

## Comment on acp-2021-541

Anonymous Referee #2

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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 ClNO<sub>2</sub> in inland China" by Haichao Wang et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-541-RC2>, 2021

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Nitryl chloride (ClNO<sub>2</sub>) is an important precursor of atmospheric chloride radical, which influences the atmospheric oxidation and regulates the fate of air pollutants. This work conducted a comprehensive lab study of ClNO<sub>2</sub> formation from N<sub>2</sub>O<sub>5</sub> uptake on eight kinds of saline mineral dust samples collected from different regions in China. The result shows that the ClNO<sub>2</sub> yield largely impacted by the chloride contents in the saline mineral dust, but the relative humidity seems have no consistent rule in influencing the yield, indicating a complicated relationship between RH and the yield. Further simulation by GEOS-CHEM model demonstrates that the heterogeneous uptake of N<sub>2</sub>O<sub>5</sub> on saline mineral dusts acted as an important source for the atmospheric ClNO<sub>2</sub> during the dust event over China. Overall, this topic is interesting and within the scope of ACP, the data analysis is sound and the manuscript is well written. It can be considered to accept after addressing the following several minor comments.

- Line 40, suggest adding a phrase such like "in addition" before the sentence "Assuming a uniform  $\phi(\text{ClNO}_2)$ ...", to make clear that the subsequent contents have no relationship with the previous sentence "We further found that current parameterizations significantly overestimated  $\phi(\text{ClNO}_2)$ ...".
- Line 214, in Fig. 2, the RH values are not completely consistent with those listed in Table 2, please confirm them.
- Line 244, in Fig. 3(b), the value of mw (wet particle mass) to m<sub>0</sub> (dry particle mass) under different humidity should be usually in the range from 1 to more than 1 due to the hygroscopic effect. The current values can be  $\Delta m/m_0$  (the ratio of mass difference to the dry mass). Suggest correcting it if there is any mistake. Same comment is put forward for Fig. 4 and 5.
- Line 310, Figure 6 shows that when the mass ratio of Cl to total less than 0.1, the increase in ClNO<sub>2</sub> yield with respect to the increasing Cl content seems more significant at high RH condition (56% and 75%), is it possible that high RH promote the dissolution of chloride into the aerosol liquid water?
- Line 348, here the inconsistent results between measurement and calculation may be due to the overestimated  $[\text{Cl}^-]/[\text{H}_2\text{O}(\text{aq})]$ , but another possibility is that compounds suppressed the formation of ClNO<sub>2</sub> or compete with Cl<sup>-</sup> to react with NO<sub>2</sub><sup>+</sup>. I encourage the authors to do some discussion.
- Line 355-357, the sentence is not very clear. Nonhomogeneous chloride distribution across road salt aerosol particles during the field observation resulted in higher ClNO<sub>2</sub>

yield than the theory prediction, right?