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Atmospheric Measurement Techniques Discussions

Interactive comment on “Calibration of a photoacoustic spectrometer cell using light absorbing aerosols. A technical note” *by* Nir Bluvshtein et al.

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GENERAL COMMENT

The presented work tackles the important experimental question of how to calibrate photoacoustic aerosol instruments for wavelength regimes where no reference gases are available. The authors suggest the use of light absorbing aerosols generated from nebulized light absorbing organic materials which were preselected in size before measurement by means of an electrostatic classifier. The reference absorption coefficient for the calibration is calculated from the size of the aerosol by using Mie theory. The required complex refractive index for the material is determined experimentally by means of spectroscopic ellipsometry. The presented work builds on carefully conducted experimental studies and deserves publication in AMT after consideration of one major concern which is discussed below.

SPECIFIC REMARKS

1. My major concern refers to the calibration procedure. The method of generating particles of given size and spherical shape, and calculating the absorption coefficient from measured number concentrations by Mie theory is justified and works well for calibrating optical instruments. Here, the additional complexity arises from the fact that the complex index of refraction for the used materials has to be determined separately. The authors demonstrate the robustness of their approach by comparing calibrations with three different materials. They found similar instrument responses for all materials, which is shown in their Figure 5.

On the other hand, they applied the accepted methodology of using ozone as a light-absorbing gas at the selected wavelength of 404 nm. The ozone calibration however produces an instrument response two times higher than the values found for particulate calibration material.

To me, it has to be discussed in more detail which process can cause the differences between the calibration using light absorbing gases or particles. It would be highly beneficial to show simultaneous measurements of light extinction and scattering coefficients and apply the difference method. A separate proof of the robustness of the calibration by particulate matter combined with Mie theory would be a convincing argument which is not yet given.

2. A full theoretical description of photoacoustic signal generation is provided by Petzold and Niessner (1996), however for an azimuthal resonator. Together with the description of a longitudinal photoacoustic resonator given by Arnott et al. (1999), the authors may investigate potential sources of this discrepancy between the calibration approaches also on a theoretical basis.

MINOR COMMENTS

1. Line 45: The correct reference is Müller et al. (2011).

2. Line 49: correct: "... to measure ..."

3. Line 82: correct: "... photolyses ..."

4. Line 203: I assume the later used acronym SE refers to spectroscopic ellipsometry. If this is the case, it should be introduced here.

5. Line 285: correct "PAS instrument".

6. Figure 5: It should be noted in the y-axis title that the absorption coefficient is obtained from Mie theory.

REFERENCES

Arnott, W. P., Moosmuller, H., Rogers, C. F., Jin, T. F., and Bruch, R.: Photoacoustic spectrometer for measuring light absorption by aerosol: instrument description, Atmos. Environ., 33, 2845-2852, 1999.

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