



## 2012 SORCE Science Meeting Summary –

### *“Models of Spectral Irradiance Variability: Origins in the solar atmosphere and impacts on Earth’s atmosphere”*

The SORCE team continued its series of science meetings in Annapolis, MD, September, 18-19, 2012. The title of this year’s 2-day meeting focused on *Models of Spectral Irradiance Variability: Origins in the Solar Atmosphere and Impacts on Earth’s Atmosphere*, with two sessions each day – one on observations and one on models. A poster session crossed-over all sessions of the meeting to end the first day.

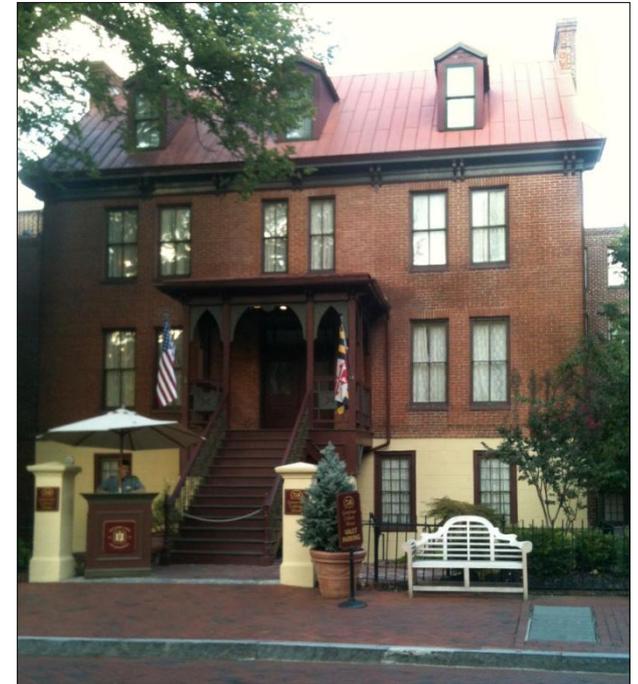
A full summary of the meeting, including .pdf versions of the many excellent presentations is available at:

<http://lasp.colorado.edu/sorce/news/2012ScienceMeeting/index.html>.

(“Meetings” are under “News and Events” on the SORCE main web page.)

#### **SORCE Meeting Key Questions:**

1. *Development of three-dimensional (3-D) models of the solar atmosphere are rapidly progressing; how will these models further our understanding of the radiative properties of the solar atmosphere relative to static 1-D models of the solar radiation?*
2. *Do small scale processes on the Sun scale to give irradiance variability, and do they give a reasonable explanation of changes that can occur on decadal or centennial scales that relate to climate change?*
3. *Does incorporating solar spectral irradiance (SSI) data into general circulation models (GCMs) improve the prediction skills of these models, and do different models produce similar results with the same solar input?*
4. *For both solar models and GCMs, how well do model predictions agree with observations over decadal time scales?*



*Historic Inns of Annapolis, a refreshing mix of Victorian charm and modern convenience located in the Annapolis Historic District. This beautifully restored property blends into the setting, complete with cobblestone streets and plenty of local history.*

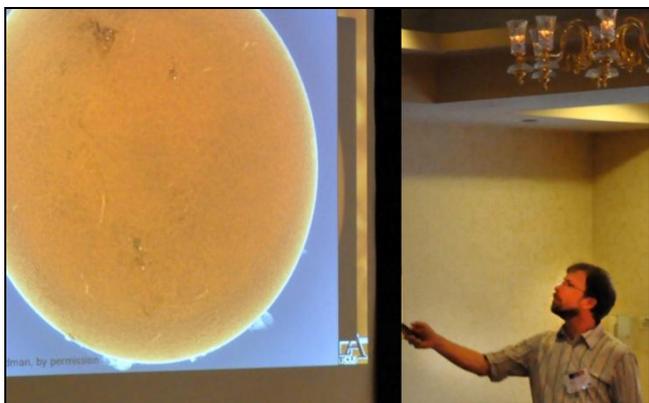


^^ SORCE PI Tom Woods kicked off the SORCE Meeting with an overview of the meeting objectives and an update on the SORCE Mission, including the satellite and instrument health.

