



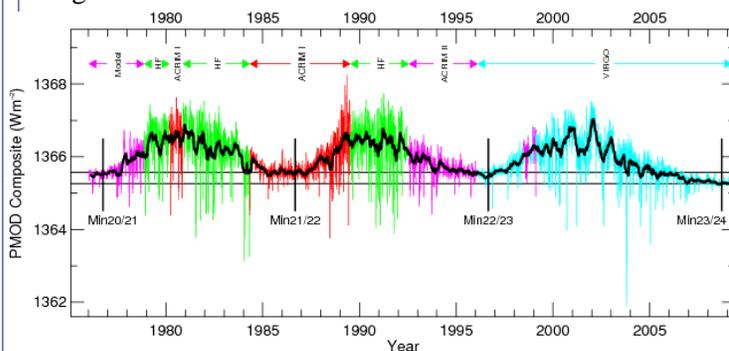
TSI Solar Minimum Discussion –

By Greg Kopp, *LASP, Univ. of Colorado*

TIM instrument scientist, Greg Kopp, organized a small group of local solar researchers for a Friday lunch-time discussion on the total solar irradiance (TSI) record. Institutions participating were LASP, NOAA, and HAO from NCAR.

Some of the questions addressed were:

1) How does the current solar minimum compare to the last in the TSI composites? To what level of accuracy do we trust minimum-to-minimum differences over these time ranges?

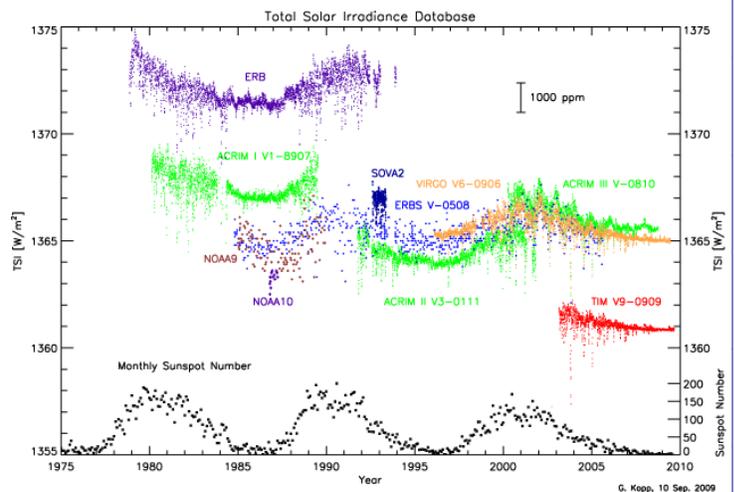


A recent paper by Claus Fröhlich, a SORCE Science Team member, provides the most complete current estimate and uncertainties of the TSI variation between the current and prior solar minima, and indicates a decrease in the current minimum of 140 ± 92 ppm. (Figure from Fröhlich, *A&A*, **501**, 2009).



Greg Kopp led a TSI discussion for about 20 solar scientists, including Stan Solomon from NCAR HAO and Frank Eparvier from LASP (as mentioned, left to right).

- 2) How are the on-orbit instruments degrading with time, and how well are they corrected?
- 3) How independent are the values from each instrument?
- 4) What are we learning with new calibrations, such as those from the TSI Radiometer Facility, about the causes of offsets in stated absolute values of the on-orbit TSI instruments?



The TSI Radiometer Facility, the world's first facility able to validate a TSI instrument's irradiance measurements against a NIST-calibrated cryogenic radiometer, has been used to validate the accuracy of the future flight Glory/TIM and PICARD/PREMOS instruments. Such end-to-end instrument validations will improve the accuracy of the TSI record shown.

Spacecraft Anomaly Update –

SORCE team members from Orbital, NASA GSFC, and LASP met in Dulles, Virginia, at the Orbital Sciences facility on Tuesday, Sept. 29 for a Technical Interface Meeting (TIM). The group included Ed Chang, Dave Mangus, and David Jung from NASA; Dave Oberg, Grace Baird, Brian Class, Jim Bobbett, Dominick Bruno, and Robin Harris from Orbital; and Tom Woods, Tom Sparn, Sean Ryan, Deb McCabe, Bill Possel, Jerry Harder, Brian Boyle, and Mike McGrath from LASP.

