

Interactive comment on “Retrieval of aerosol complex refractive index from a synergy between lidar, sunphotometer and in situ measurements during LISAIR experiment” by J.-C. Raut and P. Chazette

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The positive comments of the referee#2 are greatly appreciated.

1/ “What uncertainties will be introduced by using equivalent BER instead a real one?” An altitude-dependent BER would have been indeed particularly appreciated in this study but the lack of a Raman lidar leads us to suppose a constant BER in the atmospheric column. This hypothesis is not however to discard since extinction profiles simulated in Sect. 3.3.2 are in agreement with lidar-derived extinction coefficient profiles. Flamant et al (2000) assessed uncertainties in the BER profile on the error in the extinction profile. They derived the particulate BER from modal diameters and refrac-

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tive indices in literature introducing them into a Mie code. They showed that errors on lidar-derived extinction coefficient values throughout the lower troposphere are mainly due to the error on the reference extinction coefficient (about 20%) rather than the error on BER profile (about 5% in the plume). Furthermore, BER does not rapidly evolve with increasing RH. Calculations of the relative variation BER as a function of RH have been performed at 355 nm for RH comprised between 30% and 80%. In this range, BER shows variations lower than 10%. That comment has been introduced in Sect. 6.2.

This reference will be added in our list of references: Flamant, C., Pelon, J., Chazette, P., Trouillet, V., Quinn, P.K., Frouin, R., Bruneau, D., Leon, J. F., Bates, T.S., Johnson, J., Livingston, J. : Airborne lidar measurements of aerosol spatial distribution and optical properties over the Atlantic Ocean during a European pollution outbreak of ACE-2, Tellus B, Vol. 52, N. 2, 662-677(16), 2000

2/ We completely agree with the referee that altitude dependence can also explain the different values of Angström parameter in Fig.2 derived from the instruments. This remark will be added in the revised version (Sect. 2.3).

3/ As noticed by the referee, the ACRI derived from AERONET are averaged through PBL and are therefore lower than ACRI retrieved from in situ measurements that deal with ground level measurements. This comment was always included in the manuscript but it is probably worth to quote it again when comparing ACRI to AERONET retrieval in Sect. 4.3.

4/ The revised version of the article will mention in Sect. 1 the interesting work of D. Müller et al. to retrieve ACRI from an other method using multiwavelength backscatter and extinction lidar measurements:

Müller, D., Wandinger, U., and Ansmann, A: Microphysical particle parameters from extinction and backscatter lidar data by inversion with regularization: Theory, Appl. Opt., 38, 2346- 2357, 1999.

Müller, D., Ansmann, A., Wagner, F., Franke, K., Althausen, D.: European pollution outbreaks during ACE 2: Microphysical particle properties and single-scattering albedo inferred from multiwavelength lidar observations, *J. Geophys. Res.*, 107(D15), 4248, doi: 10.1029/2001JD001110, 2002.

5/ Figure 15 caption is erroneous. The revised version will include the technical correction: “Evolution of BER (left) and (right) with increasing relative humidity (RH) at 532 nm (a) and 355 nm (b)”. These results are in agreement with experimental results obtained on the ground with RH=28% and presented in Fig. 6.

6/ In Sect. 6, “Should vertical variability of BER be taken into account in Fig. 16, 17 when deriving the extinction profiles from lidar data?” The study performed in Sect. 6 leads to a comparison of extinction profiles simulated on the one hand from ACRI and size distribution retrieved on the ground as well as RH profiles through Hänel's laws, and on the other hand inverted from lidar data. This approach enables to validate our method developed so as to retrieve ACRI, since it compares profiles deduced from two independent ways, although the determination of ACRI has recourse to the BER. The only way to take into account the vertical variability of BER in the atmospheric column when deriving the extinction profiles from lidar data would be to calculate backscatter and extinction cross-sections through Hänel's laws and a Mie code. That requires using ACRI and size distribution retrieved on the ground, and thus introduces a strong correlation between the two expected kinds of extinction profiles. The comparison would therefore not be possible any longer. Taking into account the vertical variability of BER thanks to the effect of RH on aerosol scattering properties would have been welcomed if our objective had been the retrieval of extinction profiles. That is not the purpose of this article.

7/ In the acknowledgments, we have also included : Part of this research was also funded by the French PRIMEQUAL-2 program.

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