## Introduction and Meeting Overview

This year's SORCE Science Team Meeting revolved around key scientific questions that span issues related to our ability to understand the origins of spectral irradiance in the solar atmosphere, and how these variations impact Earth's atmosphere and climate. Many interesting and perhaps even conflicting perspectives were presented at this meeting, demonstrating that our knowledge of the role of solar variability in understanding climate change remains 'low' as stated in the most recent IPCC Report. However, as always, the SORCE Meetings provide an effective forum for addressing these outstanding and important climate sensitive issues and provide inspiration for future studies.

**Session 1. *Modeling of the Solar Atmosphere with Emphasis on Spectral Irradiance***, featured six talks on state-of-the-art solar models. Speakers included Han Uitenbroek, Juan Fontenla, Regner Trampedach, Judith Lean, Phil Chamberlin, and Alexander Shapiro.



^^ Regner Trampedach from JILA at the University of Colorado spoke on *The 3D and Dynamic Solar Atmosphere in a Box*. He explained modeling results showing that small scale magnetic elements in active regions heat in a lateral direction and show brightness variations with viewing angle/ This result provides a better understanding of the cause of center-to-limb variability in active regions.



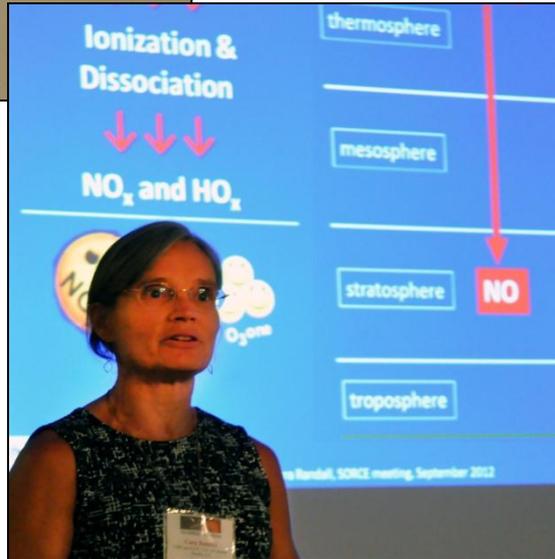
<< Han Uitenbroek from the National Solar Observatory in Sunspot, NM, was a keynote speaker. He showed that 1-D model-derived radiance is expected to be lower than that from the 3-D model due to the different ways that temperature is averaged.



<< Judith Lean from NRL gave a second keynote presentation in Session 1, discussing the development of the NRL SSI model. Lean described the model's ability to reproduce total solar irradiance trends, and noted that a new version of the model will reflect the change in TSI level observed by SORCE's TIM instrument.



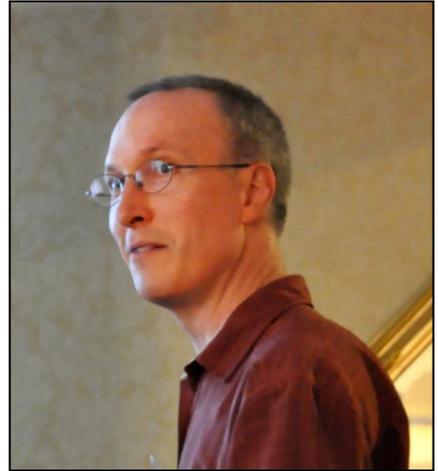
Charles Jackman (above) from NASA GSFC and Cora Randall (right) from the University of Colorado discussed in detail the mechanisms of energetic proton and electron impacts on polar total reactive oxidized nitrogen chemistry, with influences felt over several months.

