

*Reviewer #3 Comment*

*The authors investigate aerosol particles' iron (Fe) properties over the Indian Ocean aboard a research vessel. The article presents important information on these particles' morphology, concentration, and degree of solubility. In general terms, the article is well-written. However, some minor observations need to be addressed. The article can be accepted after answering the following questions.*

**Response:**

We appreciate the many constructive comments offered by anonymous reviewer #3, which have improved our manuscript considerably. Revisions have been highlighted as red in the text of the revised manuscript. This manuscript was checked according to the journal guidelines by a native-English speaking professional with experience in the review of technical documents in this field.

*Comments:*

*Abstract*

*line 15. the authors mention that they analyzed particles in the size range 0.3-0.8, using a cascade impactor. As written, it appears that they studied a continuous range of particle sizes. However, the methodology mentions that the sampler only has three nominal sizes (1.6, 0.8, and 0.3  $\mu\text{m}$ ). Please mention these three sizes in the abstract.*

**Response:**

TEM samples were collected using a three-stage cascade impactor, but only those of the third stage were used for this study. Particles larger than the 50% cut-off diameter of the stage are collected to efficiency of higher than 50% on the stage. Therefore, in the third stage of the impactor, particles from about the third stage of cut-off diameter (aerodynamic diameter) to about the second stage cut-off diameter were collected. For this study, we specifically examined submicrometer particles that can include many anthropogenic aerosols, and analyzed only the stage samples that mainly submicrometer particles collected. Therefore, we described only the size range of the stage used for analysis as necessary information in the *Abstract*. Although use of only a third stage was also explained before revision, it might have been difficult to understand that point in the *Abstract*. Therefore, we revised the text in the *Abstract*.

*Comments:*

*Methodology*

*The water dialysis process was important to study the water's mixing state and elucidate the Fe's solubility. Could you expand the description of this technique and mention the instrument used for it? Indicate the bibliographic source from which equations 1 and 2 were obtained.*

Response:

Water dialysis method with image analysis had been used for quantification of the volume of water-soluble materials by Okada (1983). This method needs no other special instruments of already written EDS and TEM, although a petri dish and simple dropper are used. For the method described by Okada (1983), they estimated the particle volume before and after water dialysis using image analyses. For our present studies, we tried and applied water dialysis to quantify changes of Fe before and after water dialysis using EDS analysis. Therefore, the experimental method can be cited from earlier studies, but the quantitative method of Fe by the equations is our original. We also used the same method in Ueda et al. (2022), but did not mention the equations. For this study, demonstration of these equations was supported in supplemental materials before revision. In the revised version, we moved the demonstration in the main text (sections 2.3.1 and 2.3.2) and reinforced the description of this technique.

*Comments:*

*Please revise the wording in the first line of the first paragraph of section 2.1. It is not easy to understand the name of the cruise ship where the study was conducted.*

Response:

The sentence was revised as presented below.

Before revision>> Atmospheric observations were conducted over the Indian Ocean during the R/V Hakuho Maru during KH-18-6, which took place on 6–28 November 2018.

After revision>> Atmospheric observations were conducted over the Indian Ocean during the R/V *Hakuho Maru KH-18-6* cruise, which took place on 6–28 November 2018.

*Line 200: Check the spelling in this sentence.*

Response:

The spelling is no problem because the spelling represents the origin of the model's name. We have used the same form in reports of earlier studies (e.g. Matsui, 2018; Liu et al., 2022).

*It is recommended to use the same concentration units in tables and figures. Tables 2 and 3 report the concentrations in  $\mu\text{m}/\text{m}^3$  and  $\text{ng}/\text{m}^3$ , respectively. While in Figure 2, the units are reported as  $\mu\text{g}/\text{kg}$ .*

Response:

Mass concentrations of ions and metals were measured in units of  $\mu\text{g}/\text{m}^3$  and  $\text{ng}/\text{m}^3$ . For Figure 2, the Fe mass concentration is shown as a mixing ratio ( $\mu\text{g}/\text{kg}$  and  $\text{ng}/\text{kg}$ ) for readers to compare them to model output data of Figure 8. Mixing ratios were calculated using the daily average of temperature and atmospheric pressure measured onboard. We added the explanation given above to section 3.1. The units in the revised Tables 2 and 3 were presented uniformly as  $\mu\text{g}/\text{kg}$  and  $\text{ng}/\text{kg}$ .

*Comments:*

*Results*

*It is suggested that labels (a), (b), (c), and (d) have to be added to each panel in Figure 8. The figure caption should also be improved to make it easier to read.*

Response:

We added the related labels and revised the captions.

*Comments:*

*Figure 10 has many elements. It is suggested to separate them and present some results individually. In addition, the figure caption is very long and difficult to read.*

Response:

We separated the figure to Figures 10 and 11. The caption was also revised.