

Dear Editor,

Thanks for your suggestions which significantly help us to improve the manuscript. Hereby, we submit our responses and the manuscript has been revised accordingly. If there are any further questions or comments, please let us know.

Best regards

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Editor (Minor Comments)

1. Your first figure inserted to the Reply file shows that the $d[O_3]/dt$ becomes NEGATIVE from around 1700LT (or as early as 1500LT). Which process is driving this? Why bringing down to -5 ppb h^{-1} throughout midnight? NO titration or ground-surface dry deposition? If you take into account diurnally-varying boundary layer height (i.e. shallow layer in the night), please describe this.

Then your second figure here shows " $P(O_3)$ ", kept positive throughout the night. Is it GROSS or NET production from photochemistry? Just by adding dry deposition, do you have the quantity you showed as $d[O_3]/dt$ in the first figure?

Reply:

Thanks for your suggestion. In this figure, we did not consider the diurnally-varying boundary layer height into the box model. Regarding the decrease in $d(O_3)/dt$ around 17:00, we believe it is the result of the combined effects of attenuated photochemistry and dry deposition after 17:00. Similar diurnal profiles have been observed in other sites (Tan et al., 2019). To further investigate the influence of NO titration, we conducted tests based on the change rates of Ox concentration, i.e., $d(O_x)/dt$ (Figure 1(a) below, the difference from the previous version is that we have corrected the time offset for $d(O_x)/dt$). The results showed that $d(O_x)/dt$ did not exhibit significant differences compared to $d(O_3)/dt$. Therefore, NO titration is not the main reason for the O_3 concentration change.

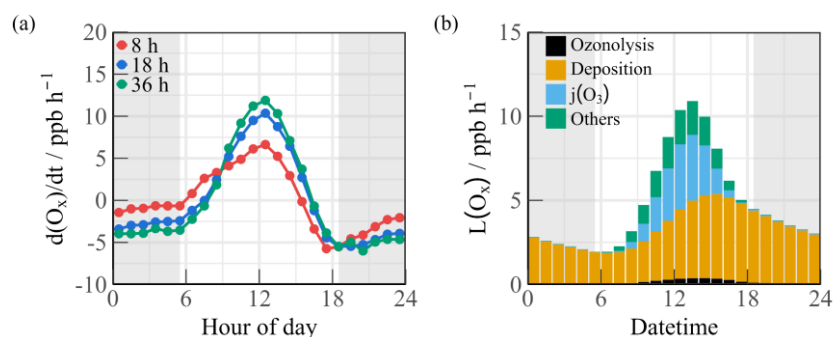


Figure 1(a) The change rates of Ox concentration ($d(O_x)/dt$) at different dilution times **(b)** The removal pathways of Ox over an 18-hour dilution time.

Regarding decrease trend of $d(O_x)/dt$ of -5 ppb/h around midnight, we have

conducted additional discussions on the removal pathways of Ox over an 18-hour dilution time (the Figure 1(b) above). The "Deposition" term includes the removal of NO₂ and ozone through deposition, the "Ozonolysis" term involves the O₃+alkenes reactions, and the "j(O₃)" term represents the photolysis channel of ozone. The "Others" term represents the removal processes of Ox through reactions with other species (such as the reactions between O₃ and OH, HO₂). The results indicate that the deposition process is the main pathway for Ox removal during the nighttime.

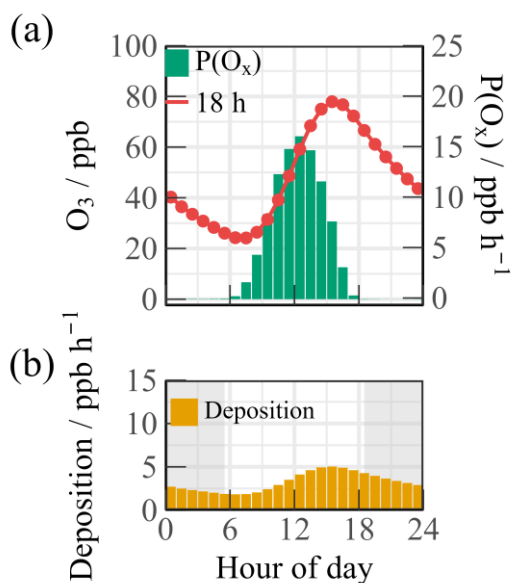


Figure 2 (a) The diurnal profile of modelled ozone concentration and P(Ox). **(b)** The deposition pathway of Ox.

Regarding your second question, the "ozone production" mentioned in the second figure should refer to the net production of total oxidants, which is represented as P(Ox). We updated the image label (Figure 2(a)) to reflect this correction. We have now included the calculation of P(Ox) based on the ozone simulation scenario, specifically considering the input of NO₂ without inputting NO and O₃. This calculation is represented by the green bars in Figure 2(a). After adding the dry deposition in Figure 2(b), the quantity of ozone change is similar with the d(Ox)/dt in Figure 1(a).

Reference

Tan, Z., Lu, K., Jiang, M., Su, R., Wang, H., Lou, S., Fu, Q., Zhai, C., Tan, Q., Yue, D., Chen, D., Wng, Z., Xie, S., Zeng, L., and Zhang, Y.: Daytime atmospheric oxidation capacity in four Chinese megacities during the photochemically polluted season: a case study based on box model simulation, *Atmos Chem Phys*, 19, 3493-3513, 10.5194/acp-19-3493-2019, 2019.