



## *Earth's Radiative Energy Budget Related to SORCE –*

**2006 SORCE Science Meeting  
September 20-22  
San Juan Islands, Washington**



Rosario Resort and Spa, Orcas Island.

Everyone is invited to attend the 4<sup>th</sup> annual SORCE Science Meeting! The meeting will be held at *Rosario Resort and Spa* on Orcas Island. With over 172 named islands in the San Juan archipelago, Orcas Island is in the midst of spectacular beauty and diverse nature.

### ***Tentative Agenda***

#### Tuesdays, Sept. 19

5:30 p.m. ***Kick-Off Reception*** – 4<sup>th</sup> Annual SORCE Meeting

#### Wednesday, September 20

8:30 a.m. ***Session 1 – SORCE Contributions to Earth's Radiative Energy Budget***

12:00 p.m. Lunch

1:00 p.m. ***Session 2 – Radiative Energy Budget***

4:45 p.m. ***Poster Session Briefing / Reception***

#### Thursday, September 21

8:30 a.m. ***Session 3 – Radiative Forcings***

12:00 p.m. Lunch

1:00 p.m. ***Session 4 – Climate Responses and Feedbacks***

3:45 p.m. ***Excursion to San Juan Island*** – Optional activities available

6:30 p.m. ***SORCE Meeting Science Dinner*** – San Juan Island Yacht Club

#### Friday, September 22

8:30 a.m. ***Session 4 continues – Climate Responses and Feedbacks***

12:00 p.m. Adjourn

1:30 p.m. ***Wildlife / Whale Watching Excursion*** – Optional special event

**Abstract Deadline – July 14**  
**Registration and Hotel Deadline – July 14**

Complete meeting information is available at – <http://lasp.colorado.edu/sorce/2006ScienceMeeting/>. There you will find a detailed science program description, tentative speaker list, online abstract form, registration form, as well as complete lodging and logistical information. Between the great science program and magnificent setting, you won't want to miss this SORCE Meeting!

## ***SORCE Science Team Members Attend ASIC<sup>3</sup> Meeting –***

*By Jerry Harder, LASP, University of Colorado*

On May 16-18 Peter Pilewskie, Greg Kopp, and Jerry Harder of the SORCE science team attended the Achieving Satellite Instrument Calibration for Climate Change (ASIC<sup>3</sup>) Workshop in Lansdowne, VA. The workshop, sponsored by NIST/ USMS and other government agencies such as NOAA, NASA and NPOESS, was organized by the Space Dynamics Laboratory of Utah State University. The primary objective of the workshop was to formulate a national roadmap for calibration and on-orbit measurement systems needed to monitor long-term global climate change. The current findings from the SORCE TIM and SIM instruments, and the plans and proposed calibration activities for future versions of these instruments were the subjects of invited presentations from Greg Kopp and Jerry Harder. Of particular interest to attendees were the methods used to transfer preflight calibration to the on-orbit measure-

ments of spectral and total irradiance and how long-term stability is maintained for the instruments; key issues in producing the reliable data records needed to discern climate change.

In his presentation, Greg Kopp discussed several important topics related to measuring total solar irradiance (TSI). TSI remains one of the critical measurements for climate research, and its overlap from current platforms such as SOHO, ACRIMSat and SORCE to the future GLORY and NPOESS missions insures the continuity of this measurement. At the present time, a number of outstanding calibration issues remain for the construction of a 28-year TSI composite time series. At this meeting, Greg discussed the findings of the July 2005 TSI Accuracy Workshop emphasizing the importance of optical and thermal design for TSI instruments, the need for NIST involvement for critical calibrations, and the development of an end-to-end irradiance calibration facility to intercompare existing and future instruments at power levels comparable to solar output.

Jerry Harder discussed the importance of solar spectral irradiance (SSI) and its variability, and how the combination of TSI and SSI bound both the total energy and its spectral distribution incident on the Earth climate system. Like the TSI instruments, the calibration of a spectrometer like SIM follows a measurement equation, and he discussed how NIST facilities could aid in future calibrations. Facilities like SIRCUS (Spectral Irradiance and Radiance Calibrations with Uniform Sources) and SURF (Synchrotron Ultraviolet Radiation Facility) can potentially improve the difficult calibration of detector radiant sensitivities, the spectrometer response function, and the instrument throughput at a system level. Because satellite-borne spectrometers are susceptible to long-term degradation, Jerry talked about the effectiveness of SIM's ability to measure degradation of individual components such as the prism and the photodiodes, and to cross-check the instrument's two independent spectrometer channels.

