

Interactive comment on “Spectral Aerosol Extinction Monitoring System (SAEMS): setup, observational products, and comparisons” by A. Skupin et al.

Anonymous Referee #2

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General Comments: This is a paper that presents the operating principle along with the technical details, of an instrument (SAEMS) continuously measuring the spectral extinction coefficient of atmospheric aerosol particles. A case study is also analyzed, and for the reliability of the atmospheric products provided by SAEMS a comparison with other instruments (lidar, sun photometer, in situ sensors) is reported. The study reported here is, in reviewer's opinion, worth of being published in Atmospheric and Measurement Techniques scientific journal. I would suggest to the authors, especially to the abstract and conclusion section, to highlight more the rationale behind this development. The message from this paper should be more clearly stated. To the reviewer's

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knowledge, SAEMS is the first instrument capable of reproducing ambient aerosol optical properties at near ground level, and this is the major advantage of SAEMS, compared to other commercial instruments. The paper is well written, very innovative and in order to be improved I would suggest to the authors to take into consideration the following comments. Minor Comments: 1. Page 8652, line 18 [Equation 5]: The sign of minus is missing from the right side of the Ångström exponent equation.

2. Page 8670: The caption of Figure 5 is really very explanatory, but it is recommended also a legend on the plots [especially for the bottom plot of Fig.5], for better and easier understanding of the case.

3. Page 8659 line 10: Please add to the reference, the “Ansmann, 2006”, you are mentioning in this line.

Major Comments: 4. Page 8658, line 1: “The slight AOT decrease with time may be partly related to a decrease in relative humidity in the PBL from the morning to the noon hours”. Is this correct? From AERONET time series for the case study shown, during early morning hours from [05:00-10:00 UTC] AOT values are quite stable at 0.5 [at 500nm], with varying total columnar water vapor values [from 1.38 to 1.51 cm]. In addition from 09:00 to 11:00 UTC there is a sharp increase in the PBL top height, staying stable later on. The same behavior [with the same rate actually] can be observed for values of AOT at 500nm. As the PBL top height increase, is easier for the aerosol entrapped below this height limit, to be diffused in larger areas, leading to slightly smaller AOT values. Why not the AOT variation is not linked with the PBL top height instead of the RH values measured in ground level?

5. Before 09:00UTC lidar measurements do not exist? If so, from where information of the PBL top height was taken for the production/calculation of dark blue triangles used at the last plot of Figure 5? For those calculations, is the first lidar observational value of the PBL at 09:00UTC [800m] used, supposing stable PBL height until 09:00 UTC? In any case this is something that should be mentioned in the paper.

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6. Figure 7: In the same way that the aerosol extinction coefficient retrieved by SAEMS at 550nm [circle filled with green color], would be also great to be demonstrated for the other also near lidar wavelengths [355 and 1064nm].
7. In Figure 9 the authors are demonstrating the spectral particle extinction coefficient measured with SAEMS, in-situ measuring dry aerosol particles and AERONET. It is clearly explained why a spectral slope of 33% difference is observed between AERONET and SAEMS. What is not sufficiently explained is why in all wavelengths the extinction vertical mean values up to 3km, derived from AERONET is always lower than the ones measured by SAEMS, at ground level. A discussion on this was made by the authors in page 8658 lines 13-16 [Because relative... SAEMS values], is this really the case? SAEMS measure the extinction coefficient for an optical path [~ 3 km] in ground, while AERONET in the atmospheric column, with a lot of assumptions.
8. Please provide some references in the text, for the aerosol optical properties and inverted products, retrieved by AERONET sun-sky radiometer. It would be very interesting if the authors could provide a more quantitative error indication on the volume size distribution calculations by the three instruments, demonstrated in Figure 10. This could give an idea of how such a comparison would be in case of coarse particle domination from ground up to the top of PBL height, in case that this is not examined so far.
9. The authors estimated that the temporal changes to the derived particle extinction coefficient could lead up to 5% uncertainty. This is due to the 30 min of measurement cycle because of the usage of one mirror [element 6 from Figure 1] for reference and measurement tower procedure. The usage of an extra mirror splitting the initial light source to the corresponding towers would significantly decrease the measuring cycle to 15 min, since the procedure will be done in parallel for both towers. How possible is the approach to use the same optomechanical detection module but different mirrors for sending the light to the retroreflectors?

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Please also note the supplement to this comment:

<http://www.atmos-meas-tech-discuss.net/6/C3630/2013/amtd-6-C3630-2013-supplement.pdf>

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 8647, 2013.

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