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Interactive comment on “Aerosol vertical distribution, optical properties and transport over Corsica (western Mediterranean)” by J.-F. Léon et al.

Anonymous Referee #3

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This paper presents a study of the aerosol vertical profiles in Corsica Island mainly from lidar measurements. Sun-photometer and satellite AOD measurements are used to constraint the inversion of the lidar signal using the Klett's method. Then, the vertical profiles of the aerosol extinction coefficient are obtained and their monthly evolution and their relationship with the air mass origin are studied in the paper. Moreover, the discussion of specific episodes for mineral dust and pollution aerosol are carried out. However I am concerned of publishing this paper on ACP due to the following reasons: - The paper lacks a clear focus and there are no new scientific findings. - The used methodology is well known and the database is too short (around 1-year mea-

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surements) to establish a climatological study of the aerosol vertical profile. As the authors claim in Pag. 3 and Line 21, there are already a lot of papers devoted to the characterization of the aerosol vertical profiles in the Mediterranean basin. What is different in this paper? - A more detailed analysis of the quality of the lidar data is needed (see specific comments) - The paper is not well organized. The instruments, the observations, the data processing methods for each kind of measurements (lidar, sunphotometer, satellite, etc.) and the results are addressed in the same section. I suggest the separation of observations, methodology and results in different sections. - The data analysis is poor and confusing, a more in deep discussion of the obtained results is desired.

Specific comments: P 2. L 10: What the ± 0.09 means? The same throughout the entire paper, Are these quantities the standard deviations, the uncertainties? Please explain it. P9. L5. Figure 4 compares the AOD obtained from sun-photometer, lidar and satellite. If the sun-photometer (or satellite) AOD are used to constraint the inversion of Lidar signal. It is clear that the AOD obtained from the lidar is close to the sun-photometer and satellite observations. What do the authors attempt to demonstrate with this picture? P9. L10. In Figure 5, the authors show the extinction profiles on a monthly basis for 2012 and 2013 separately. This is the most problematic figure. Several issues indicate that the quality of the lidar data or the way in which the Klett inversion was applied are suspicious. - Usually such sharp peaks in the extinction coefficient, which are observed in most of the figures, are associated to the presence of clouds. However, it is rare to observe them in the monthly mean profiles since the average of several profiles should smooth that peaks. Therefore, this feature may indicate that the cloud screening is not working well during the automatic data processing. Has the cloud screening been tested by visual inspection? On the other hand, how many measurements were used to evaluate the monthly mean extinction profiles? If the average is done only with few profiles, the remaining cloudy peaks may strongly impact the resulting average. I suggest to impose a minimum number of profiles to carry out the average and to avoid this. - The figures show a systematic increase in the extinction

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coefficient with the altitude over the 2 km. It is difficult to associate this increase with the real aerosol behavior, especially in the monthly mean profiles. In almost all cases the extinction at 7 km altitude is higher than that observed near the ground (e.g. Fig. 5 May, October). This behavior might be related with the poor quality of the lidar signal or with the reference altitude chosen for the molecular signal. In the unlikely case in which this high extinction coefficient (around 7 km) was due to the aerosols, why not extend the y-axis in order to show the upper boundary of the aerosol layer? The authors should explain this issue with detail. - The authors should include the standard deviation in these figures and give the number of measurement profiles used in the average.

A detailed check of these point is mandatory to trust in the results presented in this paper.

Sections 3.3 and 3.4. The comparison of the extinction coefficient obtained with lidar with the in situ measurements at the surface and the determination of the layer altitude is meaningless if the quality of the lidar profiles is not firstly checked.

Pag. 12. The discussion section is confusing. The authors analyze several specific events (dust and pollution) during the measurements period in terms of the AOD and air mass origin. They study a day-by-day characteristics of each single episode. I suggest analyzing separately the average behavior and characteristics for all the dust episodes, and all the pollution episodes founded during the measurements period.

Unfortunately, I am very suspicious of the data analysis procedures and the results obtained in this paper.

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 9507, 2015.

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