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Atmospheric Measurement Techniques
Discussions

Interactive comment on "Benefit of depolarization ratio at $\lambda = 1064$ nm for the retrieval of the aerosol microphysics from lidar measurements" *by* J. Gasteiger and V. Freudenthaler

Anonymous Referee #2

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The authors present simulation results in regard of the benefit of using the lidar depolarization ratio at 1064 nm for an improved characterization of volcanic ash. The topic deals with one important question that currently is placed rather high on the list of potential future lidar development: at how many wavelengths should the depolarization of dust and ash be measured in order to improve our current knowledge of physical properties of these particles?

The paper is well written and acceptable. Some additional information would be helpful and would increase the merit of the paper. The authors tackle this question be means of forward computations in which they use particles of ellipsoidal shape. To which size

range was the T-matrix method applied before the geometrics optics approach was used? What is the maximum radius of the particles that could be considered in the computations? The authors point out that parameters are given in one of their previous publications. I consider it helpful if an overview (table) is given in this paper, too. The paper reports on one measurement of volcanic ash. To my opinion, the merit of the paper could be increased if the authors also show one example of dust measurements. Volcanic ash certainly is important in view of the impact the Iceland volcanic eruption had. The decision on measuring depolarization at two or three wavelength however will be mainly driven by the question: how much do we gain in regard of observations of mineral dust? I am not sure if I understand the simulations in the results section/statistical verification. Did you use one particular size distribution as "truth" for your tests? What happens if the volcanic size distribution, i.e. effective radius is a factor two lower or a factor two higher? Are depolarization measurements at 1064 nm still that important? What is the impact of the quality of the retrievals if the real part of the refractive index is different for another type of volcanic ash, or in other words: is it possible to generalize the results of your study so that the lidar community can use these results for a future volcanic ash even if the composition of the particles differs? Figure 3 shows the results for m-real versus effective radius. Can you show the same plot for the imaginary part? Can you explain why the "correlation" shown in Figure 3 fans out, becomes wider with increasing effective radius? You assumed a wavelength independent refractive index in your simulations and also in your assumption of the "true value". Can you corroborate this assumption, or in other words: do you have information in how much real and imaginary parts could vary across the three measurement wavelengths? I am missing a brief overview on results by other authors who reported on this volcanic ash event. Did they find results that could either influence the conclusions of our study or point toward parameter values you would need to consider in a follow up study? What would be the impact on the quality of your results? This question is also important if these results are to be applied to observations of ash in other regions where volcanic activity and thus the impact on air traffic is high. Your study in that regard would potentially contribute to discussions if a next generation space lidar should be equipped with one, two, or three depolarization channels. A respective comment on this would be very helpful in the abstract and the conclusions section. All in all it is a nice paper that contains valuable information and it points to future research that needs to be done on this topics.

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 5095, 2014.