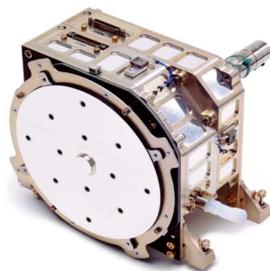




XPS Update: Calibration Improvements and Filter Wheel Status –

By Tom Woods, LASP, University of Colorado

As is with all of the SORCE instruments, the validation of the solar irradiance data products is a high priority and an on-going process throughout the life of the SORCE mission. On January 6, several scientists met at LASP for an XPS Workshop to discuss the validation of the SORCE XPS solar irradiance results. Participants included Scott Bailey (Univ. of Alaska, Fairbanks), Stan Solomon (HAO), and Phil Chamberlin, Frank Eparvier, and Tom Woods (LASP).



Discussions focused on the calibrations of the XPS and a variety of data analysis techniques used for the XPS. There have been outstanding differences between the three different calibration techniques by as much as a factor of 2 at some wavelengths. Woods, Rottman, and Vest [*Solar Physics*, **230**, 375-387, 2005] discuss these calibration techniques and results and provide comparisons between the PTB BESSY and NIST SURF calibration facilities. From discussion at this workshop, a plan to improve the values of the responsivities used in XPS data processing was formulated and is now being implemented. As an example of these different calibration results and the new calibration result, Figure 1 shows the responsivity for the Ti/C photodiodes that are used both in SORCE XPS and TIMED SEE XPS. Notice that the differences are as much as a factor of 2 at some wavelengths on this log-scale plot. From the recent analysis, the new calibration approach is to use the BESSY calibration results in the 1-3 nm range, NIST SURF calibration results longward of 5 nm, and the other SURF Beam Line 2 (BL-2) results to fill in spectral gaps as these BL-2 results are based on modeling the responsivity using Henke atomic constants for the filter materials.

The previous calibration for the Ti/C diode on SORCE XPS is shown in blue, and the new calibration is shown in green. With these new calibration results, it is anticipated that the XPS irradiance results in the 0.1-27 nm

Happy Birthday SORCE!

On January 25th SORCE has been in orbit for 3 years! Spacecraft separation occurred at approximately 1:27 p.m. EST, and the first signal from SORCE came through about a minute later via a NASA tracking satellite. Thanks to a very committed team, the mission continues to go extremely well!



range will change by about 10-30%. These new calibration results for XPS are expected to provide more consistent results between the various photodiodes used in XPS, and they have the potential to resolve some of the differences between the various solar XUV measurements from SORCE, TIMED, SNOE, and SOHO. These changes are planned for the SORCE XPS version 8 data products (noting that current XPS data products are version 7).

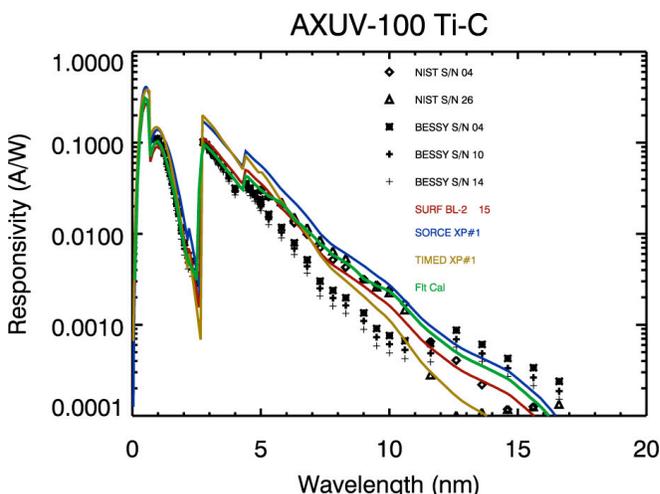


Figure 1. Shows the responsivity for the Ti/C photodiodes that are used both in SORCE XPS and TIMED SEE XPS. The previous calibration for the Ti/C diode on SORCE XPS is shown in blue, and the new calibration is shown in green.

