

Comment on “Formation and impacts of nitryl chloride in Pearl River Delta” by Wang et al

Wang et al., presented field measurements of N_2O_5 , ClNO_2 and related species at a rural site of South China. Comprehensive analysis is performed regarding the sources of particulate chloride and kinetic parameters like uptake coefficient and production yield. The authors also performed model simulation to evaluate the impacts of ClNO_2 on atmospheric oxidation capacity, although the impacts look minor during this observation period. The contents look rich and well fits into the scope of ACP. The methods are suitable and described with proper details. The results and conclusion are reasonable. However, the authors are suggested to show the highlight of this paper more clearly. Besides, the conclusion part can be more concise. The language polish is also necessary. Other issues are listed below. Overall, I would suggest a major revision.

Major comments:

1. Many of the results presented here are within expectations or can be found in previous work. The authors are suggested to show the unique value of this work. One possible way is that the authors may make more detailed comparisons with previous field observations in China and abroad and demonstrate how the results exhibited here are different from previous studies and briefly discuss why.
2. The authors are suggested to distinguish the concepts of “chlorine” and “chloride”. In many places of this paper, “chlorine” should be used instead of “chloride”. Examples include but are not limited to lines 38 and 39.
3. Please carefully check the language. Below are two examples: 1. Line 113, change “ubiquity” to “ubiquitous”; 2. Line 122: change “both they” to “they both”.
4. Some doubts about the CIMS measurement. (1) Was any background measurement performed during the campaign? If yes, please present the result. If no, please clarify this point and remind readers about the uncertainty caused. (2) How often was the calibration for N_2O_5 and ClNO_2 ? Regular checking of the sensitivity of N_2O_5 or ClNO_2 is critical to ensure the reliable quantification of CIMS measurement. In case regular calibration is challenging in the field, the authors may investigate the record of instrument voltages, pressure, and other parameters to show how stable was the instrument during the campaign. (3) How much is the inlet artefact? As we know, N_2O_5 may deposit on the inlet wall and produce ClNO_2 .

Minor comments:

1. Line 227-231: it is more relevant to discuss nocturnal PNO_3 , as N_2O_5 and ClNO_2 are mostly produced during the night.
2. Line 398: change “ NO_2 ” to “ NO_2^+ ”.

3. Line 437-438: In my opinion, when ClNO₂ shows no correlation with PNO₃, no clear conclusion can be drawn. For example, highly variable ClNO₂ yield may also cause poor ClNO₂-PNO₃ correlation.
4. Line 498: In figure 9, it shows that O₃+OVOC pathway has the largest contribution to P(ROx). This is somehow surprising to me. Please double check this result.
5. Line 528: Again, it is surprising to me that Cl radical only have 3% to 4% contribution to long-chain alkane oxidation during morning hours. Please double check this result.
6. Line 533-538: Did any signals of Cl₂, BrCl, Br₂ detected during the campaign? Recent studies found that these more reactive halogens may have larger impacts than ClNO₂.
7. As mentioned above, the conclusion part can be more concise.