SORCE-SIM Release Notes for Version 25, Level 3 data products (v3, 06/19/19)

SIM data Version 25 (V25) appears in three locations, on the LISIRD website (see: http://lasp.colorado.edu/lisird/sorce/), on the SORCE website (see: http://lasp.colorado.edu/home/sorce/data/) and on the NASA DAAC (see: https://disc.gsfc.nasa.gov/datasets/SOR3SIMD_025/summary/). Table 1 below gives a description of available time and wavelength ranges for each location.

An IDL reader for the ASCII formatted data present on the SORCE web site is available at: http://lasp.colorado.edu/home/sorce/data/lasp.colorado.edu/sorce/file_readers/read_lasp_ascii_file.pro

Time Range	Wavelength Range (nm)		
04/14/2003 - present	240 – 2400	300 – 2400	240 – 2400
	SORCE	LISIRD	NASA DAAC

Table 1: Time and wavelength ranges for each repository location.

Calibration Changes :

V25 of SORCE SIM employs the same correction algorithms as V24 with the following changes:

1) The diode temperature correction coefficients have been rederived for all diodes.
2) Two errors were corrected in the processing code that applies the diode temperature corrections. This affects both the calculated irradiances and the CCD (wavelength) shifts for all modes.
3) CCD shifts were recalculated using an improved 18-day smoothing method for the entire mission.
4) The time variability function (F-function) used to calculate the prism degradation models were enhanced in the following ways:
    a. The solar exposure record was being combined with the F-function prior to smoothing during the prism degradation calculation. The solar exposure record is now correctly applied after the F-function smoothing.
    b. The fitting parameters for the F-functions were changed to accommodate the change in smoothing over the whole mission.
5) The daily updates of the calibration database tables for the V24 CCD shifts and prism degradations were not being ingested properly.
6) Fiducial irradiance windows before and after the On-board Computer (OBC) "Jump" corrections (see Figure-1) were selected in the following ways:
    a. Minimize the spacecraft temperature differences before and after the correction. Typically, these temperature differences were < 0.5 °C.
    b. Minimize the irradiance difference measured by SORCE-TIM (typically < 0.1 W/m^2).
7) In previous versions, the UV diode data extended to 306 nm and the VIS diode data began at 310 nm. In V25, the UV-VIS gap from 306-310 nm has been eliminated by increasing the wavelength range of the UV diode after SORCE mission day (SD) 800 (SD800: April 3, 2005). Before SD800, 306—310 nm was saturated, preventing a reliable measurement of the irradiance (see Figure-2).

A comparison of the integrated spectral irradiances of SORCE-SIM V24, V25, and SORCE-TIM V17 is given in Figure-3. Note the significant improvement in the agreement between TIM V17 (black) with SIM V25 (green) as compared to SIM V24 (red).

