

Comment on acp-2021-508

Anonymous Referee #1

Referee comment on "Long-term characterisation of the vertical structure of the Saharan Air Layer over the Canary Islands using lidar and radiosonde profiles: implications for radiative and cloud processes over the subtropical Atlantic Ocean" by África Barreto et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-508-RC1>, 2021

GENERAL COMMENTS

The study by Barreto et al. focuses on the vertical profiles of aerosol extinction and meteorological variables over Tenerife during Saharan dust outbreaks, compared to clean scenarios. The analysis is based on 12 years of data and is differentiated between winter and summer. The dust layer and the marine boundary layer characteristics are studied separately. The direct radiative effects of both aerosol and water vapour advected during the outbreaks is assessed in both the short- and long-wave ranges based on average profiles. Finally, some considerations about ice nucleation processes are given based on cloud statistics and model results.

Although the paper is quite long and not always a compelling read, it condenses a great amount of information that the interested reader can have all in one place. Hence, the paper deserves publication on ACP. Some marginal comments follow, mainly based on the reviewer's expertise.

SPECIFIC COMMENTS

1. Is the asymmetry factor the best way of representing highly forward-scattering particles? Have the authors checked whether there is any difference if the full phase function is used?
2. Have the authors compared the MOPSMAP output to the AERONET-derived aerosol properties within the common wavelength range?

3. As mentioned at line 579, low cumulus clouds prevent observation of higher clouds using the lidar. Could the anticorrelation seen in Fig. 6 between low and high clouds be partly due to this limitation? In the specific case study, an all-sky camera was used to prove the presence of cirrus (not seen by the MPL-3). However, the cloud statistics in Fig. 6 only rely on the lidar profiles.

TECHNICAL REMARKS

- abstract: acronyms should be avoided in an abstract unless a term is used multiple times (e.g., MPL-3 is only used one and other abbreviations only twice);

- l. 54: "studies... study" ("investigation" or "research" can be used instead?);

- l. 61-69: the Introduction is very long. Maybe these lines with detailed considerations might be dropped?

- l. 78: "Therefore" is used as a consequence of what? It is not obvious that biomass-burning aerosol has specific geographical provenance;

- l. 98: "from Tenerife" (Tenerife was already mentioned one line above) could maybe be replaced by "in the same area"?

- l. 161-163: information on how aerosol properties at slightly different wavelengths are compared (mentioned at lines 441-443) could be anticipated here;

- l. 183: only arrival altitudes are mentioned. Does ARTI also accounts for the trajectory altitude above the Saharan-Sahel surface?

- l. 189: it could be anticipated that an additional criterion based on aerosol quantities derived by AERONET (l. 247-250) is also used to identify the dust air masses;

- l. 228: this sentence is too general and unclear. Please, rephrase;

- l. 267: is the presence of residual dust a sign that 120h is a too short period for the back-

trajectory calculations?

- l. 267-268: the two sentences are maybe a bit confusing? It sound like both the second extinction maximum and the minimum are located at the same place, i.e. near the MBL top;

- l. 297: what does "500 km above Western Sahara" mean here? Is it "north of"? Same at line 358;

- l. 374: please, state the altitude levels used to estimate the temperature inversion;

- l. 399-400: "As a consequence" does not refer to the previous sentence, but to the one before. Please, reorder or rephrase;

- l. 427: acts "in" modifying?

- l. 514-519: have the authors validated the cloudscreening procedure described, and how? How different are thick Saharan dust layers from clouds, as seen by the MPL?

- Fig. 10: "ln10" --> "log10".