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Monitoring optical properties of aerosols with cavity ring-down spectroscopy

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This articles describes the design and performance of a cavity ring-down spectroscopic (CRDS) instrument for measuring extinction coefficients of laboratory and ambient atmospheric aerosols. Through averaging 1000 individual waveforms, a minimum detectable aerosol extinction coefficient of 6.1e10-7 m-1 is achieved. Tests with Polystyrene spheres (PSS), we suggested this CRDS system could measure the extinction coefficient of aerosol with uncertainty less than 3% under laboratory controlled experimental conditions. The visual range measured with CRDS agrees well with visibility observations from Shanghai Meteorological Bureau. Combined with the TSI integrating nephelometer and NOx analyzer, CRDS was used to monitor the optical properties of ambient aerosols in heavy pollution episode. The uncertainty for using the CRDS and TSI nephelometer to measure single scattering albedo (SSA) in ambient measurement is estimated to be less than 12%.