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Aerosol optical properties measurement by recently developed cavity-enhanced aerosol single scattering albedometer

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Development of appropriate and well-adapted measurement technologies for real-time *in-situ* measurement of aerosol optical properties is an important step towards a more accurate and quantitative understanding of aerosol impacts on climate and the environment. Aerosol single scattering albedo (SSA, ω), the ratio between the scattering (α_{scat}) and extinction (α_{ext}) coefficients, is an important optical parameter that governs the relative strength of the aerosol scattering and absorption capacity. Since the aerosol extinction coefficient is the sum of the absorption and scattering coefficients, a commonly used method for the determination of SSA is to separately measure two of the three optical parameters – absorption, scattering and extinction coefficients – with different instruments. However, as this method involves still different instruments for separate measurements of extinction and absorption coefficients under different sampling conditions, it might cause potential errors in the determination of SSA value, because aerosol optical properties are very sensitive to the sampling conditions such as temperature and relative humidity (RH).

In this paper, we report on the development of a cavity-enhanced aerosol single scattering albedometer incorporating incoherent broad-band cavity-enhanced spectroscopy (IBBCEAS) and an integrating sphere (IS) for direct *in-situ* measurement of aerosol scattering and extinction coefficients on the exact same sample volume. The cavity-enhanced albedometer holds great promise for high-sensitivity and high-precision measurement of ambient aerosol scattering and extinction coefficients (hence absorption coefficient and SSA determination) and for absorbing trace gas concentration. In addition, simultaneous measurements of aerosol scattering and extinction coefficients enable a potential application for the retrieval of particle number size distribution and for faster retrieval of aerosols' complex RI. The albedometer was deployed to characterize the aerosol optical properties in the Haze Observation Project Especially for Jing-Jin-Ji Area (HOPE-J^{3}A) during Nov. 2014 - Jan. 2015 and the primary measurement results will be presented.