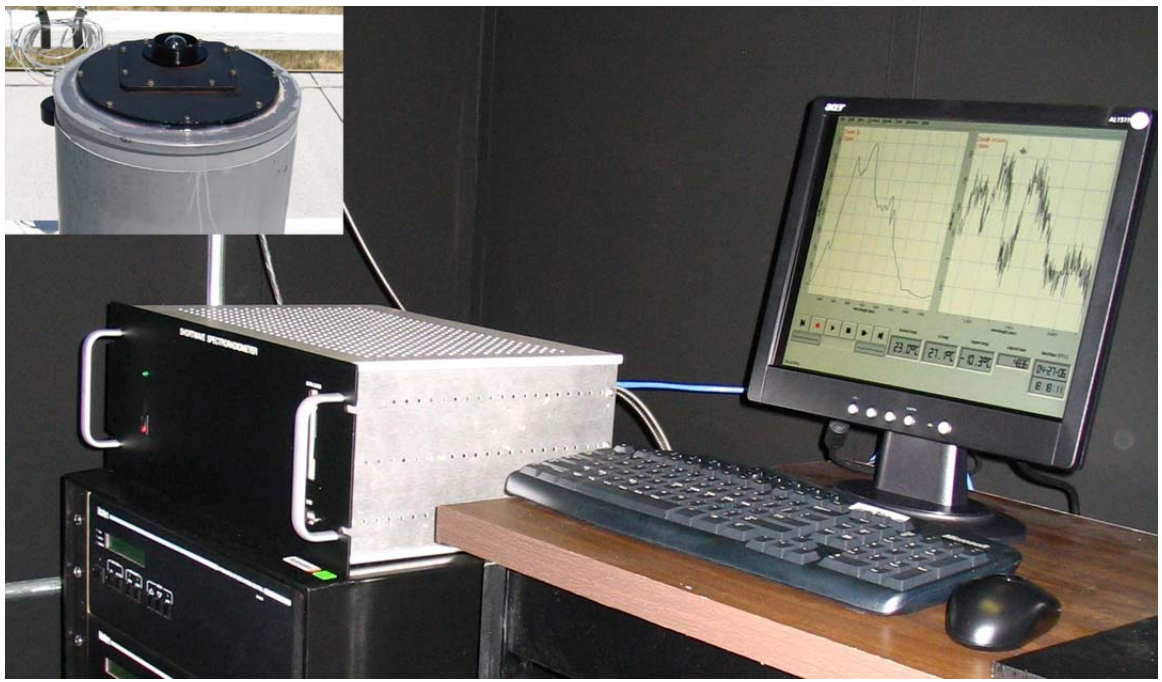
Shortwave Spectroradiometer (SWS)



Mentors

John Pommier
Bay Area Environmental Research Institute
NASA-Ames Research Center
jpommier@mail.arc.nasa.gov

Patrick McBride
University of Colorado
patrick.mcbride@lasp.colorado.edu

Technical and QA support:

Warren Gore (Warren.Gore@nasa.gov)
Peter Pilewskie (peter.pilewskie@lasp.colorado.edu)

Instrument Specifications

- Wavelength range: 380 to 2200 nm
- Narrow field-of-view (1.4°) collimator at the front end of a high grade, ultra-low OH fiber optic cable.
- Spectrometer: Zeiss MMS 1 NIR enhanced (300-1100 nm), flat-field, 366 1/mm grating, Hamamatsu Si 256 element linear diode array. Operating temperature regulated to 27° C by heater. Zeiss NIR-PGS 2.2 (900 – 2200 nm), 300 1/mm flat grating, Hamamatsu InGaAs 256-element linear diode array. Operating temperature regulated to -10° C by 2-stage thermoelectric cooler.
- Spectral resolution: 8 nm resolution (full width half max) from 380-975 nm and 12 nm resolution from 975-2200 nm.

Instrument Specifications

- Automated shutter for dark current measurement.
- A 933 MHz Pentium III based computer (PC104 format) for automated data acquisition and control.
- Operating system is Linux Fedora.
- A USB interface between the computer and the spectrometers.
- Spectral sampling rate is approximately 1 Hz.
- Internal data storage on 1 GB compact flash card; remote data collection via Ethernet interface.
- Remote instrument control via Ethernet interface.
- Power: 120 VAC 60 Hz.

