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Mass spectrum analysis for aerosol particles with different hygroscopicity: Observation in the atmosphere of Nagoya

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The differences in the chemical composition from particle to particle in atmospheric aerosol are potentially very important to understand the roles of the particles in the atmosphere, e.g., the role as cloud condensation nuclei. Recent studies explored the relationship between the particle composition and the hygroscopicity based on single particle analysis (e.g., Zelenyuk et al., 2008; Herich et al., 2008), and demonstrated the capability of this method for the assessment of the aerosol mixing state. In this study, we performed single particle measurements for urban aerosols using an instrumental system that is an combination of a hygroscopicity tandem differential mobility analyzer (HTDMA) and a high resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS) equipped with a light scattering (LS) module.

Single particle mass spectrum analysis for urban aerosols were performed in Higashiyama Campus, Nagoya University, Nagoya, Japan from 8 to 15, November 2011. Sample aerosols that passed through a PM1 cyclone and diffusion dryers were introduced to the HTDMA. Particles with dry mobility diameters of 330 nm were selected in the first differential mobility analyzer (DMA) of the HTDMA, then the classified aerosol was humidified and introduced to the second DMA. The particles with different diameters under the humidified conditions were selected and introduced to the HR-ToF-AMS equipped with the LS module. The collected data were analyzed using the LS analysis software.

Both the increases in the LS and mass spectrum signals were observed at least for some of the recorded data, indicating a successful detection of single particles after the classification based on both size and hygroscopicity in the HTDMA. Preliminary analysis, although it is for a very small number of samples, shows that the mass spectra varied substantially depending on particles. Although more analyses, including the analysis about the particle detection efficiency, should be performed to adequately assess the performance of the observation using the system, the initial result suggests that this method is usefulness to understand the relationship between the chemical composition and the hygroscopicity of aerosol particles.