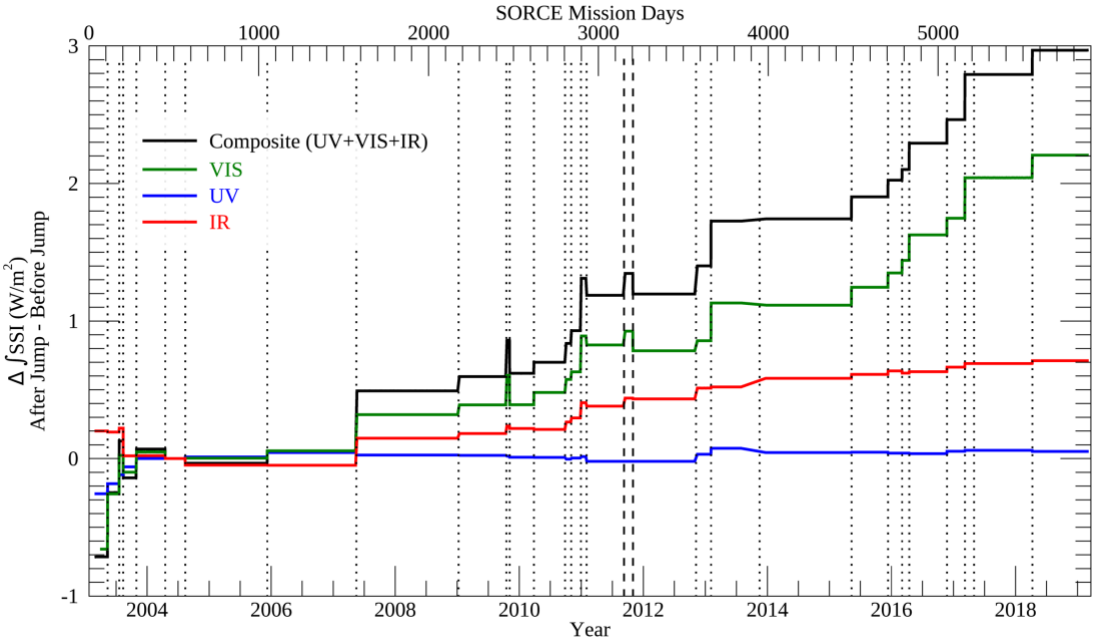

Figure-1: Cumulative "Jump'' corrections for each SIM diode show the corresponding integrated irradiance adjustments as a function of SORCE mission day (SD) and calendar year. Vertical lines show the timestamp where an individual jump correction is applied. Dotted lines were applied to the UV, VIS and IR channels, while the dashed lines indicate jump corrections only applied to the UV+VIS channels.

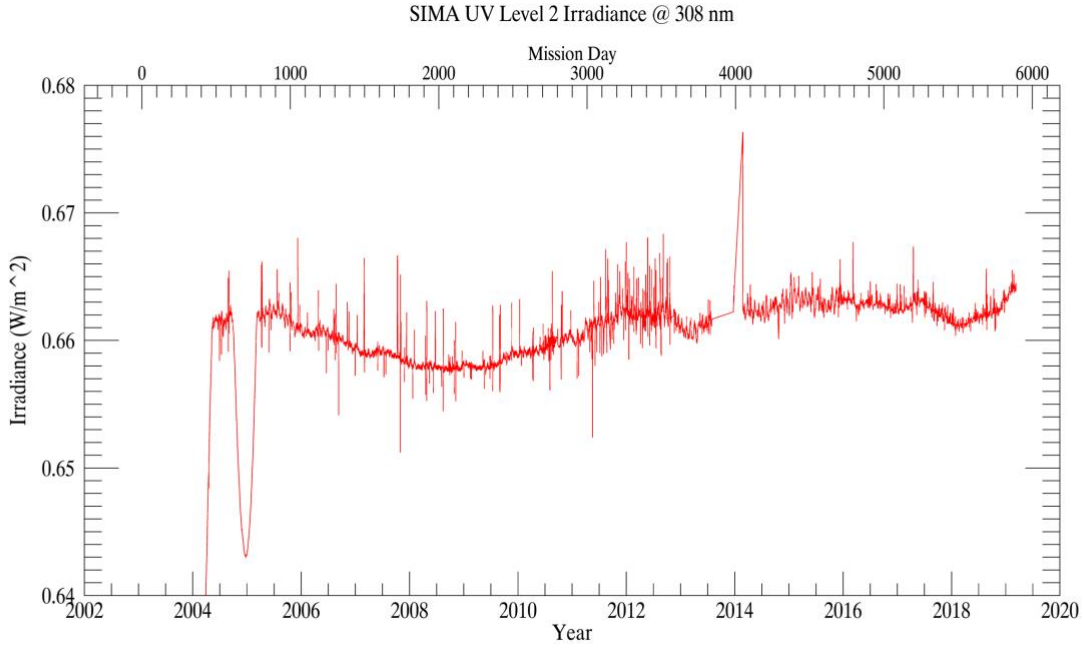

Figure-2: SIMA UV Level 2 irradiance at 308 nm versus calendar year and SORCE mission day (SD). Prior to SD800 (April 23, 2005), the UV diode was often saturated. This prevented reliable irradiance measurements, as seen on SD709 (Jan 1, 2005); the Earth-Sun perihelion. As SORCE neared the Sun in 2005, the UV diode saturated. The UV diode was not saturated closer towards the 2004 Aphelion. Since the 2005 perihelion, SORCE prism throughput has decreased and the UV diode no longer saturates at any time of the year. Prior to SD460 (May 2004), the UV diode was continuously saturated in the 306—310 nm bandpass.

