

Atmos. Chem. Phys. Discuss., referee comment RC1
<https://doi.org/10.5194/acp-2022-800-RC1>, 2023
© Author(s) 2023. This work is distributed under
the Creative Commons Attribution 4.0 License.

Comment on acp-2022-800

Anonymous Referee #1

Referee comment on "Impact of HO₂ aerosol uptake on radical levels and O₃ production during summertime in Beijing" by Joanna E. Dyson et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-800-RC1>, 2023

This paper examines the role of aerosol uptake on radical budget and ozone production in summertime Beijing, China. They find that HO₂ aerosol uptake plays a minor role in radical budget using two choices of aerosol uptake, a parameterization based on copper concentrations and a fixed gamma of 0.2 (Figure 6). They show that their model bias on HO₂ cannot be corrected by including aerosol uptake of HO₂ (Figure 7). The authors further examine the ozone sensitivity and found that HO₂ aerosol uptake does not really affect ozone sensitivity. Overall, I find this paper lacks in-depth analysis and needs significant improvement. I have several comments:

1. It is unclear why the authors examine the HO₂ loss pathways not the HO_x loss pathways. In Figure 8 and Tables 4&5, HO₂+NO is only a radical propagation channel, and does not lead to loss of radicals. So is HO₂+O₃. HO₂+NO is the fast cycling between OH and HO₂, and of course they are much faster than other pathways in Figure 8. It seems that the authors should compare radical sinks (peroxide, nitrogen and aerosol uptake) as they did in Section 3.3.3 for O₃ sensitivity, as it makes little sense to compare radical propagation channels to radical sink channels.

2. The aerosol uptake of HO₂. It is unclear why the authors only focus on copper here. In previous studies, it was clear that Cu, Fe and potentially other metals can all contribute to HO₂ aerosol uptake, which could make the gamma a lot higher. Was Fe measured in this study? If so, it should be mentioned in Tables 2 and 3.

The parameterization used in this study in Equation (1) only includes copper, but it does not necessarily reflect what is happening in the atmosphere. The choices of Equation (1) and fixed value (0.2) seems inadequate to address the role of HO₂ aerosol uptake. Given the dataset the authors provided, it would be useful if the authors can provide some observational evidence on gamma(HO₂), maybe a plot of obs/mod HO₂ as a function of aerosol surface area?

3. In Figure 2, was the surface area for dry aerosols or wet aerosols? If it was for dry aerosols, the surface area should be corrected for hygroscopic growth and please provide details.

4. It seems that RO₂ uptake was discussed in Section 3.3.3, but RO₂ uptake was never mentioned in Section 3.3.1 and Section 3.3.2.

5. Figures 7 and 9 seem redundant.

6. L305: Henry's law constant for HO₂ is temperature-dependent. Is that taken into account here?

7. Line 570-615 is largely from Sakamoto et al. paper.