Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC3
https://doi.org/10.5194/acp-2021-66-RC3, 2021

Comment on acp-2021-66

Anonymous Referee #3

Referee comment on "Overview of the SLOPE I and II campaigns: aerosol properties retrieved with lidar and sun–sky photometer measurements" by Jose Antonio Benavent-Oltra et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-66-RC3, 2021

This paper addresses an evaluation of the aerosol property profiles retrieved from GRASP algorithm and which uses as inputs lidar and sun-photometer (SPM) measurements versus in-situ measurements. The in-situ measurements were carried out at Sierra Nevada Station (SNS) and on board of an aircraft. The work presents different relevant aspects that show its importance and novelty. This is the first time that GRASP algorithm using as inputs lidar and SPM measurements (GRASP) has been evaluated for absorption coefficient in a long-term comparison. In addition the work have dealt with the complexity of comparing different techniques (remote and in-situ) which also cover different ranges in the Earth-atmosphere system (surface and almost full troposphere). The results presented here show a good agreement between the optical properties from techniques and larger discrepancies in the volume size distribution when fine particles are dominant.

So after these comments I conclude that the paper is very interesting, well written and show the capability of GRASP approach to retrieve vertical information of aerosol properties based on this long-term study. I consider that this work is appropriated for Atmospheric Chemistry and Physics and it should be published after some minor corrections:

Specific comments:

Line 23 -26: Sentence needs rewording

Lines 65 - 69: If you have elastic and inelastic signals you can also calculate the backscatter coefficient using the Raman techniques, which present the advantage that you don’t need any assumption of LR. So please be more precise in this sentence, it sounds

that you only can calculate the backscatter coef. using klett method.

Line 75: replace “retrievals” by “retrieval”.

Lines: 100 – 104: Confusing sentence: I imagine that you mean that the combination of SPM and ceilometer allows obtaining less optical properties than using multi-wavelength lidars, but the sentence should be more explicit. The authors refer “long-term vertical profiles” from the combination of SPM and ceilomter, it is difficult to know what you mean.

Line 207: d.o.o. : Can you say what it means for the first time that is cited in the manuscript?

Line 8: Please, replace “de” by “the”.

Methodology. General comments: I recommend to put the description of GRASP in a subsection, for example 3.1, in order to put it at the same level than aircraft data section. In addition, I suggest including in this section a paragraph talking about the lidar inversions. I guess that you are using the Klett algorithm to obtain the backscatter profiles, but it should be indicated. If this is the case, the assumed lidar ratio and the criteria for choosing those values should be discussed.

Lines 235-236: This sentence should be clarified. The sentence mixes GRASP and LIRIC algorithms, with an inversion method (for lidar measurements, which is not indicated) with a measurement technique (in-situ). It should be more elaborated to make it more understandable.

Results. General comments: The statistical analysis should be better described. The number of the cases (profiles) used for the different analyses is not mentioned at any time.

Lines 276 – 277: Please rephrase the sentence. You could write something like: “The aerosol volume concentration at SNS were calculated for the 0.05 – 0.5 and 0.5 – 10 μm radius size ranges for the fine and coarse modes, respectively.

Lines 317 – 318: It should be mentioned that is at 532 nm. Why is it not calculated for other wavelengths? How is it calculated the extinction from in-situ? Did you use the sum of the scattering and absorption from different in-situ instrument? This should be indicated in the manuscript, perhaps in the methodology section.

Figure 6: For clarity, it should be helpful to indicate the year for each plot of the figure.

Lines 408 – 409: “The decays do not reveal any decoupled layer with altitude”: This statement is difficult to corroborate when all the profiles are plotted. I guess that for some individual profiles decoupled layers of the Planetary Boundary Layer could be present.

Lines 420: Comment: The shape of the profiles does not look like exponential.

Line 471: “For intensive optical properties, …”. Do you mean “extensive” ?