

6.127 Effects of Wet Deposition on the Abundance and Size Distribution of Black Carbon in East Asia.

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Abstract:

An improved understanding of the variations in the mass concentration and size distribution of black carbon (BC) in the free troposphere (FT) over East Asia, where BC emissions are very high, is needed to reliably estimate the radiative forcing of BC in climate models. We measured these parameters and the carbon monoxide (CO) concentration by conducting the A-FORCE 2013W aircraft campaign in East Asia in winter 2013 and compared these data with measurements made in the same region in spring 2009. The median BC concentrations in the FT originating from North China (NC) and South China (SC) showed different seasonal variations, which were primarily caused by variations in meteorological conditions. CO concentrations above the background were much higher in SC than in NC in both seasons, suggesting a more active upward transport of water-insoluble CO. In SC, precipitation greatly increased from winter to spring, leading to an increased wet deposition of BC. As a result, the median BC concentration in the FT was highest in SC air in winter. This season and region were optimal for the effective transport of BC from the planetary boundary layer to the FT. The count median diameters of the BC size distributions generally decreased with altitude via wet removal during upward transport. The altitude dependence of the BC size distributions was similar in winter and spring, in accord with the similarity in the BC mixing state. The observed BC concentrations and microphysical properties will be useful for evaluating the performance of climate models.