

Aerosol Measurements at the Southern Great Plains Site: Equipment Installation and Operation

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Introduction

To meet the needs of the Atmospheric Radiation Measurement (ARM) Program, the Environmental Measurements Laboratory (EML) has the responsibility to establish a surface aerosol observation system (AOS) at the Southern Great Plains (SGP) Site.

Because of agricultural activities at and near the site, sampling of the ambient aerosol occurs at a height of 10 m. To facilitate

sampling at 10 m, we have designed and built a special tilt down sampling stack and manifold for aerosol characterization (Figure 1a). The system is designed for both long-term use and easy maintenance. At the top of the stack is a rain hat containing a stainless steel screen to stop birds and insects from entering the stack. The tilt down capability allows for changing the screen on the ground safely and easily. An independent Teflon sampling line, parallel to the aerosol stack is also seen in the photo and provides air for an ozone monitor in the trailer.

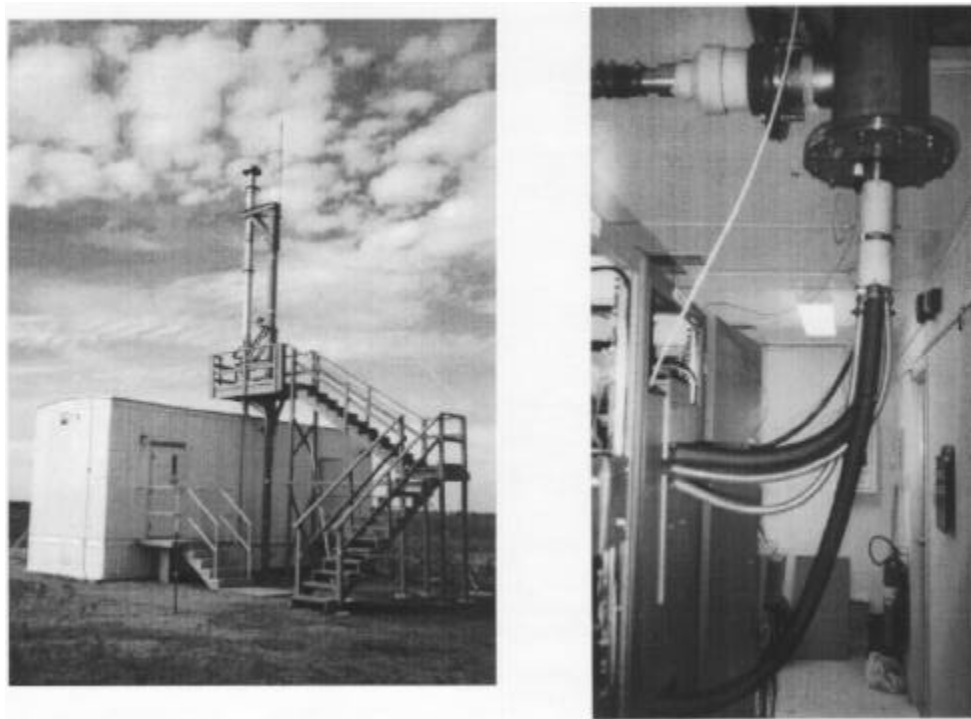


Figure 1. a) Photograph of the aerosol trailer and sampling stack at the Southern Great Plains ARM site; b) Photograph of inside the aerosol trailer.

SGP Instruments

Five aerosol instruments are installed at the SGP site: a single wavelength nephelometer ($\lambda=550$ nm), optical particle counter (OPC), condensation particle counter (CPC), optical absorption monitor (PSAP), and a three-wavelength nephelometer ($\lambda=450, 550, 700$ nm) with back scatter capability. A separate ozone sampling system using a Dasibi monitor is part of the AOS. The aerosol instruments are connected in a specially designed manifold. A $10\text{-}\mu\text{m}$ impactor limits the size of the aerosol reaching the nephelometer, PSAP, and CPC. The OPC, which measures the size distribution, is connected through an isokinetic probe to the sampling line before the impactor.

The ozone monitor has its own Teflon sampling line. As the tubing enters the trailer a temperature controlled heater gently warms the inlet air to prevent condensation during the air conditioning season. Approximately 1000 L min^{-1} of air enters the stack at a height of 10 m. A heated sampling line inside the stack allows the removal of 150 L min^{-1} of air from the main air stream. This air stream splits into five 30-L min^{-1} streams. Four lines are for isokinetic sampling (particle size preserved during sampling) and one is a non-isokinetic line. Figure 1b is a view of the inside of the trailer showing the sampling inlets and racks.