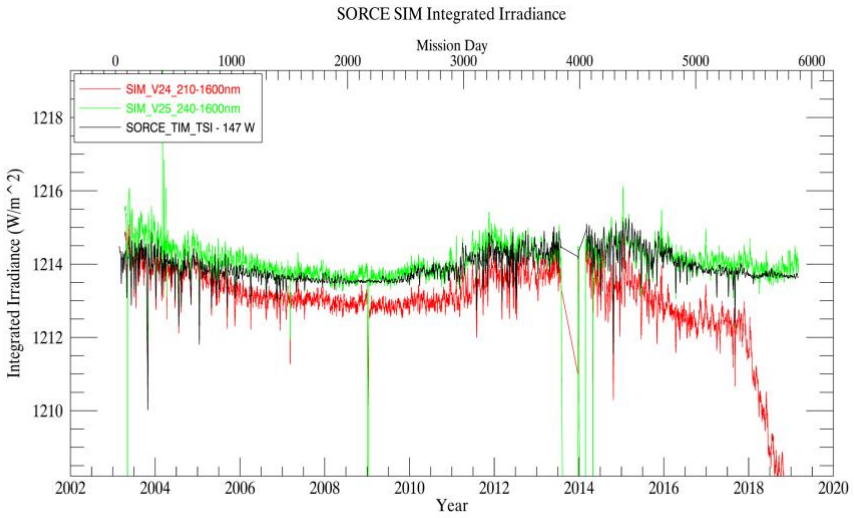

Figure-3: SORCE-SIM V24 (red) and V25 (green) Level 3 integrated Solar Spectral Irradiance (SSI) versus SORCE-TIM TSI (black) versus calendar year and SORCE mission day (SD). The SORCE-SIM TSI is a combination of the UV, VIS + IR channels from 210—1600 nm. For display purposes, 147 W/m^2 has been subtracted from the TIM TSI to account for the different bandpasses. Note the rapid, and erroneous, decrease in V24 irradiance in 2018, this has been corrected in V25.

Calibration Algorithm Details:

SORCE-SIM users should consult the V21--V24 version notes for calibration algorithm details at http://lasp.colorado.edu/home/sorce/instruments/sim/sorce-sim-data-products-release-notes/ .

Post 03/28/2019 Anomaly Reprocessing:

Beginning 03/28/2019 (SD 5907), the SORCE spacecraft encountered several anomalies that caused SORCE-SIM to be unavailable for several orbits. This resulted in colder than normal spacecraft temperatures. These temperatures caused CCD shift measurements that were out of family with surrounding values. Our default processing software uses a smoothing that is inappropriate under these circumstances. On 04/12/2019, data from 03/28 – 04/10/2019 (5907 < SD < 5920) was reprocessed without CCD shift smoothing.

Post 04/25/2019 Anomaly Reprocessing:

SORCE spacecraft anomalies between 04/25 – 06/04/2019 caused SORCE-SIM spacecraft temperatures to, again, be colder than normal. These temperatures caused CCD shift measurements inconsistent with surrounding values. Default processing software prior to 06/04/2019 used a smoothing that was inappropriate under these circumstances. Default processing after 06/04/2019 no longer smooths the daily CCD shift values. We expect to process data in this manner for the remainder of the SORCE-SIM mission.

On 06/19/2019, V25 data from 04/10 – 06/04/2019 (5920 < SD < 5975) was reprocessed without CCD shift smoothing. As noted previously, data from 03/28 – 04/10/2019 (5907 < SD < 5920) was similarly reprocessed on 04/12/2019. All SORCE-SIM data taken after 03/28/2019 uses the non-smoothed CCD shift measurements.

Full data acquisition records:

Figure-4 shows the data acquisition record for all SORCE-SIM-A instrument modes from 01/23/2003, the beginning of the mission (SD0), to 06/19/2019 (SD5990). Note the decreased ESR coverage ($1600 < \lambda < 2400$ nm) during the SORCE Day Only Operations mode (DO-Op, March 12, 2014 (SD4065) – present, and the change in UV wavelength coverage starting on April 4, 2005 (SD800, see Figure-5).

