CHARACTERIZATION OF AEROSOL AND SURFACE BRDF IN SOUTHERN AFRICA FROM AIRBORNE MEASUREMENTS TAKEN DURING SAFARI-2000

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The problem to be examined in this study involves deducing characteristics of atmospheric aerosols (volume size distribution, complex index of refraction and single scattering albedo) and surface reflectance properties (bidirectional reflectance distribution function and spectral albedo) from measurements of diffuse and/or direct solar radiation. The measurements were taken during Southern African Regional Science Initiative-2000 (SAFARI-2000) dry season campaign with National Aeronautics and Space Administration's (NASA's) Cloud Absorption Radiometer (CAR), which was flown aboard the University of Washington Convair CV-580 research.

The CAR instrument provides a rich dataset consisting of multiangular and multispectral radiance measurements at fourteen spectral bands between 0.34 and 2.30 microns and has operated on different airborne platforms (see http://car.gsfc.nasa.gov). In a normal mode of operation data are sampled simultaneously and continuously on nine individual detectors. Eight of the data channels are for spectral bands from 0.34–1.27 microns, which are always registered during the operation, while the ninth data channel is registered for signal selected among six spectral channels (1.55-2.30 microns) on a filter wheel. The filter wheel can either cycle through all six spectral bands at a prescribed interval (usually changing filter every fifth scan line) or lock onto any one of the six spectral bands, mostly 1.656, 2.103 or 2.205 microns and sample it continuously. The CAR scan mirror rotates 360° in a plane perpendicular to the direction of flight and the data are collected through a 190° aperture that allows observations of the earth-atmosphere scene around the starboard horizon from local zenith to nadir.

We will focus our study on four cases, two of which are NASA's Earth Observing validation sites: Skukuza tower, South Africa (25.0°S, 31.5°E) and Mongu tower, Zambia (15.4°S, 23.3°E). The additional sites to be included are the Maun tower, Botswana (20.0°S, 23.5°E), Sua Pan, Botswana (20.6°S, 26.2°E) and Etosha Pan, Namibia (19.0°S, 16.0°E). We use a new inversion algorithm described by Gatebe et al. (2009), which is based on the standard Aerosol Robotic Network (AERONET) retrieval algorithm as described by Dubovik and King (2000). The retrieval algorithm uses general methods and principles of statistical estimation theory to describe the character and level of uncertainties in the initial data. The wide spectral (0.34–2.30 μm) and angular range (180°) of the CAR instrument combined with observations from AERONET Sun photometer provide sufficient measurements constraints for characterizing aerosol and surface properties with minimal assumptions.

References

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