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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Impacts of aerosols on the chemistry of atmospheric trace gases: a case study of peroxides and HO_2 radicals" *by* H. Liang et al.

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Thanks for your constructive and thoughtful comments. We have revised our manuscript, according to your comments. Below is our response, as shown in answer (A), to your comments.

General: This is a sound study on peroxides, mainly studied in field measurements in Beijing, China which in a modelling part also deals with the impact of aerosol particles on gas phase HO_2 and hence H_2O_2. The field measurement part contains a number of interesting results. The modeling part much resembles recent work by Mao et al.

Overall, the paper can be published in ACP subject to a few revisions.

A: Thank you for your constructive comments.

Page 16557, line 7: The model mechanism which has been used should be fully documented. It is not sufficient to state "it has been chiefly drawn"....The full documentation can be given in a supplement.

A: Yes, we have given the full documentation as a table in the Supplement (Table S1).

P 16562, l 24: Schuchmann and von Sonntag

A: Yes, we have corrected it.

P 16572, l 15ff: Please give evidence that really diffusion is a very important difference between aerosol and haze periods. That might also be due to different aqueous phase chemical conversion as concentration change.

A: Yes. We think that the aqueous phase diffusion of HO_2 is really important for the differences between non-haze and haze periods. According to Jacob (2000), the corresponding characteristic time of aqueous phase diffusion and chemical reactions in aerosols could be given as follows:

$\tau_{diff} = \frac{r^2}{\pi^2 D_l}$

$\tau_{chem} = \frac{1}{k_{chem}}$

where r is the radius of the particle (m), D_l is the aqueous phase diffusion coefficient (m^2 s^{-1}), and k_{chem} is the first-order reaction rate constant. For HO_2, both τ_{diff} and τ_{chem} are on the order of 10^{-6}- 10^{-5} s, indicating that both processes could affect the uptake coefficient of HO_2. Larger particle radius in the haze period would lead to a slower aqueous phase diffusion and hence a smaller γ_{HO2}. We agree that in addition to diffusion, γ_{HO2} is affected by the different chemical conversions due to the HO_2 concentration change. We have rewritten the relevant statement in the revised manuscript as follows: "We estimated the characteristic times of aqueous phase diffusion (τ_{diff})

and chemical reactions (τ_{chem}) for HO_2 according to the equations given by Jacob (2000), and found that both τ_{diff} and τ_{chem} were on the same order. This indicates that γ_{HO2} would be determined by the combination of both processes."

References

Jacob, D. J.: Heterogeneous chemistry and tropospheric ozone, Atmos. Environ., 34, 2131-2159, 10.1016/S1352-2310(99)00462-8, 2000.

Interactive comment on Atmos. Chem. Phys. Discuss., 13, 16549, 2013.