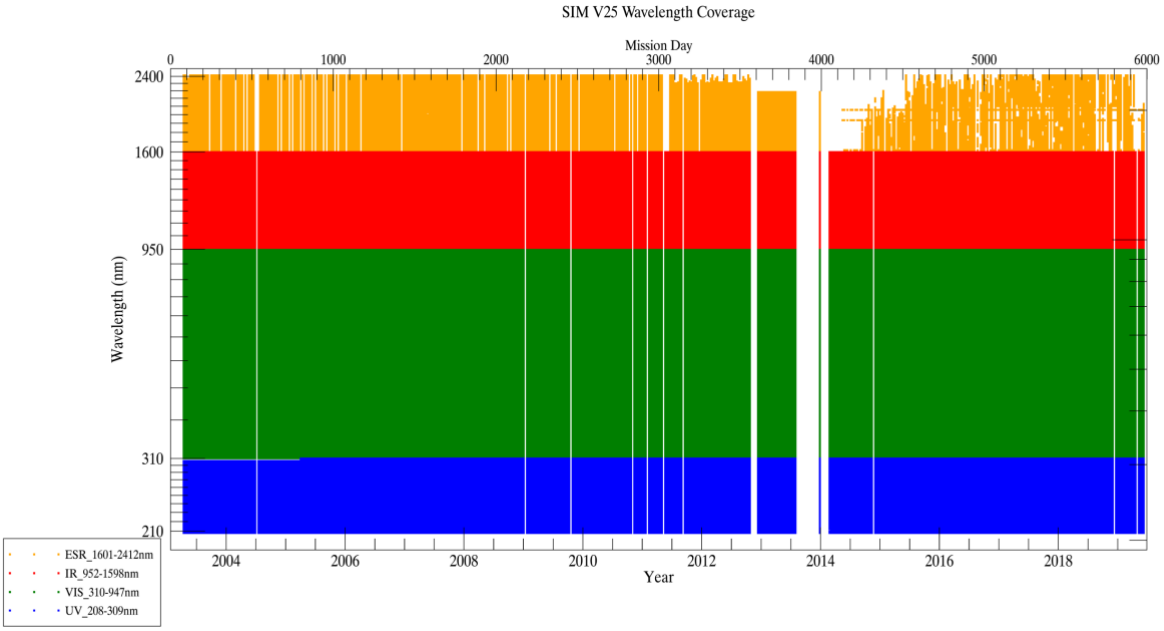

Figure-4 : The wavelength coverage of the SORCE-SIM-A UV, VIS, IR, and ESR modes is shown for the SORCE mission (04/14/2003 -- 06/19/2019). See Figure-5 for more details on the UV coverage.

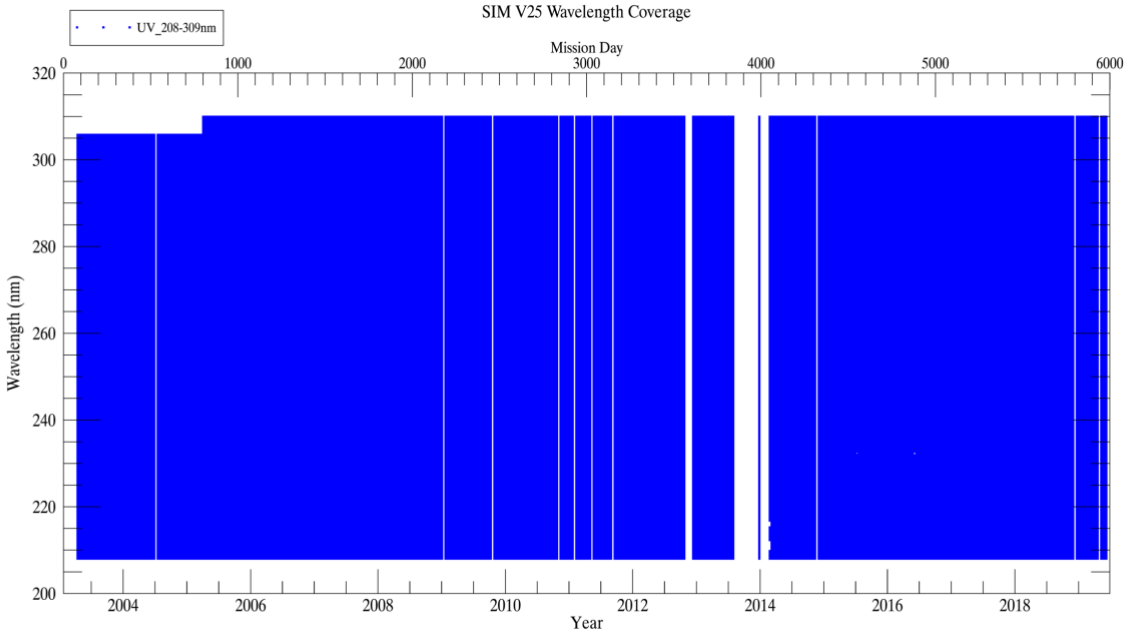

Figure-5 : Wavelength coverage of SORCE-SIM-A UV for V25. Note the increased waveband (from 306 nm to 310 nm) beginning on April 4, 2005 (SD800).

Revision History –

1.0 : 03/20/2019 – Stéphane Béland, James Mothersbaugh (JM), Steven Penton (SP) and Laura Sandoval (LS)

- Initial Release

2.0 : 04/12/2019 – Post SD5907 spacecraft anomaly: SP and JM

- Introduced SD as an abbreviation for SORCE mission day (e.g., SD800).
- Added waveband coverage plots and notes about SORCE Days (SD) 5907 < SD < 5920
- Clarified dates of notable events.
- Reprocessing of 04/10 – 04/10/2019 data (5907 < SD < 5920) without CCD shift smoothing.

3.0 : 06/19/2019 – Additional anomaly mitigations: SP, JM, and LS.

- CCD shift processing change (default no smoothing) on 06/04/2019.
- Reprocessing of 04/10 – 06/04/2019 data (5920 < SD < 5975) without CCD shift smoothing.
- Minor reformatting of graphics.