Radiative Closure Studies for Clear Skies During the ARM 2003 Aerosol Intensive Observation Period

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The Atmospheric Radiation Measurement (ARM) program sponsored a large intensive observation period (IOP) to study aerosol during the month of May 2003 around the Southern Great Plains (SGP) Climate Research Facility (CRF) in north central Oklahoma. Redundant measurements of aerosol optical properties were made using different techniques at the surface as well as in vertical profile with sensors aboard two aircraft. One of the principal motivations for this experiment was to resolve the disagreement between models and measurements of diffuse horizontal broadband shortwave irradiance at the surface, especially for modest aerosol loading. The focus here is using the redundant aerosol and radiation measurements during this IOP to compare direct beam and diffuse horizontal broadband shortwave irradiance measurements and models at the surface for a wide range of aerosol cases that occurred during clear-sky periods of May 2005. Models and measurements are compared over a large range of solar-zenith angles. Five different models are used to assess the relative agreement among them and the measurements. Better agreement than previously achieved appears to result from smaller measured asymmetry parameters than those assumed in prior studies as shown in Figure 1.

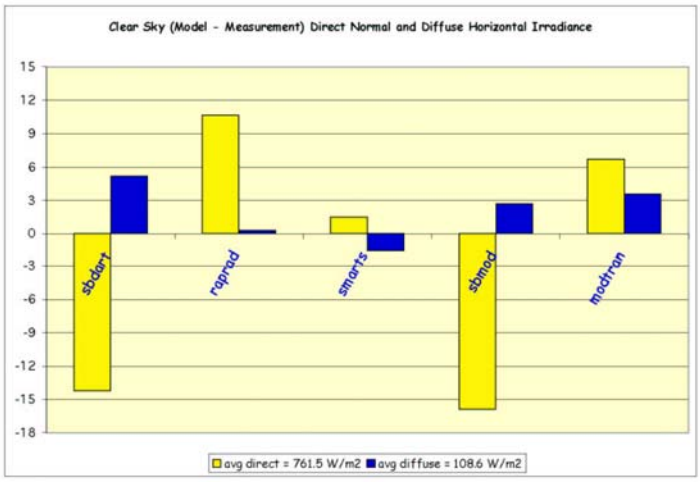

Figure 1. Average difference between named model and measurements for 30 cases of clear-sky direct (yellow) and clear-sky diffuse (blue) irradiance in W/m^2.