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SOLSPEC investigation on board the International Space Station: The Absolute Solar Spectral Irradiance in the Infrared Domain

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Onboard the SOLAR payload of the International Space Station (ISS), the SOLSPEC spectrometer measures the solar spectral irradiance (SSI) from 16 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). Initially, the infrared absolute irradiance scale was determined from the preflight laboratory calibration coefficients and the in-flight measurements gathered at first light in April 2008. Subsequent publications suggest a systematic discrepancy between SOLAR-ISS measurements and the ATLAS 3 spectrum obtained from SOLSPEC observations onboard the shuttle-ATLAS missions with the discrepancy reaching 10 % at 1800 nm. We show that such a discrepancy has strong implications for the Total Solar Irradiance (TSI) and the brightness temperature of the lower solar photosphere. Furthermore, comparisons with independent spectra either obtained on ground and in space will be also shown and commented. The origin of the ATLAS 3 to SOLSPEC differences have been extensively analyzed; the onboard lamp and solar data time series indicates that the IR spectrometer did not reach a permanent regime until after several months of operation. The solar measurements at first light and in permanent regime show a difference, which provides an effective wavelength dependent correction factor for the first light spectrum. The SOLSPEC-ISS spectrum obtained in this permanent regime is consistent with the ATLAS 3 spectrum within their combined uncertainties and will be identified in the literature as SOLAR 2rev. We present analysis of this SOLAR 2rev spectrum in terms of its contribution to TSI, the lower photospheric temperature, and comparisons with independently measured IR spectra from ground-based and on-orbit platforms.