulations. The ozone-rich air mass from RL can be touch surface and enhance surface ozone levels by strong daytime CBL mixing processes. The authors clarify the ozone episode with the important mechanism. The results are very interesting and the study is meaningful for understanding the formation of the high ozone episodes in the YRD region. I recommend its publication in a revision in accordance with the following review comments*."

Response 1: We appreciate the reviewer's positive comments on our manuscript. And we have revised carefully the manuscript based on the following comments.

Specific comments:

1. *"Maximum 8-hour ozone is used in observational ozone analysis, for example in Table 1. However, the model results are hourly-basis. That may lead to some mismatches in the description of the variation of ozone concentrations because the diurnal cycle of hour-ozone and 8-hour ozone are different and time of peak values is shifted from each other."*

Response 1: Thanks for reviewer's comments. In the ambient air quality standards, the standard of O_3 pollution (photochemical smog or summer smog) is defined with the maximum 8 hour running mean of O_3 concentrations. According to the standard of O_3 pollution, we analyzed the maximum 8 hour running mean of O_3 concentrations to only identify the O_3 pollution episode over YRD (Table 1) in sections 2.2

and 2.3. Hourly O_3 concentration was used to analyze the diurnal cycle over NJ (Fig. 2). To better validate the modelling, we compared the hourly changes of observed and simulated O_3 concentrations. Based on the hourly data of O_3 simulation, we discussed the diurnal cycle of hourly O_3 concentration and O_3 transport. We have added the description to avoid the misleading in the revised manuscript (sections 2.2 and 2.3).

2. *"Diurnal cycle of Temperature, solar radiation, hourly, and 8-hour ozone are peaked in different time. It is hard to directly relate those parameters with 8-hour ozone concentrations."*

Response 2: Thanks for reviewer's comments. We have used the maximum 8 hour running mean O_3 concentrations to only identify the O_3 pollution episode over YRD, and used hourly O_3 concentration to represent O_3 diurnal cycle related with solar radiation and temperature. We have added the description to avoid the misleading in the revised manuscript (sections 2.2 and 2.3).

3. *"Different high air temperature and maximum total radiation described in Table 2 may lead to significant difference of biogenic VOC emissions. I agree with you about the anthropogenic emission can be considered as constant during the episode. But the impact of changes in BVOC on variation of ozone concentrations may also need to be checked."*

Response 3: We agree with reviewer's suggestion. Different high air temperature and maximum total radiation may lead to a significant difference of biogenic VOC (BVOC) emissions. The impact of changes in BVOC on O_3 concentrations would be done in future study with available data of BVOC emissions.
The above discussion has been added in the conclusions of revised manuscript (section 5 (last paragrphy)).

Minor comments:

1. *"Line 59 on Page 3: '... by the downwind the low-level jets over the eastern coast of U.S. Lee et al' might be ' ... by the downwind the low-level jets over the western coast of U.S. Lee et al'."*

Response 1: Thanks for this suggestion. We have checked that it was over the eastern coast of U.S.

2. *"Line 79 on Page 4: 'WRF-Chem model methodology and validation ...' is better to change into 'WRF-Chem modelling methodology and model validation ...'."*

Response 2: It has been changed in the revised manuscript.

3. *"Line 91 on Page 4: 'maximum 8-hr running mean values' should be 'maximum 8-hr running mean values'."*

Response 3: It has been corrected as follows (section 2.2):

During a heat wave episode with the maximum temperature ≥32 °C for 3 consecutive days over August 22-25, 2016, a summer smog with severe O_3 pollution occurred over the YRD region (Table 1)

and high surface O_3 concentrations with the averages of maximum 8-hour running mean values from 141.1 to 204.3 μg m^{-3} were measured at the 6 urban sites of NJ, ZJ, CZ, WX, SZ and SH (Table 1), which exceed the second national primary standard of ambient air quality standards (100 μg m^{-3}).

4. *"Line 68 on Page 3: I do not understand how the large-scale and long-term climate change of East Asian summer monsoon can significantly influence the surface ozone variations like this two days episode."*

Response 4: Thanks for comments. We have deleted the "the large-scale and long-term" there in the revised manuscript.

5. *"Line 84 and 87 on Page 4: change 'the chemical data' into 'the air quality monitoring data'."*

Response 5: It has been changed in the revised manuscript.

6. *"Line 142-144 on Page 5: Re-write '...The simulation reasonable ....in the following section' because it is hard to be understood."*

Response 6: Thanks for comments. We have rewritten these sentences as follows:

The simulation reasonably captures the observed changes of O_3 and meteorology during the summer smog episode over the YRD. Therefore, the simulation data could be used to investigate the regional O_3 transport and the underlying mechanism over the YRD during the summer smog period, as presented in the following sections.

7. *"Line 170-173 on Page 8: please re-write this paragraph for more clear."*

Response 7: Following the comments. We have rewritten those sentences as follows (section 4.1 (last paragraph)):

Considering the prevailing easterly winds in the lower troposphere over the YRD region during the summer smog period, we could speculate that the regional O_3 transport in the nocturnal RL could connect between the eastern decreases and NJ increases of overnight O_3 "reservoir" over the YRD region (Figs. 4a and 4b). We further investigated that the regional O_3 transport in the nocturnal RL over the YRD to interpret the observational evidence of the exacerbated O_3 pollution in weaker photochemical production on August 25 in the NJ site of western YRD (Figs. 1b-2, Table 2).