SNS • SORCE News Source

Solar Radiation and Climate Experiment Monthly Newsletter **October 2010**

LASP Mission Operations Team Recovers SORCE –

The LASP Mission Operations SORCE team has been working round-the-clock to successfully recover the SORCE satellite after it went into a safehold on Sunday, September 26 (day 269). The safehold was caused by an on-board computer (OBC) reset, which appears to be similar to the OBC reset event of May 2007. The cause is still under investigation.

Following analysis by LASP mission operations and Orbital Sciences Corporation engineers, SORCE was commanded out of safehold mode and then placed into normal solar mode on Thursday, September 30. The microprocessor unit (MU) responsible for instrument command and data handling was turned on first, and was followed by the instruments one at time to reduce stress on the battery and to allow for careful monitoring of battery performance.

SORCE instruments are all back on and collecting data. The turn on sequence was as follows:

TIM: turned on 2010 / 274 (Fri., Oct. 1)
SOLSTICE-B turned on 2010 / 275 (Sat., Oct. 2)
SIM-A turned on 2010 / 276 (Sun., Oct. 3)
SOLSTICE-A turned on 2010 / 278 (Tue., Oct. 5)
XPS turned on 2010 / 279 (Wed., Oct. 6)
SIM-B turned on 2010/292 (Tue., Oct. 19)

The battery performance during the first week had anomalous behavior but appeared nominal after the battery heaters were turned back on. The battery voltages have been closely monitored throughout the recovery process. At this point the SORCE battery continues to perform as expected. Some of the formerly "good" CPVs have seen some degradation in performance when compared to pre-anomaly performance. On the other hand, some of the "bad" CPVs are now performing better. The net result is that the overall battery performance has not been significantly impacted by the safing event.

All during the recovery and when making future plans, the strain on the battery has been key. The orbital eclipse duration is currently shorter than 30 minutes. These brief eclipses have provided an adequate power margin to turn on all instruments and run routine experiments. This especially pertains to the SIM instrument since it requires so much more heater power than the other instruments. SOLSTICE B was initially only powered up during the orbit day to collect solar data. Two weeks later the SOLSTICE-B instrument started collecting stellar calibration data during orbit night.

As a side note, the three good reactions wheels appear to be working fine, and the battery and attitude control performance are nominal. As SORCE recovers, engineers from LASP, GSFC, and Orbital Sciences Corporation continue to look into the cause of the OBC anomaly.

SORCE Weekend Warriors (front to back) – Sean Ryan, Dave Welch, and student Katelynn Finn monitor the status of SORCE carefully during the recovery process. *Photo credit: Marty Snow.*

SOLSTICE-B Stellar Observations

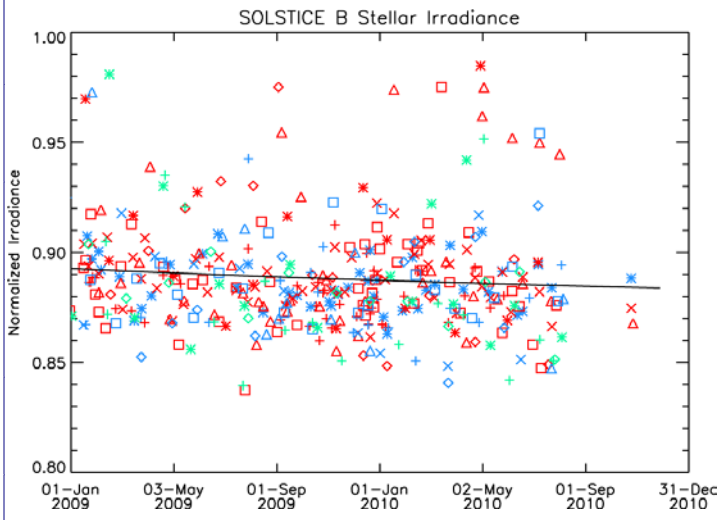
By Marty Snow, LASP, Univ. of Colorado

In order to proactively reduce the rate of degradation on SORCE's batteries, we have been reducing the load on them by turning off some of the instruments during eclipse. This began nearly a year ago (December 2009) with

SOLSTICE-A and XPS. Neither of these two instruments were actively collecting data during orbit night, so there was no impact on SORCE science. However, beginning in August 2010, it was decided to reduce the load on the battery further by also powering off SOLSTICE-B during any eclipse lasting longer than 30 minutes.

The instrument degradation rate tracked by the stellar measurements is very stable, and estimates show no increase to the uncertainty of the degradation correction if we only observe stars during short eclipses. Stellar observing campaigns will last for about a week and will occur approximately every other month. We have adjusted the parameters of the expert system which schedules the stellar observations in order to optimize the reduced observing time.

Since this SOLSTICE-B change was implemented, we have had only one stellar observing campaign. It was somewhat impacted by the safehold recovery activities, but we still managed to get repeat observations of all stellar experiments. These measurements were perfectly in line with our predictions, and we are confident that we can continue to track the SOLSTICE degradation with no loss of precision.