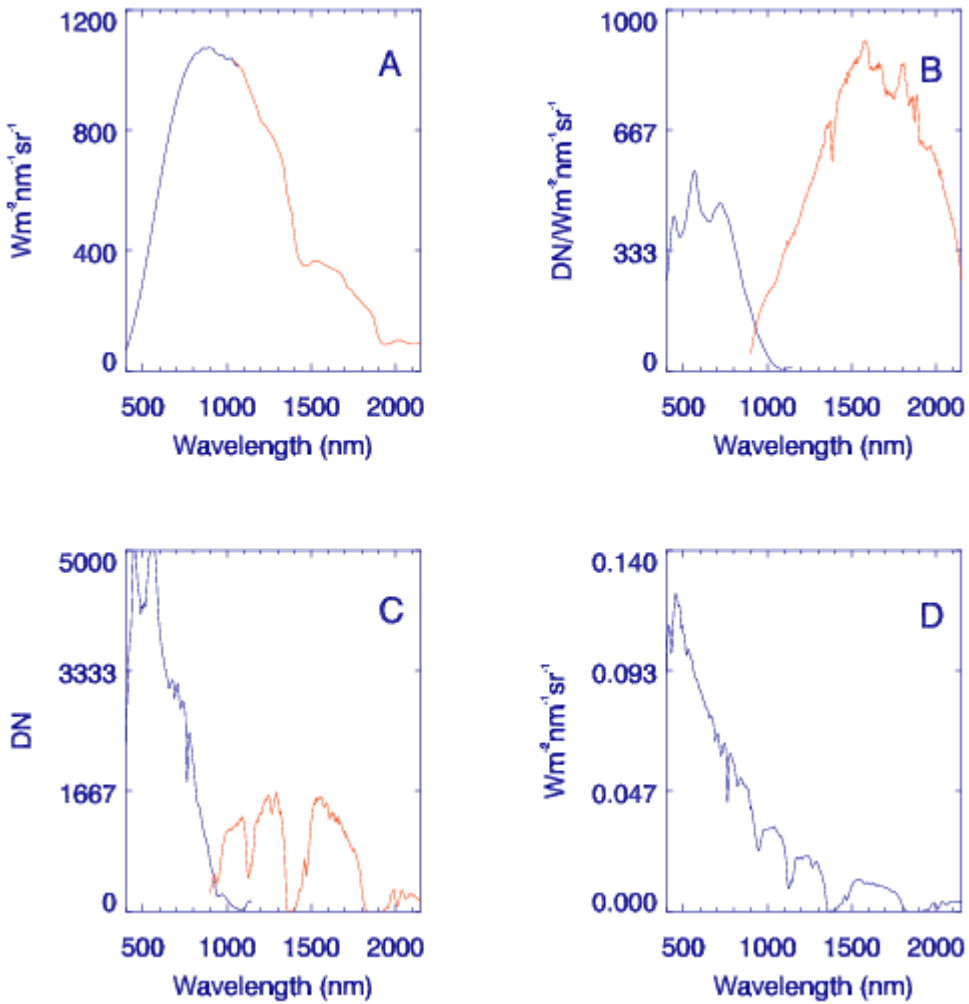
Instrument Status

- The SWS was designed and built at NASA-Ames Research Center.
- The SWS was deployed at the Southern Great Plains (SGP) Central Facility on 27 April 2006.
- The SWS began full operation 28 April 2006 and has run continuously to the present.
- Current daily operation is from1100-0200 UTC.
- Dark spectra are measured at startup and at hourly intervals.
- Over 25 GB of spectra have been collected, calibrated and archived.

