

Interactive comment on “Seasonal changes in Fe species and soluble Fe concentration in the atmosphere in the Northwest Pacific region based on the analysis of aerosols collected in Tsukuba, Japan” by Y. Takahashi et al.

Anonymous Referee #2

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General comments

Numerical predictions of soluble iron deposition to the ocean are highly uncertain. The authors presented the seasonal changes in iron species and soluble iron concentration. The analysis of the observations over a year reveals that the oil combustion is the major source of soluble iron in Tsukuba. The paper is well written and the work conducted in this paper may contribute to improve the understanding of iron cycle. The paper is worthy of publication in ACP after the authors respond to my concern.

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Specific comments

Abstract

Asian dust can be transported above the atmospheric boundary layer to the Northwest Pacific region. Thus surface concentrations of aerosols collected in Japan are not representative of the total dust column. Indeed, Ooki et al. (2009) measured much lower iron solubility of snow samples collected in Japan (< 1%). My concern is that the extrapolation of surface concentrations in Tsukuba would lead to an underestimate of the soluble Fe from Asian dust in the North Pacific region.

3.4 Atmospheric concentrations of soluble Fe and fraction of soluble Fe

The positive correlation with the anthropogenic components such as sulfate or oxalate also suggests the possibility of the proton-promoted Fe dissolution, the oxalate-promoted Fe dissolution, and the photoreductive dissolution. Wet deposition is a significant fraction of the input of soluble aerosol iron to the ocean. According to Takahashi et al. (2011), the iron solubility of ferrihydrite in rainwater is 40%. Please discuss why ferrihydrite does not contribute to the total soluble Fe significantly. For example, please present the results with soluble Fe fraction simulated in rainwater as in Fig. 10 and Fig. 14.

The molar ratio of oxalate to FeMQ is not necessarily constant, even if oxalate can contribute to the increase in the iron solubility, because the solubility also depends on pH and the value of pH in MQ solution is different from that in aerosol water.

Please present the results for FeSW in Fig. 13 to discuss the importance of Fe(III) sulfate as a source of soluble Fe in seawater.

Technical corrections

Fig. 14: The soluble Fe fraction was simulated in seawater. Please correct FeMQ to FeSW in Fig. 14b.

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References: Please provide the reference of Xie et al. (2005).

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