Atmospheric Radiation Measurement
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New Radiometer Tested for Measurements of Thin Clouds

In a month of testing at the ACRF Southern Great Plains (SGP) site, a Thin-Cloud Rotating Shadowband Radiometer (TCRSR) retrieved simultaneous measurements of the size and density of cloud droplets in "thin" clouds. Both measurements are essential in understanding cloud-climate interactions, and current measurement techniques are not as accurate as desired. (Thin clouds have low water content — less than 100 grams per square meter.)

The TCRSR measures the angular distribution, or spread, of light from the sun scattered toward the instrument in six narrow spectral bands. The six bands, each approximately 10 nanometers (nm) wide, are centered at 415, 500, 610, 660, 870, and 940 nm. The prototype instrument was designed and tested in the summer and fall of 2007. After its promising initial performance, the TCRSR was deployed at the SGP site in early January 2008. Its observations there will be compared to data from other ARM instruments. If the results are favorable, the TCRSR may be considered for routine deployment at all ACRF sites.

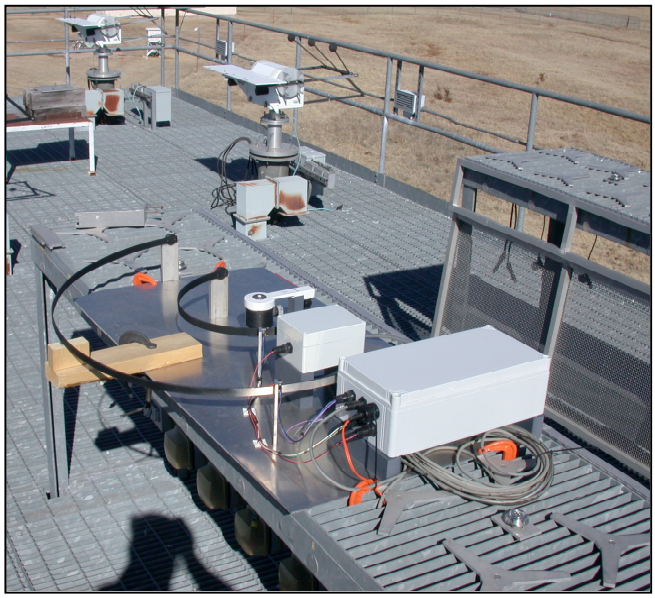

Figure 1. The TCRSR is shown here on the roof of the Radiometer Calibration Facility at the SGP site. Two “shadowbands” rotate around the radiometer’s sensor, located just inside the smaller shadowband. They reflect light away from the sensor at multiple angles so that it simultaneously records signals of scattered light (ARM photo).

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Winter Weather Hampers Work at SGP

One of the worst ice storms in recent history moved through Oklahoma and a large part of the Midwest on December 9-11, 2007. Data collection and delivery suffered when half of the SGP extended facilities lost power or communications. Immediately, all available SGP staff members were dispatched to visit the instrument stations and evaluate the damage.

Figure 2. Two days after the mid December ice storm, the downwelling radiometers at Plevna, Kansas, were still encased in ice (James Martin photo).

The evaluation, occurring as power was restored by the local power company crews, took 7-10 days. Surprisingly, the instruments had suffered little damage, except for blown fuses and power-related computer issues. Through tireless effort, the SGP staff quickly restored normal operations and restarted the data flow.

Less than two weeks after the ice storm, another major winter storm packing strong winds, freezing rain, and 4-6 inches of snow took aim on the SGP. This storm caused several intermittent power outages lasting 2-3 hours, affecting the Central Facility and a few northern instrument stations. The power outages triggered emergency procedures to protect sensitive instruments from damage.

After the power was restored, the SGP information technology staff was able to bring the site computer systems back online late on December 23. The site technicians restored the remaining instruments to operation the next day to minimize data disruption.

Figure 3. The wind speed and direction sensors of the energy balance Bowen ratio system at Hillsboro, Kansas, were frozen in place by the ice deposited in the mid December storm (James Martin photo).