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Atmospheric Measurement Techniques Discussions

Interactive comment on "GARRLiC and LIRIC: strengths and limitations for the characterization of dust and marine particles along with their mixtures" *by* Alexandra Tsekeri et al.

Anonymous Referee #1

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The authors provide comparison the inversion of lidar data combined with sun photometer (SP) measurements using GARRLIC and LIRIC algorithms. These algorithms are widely used in the lidar community, so their comparison is important. Moreover, inversion of lidar observations collected during CHARADMExp helps to understand better the potential and issues of lidar-SP combining. The manuscript is well written, the authors understand the limitations of their approach and openly discuss it. I think manuscript can be published after minor revisions.

I think in the introduction it would be useful to mention the main (to my opinion) issue of lidar-SP combining. The modal radii of both modes are taken from SP and assumed

to be height independent (refractive index as well). Still these values may change with height, for example, due to hygroscopic growth, or due to the presence of layers with different aerosol types. So what will be impact of this height variation to the retrieval?

Additional comments

1. Reference "Müller, et al., Atmos. Meas. Tech. Discuss., 8, , 2015". Why AMTD? Wasn't it published?

2. p.11 ln.20 "More specifically, they managed to reproduce this backscatter spectral dependence with imaginary part values of 0.005-0.05 at 355 nm and 0.005 at 532 nm".

In the paper Veselovskii et al., 2016, the simulation was performed imaginary part at 355 nm (mI(355)) varying in the range 0.005-0.05, but values of BAE close to experimentally observed were obtained for mI(355) about 0.01.

3. p.11, ln.22 "Although these values are not the same with the 22 retrieved 0.001 at 355 nm and 0.0005 at 532 nm for our case. . ."

These values of mI are too low for dust

4. p.11, ln.23 "The backscatter spectral dependence can be a combination of the effect that different factors have on the backscattered light, as the size, shape or orientation of the dust particles" I think this statement is unclear and unsupported. Yes, size distribution will influence". I am not sure about shape, at least not in the frame of spheroids model. How orientation can influence?

5. p.11, ln.27. "Differences are seen only for the real part of the refractive index, which for GARRLiC is at $\sim$1.45, at the low end of the dust climatological value range of 1.48$\pm$0.05-1.56$\pm$0.03 as reported in Dubovik et al. (2002)." AERONET can't be used as a referencel value for dust refractive index, because it may underestimate the real part. Laboratory and in situ measurements are more reliable.

6. Fig.5. AERONET shows increase of mI at short wavelengths, which agrees with

known in situ measurements, while mI in GARRLIC doesn't show spectral dependence. Can you comment it? Low values of mI are usually obtained in inversion when high depolarization ratios are considered, because spheroids model can reproduce it only for low mI. Do authors use depolarization ratio in retrievals?

7. Fig.8. Second row. Misprint. "Garrlic 532" is printed twice

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