Calibration

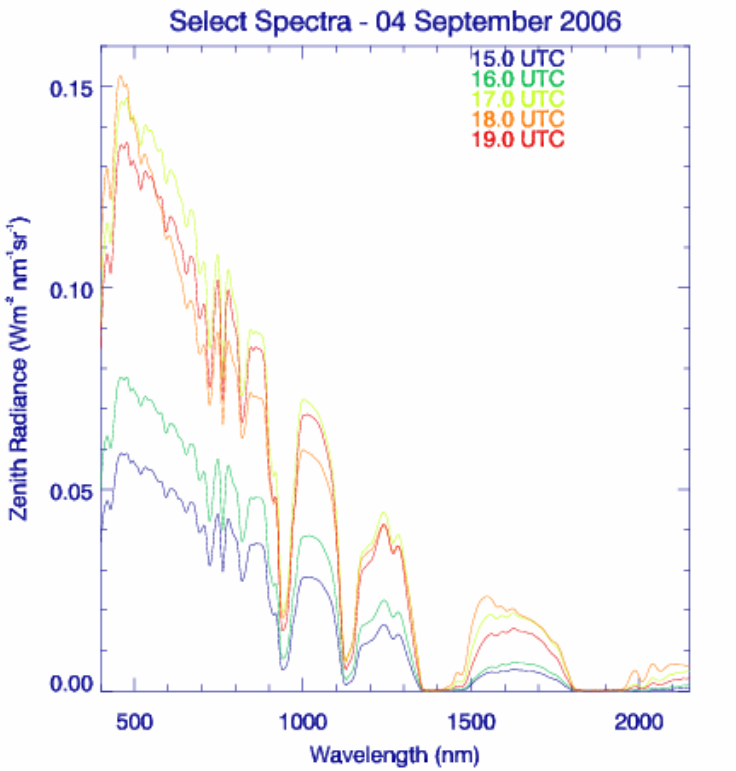
- A pre-deployment calibration was conducted at the Airborne Science and Technology Laboratory (ASTL) at NASA-Ames Research Center using a 30 inch integrating sphere which has been calibrated according to NIST standards.
- A yearly calibration using the 30 inch integrating sphere at the ASTL is planned.
- Weekly calibrations are being performed at the SGP site by site personnel using a Labsphere 12 inch integrating sphere.

Calibration

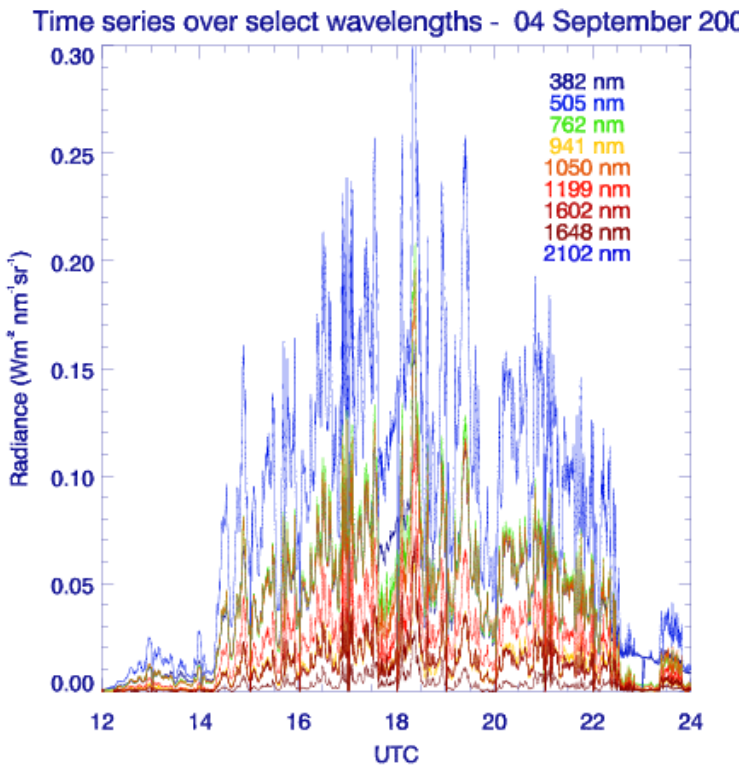


The calibration transfer from the ASTL 30 inch integrating sphere to 12 inch field integrating sphere (A) is used to derive the SWS response function (B). The response curve is used to convert the raw field spectrum (C) to a calibrated spectrum (D).

