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Observational and laboratory studies of optical properties of black and brown carbon particles in the atmosphere using spectroscopic techniques

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Light absorption and scattering by aerosols are as an important contributor to radiation balance in the atmosphere. Black carbon (BC) is considered to be the most potent light absorbing material in the visible region of the spectrum, although light absorbing organic carbon (brown carbon or BrC) and mineral dust may also act as sources of significant absorption, especially in the ultraviolet (UV) and shorter visible wavelength regions. The optical properties of such particles depend on wavelength, particle size and shape, morphology, coating, and complex refractive index (or chemical composition), and therefore accurate in situ measurements of the wavelength dependence of the optical properties of particles are needed.

Recently, cavity ring-down spectroscopy (CRDS) and photoacoustic spectroscopy (PAS) have been used for the direct measurements of extinction and absorption coefficients of particles suspended in air. We have applied these techniques to the observational studies of optical properties of BC and BrC in an urban site in Japan and to the laboratory studies of optical properties of secondary organic aerosols (SOAs) generated from a variety of biogenic and anthropogenic volatile organic compounds and those of diesel exhaust particles (DEPs). In the presentation, the basic principles of these techniques and the results obtained in our studies and in the recent literatures will be overviewed.

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