A field data ingestor (Sun Workstation) located in the aerosol trailer interrogates and controls the various instruments and components of the AOS via RS-232 serial interface ports and analog signals.

The Sun Workstation collects information on 125 different parameters. Each parameter has an additional status channel used for diagnostics. Data are provided for one-minute intervals and hourly data files are generated. Every day, 250 channels of information are recorded in 24 files totaling more than 2.5 mb of information.

As of the end of February 1996, the AOS has not been transferred to SGP Site operations and is operated under EML's direction. The AOS is continuously maintained by site operations and information transferred to EML for evaluation. The collection system (Sun Workstation) is continuously being upgraded by Richard Eagan of ANL. An example of the data from February 10, 1996, is shown in Figure 2. Included are observations of the ozone concentration, aerosol scattering coefficient at 550 nm, aerosol absorption coefficient, condensation particle concentration and the aerosol number concentration in two size intervals, $0.10\text{ }\mu\text{m}$ to $0.20\text{ }\mu\text{m}$ and $2\text{ }\mu\text{m}$ to $3\text{ }\mu\text{m}$. A transition in air mass type, at approximately 10:00 GMT can be seen from this data set.

Acknowledgments

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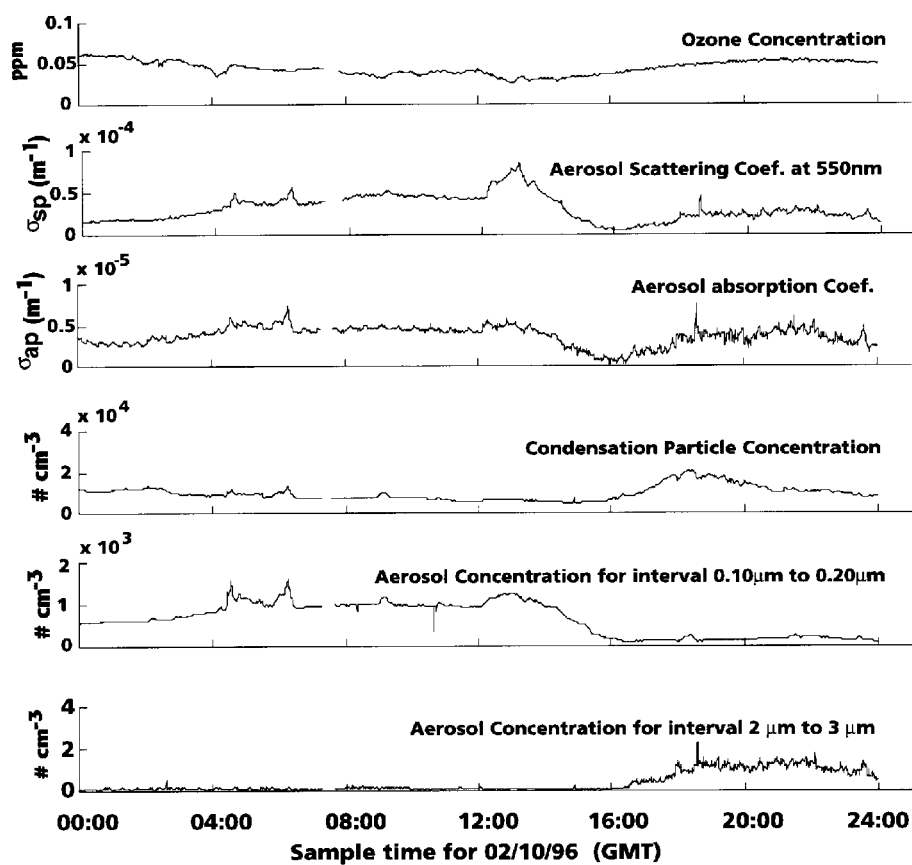


Figure 2. February 10, 1996, observations from the aerosol observation system. Included are the ozone concentration, aerosol scattering coefficient at 550 nm, aerosol absorption coefficient, condensation particle concentration and the aerosol number concentration in two size intervals, 0.10 μm to 0.20 μm and 2 μm to 3 μm .