SORCE SIM Release Notes for Version 22, Level 3 data product

SIM data Version 22 appears in three locations: the LISIRD website (see: http://lasp.colorado.edu/lisird/sorce/), on the SORCE website (see: http://lasp.colorado.edu/home/sorce/data/), and at the Goddard Earth Sciences Data and Information Services Center (http://disc.sci.gsfc.nasa.gov/SORCE/data-holdings). 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

Table 1. Available time and wavelength ranges at the SORCE and LISIRD web sites.

Time Range	Wavelength Range (nm)		
	240-1600	300-1600	1600-2400
2004/04/14-2011/05/09	SORCE	LISIRD	SORCE/LISIRD See Figure 1 for data gaps
2013/07/31-Present (DO-Op mode)	SORCE	LISIRD	

The largest gaps in the spectral record shown in Table 1 and Figure 1 occur in the infrared portion of the spectrum where spacecraft operations limit the available time to acquire the infrared portion of the spectrum. For the majority of the mission (2004/04/14-2011/05/09) when the instruments were operational full time, the data extends to 2400 nm, but during the time period where the instruments are power cycled every orbit (2011/05/09-2013/07/30) a smaller wavelength range is available in the infrared (1600-2200 nm). Presently in the SORCE Day Only Operations mode (DO-Op, starting March 12, 2014) a partial infrared data set is acquired. A new flight software load is schedule for Spring 2015 that will segment the infrared scan into two separate activities to assure the full 1600-2400 nm coverage. Figure 1shows a more detailed view of the infrared data gaps.

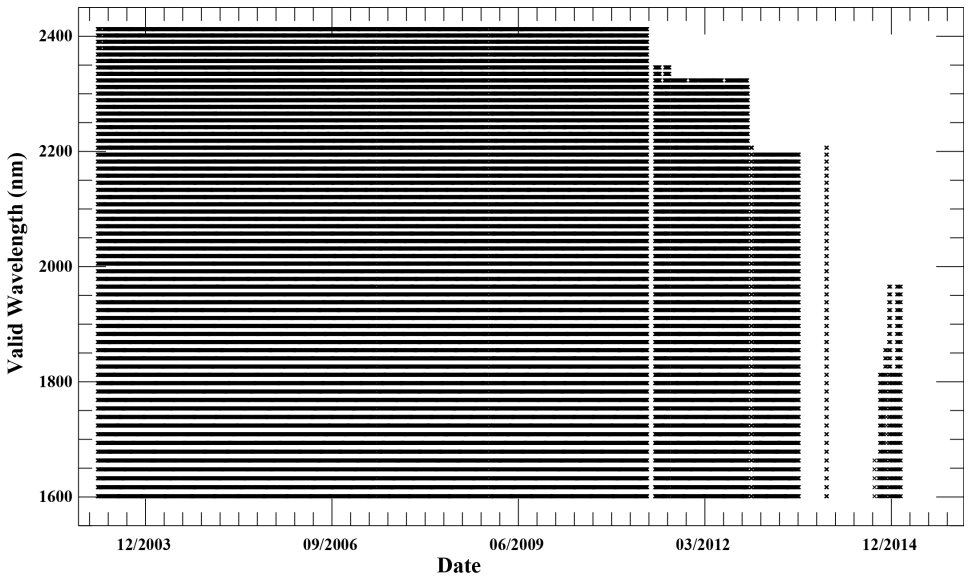

Figure 1. The full data acquisition record for the infrared portion of the spectrum (1600-2400 nm). After completion of the flight software load in the Spring of 2015, resumption of the full coverage of infrared observations will resume on a once per week basis.

Version 22 of SORCE SIM is an incremental improvement on Version 21 in that it restarts daily processing in the 240-1600 nm range for the DO-Op mode that started on February 21, 2014 and also includes data from the SORCE Campaign mode that was conducted over a 6-day period from 2013/12/22-2013/12/28. SIM Version 22 extrapolates the same basic degradation model derived for Version 21 data processing with the following attributes:

1. Processing code re-instates the daily calculation of SIM A and SIM B exposure time. This step required additional processing code changes because the SORCE planning page (as employed prior to the Do-Op mode) does not necessarily reflect the actual executed experiments.
2. As in Version 21 data, offset corrections are performed at the boundaries where spacecraft safe-hold events introduce offsets in the measured irradiance. Offset corrections are made by selecting time periods before and after the safe-hold events where the passages of solar active regions do not disturb the locally flat time series. The difference in the median irradiance for these two time ranges is added to the time series after the safe-hold event. This problem is exacerbated in the SIM data during the DO-Op mode since there is an ambiguity in closing the 225-day data gap in the extension of this record.