The purpose of the meeting was to discuss the progress made on addressing two SORCE spacecraft anomalies and future mitigation plans. The group first addressed the SORCE reaction wheel 3 (RW3) issue. In September 2008 the operations group first noticed that RW3 was not performing properly. After weeks of analysis and exploring options RW3 was turned off, and the spacecraft continues to operate under 3-wheel control instead of 4-

wheel control. This mode of operation still fully meets SORCE pointing requirements. Engineers have been studying and testing 1-wheel and 2-wheel control flight software options as a back-up plan, while the scientists and data processing group investigate how to maximize science results, if the spacecraft pointing were to be impacted.

The second half of the meeting addressed the SORCE spacecraft battery performance. In early 2009 during routine housekeeping observations, the operations team noticed that the battery was showing signs of degradation. Three of the CPVs (common pressure vessels) on the battery are experiencing reduced voltage. Engineers from LASP, Orbital,

NASA, and the battery manufacturer have been investigating why this is happening and how to slow further degradation. Many options have been explored and the group met to review the best plan to maximize battery life for the remainder of the mission.

With the ultimate goal being to do everything possible to optimize the odds of SORCE flying for many years to come, several action items resulted from this TIM. These action items included further analysis in several areas with possible actions, depending on the findings. The group will continue discussing options and progress at weekly telecons, as they have been doing over the past months. Action will be taken on items determined to be low risk and in the best interest of the spacecraft.

2010 SORCE Meeting

Keystone, Colorado

May 19-21, 2010



Solar and Anthropogenic Influences on Earth: The Current Solar Minimum and Predictions for Future Decades

We are pleased to announce the next SORCE Science Meeting! The organizing committee (Bob Cahalan, Greg Kopp, Judith Lean, Peter Pilewskie, and Tom Woods) have been honing in on the best sessions

to address *Solar and Anthropogenic Impacts on Earth: The Current Solar Minimum and Predictions for Future Decades*. We will be meeting in beautiful Keystone, Colorado, May 19-21, 2010.

As in the past, this interactive meeting will be an opportunity for cross-disciplinary interaction between solar, climate, and atmospheric scientists. The agenda will consist of invited and contributed oral and poster presentations. A brief meeting summary is below.

Relative to the past three solar minimum epochs of the space era (1976, 1986 and 1996) the current solar minimum (2008-2009) between solar cycles 23 and 24 is unusually prolonged, with record numbers of sunspot-free days, record low solar polar magnetic fields, and record high levels of cosmic ray flux. Evidence is accumulating for broad ranging terrestrial responses to the current inactivity of the Sun. The lack of global warming since 2002 can be attributed in part to declining solar irradiance, which, together with La Niña cooling, has cancelled much of recent anthropogenic warming. Reduced solar UV irradiance and corresponding lower ozone levels may be obscuring the recovery from anthropogenic ozone depletion by CFCs. In the upper atmosphere and ionosphere, temperatures are anomalously cool and densities are reduced relative to previous solar minima; but these changes may also be related to accumulated greenhouse gas cooling in the upper atmosphere.

Are spectral and total solar irradiance levels lower now than during past minima, and how much will they increase during solar cycle 24? Are we entering a new prolonged period of anomalously low activity such as the Dalton Minimum in the early 1800s? Can we identify anomalous behavior in the solar dynamo and surface flux

transport during the current minimum? How are heliospheric changes altering incident cosmic ray fluxes and the Earth's near-space environment? Can we reliably discern the terrestrial signatures of the current solar inactivity – at the surface, in the stratosphere and in space weather? What does understanding of the present (in the context of the past) infer for the future variability of Earth's environment?

Motivated by these questions, the 2010 *SORCE* Meeting will address the current state of and future expectations for the integrated Sun-Earth system.

Proposed Sessions:

1. This Unique Solar Cycle Minimum

- 1.1. Total Solar Irradiance (TSI): Comparison of Solar Cycle Minima and Recent Validation Results
- 1.2. Solar Spectral Irradiance (SSI): Solar Cycle Variation and Comparison of Cycle Minima
- 1.3. Solar Physics: What do we learn about the Sun from this unique cycle minimum?



2. Forcings During This Solar Minimum and Forecasts for the Next Solar Cycle

- 2.1. Space Weather Effects Observed During This Solar Cycle Minimum
- 2.2. Atmosphere and Ozone Change: Has the ozone recovery started yet?
- 2.3. Climate Change: What's the future going to be?

3. Recommendations for the Future: How to improve the climate data records?

Meeting details will be posted on the *SORCE* website (<http://lasp.colorado.edu/sorce/news/meetings.htm>) as soon as they are available. Registration materials will be available in early 2010, but mark your calendar today! We encourage your participation and hope you will join us. The meeting will be held at the *Keystone Resort and Conference Center*. Additional activities prior to the *SORCE* Meeting are in the planning stages as well. Stay tuned!

