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Interactive comment on "Seasonal provenance changes of present-day Saharan dust collected on- and offshore Mauritania" *by* Carmen A. Friese et al.

Anonymous Referee #2

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In the manuscript, "Seasonal provenance changes of present-day Saharan dust collected on- and offshore Mauritania" the authors present data from sediment traps at multiple depths off the coast of Mauritania and surface collection sites close to the coast. They attempt to determine location and seasonality in potential source regions for different case studies based on the mineralogy of the samples and back trajectory analysis.

The description of the methodology and measurements is comprehensive and well thought out. I cannot speak to the specifics of the measurement methodology but have added minor comments and clarification requests below. Unfortunately, the broader context and the scientific developments are lacking in the paper. The measurements

are clearly valuable and should be published. The analysis of collected samples and the potential source regions is thorough in a qualitative sense. However, the useful scientific conclusions are not clear. This is indicated by the abstract that reads more like and introduction, the long, subjective discussion, and the relatively sparse summary and conclusions. For example, the last paragraph of the manuscript states that sediment records from land and ocean are likely to sample different source regions, based on the measurements showing more local sources over land. This could be an interesting point, but without further analysis (firmer understanding of the sources, dependence on the particular measurement site) the conclusion that sources are more likely to be local on land than at an ocean site further downwind seems common sense. I'm also not convinced that the atmospheric and sediment trap data should be presented side by side based on the difference in collection methodology and catchment. I think the authors need to consider how to better frame the important measurements presented in this manuscript, by presenting the data in a way that is easier to compare with other dust deposition and concentration measurements and a more thorough back trajectory analysis that answers the questions laid out in the introduction.

The choice of questions (lines 76-79) is a little strange. For example, (1) why would one not expect there to be seasonality in the deposition when we know that there is seasonality in winds leading to dust emission and transport? (2) This is an interesting question, but how dependent is this on the specific locations chosen? (3) This is very similar to question (1). (4) This is a good question but is only tackled in a qualitative way in the manuscript. I think laying out the questions to be answered is a good format; however, they currently seem like an afterthought and they should be returned to explicitly in the summary/conclusions.

While the back trajectory analysis is interesting, it is rudimentary. The choices of back trajectory heights appear to be arbitrary, I did not find a reason for the choice of 4500 m and 10 m is understandable, but those trajectories will be highly uncertain. A larger ensemble of back trajectories from different altitudes and start points would better quantify

the likelihood of dust sources and also help represent the uncertainties in back trajectories that pass so close to the surface. Further, including surface wind reanalyses (and other meteorology) in a comprehensive analysis of the mineralogy measurements and back trajectories, a more rigorous statistical analysis of likely source regions could be undertaken. A statistical approach would also provide a framework to analyze future measurements, rather than the case-by-case methodology shown. This would also help reduce the speculatory nature of the discussion of sources in Section 4.2.

Are the distributions really unimodal in Figure 6, as stated on line 620? I can see the finer mode and sometimes a third mode in there. Coming from an atmospheric modeling perspective, the mode between 1-10um is of great interest and it is a shame that this is not discussed more. From an atmospheric perspective, the value of this work could be increased by presenting more information on the finer dust particles. Models are always in need of aerosol size distribution measurements for evaluation of dust emission, transport and deposition. It would also be useful to have the size distributions presented as dM/dlnD or dV/dlnD to allow for comparison with model simulations and other measurements.

To summarize, I think:

- The measurements and presentation of the results are of great value

- Determining dust sources could benefit greatly from an analysis of surface winds from meteorological reanalyses to accompany the back trajectories.

- The summary and conclusions seems like an afterthought in the current presentation. Consider expanding this to crystallize the findings of the research better.

- The questions to be answered that are set out in the introduction are vague. It is useful to set out the motivational questions for the manuscript in this way, but I think more time should be put into the questions to be addressed and then ensuring that you return to these points in the discussion/summary/conclusions.

Minor Comments

line 14-15, 34 "Environmental parameters" is non-descriptive. Please revise. Line 34 could be deleted.

line 95 "In the following," - add comma

line 131 - Haboobs are normally defined as the dust storm from evaporatively driven cold pool outflow from convective events, not low-level jets

line 161-163 - this paragraph seems disconnected from the rest of the section

line 222 and 235 repeat

line 247 - why is 2xCorg removed from the total mass? Is this a general scaling from organic carbon to organic mass?

line 350 - I think the long url links should go in the data availability section rather than in the text. Write out the usage but simply reference the data section rather than talking about downloading files in the manuscript.

line 357-358 - this repeats the previous sentence, condense.

line 377 - "ground station" could be misinterpreted as on land, consider "surface station"

line 461 - define "well sorted"

Figure 6 - These are not really unimodal, as referred in the text (line 620)

line 602 - which year?

line 608 - is horizontal flux a useful metric to compare with ocean deposition?

A minor issue, but there are formatting errors with brackets on the references throughout that need fixing.