Users of SIM Version 22 should consult the Version 20 and 21 version notes found at
http://lasp.colorado.edu/home/sorce/instruments/sim/sorce-sim-data-products-release-notes/
for more information about the data correction methodology.

The successful resumption in the production of daily SIM data is reflected by continued agreement between the SIM A and SIM B channels in the 225-day time period. Examples of this are shown in Figure 2 for two cases at 340 and 515 nm. The high level of coherence between the two SIM channels indicates that the degradation methodology used for SIM corrections can be continued into the indefinite future. Overall refinements of the degradation methodology are still required to account for systematic trend errors since the onset of power cycling. See the discussion concerning analyses for Version 23 processing at the end of these version notes.

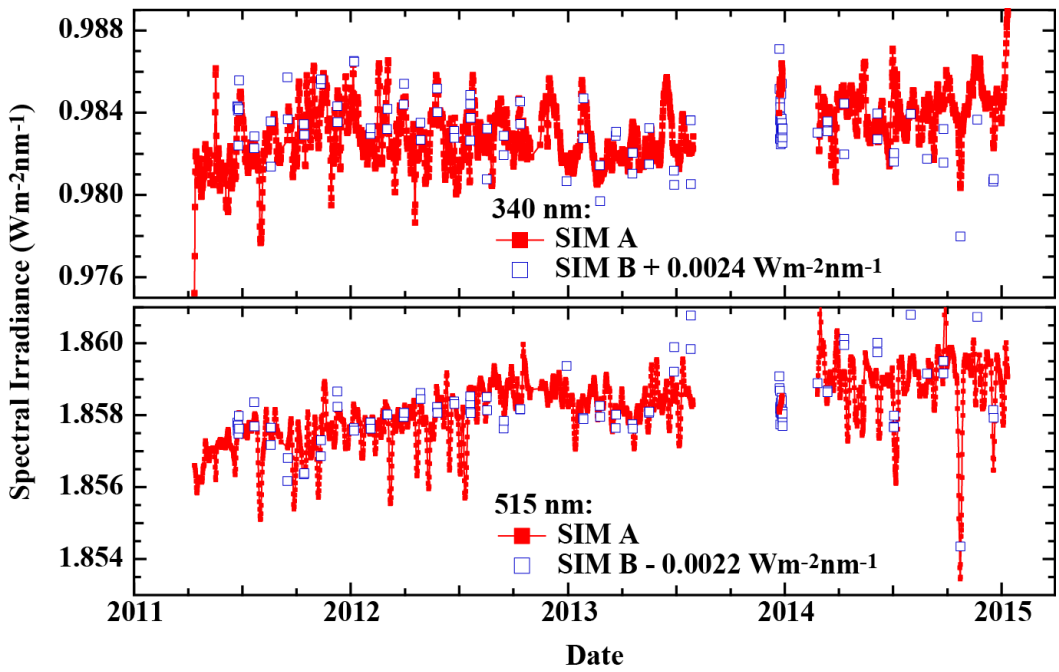

Figure 2. Comparison of SIM A and SIM B at two wavelengths in the visible portion of the spectrum. The offset between SIM A&B quoted in the graph label is a global calibration correction.

In terms of the integrated SIM spectrum, SIM Versions 21 and 22 during their common time period are nearly identical (less than 40 parts per million) until the 2011/09/04 safe-hold event where an additional 120 part per million correction is applied in Version 22. The differences between these two versions are shown in Figure 3.

