

## TSIS SIM Release Notes for Version 5, Level 3 data product (2020/12/07)

TSIS SIM data Version 5 appears in three locations:

- the LISIRD website (see [http://lasp.colorado.edu/lisird/data/tsis\\_ssi\\_24hr](http://lasp.colorado.edu/lisird/data/tsis_ssi_24hr))
- the TSIS website (see: <http://lasp.colorado.edu/home/tsis/data/>)
- the NASA DAAC (see: <https://disc.gsfc.nasa.gov/>)

Instrument line spread function details are now available on the TSIS SIM website:

- <http://lasp.colorado.edu/home/tsis/data/ssi-data/>

An IDL reader for the ASCII formatted data present on the TSIS web site is available at:

- [http://lasp.colorado.edu/data/tsis/file\\_readers/read\\_lasp\\_ascii\\_file.pro](http://lasp.colorado.edu/data/tsis/file_readers/read_lasp_ascii_file.pro)

Version 5 change list:

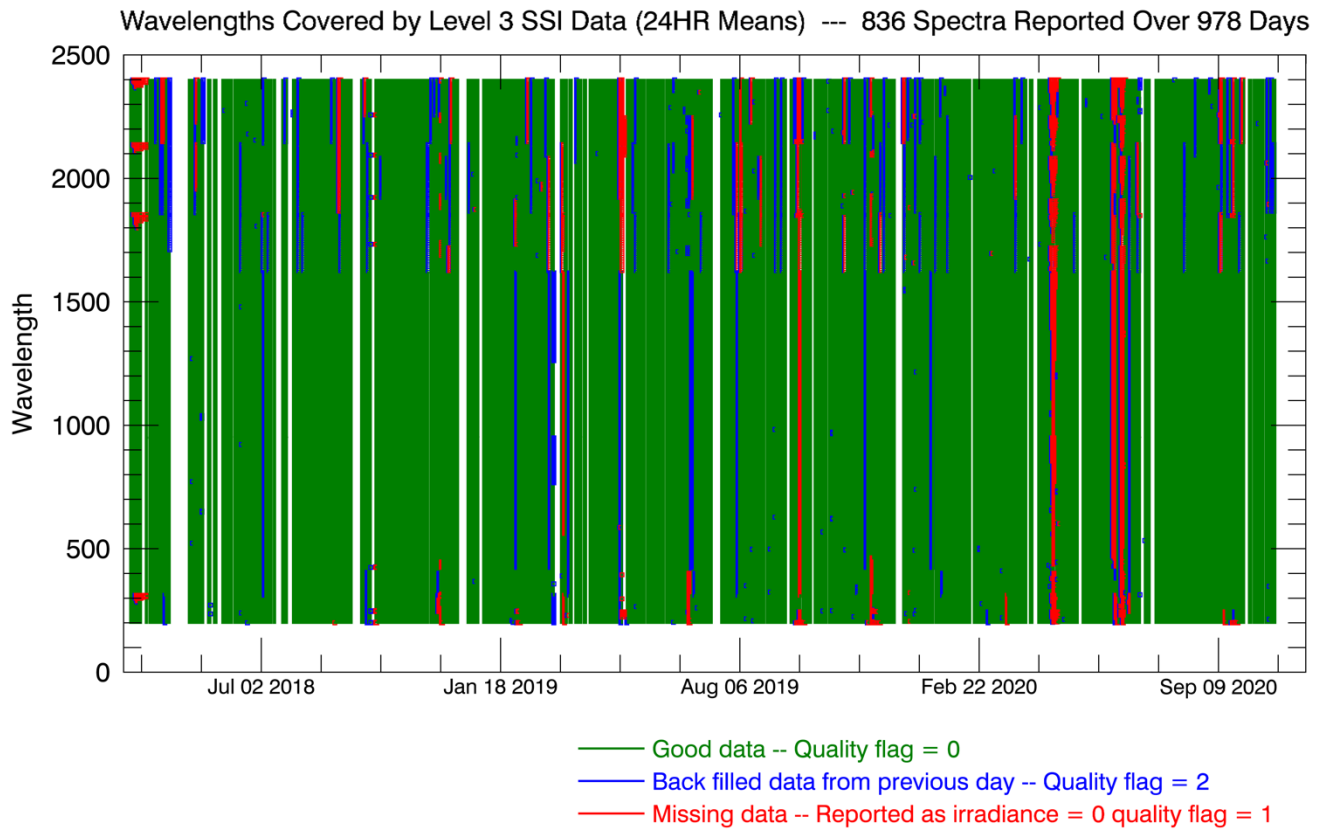
- Reprocessed degradation corrections utilizing latest Channel C calibration scans from October 2020.
- Re-implemented our degradation model with improved interpolation methods.
- Between 400nm – 800nm and 950nm-1050nm the degradation model has been improved in these regions resulting in reduced noise.
- Fixed an issue with the Level3 processing which would occasionally result in days without some wavelengths instead of processing all wavelengths and setting the irradiance to 0 and flagging the missing data. This has been corrected so that every reported spectrum should contain the same number of wavelengths, though there is an increase in wavelengths flagged as missing.
- Level3 data marked as back-filled from the previous day (qualityflag=2) now also copies the uncertainty values along with the irradiance instead of marking them as zero.
- A note to the user: Larger than anticipated temperature fluctuations, due to changes in beta angles and eclipse durations, have resulted in instrumental effect in the data. Analysis is ongoing to derive new instrument corrections accordingly. This correction will be applied in future data releases with associated uncertainties. Temperature changes have been experienced throughout the mission, but the aforementioned effect is primarily noticeable during 3 separate periods of high temperatures slightly above the nominal range. These periods are: (2019/01/13 – 2019/01/23), (2019/11/09 – 2019/11/24) and (2020/01/11 – 2020/01/23).
  - Temperature effects were primarily observed in ESR secondary channel data, which is no longer used to create the degradation model between 400nm – 800nm and 950nm-1050nm. Therefore, the impact of these temperature effects has been reduced.. We are still investigating the underlying cause of the temperature effects and improvements are ongoing.

