Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC2
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Comment on amt-2021-152

Anonymous Referee #2

Referee comment on "A Bayesian parametric approach to the retrieval of the atmospheric number size distribution from lidar data" by Alberto Sorrentino et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-152-RC2, 2021

Report:

The Manuscript is interesting to read and provides a new idea in using a Bayesian model and a Monte Carlo algorithm under a few strong assumptions:

(1) The complex refractive index (CRI) is fixed (wavelength independent) and must be known a priori. Therefore, the title of the manuscript is not appropriate, since lidar data do not provide the CRI.

(2) The modes (fine, coarse...) are fixed log-normal distributions.

(3) The number of modes has to be known a priori, otherwise the retrieval could fail, see given examples.

(4) The values r_min and r_max are essential values, too, known from other References. In line 203 one learns that these values also must be known a priori.

(5) The tested error level of 5% is too small for lidar data.

Other remarks:

- Line 137 misprint
- Line 154 misprint
- Equation (13): What is \delta?
- What is the difference between r_a and r_min and r_b and r_max, respectively?
- Line 218 misprint
- Figure 2: axis labels?
- All Figures: captions provide not enough information.
- Only one CRI was used for the simulations: 1.49+0.019, which is known from other References that it is a "good" one, i.e., the degree of ill-posedness is small.
- Figure 8 is not discussed and the results are astonishing.
- Section 3.4. Results with real data: This is not at all a retrieval with real data. This is only a simulation with size distributions and CRI which were found by AERONET retrievals.

Further References which are important and missing:

Ritter, et al., Microphysical Properties and Radiative Impact of an intense Biomass Burning aerosol event measured over Ny-Ålesund, Spitsbergen in July 2015, Tellus B: Chemical and Physical Meteorology, 2018.

Ortiz-Amezcua, et al., Microphysical characterization of long-range transported biomass burning particles from North America at three EARLINET stations, ACP, 2017.

Müller, et al., Microphysical particle properties derived from inversion algorithms developed in the frame of EARLINET, AMT, 2016.