SWS Products: overcast sky

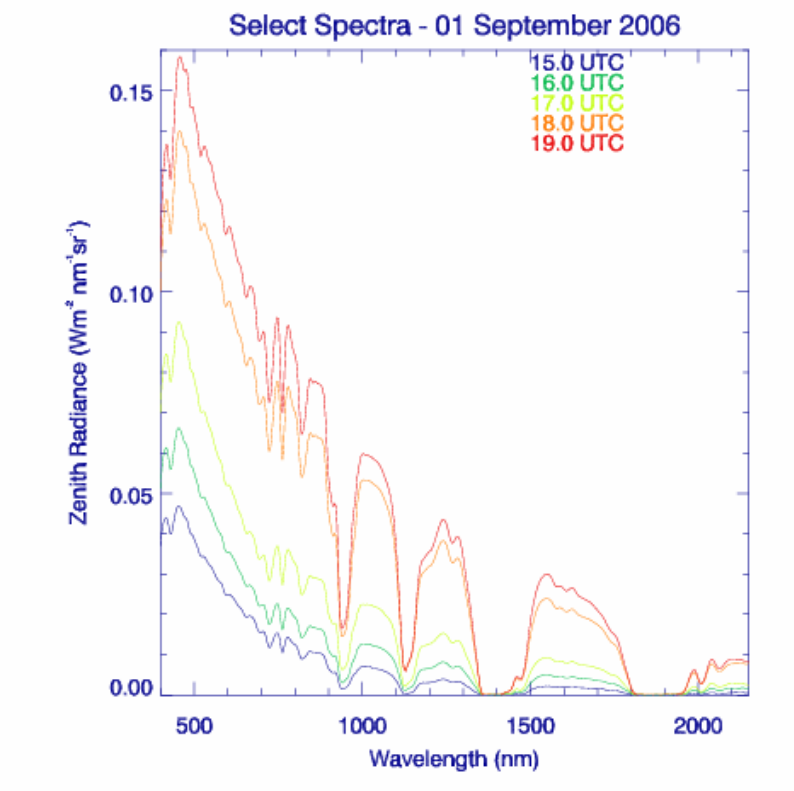


Sample hourly spectra during the period 15–19 UTC on 4 September for a heavy overcast day. Data are not averaged; they are 1 Hz spectra collected at the indicated times.

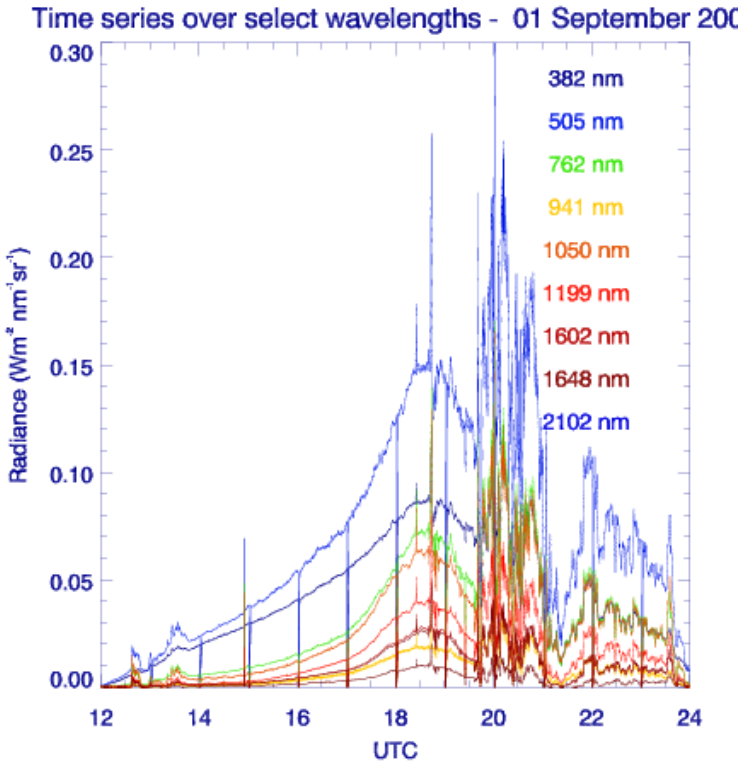


Radiance time series at seven select SWS wavelengths.

