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Simultaneous measurements of relative humidity dependence of light extinction and aerosol chemical compositions in Tokyo

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Atmospheric aerosols scatter and absorb solar radiation, thereby influencing the Earth's radiation balance. Light extinction is the sum of scattering and absorption. The extinction coefficient of particles is dependent on the particle number density, size and chemical composition. Because uptake of water by aerosol particle changes particle size and shape, aerosol optical properties are dependent on relative humidity (RH). The RH dependence of optical properties is highly influenced by the chemical composition. Therefore, the detailed understanding of the relationship between the RH dependence of the optical properties and the chemical composition is very important.
In this work, simultaneous measurements of the RH dependence of aerosol extinction coefficients, the aerosol chemical compositions and the particle size distributions of ambient aerosols were performed in central Tokyo from 30 July to 11 August. Aerosol extinction coefficients at 532 nm were measured using a newly developed cavity ring-down aerosol extinction spectrometer (CRD-AES). The CRD-AES instrument has two measurement cells, in which the RH were controlled at < 30% and 80%, respectively. The chemical compositions were measured by a time of flight aerosol mass spectrometer (ToF-AMS) and an EC/OC analyzer. The size distributions were measured by a scanning mobility particle sizer (SMPS). The sampling inlet's temperature of CRD-AES, ToF-AMS and SMPS were switched among 400, 180 degrees and unheated every 20 minutes.
The RH dependence of aerosol extinction coefficients showed a negative and positive correlation with the mass fraction of organics and sulfate, respectively. In this presentation, the impact of chemical compositions on RH dependence of extinction coefficients of aerosols will be discussed.

Keywords: aerosol, extinction coefficients, Cavity Ring-Down Spectroscopy, relative humidity dependence of optical properties