Observational study of wet removal process of black carbon particles

*Tatsuhiro Mori[1], Sho Ohata[1], Moteki Nobuhiro[1], Makoto Koike[1], Yutaka Kondo[2]

1.Graduate school, Tokyo University, 2.National Institute of Polar Research

Black carbon (BC) particles absorb visible solar radiation and heat the atmosphere. An improved understanding of wet removal process is important because it strongly influences temporal and spatial distribution of BC in atmosphere. There are two categories of removal mechanisms: nucleation scavenging and impaction scavenging. The former refers to the mechanisms that BC particles are incorporated into cloud droplets by serving as cloud condensation nuclei (CCN), while the latter refers to scavenging via impaction with cloud droplets or rain droplets. Theoretically, the efficiencies of these mechanisms depend on BC sizes. However, their relative contribution to the removal of BC has never tested by direct observation.
In this study, we observed relationships between size-dependent removal efficiency (RE) and size-dependent CCN activity in Tokyo during summer 2014 and 2015. The size-dependent RE was determined by measuring both size-resolved BC number concentrations in air and in rainwater. The size-dependent CCN activity was estimated by measuring coating thickness and hygroscopicity of BC particles.
Out of 32 rain events during observation period, the strong size-dependent RE was successfully explained by the size-dependent CCN activity for 29 rain events, indicating that nucleation scavenging was the dominant removal process of BC particles. For the other rain events, impaction scavenging might be also effective for larger BC particles.

Keywords: Black carbon, wet deposition

