

Interactive comment on “Advanced characterization of aerosol properties from measurements of spectral optical depth using the GRASP algorithm” by B. Torres et al.

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Review of “Advanced characterization of aerosol properties from measurements of spectral optical depth using the GRASP algorithm” by B. Torres, O. Dubovik, D. Fuertes, G. Schuster, V. E. Cachorro, T. Lapyonok, P. Goloub, L. Blarel, A. Barreto, M. Mallet, C. Toledano, and D. Tarré

Recommendation: This paper presents a sensitivity analysis and application of determining the aerosol size distribution from spectral measurements of aerosol optical thickness, in particular determining 6 parameters of a bimodal aerosol size distribution. After the sensitivity study, it applies the method to real observations from AERONET, airborne measurements, and lunar transmission measurements. The pa-

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per is extremely thorough and well written. I recommend that this paper be accepted for publication with only minor editorial changes.

General Comments: This important paper is very easy to read and covers an important topic of determining the aerosol size distribution from (primarily) ground-based measurements of spectral optical thickness in the absence of almucantar measurement. The treatment of calibration (optical thickness), initial guess, and refractive index sensitivity is clearly presented.

Major Comments: All references are missing full initials of authors (like middle initials). The references should be complete in this regard. Please check.

Minor Comments: Page 2, line 12 – change ‘one on the first type of measurements’ to ‘one of the first types of measurements.’

Page 3, line 25 – change ‘airborne photometers’ to ‘airborne sunphotometers’.

Page 3, line 30 – change ‘at polar regions’ to ‘in polar regions’. Later in same sentence, change ‘aerosol load’ to ‘aerosol loading’.

Page 4, line 12 – Consider adding an additional reference to a recent paper by van Donkelaar et al., 2016:

van Donkelaar, A., Martin, R. V., Brauer, M., Hsu, N. C., Kahn, R. A., Levy, R. C., Lyapustin, A., Sayer, A. M., and Winker, D. M.: Global estimates of fine particulate matter using a combined geophysical-statistical method with information from satellites, models, and monitors. *Environmental Science & Technology*, 50,3762-3772, 2016.

Page 5, line 21 – Consider adding an additional reference to a book chapter by King and Dubovik:

King, M. D., and Dubovik, O.: Determination of aerosol optical properties from inverse methods. *Aerosol Remote Sensing*, J. Lenoble, L. Remer, and D. Tarré, Eds., Springer-Verlag, 101–136, 2013.

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Page 6, Equation (2) – $v(r)$ in equation not defined.

Page 9, Figure 1 – the line types (dashed, and dot-dashed) are hard to distinguish. Please improve.

Page 21, line 21 – reference to ‘Chapter 2 of Lenoble et al. 2013’ should be to ‘Lenoble et al. 2013’:

Lenoble, J., Mishchenko, M. I., and Herman, M.: Absorption and scattering by molecules and particles. *Aerosol Remote Sensing*, J. Lenoble, L. Remer, and D. Tanré, Eds., Springer-Verlag, 13–51, 2013.

Page 13, line 5 – change ‘regardless the initial guess’ to ‘regardless of the initial guess’.

Page 15, line 5 – after analysis, add reference back to Table 2 (i.e., ‘analysis (cf. Table 2). The standard deviation. . .’)

Page 16, line 18 – change ‘aerosol cases are here’ to ‘aerosol cases here’.

Page 17, line 32ff – the fact that the refractive index (mostly real part) affects the derived size distribution was also discussed in King et al. (1978), where it was pointed out that the shape of the size distribution remains the same but shifts with a varying real part (with little sensitivity to the imaginary part). This is derived from anomalous diffraction theory of van de Hulst, and was also discussed in Yamamoto and Tanaka (1969).

Page 20, line 11 – change ‘MEXI-A’ to ‘MEXI-C’ if I understand this correctly.

Page 20, line 15 – change ‘thought’ to ‘though’.

Page 31, line 25 – the Kieffer and Stone reference needs to have the page range of the publication, not just the first page.

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