Wavelength-dependent optical properties, mass absorption coefficients, and closure studies for carbonaceous aerosol at the 2010 CARES Campaign, Sacramento, CA

B. A. Flowers1, A. Aiken1, M. K. Dubey1, M. Gyawali2, P. Arnott2, K. Gorkowski3, C. Mazzoleni3, R. Subramanian4, A. Sedlacek5, G. Senum5, S. Springer5, A. Setyan5, Y. Sun5, Q. Zhang5, C. Song6, J. Shilling7, J. Berank7, A. Zelenyuk7, and R. Zaveri8:
1Los Alamos National Laboratory, 2 UN-Reno, 3Michigan Tech. Univ., 4Brookhaven National Laboratory, 5DMT, 6UC-Davis, 7Pacific Northwest National Laboratory

Aerosol absorption and scattering coefficients measured at ground sites and the DOE-G1 aircraft during the Carbonaceous Aerosol and Radiative Effects Campaign (CARES) of summer 2010 are analyzed. We report wavelength-dependent single scatter albedo ($\omega_{\omega_{\lambda}}$) and asymmetry parameter ($g_{\lambda}$) from simultaneous measurements of aerosol absorption and scattering at 9 wavelengths between 1047 – 355 nm by 8 separate integrated photometric/nephelometer (IPN) instruments. The 9-λ absorption coefficients are combined with black carbon mass measurements from single particle soot photometers (SP2) to derive wavelength-dependent mass absorption coefficients, including new results at UV wavelengths. The absorption and scattering data are combined with concurrent particle size distributions to estimate complex refractive indices (n,k). The imaginary part of the complex refractive index (k) is sensitive to enhanced absorption by organic coatings on soot cores and/or directly emitted primary and secondary organic particles. Closure studies will compare the estimated top-down refractive indices with bottom-up calculations using the observed chemical composition from aerosol mass spectrometers (e.g. Flowers, et al. ACP 2010). The wavelength dependence of optical properties and MACs for fresh and aged urban and rural emissions, including biomass burning, will be presented to help models accurately estimate net radiative effects for carbonaceous aerosol.

Wavelength Dependent Mass Absorption Coefficient: MAC (λ) [T0 site]

Conclusions
- Coating enhancements larger for OA dominated T1 aerosol
- MAC(λ) shows behavior for coated soot particles (no enhancement @ 781 nm)
- PASS-3/PASS ratio closer to 1 for during second half of T1 when aerosol had more BC mass

References