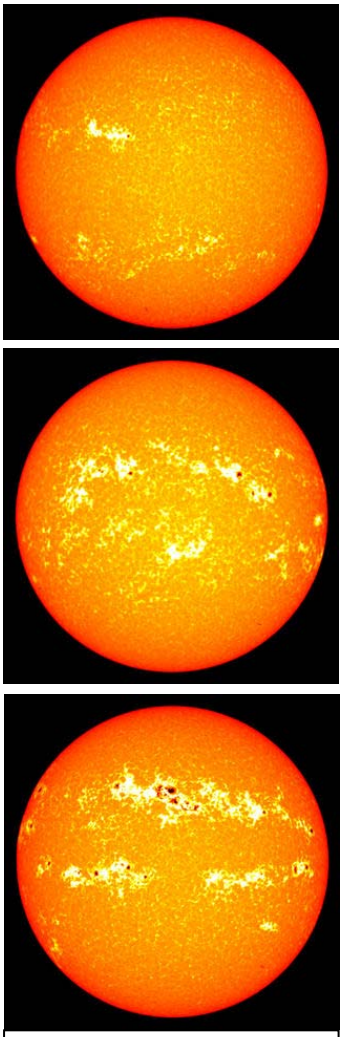
Time series of stellar irradiance at 168 nm from SOLSTICE B for the last two years. The small symbols are the individual measurements from different stars (blue asterisks are alpha Cru, for example), and the solid black line is the fit to all the data over the entire mission.

Harder Co-Authors Nature Paper –

By Stephanie Renfrow, LASP, Univ. of Colorado

Study shows unexpected relationship between solar activity and Earth's climate

The role of Sun's influence the Earth's atmosphere and climate has been re-evaluated based on findings from the CU-lead SORCE satellite experiment and Earth atmospheric photochemical modeling performed at Imperial College London, and presented in a recent publication in the journal *Nature*. Instruments on the SORCE satellite have been measuring the Sun's energy output over a very broad wavelength range and the researchers fed this data into the Imperial College computer model and compared their results with earlier estimates of solar cycle changes of the solar spectrum. The findings show that contrary to expectations, more light from the Sun does not always mean that the Earth becomes warmer. The study also reveals that recent reductions in energy from the Sun at ultraviolet wavelengths have been greater than predicted. The study looked at the Sun's activity over the period 2004-2007, when it was in decline during its 11-year activity cycle. The response of tropospheric and surface climate to variations in solar activity is an important consideration in the attribution of surface temperature trends to human or natural factors. It is known that solar radiative forcing is modulated by the ozone response to changes in solar ultraviolet radiation. The effect of an increase in ozone is twofold: first to reduce the flux of solar radiation reaching the tropopause (the Earth's lower atmosphere) and second to increase the flux of infrared radiation, mainly through its impact on stratospheric temperatures. The UV heats the stratosphere and this affects the dynamical (winds and circulations) structure of the atmosphere down to the surface – it may affect weather patterns but plays no role in global warming. The much larger changes in UV seen in the SORCE data make this a more plausible scenario than we thought up to this point in time. The study authors emphasized that the study only looks at three years of data; a longer timeseries is needed to be sure that the results are not an anomaly. LASP developed and built the four science instruments aboard SORCE; science and mission operations are conducted from the LASP Mission Operations Center. Observations of solar cycle variability will continue through

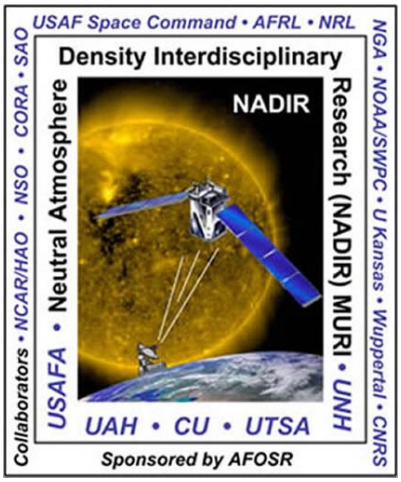


A new study shows that decreased levels of solar activity may actually warm Earth's climate. This image shows three views of the Sun with different levels of solar activity, with faculae (hotter white regions) and sunspots (red-black regions). *(Courtesy NASA/Goddard Space Flight Center)*

the LASP-lead TSISS mission that is slated for launch in 2014.

Citation: Haigh, Joanna D., Ann R. Winning, Ralf Toumi, and Jerald W. Harder. 2010. An influence of solar spectral variations on radiative forcing of climate. *Nature*, 7 October 2010.

Fontenla Presents at MURI –



SIM scientist Juan Fontenla participated in the annual MURI (Multidisciplinary University Research Initiative) Workshop in Boulder, Colorado, October 27-28, 2010. The MURI program is sponsored by the Air Force Office of Scientific Research and the objective of NADIR (Neutral Atmosphere Density Interdisciplinary Research) is to significantly advance understanding of drag forces on satellites, including density, winds, and factors affecting the drag coefficient. We seek a level of understanding that will enable specification and prediction at the "next level" of performance.

