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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Unusual vertical structure of the Saharan Air Layer and giant dust particles during AER-D" *by* Franco Marenco et al.

Anonymous Referee #1

Received and published: 11 September 2018

The manuscript nicely provides an overview on the research flights performed during the AER-D aircraft campaign (6-25 August 2015). The presented study documents the vertical structure of the dust transport layer over the tropical eastern Atlantic between the Cape Verde Islands and the Canary Islands, highlighting a case of an exceptional SAL structure occurring during the AER-D campaign. For this, the authors make use of airborne lidar data, particle size distribution (more details in Ryder et al., 2018), and pyranometer measurements.

General comments:

(1) In the abstract (line 15-16), the authors suggest that "future campaigns should focus more on events with high aerosol load"- Would that create a bias towards high dust loading events? In particular as such events are less frequent than dust events

with average or low dust loadings.

(2) Introduction: It may be worth to add a few more sentences on the seasonal variability of the SAL regarding height, extent, presence etc. in order to seasonally place the results obtained in the framework of AER-D.

(3) The individual section on lidar measurements (vertical distribution of dust particles), dust particle size distribution and pyranometer measurements could be tied together in closer way. Something like a systematic clustering of cases (flights) could be a way to illustrate coincidences as an interpretation guidance on the one side, and be an outcome with potential of application beyond AER-D on the other side.

(4) Page 4, line 19: "exceptional vertical structure". Exceptional with respect to which reference? Please clarify.

(5) Which impact of the meteorological situation / atmospheric circulation regime on the occurrence of the exceptional SAL structure can be expected? Was the atmospheric circulation regime during August 2015 unusual ultimately allowing for the formation of such a dust front? Some sentences on the meteorological / atmospheric situation would help to understand the meteorological circumstances resulting into this case.

(6) Following the present structure of the manuscript, results on lidar measurements, size distribution and radiation are presented in separate sections. The conclusion section briefly addresses all measurement techniques applied in one section. A discussion combining lidar profiles, particle size distribution and pyranometer measurements in concert would provide the opportunity to thoroughly tie together and benefit from this multi-method approach.

(7) Which role play the giant particles for radiative forcing? A brief paragraph discussing this would be a valuable contribution, in particular with respect to the motivation given in the introduction section.

(8) Page 9, line 23-30: Lightning due to presence of dust aerosol or due to meteorolog-

ical condition? The link is quite interesting, however, here it remains rather speculative. Maybe some more arguments can be provided? (Please see also comment (5) above.)

(9) Page 10, line 6-13: Here, a list of suggestions for further investigations is provided. The first suggestion is on quantifying how unusual the observed vertical structure was by means of satellite observations. The manuscript could benefit from including such a study as this would extend the scope of the results presented. This would also contribute to comment (4) made above as it could serve as a kind of reference when identifying exceptional structures.

Minor comments:

Page 6, line 24: Are times given in UTC? Please clarify.

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