Interactive comment on "Overview of SLOPE I and II campaigns: aerosol properties retrieved with lidar and sun-sky photometer measurements" by Jose Antonio Benavent-Oltra et al.

Anonymous Referee #2 Received and published: 27 March 2021.

We would like to acknowledge the work done by the referee in the revision of our manuscript. We appreciate his/her effort and contributions to improve the quality of the paper. Our answers to reviewer are shown in bold and the changes inserted in the manuscript are noted here in italic and between quotation marks. The changes in the new version of the manuscript are noted in blue.

Reviewer's comment

Author's response

Changes in the manuscript.

General comments:

The paper offers an overview of the remote sensing, in situ and aircraft measurements done in SLOPE campaigns at Granada. In addition, it is aimed at testing GRASP performance, using the configuration combining photometer and lidar, in determining microphysical and optical aerosol properties. These retrievals have been validated against in situ and aircraft measurements. The validation results confirm the feasibility of GRASP to characterize the aerosol properties in different aerosol conditions and show its potential to analyze high-load aerosol events (dust and biomass burning). These results provide significant information for the operative use of GRASP retrievals in climate studies. The paper is well written and structured. It is well written and structured and fits perfectly with the aims and scope of the ACP journal and the research interests of its readers.

The point-to-point responses to the Referee #2's comments are summarized below:

Specific comments:

Instrumentation

At the begining of the site and measurements section (Sect. 2) the authors assert that airplane measurements on board of Partenavia P68 airplane were done (L132). However the instrumentation described in sect. 2.3 is referred to flights carried on by a Piper PA 34 Seneca airplane. As far as I know they are two different types of airplane. Can you explain this or correct it, if needed?

We specially acknowledge this comment since it is a mistake. There was only one type of airplane: the Partenavia P68 airplane. We have corrected it as follows:

(sect. 2.3, line 209): "*... with an airplane* (Partenavia P68) *equipped with in-situ instrumentation ...*"

Results:

L372. There are different papers in the literature that revealed larger absortion in the UV for mineral dust in the Mediterranean region, that is not observed in this work. Do you have any explanation about it?

We agree with referee # 2 that the obtained SSA values reveal a lower absorption than those reported in the literature for pure desert dust. However, these values are consistent with those obtained by other authors in the same study area for dust events (Valenzuela et al. 2012). The SSA values obtained in the UV region are lower than in the visible and IR regions, showing the typical pattern of mineral dust. Besides, in these cases there are a mixture of different types of aerosols and AOD. Fig. 7a shows that the 25th percentile of SSA values are smaller than 0.85 in the UV region; it indicates that there were cases with a large absorption in this region.

L382. Apparently there is contradictory information in this paragraph. First, in L374 the authors assert: ...relative large values of SSA for all wavelengths indicate important fraction of non-absorbing aerosol particles. And then in L382. "GRASP has revealed the large contribution of aerosol absorption in total aerosol optical depth during SLOPE I and II field campaigns even for cases with relatively low AODs" Please, explain it better.

We agree with referee # 2 that these two sentences are contradictory. We have rewritten these sentences as follows:

(sect. 4.2.1, line 388-389): "These relatively large values of SSA for all wavelengths indicate a small concentration of absorbing aerosol particles (e.g., mineral dust)."

(sect. 4.2.1, line 398): "*Nevertheless, GRASP has revealed* a small *contribution of aerosol absorption in total aerosol optical depth …*"

L426. The sentence: " ..GRASP retrieval...." should be rewritten for a better understanding.

Following reviewer suggestion, we have rewritten this sentence as follows:

(sect. 4.2.2, line 442-444): "Thus, GRASP retrievals show the capability of this code to characterizing aerosol absorption coefficients with vertical resolution, being a step forward to aerosol characterization."

L93. Please change "allow" by "allows".

Corrected

L132. Please change "allow" by "allowed".

Corrected

Figures:

Fig. 6. Since the figure represents a time serie, please add stright lines joining the markers to an easier view of the evolution.

We add lines joining the markers in Figure 6.

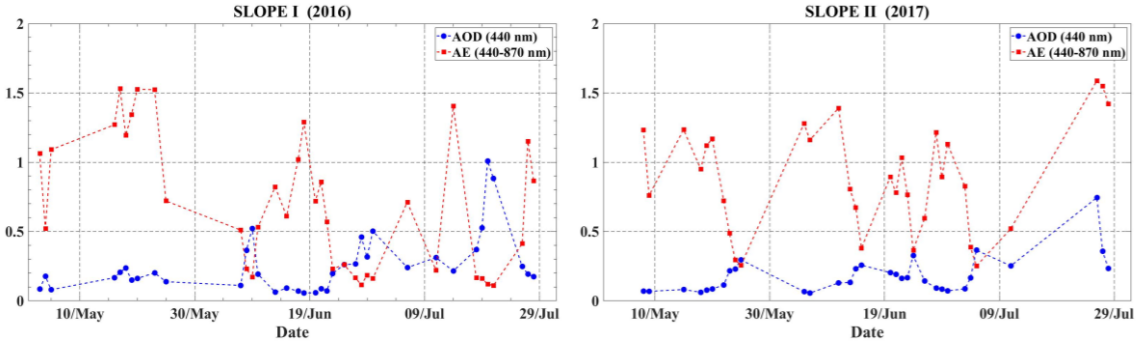

Figure 1. Temporal evolution of aerosol optical depth (AOD) at 440 nm and Ångström exponent (440–870 nm) retrieved by GRASP during (**a**) SLOPE I and (**b**) SLOPE II campaigns.

References:

Valenzuela, A., Olmo, F.J., Lyamani, H., Antón, M., Quirantes, A., Alados- Arboledas, L.: Analysis of the desert dust radiative properties over Granada using principal plane sky radiances and spheroids retrieval procedure. Atmos. Res. 104–105, 292–301, https://doi.org/10.1016/j.atmosres.2011.11.005, 2012.