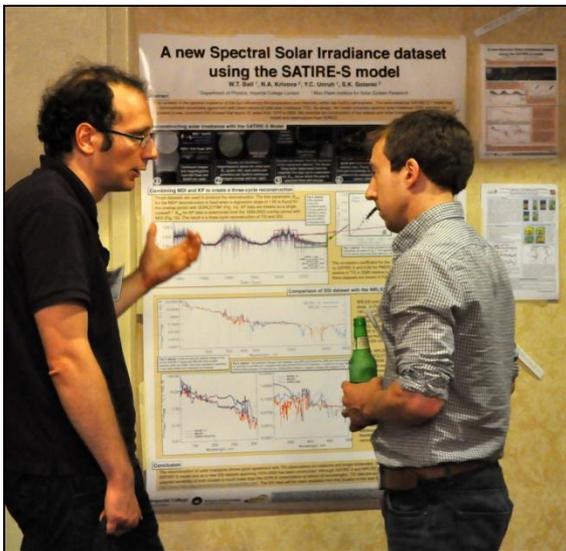


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There was plenty of interesting audience discussion during the SOFIE Meeting. Left to right: Dong Wu (GSFC), Shuhui Wang (JPL), and Jae Lee (GSFC).

The highlight of **Session 2. Modeling of the Solar Influence on Earth Climate** was keynote speaker Sarah Ineson (Met Office, UK). Other speakers were Bill Swartz, Nicola Scafetta, Charles Jackman, Cora Randall, and William Ball. The session focused on the North Atlantic Oscillation (NAO), which may have little impact on global temperatures, but plays an important role in regional climate phenomena. The NAO is a topic of great interest particularly in Northern Europe, due to the need for long-term weather forecasting.

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Bill Swartz from Johns Hopkins University, APL, showed results from model-based sensitivity studies that provide insights into predicting ozone changes in the stratosphere arising from solar variability.



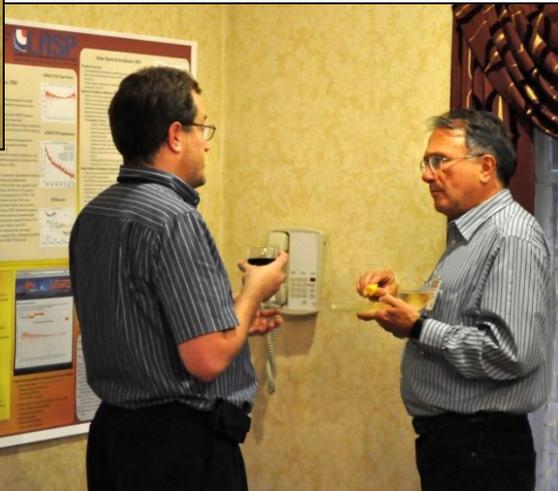


^^ William Ball (right; Imperial College, UK) and Alexander Shapiro (PMOD) discuss Will's poster on the SATIRE-S Model.

To conclude the first day, a special **Poster Session** was held to highlight the many excellent poster presentations. Attendees enjoyed refreshments while they wandered through the poster area and discussed their content with the authors.

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Colgate University student Lauren Bearden (left) shares a moment with Odele Coddington (right). Lauren was an REU student this past summer working with Odele at CU/LASP. Her poster, *Trends in the Short-Term SSI Variability during the Declining Phase of SC23*, reflected her summer studies.



<< Doug Lindholm (left) talks with Gary Rottman about the *SORCE solar irradiance data products* on the *LASP LISIRD website*.



<< Bill Swartz (left) and Shuhui Wang.



