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Atmospheric Measurement Techniques Discussions

Interactive comment on "Characterisation of aerosol size properties from measurements of spectral optical depth: a global validation of the GRASP-AOD code using long-term AERONET data" *by* Benjamin Torres and David Fuertes

Anonymous Referee #1

Received and published: 25 November 2020

General comments:

Overall, this is a well-written paper describing the large scale validation of the GRASP-AOD product. Considering this product is able to retrieve total column size distribution and some optical properties without the need of having sky radiance measurements, GRASP-AOD will provide valuable information for atmospheric research and will certainly be widely used. I consider that this manuscript fits perfectly into the scope of AMT. I recommend publishing the manuscript, but there are some minor/technical details that I would like to be addressed in this discussion process.

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Discussion paper

As general comment, this paper presents a very comprehensive and compelling study on the validation of the GRASP-AOD product. A similar study was already performed by Torres et al. (2017). However this new paper is approached as a large-scale validation using AERONET as the most widespread operational network for ground-based aerosol observation. The use of thirty sites and some million of observations worldwide provides robustness to this analysis. However, the results have been listed in this work as a pure sequence of 20 pages with numbers and some partial conclusions that are very difficult for a reader to follow. I therefore suggest that the authors make a synthesis effort so that the results are clearer for the reader.

Specific and technical comments:

Page 4, line 120: This is not the first time that GRASP has been mentioned in the text. Therefore, I recommend including the acronym once GRASP-AOD product is referred.

Page 5, line 153: Please, correct the typo “teen”.

Page 6, footer line: Please correct the Cimel version. It is not CE-310 but CE-318.

Page 8, first paragraph: In this part of the text the authors stated that the priority was the selection of sites with high aerosol loads. However, some lines below, they stated that the GRASP-AOD products do not depend on aerosol load. This sentence seems confusing for the reader. It is also confusing the fact that, if your aim is including sites with predominantly clean conditions, why selecting only two among some hundred stations? Please clarify.

Page 11, line 255: Are you using the AERONET Version 2 instead of Version 3? Is this specific process you are talking about in this paragraph not provided in Version 3?

Page 19, second paragraph: The reason for having higher on-average AERONET retrievals in comparison to SDA and GRASP-AOD is attributed by the authors to the radius cut-off used in AERONET to define the two modes. I suggest the authors to describe briefly the differences between the three compared techniques. This description

would be more enlightening than attributing beforehand the problem to the AERONET's cut-off.

Page 23, last line: Is there a typo or a lost sentence within the text? Please, correct.

Page 24, line 424: "the interest of presenting"

Page 36, second paragraph: In this part of the text is stated that the main interest of having aureole measurements is adding extra information for improving the coarse mode characterization in situations of partial cloudiness. However, I consider that this improvement cannot be linked only to conditions of partial cloudiness. Furthermore, there are other possible and important applications in the use of this type of measurements, such as quality control, cloud screening, among others, that should be acknowledge. Regarding the use of aureole measurements to improve the aerosol characterization, there are published papers that have also followed this philosophy, such as the work published by Román et al. (2017). These authors proposed the use of an all sky camera to add aureole information into the GRASP code. Please acknowledge in this Section.

Page 36, line 645: Refractive indices are necessary to run the GRASP-AOD, even when aureole measurements are performed. But, taking into account that aureole measurements are relatively insensitive to chemical composition, do the authors consider is still relevant the use of climatological data, or the effect of the uncertainty on the refractive index in this case is less important?

Pages 38-40, lines 704, 711, 714 and 744: The statement about the excellent agreement for fine mode is repeated throughout the conclusion section. Please avoid using redundant conclusions in this section.

Page 39, line 739: Spectral Deconvolution Algorithm is written here without the acronym, as the first time in the conclusion section, despite "SDA" has been mentioned in previous lines. Please homogenize the use of acronyms in the text.

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Discussion paper