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Atmospheric Measurement Techniques Discussions

Interactive comment on "High temporal resolution estimates of columnar aerosol microphysical parameters from spectrum of aerosol optical depth by Linear Estimation: application to long-term AERONET and Star-photometry measurements" *by* D. Pérez-Ramírez et al.

Anonymous Referee #2

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Summary

The manuscript of Pérez-Ramírez et al. is devoted to the retrieval of the aerosol volume content and effective radius using the data on spectral aerosol optical depth, obtained with the use of sun and star photometers. Authors applied a modification of the least square method, which they called Liner Estimation (LE), method to the solution of the Fredholm's equation. Inversion of only the direct solar radiation measurements

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Interactive Discussion
Discussion Paper

allows assessment of the aerosol parameters with significantly better temporal resolution compared to standard AERONET procedure. In order to minimize biases between standard AERONET algorithm retrievals and LE, correction functions are proposed using the multi-year database of observations. The approach developed was applied to AERONET and star-photometry measurements at the city of Granada (Spain) and day-to-night time-evolution of columnar aerosol microphysical properties have been analyzed. The paper can be published in AMT once the general and specific comments have been addressed

General comments

1. Please specify, what are the advantages of your method over a number of known.

2. Throughout the paper the quantities V and reff are used, not specifying the size interval to which they refer. But inversion is carried at different values of rmin and rmax (p. 2339). This obviously has an effect on the values of the parameters retrieved.

3. Authors have limited analysis to only two microstructure parameters – volume content and effective radius. They are calculated from the retrieved size distributions. But no comparison of the LE size distributions with initial models and AERONET retrievals has been performed.

4. Spectral range of sun and star photometers in the paper is rather narrow – 380 – 1020 nm. The ratio of the maximal wavelength to minimal one is less than 3. How can you retrieve aerosol size distributions in the radius interval from 0.05 to 10 micrometers with ratio of maximal to minimal radius equal to 200? Do authors really declare the possibility to retrieve volume of content of the coarse aerosol fraction from extinction measurements in the spectral region 380 – 1020 nm? If so, it should be proved.

5. The statement that retrievals of columnar volume aerosol content by inverting AODs do not depend on particle refractive index is wrong. Scattering efficiency factors for particles of fine fraction in visible region is approximately proportional to n-1. So, retrieval

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with overestimated refractive index leads to underestimation of the volume content and effective radius, and vice versa.

6. Authors analyzed parameters of correction as function of the relative input of the fine fraction into AOD at 500 nm. But this parameter is not measured directly instead of Angstrom exponent. Possibly it might be better to connect correction immediately with Angstrom exponent.

Specific comments

P. 2335, line 16

-What do you mean under “measurement kernels”? Are they the measured parameters simply?

P. 2337, line 9

-What values of real and imaginary parts of refractive index have you used in inversion? How changes in the refractive index affected the retrieval of fine and coarse fraction?

P. 2340, lines 17-19

- Why you do not utilize AOD at 340 nm?

-What do you mean under effective radius? Does its value depend on the size interval used in inversion?

P. 2341.

-What values of the refractive index were used in numerical simulations?

P. 2341, line 4

- Correct Nf/Nc on Nc/Nf.

P. 2342, line 26

-How can you compare effective radius given by AERONET (radius range 0.05 -15

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micrometers) with yours retrievals?

P. 2346, lines 3 – 6

- The retrievals of columnar volume aerosol content by inverting AODs haVE more limitations as they DO DEPEND on particle refractive index.

-Lack of information about coarse particle contribution is caused by another reason.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 2331, 2015.