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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 #2

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This is a well-written and thoughtful manuscript that describes high FA and AA in the Arctic. The authors note some interesting features in the data (correlation to high wind speeds), and then move to examining the sources. Anthropogenic activity is not a source (while the authors have few tracers for anthropogenic activity, I am satisfied by the use of aerosol number in this environment). The authors further demonstrate that partitioning from the snowpack is unlikely using back-of-the-envelope calculations. Attribution of flux to soil emissions is more challenging due to the lack of data, but the authors present a balanced picture of the relevant literature. Similarly, plants are an unlikely source of formic acid. Overall, the authors attribute the elevated formic and acetic acid concentrations to a combination of sources, but cannot point to a clear source or specific insight. However, I suspect this gets to the core of the challenge of modeling

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organic acids: there is no single missing source or single problem: instead, multiple equilibria control the system. Thus, I think this paper provides new information and is presented in a robust manner. It warrants publication in ACP with minor corrections.

Specific comments:

Regarding iodide ionization: - P2, l22: Ionization is generally thought to be a ligand-exchange reaction, not a clustering reaction. The end product is a cluster (or adduct). The authors allude to this later in the section, but as written, I don't quite agree with this sentence.

- P4, l8: my understanding is that water vapor can enhance the ionization efficiency for some molecules and suppress it for others – particularly at low RH

Figure 4. I don't understand where these data come from. Could you be more specific about what you mean by 'greatest FA and AA mixing ratios', and exactly what data went into this figure. Arbitrarily choosing to only show a diurnal profile for high mixing ratio days seems quite selective, and I instead recommend a more robust line of reasoning – for example 'wind speed > x' or somesuch.

Technical corrections

P2 l28: should read 'source that exceeds'

Figure captions are inconsistent on the use of 'formic acid' vs 'FA' and 'acetic acid' vs 'AA'. Please be consistent.

Dates are in UTC in the first figures, and then local time in Figure 6 (though 6a denotes local time and 6c does not). This is quite confusing to the reader, and it would be helpful to either include both times, a clear conversion, or – preferably – all the data in local time. The problem with UTC is that I have no sense of what is happening to solar radiation or when daylight is. If the authors wish to continue with UTC, a clear conversion for UTC to local time AND a timetrace of solar radiation or actinic flux would be useful. Overall, though, the authors should be consistent.

P19, l7: should read “of not only a shallow boundary layer, but also of “

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