

## ***Interactive comment on “Impact of long-range transport over the Atlantic Ocean on Saharan dust optical and microphysical properties” by Cristian Velasco-Merino et al.***

### **Anonymous Referee #1**

Received and published: 16 January 2018

The discussion paper by Velasco-Merino et al investigates changes of the Saharan dust properties due to the trans-Atlantic transport on the basis of AERONET sun photometer data. The analysis is supplemented with trajectory simulations. Overall, this is a nice study covering almost 20 years of data. However many, mainly minor, improvements are necessary before publication in ACP is recommended.

General comments:

\* The language needs to be improved. It would be really good if the paper is corrected by someone who speaks English as his/her first language. Though there is a "English copy-editing service" that the paper will go through before publication in ACP, the au-

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thors should pay attention to correct spelling and grammar (according to the "General obligations for authors" of ACP).

\* "African zone", "African area", "West African area", "African sites" are used to describe the same thing. Same for the Caribbean. I suggest to always use "West African sites" and "Caribbean sites" to be clear.

\* Also the term for the trajectory-derived links varies and thus is not precise. I suggest to make this more clear, for example by avoiding "connection" and using only "links" throughout the paper.

\* In general, it should be mentioned in the legends (and where important in the text) what the uncertainties in the figures stand for and how they were derived.

\* In the discussion it is not mentioned that there is also some uncertainty in the AERONET products.

\* Furthermore, putting the results into context with existing literature could be done more extensively (for example using additional SALTRACE papers). Most evidently, the conclusion section lacks a discussion of the impact of the paper, which should be added.

Some specific comments:

\* Something like "based on AERONET data" should be added to the title to make clear that this study is based on AERONET data.

\* In the abstract it should be mentioned that AOD refers to 440nm.

\* Page 1 / Line 17ff.: I suggest "... we identify 3174 days on which the air mass over the Caribbean sites was linked to at least one of the two West African sites, which is on average 167 days per year. For 1162 of these days, AOD data is available for the Caribbean sites as well as for the corresponding West African sites about 5-7 days when the air mass overpassed these sites." (might be corrected if necessary)

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- \* P1/L20: You need to include in the abstract how you characterize "mineral dust outbreaks" (high AOD, low AE on both side of the Atlantic?)
- \* P1/L23: I suggest to show "ER\_CAR-ER\_AF" not "ER\_AF-ER\_CAR" (also in the main text and Fig. 10) since you want to show the impact of long-range transport.
- \* P1/L23: The change of effective radius does not really fit to "the volume particle size distribution shape shows no change".
- \* P1/L24: Of which cases? Saharan dust should always be non-spherical.
- \* P1/L27: Suggestion: "... deposited into the Atlantic Ocean but significant amounts reach the northern ..."
- \* P2/L1: Please make more clear what you mean with "to human health transporting bacteria".
- \* P2/L3: Suggestion: "Observations of the dust transport from Africa over the Atlantic Ocean to the Americas were performed using meteorological ..."
- \* P2/L10: "in the subtropical zone" could be removed.
- \* P2/L12: "held" -> "performed"
- \* P2/L19: Suggestion: "The temporal coverage of the AERONET data is as large as 19 years from 1996 to 2014." (Remove "1996-2014" on line 22)
- \* P2/L25: "comparison" -> "correlation"
- \* P3/L3: "includes cloud-free screening" -> "is cloud-screened"
- \* P3/L4: "are only referred" -> "refer"
- \* P3/L4-5: The part starting with "hence" is redundant.
- \* P3/L9: Why write here 340nm when the lowest sky wavelength is 440nm? Or are there really sky measurements at 340nm? For consistence with P3/L1 (AOD range) I

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would suggest to write 1020nm as the upper limit.

\* P3/L8: Do you also use principle plane measurements? If not, this should be mentioned.

\* P3/L26: Though "global" is not completely wrong here, I suggest to use a different term because now it also sounds like you have a world-wide climatology...

\* P4/L3-4: "using the model vertical velocity": This sentence now sounds like the back-trajectories don't need horizontal velocity. Please rephrase.

\* P4/L30: What about case "NoD\_AF+D\_CAR"?

\* P4/L33: after "AE" you could insert: "The measurements at the other days are affected by clouds on one or both sides of the Atlantic" (or maybe for additional reasons?)

\* P4/L34: "as mineral dust outbreaks". Is this when the criterion on line 24 is met on both sides of the Atlantic? Should be specified more clearly.

\* P5/L9-10: It is not clear what this sentence means.

\* P5/L13: Remove "West Africa" and add "at the West African sites" after "AE"

\* P5/L20: "tropical biomass burning aerosol emissions throughout the year": I can not find this in Leon et al. (2009). Please check again.

\* P5/L25: It is not clear what "This feature" refers to. Please rephrase.

\* P6/L22: "aerosol size parameters" -> "size-related aerosol parameters" (or something else) - The term "size parameter" normally refers to the size of a particle relative to the wavelength.

\* P6/L26: Please rephrase "The seasonal cycle shape of VPSD"

\* P6/L30: "The fine mode plays an almost negligible role ": This is too general (also at some other places in the text). This is true for particle volume and mass. However for the optical properties, in particular at short wavelengths, the fine mode can not be

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neglected. For things like particle number concentration (or for cloud condensation nuclei) the fine mode is dominant even during dust outbreaks.

- \* P7/L6: "but the shape is identical" is redundant.
- \* P7/L21: "3174 cases": It is not clear what happens in the case when for more Caribbean sites a trajectory link is found on one day. Is it counted as one day and the aerosol data of that day is averaged over the stations? Should be clarified.
- \* P7/L24: "only 2 days per year": I think "per month" would be better here (same on line 28)
- \* P7/L24: "could be linked" -> "coincides"
- \* P7/L30: Data present at both regions?
- \* P8/L12-15: So 16 days are "NoD\_AF+D\_CAR"?
- \* P8/L15+L18: Figure 7 not 8.
- \* P8/L23: Write "... lowering the AOD threshold so as to ..."
- \* P9/L1: The sentence "The decreases ..." could be removed in my view.
- \* P9/L16: "... and only in Africa (D\_AF+NoD\_CAR)" is not in Fig. 9
- \* P9/L30-31: Also uncertainties of the inversion can be a reason for negative differences.
- \* P10/L9: "together" -> "in the same layer"
- \* P10/L18: "absorption power" is proportional to AOD times (1-SSA). So this term is not correct here.
- \* P11/L3-4: "in the eastern Atlantic" -> "on the east side of the Atlantic"
- \* P11/L15: But the relative decrease is the same for smaller and for larger AOD values?

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\* P11/L19: Change of effective radius does not fit to line 17 ("no substantial changes in the shape of the volume particle size distribution")

\* P11/L20: "The change of these quantities": It is unclear what this refers to because some before-mentioned quantities did not change.

\* Table 1 legend: "period of AERONET data" -> "considered time period" ; "different sites" -> "different AERONET sites"

\* Figure 6: Is it possible to divide the number of connection by number of months?

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