New Absolute Reference Spectrum SOLAR-ISS2 at 2008 Solar Minimum and its Extension at Very High Resolution (0.01 nm) from 500 nm up to 4200 nm for Atmospheric Modeling and Remote Sensing

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Since April 5, 2008 and up to February 15, 2017, the SOLar SPECtrometer (SOLSPEC) instrument of the SOLAR payload on board the International Space Station (ISS) has performed accurate measurements of solar spectral irradiance (SSI) from the middle ultraviolet to the infrared (165 to 3088 nm). SOLAR-ISS (representative of the 2008 solar minimum) is a solar spectrum based on SOLAR/SOLSPEC data, which has a resolution better than 0.1 nm below 1000 nm and 1 nm in the 1000—3000 nm wavelength range. A new version has been developed, the SOLAR-ISS2 spectrum (SOLAR-ISS v2.0) improved for FUV (<180 nm), MUV near 220 nm and NIR (2.4 to 3 μm). SOLAR-ISS2, extending from 165 to 3000 nm is the more elaborated spectrum presently (with uncertainties evaluated). It is compared with other recent spectra and models. SOLAR-ISS2 was further developed in a very high resolution version (SOLAR-ISS2-HR, 0.01 nm resolution) to serve as a reference for climate models, atmospheric observations (MicroCarb O2, CO2 mission) and planetary atmosphere measurements from 500 to 4200 nm. There are four methods to determine the solar spectrum: theoretical, exo-atmospheric, zero airmass extrapolation, and telluric subtraction. Based on the telluric subtraction approach, an empirical solar linelist has been generated by simultaneous fitting of ATMOS, MkIV, Kitt Peak, Denver U, and TCCON spectra (Toon *et al.*, 2014). The telluric absorptions were fitted using the HITRAN linelist and any remaining airmass-independent absorptions were attributed to the Sun. Together, with a simple lineshape function, this linelist allows the computation of a solar pseudo-transmittance spectra for disk-integrated. From this solar pseudo-transmittance spectra (high resolution) and from the SOLAR/SOLSPEC spectrum (absolute determination at lower resolution), we determine this new reference spectrum at very high resolution (better than 0.01 nm).