

Interactive comment on “Determination of the refractive index of insoluble organic extracts from atmospheric aerosol over the visible wavelength range using optical tweezers” by Rosalie H. Shepherd et al.

Anonymous Referee #3

Received and published: 11 September 2017

Review of Shepherd et al., ‘Determination of the refractive index of insoluble organic extracts from atmospheric aerosol over the visible wavelength range using optical tweezers’.

In this manuscript, the authors present measurements of the complex refractive index of insoluble ambient aerosol matter collected on filters from a range of different environments. Refractive index (RI) measurements were made using a combination of optical trapping, white light spectroscopy and UV-VIS spectroscopy. The retrieved refractive index values were then used to model the effect of core-shell particles coated with the

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organic matter on the aerosol radiative effect.

The reported research is original and well presented, and is suitable for publication subject to the corrections/clarifications listed below being addressed:

1) Given that the paper looks at extracting the complex refractive index from optically trapped droplets using Mie theory, the authors should be aware of the following reference and include it in the introduction.

R.E.H. Miles, J.S. Walker, D.R. Burnham and J.P. Reid, ‘Retrieval of the Complex Refractive Index of Aerosol Droplets from Optical Tweezers Measurements’, *Physical Chemistry Chemical Physics* 14 (2012) 3037–3047.

2) Page 3, Line 8-9.

The authors state that ‘The technique allowed the refractive index to be resolved to within 0.015 over a large wavelength range of 460 to 700 nm’. I take this sentence to mean that the uncertainty in the RI values extracted using this technique is ± 0.015 . However, in Table 1 much reduced uncertainties are given for the samples tested, which correspond instead to the standard deviation in RI values retrieved from multiple droplets. For some of the samples, no uncertainty is given at all. If the precision of the RI measurement is indeed ± 0.015 as stated in the introduction (and again on page 10, line 22), then this is the error which should be included in Table 1.

3) Page 6, Line 2-4.

The authors state that ‘The values of the three empirical constants and the radius of the trapped aerosol were iterated until a good comparison was achieved between the simulated and the experimentally obtained Mie spectrum’

Were the experimental and simulated spectra compared by eye or was a fitting algorithm used? The authors should include a figure which shows how sensitive the simulated spectra are to small changes in the radius and RI, in particular for the more featureless spectra, so the reader can see for themselves the sensitivity of the fit.

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4) Page 6, Line 21-22.

The authors should state what the instrument detection limit of the UV-VIS spectrometer was in order to provide an upper bound on the absorbance of the atmospheric samples.

5) Figure 7

In keeping with the description in the text (Equation 4) the y-axis label should be ARE(TOT). Based on the description of the x-variable as the volume fraction of the shell (page 11, lines 2-3) the x-axis label also needs changing to $V_{shell}/(V_{shell}+V_{core})$.

6) There are several places in the text which seem to contradict each other as to how the Angstrom exponent was determined ie. from optical trapping or from UV-VIS spectroscopy, or from both. Please could the authors clarify the following explicitly: Were values of the Angstrom exponent extracted from the Mie spectra and from the UV-VIS spectra independently and these values then compared to show they were equivalent? The authors should include somewhere the values of the Angstrom exponent determined from each method, along with associated uncertainties.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2017-693>, 2017.