

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-29

Anonymous Referee #1

Referee comment on "Retrieval of aerosol microphysical properties from atmospheric lidar sounding: an investigation using synthetic measurements and data from the ACEPOL campaign" by William G. K. McLean et al., Atmos. Meas. Tech. Discuss.,
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Authors suggest an approach to inversion of multiwavelength lidar measurements to the particle microphysical parameters based on iteration scheme with prior assumption about particle properties. In this manuscript authors make an important step considering parameters both the fine and the coarse mode. Simulation performed with synthetic data provides estimation of retrieval uncertainties for different lidar configurations. The manuscript is well and clearly written and matches AMT scientific criteria.

I have just several short comments.

Authors consider 12 independent parameters of aerosol, when even for "super-lidar" only 9 observations are available. The problem is underdetermined and unique solution does not exist. I think this principal question should be discussed in the beginning of the manuscript.

This becomes especially critical when configuration corresponding CPL or ATLID lidar are considered.

Choose of model refractive indices for different types of aerosol is somehow convenient, but question is how sensitive are results to the choice of model. For example, in Table 1 the imaginary part of dust at 355 nm is 1.66×10^{-2} . The same time, in recent study the Im for dust at 370 nm is below 0.005 (Di Biagio, Atmos. Chem. Phys., 19, 15503–15531, 2019) for dust of different origin. Will it influence the inversion?

In Table 7 the parameters of the coarse mode obtained from the lidar measurements are

not provided. Any reason?

Fig.1. Axis title fonts should be increased.