Broken cloud

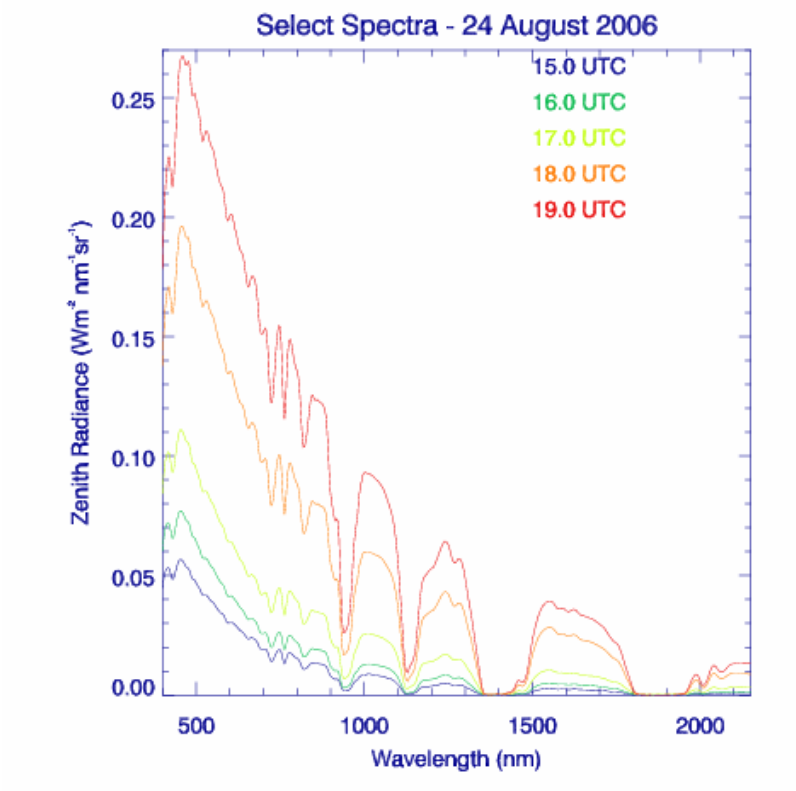


Sample hourly spectra on 1 September 2006.

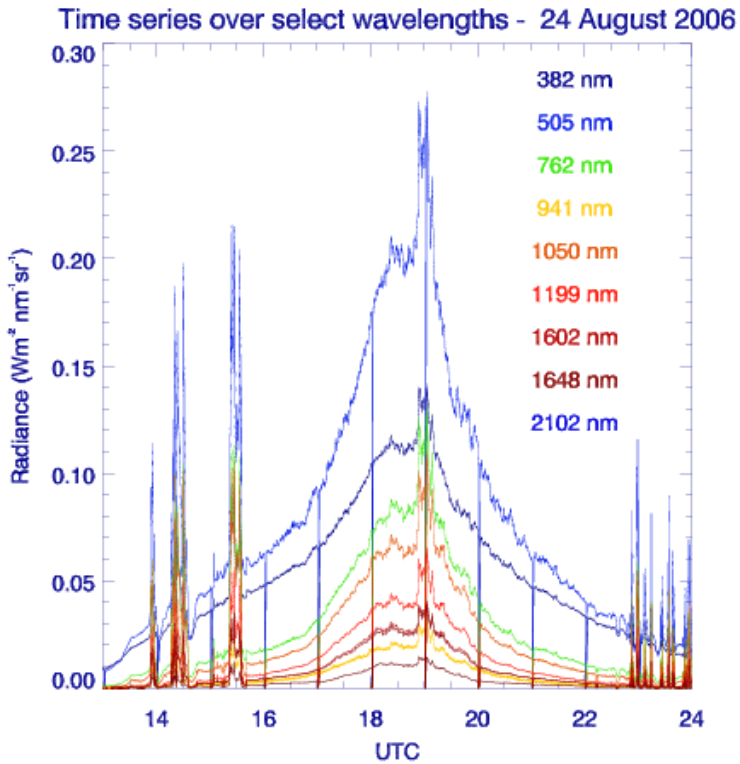


Radiance time series at selected wavelengths.

