

Interactive comment on “Understanding the Primary Emissions and Secondary Formation of Gaseous Organic Acids in the Oil Sands Region of Alberta, Canada” by John Liggio et al.

Anonymous Referee #1

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This paper presents the results of low molecular weight organic acids (LMWOA) measurements using an acetate ion time of flight mass spectrometer in an oil sands region near Alberta, Canada. The focus of the paper is to identify several organic acids observed downwind of the facilities and compare estimates of LMWOA emission and formation rates using observations from aircraft and compare the result to emission estimates derived using a box model. The results indicated that while oil sands regions are a large local source of secondary LMWOA, on a global source the estimated emissions account for <1% of the global secondary anthropogenic/biomass burning budget. A comparison to the box modelling results showed significant under prediction of secondarily formed LMWOA, which is in agreement with other previous reports of LMWOA

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formation. The manuscript is well written and certainly of interest to the readership of Atmospheric Chemistry and Physics. It is a nice addition to the existing literature on LMWOA and also once again highlights the need for an improved understanding of the sources of these important secondary products. I support the publication of this manuscript in ACP subject to the following minor technical corrections.

Comments:

In the abstract the authors claim the emissions of the C1-C5 organic acids are directly from off-road diesel vehicles in the regions studied. However, at no time during the manuscript do the author make a case for the attribution to this versus other potential emission sources in the highly complex oil sands regions. They do in fact show that a primary source exists however, do not attribute that in a manner sufficient enough to make this claim. Do the authors have a comparison of observed BC/OA to previously published BC/OA ratios in diesel exhaust?

I may have missed this detail, but, why not directly calibrate for acetic acid using the LCU, instead opting to calculate the sensitivity using known kinetic rates?

Page2, line27, put a space before the citation

Page 4, line 22, the statement “quantify facility overall primary emissions” is awkward and needs editing

Page 6, line 19, suggest deleting the word ‘with’ in “derived with utilizing box-like”

Page 7, line 22, suggest to add some detail about the flight tracks being at varying altitudes to make that clear here.

A general figure map comment. In the figures where a red box is used to indicate the areas of mining activity it is difficult in some to see that this is a legend and not an indication of the area. One such example is figure 3. I think that Figure 1 does a good job of placing that legend so that it is not confusing. If possible I would recommend making all of the graph legends of the format and location on figure 1.

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Figure 1. It would be nice to see a black trace of the flight tracks on this in altitude space so the user can visually see the degree of interpolation or smoothing of the model.

Figure 7. The bars in this case I believe are not stacked, though it is not explicitly mentioned. Could the authors clarify this in the figure description?

SI page 4, line 6, there is an incorrectly formatted alpha in alpha-pinene in my version.

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2017-220, 2017.