



## **SORCE Spacecraft Status –**

August 19, 2013

With the loss of another battery cell, SORCE is now operating in a new configuration. While we are working ultimately towards recovering back to normal operations with daily solar irradiance measurements, our current focus is preparing the spacecraft to support a campaign mode to assure overlapping measurements between SORCE and TCTE in December 2013. There will be a data gap for SORCE for several weeks, but we plan to continue the SORCE solar irradiance measurements as soon as it is feasible.



The following lists more details about SORCE status and plans for future operations.

### **SORCE spacecraft is currently operating in an ‘emergency’ mode.**

- SORCE has experienced a cell failure for CPV6 (each nickel hydride common pressure vessel, CPV, has two cells, and SORCE has 11 CPVs). This CPV6 failure caused the end-of-orbit discharge voltage to fall below the voltage level needed for operation of critical flight functions controlled by the Onboard Computer (OBC). This ‘brown-out’ condition causes the system to revert to a spacecraft safe-hold condition under control of a more limited satellite controller called the Attitude and Power Electronics (APE). The APE system controls basic functionality of the spacecraft in safe-hold mode until the OBC is able to resume command.
- Current efforts are in progress at Orbital and LASP for an update to the APE flight software so that safe-hold mode operation does not require 24/7 operations. This update will enable more heating on the orbit day side and turning off non-essential components before the orbit eclipse begins (night side).
- The SORCE flight operations and science teams are now developing new operations and science concepts for the continuation of the mission given the current status of the SORCE power systems.

**Prior to the onset of the CPV6 failure all the instruments were powered-off during eclipse and**

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**making solar measurements during orbit day side.** This mode of operation has been on-going for several months prior to the CPV6 failure.

- The key impacts on instrument operations in this power-cycling mode are:
  1. Larger thermal variations for all instruments – SIM data quality is impacted more than other instruments
  2. SOLSTICE no longer has stellar calibration observations
  3. TIM no longer has dark calibrations (night side)
- While these impacts are significant, they do not exclude the acquisition of useable science data.

**With the current spacecraft performance and software configuration, we believe that future science data acquisition will be limited to times of the year where the eclipse period is less than 23 minutes.** This is necessary to keep the end-of-eclipse voltage above 19 volts. These short eclipse periods will limit the data to time periods in June and December where the minimum eclipse duration is about 15 minutes. Consequently, these time periods are the best opportunities for SORCE data campaigns.

- SORCE will perform measurement campaigns in these time periods with priority given to TIM TSI observations to provide overlap with the TCTE mission scheduled for launch in November 2013. As the orbit day side is not power limited, we expect to make SSI measurements by SIM, SOLSTICE, and XPS during these SORCE campaigns.

**Following the stabilization of SORCE safe-hold operations for the campaign mode, the effort will focus on returning SORCE back to continuous (daily) science data acquisition.** There are two potential paths toward this goal.

1. Update operation plans and possibly also MU flight software so solar observations can be performed in Safe Mode. TIM and XPS have large fields of view so useful data could be acquired realtime from them even with poor pointing (+/- 4 degree pointing capabilities in Safe Mode).

- Investigate updating OBC flight software so daily solar observations can be made. For this plan, the OBC, MU, and Instruments will be off in eclipse and then be activated after orbit sunrise and make "normal" solar observations for ~30 minutes when the orbit geometry is favorable. This mode would require downloading data at the end of the contact, as the flight recorders are not available after turning off the OBC prior to orbit sunset.

Finally, the *SORCE* mission operation team (LASP, OSC, and GSFC) deserves an enormous amount of credit for finding and executing very effective measures to keep *SORCE* healthy and leading the recovery plans back to continuing solar observations for *SORCE*.

## 2014 *SORCE* Science Meeting –

**Jan. 28-31, 2014**  
**Cocoa Beach\*, Florida**  
 (\* Note: Location Change)

### Call for Abstracts: Due Oct. 11

At the *SORCE* Science Meeting in September 2012, attendees agreed that rather than having a 10-year anniversary meeting, there should be an 11-year celebration in honor of *SORCE*'s observations over the full 11-year solar cycle. The next *SORCE* Science Meeting will focus on *Variability in the Sun and Climate over the *SORCE* Mission*, as we look back at what we have learned over the last 11 years.



