Dear editors and four reviewers:

Thank you all for your 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. The 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 #1:

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. "*In this work, the authors used WRF-Chem modelling system to simulate ozone and its precursors in YRD region in China, and analyzed the mechanism of regional ozone transport in a severe photochemical pollution episode. The combination of observation data and mode simulation illustrates the important mechanism of O3 transport from the upstream to the downstream through the residual layer in the Yangtze River Delta region, which is of great significance for understanding the summer daytime O3 pollution. The manuscript is well organized and the methodology is feasible, and it may be of great interest to the China's ozone modelers and the local governments. However, there are some problems in the simulation and discussion (as shown below). I recommend the publication of journal ACP after the problems were clarified.*"

Response 1: Thanks for the reviewer's positive comments on our manuscript. We have revised carefully the manuscript following the reviewer's comments.

Specific comments:

1. *"Abstract should state briefly the purpose of the research, the principal results and major conclusions. Therefore, I suggest the author to rewrite the abstract, avoiding some unimportant statements."*

Response 1: Following the reviewer's comments, we have rewritten the abstract in the revised mmanuscript.

2. *"The validation of the vertical profile of ozone (or column ozone concentrations) is very important in the analysis of ozone budget, but missing in this study. The reviewer suggests that the evaluation of ozone characteristics and budget should be conducted using not only surface measurements but also aircraft and/or column measurements."*

Response 2: We agree with the reviewer's suggestion. The validation of the vertical profile of O_3 (or column O_3 concentrations) is very important in the analysis of O_3 budget. However, the observation data of O_3 vertical profile (or column O_3 concentrations) over YRD during this pollution episode are not available for us to evaluate the vertical structure of O_3 from simulation. In the revised manuscript, we have added the following discussions in the last paragraph of 3.2 Modeling Validation (section 3.2):

The validation of the vertical structures of O_3 is very important in the analysis of O_3 budget, but unavailable for us to evaluate the vertical structure of O_3 from simulation. If there would be observational data of O_3 vertical profiles, the validation of vertical profiles of O_3 could be done in future study of O_3 budget.

3. *"In addition to temperature and radiation, wind direction and speed also important meteorological factors for ozone pollution. I recommend the authors adding the statistics of wind in Table 2 and interpreting the difference in the manuscript."*

Response 3: Following the reviewer's suggestions, we have added wind speed and direction in Table 2 and the corresponding discussions (section 2.3 (paragraph 2)) in the revised manuscript as follows:

The near-surface easterly winds prevailed in the directions of 90 deg. and 111 deg. with the daily averaged wind speeds of 2.4 and 2.6 m s^{-1} respectively on August 24 and 25 at NJ (Table 2), indicating the fewer changes in both wind speed and direction over NJ during those two days.

Table 2: Meteorological and environmental elements observed at an urban site NJ of the western YRD from August 24 to 25, 2016 with their daily differences (Δx).

	Aug. 24	Aug. 25	Δx
Maximum 8-hour running mean surface O_3 concentrations (μg m^{-3})	230.1	284.8	54.7
Maximum hourly surface O_3 concentration (μg m^{-3})	256.8	317.2	60.4
Daytime mean surface O_3 concentrations (μg m^{-3})	180.6	230.1	49.5
Daytime mean surface NO_2 concentrations (μg m^{-3})	27.9	27.8	- 0.1
Daily maximum air temperature at 2 m (℃)	34.1	33.9	- 0.2
Maximum surface total radiation irradiance (W m^{-2})	896.0	872.0	- 24.0
Daytime mean surface total radiation irradiance (W m^{-2})	511.8	423.4	- 88.4
Daily mean wind speed at 10 m (m s^{-1})	2.4	2.6	0.2
Daily mean wind direction at 10 m (deg.)	90	111	21

4. *"Vertical mixing and chemical production are two main factors for ozone difference between 24 and 25 Aug. However, the authors forgot the other factor – dry deposition. I recommend the authors showing the difference of dry deposition in different days."*

Response 4: Thanks for reviewer's comments.

Based on the modeling, we have calculated the hourly changes of O_3 dry depositions (Fig. S1) and estimated the daily averages of dry deposition rates with about 0.42 and 0.49 μg m^{-2} s^{-1} respectively for August 24 and 25. The dry depositions of O_3 varied little over these two days with a slight enhancement on August 25, reflecting O_3 dry depositions exerted less impact on surface O_3 change during August 24-25. The contribution of O_3 dry deposition to tropospheric O_3 changes was trivial compared to vertical mixing and chemical reactions (Wang et al., 1998; Fowler et al., 1999; Zavier et al., 2003).

We have added the above discussions in the revised manuscript (section 4.3 (paragraph 2)).