The SORCE XPS had a malfunction on days 19-21 December 2005 whereby the XPS filter wheel did not move from position 0 for about 38 hours. The filter

wheel mechanism began working again on 21 December and has performed well since. After noting this behavior, the XPS filter wheel was promptly parked in position 6 while the XPS data are studied and this behavior investigated. XPS continues to collect good solar irradiance data, and the only data gap in the XPS Level 3 (daily averaged) data product will be for 20 December.

LASP held meetings on 22 December 2005 and 20 January 2006 to discuss the sequence of events, analysis of XPS data, and planning for future XPS observations. It is suspected that the cause could be from debris in the filter wheel mechanism gears, binding of gears, or Single Event Upset (SEU) of the filter wheel control electronics. While studies continue, the XPS filter wheel remains parked at position 6 because this maximizes the instrument's science output. In this fixed filter wheel position, XPS obtains data covering the 0.1-18 nm spectral range that constitutes about 70% of the normal XPS spectral range (0.1-27 nm). A side benefit of this fixed position is a one minute measurement cadence instead of the normal 5 minutes, but the disadvantages are: 1) a 30% loss of spectral coverage, and 2) the loss of a visible light correction measurement through a fused silica window in another filter position.

The three future operation scenarios being considered are: (1) reduced filter wheel operation with fixed filter wheel position for majority of solar observations, (2) fixed filter wheel position, and (3) return to normal operations stepping the filter wheel about once per minute. Scenarios 1 and 2 are lower risk if the cause is considered to be a mechanical concern, and scenario 3 is the better solution if the behavior was caused by electronics SEU. The long term XPS observing plan will be determined in about 2 weeks, following additional analysis.

Instrument Degradation Workshop Planned for February 2 –

Early next month the SORCE scientists will hold an Instrument Degradation Workshop. A summary of the workshop will appear in the February SNS. Agenda items will include SIM Prism – Juan Fontenla, SIM Diodes – Jerry Harder, SIM Hard Radiation Trap – Erik Richard, SOLSTICE – Marty Snow and Bill McClintock, TIM – Greg Kopp, and XPS – Tom Woods.

168,744

Hits to the SORCE Website

(Since 4/21/03, As of 01/23/06)

LASP Hosts Mg II Workshop –

By Marty Snow, LASP, University of Colorado



A few of the meeting attendees stayed after to further discuss the issues. Left to right are Claus Fröhlich, Tom Woods, Marty Snow, Rodney Viereck, and Dick White.

On January 20, 2006, LASP's SORCE scientists met with Claus Fröhlich, Dick White, and Rodney Viereck for an informal workshop on the long-term composite Magnesium II index produced by NOAA. The Mg II time series stretches back to 1978, which makes it a very valuable proxy for variability in the solar chromosphere. One of the ways that the Mg II index is used is shown in Figure 1. The variation in total solar irradiance (TSI) can be modeled with contributions from sunspots and faculae on top of a base irradiance level. Dark sunspots reduce the total, while bright faculae increase it. The long and short term variation in the facular brightening (P_{fs} and P_{fl}) are both derived from the Mg II record.

This model produces a very flat residual TSI (blue curve in Fig. 1) for solar cycles 21 and 22 (1978-1998), but there appears to be a trend during cycle 23. Further

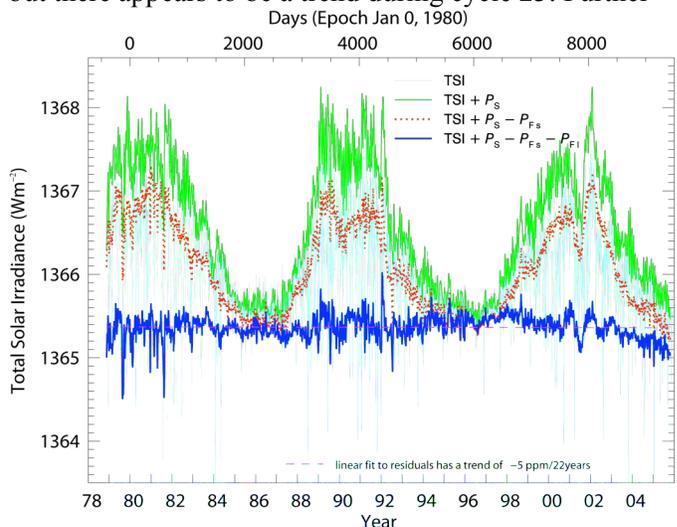


Figure 1. The variation in TSI can be modeled with contributions from sunspots and faculae on top of a base irradiance level. The long and short term variation in the facular brightening P_{fs} and P_{fl} are both derived from the Mg II record. (Courtesy C. Fröhlich)

