

Measured and Modeled Cloud and Radiation Interactions over West Africa

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Coincident, continuous measurements of the surface and top-of-atmosphere (TOA) broadband radiative fluxes made during the Atmospheric Radiation Measurement Mobile Climate Research Facility (AMF) deployment in Niamey, Niger, Africa provided an unusual opportunity to investigate the interworking's of GCM simulations of cloud and radiation interactions. Measurements from a unique satellite sensor known as the Geostationary Earth Radiation Budget (GERB) instrument were combined with data collected using AMF1 to enable 15-minute resolution measurements the Cloud Radiative Forcing (CRF), which quantifies the radiative impacts of clouds at the surface and the TOA, and Cloud Radiative Effect (CRE), which quantifies the radiative effects of clouds on the atmospheric column itself. This unprecedented radiation measurement frequency is compatible with the time scale of changes in water vapor, aerosol, and cloud structure that modulate the radiation budget, thereby producing a detail-laden Global Climate Model (GCM) evaluation tool. Simulations of the climate in the African Sahel region from four GCMs used in the in the Intergovernmental Panel for Climate Change (IPCC) fourth assessment report (AR4) were vetted using these unique data and the representations of clouds and accompanying radiative throughput in two of these GCMs were studied in detail.