Discerning the role of the Sun in climate variations on time scales of decades is a challenging task. Climate forcing is well correlated with variations in the Sun's energy output. This is well established for

total and UV irradiance using high-precision, space-based solar measurements spanning more than two decades. When the Sun is near the maximum of its activity cycle, it is about 0.1% brighter overall, with much greater changes at UV wavelengths. *SORCE* and other missions measure these variations of the total solar irradiance (TSI) and solar spectral irradiance (SSI) with unprecedented accuracy, precision, and spectral coverage across the UV, visible, and IR.

Widespread empirical evidence from the extensive Earth climate datasets suggests the presence of an 11-year

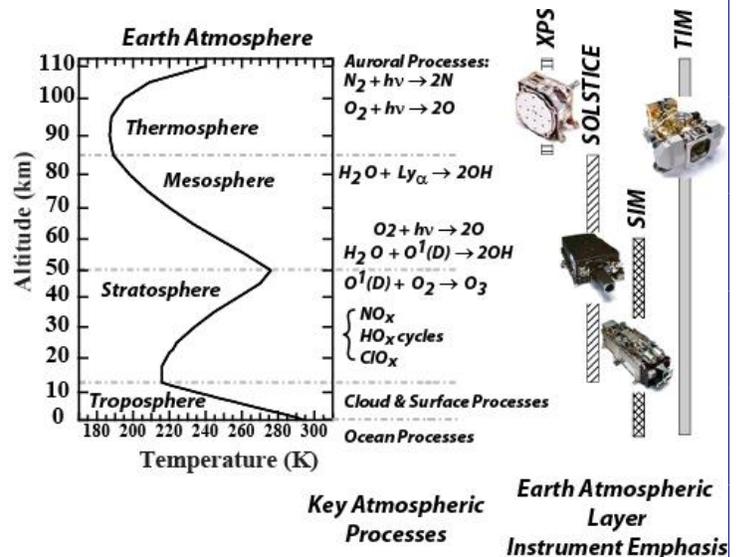
solar signal of order 0.1K in surface, atmospheric, and ocean temperatures. The solar forcing processes and pathways can be complex though. For example, the top-down pathway considers solar variations in the UV spectrum modulating stratospheric ozone concentrations, which then couple down to climate change via radiative and dynamical pathways. Internal atmosphere-ocean oscillations such as the NAO and ENSO may also play a role. Clouds may expedite the process via feedbacks, which require modeling very complex interactions.

We seek new understanding of the evidence for and mechanisms involved in decadal variability in the Sun and climate. The 2014 *SORCE* Science Meeting will review what we have learned in the past 11 years during the *SORCE* mission.

### Website:

<http://lasp.colorado.edu/home/sorce/news-events/meetings/>

**\* Abstract Deadline: Oct. 11, 2013 \***  
**Registration, Hotel Deadline: Dec. 20, 2013**

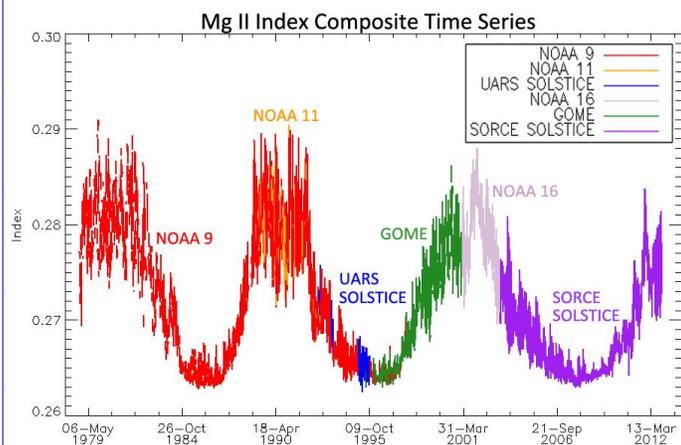


This figure represents a synopsis of the primary studies with *SORCE* data. The *SORCE* total and spectral radiometers measure daily the spectrum of the Sun and its variability. Solar energy establishes the structure of Earth's atmosphere through a series of key chemical reactions and thermodynamic processes. The *SORCE* instruments were designed to provide input for studying different layers of Earth's atmosphere and influences on climate change.

