Title: Look−up tables for complex refractive index correction of particle sizes measured by common research−grade optical particle counters

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Dear editor and dear Referees

We thank you for the positive and rapid evaluation and useful comments which certainly improve the precision and significance of the publication. Here below find our point by point responses in blue.

Referee 1

When using optical particle counters (OPCs) to measure airborne particles, the unknown complex refractive index is one of the main sources of uncertainty in particle sizing. This manuscript addresses this issue by providing correction factors for specific instruments. Although all but one of the instruments are from the same manufacturer, the procedure used to obtain the correction factors is clearly described and could be applied to other spectrometers with different scattering geometries.

Specific comments:

1. The nominal measuring range of the UHSAS (Table 1) is 0.06–1 µm. Where do the marine and urban aerosol data shown in Figure 4 come from?

For all aerosol types, the synthetic number size distribution in Fig 4 is equal and consists in a two-mode lognormal centered at 150 nm (sigma = 1.6) and 1 µm (sigma = 1.8). The complex refractive index is varied as explained at the beginning of section 3, so that for marine aerosols is m = 1.38 – 0.001i (Zieger et al., 2017) and urban aerosols is m = 1.56 – 0.087i (Radney and Zangmeister, 2018)

2. Please use a larger font for the x- and y-axis labels in all figures to improve readability.

This is now done

3. I suggest examining the papers cited below and including them in the Introduction to better highlight the development of the issues related to the topic of this contribution.

Numerical and experimental study of the performance of the dual wavelength optical particle spectrometer (DWOPS), Nagy et al. https://doi.org/10.1016/j.jaerosci.2007.02.005

Optical particle spectrometry—Problems and prospects, Szymanski et al. https://doi.org/10.1016/j.jqsrt.2009.02.024.

Real-Time Determination of Absorptivity of Ambient Particles in Urban Aerosol in Budapest, Hungary, Nagy et al. https://doi.org/10.4209/aaqr.2015.05.0356

These references are now included in the introduction, thank you for pointing out to them

Referee 2

The subject of the present manuscript is relevant with Aerosol Research topic's, specifically addressing the issue of the impact of complex refractive indices on the size classification of optical particle counters by providing a dataset of correction factor. The approach described in this paper is thoroughly delineated and may be generalized to other optical particle counters (e.g. the OPS3330) and certain low-cost sensors.

Comments:

1-I recommend to check Grimm description. According to the GRIMM publication, a single elliptical mirror is utilized, with light scattering being collected between 60 and 120°. Such opening angle may change the results describe in this paper. Indeed, Mie oscillations are expected to be more pronounced.

Indeed the Grimm description in the literature is an issue as many papers report different configurations. So we directly checked with the manufacturer, as stated in line 176, and we believe that our description is correct. However, as mentioned below (point 6), we inverted the terms « direct » and « reflected » in table 1 and accompanying text, this mistake is not corrected.

2-Please note that Equation 1 refers to the geometric bin diameter, not the midpoint diameter.

The word geometric was added to the text (line 196)

3-Use coherent writing for geometric diameter along the paper: Dgeom and after Dgeo

Thank you for pointing out, instances where the notation Dgeom was used are now corrected

4-Line 65: OPC is based on single-particle counting. Please suppress "ensembles"

Done

5-Please provide justification for the sentence appearing on lines 137 to 139

We are unsure which sentence the referee is mentioning. If it is « Calculations are performed under the hypothesis of spherical particles, which is a good approximation for a wide range of aerosol types and conditions. » we rephrased as « Calculations are performed under the hypothesis of spherical particles, which is a good approximation for a wide range of aerosol types, excluding mineral dust, and environmental conditions, notably considering ambient relative humidity" to increase clarity

6-In Table 1, I believe that 'direct beam' and 'reflected beam' should be inverted. The range of 30-150° (GRIMM) corresponds to the angular aperture where light is reflected by the mirror. The range of 81-98° corresponds to the angular aperture where light is directly collected by the detector.

Thank you for pointing out, you are right we inverted the terms. This mistake is now corrected

7-Line 210 to 222: please add units

Done

8-Figure 2 does not contain any dotted lines. Please correct the text on lines 298-299.

This is now corrected to make clear that is refers to the CDP figure only

9-Figure 3 does not contain any black lines. Please correct the figure legend.

This is now corrected

10-The majority of low-cost sensors have a poor size resolution (five bins) and significant sizing errors caused by the position of particles in the laser beam (see references below). As far as I am aware, only a few LCSs have a good degree of classification accuracy and size resolution (OPC-N3, OPC-R2, SDS029). This aspect should be considered during the discussion.

Ouimette, J. Arnott, W.P., Laven, P., Whitwell, R., Radhakrishnan, R., Dhaniyala, S., Sandink, M., Tryner, J., and Volckens, J. 2024. Fundamentals of low-cost aerosol sensor design and operation. Aerosol Sci. Tech. 58 (1): 1-15. doi: 10.1080/02786826.2023.2285935

Pribošek, J. and G. Röhrer. 2018. Estimation of the particle sizing error due to particle position in an integrated PM2.5 optical particle counter. Proceedings 2 (13): 850-. doi: https://doi.org/10.3390/proceedings2130850

11-Sphericity is a rare particle shape characteristic. A brief discussion on the potential impact of shape on the correction factor would be beneficial. I would encourage the authors to investigate this aspect, as this would represent a significant step forward and useful.

Both questions raised in points 11 and 12 have been addressed in lines 403-417. The text now reads « The approach presented in this work could be extended to other research-grade OPC, such as the Palas® WELAS operating with white light (Heim et al., 2008), as well as to low-cost sensors, provided that their geometrical characteristics are known with sufficient precision (Hagan and Kroll, 2020). As a matter of fact, to date, only a few LCSs have a good degree of classification accuracy and size resolution (OPC-N3, OPC-R2, SDS029) while the majority of low-cost sensors have a poor size resolution (five bins) and significant sizing errors caused by the position of particles in the laser beam (Pribošek and Röhrer, 2018; Ouimette et al., 2024). This aspect limits the applicability, and possibly also the need, of complex refractive index corrections, as the coarse size resolution should smooth out the Mie oscillations and the ambiguity related to those. Further work should also address the impact of morphology and provide a shape−dependent formulation to optimize the correction to non-spherical particles such as mineral dust, soot, salts and crystals. The recent progresses in developing numerically-efficient optical scattering theory allow to do so (Saito et al., 2021; Zhang et al., 2024; Chang et al., 2025) and will be applied in the near future to increase the universality of the corrections and the applicability of the OPC for studying atmospheric aerosols. »

12-It’s not possible to access the MIE routine via the provided link; furthermore, the DOI does not respond.

The link is now corrected

13-It can be hard to read the labels and axes of the graph. Please check all the figures, including the one in the supplementary material.

All figures have been redone to increase lisibility