As the moderator for the ***Forecasting Solar Radiation*** session on the first day, Juan began with a brief introduction to the subject, including relevant background and the context for this particular workshop, which focused on Neutral Atmosphere Density Interdisciplinary Research (NADIR). Juan gave two talks – *Progress on Automatic Features Identification and Synoptic Maps Updates* and *Progress on the Solar Features Physical Models and Their Spectra.*

SOLSTICE & SPICAM/SPICAV Stellar Cross-Calibration

By Marty Snow, LASP, Univ. of Colorado

Eric Quémerais and Aurélie Reberac, both from Laboratoire ATmosphères, Milieux, Observations Spatiales (LATMOS), Paris, France, visited LASP the week of October 25th to meet with SORCE scientist Marty Snow. The French scientists will use stellar spectral measurements from SOLSTICE as part of their in-flight calibration of the spectrometers on Venus Express and Mars Express. The instruments are SPICAV and SPICAM (Spectroscopy for Investigation of Characteristics of the Atmosphere of Venus/Mars).

Eric Quémerais and Aurélie Reberac from the Laboratoire ATmosphères, Milieux, Observations Spatiales (LATMOS)in Paris, France met with SORCE SOLSTICE scientist Marty Snow to work on calibration issues.

Since SPICAV and SPICAM are primarily occultation instruments, they did not have an extensive preflight absolute calibration program. But some of their secondary science goals, such as lunar surface reflectance measurements, do require absolute calibration. By comparing spectral measurements of standard stars, we are able to transfer the calibration of SOLSTICE to SPICAM and SPICAV.

The results of this comparison will be published as part of the report from the ISSI working group "FONDUE" (http://www.aerov.jussieu.fr/projet/FONDUE/) early next year.

1,975,289

Hits to the SORCE Website

(Since 4/21/03, As of 10/22/10)

7th Canadian Solar Workshop –

By Jerry Harder, LASP, Univ. of Colorado

This year's conference was chaired by Ken Tapping and Larisa Trichtenko of the Canadian National Research Council and Herzberg Institute of Astrophysics in Penticton, British Columbia. These informal workshops are motivated by the desire for the Canadian Solar Physics community to foster collaborative endeavors and to ensure

that everyone remains well-informed of research activities in other organizations nationally and internationally.

Jerry Harder delivered one of two keynote presentations at this meeting entitled “Application of Solar Spectral Irradiance Variability in an Earth Atmospheric Model”, with contributions from SORCE team co-authors Aimee Merkel, Juan Fontenla, and Tom Woods along with Mark Rast of the University of Colorado Astrophysics and Planetary Science Department. This presentation discussed the observations of the SORCE instruments and the application and the usage of the data in the NCAR WACCM model (National Center for Atmospheric Research, Whole Atmospheric Community Climate Model). In addition to presenting the modeling study, he also showed progress on the analysis of Earth atmosphere satellite data used to assess the model findings. Frequent SORCE contributor and Picard principal investigator Gerard Thuillier also gave presentations on the ‘first light’ performance and analysis of the SODISM instrument (Solar Diameter and Surface Mapper). Additionally, he also discussed findings from the SOLAR instrument on the International Space Station.

Beautiful fall weather in October at the La Petite Rouge Resort, Quebec, site of the 7th Canadian Solar Workshop.

These workshops always incorporate a very strong educational component, and provide an excellent opportunity to interact with Canadian students interested in solar physics and Earth climate. Of particular interest were the contributions from Paul Charbonneau and his students from the University of Montreal on their analysis of solar dynamo modeling.

Other notable contributions came from David Thomson of Queen’s University in Kingston, Ontario, who gave a very interesting presentation on the search for solar g-modes using his advanced statistical methods. Ken Tapping presented work on the development of the next generation solar flux telescope (in addition to the long standing and important F10.7 cm radio flux), Stella Melo discussed solar and particle forcing using the Canadian Middle Atmospheric Model, and Larisa Trichtenko described the Canadian contributions to the space weather community.

Upcoming Meetings / Talks –

SORCE scientists plan to present papers or attend the following 2010-2011 meetings:

Eddy Cross-Disciplinary Symposium on Sun-Climate Research, Oct. 22-24, Aspen, Colorado
MURI (Multidisciplinary University Research Initiative) Meeting, Oct. 27-28, Boulder, Colorado
AGU Fall Meeting, Dec. 13-17, San Francisco, California
ISSI Working Group – Cross-Calibration of 30 years of FUV Instruments, Jan. 10-11, Bern, Switzerland
ISSI Workshop – Observing and Modeling Earth’s Energy Flows, Jan. 10-14, Bern, Switzerland
Space Climate Symposia, Jan. 16-21, Goa, India