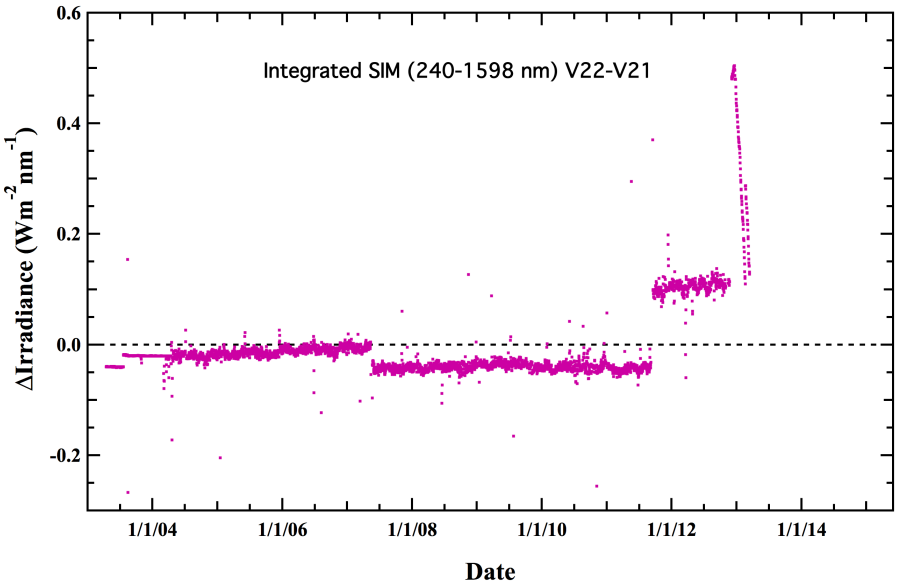

Figure 3. SIM Versions 22 and 21 show only very minor differences between the data sets until 2011/09/04 with the start of full-time power cycling. Solar minimum values in this integral range are 1214.56 Wm^{-2}. Version 22 processing improves the overall agreement with the TSI and the integrated SIM (see discussion of Figure 4 and 5 below).

In terms of comparison with the SORCE TIM instrument extended to the present time, short-term variations are clearly correlated, but some residual slope differences are still present mostly due to the extrapolation of the Version 21 degradation model. These problems will be addressed in Version 23 processing with a planned release in the Fall of 2015.

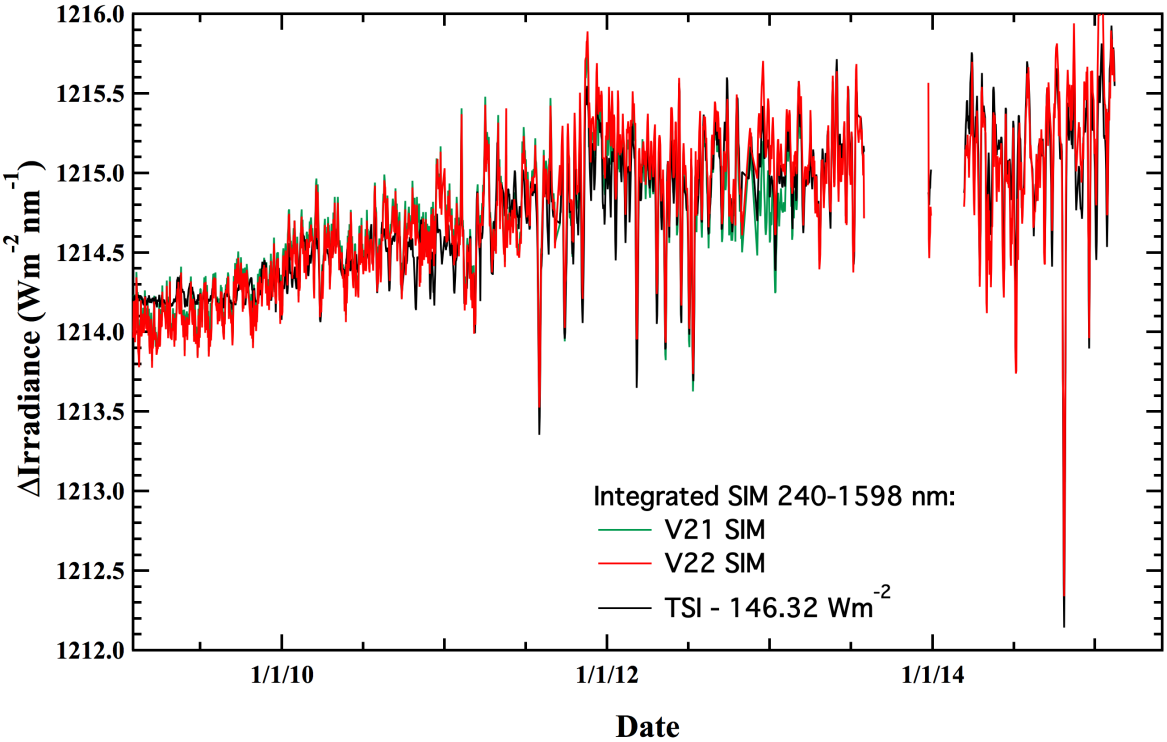

Figure 4. Versions 21 and 22 of SIM compared with the SORCE TSI. TSI is reduced by 145.144 Wm-2 to bring it onto the same scale as the integrated SIM in the 240-1598 nm range. SIM Version 21 data is plotted to its last reported day (2015/03/13); Version 22 extends up to the present time. Differences between Version 22 of SIM and the TSI are shown in Figure 5 over the time span.

