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Atmospheric Measurement Techniques Discussions

Interactive comment on "Assessment of aerosol's mass concentrations from measured linear particle depolarization ratio (vertically resolved) and simulations" *by* A. Nemuc et al.

A. Nemuc et al.

nnicol@inoe.ro

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We would like to thank the reviewers for their time ad valuable comments related to the paper "Assessment of aerosol's mass concentrations from measured linear particle depolarization ratio (vertically resolved) and simulations". We really appreciate your efforts to help us deliver a better article and we consider very important your assessments .We addressed each of the comments and made revisions in the paper. Please find below each of the reviewer's comments, our clarifications and details of the modifications made in the revised paper.

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Interactive Discussion

Discussion Paper

Comments Anonymous Referee #2 The authors evaluated mass concentrations of smoke and mineral dust aerosols using multi-wavelength Raman lidar data observed at Magurele, Romania in 2012 and discussed the features of the vertical profiles and seasonal variation for the derived smoke and dust concentrations. They assumed depolarization ratio of 3% for smoke aerosols and 35% for mineral dust aerosols and estimated their extinction coefficients from the Raman lidar measurements. They calculated mean mass-extinction efficiencies for smoke and mineral dust using the OPAC data at relative humidity of 70% and used them to convert the derived smoke and mineral dust extinction coefficients to their mass concentrations. The authors demonstrated to be able to calculate vertical profile of mass concentration for each aerosol component using Raman lidar data, and the derived data are useful for validation and assimilation of numerical models such as aerosol transport model. The retrieval methods are logically constructed based on the concepts (ideas) of previous studies. On the other hand, this paper has needs some revisions as follows: 1)1. Introduction The introduction does not match the gist of this paper. You should describe why mass concentration data, especially their vertical profiles, for each aerosol component are needed and should review mass-extinction efficiency (e.g., see Shimizu et al. SOLA, 2011, vol. 7A, 001-004, doi:10.2151/sola.7A-001).

Our reply

The introduction tried to underline the following issues: why to study aerosol, lidar for aerosol vertical measurements, lidar network results, previous methods for separation of aerosol into-spherical non-spherical particles, previous depolarization measurements and about Tesche et al. method for separating in aerosol's components. We mentioned also Ansmann et al. (2012) with an extended review of mass-extinction efficiency.

2)2.2 Assessment of mass concentration It seems that the retrieval method to evaluate extinctions for smoke and dust needs only two channels of the multi-wavelength Raman lidar data that are extinction coefficient and depolarization ratio at one wavelength. You

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should describe this point clearly.

Our reply

The manuscript has been modified as follows: “In this study the multiwavelength depolarization Raman lidar measurements were used to derive the backscatter coefficient profile without any assumption on the lidar ratio (LR). We used measured signals (the nitrogen Raman signals at 607 nm and the elastic backscatter signal at 532nm-cross and parallel) to compute the backscatter coefficients at 532nm and the extinction coefficients at 532 nm (Ansmann et al 1992), therefore the lidar ratio of the mixed aerosol profile. The cross and parallel polarized channels were used to calculate the particle depolarization profiles at 532nm, and further to separate the high and low depolarizing particles‘ contribution to the backscatter of the mixed aerosol (Tesche et al., 2009a)”.

3) P5933, L18: You should describe cause for using the OPAC results at relative humidity of 70%.

Our reply

We have chosen the OPAC results at relative humidity of 70% due to the fact that during the studied period this is the most frequent humidity measured in the altitude range 2-5 km. In our location a microwave radiometer measures continuously the vertical profile of relative humidity. The manuscript has been modified as follows: “In this study we used the OPAC results at an average relative humidity (RH) of 70 % since this was the most frequent RH value measured by our microwave radiometer during the studied period between 2 and 5km. The average mass extinction efficiency used for low-depolarizing component (smoke) is 3.14 ± 0.43 m2 $g-1$ and 0.62 ± 0.04 m2 $g-1$ for high-depolarizing component (mineral dust). OPAC results for RH=0% and 50% are presented in Fig.1 of Nicolae et al. (2012)”

4) P5934 L11 “The error bars represents the uncertainties . . ...the algorithm.” How did you evaluate the uncertainties? You should describe the method

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Our reply

The error bars in Fig.3 represents the statistical errors propagated through the calculus chain, conform to the described procedure lines 8-11 page 5934

5)P5937 Figure 10, 11, and related discussion. You should add the figure for the monthly variation of the mean mass concentration of the dust and smoke and discuss the seasonal (temporal) variation of mass concentration of dust and smoke as well as the ratio.

Our reply

We have chosen to use only Fig.10 and 11 as the most relevant information can be depicted from them, emphasizing the dominant component variation during the two seasons.

6) 5938 L25, "This study shows with sufficient accuracy." This paper does not show sufficient cause for this conclusion. This study has no validation study and does not show the methods and results of sensitivity studies, especially related to assumptions such as use of fixed values for depolarization ratio of 3% for smoke and 35% for dust and use of fixed values for mass-extinction efficiency evaluated from OPAC data. If you suggest the agreement with LIRIC as the cause for this conclusion, you should describe the accuracy (and performance) of the LIRIC.

Our reply

The choice of using fixed values for depolarization ratio of each component is described in details by Tesche et al 2009a- page 14; a detailed validation study related to the use of fixed values for mass-extinction efficiency evaluated from OPAC data , comparison with outputs from LIRIC is under preparation. We modified the paragraph 5938 L25 as follows: "This study shows that the retrieval of mass concentration profiles from multiwavelength depolarization Raman lidar measurements is possible, but dependent on an appropriate calibration of the depolarization and careful selection of the mass-

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extinction efficiencies in OPAC. Main advantage of this method is that is simple and fast, providing sufficient information for real time assessment."

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 5923, 2013.