

Absorption coefficient measurements and their relation to air quality and climate change: Intercomparison of a photometer and aethalometer

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Abstract

Atmospheric aerosols (suspensions of particles) derive from multiple human and natural sources. They contribute to climate change by alternately enhancing or masking greenhouse gas warming depending on aerosol properties. Aerosols' effect on climate is currently the single largest physical uncertainty in climate modeling efforts as it ultimately impacts cloud feedbacks. Aerosol absorption is the dissipation of radiant energy as it passes through a particle resulting in the heating of the particle and surrounding air. Based on the refractive index, a particle will absorb, reflect, or transmit radiant energy. The absorption coefficient (babs), measurable at multiple wavelengths in typical units of 1/Mm, quantifies warming from particles. Measurement techniques are diverse; here we focus on the Tricolor Absorption Photometer (TAP) and MA200 mini-Aethalometer (MA200). The TAP and MA200 measure light attenuation due to aerosol deposited on a filter. The TAP has 3-wavelengths (375, 525, and 625 nm) while MA200 has 5 wavelengths (375, 470, 528, 625, and 880 nm) spanning the UV, visible, and IR spectrum. Here the instruments are compared with continuous measurements of ambient aerosols at NMT. Our focus is comparing (1) temporal trends, (2) wavelength dependence, and (3) the overall accuracy of both instruments. Measurements show peaks in absorption coefficients between 8:00 PM to midnight in winter months, likely a function of wood-burning. Early results show a strong statistical correlation between the instruments and general agreement on wavelength dependence. MA200 has, however, has an absorption coefficient larger by a factor of 1.2-1.7 than the TAP which is under investigation.