IRS2012-254
International Radiation Symposium 2012
Dahlem Cube, Berlin, Germany, 06 – 10 August 2012

Assessment of the NASA GISS AR5 GCM Simulated Clouds and TOA Radiation Budgets using CERES-MODIS Observations

X. Dong
University of North Dakota, Atmospheric Sciences, Grand Forks, United States (dong@aero.und.edu, 701-777-6991)

Ryan Stanfeld, Baike Xi, and Aaron Kennedy, University of North Dakota
Tony Del Genio, NASA GISS
Patrick Minnis, Norman Loeb, and David Doelling, NASA Langley Research Center

The past, current and future Earth climate has been simulated by the NASA GISS ModelE climate model and has been summarized by the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, AR4, 2007). New simulations from the updated AR5 version of the NASA GISS ModelE GCM have been released to the public community and will be included in the IPCC AR5 ensemble of simulations. Due to the recent nature of these simulations, however, they have yet to be extensively validated against observations.

To evaluate the GISS AR5 simulated global clouds and TOA radiation budgets, we have collected and processed the NASA CERES and MODIS observations during the period 2000-2005. In detail, the 1ox1o resolution monthly averaged SYN1 cloud product has been used with combined observations from both Terra and Aqua satellites, and degraded to a 2ox2.5o grid box to match the GCM spatial resolution. The monthly means of the CERES EBAF radiation dataset have been used in this study where the EBAF data are temporally interpolated using geostationary observations to infer the diurnal signal between CERES measurements. The GISS AR5 products were downloaded from the CMIP5 (Coupled Model Intercomparison Project Phase 5) for the IPCC-AR5.

The GISS AR5 simulated global TOA NET flux has an excellent agreement with CERES EBAF, having an annual difference of 0.8 Wm-2 during the period 2000-2005. The monthly means are nearly the same for both datasets except for the period November-February where AR5 results are approximately 2-3 Wm-2 higher than EBAF. Latitudinal comparisons have shown that this 2-3 Wm-2 difference comes from southern mid-latitudes during this time period. To understand if this 2-3 Wm-2 difference is due to OLR, or reflected SW flux, we compare both of these properties at the TOA in this study. The annual OLR difference between AR5 and EBAF is 0.8 Wm-2, while most of the monthly mean AR5 OLRs are about 1-2 Wm-2 lower than CERES EBAF. However, there is excellent agreement during the period October-January. The reflected SW flux comparison nearly mirrors the OLR comparison, that is, most of the monthly mean AR5 reflected SW values are about 1-2 Wm-2 higher than CERES EBAF except for during winter months (NH). These two oppositing comparisons have resulted in an excellent agreement in NET flux nearly year-around except during winter months (NH). The global distributions of AR5 and EBAF have shown that the AR5 underestimated reflected SW over the southern mid-latitudes during NH winter months, which resulted in a higher simulated NET flux over that region. Further study has illustrated that the underestimated reflected SW in AR5 simulation is strongly associated with lower simulated cloud fractions over that region.