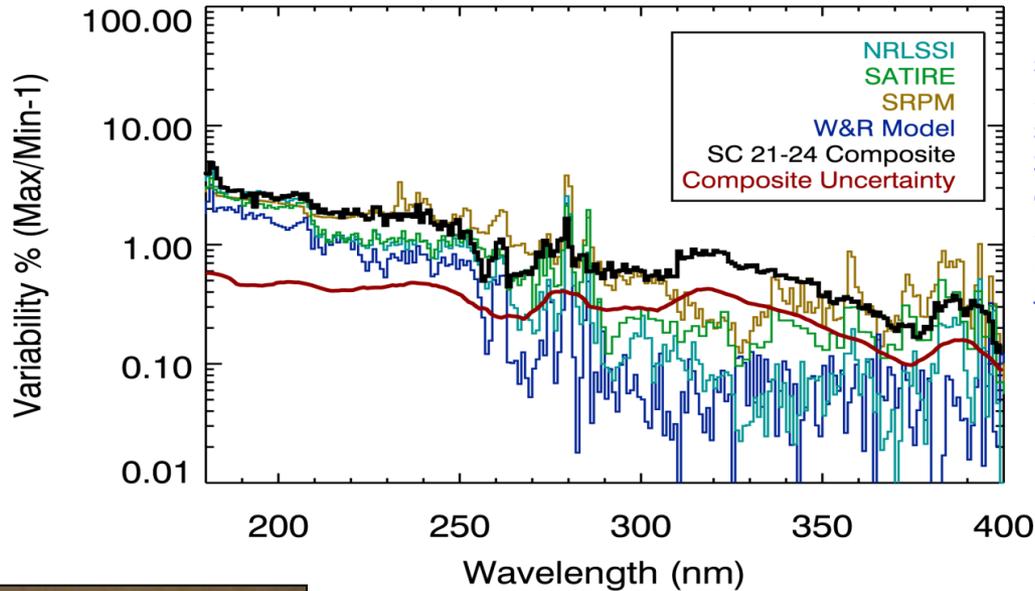
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Erik Richard (front left) talks with Dave Harber. Both Erik and Dave are working on the next generation *SIM instrument* at *LASP*.

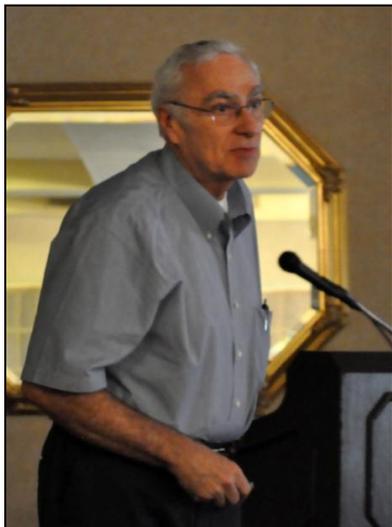


<< Guoyong Wen from *NASA* (right) discusses his poster, *GCM Modeling Climate Response to Spectral Solar Forcing*, with Sarah Ineson.

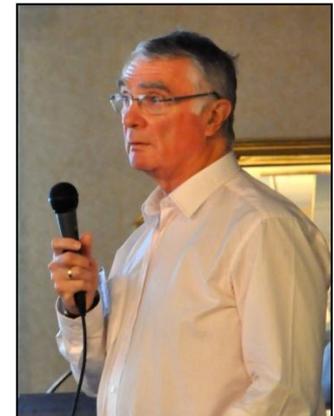
On Wednesday morning, Sept. 19, **Session 3. Observations of Solar Spectral Irradiance Variability**, chaired by Gary Rottman (LASP), concentrated on the measurements of SSI. It began with a keynote talk by Scott McIntosh from the High Altitude Observatory at NCAR in Boulder. Scott's talk was presented by Bob Leamon from NASA Headquarters. The session continued with ten additional speakers, including Gerard Thuillier, Martin Snow, Linton Floyd, Jerry Harder, Tom Woods, Doug Rabin, Russell Howard, Dora Preminger, Mark Rast, and Ken Tapping. The session focus was on comparing observations from SORCE and other solar irradiance instruments, both orbiting and ground-based.



<< This plot by Tom Woods shows a comparison of several solar irradiance models with a LASP Solar Cycle 21-24 composite MUV spectrum constructed from several instruments (SME, UARS SOLSTICE, UARS SUSIM, SORCE SIM, and SORCE SOLSTICE). The composite is generally higher than the models in the 290-350 nm range. This composite construction indicates lower UV variability than presented in Harder, J., et al., *GRL*, 36, L07801, 2009.



<< Russ Howard from NRL discussed a unique measurement of solar variability at visible wavelengths, using scattered light from the solar corona that gave results consistent with TSI variations measured by SORCE TIM. His scattered-light measurements indicate that SSI variations are in-phase with the solar cycle in the visible spectral band.



