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Atmospheric Measurement Techniques Discussions

Interactive comment on "Spectral Intensity Bioaerosol Sensor (SIBS): A new Instrument for Spectrally Resolved Fluorescence Detection of Single Particles in Real-Time" *by* Tobias Könemann et al.

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This paper examines the technical capabilities of the new SIBS UV-LIF bioaerosol spectrometer and describes several technical corrections and calibrations that are necessary to deliver high quality and accurate data products. As a long term WIBS user it is encouraging to see the next generation of high spectral resolution UV-LIF spectrometers that are coming to market being examined in detail early on in their lifecycle; while there is still undoubtedly still utility in broadband spectrally integrated instruments such as the WIBS for broad bioaerosol detection, it has been clear for some time now that

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deeper specificity/classification requires greater spectral resolution so these technical developments are timely. The authors present a fair assessment of SIBS capability to resolve key biofluorophores and make a number of suggestions and cautions that apply to the SIBS and also UV-LIF spectrometers generally. Overall the paper is well written and the technical validation experiments are well thought out. The results and methodologies reported here will serve as a useful framework for assessing the performance of other multichannel high spectral resolution UV-LIF spectrometers which are entering circulation. I recommend publication after the following comments have been addressed.

Specific comments:

L98: Can you please check the size range reported for the WIBS-NEO. It is my understanding that the instrument sizes over the range of 0.5-30 μm.

L125: I think that a short sentence summarising some of the validation work would round this out while showing some of the limitations of the instrument/approach. A statement on how the Crawford et al. (2015) method was validated by Gosselin et al. (2016) by showing a good correlation between fungal molecular tracers and assumed fungal clusters but poor agreement between bacterial tracers and assumed bacterial clusters would contextualise this. It may also be worth commenting that the relatively high lower size limit of 0.8 μm used in this study due to instrument limitations may have impacted the latter which may potentially be alleviated by an improved lower detection limit.

L209: Can you comment further on the choice of 1σ thresholding use here. I appreciate that the conventional wisdom used to determine the threshold for WIBS instruments may not carry over here due to the differences in the optical setup but 3σ and 9σ thresholds are used later in the paper when reporting ambient concentrations.

L218: This looks like it may be due to coincidence errors arising from multiple particles being present in the sample volume causing odd scattering behaviour. This is a known

problem when sampling high concentrations with forward scattering cloud probes, resulting in spectral broadening (e.g., Cooper, 1988).

L435: This is a very interesting point that is raised here about the range irradiance imbalance between xenon lamps. This confirms some of my suspicious about the utility of presenting ABC analysis in general terms without appropriate caveats or a calibration standard and I think this is worth further comment. The Hernandez et al. (2016) work showed some of the results of the issues mentioned here when they compared two WIBS-4As where there were some significantly different classifications between the two units for the same test particle. They speculated that the difference between units was due to detector gain but your results suggest that xenon intensity may significantly contribute towards the observed differences. As a follow on comment this also shows the need for a common calibration reference standard to be adopted by the UV-LIF community (e.g., Robinson et al., 2017). This potentially raises a significant challenge for UV-LIF spectrometers with increased spectral resolution as I don't know if there is likely to be a single fluorophore that will adequately cover the whole spectral range?

L517: In my experience of calibrating forward scattering cloud probes it is often common to find a dip in sizing performance in the lower region of an instruments detection range due to Mie-Lorenz resonances in the applied Mie curve exceeding the bin thresholds or the bin thresholds being relatively narrow. Mis-sizing can also be further exacerbated by the particles position in the sample area as recently demonstrated by Faber et al. (2018), however this is less likely to be an issue with SIBS/WIBS type instruments as the sample flow jet should be well constrained to the central sampling region. Given that the fit to the calibration has a slope of approximately 1 and a negligible intercept the assumed Mie curve appears to be adequate, however, should there routinely be a dip in the particle size distribution around this size this may explain why.

Technical Corrections:

Fig. 7: Can you add to the caption what the red line represents. I assume it is the

rebinned reference spectra as in Fig. 5.

Fig. S10: This would be easier to interpret if the two plots were scaled over the same x-axis range.

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