

**Paper acp-2014-190 by Formenti et al.**

**Answers to Anonymous Referee #3**

We would start by thanking the referees for useful comments and suggestions which surely improve the readability and the significance of the paper. We have tried and addressed their comments at the best of our possibilities.

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 TiO<sub>2</sub> are partly 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.

Shi, Z., 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

The paper is mainly focused on the mineralogical composition of dust. The chemical/mineralogical relation between the aerosol and parent soils is one of basis of the identification of sources. In consequence, it is difficult to talk about the effect of soil weathering on aerosol composition since it is one of our working hypotheses (section 3.1.). However, to clarify the difference of mineralogical composition of parent soils in the introduction and to mention the difference of soil weathering, we have added a sentence add in L15 P10245:

“The mineralogy of the Saharan and Sahelian source areas have different mineralogy: the Sahara is mainly composed by calcisols or arenosols, whereas the Sahel is richer in weathered plinthosols (Fe oxides/kaolinite/quartz) (Pye, 1987; Claquin et al., 1999; Caquineau et al., 2002; Nickovic et al., 2012; Journet et al., 2014). As a consequence, mixing or layering of dust transported from the Sahara and locally emitted by convection over the Sahel should be detectable through differences in the composition over the atmospheric column. “

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.

To balance the discussion on the minerals which are providers of soluble iron, we add a sentence in L15 P10272: " Moreover, Shi et al. (2011) mention the presence of highly-soluble nanoparticles of ferrihydrite or poorly crystallized iron in fine fraction of soils. However, the quantification of this iron phase is obtained by sequential extraction and is difficult to apply on field samples due to the low mass. So we are not able to consider this species in our calculation."