Aggregated, iron-oxide nanoparticles as a major metal atmospheric aerosol

*Kouji Adachi[1], Nobuhiro Moteki[2], Atsushi Yoshida[2], Sho Ohata[2]

1. Meteorological Research Institute, 2. The University of Tokyo

Iron-oxide particles possibly contribute to climate, if they absorb light; marine environment, if they dissolve to water; and human health, if they have toxicity. However, little is known about the influences of iron-oxide particles in atmosphere to these important issues. This study examines iron-oxide particles by using transmission electron microscopy (TEM) and single-particle soot photometer (SP2) from samples collected from Tokyo, Japan as well as those from other locations. TEM and SP2 use fundamentally different detection techniques for the iron-oxide particles. TEM allows characterization of the morphological, chemical, and structural features of individual particles, whereas SP2 optically measures the number, size, and mixing states of iron-oxide particles. By using both techniques, we aim to understand the occurrence, abundance, and chemical and physical properties of iron-oxide particles in atmosphere.
In this presentation, we mainly focus on the results by using TEM. TEM revealed that there are substantial amount of iron-oxide particles in aerosol samples with smaller than one micrometer, consistent to the results from SP2. These iron-oxide particles are mostly aggregates of iron-oxide particles with less than one hundred nanometer, similar to soot particles, suggesting that they are emitted from anthropogenic sources. They mainly consist of iron oxide although manganese, chromium, nickel, and other elements are occasionally detected. Electron-energy loss spectroscopy (EELS) analysis shows that these iron-oxide particles are magnetite, which absorbs light and has potential toxicity. Our results suggest that iron-oxide particles could be abundant in the aerosols having anthropogenic sources and may have an important contributions to climate, marine environment, and human health.

Keywords: Transmission electron microscope, Single-particle soot photometer, Magnetite, Tokyo