Development, Testing and Performance of a New Filter-Based Light Absorption Instrument

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Light absorption by atmospheric aerosols is an important factor in determining the radiative forcing of climate. The long-term measurement of the aerosol light absorption coefficient at surface monitoring stations is complicated by shortcomings in existing methods. Photoacoustic and absorption by difference (extinction minus scattering) methods are expensive and require highly trained operators and frequent attention, and thus are not ideal for long-term deployment at remote stations. Filter-based methods collect the aerosol particles on a filter and measure the increase in attenuation of light through the filter caused by the particles, and through calibration procedures the amount of light absorption from the particles can be determined. Since the late 1990s the ESRL Global Monitoring Division (GMD) and organizational precursors have been using a filter-based instrument, the Particle Soot Absorption Photometer (PSAP, Radiance Research, Seattle, WA) to measure the aerosol light absorption coefficient at the stations in the NOAA Global Collaborative Aerosol Monitoring Network. One of the major difficulties in the operation of the PSAP is the fact that the filters need to be changed frequently, on the order of a few hours to one day at most locations. This requires operators to visit the station frequently to avoid PSAP data loss, something that became a significant problem at some stations (e.g., very long driving distance from town, over weekends, etc.). For this reason GMD scientists and engineers have developed an inexpensive filter-based instrument that can measure aerosol light absorption from particles on eight filters in succession before requiring a filter change. This new instrument has been named the Continuous Light Absorption Photometer (CLAP), and is already deployed and making measurements at several of the Network stations. This presentation will provide an overview of instrument development, testing, performance characterization, and attempts at technology transfer to the private sector.

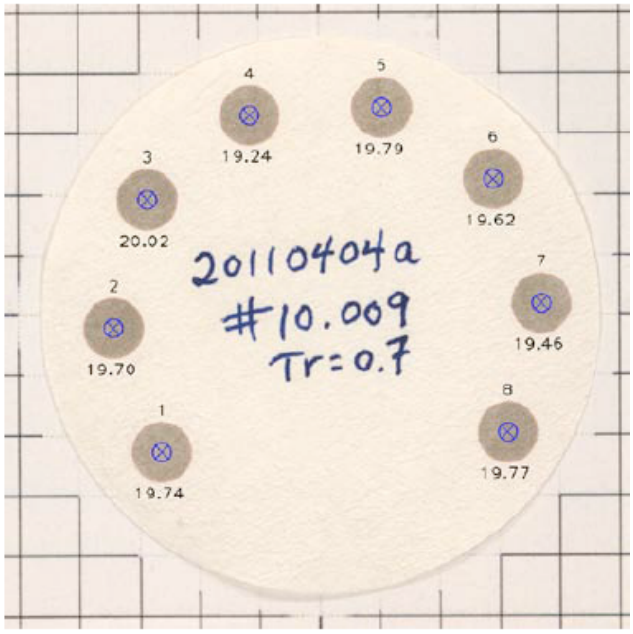

Figure 1. Photos of the new CLAP instrument and an exposed filter showing the eight sample spots and spot areas determined by our automated image analysis program.