

XUV Photometer System (XPS): Improved Solar Irradiance Algorithm Using CHIANTI Spectral Models

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The solar soft X-ray (XUV) radiation is highly variable on all time scales and strongly affects Earth's ionosphere and upper atmosphere; consequently, the solar XUV irradiance is important for atmospheric studies and for space weather applications. While there have been several recent measurements of the solar XUV irradiance, detailed understanding of the solar XUV irradiance, especially its variability during flares, has been hampered by the broad bands measured in the XUV range. In particular, the simple conversion of the XUV photometer signal into irradiance, which assumes a static solar spectrum, over estimates the flare variations by more than a factor of two as compared to the atmospheric response to the flares. To address this deficiency in the simple conversion, an improved algorithm using CHIANTI spectral models has been developed to process the XUV Photometer System (XPS) measurements with its broad band photometers. Model spectra representative of quiet Sun, active region, and flares are combined to match the signals from the XPS and produce spectra from 0.1 to 40 nm in 0.1 nm intervals for the XPS Level 4 data product. The two XPS instruments are aboard NASA's Solar Radiation and Climate Experiment (SORCE) and Thermosphere, Ionosphere, Mesosphere, Energetics, and Dynamics (TIMED) satellites. In addition, the XPS responsivities have been updated for the latest XPS data processing version. The new XPS results are consistent with daily variations from the previous simple conversion technique used for XPS and are also consistent with spectral measurements made at wavelengths longer than 27 nm. Most importantly, the XPS flare variations are reduced by factors of 2 to 4 at wavelengths shorter than 14 nm and are more consistent, for the first time, with atmospheric response to solar flares. Along with the details of the new XPS algorithm, several comparisons to dayglow and photoelectron measurements and model results are also presented to help verify the accuracy of the new XUV irradiance spectra.