Cloud-free



Clear-sky sample spectra on 24 August 2006.



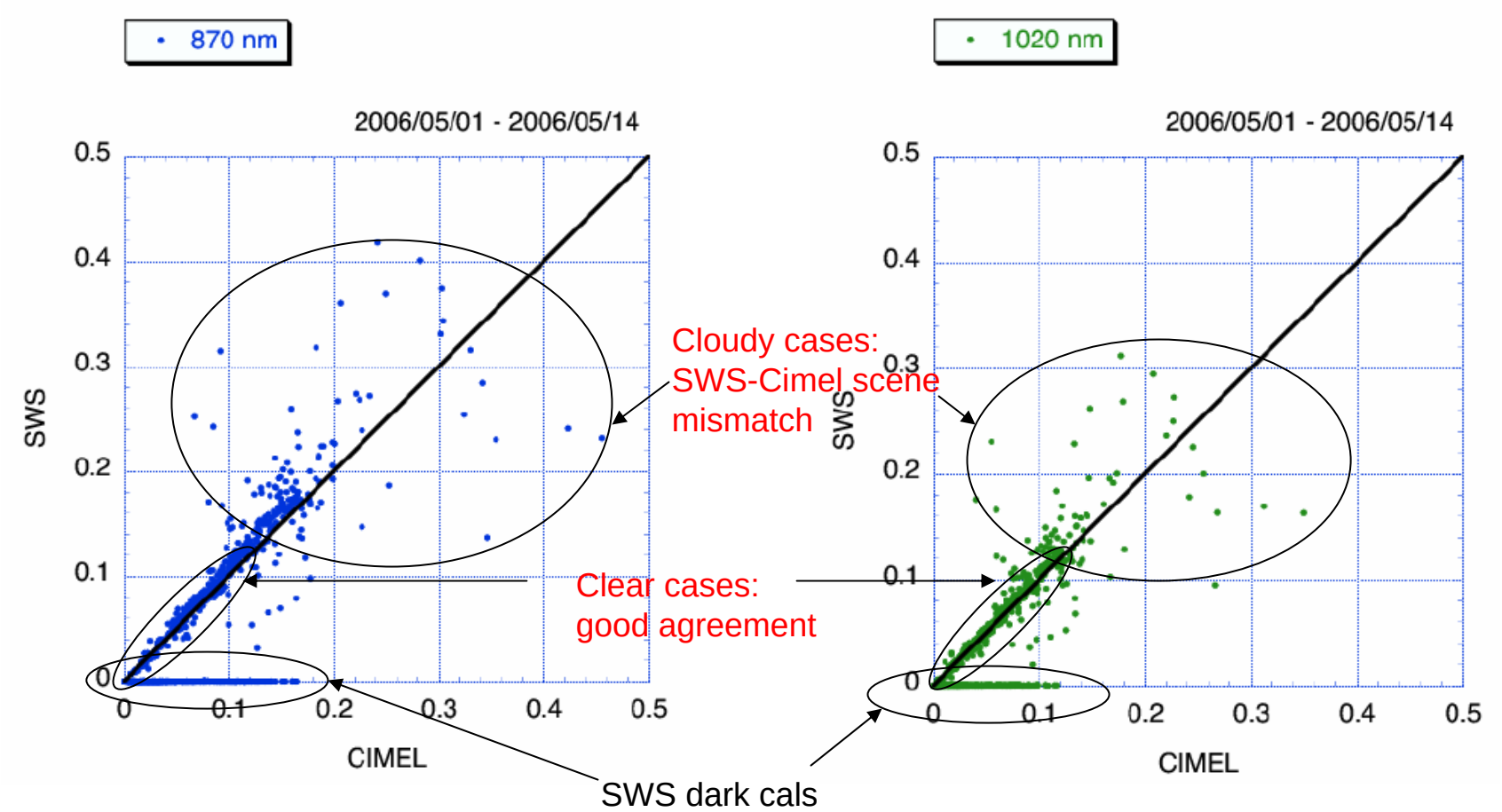
Radiance time series at selected wavelengths.