A major workshop objective is to update the NIST-sponsored document *Satellite Instrument Calibration for Measuring Global Climate Change* (Nov. 2002). Chapters of the forthcoming document will be written by committees comprised of the workshop participants; Greg, Jerry, and Peter will contribute to one chapter on broadband measurements and another on UV, visible and near IR measurement systems.

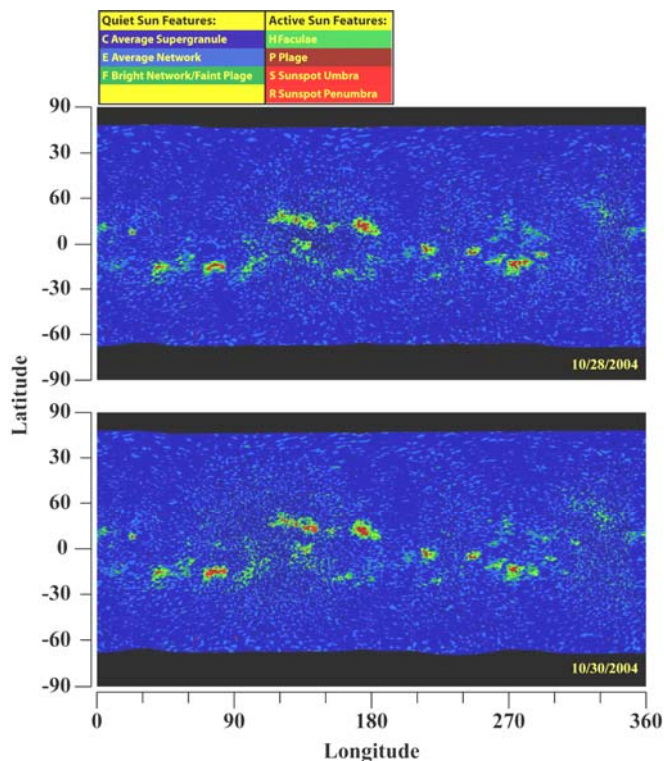
## Synoptic Maps Derived From SRPM/PSPT Analysis –

By Jerry Harder and Juan Fontenla, LASP, University of Colorado

As part of an on-going modeling effort, Juan Fontenla is now generating synoptic maps of the Sun based on the 7 solar features described in the SRPM

(Solar Radiation Physical Modeling) and identified in PSPT images (Precision Solar Photometric Telescope). These synoptic maps are generated by trigonometrically flattening the solar image on a given day and then using images from previous and subsequent days to fill in the non-visible portion of the Sun. As an example, the figure shows the maps on October 28 and 30, 2004 and is color coded according to the solar activity features identified in the legend. Careful inspection of these two images shows the evolution of active areas on the Sun that have changed over a two-day span. The SRPM model and PSPT image analysis are used extensively in conjunction with SORCE instrument irradiance measurements to describe solar variability associated with the emergence of active regions on the Sun. Recent papers include:

- 1) Fontenla, J., E. Avrett, G. Thuillier, and J. Harder, "Semi-empirical Models of Solar Atmosphere. I.", *ApJ*, **639**, 441, 2006.
- 2) Fontenla, J. and J. Harder, "Physical modeling of spectral irradiance variations", *Memorie della Societa Astronomica Italiana*, **76**, 826, 2005.
- 3) Harder, J., J. Fontenla, O. White, G. Rottman, and T. Woods, "Solar spectral irradiance variability comparisons of the SORCE SIM instruments with monitors of solar activity and spectral synthesis", *Memorie della Societa Astronomica Italiana*, **76**, 735, 2005.



Synoptic maps of the Sun generated from SRPM analysis of PSPT images on two dates in 2004. The legend identifies the color code of the solar surface features identified in the model. Comparing these two maps shows subtle changes in the Sun's active regions in just two days. Some small differences appear in the central part of the map particularly noticeable for the model C and E contributions.



## *SORCE MU Completes 3<sup>rd</sup> Year of Continuous On-Orbit Operation –*

*By David Gathright, LASP, University of Colorado*

On April 21 the SORCE instrument Microprocessor Unit (MU) completed its third straight year of continuous on-orbit operation. The computer was last power cycled on April 21, 2003 as part of planned SORCE spacecraft safhold testing. This is a huge achievement!

For LASP Engineering, the SORCE MU represented a significant design and development challenge, as the computer was much more complex than any LASP had previously attempted. The complexity was due to the fact that one computer would be used to control six separate instruments simultaneously. The system had to be designed such that a failure in the hardware or software for one instrument had little chance of affecting any of the other instruments. This design choice led the lab to design the SORCE MU around the Rad6000 space flight computer and the VxWorks real-time operating system, a decision which led, in turn, to the development of an electronics board that would use a PCI bus to interface between the Rad6000 and the SORCE instrument suite. This board, dubbed the PCI I/O board, would also be used to house additional EEPROM and the Mil-std-1553 controller used to interface with the main SORCE spacecraft bus computer.

