

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2021-508

Anonymous Referee #2

Referee comment on "Long-term characterisation of the vertical structure of Saharan dust outbreaks over the Canary Islands using lidar and radiosondes 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-RC2>, 2021

The manuscript presents the seasonal evolution of meteorological vertical profiles and lidar-derived extinction coefficients using long-term observations in Tenerife. Data were analysed under the clean scenario, the summer-Saharan scenario, and the winter-Saharan scenario. Both dust and water vapour impacts in the radiative balance were investigated. The ice nucleation processes were also discussed. The dataset is interesting, and the manuscript is well written. The manuscript is worthwhile to be published, after addressing all the points raised by reviewers.

Please see below some suggestions and comments:

The manuscript is long, and with too many acronyms. The Appendix A helps a bit, but I had to continuously go back and forth to remind myself what all those acronyms represent. Maybe reduce some used of abbreviations, e.g. clean FT (CFT). Besides, it would help if some important abbreviation definitions were added in the figure captions.

I agree with the first reviewer, that acronyms should be reduced in the abstract.

In the abstract (l 8) and conclusion (l 600), "it was associated with lidar extinction coefficients $\sim 0.030 \text{ km}^{-1}$ ". Please clarify this "extinction coefficients" (max at which height? mean with standard deviation?). In line 265, you mentioned the maximum in the median extinction profile is $\sim 0.033 \text{ km}^{-1}$.

l 9 add "+" for 48%

l 10-11 clarify "lower levels" and "higher levels"

l 128-131 this paragraph is more related to the section 2 "site"

l 154-158 The full overlap of MPL-3 is at ~ 5 km agl. I assume you have applied overlap corrections in this study, was the same overlap correction applied to all profiles?

The lower limit of the reliable backscatter / extinction profiles after the overlap correction is 300 m? With the uncertainty of only 10 % near ground?

"a relative uncertainty in the overlap correction between 5 % and 10 %", do you mean uncertainty on the NRB or derived optical profiles?

Any vertical smoothing was applied in the profiles?

l 159-167 LR were estimated using two-layer approach, and then applies to derive extinction coef. What were the LR values? These are interesting information to present.

What is the error/uncertainty on the derived extinction coefficients? Can it be added in the median extinction profile (e.g. by error bar)? I assume in the overlap region (below 5km), this uncertainty has higher value.

Fig.1 Mean extinction profile is not in the grey shaded area, especially in fig.1b. do you have an explanation?

Please specify "lidar total extinction at each level".

Is the height asl in all figures?

Table2, for winter "and summer" seasons.

Fig.4,5 add "523nm" in the caption for extinction.

l 547 fig.6b not a

l 563-564, information was not shown in fig.7b, add the reference of Fig S8 here.

"-" are not visible in fig.7b, change the figure as in Fig S8.

Fig.7 change "nINP"

1567 m³

fig S7, 1h time averaged MPL-3 profile centred on 10:54? please clarify.

add the time for the DREAM extinction profile. what's the shaded area for DREAM profiles?