Atmos. Meas. Tech. Discuss., 6, C1824–C1826, 2013
www.atmos-meas-tech-discuss.net/6/C1824/2013/

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.

Anonymous Referee #3

Received and published: 29 July 2013

The authors try to estimate aerosol mass concentration of different components by using particle backscattering coefficients. The task is important, but difficulty of the problem makes such conversion very unstraightforward. In conclusion authors write: "This study shows that the retrieval of mass concentration profiles from multiwavelength depolarization Raman lidar measurements is possible with sufficient accuracy..." But actually, the authors just split backscattering for dust and smoke components and multiply these by corresponding conversion factors from OPAC. So the main question is how trustable is such approach. What kind of validation can be suggested? I think the sensitivity study should be added to understand how sensitive technique is to the

choice of components depolarization coefficients. How accurate will it work when depolarization is low? The authors assumed RH=70%. How variation of RH will affect their results? I think all these factors should be carefully considered to get realistic uncertainty of the approach.

Specific comments

Introduction should be improved, for me it seems a bit chaotic, I would make it shorter. Authors mention things not related to this study. For example: p.5926, ln.4 "...features such as clouds, wind, ozone..." Why should wind or ozone be mentioned? Ln.26. "Moreover, particle volume tends to extinct more light with increasing non-sphericity." Particle extinction coefficient weakly depends on shape. So this statement should be reconsidered.

p.5926, ln.9. "Based on the assumption that non-spherical particles have a spheroidal shape..." Particles have irregular shape, the ensemble of randomly oriented spheroids just mimics their optical properties.

p.5928. ln 3-9. These are known things so can be skipped. Ln 10. "To minimize the noise, the laser beam has a low divergence 1.085 mrad @ 1064 nm, 1.124 mrad @ 532 nm, 1.57 mrad @ 355 nm), and..." 1.57 mrad at 355 nm is very large divergence, normally in lidar measurements this value is $\sim$0.2 mrad. What is divergence of beam in the detection module? Does it affect depolarization measurements?

p.5928 Ln.26 – p.5929 Ln.12 Description of photon counting and analog detection is too simplified and can be skipped. Otherwise the authors should do it more deep, discussing corrections used and details of gluing procedure.

Ln.15 "...backscatter and extinction coefficients profiles can be derived relatively without assumptions for Raman lidars..." Angstrom is still assumed, and for backscattering coefficient corresponding error is accumulated.

p.5930. ln.10 "...is estimated using the system dependent molecular-depolarization,

estimated for a aerosol free region. . .” The filter bandwidth and assumed molecular depolarization coefficient should be provided.

p.5931 ln.5 “. . .certain classifications are possible and the following four general aerosol classes are associated with different sources and are expected to have different optical properties(Chaikovsky et al., 2004)” For classification I would also recommend reference: Dubovik, O., Holben, B. N., Eck, T. F., Smirnov, A., Kaufman, Y. J., King, M. D., Tanré, D., and Slutsker, I.: Variability of absorption and optical properties of key aerosol types observed in worldwide locations, J. Atmos. Sci., 59, 590-608, 2002.

Ln.24 “. . .extinction profiles of each component are calculated using the separated backscatter contribution and measured LR profile.” Do authors use the same lidar ratio for all components? But these are different.

p.5934 ln.10. Are fractions of dust and smoke calculated from backscattering or extinction coefficients?

Fig.9 Above 3 km particle depolarization is about 3%, there is no depolarization enhancement and still authors calculate dust fraction. What makes them think that it is dust? This question is probably related to all measurements with low depolarization. Again, sensitivity study are necessary.

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