

Authors use Bayesian approach and Monte Carlo algorithm to retrieve the particle size distribution from so called 3+2 observations. This is definitely important task, but authors in beginning of manuscript, should clearly formulate: how many unknowns they have (six at least) and how many input data they use (five). The problem is underdetermined and unique solution does not exist. So authors should clearly explain how do they treat this issue. The plans to retrieve three – modal distributions in the future look unrealistic.

5% error in input data is rather optimistic assumption, it can be up to 10% or even higher. How level of errors in input data will influence the retrieval? Authors should clearly formulate what is advantage of their method comparing to existing approaches.

Authors assume that refractive index is known. This is a weak point of this research. I think that variation of RI will strongly complicate the retrieval. And application of algorithm to real lidar measurements is very desirable.

Technical comments

Ln 11-14. Can be skipped. It is well known.

Ln 15-19. There are too many papers on this subject. Better refer to books or reviews.

Ln 27. In order to retrieve the microphysical properties of the aerosol from lidar measurements, two inverse problems must be solved in sequence: in the first inverse problem, one uses the measured backscattered power to obtain an estimate of the aerosol optical parameters

I am not sure that calculation of backscattering and extinction coefficients should be called an inverse problem.

Ln.31 estimate of the number size distribution

Why do author consider number size distribution? Normally volume distribution is used. Number distribution can be tricky when fine particles are considered.

Ln 114. total number of parameters to be estimated is therefore $3N$, which is substantially smaller than the number of parameters

So for bimodal PSD you have 6 unknown parameters plus unknown real and imaginary part. How many input data do you need?

Fig.3-6 In caption should be given parameters used in calculations.