

Reply to the editor review of the manuscript “On the parametrization of optical particle counter response including instrument-induced broadening of size spectra and a self-consistent evaluation of calibration measurements” by A. Walser et al.

We wish to thank the editor for carefully reading our manuscript and for providing valuable feedback which helped us to improve the manuscript. In the following, the questions and comments raised by the editor are marked in blue. Our answers are written in black and include a description of changes done to the manuscript in separate paragraphs.

Reviewer #1 raised questions about assessing the value of this new approach for practical determinations of particle size distribution in ambient conditions with unknown mixtures of aerosol species with differing index of refraction as well as shape. Clearly, without additional information about the actual particle populations, the new approach cannot realistically reduce uncertainty about the intrinsic uncertainties in the ambient particles. Your response made this clear, yet I am concerned that the reader of the revised manuscript may still suffer from some misunderstanding. Reviewer #1’s question appeared to include the suggestion that your approach would provide an *optimized* return of index of refraction. This is not the case - it will only return a set of possible solutions without any “relative value” associated with each solution. Please add short discussion making this explicitly clear to the (new) reader, perhaps with some guidance about whether you recommend that this approach be performed for all data collected, for special sampling opportunities, or for "spot assessments" of uncertainties in sub-sets of larger data sets.

We never intended to cause any misunderstanding about the capabilities of the proposed size distribution retrieval method and we agree that it is important to make its limitations clear to the reader. The method allows for a thorough propagation of all initial parameter PDFs into a final size distribution PDF, but it cannot rate the value of individual parameter picks, i.e. it cannot refine the initial parameter PDFs/uncertainties.

Changes to manuscript

Section 2.5.3:

We complemented the discussion about the benefits of the proposed size distribution retrieval method by a sentence clarifying the above-said. We further added a recommendation for when to use the proposed approach.

The use of “spectral” (eg at lines 18 - 22 of page 6, and line 10 of page 10, etc.), could be confusing to some readers (who may think of wavelength-dependencies). Perhaps “signal” broadening? or “size broadening” would be clearer? Or simply “light intensity variations”?

We appreciate this hint and the proposed alternatives.

Changes to manuscript

The (misleading) term “spectral broadening” is replaced by “signal broadening”.

In section 2.5.1, the discussion about light intensity variability focused on in Section 2.3 is rehashed; later you mention (page 9) changes in scattering geometry again. Please consider if these “partial” references should simply be redirects to a complete discussion of all the sources in Sec 2.3. Perhaps this section should also include a wider range of possible broadening source. Ones that occur to me include: the time response of the detectors/sensing system to particles passing through the lit region at different speeds, the temperature dependent variation in detector sensitivity, and the altitude dependent variations in background-noise that are possible with some systems...others were referenced at other points in the paper.

We concur that the rehashed discussion about light intensity variability in Sect. 2.5.1 is redundant. Yet, the subject of the discussion on page 9 isn’t instantaneous broadening of size spectra (“signal broadening”) but tries to give possible explanations for remaining (temporal) deviations between measured and modeled OPC response, e.g. induced by light source intensity fluctuations (on larger time scales). This discussion is not really belonging to the signal broadening topic treated in Sect. 2.3. Therefore, we think it is better kept separated from the latter.

Changes to manuscript

Section 2.3 and 2.5.1:

The detailed discussion about the non-uniformity of light intensity in the OPC sampling volume and its implications for the width of recorded size spectra is now included in Sect. 2.3. The respective part in Sect. 2.5.1 is replaced by a reference.

Section 2.5.2 (Page 9):

The discussion of potential reasons for remaining (time-dependent) model deviations is kept in place, but the differences to the signal broadening topic (Sect. 2.3) are now made explicitly clear. Further, some of the proposed additional sources for time-dependent OPC response fluctuations are included.