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Title of Abstract / Talk: Spectrometer for Sky-Scanning, Sun-Tracking Atmospheric Research (4STAR)
Instrument Improvements

Abstract Text:

The Spectrometer for Sky-Scanning, Sun-Tracking Atmospheric Research (4STAR) combines airborne sun tracking and sky scanning with grating spectroscopy to improve knowledge of atmospheric constituents and their links to air-pollution and climate. Hyper-spectral measurements of direct-beam solar irradiance provide retrievals of gas constituents, aerosol optical depth, and aerosol and thin cloud optical properties. Sky radiance measurements in the principal and almucantar planes enhance retrievals of aerosol absorption, aerosol type, and size mode distribution. Zenith radiance measurements are used to retrieve cloud properties and phase, which in turn are used to quantify the radiative transfer below cloud layers. These airborne measurements tighten the closure between satellite and ground-based measurements. In contrast to the Ames Airborne Tracking Sunphotometer (AATS-14) predecessor instrument, new technologies for each subsystem have been incorporated into 4STAR. In particular, 4STAR utilizes a modular sun-tracking/sky-scanning optical head with fiber optic signal transmission to rack mounted spectrometers, permitting miniaturization of the external optical head, and spectrometer/detector configurations that may be tailored for specific scientific objectives. This paper discusses technical challenges relating to compact optical collector design, radiometric dynamic range and stability, and broad spectral coverage at high resolution. Test results benchmarking the performance of the instrument against the AATS-14 standard and emerging science requirements are presented.

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