

Spectral Shortwave Radiative Closure Studies at SGP: Improving Treatment of Aerosol Properties

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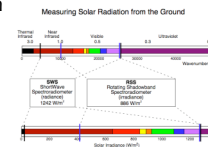
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Milestones in 2009/2010

AEROSOL OPTICAL PROPERTY IMPROVEMENTS: Improved aerosol optical depth estimates (AODs) from multi-filter radiometer measurements; Upgrade the Aerosol Best Estimate (ABE) Product to include multi-wavelength measurements from the Aerosol Observing System (AOS).

SPECTRAL SURFACE ALBEDO PRODUCT: Release of spectral surface albedo product that provides an estimate of the spectral surface albedo from 2500 - 50,000 cm^{-1} (0.2 to 4 μm) at 10 cm^{-1} spacing.

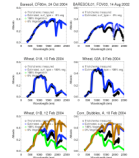
INSTRUMENTS: RSS & SWS redeployed to SGP after extensive refurbishments and design improvements.



SGP Spectral Surface Albedo Product

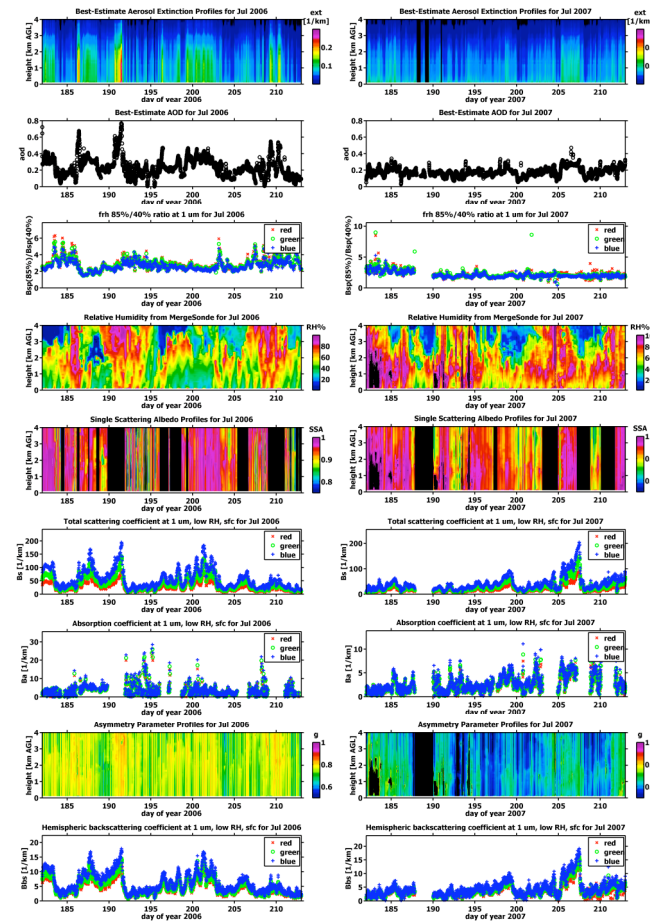
Categories identified for SGP site

- bare soil or no green vegetation
- thick, lush green vegetation
- partially covered soil or green vegetation
- snow



Product tested against measurements by A. Trishchenko

SGP ACRF's Aerosol Optical Properties Products



The “aerosolbe1turn” product (ABE) has been expanded to explicitly include NIMFR & MFRSR aerosol optical depths (AODs). In clear, daytime conditions, the best-estimate AOD @ 500 nm is derived from the NIMFR or from the MFRSR when the NIMFR is not available.

The “aipfthr” product has been updated to include improved estimates of $f(\text{RH})$ - which relates the total aerosol scattering to the ambient relative humidity. Improved quality control measures have also been applied to $f(\text{RH})$.

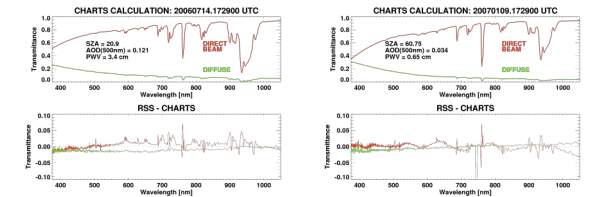
The “aip1ogren” product reports dry calculations of single-scattering albedo and asymmetry parameter for two size cuts (1 and 10 μm) and 3 wavelengths (467, 550, 660 nm).

ABE takes advantage of the “mergesonde1mace” relative humidity field to calculate a vertical profile (up to 7 km) of the humidified single-scattering albedo and the asymmetry parameter every 10 minutes and at 3 wavelengths. Previously, only “green” values were reported.

ABE is extremely useful for examining seasonal and long-term aerosol trends at the SGP ACRF site. ABE improvements at the NSA and TWP ACRF are underway.

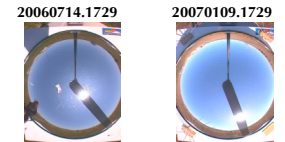
Radiative Closure Studies

A number of comparisons between CHARTS radiative transfer model calculations and cloud-free RSS measurements have been generated. For these cases, the aerosol optical properties were “hand-calculated” using NIMFR aerosol optical depths and spectrally grey single-scattering albedos and asymmetry parameters.

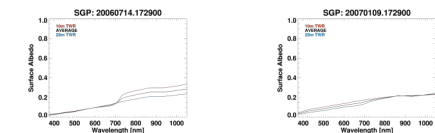


Steps for future ABE-based radiative closure comparisons

- 1) Clear-sky conditions required for aerosol radiative closure studies. Use ABE cloud-screening and ancillary SGP data.



- 2) Use the “sgpsurfspectralbmlawr” surface spectral albedo.



- 3) Derive transmittance T_{RSS} from RSS irradiance measurements.

- 4) Compute radiative transfer model transmittance T_{CHARTS} using ABE profiles of wavelength-dependent aerosol optical properties. The “mergesonde1mace” provides the atmospheric thermodynamic properties.