Response to Referee #1

Comment:
This work is of heavy workload and detailed analysis. Effects of typhoon on the transport, production, accumulation of O_3 are presented. Long time series of observations make the conclusions convinced. A series of sensitivity experiments are conducted to help understand how the differing location of typhoon would influence O_3 pollution in the PRD.

Response:
Thanks for your positive comments and valuable suggestions to help us improve the manuscript. The responses to the comments (in blue) and corresponding revisions (in red) are presented as follows.

Comment:
1. As mentioned in line 127, the differing location of typhoon will have diverse effects on O_3 pollution. In term of relationship between typhoon location and O_3 pollution, in what condition will the transport dominate, and in what condition will the accumulation lead? Likewise, how typhoon location affects the promotion/reduction of O_3 production? It would be better to summarize the general rule if possible, and show it in the conclusions.

Response:
Thanks for this good suggestion. Chow et al (2018) analyzed the connections between typhoon locations and O_3 levels in Hong Kong based on 2000–2015 O_3 observation data, and indicated that typhoons located to the east (south) of Hong Kong tend to cause more (less) severe O_3 pollution. However, according to our knowledge, there is still no report about how different typhoon locations lead to varied O_3 levels and processes (transport, production and accumulation) in the whole PRD or adjacent regions.

In this study, we focus on the overall differences of O_3 transport, production and accumulation with and without the influence of typhoons in the PRD. The comparison also suggests varied effects of typhoon on the above O_3 processes in autumn and summer. These conclusions can provide useful suggestions for efficient O_3 reduction in the PRD. However, the detailed connections between typhoon locations and O_3 processes were not involved in this study. We wish to explore this important question in the next-step studies based on the collections of longer-term O_3 observation datasets in the PRD.

Similar to this suggestion, the following content was presented in the *Discussion and conclusions* part of the manuscript, in lines 477–479 of the ACPD manuscript:
"Moreover, owing to the small sampling size, the influence of typhoons on O_3 pollution in the PRD is still not fully understood, including, for instance, the detailed connections between the features of typhoons (intensity, position) and O_3 pollution."

Comment:
2. In line 305-306, authors declare that vertical transport plays less significant role in the typhoon-induced O_3 pollution in summer, however, as what has been shown in figure 9, vertical transport contributes significantly in O_3 production. It makes me confused. Please give the explanation.

Response:

In lines 305-306 of the ACPD manuscript, "vertical transport" indicates the influence of large-scale air motion, namely, downdraft or updraft, which was mainly found at the height of above ~850 hPa. In Fig. 9, "vertical transport" includes vertical convection and diffusion (including diffusion caused by O_3 gradients and turbulent mixing within the planetary boundary layer (PBL; about 0-1 km in height, Guo et al., 2016)), which is different from the former one. According to the Process Analysis results (Fig. 9), dry deposition led to rapid O_3 removal near the surface, as well as high gradients of O_3 concentrations that promote downward O_3 diffusion. Therefore, vertical transport contributes significantly to O_3 in the first layer. But in other layers within the PBL, both vertical convection and diffusion served as sink processes for O_3.

Besides specifying the "vertical transport" in Fig. 9 as "vertical convection" and "vertical diffusion" in the last revision, the above discussions on Fig. 9 were also presented in the manuscript, in lines 386–389:

"Dry deposition dominated O_3 removal near the surface, and it also led to high gradients of O_3 concentrations that promote downward O_3 diffusion. Within the PBL (about 0–1 km in height), O_3 was mainly contributed by horizontal transport and chemical process, and vertical convection led to the drop of O_3 concentrations."

Reference

Chow, E. C., Li, R. C., and Zhou, W.: Influence of tropical cyclones on Hong Kong air quality, Adv. Atmos. Sci., 35(9), 1177–1188, https://doi.org/10.1007/s00376-018-7225-4, 2018.

Guo, J., Miao, Y., Zhang, Y., Liu, H., Li, Z., Zhang, W., He, J., Lou, M., Yan, Y., Bian, L., and Zhai, P.: The climatology of planetary boundary layer height in China derived from radiosonde and reanalysis data, Atmos. Chem. Phys., 16, 13309–13319, https://doi.org/10.5194/acp-16-13309-2016, 2016.