

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: The method for the soluble Fe extraction from the aerosol samples (with ammonium acetate buffer at pH 4.7 for 1-2 hours) was originally used by Sarthou et al. (2003) “as a model for Fe release from aerosol in rainwater.” Please provide an explanation how does this extraction procedure originally designed for the rainwater is relevant for the conditions of the current study. How would the conclusions of the current study change if 3, 4, 5 etc. hours were used for the extraction?

RESPONSE: In the current study, we aim to compare the simulated Fe solubility due to physical size sorting only to those measured Fe solubility in Baker and Jickells (2006). Therefore, we have to use exactly the same extraction scheme as in Baker and Jickells (2006), which followed Sarthou et al. (2003). We understand that no extraction scheme

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is perfect but the trend of the increase in Fe solubility with decreasing dust mass concentration appears to be universal regardless of the extraction scheme (e.g., Chen and Siefert, 2004; Baker and Jickells, 2006; Sedwick et al., 2007; Kumar et al., 2010; Witt et al., 2010).

If we used longer time extraction, e.g., 5 hr, our data would not be directly comparable with the field data sets in Baker and Jickells (2006), but the trend of increase solubility with decreasing dust concentration would likely still be present.

FURTHER REFERENCES

Sedwick, P. N., et al. (2007), Impact of anthropogenic combustion emissions on the fractional solubility of aerosol iron: Evidence from the Sargasso Sea, *Geochemistry Geophysics Geosystems*, 8, Q10Q06, doi:10.1029/2007GC001586.

Kumar, A., et al. (2010), Aerosol iron solubility over Bay of Bengal: Role of anthropogenic sources and chemical processing, *Mar. Chem.*, 121, 167-175.

Witt, M. L. I., et al. (2010), Atmospheric trace metals over the south-west Indian Ocean: Total gaseous mercury, aerosol trace metal concentrations and lead isotope ratios, *Mar. Chem.*, 121, 2-16.

COMMENT: Pg. 14310, Ln. 3 Please change “dramatically” to considerably. Also on Pg. 14312 Ln. 1.

RESPONSE: Changed.

COMMENT: Pg. 14310, Ln 1. “higher values generally observed over more remote parts of the oceans” leaves a reader with the impression that high values of soluble iron generally occur over the remote oceans. This is incorrect; very high values of soluble Fe were reported in urban fog/rain samples (e.g., Erel et al., 1993; Sedlak et al., 1997). Please revise.

RESPONSE: We have changed this sentence to “While the estimated total flux of dust

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to the ocean and FeT in the dust are relatively well known (Jickells et al., 2005; Mahowald et al., 2005; Guieu et al., 2002), the FS-Fe term varies considerably from ~0.1 to more than 80%, with higher solubility values generally observed when dust mass concentrations are low both over remote parts of the oceans and over polluted areas (e.g., Hand et al., 2004; Chen and Siefert, 2004; Baker and Jickells, 2006; Sedwick et al. 2007; Mahowald et al., 2005; Kumar et al., 2010; Erel et al., 1993; Sedlak et al., 1997; Theodosi et al., 2010)."

COMMENT: Pg. 14312, Ln. 3. It is not clear "In addition" to what. Please revise.

RESPONSE: We have deleted "In addition" and add an "also" between "Measures et al. (2010)" and "found"

COMMENT: Pg. 14313, Ln. 13: Please define "dithionite Fe."

RESPONSE: We have added "(crystalline Fe(III) oxides, mainly goethite and hematite, which can be extracted by citrate buffered dithionite solution)" after "The dithionite Fe"

COMMENT: Pg. 14313, Ln. 15: Please explain how does the similarity in dithionite Fe to total Fe ratio observed at the source region (of the Western Sahara and Tibesti samples) and in airborne Saharan dust samples suggest that "the Fe mineralogical compositions of the soil samples are similar to that of the airborne Saharan dust."

RESPONSE: As detailed in Shi et al. (2011, Global Biogeochemical Cycles), the dithionite Fe to total Fe ratio is a major parameter for Fe mineralogical composition, which is controlled by the degree of chemical weathering in the source region.

We have inserted "which is a major parameter for Fe mineralogical compositions in the dust (Formenti et al., 2010)" between "which" and "is dependent on the degree of chemical weathering of the source materials".

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