

## Comment on acp-2021-541

Anonymous Referee #1

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Referee comment on "N<sub>2</sub>O<sub>5</sub> uptake onto saline mineral dust: a potential missing source of tropospheric CINO<sub>2</sub> in inland China" by Haichao Wang et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-541-RC1>, 2021

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This paper investigated the heterogeneous N<sub>2</sub>O<sub>5</sub> uptake and CINO<sub>2</sub> production on the saline mineral dust through laboratory experiments, and evaluated the impacts of this heterogeneous process on tropospheric CINO<sub>2</sub> using a 3-D model. The results showed substantial formation of CINO<sub>2</sub> from the heterogeneous process on different saline mineral dust samples, and the CINO<sub>2</sub> yield varied with the mass fraction of particulate chloride and RH. The model simulation also showed significant impacts of this heterogeneous process on CINO<sub>2</sub> production and even O<sub>3</sub> formation during a severe dust event in China. This study provides valuable information on the heterogeneous process of N<sub>2</sub>O<sub>5</sub> and CINO<sub>2</sub> 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 N<sub>2</sub>O<sub>5</sub> concentrations' mean. Does the author mean the N<sub>2</sub>O<sub>5</sub> 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/m<sub>0</sub>.
- Line 285-290. It's interesting to see that the Ca and Mg amount may affect the CINO<sub>2</sub> yield. Can any figures or plots better depict the dependence of CINO<sub>2</sub> 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 choloride is soluble may lead to overestimated ClNO<sub>2</sub> 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]/[H<sub>2</sub>O] 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 ClNO<sub>2</sub> yield in the model simulation?
- Line 397-399. The 'short' night in summer may still be enough to accumulate ClNO<sub>2</sub> with plenty of NO<sub>x</sub>, O<sub>3</sub>, and particles. The statements here need further revision and improvement.