TSIS / SORCE News

Total & Spectral Solar Irradiance Sensor / Solar Radiation & Climate Experiment

Jan. – Feb. 2020

2020 Sun-Climate Symposium: Meeting Summary –

What is the Quiet Sun and What are the Subsequent Climate Implications?

Tucson, Arizona
Jan. 27-31, 2020

The sunset in beautiful Saguaro Natl. Park, just west of Tucson.

The 2020 Sun-Climate Symposium was held at the Marriott University Park in Tucson, AZ, Jan. 27-31, 2020. The Sun-Climate Research Center—established as a collaboration between NASA's Goddard Space Flight Center (GSFC) and the Laboratory for Atmospheric and Space Physics at the University of Colorado (LASP/CU)—organized this gathering of experts from the solar-terrestrial community and various sun-climate disciplines. The unique theme of the symposium was ***What is the Quiet Sun and What are the Subsequent Climate Implications?***

The kick-off session of the seven oral sessions highlighted the achievements of the SORCE mission, which was decommissioned February 25th. The remaining sessions covered solar and climate observations, models, solar variability, and expectations for the next solar cycle. There was also a poster session spanning these same topics. Over 90 scientists and students from around the world gathered to present their findings and to engage in spirited discussions.

Meeting Overview:

What is the quiet Sun? Is it a time-invariant base level or is there secular variability in the Sun's radiative output? What do those alternate scenarios imply for Earth-climate responses? The current solar minimum provides an opportunity to answer these and related questions.

Observations of the Sun and Earth from space have revolutionized our view and understanding of how solar variability and other natural and anthropogenic forcings impact Earth's atmosphere and climate. For more than four decades the solar irradiance, and global terrestrial atmosphere and surface have been observed continuously, providing high-quality data for Sun-climate studies. The 2020 Sun-Climate Symposium convened experts from across the solar-terrestrial community, including the disciplines of climate research, atmospheric physics and chemistry, heliophysics, and metrology, to discuss solar and climate observations and models over both spacecraft-era and historical timescales.

Session titles:

1. The Sunset of SORCE.
2. Recent / Space-Era Solar Cycle Timescales
3. Solar Variability and Climate Trends on Secular Timescales
4. Solar Influence on the Atmosphere and Climate
5. A New Reference Spectrum for Remote Sensing
6. Observational Predictions
7. Looking Ahead – Future Observations of the Sun and Earth

For the final agenda, description of each session, abstracts, and most of the presentations, please visit the website at:

http://lasp.colorado.edu/home/sorce/news-events/meetings/2020-scs/science-program/.

Attendees at the 2020 Sun-Climate Symposium in Tucson, AZ, pose for a picture on Friday morning before adjourning. The Tucson weather fully cooperated for us during the week.

The 2020 Symposium got underway with a **Welcoming Reception** on Monday evening, Jan. 27. Tuesday morning Peter Pilewskie and Tom Woods, the TSIS-1 and SORCE PIs respectively, kicked-off the week with an introduction to this year's gathering. Keynote speaker Gary Rottman, original SORCE PI, began **Session 1, *The Sunset of SORCE,*** by highlighting the importance of the SORCE mission concept to where it is now. Other speakers in this session included Bob Cahalan, retired NASA GSFC SORCE Project Scientist; the four instrument scientists from LASP – Greg Kopp (TIM), Jerry Harder (SIM), Marty Snow (SOLSTICE), and Tom Woods (XPS); followed by Sean Ryan from LASP Mission Operations and Tom Sparn, the LASP SORCE Project Manager in the early years.

Session 2, *Recent / Space-Era Solar Cycle Timescales,* began with Bo Andersen from the Norwegian Space Agency giving a nice tribute to Claus Fröhlich, who passed away in February 2019. Claus was one of the original Co-Investigators on SORCE. He led several key solar missions in Europe, and was key in pushing the continuation of the long-term solar irradiance data record. The session continued with Bo giving a talk on TSI values at solar minima in the space age. Other speakers in this session were Serena Criscuoli, Erik Richard, Stéphane Béland, Betsy Weatherhead, Margit Haberreiter, Jim Limbacher, Shashi Gupta, Hanna Strecker, Debi P. Choudhary, Matt DeLand (for Sergey Marchenko), and Thierry Dudok de Wit.

The second meeting day began with Alexander Shapiro leading off **Session 3, *Solar Variability and Climate Trends on Secular Timescales,*** followed by Greg Kopp (for Frédéric Clette), Lisa Upton, Leif Svalgaard, Matthias Rempel, Valerie Trouet, Alexander Ruzmaikin, Jennifer van Saders, and Tom Ayres.

On Wednesday afternoon, attendees had the opportunity to tour two world-class laboratories at the **University of Arizona** – the Richard F. Caris Mirror Laboratory and the Laboratory of Tree-Ring Research (LTRR). The weather more than cooperated (gorgeous!) for the walk to/from the beautiful campus. They returned to the Marriot for a special **Poster Session**, featuring 33 excellent poster presentations. Attendees enjoyed refreshments while they wandered through the poster area and discussed their content with the authors.

