In this manuscript the authors report the development of a micronebulization-AMS (MN-AMS) technique that can provide quantitative analysis of nanogram level of organic and inorganic substances by utilizing an isotopically labeled internal standard ($^{34}SO_4^{2-}$). Its major advantage is the less requirement of liquid volume for stable aerosol generation. As a result, it will meet the needs of applying AMS on offline chemical analysis of weight-limited PM samples from uncrewed atmospheric measurement platforms (UxS). Overall the manuscript is well written and the analysis is fairly easy to follow. I really enjoyed reading this article because it provides enough details of the experimental design, and also because the authors take an effort to validate the methods via multiple comparisons to other techniques such as IC, ACSM and SIMS. Therefore, I strongly support the publication of this work. Below are several minor comments that I would like to further discuss with the authors.

Minor comments.

1) Lines 227-229: Comparisons are made between the standard atomizer and the micronebulizer by atomizing a solution of sucrose and ammonium sulfate. The mass spectra derived from each atomizer show a high degree of similarity. What are the concentrations of sucrose and ammonium sulfate applied in this solution? Did the authors try different inorganic-to-organic mass ratio for this validation? Since atmospheric aerosol particles usually exhibit different morphologies and have complex chemical compositions, a validation by using a more complicated solution extracted from atmospherically relevant particles may be worthwhile. If this kind of sample is not available, adding some SVOCs, nitrogenated organic compounds, or chlorine species into the current solution could be some options. This validation can be critical, since one focus of this study is the micronebulization system, and Sections 3.2 and 3.3 are field applications rather than standard lab validations.

2) Lines 299-308 in the main text and Figure S4 in the SI: I am wondering if it's reasonable to conclude "Overall, the chemical compositions of the filter extract and the impactor extract are similar". In Figure S4 c), the fractions of total organic and "Chl" look quite different between the filter and impactor samples. The contamination from methanol is mentioned as one reason for higher concentrations of organic matter in the filter sample. Could the authors help explain why filter extracts contain more methanol but have less total organic matter? Will more methanol residuals contribute to more total organic matter in Fig. S4 c)? The similarity is also evaluated in the Figure S4 b), and it looks like the normalized signals are more consistent to each other in the region of both x and y values < 0.015? Is this similarity mainly from the methanol signals? Is it possible to make a comparison without methanol-related signals? As the authors mentioned in lines 297-299, the comparison between the filter (PNNL_F8) and the impactor (PNNL_I3) assesses biases either in the sampling system or the extraction procedure. For me it's totally ok if two samples do not show apparent similarities due to many factors. Some random thinking. What about the RH of that day and the particle viscosities? Is it possible that the impactor preferably holds more viscous particles that have larger mass fraction of organic matter?

3) Lines 330-331: "The organic mass spectra patterns from the two approaches are similar too for the indicated sampling periods (Fig. 5 b-e and Figure S5 a-d)." Is there a way for us to quantify the similarity between mass spectra obtained from MN-AMS and ACSM? I did not see r^2 in Figure 5 b-e as noted in Figure S5. Also, is r^2 a good way to represent similarity? As in Figure S4 b), if we use r^2 to show similarity, what does the slope mean in the fitting? If we use the same method in Figure S4 b) to estimate the similarity between mass spectra of MN-AMS and ACSM, should we use a slope of 1 to do the fitting? If not, does the slope represent the systematic over- or under- estimation between those two methods?

4) Line 222: What temperature the spray chamber is heated up to? Will some dissociation reactions occur at this temperature?

5) Lines 236-238 in the main text and Figure S2 in the SI: I saw for the concentration of 1.75 mg L^{-1} there is already a considerable fraction of particle mass outside the 100% transmission range of the AMS. I am wondering how large is this fraction and how this will influence the sensitivity of AMS? Will the transmission drop significantly once the particle diameter is below 100 nm? Also, what about the case for the concentration of 1 mg L^{-1}?

6) Lines 140-141: In Figure 1. b). Is it better to present different parts in number and list their names aside as a legend? Readers might not be able to clearly see the setup underneath the text of "Spray chamber heater". Is the condensation liquid reusable? This is hidden by the text on the graph.

Typos or Formats

1) *Line 14 in the Abstract, "as low as 10 μL" is not consistent with line 380 "as low as 100 μL"*
2) *Line 193: The [X] item in equation (2) seems not quite right.*
3) *Line 228: "similarly" or "Similarity"?*
4) *In Figure 5(a), the pie charts can be rotated in a way so that the readers can make easy comparisons, especially for the green parts representing organics. Top boundary for the green portion can be vertical.*
5) *Figure S6 (b), "CH3NO2" should not be at m/z=59?*