A UV-visible Broadband Cavity Enhanced Spectrometer for Atmospheric Aerosol Extinction

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Atmospheric aerosols directly affect Earth's radiative balance by absorbing and scattering incoming solar radiation, and the aerosol direct effects contribute some of the largest uncertainties to predictions of Earth's future climate. Thus, understanding the optical properties of aerosols is vital to the development of appropriate policies attempting to tackle the issues of climate change and air pollution. The cavity enhanced spectroscopies, such as cavity ringdown spectroscopy and broadband cavity enhanced spectroscopy, provide sensitive methods for measuring light extinction by aerosols in-situ. However, due to the narrow spectral coverage of highly reflective mirrors and the lasers often used as light sources, aerosol extinction measurements have been traditionally limited from 1 to 50 nm wide regions of the spectrum. Aerosol extinction follows a power law relationship with wavelength, with increased extinction in the UV, and it is therefore desirable to measure extinction throughout the UV-visible spectrum. We have built an instrument composed of 4 parallel cavities coupled into a single grating spectrophotometer, in which each cavity contains its own LED light source. The robust and portable instrument provides access to wavelength-resolved measurements of aerosol extinction in four ~50nm wide regions spanning from 350 to 690 nm.