Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

AAS21-03 Room:201B Time:May 27 15:45-16:00

Measurements of the hygroscopicity and wet removal of black-carbon-containing particles in Tokyo

OHATA, Sho[1*] ; NOBUHIRO, Moteki[1] ; MORI, Tatsuhiro[1] ; KOIKE, Makoto[1] ; TAKAMI, Akinori[2] ; KONDO, Yutaka[1]

[1]Department of Earth and Planetary Science, Graduate School of Science, The University of Tokyo, [2]Center for Regional Environmental Research, National Institute for Environmental Studies

Megacities are very large, concentrated anthropogenic sources of black carbon (BC) aerosols. Freshly emitted BC particles inside megacities affect local air quality and regional and global climate. The microphysical properties (e.g., number size distribution, coating thickness, and hygroscopicity) of atmospheric BC-containing particles are important because their efficiency of wet removal from the atmosphere can be highly dependent on these properties. In this study, we conducted intensive observations of the hygroscopicity and wet removal of BC-containing particles in the urban atmosphere of Tokyo during summer 2014. The number size distribution and coating thickness of BC-containing particles were measured with a standard Single Particle Soot Photometer (SP2). The hygroscopicity of BC-free and BC-containing particles was measured with a modified (humidified) SP2. In addition, the number size distribution of BC cores in rainwater was also measured with a nebulizer?SP2 system during rain events.

Throughout the observation period, for BC-containing particles with a dry diameter of about 200 nm, the particles with smaller BC fractions tended to represent greater water uptake, and the number fraction of the less hygroscopic (Growth factor $<$1.2 at 85% relative humidity) BC-containing particles was more than 70% of the total BC-containing particles. The measured average number size distribution of BC cores in rainwater was larger than that in the surface air before precipitation began, and the dependence of the wet removal of BC-containing particles on their BC-core sizes was successfully explained by the measured microphysical properties of BC-containing particles in the air and an assumed maximum supersaturation that the particles would have experienced during rain events. These measurement data indicated that BC-containing particles in Tokyo, especially particles with small BC cores (or with high critical supersaturation), were efficiently transported upward without being removed by precipitation.

Keywords: black carbon, hygroscopicity, wet removal