^^ Gerard Thuillier from LATMOS in France gave a talk entitled, *Analyses of Different Solar Spectral Irradiance Reconstructions*.

**Session 4. *Observations of the Solar Influence on Earth Climate***, the final session of the meeting tackled observations and models of Earth's atmosphere as related to solar cycle variations. One important topic discussed was comparison of 2-D and 3-D atmospheric models. There appears to be good consistency in the results between different models, suggesting that the chemistry and dynamics in these models are well represented in both. Different atmospheric measurements can provide diverse – and seemingly conflicting – conclusions about which solar variability inputs to the models produce results that best agree with the atmospheric observations. Talks were given by Shuhui Wang, Aimee Merkel (presented by Jerry Harder), Jae Lee, Dong Wu, Kurt Thome, Sebastian Schmidt, and Ralph Kahn.



^^ Sebastian Schmidt from CU/LASP discussed aircraft and ground-based measurements of spectral solar radiation.



>> Kurt Thome from NASA GSFC gave an interesting talk on *Use of Lunar Irradiance for Earth Climate Observations*.



<< SORCE Meeting attendees enjoyed a Science Meeting Dinner at *Carrol's Creek Waterfront Restaurant* during the week. *Carrol's* is a local favorite tucked in the Annapolis City Marina, a bustling business and dock area where Annapolis' colorful sailing scene comes to life.

**The next SORCE Science Meeting:** The final topic of discussion focused on determining the theme of the next SORCE Science Team Meeting. It was generally agreed that rather than 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 Meeting will likely take place in early 2014, centered on topics that address the key results obtained during the SORCE Mission. Stay tuned to the SORCE website for details!

## Summary and Conclusion

To conclude the *SORCE* Meeting PI Tom Woods came full circle by addressing the key questions that the attendees had hoped to tackle. The complete 2012 *SORCE* Meeting details, including agenda, abstracts, summary, and most of the presentations, can be found online at:

<http://lasp.colorado.edu/sorce/news/2012ScienceMeeting/>



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Marty Snow (LASP) was the official meeting photographer in addition to giving his talk on *Ultraviolet Solar Spectral Irradiance Variability from SORCE SOLSTICE* in Session 3.

**Note:**

**Most photos in this newsletter were taken by Marty Snow.**



*The SORCE team extends a hearty thanks to all participants for making the 2012 SORCE Science Team Meeting a success!*

## *Solar Spectral Irradiance Trends Workshop – Monday, Sept. 17, 2012*

One day prior to the SORCE Science Meeting, a small group of experts who measure solar spectral irradiance met in Annapolis, MD, to discuss recent SSI observations. The primary topic of interest is that SORCE measurements show larger solar variability in the descending phase of solar cycle 23 (i.e., from mid-2003 to the end of 2008) than most other previous instruments in solar cycle 22. This workshop was a sequel to a workshop held at NIST in February 2012, and the ultimate goal of these SSI workshops is to understand the uncertainties in the comparisons to previous and overlapping datasets, and to validate SORCE measurements.

The morning session was devoted to *Degradation Models and Analysis* and the afternoon addressed *Comparison of Datasets*. For a full workshop summary, please see the last page of the 2012 SORCE Meeting Summary which is posted on the SORCE Meeting website: <http://lasp.colorado.edu/sorce/news/2012ScienceMeeting/index.html>.



### **SSI Trends Workshop participants.**

[Front row] Martin Snow, Odele Coddington, Guoyong Wen, Don McMullin, William Ball, Jae Lee; [Second row] Tom Woods, Gerard Thuillier, Matt DeLand, William McClintock, Jerry Harder, Stéphane Beland, Linton Floyd; [Third row] Doug Lindholm, Peter Pilewskie, Judith Lean, Erik Richard, Dong Wu, Bob Cahalan, Tom Sparn, Gary Rottman, Alexander Shapiro, Dave Harber, and Jeff Morrill.