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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Mapping the physico-chemical properties of mineral dust in western Africa: mineralogical composition" *by* P. Formenti et al.

Anonymous Referee #3

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The paper compiles and provides an overall assessment on mineral dust properties in Northern Africa based on data collected during several field campaigns. Regional variations on dust mineralogical and chemical composition are poorly described in climate models and this paper will clearly help to understand and constrain some important parameters. The paper assesses mineralogical composition, which is important in radiative calculations, and iron speciation, which may partly constrain iron solubility.

The paper deserves publication in ACP as it provides a very rich dataset and an interesting data analysis. I also acknowledge the authors for collecting and publicly sharing their database. I believe that more detailed studies on dust properties will follow using

these dataset.

I have three major comments:

1) The paper needs a thorough revision by an native English speaker, particularly the Introduction.

2) Many of the results presented and discussed in the paper are related (or partly related) to the effects of soil weathering. I refer to figures 3, 6, 7 and 8. The relative proportions of Ca, Fe and Fe oxides and TiO2 are party related to soil weathering at sources. The Sahel is highly weathered, showing low amounts of Ca, higher amounts of Ti and iron oxides. Surprisingly there is no reference to these well-known processes. I recommend the authors to read the publications of Shi et al (2011 and 2012) and I ask them to enrich the discussion of the results.

Shi, Z., et al. (2011), Influence of chemical weathering and aging of iron oxides on the potential iron solubility of Saharan dust during simulated atmospheric processing, Global Biogeochem. Cycles, 25, GB2010, doi:10.1029/2010GB003837.

Zongbo Shi, Michael D. Krom, Timothy D. Jickells, Steeve Bonneville, Kenneth S. Carslaw, Nikos Mihalopoulos, Alex R. Baker, Liane G. Benning, Impacts on iron solubility in the mineral dust by processes in the source region and the atmosphere: A review, Aeolian Research, Volume 5, August 2012, Pages 21-42

3) Related to the previous point. I have my concerns about the validity of the assumptions in section 4.2.2. The section assumes that iron in aluminosilicates control iron solubility in dust. This section is written as if this is not an assumption but something proved. There is quite a lot of debate in the literature in this respect. I again refer to Shi et al. (2012) for this discussion. I am not asking to change the section. I am asking the authors to balance and discuss this assumption acknowledging other points of view. It is not clear that aluminosilicates control iron solubility. Nanometer-sized iron oxides in poorly weathered soils may be also important. This should be noted and discussed in

the section and the final discussion.

Minor comments:

- Figure 3 and related text (page 10261, lines 14 to 30): It would help the reader to distinguish between the sub-ranges in the figure with different colors following the text.

- Page 10266, lines 16 t 20. The sentence makes no sense unless you refer to the “clay” mineralogy of the soil.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 10241, 2014.