SOLSPEC onboard the International Space Station: Absolute Solar Spectral Irradiance in the Infrared Domain and Comparison with Recent Solar Models

Gerard Thuillier[1] *[gerard.thuillier@latmos.ipsl.fr], J. W. Harder*[2]*, A. Shapiro*[3]*, T. N. Woods*[2]*, J.-M. Perrin*[4]*, M. Snow*[2]*, T. Sukhodolov*[5]*, W. Schmutz*[5]

[1] *LATMOS-CNRS, 11 blvd d'Alembert, 78280 Guyancourt, France*
[2] *Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, CO, USA*
[3] *Max-Planck-Institut fur Sonnensystemforschung, Gottingen, Germany*
[4] *Observatoire de Haute-Provence du CNRS, F-04870 Saint Michel l'Observatoire, France*
[5] *Physikalisch-Meteorologisches Observatorium Davos World Radiation Centre (PMOD/WRC), Davos Dorf, Switzerland*

Onboard the SOLAR payload of the International Space Station (ISS), the SOLSPEC spectrometer measures the solar spectral irradiance (SSI) from 170 to 2900 nm. This instrument uses lamps to monitor its behavior in orbit. In particular, it employs two tungsten ribbon lamps in the IR domain (1000-2900 nm). The infrared absolute irradiance scale was determined from preflight laboratory calibration measurements and the in-flight measurements gathered at first light in April 2008. We reported a systematic discrepancy between SOLAR-ISS measurements and the ATLAS 3 spectrum obtained from SOLSPEC observations onboard the shuttle-ATLAS missions with a discrepancy reaching 10 % at 1800 nm. If confirmed such a discrepancy would have strong implications for the Total Solar Irradiance (TSI) and the brightness temperature of the lower solar photosphere. However, the onboard lamp and solar data time series show that the IR spectrometer did not reach its permanent regime at first light but only after several months of operation. The solar data at first light and in permanent regime show a difference, which is wavelength dependent. Using that difference (or the data in permanent regime), we show that the SOLSPEC-ISS IR spectrum is consistent with the ATLAS 3 spectrum within their combined uncertainties. We present the properties of that corrected spectrum in terms of its contribution to TSI, the photospheric temperature, and comparisons with independently measured IR spectra from ground-based and on-orbit platforms.

The absorption coefficient of the negative ion of hydrogen has its minimum around 1600 nm so that measurements at this wavelength provide a unique opportunity to probe the deepest layers of the solar photosphere. Thus the comparison between the IR measurements and model predictions is of particular interest for understanding the structure of the solar photosphere. We present a comparison of the corrected spectrum with theoretical spectra calculated with radiative transfer codes COSI and ATLAS9 and discuss different physical mechanisms which can affect the absolute level of the IR irradiance.