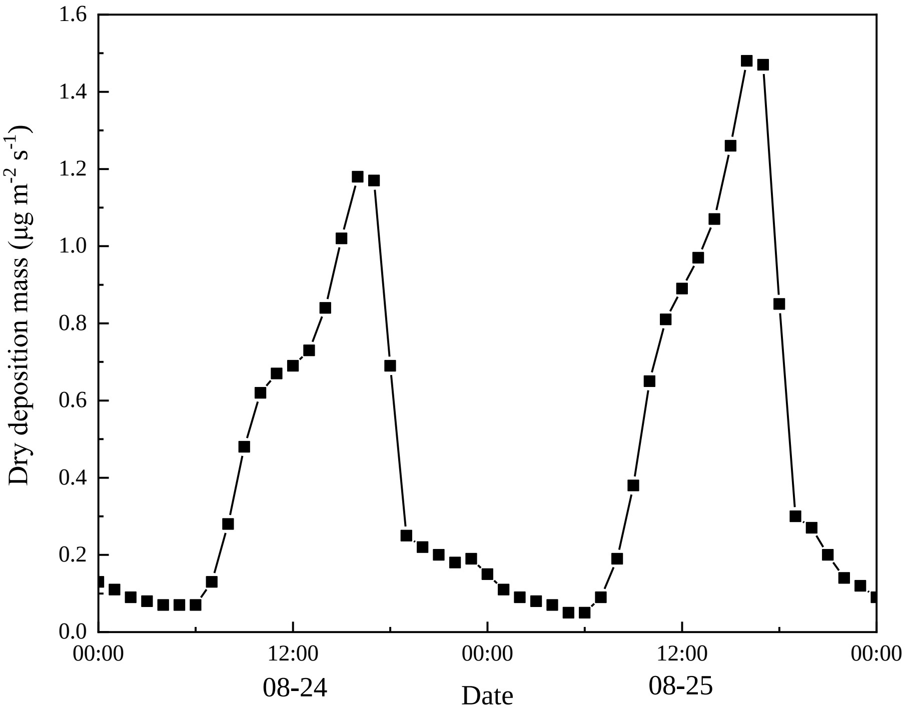

Figure S1. Hourly changes of O_3 dry deposition flux in NJ, an urban area of the western YRD during August 24 (08-24) and 25 (08-25).

References:

Wang, Y., Logan, J. A., and Jacob, D. J.: Global simulation of tropospheric O_3-NOx-hydrocarbon chemistry: 2. Model evaluation and global ozone budget, Journal of Geophysical Research Atmospheres, 103, 10713-10725, 1998.

Fowler, D., Cape, J., Coyle, M., Smith, R., Hjellbrekke, A.-G., Simpson, D., Derwent, R., and Johnson, C.: Modelling photochemical oxidant formation, transport, deposition and exposure of terrestrial ecosystems, Environmental Pollution, 100, 43-55, 1999.

Zaveri, R. A., Berkowitz, C. M., Kleinman, L. I., Springston, S. R., Doskey, P. V., Lonneman, W. A., and Spicer, C. W.: Ozone production efficiency and NOx depletion in an urban plume: Interpretation of field observations and implications for evaluating O3-NOx-VOC sensitivity, Journal of Geophysical Research: Atmospheres, 108, 2003.

5. *"As the authors hypothesize horizontal transport in the residual layer is the main reason for the ozone pollution in 25 Aug. I recommend the authors analyzing the horizontal contribution in the RL carefully using the process analysis."*

Response 5: Thanks for reviewer's comments. We have accordingly calculated the O_3 transport flux of NJ from the eastern YRD region based on the process analysis. We have added the analysis in the revised manuscript (section 4.2 (paragraph 2)):

The O_3 transport flux in the nocturnal RL over the YRD region was calculated based on the process analysis. It was estimated that the O_3 horizontal transport flux in RL averaged over the nighttime from 20:00 on August 24 to 8:00 on 25 was 541 μg m^{-2} s^{-1} at the western site NJ with 119 μg m^{-2} s^{-1} stronger than that during the preceding night to August 24, reflecting the larger contribution of O_3 horizontal transport in RL to the O_3 pollution on August 25 over the western YRD.

Technical comments:

1. *"I recommend changing summer smog to photochemical smog throughout the manuscript."*

Response 1: This study is mostly focused on the analysis on physical process of regional O_3 transport. To avoid the confusion with the photochemical process, we have kept "summer smog" with some changes to "photochemical smog" in the revised manuscript.

2. *"Please check all the subscript and superscript throughout the manuscript."*

Response 2: We have checked and corrected all the subscripts and superscripts throughout the manuscript.

3. *"Please check all the abbreviation throughout the manuscript. All the abbreviation should be interpreted in abstract and main article separately. Generally, if the phrase used more than three times, it can be defined by abbreviation. Otherwise, please use the full name of the phrase. For example, AGL has not been used more than three times."*

Response 3: Thanks for the careful edition of reviewer. We have checked and corrected these errors throughout the manuscript.