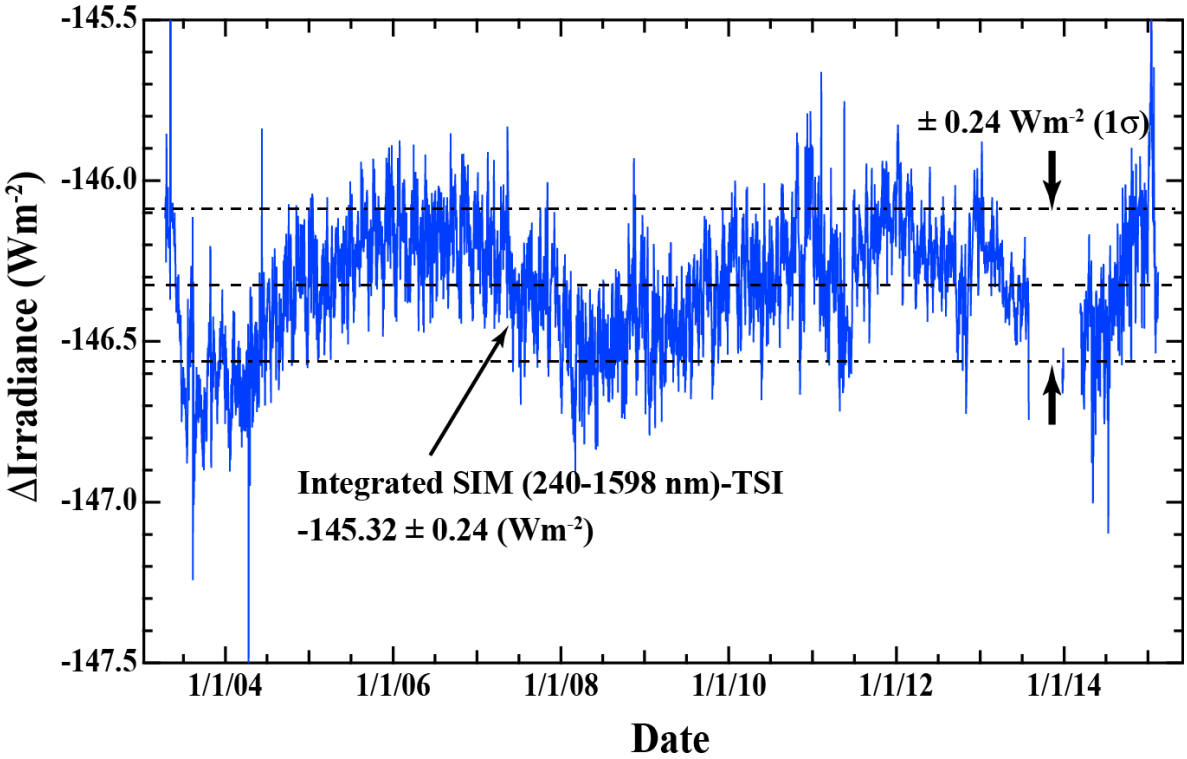

Figure 5. SIM integrated in the 240-1598 nm range compared to the TSI. There is a 145.32 Wm-2 deficient in the integrated spectrum relative to the TSI. After accounting for the ~145 Wm^{-2} irradiance deficient long-ward of 1598 nm, the standard deviation (1σ) of the difference with the TSI is about 200 parts per million. Improvements in the agreement between the TSI and integrated SIM are expected in the time period of the DO-Op mode for Version 23 of SIM where a measured degradation model is used in the place of extrapolated Version 21 degradation corrections.

Version 23 of SIM processing will emphasize:

1. Continued analysis of the effective solar exposure for the UV and the VIS photodiodes. We will expand our analysis to optimize a new effective solar exposure that can be applied uniformly to all detectors.
2. The ESR data remains significantly noisier after the start of the power cycling. These are attributed to either changes in the electrical characteristics of the ESR or a potential lag in the measured and actual temperatures of the ESR.
3. A remnant temperature effect is still present in the IR photodiode in the latter part of the mission, and to a lesser extent in the VIS photodiode. Initial investigations indicate that the temperature response of these photodiodes may be changing over the course of the mission.