

The Spectral Irradiance Monitor (SIM) measures solar spectral variability in the 200-2400 nm range, accounting for about 97% of the total solar irradiance (TSI). This instrument monitored the descending phase of solar cycle 23 and is now continuing these observations in the rising phase of cycle 24. The SIM observations clearly show rotational modulation of spectral irradiance due to the evolution of dark sunspots and bright faculae that respectively deplete and enhance solar radiation. In addition to this well-known phenomenon, SIM observations indicate a slower evolutionary trend in solar spectral irradiance (SSI) over solar cycle times periods that are both in and out of phase with the TSI. Wavelengths where the brightness temperature is less than $T_{\text{eff}} = 5770$ K are in phase, and where the brightness temperature $> T_{\text{eff}}$ in the visible and infrared, the time series show an anti-solar cycle trend. This observation is discussed in terms of the Solar Radiation Physical Modeling (SRPM) program and solar images from Precision Solar Photometric Telescope (PSPT) that provides the areas of active regions on the solar disk as function of time to generate a modeled SSI time series that is concurrent with the SIM observations. Preliminary sensitivity studies using Earth-atmospheric models suggest a very different atmospheric response to the solar forcing indicated by these observations.