Atmospheric Measurement Techniques Discussions

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Comment on amt-2021-307

Anonymous Referee #1

Referee comment on "Retrieval of UVB aerosol extinction profiles from the ground-based Langley Mobile Ozone Lidar (LMOL) system" by Liqiao Lei et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-307-RC1, 2021

This work present and iterative method to obtain lidar ratio at 292 nm, which is later applied, to Langley Mobile Ozone Lidar (LMOL) backscattered signal. Once lidar ratio at 292 is estimated, authors use the classical Klett method to obtain independent aerosol extinction and backscattering. It is well-known in lidar literature that Klett method can not provide accurate estimates of extinction profiles because of possible variations of lidar ratio with height.

Nevertheless, the authors try to address an important challenge and provide an estimation of lidar ratio at 292 nm. Typically, backscattered lidars use co-located measurements of sun-photometry AOD for estimating lidar ratios (see for example MPLNET or EARLINET/ACTRIS retrievals). Currently, there are not many radiometric measurements that provide aerosol AOD at 292.

However, I do not rely in the approach presented by the authors. It might need further explanations. But as I understand they propose iterative variations of lidar ratio in LMOL system and provide different aerosol extinction profiles. The range of variation of lidar ratios is not enough because absorbing aerosol can present lidar ratios larger than 90, and OMI satellite retrievals demonstrated the importance that aerosol absorption might have extinction. On the other hand, I understand that they vary Angström exponent iteratively in HALO system to obtain equivalent aerosol extinction at 292 nm. They are ignoring possible effects of variations of Angström exponent with altitude. If so I would rely more on Angström exponent measurements using sun photometry. Finally, for the evaluation they are using the same data that for the computation in the iterative method, which is not appropriate.

With all these points I propose to evaluate the method with CCNY lidar for 355 nm and make intercomparisons with extinction coefficient at that wavelength computed by Raman methodology.

Section 4.2 does not provide any relevant scientific results. It only shows coherence in the vertical structures of aerosols, and for that it is not necessary to retrieve extinction coefficients. Moreover the study-case selected to demonstrated the novel methodology must be different than that used for the validation.

Finally, section 5 only shows that lidar ratio is the most important parameter in the retrieval of backscattering and extinction, which is widely known in lidar community. What is necessary in section 5 is sensitivity test of the new methodology proposed by the authors, which can be done using synthetic data.