Sources and Optical Properties of Light-absorbing Aerosols in Fresno, California during DISCOVER-AQ 2013

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Light-absorbing materials such as black carbon (BC) and brown carbon (BrC) in atmospheric aerosols play a pivotal role in regulating the earth's radiative budgets and climate. However, the representations of BC and BrC in state-of-the-art climate models remain highly uncertain, due to the poor understanding of their microphysical and optical properties. Direct observations and characterizations of the mixing state and absorption enhancement of ambient aerosols could provide invaluable constraints for current model representations of aerosol radiative effects.

This work reports real-time measurements of submicron aerosol (PM_1) optical properties (i.e., light extinction and absorption) made with the UC Davis two-wavelength cavity-ringdown/photo-acoustic spectrometer in Fresno, CA during winter of 2013 as part of the NASA DISCOVER-AQ Experiment. The absorption enhancement (E_{abs}) of BC particles due to the "lensing" effect from coatings to BC core and/or the presence of other absorbing aerosols (i.e. BrC) is quantified using a novel thermodenuder method. E_{abs} is estimated to be ~20% at 532 nm, consistent with previous observations during CalNex (*Cappa et al*., 2012). Both E_{abs} at 405 nm and the Absorption Angstrom Exponents (AAE) exhibited strong day-night variation, indicating different dominant sources of light-absorbing aerosols throughout the day. Statistical analysis of optical and concurrent aerosol chemical composition data suggests that residential wood burning is the major source of BrC in Fresno during winter, which contributed > 20% of the total absorption at 405 nm during nighttime.