

## Comment on amt-2021-259

Anonymous Referee #2

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Referee comment on "Estimation of sulfuric acid concentration using ambient ion composition and concentration data obtained with atmospheric pressure interface time-of-flight ion mass spectrometer" by Lisa J. Beck et al., Atmos. Meas. Tech. Discuss., <https://doi.org/10.5194/amt-2021-259-RC2>, 2021

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### General comments:

The manuscript by Beck et al. presents the derivation of an equation to approximate sulfuric acid concentrations in the atmosphere using APi-TOF data when CI is not available. The manuscript is fairly short and as such focuses on a narrow topic, albeit an important parameter that can be observed in the atmosphere by (CI-)APi-TOF. I understand that this can be of use to the community of APi-TOF users and for measurements of sulfuric acid in new particle formation studies, and would therefore support publication after reviewer comments have been addressed. I would however have hoped for a somewhat more comprehensive study and especially evaluation of the proposed approximation, and would encourage the authors to expand especially the validation section with more datasets, which must be available to them. How well does their approximation compare to the other proxies mentioned in the introduction? Are there other data than CI-APi-TOF data available to validate the approximation?

Figure 1 presents a spectrum in ions per second (the caption mentions time and day but not location, this should be added), Figures 2 and 4 molecules per cm<sup>3</sup>. No information is given on conversion factors or sensitivity assumptions. This is especially important when comparing CI-APi-TOF and APi-TOF. Related to that, how reproducible are ratios of SA monomers, dimers, trimers between APi-TOF instruments? Can it be assumed that all clusters are detected with equal sensitivity? Can the authors elaborate on that?

### Technical comments:

Title: Since the technique is mentioned as abbreviation in the title, I suggest using its full name in the title as well.

Line 18 – 19: Move “CI” behind “chemical ionization” and remove it from “(CI-APi-TOF)”

Line 33: “detect this concentration” – at all? Quantitatively? Can the authors be more specific?

Line 34: Not clear to me what is meant by “clear steps”

Line 38: “During the past decade or so” sounds rather colloquial, suggest rewording

Line 46: should read “ions”

Figure 1: Red peaks could be labelled individually