A Different View of Solar Spectral Irradiance Variations: Modeling Total Energy over Six-Month Intervals

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A different approach to studying solar spectral irradiance (SSI) variations, without the need for long-term (multi-year) instrument degradation corrections, is examining the total energy of the irradiance variation during six-month periods. This duration is selected because a solar active region typically appears suddenly and then takes five to seven months to decay and disperse back into the quiet Sun network. The solar outburst energy, which is defined as the irradiance integrated over the six-month period and thus includes the energy from all phases of active region evolution, could be considered the primary cause for irradiance variations. Because solar cycle variation is the consequence of multiple active region outbursts, understanding the energy spectral variation may provide a reasonable estimate of the variations for the 11-year solar activity cycle. The moderate-term (6-month) variations from the Solar Radiation and Climate Experiment (SORCE) instruments can be decomposed into positive (in-phase with solar cycle) and negative (out-of-phase) contributions by modeling the variations using the San Fernando Observatory (SFO) facular excess and sunspot deficit proxies, respectively. These excess and deficit variations are fit over 6-month intervals every 2 months over the mission, and these fitted variations are then integrated over time for the six-month energy. The dominant component indicates which wavelengths are in-phase and which are out-of-phase with solar activity. The results from this study indicate out-of-phase variations for the 1400-1600 nm range, with all other wavelengths having in-phase variations.