Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-1027-RC3, 2018

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Low levels of nitryl chloride: Nocturnal nitrogen oxides in the Lower Fraser Valley of British Columbia" *by* Hans D. Osthoff et al.

Anonymous Referee #3

Received and published: 15 February 2018

General Comments:

This is a well written manuscript describing studies of nocturnal chemistry in the Lower Frasier Valley, a region near a megacity (Vancouver) and with sea salt sources. The combination of these pollution (NOx) sources and sea salt aerosol particles might be expected to produce nitryl chloride. In fact, Pasadena, CA, in the Los Angeles area (also a megacity near the ocean) had much larger nitryl chloride at ground level. The authors argue that shallow boundary layers, titration of ozone by fresh NO emissions at ground level and potentially biogenic VOC inputs often preclude nitryl chloride formation at ground level, which is supported by the data in the manuscript. The work is

well written, sufficiently referenced, and appropriate for publication in ACP.

There is a lot of evidence in this manuscript that titration of ozone at ground level was a reason for low NO3 and N2O5 levels. On the nights when there was ozone, N2O5 and ClNO2 were at their largest mixing ratios. Presumably this titration is caused by input of NO at ground level, which does not mix to very high altitude. Therefore, it is likely that aloft there is more active N2O5 chemistry and probably ClNO2 production. For this reason, I think that the manuscript's title should be modified to include "Low levels of nitryl chloride at ground level...". The peaking of ClNO2 after sunrise and coincident with breakup of the nocturnal boundary layer would seem to indicate that ClNO2 aloft is likely higher.

The manuscript has discussion about chloride measurements based upon the ACSM, which is not good at detecting chloride in the form of NaCl. There should be measurements in the area of PM2.5 chemical composition that could help to better understand the presence of sea salt chloride. The authors should examine available aerosol chloride measurements to expand their analysis and interpretation through consideration of these data.

Specific comments:

Showing population density (in some way) on the Figure 1 map would be nice.

Figure 3 seems to be mentioned before Fig. 2

Line 194: I think the word is "aging"

Line 199: I don't think ECCC is defined?

Line 202: Define THS?

Line 360: Presumably after measuring the upwelling/downwelling actinic ratio, this ratio was used to correct all downwelling actinic flux data to be a total actinic flux. If this was done, it should be noted.

Line 394: I think K2 is first used here but not defined until later. This should probably be done near line 80

Line 533: This equation is applicable when diffusion limitations are not important, which might not be true if supermicron particle surface area is involved.

Line 554: Make clear that an equivalent basis (e.g. 2x the molar concentration of sulfate) is being used in this neutralization ratio equation.

Line 559-562: Does the ACSM detect chloride efficiently? Standard filter samples would show chloride and could be used to verify its presence or absence. Historical data from the area would tell you the ratio of chloride to other inorganic ions (e.g. nitrate and sulfate), so you should be able to tell if the ACSM is not actually detecting chloride efficiently.

Line 751 area: Presumably some pollution monitoring studies looked at PM2.5 via IC and could address presence of at least $\sim$1 to 2.5 micron particles containing Cl-

---

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-1027, 2017.