LASP met this challenge head-on and in February of 2002, together with the SORCE instrument suite, the MU successfully completed instrument module integration and test, passing with flying colors. Observatory-level integration and test went almost as swimmingly, with just one MU reset occurring during thermal vacuum testing. The cause for the reset was clearly identified as a 'Read 0' problem and a MUFSW patch was prepared to detect these types of problems and to protect the MU from being reset in the event a 'Read 0' was encountered. Post-launch, the MUFSW team uplinked this patch after two 'Read 0' resets occurred shortly after commissioning activities were completed. Though hundreds of 'Read 0' events have been detected, no MU resets have occurred since.

Another major post-launch effort was the development of additional MUFSW code to deal with the GCI lockups that occur occasionally due to high-energy proton hits typically associated with the passage of the spacecraft through the South Atlantic Anomaly. This software, called the Static Packet Monitor (SPaM) Task, was a very innovative design that made use of the

VxWorks 'shell' that was integrated into the SORCE MUFSW. The foresight of including the shell in the design allowed the development team to uplink the SPaM software not as a 'patch', but as an extension of the original code. The SPaM software was uplinked to the MU in late March of 2003.

The robustness of the MU and MUFSW design has allowed the SORCE instruments to gather data for three straight years uninterrupted by any system resets or other faults. Several minor glitches have been noted with none affecting science data output. Also, mechanism faults on both the XPS and SOLSTICE-B instruments have been handled by the system without any effect on the rest of the instrument suite. Given how big a step this was for LASP Engineering, the exceptional performance of the SORCE MU is and continues to be a truly remarkable achievement for the lab.

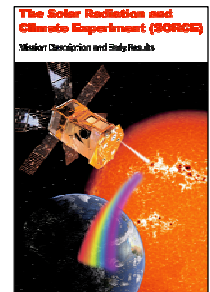
Of course, none of this would be possible without the support of everyone at LASP—the Engineers could not have done their job without their support. Everyone deserves a pat on the back for a job well done!

Here are some interesting SORCE MU statistics as of April 21, 2006:

Total Powered Time:	28,364 hours (26,411 hours continuous)
Commands Processed:	204,338,130 (includes ACS status and s/c Time Value 'commands')
Total Telemetry:	5.43E10 Bytes (51,785 MB or 50.57 GB)
Single-Bit Errors Detected:	1,789
Memory Scrub Cycles:	117,861,912
Read '0's Detected:	1,377 (still linear vs time)
SPaM Checks:	236,346
SPaM Responses:	4,059
Software Patches:	2 (additional one planned for new XPS safing algorithm)
Total MU Resets:	2

## *SORCE Solar Physics Special Issue Arrives –*

The *Solar Physics* special issue devoted to the SORCE Mission was shipped in early May. If you would like a complimentary copy, please contact Vanessa George at LASP. The 19 papers in the SORCE book provide a valuable reference about the SORCE mission ranging from the science, spacecraft, operations, and data systems of the SORCE mission to all about the designs, calibrations, and early results from each SORCE instrument. All papers are available on the Springer Publishing Company's website: <http://www.springer.com>.



## ***Upcoming Meetings / Talks –***

*SORCE scientists plan to present papers or attend the following 2006 meetings:*

NASA GSFC (Goddard Space Flight Center) Workshop  
at the Sun-Climate Center, “SORCE, Glory, TSIS  
and the Importance of Solar Spectral Variability,”  
May 15, Greenbelt, MD

American Astronomical Society, June 4-8,  
Calgary, Alberta, Canada

28<sup>th</sup> Review of Atmospheric Transmission Models,  
June 14-15, Lexington, MA

American Astronomical Society, Solar Physics Division,  
June 25-30, Durham, NH

American Meteorological Society 12th Conference on  
Atmospheric Radiation, July 10–14, Madison, WI

EUFAR (EUropean Fleet for Airborne Research) Work-  
shop on Combining Satellite Missions and Aircraft  
Activities: Future Challenges for the EUFAR Fleet,  
Sept. 13-15, Paris, France

SORCE Science Meeting, Sept. 20-22,  
San Juan Islands, WA

Coimbra Solar Physics Meeting, “The physics of  
chromospheric plasmas,” Oct. 9-13,  
Coimbra, Portugal



**210,733**

**Hits to the SORCE Website**

*(Since 4/21/03, As of 5/19/06)*

To submit information to this newsletter, please contact:  
[vanessa.george@lasp.colorado.edu](mailto:vanessa.george@lasp.colorado.edu).