

Comparison of Solar Irradiance Variability Models with SORCE Observations

Judith Lean [jlean@ssd5.nrl.navy.mil], Naval Research Laboratory, Washington, DC; and Jerald Harder and Greg Kopp, LASP, University of Colorado, Boulder.

Onboard SORCE, the Total Irradiance Monitor (TIM) and the Spectral Irradiance Monitor (SIM) measure simultaneous changes in both the total and spectral solar irradiance, at ultraviolet, visible and near IR wavelengths, for the first time. Models that combine the calculated bolometric sunspot and facular modulation have been used for many years to reproduce total solar irradiance variations, and account for over 80% of the changes observed by TIM from 2002 to 2006. Models of spectral irradiance changes, which rely on information about the wavelength dependence of the sunspot and facular contrasts, have also been developed, motivated by the need for simulations of climate and atmospheric responses to properly account for a multitude of wavelength-dependent processes that facilitate the Earth's utilization of the Sun's energy. Current spectral irradiance variability models rely on information about the wavelength dependence of sunspot contrasts made by ground-based observations and facular contrasts estimated by solar atmosphere models. SIM's unique new direct measurements permit the first quantitative assessment of the spectral structure of irradiance variability attributable to sunspot and facular sources, constrained by their integral effects as measured independently by TIM. The observed and modeled total and spectral irradiance variations are quantitatively compared with TIM and SIM observations over the duration of the SORCE mission, which now extends from the maximum to minimum of solar cycle 23. Relating the sunspot and facular contributions to ground-based or other proxy solar observations that extend over many decades permits historical reconstruction of total and spectral irradiance variations over multi-decadal epochs. An example is shown of atmospheric changes associated with the solar cycle, simulated with the GISS model which inputs the modeled spectral irradiance variations in 190 wavelength bands from 115 to 100000 nm. Solar total and spectral irradiances reconstructed monthly since 1950 are available on the LISIRD and SOLARIS web sites, for use in climate and atmospheric simulations.