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Comment on acp-2021-388

Anonymous Referee #2

Referee comment on "Statistical validation of Aeolus L2A particle backscatter coefficient retrievals over ACTRIS/EARLINET stations on the Iberian Peninsula" by Jesús Abril-Gago et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-388-RC2, 2021

General comments

This is a generally well written paper about a satellite validation effort and addresses case by case intercomparison, as well as a more statistical approach of ground based lidar observations as a reference to the novel ESA-AEOLUS/ALADIN space borne lidar aerosol products (L2A).

The intercomparison is limited to backscatter profiles of aerosols only, and pertinently does not include clouds, nor extinction profiles.

Specific comments

Introduction
The introduction of the paper is lengthy and distracts from the actual content of the paper. I miss the point why of the descriptions of all the networks is there, while the paper is based on three ground based lidar stations on the Iberian peninsula. The fact that these stations are part of ACTRIS/EARLINET is relevant, especially for the quality control of the instruments as well as the central data processing that is harmonised in the network. I suggest that the introduction is substantially shortened and focuses on these main points. It is relevant to refer to the ground based intercomparisons/validation efforts of optical profiles from other active space borne sensors, as the applied methodology is largely taken from these previous efforts (e.g. colocation criteria and network design).

Similarly, the main purpose of the Aeolus mission is a technological demonstrator for active wind profile measurements from space, as well as a demonstrator for the impact of those data on operational numerical weather prediction of those space borne observations.

The optical data are, from a point of view of the mission, a by-product. I suggest that the introduction is also shortened to help the reader.

Section 2.1, Line 134-135
"Currently, L2A products access is still limited until a more confident version of the data products is achieved." This is a rather important statement. Here more explanation is needed. Perhaps the authors consider that the value of their manuscript may be devalued because of this since the conclusion will change after a new version of the Aeolus processor is released, but for the reader it is important to know a bit more about this.

Section 2.2
A table with the station properties would be very helpful for a clear overview for the reader and gives the opportunity to shorten the lengthy descriptive text.

Section 3.1, Line 235 and further
"In the current study, only aerosol products (L2A) are considered, and in particular particle backscatter coefficients derived from the Standard Correct Algorithm (SCA) and Standard Correct Algorithm middle bin (SCAmb)." Here the authors should explain why they limit themselves to the backscatter profiles and do not take into account the ALADIN L2A extinction profiles. After all, this is a first for space borne observations (CATS was configured to provide HSRL extinction profiles, but the instrument failed partially on this point.)

Section 4.2.1, Line 365
A reference is made to profiles that are not shown. Please show the data.

Section 4.2.2, Line 391
A reference is made to sunphotometer measurements that are not shown. Please show the data.

Section 4.2.1, Line 408
A reference is made to profiles that are not shown. Please show the data.

Section 4.2.3
The case is presented as a smoke case, but proceeds to explain that there was a mixture of smoke and mineral dust. Please change the title of the section to remove the contradiction.

Section 5, Conclusions
The first paragraph contains important information about the version of the data

considered for the intercomparison. This should be mentioned either in the introduction or section 2.1 about Aeolus.