analysis is required to determine if this trend is statistically significant. If the trend is real, it can either be due to a change in the character of the current solar cycle, or it could simply be due to a subtlety in the way the Mg II index is produced.

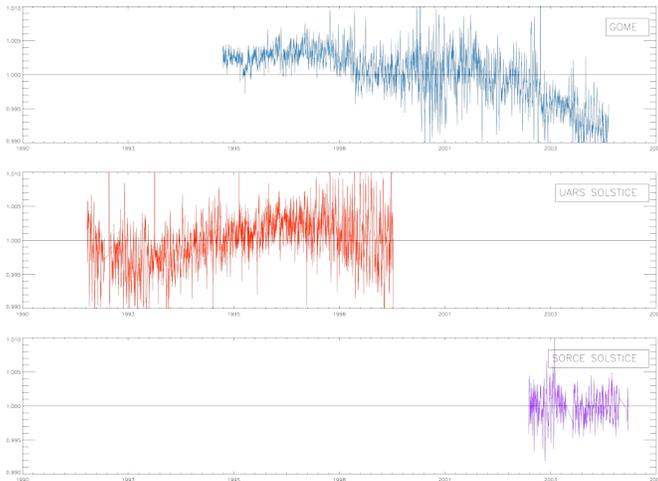


Figure 2. Ratios of Mg II index time series for three instruments to the updated composite time series of Viereck *et al.* (private communication, 2006). The short term variations relative to the composite are due to differences in resolution.

The composite Mg II index time series produced by Viereck *et al.* (2004) uses data from a variety of NOAA satellites, as well as UARS SUSIM and to a lesser extent, UARS SOLSTICE and GOME. Of all of these instruments, only GOME's time series has a significant trend in time relative to the others (as shown in Figure 2). One of the action items from this workshop is to contact the GOME and SUSIM teams to include them in further investigations. The SORCE team will continue to work on understanding and resolving these issues with the Mg II index time series.

Upcoming Meetings / Talks – *SORCE scientists plan to present papers or attend the following 2006 meetings:*

- International Living With a Star Meeting, Feb. 19-24, Goa, India
- SCOSTEP STP-11, March 6-10, Rio de Janeiro, Brazil
- Measurement Science Conference, Feb. 28 - March 3, Anaheim, California
- Dept. of Energy, ARM Meeting, March 22-26, Albuquerque, NM



Rosario Resort, Orcas Island, San Juan Islands off the west coast of Washington state.

Mark your Calendar for the 2006 SORCE Science Meeting –

Earth's Radiative Energy Budget Related to SORCE is the topic of the next SORCE Science Meeting. The 2.5 day meeting will focus on radiative forcing, feedbacks, and climate response. Specifically the meeting will address:

- The Earth's radiative energy budget: Top of the atmosphere radiative balance and imbalance, albedo and "global dimming", energy budgets at the surface and within the troposphere and stratosphere.
- Radiative forcings: Solar, greenhouse gases, O₃, aerosols (natural and anthropogenic, direct and indirect), measurements and models.
- Climate responses and feedbacks: Hydrological cycle, ice feedbacks (albedo and ocean salinity), climate sensitivity, slow versus rapid responses, linear versus nonlinear responses.
- Role of the biosphere: Response to solar variations, feedbacks through surface albedo and clouds.

Logistical details are still in the planning stages, but mark your calendar now. The dates are Wednesday – Friday, **September 20-22, 2006**. There are tentative plans for a smaller Calibration Workshop on the Tuesday before the meeting. The meeting will be at Rosario Resort and Spa on Orcas Island in the **San Juan Islands** off the coast of Washington state.

Additional details will be available in March 2006, so check the SORCE Meeting website periodically for updates.



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