

## ***Interactive comment on “Delivery of anthropogenic bioavailable iron from mineral dust and combustion aerosols to the ocean” by A. Ito and Z. Shi***

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Received and published: 19 November 2015

We would like to thank the reviewer for his/her constructive comments. Since comments by Reviewer 1 were based on the version (acp-2015-487-manuscript-version1) that has not been revised after initial submission, our responses and revisions to the manuscript will be slightly different when citing line numbers.

### Specific Comments

Comment 1. Introduction: The aim of the study is provided both in the first and last paragraph of this section. Please reorganize, the aim should be mentioned in the

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same section, preferably in the last paragraph. Moreover, avoid redundancy, lines 122-126 are not required. The titles of each section should be enough for the reader to understand and of course from what it is already mentioned in this paragraph.

Response: We deleted the last sentence in the first paragraph to avoid redundancy, and merged it to the sentence in the last paragraph of this section in the revised paper, p. 6, l. 102-106, as is shown in following. We also deleted the sentences in lines 122-126.

“The model estimates “anthropogenic” soluble Fe supply from both dust and combustion sources to the oceans in association with past changes in air quality (including direct emission of soluble Fe in primary anthropogenic aerosol as well as conversion of insoluble Fe in Fe-containing aerosols to soluble Fe due to increased aerosol acidity) based on the Intergovernmental Panel on Climate Change (IPCC) emission data set.”

Comment 2. Laboratory experiments: Details on the Tibesti dust are provided in Shi et al. (2011a; 2015). So I would suggest in order to keep the manuscript short and to the point to start this section with line 139 adding just the information that using the procedure in the above reference little impact has been seen on Fe speciation and dissolution at acidic pH. The last comment is essential, however if the reader needs additional information they can look into the citation. Moreover, the detection limit for the dissolved Fe through the spectrophotometric method seems to be rather high compared to others in the literature.

Response: We moved the details on the Tibesti dust to supplementary material 2. The detection limit for the dissolved Fe is 0.05  $\mu\text{mol/L}$ , which is much lower than the measurements in our experiments. This is reflected in the Supplement, as follows.

“The detection limit for dissolved Fe is 0.05  $\mu\text{M}$  (Shi et al., 2015), which is much lower than the measurements in our experiments.”

Comment 3: Development of a new Fe dissolution scheme based on new experimental

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results: Focus on the new findings of your study i.e. Figure 3 comparison with literature not needed, it is mentioned in the manuscript. Lines 283-291 are results from previous reference. Yet again too much you should be concise as in Section 5.

Response: We deleted the comparison with Ito and Xu (2014) (blue squares) in Figure 3. But Lines 283-291 represent the comparison of new results in this work with previous results in Shi et al. (2011). We rephrase the sentences in the revised paper, p.13, l.261-268, as is shown in followings.

“The calculated thermodynamic solubility of this Fe pool at pH 2 is  $-3.34$  (mol L $^{-1}$  on a log scale). This is comparable to the previously measured thermodynamic solubility of nanogoethite, which is  $-3.6$  (mol L $^{-1}$ ) at pH = 2 (see Fig.7 in Shi et al. 2011). Thus this Fe pool likely includes ferrihydrite and reactive nano-Fe oxides aggregated on the mineral surface. This is consistent with higher Fe solubility of 1.2% as compared to that of the highly reactive Fe (0.63%) (Shi et al., 2011). Only 3.3% of Fe was dissolved at a dust/liquid ratio of 10 g L $^{-1}$  and pH 2, and Fe dissolution stopped at 180 h. The calculated thermodynamic solubility of the second Fe pool is  $-3.55$  (mol L $^{-1}$ ).”

Technical Corrections Comment 4: Page 2, line 15-17: I suggest you change the phrase “Here, we, for the first time, interactively combined laboratory kinetic experiments with global aerosol modeling to more accurately quantify anthropogenic soluble Fe due to air pollution.” to “In this study, for the first time, we interactively combined laboratory kinetic experiments with global aerosol modeling to more accurately quantify anthropogenic soluble Fe due to air pollution.”

Response: Thanks and this has now been changed.

Comment 5: Page 2, line 17, 19: I would suggest replacing “We firstly examined...” with “Firstly, we examined...” and “We then...” with “Then, we...”, respectively for lines 17 and 19.

Response: Thanks and this has now been changed to “Firstly, we determined...” and

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“Then, we...”.

Comment 6: Page 4, line 41-43: Please re-write the sentence i.e. “Thus, improved quantification of atmospheric delivery of bioavailable Fe is essential to estimate more accurately the long-term carbon sink (Jickells et al. 2005).”

Response: Now changed to “Thus, improved quantification of atmospheric delivery of bioavailable Fe is essential to quantify the long-term carbon sink (Jickells et al. 2005).”

Comment 7: Page 13, line 251: I believe the author meant “Almost identical slopes were found at ...”.

Response: This is corrected.

#### References

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Interactive comment on *Atmos. Chem. Phys. Discuss.*, 15, 23051, 2015.

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