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Interactive comment on "High gas-phase mixing ratios of formic and acetic acid in the High Arctic" *by* Emma L. Mungall et al.

Anonymous Referee #1

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Review of Mungall et al., "High gas-phase mixing ratios of formic and acetic acid in the High Arctic"

Mungall et al describe new measurements of the concentration of formic and acetic acid in the arctic. These are exceedingly rare measurements and a welcome addition to the literature. The concentrations of FA and AA are much larger than expected and the sources that sustain the elevated mixing ratios are at this point not abundantly clear. However, this work highlights that future studies in these regions need to be carried forward to better constrain the sources of acidic gases in the high Arctic. The paper should be published following the authors attention to the following brief comments.

General Comments

I was surprised there was not a stronger focus on the use of the formic to acetic acid ratio in this study, given that the loss rates for FA and AA are similar and there are existing measurements of this ratio that can be compared to.

Specific and technical comments:

Page 2, Line 23: Does the lifetime estimate of 1-2 days pertain to the arctic conditions discussed here? If loss is driven by deposition, I would have expected more variance in this estimate based on season/location. It would be helpful for the authors to discuss this in more detail.

Page 3, Line 10: It is not clear how the absolute humidity was measured in the flow that exits the IMR based on the standard configuration of a CI-ToFMS. Was this measured in the bypass line?

Page 6, line 6: How often were radiosondes deployed?

Figure 3 and 5: Why is there more high frequency variance in the AA measurement than the FA measurement? Is the S/N ratio for FA higher than that for AA at the same atmospheric concentration, due to differences in sensitivity? Is atmospheric FA more variable at high frequency than AA? A short comment on the source of this apparent difference would be helpful.

Page 9, line 15: Can estimates of the mixing heights for Alert during this period be given?

Page 11, Line 15: The lack of suppression in FA or AA during the extended precipitation events is surprising/confusing. I can appreciate that a source could remain during the beginning of the rain storm, but it is not clear how this can persist as surface soil water content increases (I assume the ground is wet). Are there hints from other acids measured by the CIMS that this is specific to FA/AA? Presumably HNO3 should be completely titrated for the longer events. Finally, can the references be separated for those that have seen enhancements during precipitation as opposed to those following precipitation as these are two very different ideas/processes.

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Discussion paper