

Contributors

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Research Highlight

Aerosol optical depth (AOD), the most basic and important product of sun-photometric measurements, is measured routinely with shadowband radiometers. Major programs running MFRSR networks include the U.S. Department of Energy (DOE) Atmospheric Radiation Measurement (ARM) Program, U.S. Department of Agriculture (USDA) UV-B Monitoring and Research Program, National Oceanic and Atmospheric Administration (NOAA) Surface Radiation (SURFRAD) Network, and National Aeronautics and Space Administration (NASA) Solar Irradiance Research Network (SIRN).

Several technical issues specific to shadowband radiometers have consequences relative to the optical depth measurements. The problems affecting the multifilter rotating shadowband radiometer (MFRSR) involve alignment, tilt, and accuracy of angular response determination. In this study, we will estimate the errors in AOD caused by some of these problems and illustrate techniques to identify and quantify them using the multi-year data set of MFRSR measurements at the ARM Climate Research Facility (ACRF) Southern Great Plains (SGP) Central Facility.

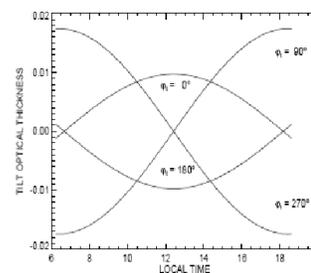
We quantified the impact of instrument tilt, artificial offsets, and filter center wavelength errors. We demonstrated techniques to correct for each of these errors with collocated normal-incidence measurements. We also devised an automated method for detecting the most severe shadowband instrument problem of inaccurate shading. When these instrument corrections are applied, the MFRSR is capable of making AOD measurements as accurately as sunphotometer instruments like the Cimel used by the Aerosol Robotic Network (Aeronet).

Reference(s)

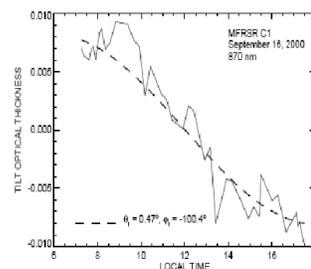
Applied Optics, accepted Sept. 2007.

Working Group(s)

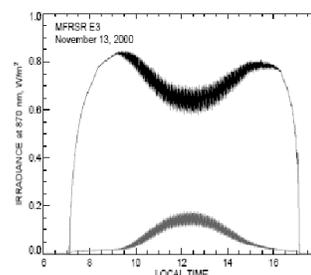
Aerosol



Effective offset to measured optical depths due to tilt of 1-degree in different directions.



Offset observed in C1 MFRSR AOD relative to Cimel and representative offset due to tilt.



Appearance of shading failure and effect on irradiance measurement.