Laboratory study on optical property of atmospheric aerosol using cavity ring-down spectroscopy

Tomoki Nakayama[1]; Yousuke Sakamoto[1]; Akihiro Yabushita[2]; Masahiro Narukawa[3]; Yutaka Matsumi[4]; Akihiro Uchiyama[5]; Masahiro Kawasaki[1]

[1] Kyoto Univ.; [2] none; [3] STEL, Nagoya Univ.; [4] STE Lab., Nagoya Univ.; [5] JMA, MRI

Aerosol particles have an important role in radiation balance in the atmosphere by scattering and absorbing incident light. Therefore, accurate determinations of the optical properties of atmospheric aerosols are essential.

Recently, strong particle formation events have been observed under low tide and sunny condition. Several studies on the formation process of the aerosol have been performed. For example, O'Dowd et al. [Nature, 2002] reported that photolysis of CH2I2 emitted from seaweed produces I atoms whose oxidation products participate in secondary particle formation. However, no experimental study on optical properties of the aerosol has been performed.

There are two components to extinction: scattering and absorption. Extinction coefficients of atmospheric aerosol have commonly been determined by measuring scattering coefficients using nephelometer and absorption coefficients using aethalometer or particle/soot absorption photometer (PSAP). Both of aethalometer and PSAP rely upon collection of the aerosol particles onto a filter substrate followed by a measurement of light reflectance and/or transmittance. Because of the temporal variations of the conversion parameter, these techniques may have relatively large uncertainties. The extinction coefficients can also been measured using cavity ring-down spectroscopy (CRDS).

In this work, we have developed CRDS system to measure the extinction coefficients. The optical properties of the iodine aerosol have been examined using CRDS and nephelometer. By comparing the extinction coefficients at 532 nm measured by CRDS and the scattering coefficients at 530 nm measured by nephelometer, the existence of absorption term has been confirmed. Using the obtained data, refractive index parameter of Mie theory for the iodine aerosol has been determined.