

Atmos. Chem. Phys. Discuss., referee comment RC1
<https://doi.org/10.5194/acp-2021-541-RC1>, 2021
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Comment on acp-2021-541

Anonymous Referee #1

Referee comment on "N₂O₅ uptake onto saline mineral dust: a potential missing source of tropospheric ClNO₂ in inland China" by Haichao Wang et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-541-RC1>, 2021

This paper investigated the heterogeneous N₂O₅ uptake and ClNO₂ production on the saline mineral dust through laboratory experiments, and evaluated the impacts of this heterogeneous process on tropospheric ClNO₂ using a 3-D model. The results showed substantial formation of ClNO₂ from the heterogeneous process on different saline mineral dust samples, and the ClNO₂ yield varied with the mass fraction of particulate chloride and RH. The model simulation also showed significant impacts of this heterogeneous process on ClNO₂ production and even O₃ formation during a severe dust event in China. This study provides valuable information on the heterogeneous process of N₂O₅ and ClNO₂ on saline mineral dust particles, the information of which has been very limited. The results will be useful to better understand the impacts of this heterogeneous process in different environments, and also will be helpful to improve the air quality model performance. Overall, the manuscript is well written, and thus I suggest that the manuscript can be published after addressing the following comments.

- Line 152-153, please clarify what does the 'initial N₂O₅ concentrations' mean. Does the author mean the N₂O₅ generated from the reaction chamber or before passing the sample filters?
- Line 162, although the dust particle loading method has been introduced in previous studies, a brief description will be useful and should be included here.
- Line 193-196 and Line 373-375. In addition to the uptake and yield on dust particles, the parameters used for non-dust particles also should be explicit. Some information needs to be briefly provided in the main text or supplementary.
- Line 201, the detection limit for these species should be provided in the experimental section.
- Table 2. Considering the errors given by the standard deviation, the author should avoid using excessive significant digits. This also needs to be checked thoroughly for the whole manuscript.
- Figure 3. Please clarify the meaning of particulate water, and definition of mw/m₀.
- Line 285-290. It's interesting to see that the Ca and Mg amount may affect the ClNO₂ yield. Can any figures or plots better depict the dependence of ClNO₂ yields on Ca and

Mg concentration or fraction in the saline mineral dust samples?

- Line 331-332, as the author stated later, the assumption that all chloride is soluble may lead to overestimated ClNO₂ yield. What would be a more reasonable assumption here, any semi-quantitative information on the water-soluble Cl fraction/content can be inferred? Is there previous data that can be used to compare the [Cl]/[H₂O] ratio on the dust samples with the normal ambient particles? I think this will be very useful for further modeling simulation works.
- Line 365, can the author explain more the rationale for choosing 0.1 as the fixed ClNO₂ yield in the model simulation?
- Line 397-399. The 'short' night in summer may still be enough to accumulate ClNO₂ with plenty of NO_x, O₃, and particles. The statements here need further revision and improvement.