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Comment on acp-2021-47

Anonymous Referee #1

Referee comment on "Improving the representation of HONO chemistry in CMAQ and examining its impact on haze over China" by Shuping Zhang et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-47-RC1, 2021

Zhang et al. implemented new (heterogeneous) HONO formation mechanisms into the CMAQ model to evaluate HONO formation and impacts in China, especially their Beijing site. The new parameterization shows much better agreement with ground observations in Beijing and the vertical profiles in another field campaign, compared to the original one. In China, in order to get a better prediction of air quality, it is important to have a good HONO parameterization in the model. Some revision should be made before accepting the manuscript.

General comments

It is critical for the HONO modeling study to clarify why specific parameterization is used. The authors have tried to conduct sensitivity runs and presented results in the SI. However, it is still not convincing why some HONO uptake coefficients were used in the model. Were they based on laboratory experiments, empirical parameters obtained from the field, or simply obtained from other models? These should be clarified.

- For example, at Lines 192-195, are these uptake coefficients based on experimental data? Please clarify here how uncertain they are. Lines 203-205: Please explain why 1.7/H is used in this study and in previous studies, and how uncertain it is.
- Lines 233-236: HNO3 and HCl deposition velocities could be highly uncertain. Please see Jaegle et al. 2018. Please give more details on how HNO3 and HCl deposition velocities were parameterized in the model and how uncertain they are.
- Please double check the reference lists. Change it to ACP format. Cite the final ACP papers, not ACPD, e.g. Line 853, Line 977.

Other comments

- Table 2, 8a and 8b: Please change S/Vg to 1.7/H.
- Line 267: What is "existing heterogeneous hydrolysis of NO2"?
- Line 326: Please show how NMB is calculated here.
- Line 336: What additional sources could that be?
- Fig.1: Please explain what the error bars are.
- Line 365: Please provide values for vehicle exhausts.
- Line 464: As shown in Fig. 1, daytime HONO was significantly underestimated in the model. Please discuss how this affects OH concentrations.
- Fig. 6: It should show the REV case instead of ORI case, as the REV cases are with HONO updates, the main focus of this study.

Reference:

- Jaeglé, L., Shah, V., Thornton, J. A., Lopezâ□□Hilfiker, F. D., Lee, B. H., McDuffie, E. E., et al. (2018). Nitrogen oxides emissions, chemistry, deposition, and export over the Northeast United States during the WINTER aircraft campaign. J*ournal of Geophysical Research: Atmospheres*, 123, 12,368– 12,393. https://doi.org/10.1029/2018JD029133