Table 1 gives a description of available time and spectral range for the data. A latency of nominally 25 days will occur for the processing of instrument degradation correction and the release of the Level-3 corrected irradiances. This delay may be extended due to ISS operations and high beta angles. The data latency is driven by the cadence at which observations on the secondary channel, which are used in the degradation correction model, are obtained.

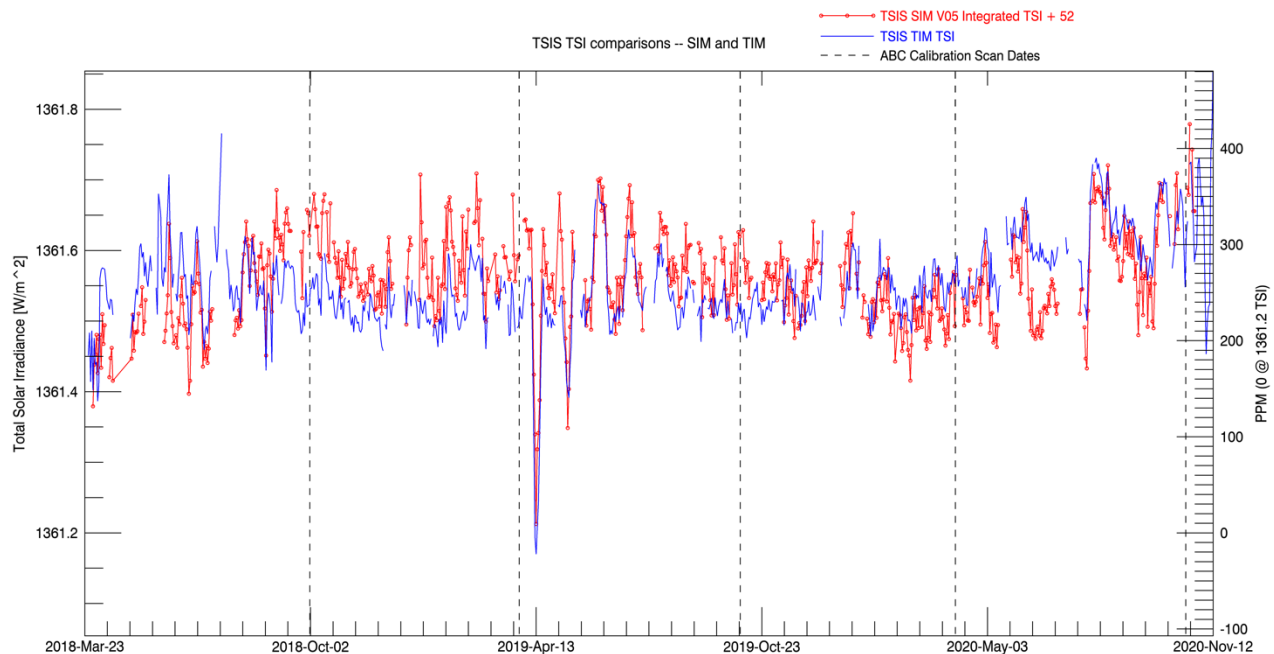
Table 1: Time and spectral range of the dataset.