### Sessions are organized around these key questions:

- How much have the TSI and SSI varied over the *SORCE* mission, starting near maximum for solar cycle 23 and currently near maximum for cycle 24?
- What has been learned from connecting the *SORCE* TSI and SSI measurements to the long-term TSI and SSI records?
- What has been learned from comparing TSI and SSI measurements to solar proxies and irradiance model predictions?

- How have Earth's atmosphere and climate changed over the *SORCE* mission?
- What are the dominant processes and pathways for solar forcing in Earth's environment?
- How have the extended cycle minimum in 2007-2009 and lower cycle 24 maximum affected climate differently than during the earlier solar cycle 23?
- How can these Sun-climate results be effectively applied for reconstructions to the past and for future climate change predictions?
- What are the key science results and lessons learned from the *SORCE* mission?
- How will the TSI, SSI, and Sun-climate records continue in the future?



Magnesium II Core-to-Wing Index Composite Time Series. This proxy for solar activity has been continuously measured since 1978 by a variety of instruments operated by both NOAA and NASA. *SORCE* SOLSTICE has been making daily measurements since its launch in 2003.

The *SORCE* Science Meeting will be in **Cocoa Beach, Florida**, Tuesday-Friday, January 28-31, 2014. We are finalizing the hotel venue and will post additional information on our website as soon as it is definite. The meeting agenda for this interactive meeting consists of invited and contributed oral and poster presentations concerning variations in the Sun's radiation and in the Earth environment. There will be 6 sessions to explore this topic:

1. Total Solar Irradiance (TSI) Measurements and Composites
2. Solar Spectral Irradiance (SSI) Measurements
3. SSI Composites, Proxies, Models
4. Sun-Climate Solar Cycle Effects and Climate Change during the *SORCE* Mission
5. Sun-Climate Reconstructions
6. Legacy of *SORCE* and Future Directions after *SORCE*

Mark your calendar now and consider sending us an abstract. **We encourage your participation and hope that you will share this announcement with colleagues.**

## *SORCE 11-Year Anniversary Celebration*

<http://lasp.colorado.edu/home/sorce/news-events/meetings/>

**Please join us at the 2014 *SORCE* Meeting!**

With the current NASA sequestration issues, this meeting is considered a "conference" which means that there is an attendee limit for NASA civil servants and contractors (CS/C). We are considering requesting a waiver to go over the 50-person limit (again this just applies to NASA CS/C), but doubt it will be necessary. On your abstract form you are asked to include if you are a NASA contractor or civil servant. We will be submitting all CS/C names to NASA for approval, and we are confident they will all be accepted.

## *SORCE Sr. Review Results In –*

The NASA Earth Science Senior Review Report was released in July. **The review panel gave the *SORCE* Mission a great report with the recommendation to continue the *SORCE* mission for fiscal years 2014-2017.** Some report highlights included:

- High priority to continue the mission for FY14-FY17
- ACRIMSAT and *SORCE* TSI teams need to work more closely together, and the panel suggested forming a TSI science team
- An independent review of SSI methods and results was recommended
- "Science" received an excellent rating and "product maturity" was determined to be good
- Due to battery concerns, *SORCE*'s technical risk rating was high
- Regarding national interests, the mission was rated high due to NOAA and Navy climate change studies and Mg II space weather operations.

The review was in depth and very thoughtful, offering insights for mission improvements. In late August NASA Headquarters will provide FY14-FY17 budget guidelines for the extended mission.

## *Upcoming Meetings / Talks –*

*SORCE* scientists plan to present papers or attend the following 2013-2014 meetings/workshops:

SPIE Optics + Photonics, August 27-29, San Diego, CA  
SOLID (1st European SOLAR Irradiance Data

Exploitation), Oct. 14-18, Orleans, France

ISSI Working Group: The Solar Activity Cycle, Nov. 11-15, Bern, Switzerland

Intl. CAWSES Symposium, Nov. 18-22, Nagoya, Japan  
AGU Fall Meeting, Dec. 9-13, San Francisco, CA

***SORCE* Science Meeting, Jan. 28-31, Cocoa Beach, FL**