Recent SWS and Cimel Comparison

- A more recent comparison between the SWS and the Cimel took place between 23-28 August 2006.
- Cimel located next to the SWS on the platform adjacent to the optical trailer.
- Cimel removed on 29 August for calibration – needed for comparison with SWS.
- Possible permanent new location for Cimel.

Full-day SWS images with Sky Imager comparisons

SWS-Cimel Comparisons

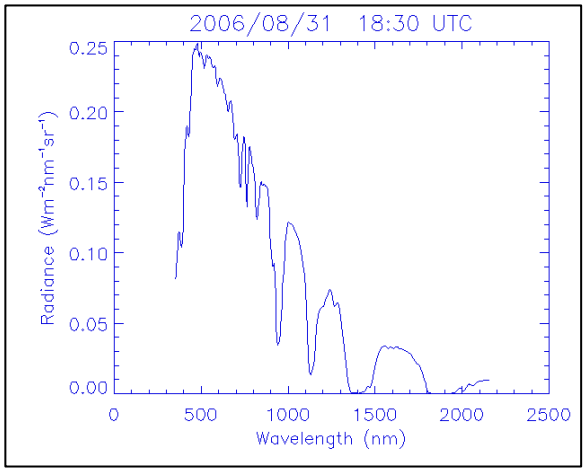


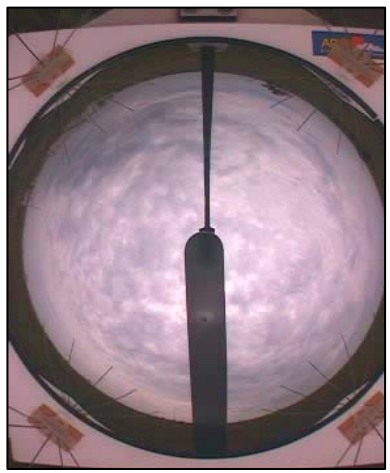
SWS – Cimel comparisons over the period between 01 to 14 May 2006 at 870 nm and 1020 nm. Prepared by Christine Chiu, cchiu@climate.gsfc.nasa.gov.

