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Atmospheric Measurement Techniques Discussions

Interactive comment on "Real time analysis of insoluble particles in glacial ice using single particle mass spectrometry" *by* Matthew Osman et al.

Anonymous Referee #1

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Review to "Real time analysis of insoluble particles in glacial ice using single particle mass spectrometry" by Osman et al., AMTD 2017

The manuscript by Osman and coworkers describes the application of a laser ablation single particle mass spectrometer on the analysis of particles in ice core samples. The authors describe the extraction of particles from the samples, the efficiency of particle transfer into the mass spectrometer and also attempt to perform a quantitative measurement of mass concentrations. The manuscript is well written and fits into the scope of AMT. Methods and results are clearly explained and presented. However, I have one major issue that is described below:

Major comments

While I do not have any concerns about the chemical analysis, which has been done by SPMS numerous times for atmospheric particles, I have serious problems with the mass concentration measurement:

- The size dependent extraction efficiency curve was measured using PSL particles, a method that is called "external calibration" (referenced to Wendl et al., which is not an SPMS but an SP2 paper).

- The measured efficiencies are very low (highest values for 657 nm PSL particles are around 0.40%). This results in a very large correction factor needed to derive the mass concentration in the sample

- The efficiency is assumed to be independent of shape and composition. This is certainly an oversimplification.

- Drifts in nebulizer efficiency have not been considered.

During the PSL calibration experiments, the authors used an OPS to monitor particle concentration and size to measure the transmission efficiency in to the PALMS (which was found to be between 1 and – 16%). Why has this (or another method to measure size and number) not been done during the ice core sample analysis? By such, the transmission efficiency into the PALMS would have been measured using the real sample particles. Non-spherical shapes of the insoluble particles can certainly influence the transmission efficiency.

Furthermore, methods exist to measure particle concentration in liquids. A comparison of the derived particle concentrations from the SPMS with such a reference measurement would have helped in validating the results.

At least a determination of the mass concentration by filtering the solution and weighing the filter would have been possible, although here larger particle may dominate the total mass concentration Without any comparison to an independent measurement of the

same sample, the quantification of the results seems not reliable and overstretches the capabilities of an SPMS.

Minor comments:

Page 11, lines 1-3: How was determined that all water was evaporated?

Figures of mass spectra in appendix: What is the method to select which mass peaks are labeled. Apparently not always the largest peaks? Are peaks unknown/not identified, e.g. in Fig. A1, lowest panel, around m/z 90? Additionally, minor tick marks and/or grid lines help the reader to determine the m/z number of a peak in the mass spectrum.

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