

# TSIS / SORCE News

*Total & Spectral Solar Irradiance Sensor / Solar Radiation & Climate Experiment*



March 2020

## ***Good-bye SORCE, Hello TSIS!***

*By Tom Woods and Peter Pilewskie – LASP, University of Colorado*

The NASA Solar Radiation and Climate Experiment (SORCE) science mission ended on February 25, 2020 after completing more than 17 years of excellent observations of the total solar irradiance (TSI) and spectral solar irradiance (SSI) between 1 nm and 2400 nm. This was a planned passivation event for SORCE now that the new NASA Total and Spectral Solar Irradiance Sensor (TSIS-1) mission has had its required overlap with SORCE. TSIS-1, aboard the International Space Station (ISS), will be continuing the four-decade-long TSI climate data record, as well as continuing the SSI 200-2400 nm climate data record that SORCE initiated for the 400-2400 nm range. These TSI and SSI measurements are key inputs for atmosphere and climate modeling, energy balance modeling, and remote sensing for NASA's Earth Observing System (EOS). The length of the SORCE mission also enabled measurements in two of the Sun's 11-year solar cycles and SORCE observed solar cycle minimum conditions in both 2008 and 2019 that are particularly useful for secular trending of the solar irradiance.

Some of the SORCE science highlights were summarized by NASA's *The Earth Observer* in the Jan.-Feb. 2013 issue celebrating ten years since launch in 2003, [https://eosps.nasa.gov/sites/default/files/00\\_pdf/Jan-Feb\\_2013\\_508\\_color.pdf](https://eosps.nasa.gov/sites/default/files/00_pdf/Jan-Feb_2013_508_color.pdf). Several of these science results are from the legacy of the TSI and SSI climate data records, plus SORCE has introduced game-changing radiometer technology for solar irradiance monitoring with the highest accuracy and precision yet achieved. Furthermore, SORCE's Solar Stellar Irradiance Comparison Experiment (SOLSTICE) has supported space weather operations with its Mg II index of chromospheric activity with greatly improved spectral resolution, highly accurate calibrations of a few O and B stars for the astrophysics community, and highly accurate measurements of lunar ultraviolet reflectance for the planetary community and for use in calibrating other Earth climate monitoring instruments. The moderately high spectral resolution measurements of the solar far ultraviolet (FUV: 115-200 nm) irradiance by SOLSTICE are unfortunately not being continued by the TSIS project. There are some lower resolution solar FUV irradiance observations that are continuing with the NOAA GOES-16 and -17 Extreme ultraviolet X-ray Irradiance Sensors (EXIS) and with the NASA Thermosphere, Ionosphere, Mesosphere, Energetics and Dynamics (TIMED) Solar EUV Experiment (SEE). Neither of those provide the higher spectral



resolution, nor the full coverage of the FUV range, or the stability calibration with UV-stable stars as SOLSTICE used. Regrettably, there will now be a gap for parts of the FUV spectral coverage in the SSI record.

SORCE does not have any on-board propulsion (fuel), therefore, it was not possible to perform a controlled re-entry as part of the decommissioning activities. SORCE was passivated on February 25, 2020 through powering off instruments and most spacecraft systems and disabling the spacecraft reaction wheels and radio communication systems. SORCE will now tumble in its orbit that will slowly decay until it re-enters the atmosphere in 2032.

We thank the dedicated engineers and scientists at the Laboratory for Atmospheric and Space Physics (LASP) at the University of Colorado (CU) for leading, implementing, and operating the SORCE mission. The long-standing support for the SORCE mission at NASA HQ and GSFC has been exceptional. We are also deeply indebted to the SORCE operations team at CU-LASP and Northrop Grumman (formerly Orbital Sciences Corp. when they built the SORCE spacecraft bus) for their dedication and inventive solutions for continuing the SORCE well past its expected 5-year lifetime after anomalies with one of the reaction wheels and battery capacity threatened to end the SORCE mission before TSIS was launched.

