

## ***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. Fuentes, G. Schuster, V. E. Cachorro, T. Lapyonok, P. Goloub, L. Blarel, A. Barreto, M. Mallet, C. Toledano, and D. Tanré

General comments: The authors propose to evaluate the using spectral aerosol optical depth (AOD) measurements to characterize the microphysical and optical properties of atmospheric aerosols, based on the new developed Generalized Retrieval of Aerosol and Surface Properties (GRASP) code. The approach is interesting and deserves to be explored for its potential for the retrieval of particle size distribution. The paper is

well written and easy to read.

Major comments: (1) For methodology of this paper, to retrieve the parameters of size distribution, the complex refractive index must be known. However, the refractive index is also a very important parameter, and change with the different place and time. When the GRASP-AOD method can be used, the synchronous measurements of Sun photometer (CE318) are needed to obtain the refractive index. Thus, if the measurements of CE318 are considered, the parameters of size distribution and refractive index could be retrieved directly in daytime, and needn't to refer GRASP-AOD method. By contrast, if the measurements of Lunar photometer are considered, the simultaneous results of refractive index can't be obtained correctly. Therefore, please make clear for the application scenario of GRASP-AOD method in the paper. (2) Just as shown in Table A1, the observation wavelengths of the instruments (CE318, PLASMA and Cimel-318U) are different, thus the information content are also different. However, the authors didn't analyze the retrieval errors for different instruments, please also make clear for this part in the paper.

Minor comments: (1) Page 2 line 12: "one on the first type" → "one of the first type". (2) Page 3 line 31 "aerosol load" → "aerosol loading". (3) Please give definition for the parameter " $v(r)$ " in Eq.(2). (4) Please give definition for the parameter " $N_r$ " in Eq.(3). (5) Page 10 section 3.2: Please add more details for the description of Figure 3 about "Forward Code" and "Inversion Code", it would be better to show the methodology detailed based on the GRASP code. (6) Page 13 line 6: "regardless" → "regardless of". (7) Page 18 line 19: "sub-figures" → "subfigures". (8) Page 19 line 15: ">40" → ">40°". (9) Page 20 line 15: "thought" → "though". (10) Page 31-33: Some expression such as "n/a-n/a" in references should be modified with the software Endnote. (11) Page 34 line 1: "Optica Pura y Aplicada" → "Optica Puray Aplicada". (12) Page 44 Figure 8: Due the captions of Figure 8 is the same as these of Figure 7, thus the expression should be concise, and please change to "Similar as Figure 7, but for the volume concentration". (13) Page 45 Figure 9: change the caption of Figure 9 to "Similar as Figure 7, but for

the geometric standard deviation”.

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