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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Profiling of fine and coarse particle mass: case studies of Saharan dust and Eyjafjallajökull/Grimsvötn volcanic plumes" *by* A. Ansmann et al.

Anonymous Referee #2

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The paper done by Ansmann et al presents their effort to profile fine and coarse aerosol fractions and evaluate their particle mass concentrations. The procedure employs depolarization lidar observations and combined lidar-photometer retrievals. The authors present an overview of the methodology and its limitations using four different case studies that deal with volcanic aerosol from two eruptions in Iceland; Saharan dust; and a mixture of dust and biomass burning aerosol. Profiling of the volcanic aerosol mass concentration is of particular interest due to the recent impact of the Eyjafjallajokull eruption on European aviation traffic. I believe that the paper will be very useful for the scientific community and I recommend it for the ACP publication after a minor revision. Please find my comments below.

The authors' fundamental assumption throughout this study is that coarse particles fraction is associated with the fraction of light-depolarizing, non-spherical particles. The authors discuss the limitation of this assumption in the case of high water content of the coarse-mode and in the case of the coarse spherical maritime aerosol. However, the authors do not discuss the possible influence of coating of the coarse particles. This may have been relevant for example in the description of the West African case study of dust mixture with biomass-burning smoke. As Figure 3 shows, the low altitude transport of desert dust, which is typical for this winter case study, allows the smoke aerosol to lift through the dust layer and adhere to the dust particles which may then produce a coating effect. I assume this would comprise the limitation case for the methodology.

p. 13368, line 15: Difference between the depolarization ratios attributed to desert dust (0.31+-0.03) and volcanic dust (0.34+-0.03) seems to be not very strong, in particular when considering the uncertainties. As I understand these are averages+- StDev from a few studies that use quite the same technique. I would suggest consideration/discussion of possible values provided in other independent studies as well. For example, for the same volcanic aerosol event in 2010 there are at least two manuscripts in the JGR special issue that discuss the depolarization ratio, e.g. using CALIPSO [Chazette et al., 2012] or using photometer observations [Derimian et al., 2012]. By the way, agreements or discrepancies with the lidar ratio calculated using only the photometer observations for the same volcanic aerosol and for the key aerosol types, e.g. [Cattrall et al., 2005] could have been mentioned in the paragraph of line 18.

p.13382, line 27-29: it seems there is a typo, replace BC by CB.

References Cattrall, C., Reagan, J., Thome, K. and Dubovik, O.: Variability of aerosol and spectral lidar and backscatter and extinction ratios of key aerosol types derived from selected Aerosol Robotic Network locations, Journal of Geophysical Research-Atmospheres, 110, D10, 2005.

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12, C4975–C4977, 2012

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Derimian, Y., Dubovik, O., Tanre, D., Goloub, P., Lapyonok, T. and Mortier, A.: Optical properties and radiative forcing of the Eyjafjallajokull volcanic ash layer observed over Lille, France, in 2010, Journal of Geophysical Research-Atmospheres, 117, 2012.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 13363, 2012.