

Review for the paper submitted by C. Aghnatiou, R. Losno and F. Dulac for Biogeosciences Discuss., 11, 2623–2637, 2014

#### General Comment

This is a very well written paper in the suite of other papers within the DUNE project and I recommend it for publication with only minor changes.

In the experiment presented here, one of the dusts prepared for the DUNE project was used: sample Q, unprocessed soil dust from a Tunisian soil considered to mimic atmospheric transported Saharan dust to the Mediterranean. The authors submitted a fraction (10 mg) of this unprocessed dust to several leaching steps with successive acidic solutions (100 mL of solution pH from lab water, pH 5, pH 3 and pH 1). This was designed with the aim to determine the solubility of the nutrients and micronutrients (Ca, Sr, Ba, Mn, Fe, Al and P) when dust comes in contact with different types of wet conditions (from non polluted rainwater at high pH to cloud acidic droplets) so that inferences and comparisons of the behavior of dust can be made with experiments where dust is introduced in a mesocosm experiment.

The experiment is well designed and described and results are correctly presented and discussed. Nonetheless I will suggest a few modifications and clarifications.

#### Specific Comments

##### Experimental Protocol

You use certified reference material SLRS-4 from NRC, Canada. However, I've been perusing in the NRC web and only could find reference material SLRS-5 (River water reference material for trace metals). Was this one the one you used?

Did you use any reference material for P?

##### Results and discussion

Page 2627 line 19. Specify how the calcium index of dust is calculated.

Page 2628 paragraph 5-10. You comment here the pH results from the leachings. The actual data are provided in Supplement Table 1. However, my opinion is that a Table containing the results is needed here. I suggest to include here a Table with the averages of the pH values and the nutrient solubilities in the 3 leachings at each pH step. To emphasize the differences between the 3 results you can also provide the range of values.

Page 2628 paragraph 15-20. The sentence starting with "Gleyzes et al (2002) and ending with Filgueiras et al 2002" is confusing. Please clarify what is stated by which of the authors.

Page 2630 paragraph 0-5. There is an error in the Mn%, since 21% corresponds to pH1 (from data in Fig 3) and here this value is attributed to pH3. At pH3 the solubility of Mn is 18%. Once this is corrected, one can see that the comparison between results from leaching with solution pH3 and results from processing with synthetic cloud water (as reported in Wuttig et al 2013) are not that similar: for Mn and Al, pH3 solubilities are about half those obtained with cloudwater (if we take 34 as a medium value for the range 27-41 % for Mn in cloudwater). On

the other hand, for Fe the solubility at pH3 (from data in Fig 3) is about double that of the cloudwater processed dust. Could you comment on that?

Page 2639 lines 10-15 when discussing the P solubility, other authors have come to higher solubility % for Saharan dust in rainwater than that reported for Corsica. For example, Herut et al. (1999) *Limnol & Oceanogr* 44 indicate a range 8-11% for P dissolution and Izquierdo et al. (2012) *Atmospheric Environment* 49 reported a 11.2% dissolution in African rains, although in this latter, the interaction of dust and pollution was also suggested. These results may be included and discussed in this section.

Minor corrections

Page 2625 Line 11. Instead of "These leaching tests", write "The leaching tests reported here"

Page 2630 line 4, instead of "let us assume" use "indicates"

Page 2630 line 26, instead of "without invoking..." use "with the acidic conditions typical of cloud water".

Page 2630 line 27, instead of "liability" use "lability"