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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Seasonal cycle of desertic aerosols in West Africa: Analysis of the Coastal transition with passive and active sensors" *by* Habib Senghor et al.

Anonymous Referee #1

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In this paper, the authors present an analysis of the seasonal evolution of desert aerosol properties (AOD, SSA in particular) along a longitudinal band covering a part of Sahel and of the Eastern Atlantic Ocean. They use a combination of passive and active space-borne remote sensing observations, together with meteorological data and numerical weather prediction analyses.

In spite of some merit, the paper contains too many inaccuracies. The authors do not really have a solid knowledge the dynamics/thermodynamics features of the WAM system impacting the atmospheric boundary layer over the Sahara, the dust emission and transport over the region. I have made numerous comments along these lines in the following. No mention is made to previous projects/campaign that have taken

place in the area and contributed to advance knowledge on dust-dynamics interactions: GERBILS, FENNEC, SAMUM. Some AMMA results are discussed.

I also think that the authors should discuss also to what extent the change in aerosol properties at land-sea transition has an impact on air-sea interactions or even the radiative budget in the region. . .

For the reasons above, my recommendation is "major revision". The authors need to address the lacks that are highlighted above and in the subsequent comments, before the paper can be considered as suitable for publication in ACP. I have not done the job of editing the manuscript at this stage.

Specific comments

Abstract

NCEP, CALIOP, OMI and SeaWIFS have to be defined

Introduction

L21-25: not only America. . . Transport pathways also include EU and the Mediterranean, depending on the season. Please correct.

L31: even larger particles have been found close to source regions: see the work of Ryder et al. during FENNEC

L37-38: no, the Observatory in Barbados set up by J. Prospero goes back to the 1960s

L39-40: also cite the work of Shepanski et al. who have used the high temporal resolution of SEVIRI to analyze emission hot spots location and frequency

L43-44: not true. MODIS or MISR allow identifying dust using SSA, deep blue is almost exclusively a dust product. . .

L46-47: what signal. . . be more specific

L48: the SAL is defined L 52

L48-49: The vertical disconnection of dust layers between land and ocean: I do not understand this. The SAL is an emanation of the Saharan ABL which is undercut by the low level flow from the Atlantic. . . this flow penetrates over the continent during the day.. so that the disconnection is not necessarily appearing at the land-sea transition..

L55-56: are those elements part of the composition of dust? Otherwise where do they come from?

L57: not true, see the recent BAMS paper on the SALTRACE campaigns

L67: CALIOP and CALIPSO need to be defined.

Section 2: methodology and data What stations did you use? They should be listed here. . . Are you using level 2 data only?

Section 3 : results

L171-173: can you explain why the SSA-related correlations with ARONET stations are so low compared to the AOD-related correlations which are quite good. . .? Is this link to the threshold of 0.9 that you have selected? Changing this threshold to a higher value may improve the correlations. . . Also, it is unclear why the SSA correlations a better near the coast (M'Bour) where I would expect greater mixing of dust with other particles) than over the continent where dust should be present almost exclusively. . .Also you are saying that the SS correlation in Cape Verde is better than over the continent, which is not true based on the numbers given in the text: 0.3 in Cape Verde Vs 0.47 and 0.5 inland.

Figure 3: To what dust hot spot are the largest AOD values observed related to? From your map this looks to be the Aïr region? What is happening there? In your domain you are not including the Bodélé depression, arguably the largest dust source in the world, why? Why are the largest AOD values observed in MAM? What are the dynamical processes related to these emissions?

L187: unclear what is meant here by "largest dust particles are mobilized and raised

above the continent by convective systems".. Are you referring to dust mobilization at the leading edge of cold pools? This is a very efficient mechanism for sure, but only when soil moisture is low and vegetation has not grown yet, i.e. May and June over Sahel. . . Please be more explicit what is meant here. Do you refer to Fig. 4c of Rajot et al?

Generally speaking, I think this Figure should be better described with more insights into the processes and hot spot regions leading to the observed distribution of AOD and SSA.

L202: "ABL develops vertically to reach the level of the SAL." No! The SAL is an emanation of the SABL has explained above. . . the fact that the aerosol layer is detached from the surface is related to the flow from the Atlantic penetrating over the continent. One way to show that would be to add zonal winds (in the form of arrows) in the cross-section: you would see westerly winds where the there is no or littles dust in the low levels and easterly winds in the upper levels where dust is observed.

Discussion

L218: "[. . .] and the vertical distribution of aerosols is not supported by a favorable wind regime ascending particles." What do you mean? This is very unclear. . .

L222: "These West African emission zones participate actively to the transport of mineral aerosols in the near Atlantic Ocean.": this is lame, please rephrase

L233-236: It is the dry convection related to the solar heating that drives the development of the Saharan boundary layer and hence the fact that dust aerosols are seen up to 6 km or more in the summer. What is happening in the region of the ITD is marginal in this process. . . The dust layer overpassing the monsoon flow maybe be slightly elevated due to the cold air undercutting the warmer dust-laden air, but the monsoon flow is not deep enough to account for the change in elevation of the top of the SAL.

L241: "In summer, atmospheric dynamics raise large dust particles that are subject

to the law of universal gravitation of Newton," Tell me something that is not!! How pompous and meaningless is that?

Section 4.2: I feel this section should be better tied up with the discussion of Figures 4 , 5 and 6 as it brings essential dynamics and thermodynamics information to the reader not familiar with West African weather.

Conclusion

L320: "In summer, convection associated with structures that develop at the ITCZ distribute dust over 6 km height and create a thicker AOD." I totally disagree.. It is dry convection over the Sahara and northern Sahel that controls the height of the top of the SAL and the altitude at which the dust from eastern sources towards the west.

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