

Interactive comment on “Significant concentrations of nitryl chloride sustained in the morning: Investigations of the causes and impacts on ozone production in a polluted region of northern China” by Yee Jun Tham et al.

Anonymous Referee #2

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Summary: Tham et al. present a novel set of measurements of ClNO₂, N₂O₅, alongside supporting observations of select trace gases and aerosol. The observations provide new insight on under sampled regions of the atmosphere, particularly with respect to molecules that are recently emerging as being important for atmospheric oxidation. The analysis follows prior work in this area conducted in the US and Europe and is well founded in the observations. I have a few select comments that should be addressed prior to publication. There are also a series of grammatical errors that should be addressed before the paper makes its way to publication in ACP.

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Specific Comments:

- 1) Page 3 lines 1-5: Perhaps discuss in terms of the ClNO₂ photolysis lifetime instead of concentrations following sunrise.
- 2) Page 5 line 10: The use of I⁻ ion chemistry in extremely polluted regions such as this is limited and it is perhaps likely that other atmospheric compounds contribute to the observed signals at 235 and 208 m/z. A few quality control questions: 1) What is the 208/210 ratio for ClNO₂ detection, is this consistent with the natural abundance of Cl isotopes? and 2) is there any signal intensity during the daytime (midday / late afternoon) at 235 and 208/210 m/z that would indicate a contribution from other molecules at these masses?
- 3) Page 7 line 31: What is meant by the “physical loss rate of the unmeasured species was set as the 6 h lifetime for the mixing height of 1000 m.” Is deposition included in these models?
- 4) Page 10 line 6: Converting the computed lifetimes to reactive uptake coefficients based on measured Sa would be a helpful addition as the community is well calibrated to that language. It would also be helpful to include specific values for the ClNO₂ yields that best fit the observations.
- 5) Page 11 line 10: What is the accuracy in the measured surface area? Is the surface area reported here dry or wet? If you need a factor of three change in gamma(N₂O₅) to match the data, is that within the uncertainty in Sa? Especially given that a growth factor may be needed to convert the measured dry to the relevant ambient Sa.
- 6) Page 12 line 15: The calculation of RL ClNO₂ is very sensitive to the boundary layer height at 5 and 8AM. Are there measurements of this height? Also, what is the accuracy in the WRF calculated nocturnal boundary layer height? It is hard to imagine this is accurate to the values quoted here (50 and 72m).