Validity of Today's Solar Irradiance Measurements to Future (100 years) Climate Studies

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Total and spectral solar irradiance are primary climate data records (CDR's). Because of absorption and scattering by our intervening atmosphere accurate measurements of the Sun are only realized from space observations beginning in about 1978. The accuracies of measurement programs are limited by unidentified and uncertain on-orbit instrument degradation. Nevertheless, from numerous observing programs solar variability has been established for short and intermediate times scales, with additional clear indications of decadal variability associated with the 11-year solar cycle.

But how will today's measurements stand the test of time and compare to those made far into the future? Total Solar Irradiance (TSI) measurements relate directly to the primary SI standards — Watt and meter (squared), and should compare well (100 ppm) to future TSI. Although Solar Spectral Irradiance (SSI) also relates to SI, its accuracy is lower and strongly wavelength dependent, and moreover tracking instrument response further decreases the accuracy.

There is one technique that shows great promise, a method that circumvents tying measurements to SI, and additionally accounts for instrument degradation. That method directly compares the Sun to an ensemble of bright, blue stars. This technique uses a single instrument — same optics and detectors — to observe the Sun and stars differing by orders of magnitude in brightness (10^8 in the UV). The Solar Stellar Irradiance Comparison Experiment (SOLSTICE) has now flown twice — UARS from 1991 to 2005 and SORCE from 2003 to the present. This talk will consider the success and limitations of the SOLSTICE UV irradiance data record.