For solar data, visit the following websites:

SORCE Data: <http://lasp.colorado.edu/home/sorce/data/>

TSIS-1 Data: <http://lasp.colorado.edu/home/tsis/data/>

GOES EXIS Data: <https://www.ngdc.noaa.gov/stp/satellite/goes-r.html>

TIMED SEE Data: <http://lasp.colorado.edu/home/see/data/>





## *SORCE Wake Party – March 11<sup>th</sup>*

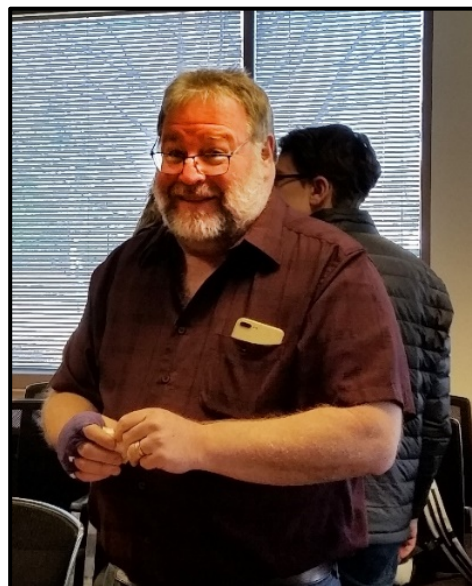
LASP employees who have worked on SORCE over the many years joined together again to celebrate this amazing mission on Wednesday afternoon, March 11. The celebration included engineers, mission ops, scientists, administrators, and many others who made helped to make this mission a success.

The operations team had been listening for two weeks following SORCE decommissioning on Feb. 25 for any signs of life. On March 10<sup>th</sup> the team stopped monitoring the spacecraft. Phase F activities have started and they will go through September 2020 when the final data products and documents are archived at GSFC.

SORCE legacy includes new highly-precise climate records of the Total Solar Irradiance (TSI) and Solar Spectral Irradiance (SSI), as well as, new instrument technology that have been used in Glory TIM, TCTE TIM, TSIS-1, and TSIS-2.







## *The Sunset of SORCE*





## Boulder Solar Day – Postponed



Sun over fresh snow, Boulder's Chautauqua Open Space.

The SORCE and TSIS teams were all set to participate in the annual Boulder Solar Day on March 17. Unfortunately the event has been postponed (hopefully not canceled) until this situation passes.

Sponsored by local organizations including NCAR/HAO, CU/LASP, NSO, NWRA, and SwRI, this event always provides an overview of solar research being accomplished at local institutes. The one-day meeting offers a relaxed setting that encourages informal interactions and collaborations with both local and visiting researchers, where they can discuss current progress on solar instrumentation, observations, and models.

The original plan was a day of oral presentations bookended with a "Director's Update" kickoff talk by Daniel Baker, LASP, and concluding with Delores Knipp from CU giving a special Keynote Talk, titled "*When the Sun Goes Rogue*." This entertaining talk was to be followed by a reception to encourage informal inter-institute interactions.

## Upcoming Meetings / Talks –

*With COVID-19 upon us, some of the meetings below have been postponed or canceled. TSIS/SORCE scientists are planning to present papers or attend the following 2020 meetings/workshops:*

### 2020

~~Space Weather Workshop, April 20-24, Boulder, CO~~  
~~European Geosciences Union (EGU), General Assembly, May 3-8, Vienna, Austria~~

New Developments and Applications in Optical Radiometry (NEWRAD). June 23-26, Boulder, CO

International Radiation Symposium (IRS), July 6-10, Thessaloniki, Greece

Solar Irradiance Science Team Meeting (SIST), July 22-23, Boulder, CO

AGU Fall Meeting, Dec. 7-11, San Francisco, CA

### JSWSC Topical Issue

The *Journal of Space Weather and Space Climate* is planning a Topical Issue on "**Space Climate: The past and future of solar activity**" to appear in 2020.

This is an open call for papers discussing any aspect of Space Climate, i.e., the long-term change in the Sun and its effects in the heliosphere and the near-Earth space environment, including solar effects on the atmosphere and climate.

The deadline for online submissions is **May 31**, <https://www.editorialmanager.com/jsWSC/default.aspx>.

For more details, please contact the Topical Editor-in-Chief, Kalevi Mursula, University of Oulu, Finland; [kalevi.mursula@oulu.fi](mailto:kalevi.mursula@oulu.fi), or visit the JSWSC website: <https://www.swsc-journal.org/news/297-topical-issue-space-climate-the-past-and-future-of-solar-activity-deadline-31-january-2020>.

# Happy Spring!

