

Interactive comment on “A new method for measuring optical scattering properties of atmospherically relevant dusts using the Cloud Aerosol Spectrometer Polarization (CASPOL) instrument” by A. Glen and S. D. Brooks

Anonymous Referee #1

Received and published: 4 October 2012

Review of "A new method for measuring optical scattering properties. . ." by Glen and Brooks.

This paper describes the operation and calibration of a new instrument, the cloud and aerosol spectrometer with polarization detection (CASPOL). The instrument is shown to be capable of detecting differences in scattering properties of different dust components, proving its potential to classify dust particles in atmospheric measurements. However, no atmospheric measurements are presented; only laboratory measurements are shown.

C7802

Because the paper focuses exclusively on instrument performance, I don't feel that it is appropriate for publication in ACP, which focuses on "studies investigating the Earth's atmosphere and the underlying chemical and physical processes". It is much more suitable for Atmospheric Measurement Techniques, which covers "the development, intercomparison and validation of measurement instruments and techniques of data processing and information retrieval for gases, aerosols, and clouds." Thus my recommendation is to reject the paper. Although the paper is a fine contribution, it should have been steered to AMT in the initial submission stage. Let's reserve ACP for the actual science, not the techniques.

In general the paper is well written, clear, and reasonably concise. I have only a few substantive comment (other than that it should be submitted to AMT rather than ACP).

1) Lack of quantitative evaluation of particle shape in Section 3.4. High resolution SEM images were taken of the different aerosol types. The qualitative conclusion is drawn that, "the SEM images of each dust . . . do not yield any distinctive similarities for dust types allocated to the same groupings indicating that shape and size are not the only determining factors in the optical scattering properties." This needs to be expanded upon. Scattering is dependent upon shape (morphology), size, refractive index, and homogeneity. It is very surprising that there is no consistent relationship between the measured polarization and scattering intensity and these particle parameters. Have the authors attempted to classify particles in the SEM images by fractal dimension, aspect ratio, or other quantitative parameters? There are image analysis packages available (e.g., for Matlab and IDL) that can perform automatic, objective classification. Simply saying (in the Summary) "no clear correlation between single particle characteristics and their optical properties were (sic) determined" is not adequate. The "characteristics" of single particles are the only things that can explain their optical properties!

2) Polarization ratios exceeding 1. Figure 9 and Section 3.5 describe polarization ratios exceeding 1. Yet Eqn. 1 describes the polarization ratio as the ratio of polarized backscatter intensity to total backscatter intensity. This ratio should never exceed one.

C7803

Please explain how this can be.

3) Section 3.7 describes theoretical calculations of backward scattering cross sections for various compounds to show the sensitivity of backscattering to refractive index. However, this calculation cannot be replicated because the necessary refractive indices are not given. Please do so.

4) Figure 6 is unnecessarily a color figure. Many of us are colorblind and simply can't read this graph. Histograms would be clearer, although they would take a bit more space. If you must use color, the "yellow hot" is a better scale to use in Figs 9-11 for most colorblind readers than is than the "rainbow" scale.

Technical corrections

a) The DMT web site describes the CAS as the "cloud AND aerosol spectrometer".

b) p. 22419 line 18. Change "variable" to "variability".

c) p. 22420 line 9. PSL equivalent optical diameter? Water equivalent? Olive oil equivalent? Please define since optical diameter is dependent upon refractive index.

d) Section 2.1. Was olive oil or oleic acid used? Is the refractive index of "olive oil" well known (e.g., for Section 3.7)?

e) p. 22421 line 20. Add a comma between "isopropanol" and "leaving".

f) p. 22421 line 24. Change to "Near-monodisperse"

g) p. 22422 line 8. What does "specially designed" mean?

h) p. 22423 line 3. Please describe the composition of the Arizona test dust.

i) p. 22424 Sect. 3.1. Add a reference for the undersizing of large particles by the VOAG.

j) p. 22425 line 1. Is this change in polarization ratio, interpreted as a change in aspect ratio, consistent with the SEM images? Please quantify.

C7804

k) p. 22425 line 7. Remove the sentence, "To improve the categorization, additional data processing was employed."

l) p. 22429 line 4. Change to "based ON the".

m) p. 22430 line 16. "calculation of the measurements"?

n) Baumgardner et al., 2012 (in prep) is not citable at this stage.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 22415, 2012.

C7805