Time Range	Wavelength Range (nm)
2018/03/14 - present	200-2400

Temporal gaps in acquiring TSIS SIM data have occurred due to a number of factors. These factors include ISS operational activities (i.e. orbit boost), ISS anomalies (i.e. power outages), and ISS obstructions that occur at extreme beta angles. The ISS obstructions can result in partial or complete loss of spectra for a given day. A partial loss of spectra occurs when shortened data collection time periods preclude observations of the full solar spectrum. Early in the mission, spectral gaps also occurred due to an error in instrument planning and operations. That error has since been fixed. Figure 1 shows the TSIS SIM data acquisition record. Colored points indicate portions of the spectrum that are missing (indicated in the data record with a quality flag = 1) or that have been backfilled from the previous day (indicated in the data record with a quality flag = 2). Backfilling is never done when temporal gaps in the data exceed 1 day.



As of November 16, 2020, the TSIS SIM data are available on 85.4% of days since the beginning of nominal operations.



The SIM TSI is generated by integrating the SIM spectra from 200nm – 2400nm and adding an offset to account for the rest of the spectrum that SIM does not measure. Only complete spectra with no missing or back filled values were used to generate this plot. This plot is meant to display the quality of long-term stability corrections of the integrated SSI against the measured TSI from TIM (which has a stability correction uncertainty of ~10 ppm/year) and not the absolute calibrations, thus the exact offset of 52.0 W/m<sup>2</sup> was chosen arbitrarily to match TIM as closely as possible. However, this value is close to the theoretical expected value of ~4% of TSI that falls outside of SIM’s spectral range.

### Definition of Uncertainties

Instrument Uncertainty (in Watts/m<sup>2</sup>/nm) is a pre-launch measure of instrument uncertainty with contributions from component and unit-level instrument laboratory characterizations and calibrations with the final end-to-end full spectrum validation of the measured irradiances against a NIST-traceable cryogenic radiometer performed in LASP’s Spectral Radiometer Facility. Reported uncertainties represent an upper limit to the calibration accuracy for each spectral band pending the resolution of an additional correction in the polarization dependence of the entrance slit transmission discovered after SIM launch.

Measurement Precision (in Watts/m<sup>2</sup>/nm) is derived from a measure of the on-orbit variance in the scan-to-scan repeatability in the observed spectral irradiances. This value is an upper limit of measurement precision.

Measurement Stability (in Watts/m<sup>2</sup>/nm) is a relative metric of the overall on-orbit degradation correction uncertainty. It has contributions from uncertainty due to post-processing of data (including correction of instrument degradation), and uncertainty due to differences between observed irradiances for the 3 separate SIM channels. Note: This is reported as 0 after the most recent bi-annual Channel C scans.