Alto cumulus

8/31/2006 1830 UTC

SWS Spectrum

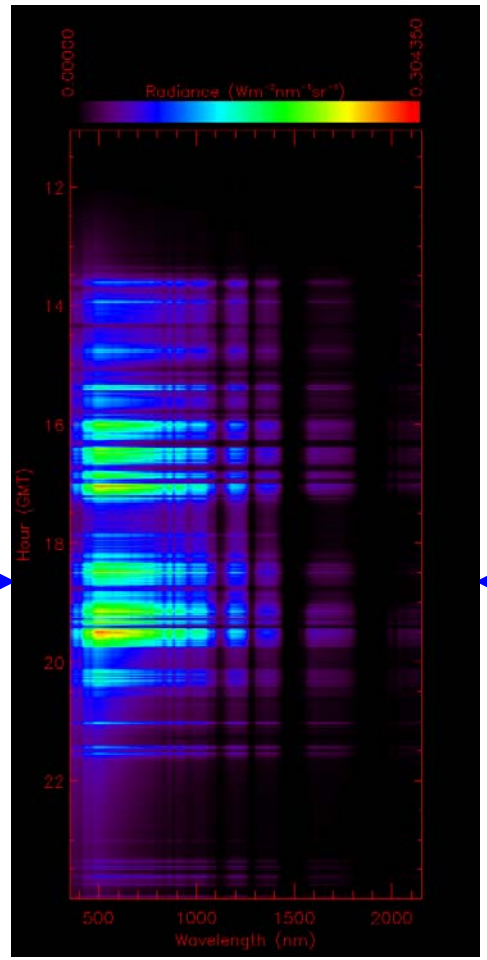




Total Sky Imager

SWS full-day image

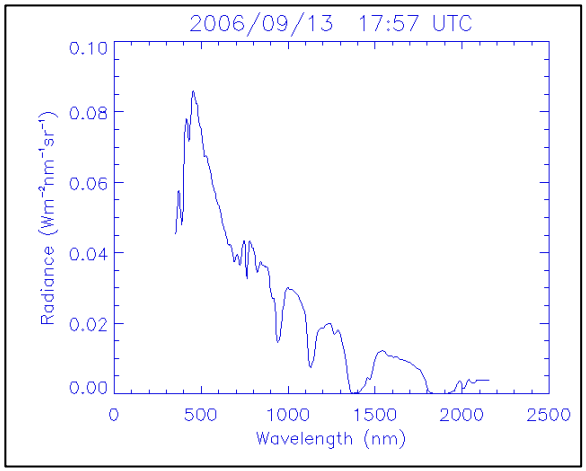
1830 UTC

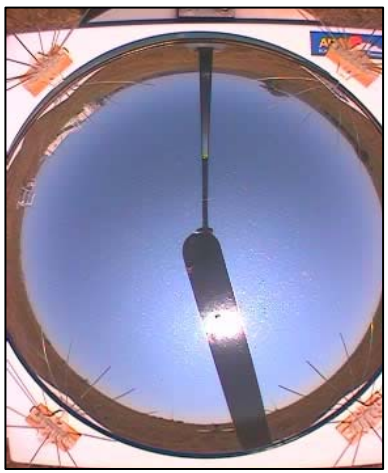


Cloud-free

9/13/2006 17:57 UTC

SWS Spectrum

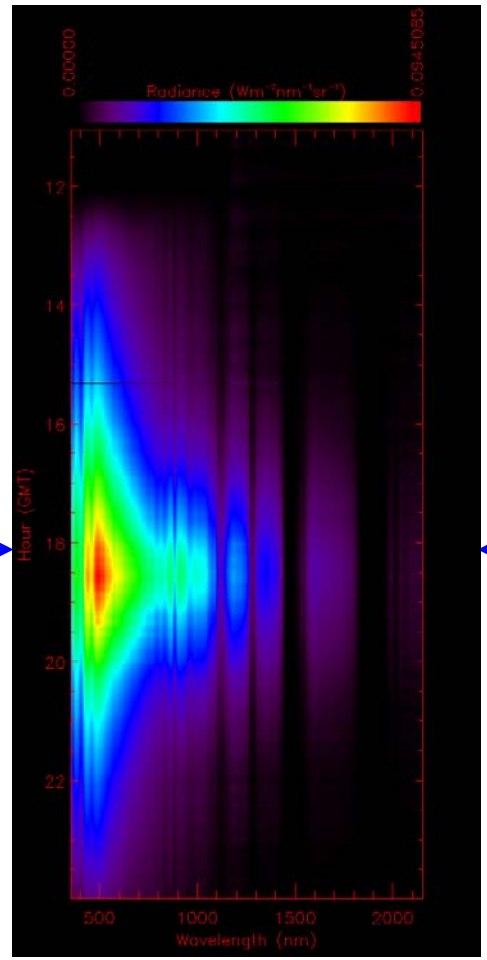




Total Sky Imager

SWS full-day image

1757 UTC →

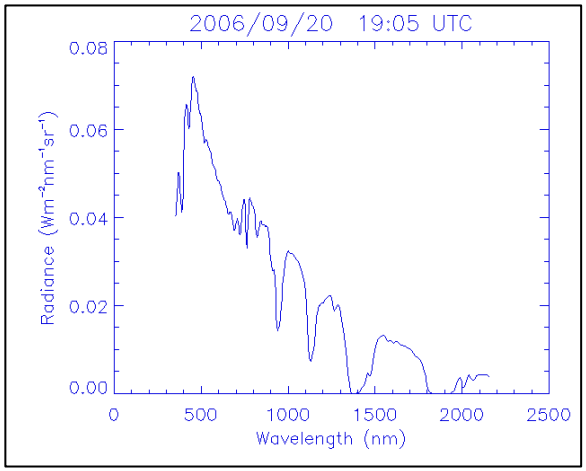


←

Cirrus

9/20/2006 1905 UTC

SWS Spectrum



Total Sky Imager

SWS full-day image

1905 UTC