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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Minor effect of physical size sorting on iron solubility of transported mineral dust" *by* Z. B. Shi et al.

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Comment: I'm not sure why you went ahead with the modeling, since it was clear you could not obtain the differences in solubilities observed in Baker and Jickells, 2006 with the soil samples you had? But it is interesting to see what those impacts are.

Response: Yes, based on the Fe solubility size distribution data, it is clear we could not obtain the difference in solubilities observed in Baker and Jickells (2006). We went ahead with modelling for two reasons:

(1) Only modelling can provide a direct comparison between Baker and Jickells (2006) datasets and the data simulated considering the physical size sorting effects. We can only know the magnitude of difference through this comparison. This is shown in Fig.

6.

(2) The model has been used to conduct a sensitivity test (Fig. 6). This test clearly showed that if the physical size sorting alone is important, the Fe solubility in the sub-micrometer size dust has to be unrealistically high. This test provided further and more concrete evidence that this process is not important itself, even if there are some variations of Fe solubility size distribution from other dust source regions.

To address this comment, we have added a sentence after page 14320, paragraph 2: "The simulated FS-Fe data are then compared with the field datasets (Baker and Jickells, 2006) under similar dust mass concentrations."

Comment: Hand et al., 2004 show that a simple chemical mechanism and the longer lifetime of fine particles does result in a realistic difference in fine and coarse mode solubilities; supporting your conclusions that size differencing alone can't explain.

Response: Chemical processing has been mentioned to be one of the possible reasons to lead to the increase in Fe solubility in dust with distance (page 14322, line 20-21). Hand et al. (2006) did provide useful information to support our conclusions. We added "Hand et al., 2004" to the reference list in page 14322 line 21 and line 24.

Comment: It is unfortunate that you did not look at P solubilities, since an interesting result of Baker and Jickells, 2006 was that while Fe solubilities did not look to change with distance from the sources, P solubilities did!

Response: It would be interesting to know how important is the physical size sorting in increasing P solubilities with distance. This is the work we are planning to do in the future.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 14309, 2011.