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Atmospheric Chemistry and Physics Discussions



# *Interactive comment on* "Tropospheric sources and sinks of gas-phase acids in the Colorado Front Range" *by* James M. Mattila et al.

**Anonymous Referee #2**

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Mattila et al. present measurements of atmospheric acids from a field campaign in Colorado, and explore the observations in terms of our understanding of the atmospheric budgets of these species. The elevator-borne acid measurements by acetate-CIMS at the 300m BAO tower provide unique vertical information to test ideas about acid sources and sinks. The paper is brief but nonetheless makes a clear and useful contribution to the literature on this topic. The writing is succinct and effective. I include some minor comments and suggestions below for the authors to consider.

The authors speculate that surface reactions of ozone might be responsible for the observed acid enhancements, but do not attempt to test this in any way, though ozone was also measured. Are there temporal or vertical correlations that provide any evidence for this? What kind of yield / precursor abundance would be required for this to



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Discussion paper

work (esp for formic acid, with its 2-3 ppb enhancement)?

4, 29 and Fig 3. “vertical profiles show a strong, near-surface gradient below 75m”. Indeed, the profiles tend to show this gradient at the same altitude regardless of time of day (morning, noon, night). Wouldn’t we expect the positive or negative vertical gradients to manifest through a deeper layer of the atmosphere for the daytime profiles (due to mixing depth changes)?

1, 26-27 “influence the acidity of precipitation, fog, and cloud droplets (. . .) and can thus impact ecosystem health”. The papers cited appear to refer to impacts associated with industrial release of organic acids in the first case, and with agricultural treatments in the second case. Are these relevant to the quantities found in wet deposition?

5, 35 “despite the demonstrable traffic source of priopionic, butyric, and valeric acid, there is little evidence that traffic was the near-surface source observed in the vertical profiles”. The basis for this argument is not clear to me.

Supplement, estimating aqueous-phase partitioning of gas-phase acids. “this estimation is limited in that it does not account for the effects of pH or other dissolved ions of [note, should be “on”] a given acid’s acidity, but we would not expect a change of several orders of magnitude by accounting for these effects.” Given the environmental conditions at hand I think you are probably correct about this conclusion. However H can indeed vary a lot with pH and it would be straightforward to repeat the calculation using effective Henry’s law constants for a feasible range of pH to demonstrate that your conclusion is robust.

3, 36 “2.35E4 ncps/ppb”. Ncps is not defined until the subsequent paragraph; consider re-ordering or inserting ‘as defined below’. I suggest also reporting here the raw sensitivity in cps/ppb as this gives a more directly interpretable measure of the instrumental response / LOD.

4, 5: misplaced comma at beginning of line

5, 13 “biogenic emissions typically cease during the night”. Should specify here that this is the case for light-dependent emissions but not for solely temperature-dependent emissions.

3, 14 “PISA” not defined

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