Geophysical Research Abstracts,
Vol. 11, EGU2009-12905, 2009
EGU General Assembly 2009

Accuracies of Incoming Radiation: Calibrations of Total Solar Irradiance Instruments

G. Kopp, D. Harber, and K. Heuerman
University of Colorado / LASP, Boulder, Colorado, United States (greg.kopp@lasp.colorado.edu)

All of the energy tracked by the GEWEX Radiative Flux Assessment and the driving energy for Earth climate is incident at the top of the Earth's atmosphere as solar radiation. The total solar irradiance (TSI) has been monitored continually for over 30 years from space. Continuity of these measurements has enabled the creation of composite time series from which the radiative forcing inputs to climate models are derived and solar forcing sensitivities are determined.

None of the ten spaceborne TSI instruments contributing to the solar climate data record have been calibrated or validated end-to-end for irradiance accuracy under flight-like conditions, and calibration inaccuracies contribute to seemingly large offsets between the TSI values reported by each instrument. The newest of the flight TSI instruments, the SOlar Radiation and Climate Experiment (SORCE) Total Irradiance Monitor (TIM), measures lower solar irradiance than prior instruments. I will review the accuracies of flight TSI instruments, discuss possible causes for the offsets between them, and describe a recently built calibration facility to improve the accuracies of future TSI instruments.

The TSI Radiometer Facility (TRF) enables end-to-end comparisons of TSI instruments to a NIST-calibrated cryogenic radiometer. For the first time, TSI instruments can be validated directly against a cryogenic radiometer under flight-like conditions for measuring irradiance (rather than merely optical power) at solar power levels while under vacuum. The TRF not only validates TSI instrument accuracy, but also can help diagnose the causes of offsets between different instruments. This facility recently validated the accuracy of the TIM to be launched this year on NASA's Glory mission, establishing a baseline that can link the Glory/TIM to future TSI instruments via this ground-based comparison. Similar tests on the TRF with a ground-based SORCE/TIM support the lower TSI values measured by the SORCE flight unit. These improved and validated TSI measurement absolute accuracies have relevance for quantifying the Earth's radiative flux balance, and are included in the upcoming GEWEX Radiative Flux Assessment.