~~ Please join us! ~~



2009 IAMAS Montreal Meeting

SORCE Session M03 Summary

Visit the SORCE Meeting website:

<http://lasp.colorado.edu/sorce/news/2009ScienceMeeting/index.html>

or download at:

http://lasp.colorado.edu/sorce/news/2009ScienceMeeting/pdf/Summary_website.pdf

Juan Fontenla Presents at HAO Colloquium –

Juan Fontenla from LASP was the featured speaker at the NCAR High Altitude Observatory Colloquium on Wednesday, Oct. 14. The abstract for his talk, *Recently Observed Solar Cycle Spectral Variations and their Modeling*, is below.



The first accurate solar spectral irradiance (SSI) observations at visible and IR wavelengths are being obtained by *SORCE/SIM* instrument since 2004 until present. Using the Solar Radiation Physical Modeling (SRPM) methods, it will be shown that the SSI variations due to solar rotation and active regions can be explained and well modeled by the activity features identified on the disk. However, such modeling does not explain the observed solar cycle trends, even when changes in the solar network are also included but the inter-network radiance is assumed to remain constant.

The solar-cycle observed trends over most of the visible and IR are in opposition to those at most wavelengths shorter than ~400 nm (and in the Ca II and Mg II lines). This is similar to the observed in stellar cycles of some “solar analogs”, but it was not expected from the previous models. The result for the spectral structure of the SSI produces a cancelling effect between UV and visible variations in which the total solar irradiance (TSI) variation is only the residual of such cancellation.

An interesting pattern emerges when examining the brightness temperature corresponding to the SSI. A plausible explanation for these effects will be presented. Also, consequences of these observations for solar influence on Earth climate studies will be suggested.

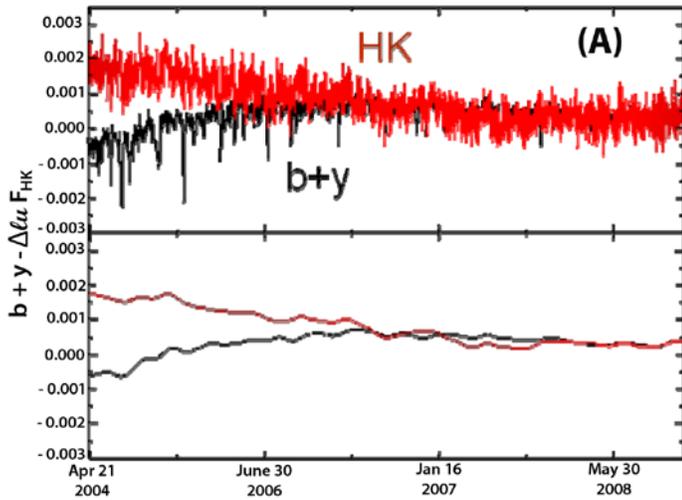


Figure A. One of the outcomes of Juan's research that was highlighted in his presentation is on the topic of how the SIM observations contribute to the study of activity and variability of the sun and sun-like stars. The starting point for this work is based on the findings Jeffrey Hall and co-workers (*ApJ*, 138, pp 312, 2009). This figure shows values of the logarithmic variation of the Ca II H and K lines compared with the magnitude of the variation (b+y) in the Stromgren visible filters as applied to *SORCE* SIM observations at 1 AU. These two filter functions are widely used in stellar photometry observations. The SIM observations coupled with SRPM modeling indicate that these time series have opposite trends for the Sun and this has implications for the study of solar analogs.

If you would like more information, you can contact Juan at Juan.Fontenla@lasp.colorado.edu.

Upcoming Meetings / Talks –
SORCE scientists plan to present papers or attend the following 2009 meetings:

- WHI (Whole Heliosphere Interval) Workshop,
Nov. 10-13, Boulder, Colorado
- MURI (Multidisciplinary University Research Initiative)
Meeting, Nov. 18-19, Boulder, Colorado
- ISSI Working Group – Modeling of Solar Spectral
Irradiance Measurements,
Dec. 9-11, Bern, Switzerland
- AGU Fall Meeting, December 14-18,
San Francisco, California
- ISSI Working Group – Cross-Calibration of past FUV
Experiments,
Jan. 11-12, 2010, Bern, Switzerland

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Hits to the *SORCE* Website

(Since 4/21/03, As of 10/23/09)

To submit information to this newsletter, please contact:
vanessa.george@lasp.colorado.edu.