

Size Segregated Characterizations of Iron in Aerosols in the East Asian Outflow in Winter-Spring Seasons: Source Apportionment and Evolutions of Water-Soluble Fraction

*Takuma Miyakawa¹, Chunmao Zhu¹, Morihisa Yokokawa², Mitsunobu Mukawa³, Yugo Kanaya¹

1. Japan Agency for Marine-Earth Science and Technology, 2. Sibata Scientific Technologies, 3. Murata Keisokuki Service

Trace metals in aerosol particles impact Earth's radiative budget, human health, and ocean biogeochemistry. Semi-continuous measurements of the elemental composition of fine-mode ($PM_{2.5}$) and total (PM_{10}) aerosols and high-volume air sampling (5-d)/offline chemical analyses were conducted on a remote island of Japan in the winter-spring of 2023–2024 to characterize the source apportionment and water-soluble fraction of geochemically important elements such as Fe in the East Asian outflow region. $PM_{2.5}$ and PM_{10} total aerosol (Fe) concentrations reached to 85 and 205 (2.7 and 7.4) $\mu g m^{-3}$, respectively (April 17–20, 2024), during the observation period, suggesting the strong influence of Asian dust transport to the outflow region causing the violence of short-term air quality standard in Japan. Water-soluble fraction of Fe (F_{solFe}) greatly varied from 3% to 40% for $PM_{2.5}$ aerosols and were less than 1.5% for coarse mode aerosols ($>2.5 \mu m$), indicating that mineral dust dominated coarse mode and that mineral dust contributions temporally varied for $PM_{2.5}$ aerosols. Temporal variations in $PM_{2.5}$ and PM_{10} Fe concentrations were analyzed with concentrations of tracer species (Si and black carbon) by following our previous study (Miyakawa et al., 2023) and were classified into dust and non-dust Fe contributions for $PM_{2.5}$ and coarse mode aerosols. Size segregated F_{solFe} were investigated using dust contributions and aging processes (transport time and impacts of acidic components). The source apportionment (dust vs. non-dust) was essential to account for the F_{solFe} variations for $PM_{2.5}$ aerosols, whereas coarse mode aerosols were affected largely by aging processes because they were mainly apportioned to be dust. Our observations provided the combined data sets of size segregated Fe concentrations and the evolutions of F_{solFe} through aging processes as useful constraints to develop, validate, and refine numerical models simulating the detailed behavior of Fe in aerosols over the regions under East Asian winter monsoon influences.

Miyakawa, T., Ito, A., Zhu, C., Shimizu, A., Matsumoto, E., Mizuno, Y., and Kanaya, Y.: Trace elements in $PM_{2.5}$ aerosols in East Asian outflow in the spring of 2018: emission, transport, and source apportionment, *Atmos. Chem. Phys.*, 23, 14609–14626, <https://doi.org/10.5194/acp-23-14609-2023>, 2023.

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