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Measurements of particle effective density distributions during summer in Nagoya: Relationship with chemical composition

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Tropospheric aerosols are known to be a complex mixture including mineral dust, inorganic salts, organic compounds, and soot particles. Mixing state and shape of aerosols are strongly affects optical properties. However, real-time (bulk) measurements of mixing state and shape of ambient aerosols are limited. Measurements of 'effective' density distribution have a potential to provide useful information about the mixing state and shape. In this work, based on aerosol density distribution measurements, the mixing state and shape of aerosols in an urban area are estimated.

Simultaneous observations of aerosol density distributions and chemical properties were conducted on August, 16-26, 2011 at the Higashiyama-campus of Nagoya University. The effective density of ambient particle with a mobility diameter of 100 and 200 nm was measured by combinations of a differential mobility analyzer (DMA, TSI, model 3081), an aerosol particle mass analyzer (APM, Kanomax, model 3601), and a condensation particle counter (CPC, TSI, model 3776). Chemical compositions of the aerosol were measured by a time-of-flight aerosol mass spectrometer (Aerodyne, HR-ToF-AMS). The density distributions and chemical compositions were measured after passing through diffusion dryers and one of the heaters controlled at 25, 100, and 300 degree-C by switching ball valves every 30 min.

As a result, ambient aerosols with a diameter of 100 nm have two distinct density peaks at 0.7-0.9 (peak 1) and 1.2-1.6 (peak 2) g/cm^3. The changes in peak areas after heating imply that peak 1 and 2 mainly consist of soot and volatile compounds (such as inorganic salts and organics), respectively. In the presentation, the temporal variations of the effective densities and their relationship with chemical properties will be discussed.

Keywords: Aerosol density distributions, Ambient measurements, Aerosol chemical compositions, Mixing states