On Thursday, Jan. 30, keynote speaker Judith Lean led **Session 4, *Solar Influence on the Atmosphere and Climate,*** with "Navigating the Causes of Modern Climate Change," followed by Karen Rosenlof, Lon Hood, Bob Meier, Scott McIntosh, Han-Li Liu, Cornelius Csar Jude H. Salinas, Jae Lee, and local Chris Castro. **Session 5, *A New***

Reference Spectrum for Remote Sensing, started the afternoon speakers which included Dave Doelling, Dave Crisp, Brent Holben, Tom Stone, Odele Coddington, Xianglei Huang, Marty Snow, Nuno Pereira, and Luc Damé.

After a full day of interesting talks, the group continued the day's science discussions with a special dinner at the beautiful historic ***Hacienda del Sol,*** a local favorite just outside of town in the beautiful Catalina foothills. We made it to the restaurant in time to enjoy a colorful sunset featuring the Sonora Desert in the background.

The final day of the Symposium started with **Session 6, *Observational Predictions,*** with Dean Pesnell and Phil Judge speaking. **Session 7, *Looking Ahead – Future Observations of the Sun and Earth,*** followed with Yolanda Shea, Julien Amand, Wolfgang Finsterle, Susan Breon, Dave Harber, Brian Boyle, and Charles Kankelborg.

The 2020 Sun-Climate Symposium Chair Peter Pilewskie gave a few concluding remarks before the 3.5-day meeting was adjourned just before noon. As always, the Symposium was a perfect forum for interesting discussions, learning new science/perspectives, and raising new questions to be addressed in the future. The complete 2020 Symposium details, including agenda, abstracts, summary, and presentations, can be found online at: http://lasp.colorado.edu/home/sorce/news-events/meetings/2020-scs/science-program/

The TSIS-1 and SORCE teams extend a hearty thank you to all participants for the making the 2020 Symposium a success! Our next gathering will most likely be in fall 2021. Stay tuned…

And a few fun photos from this great week…

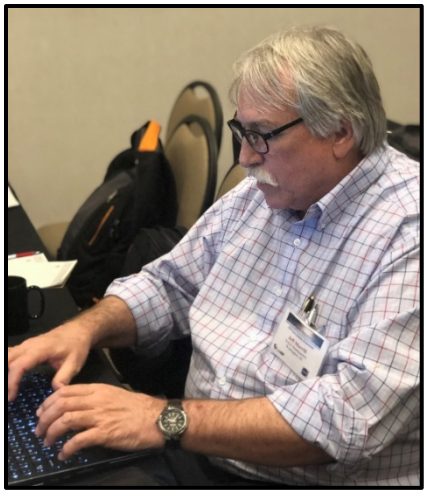
(Photos by Bob Meier, Marty Snow, Tom Woods, Kelly Hepburn, and Vanessa George)

The week started on Monday late afternoon, 1/27, with registration and a Welcoming Reception at the Marriott. Betsy Weatherhead, Dean Pesnell, Nuno Pereira, and Wes Lockwood get checked-in. Below, Tom Woods and Gary Rottman, current and original SORCE PI, touch base early in the week.

Sessions started daily at 8 am, with 57 oral presentation throughout the week in 7 different sessions.

Networking during the breaks is one the many favorite things about the Sun-Climate Symposium. Above left: Margit Haberreiter shares her computer screen with Matthias Rempel and Serena Criscuoli. Above: A passionate discussion where you must use your hands – Brian Boyle, Dave Harber, and one more set of hands! Left: Susan Breon and Erik Richard discuss TSIS-2 updates.

The group shared lunch times together on two days for more networking.



Left to right: Susan Breon, NASA GSFC; Lisa Upton, SSRC, Boulder; and and Jeff Morrill, NASA Headquarters.

University of Arizona – a visit to two prestigious laboratories

On the afternoon of the second day, attendees had the opportunity to tour two of the University of Arizona's world-class laboratories – the **Richard F. Caris Mirror Laboratory** and the **Laboratory of Tree-Ring Research** (LTRR).

In the Mirror Laboratory, a team of scientists and engineers are making giant, lightweight mirrors of unprecedented quality for a new generation of optical telescopes. Not like conventional solid-glass mirrors, they have a honeycomb structure on the inside; made out of Ohara E6-type borosilicate glass that is melted, molded and spun cast into the shape of a paraboloid in a custom-designed rotating oven. Honeycomb mirrors offer the advantages of their solid counterparts – rigidity and stability – but they can be significantly larger, and dramatically lighter. The Mirror Lab team has also developed a revolutionary new method to polish the honeycomb mirrors with a deeply curved, parabolic surface that results in much shorter focal lengths than conventional mirrors The Mirror Lab continues its impressive history of successful, ground-breaking mirror castings with the Giant Magellan Telescope. This telescope will be the largest and most advanced earth-based telescope in the world when complete. Currently, five of the seven 8.4 meter segmented mirrors have been cast. The first mirror is complete and the other four are in various stages of production.

The Laboratory of Tree-Ring Research (LTRR) was created in 1937 by leader Andrew Ellicott Douglass to study tree-rings in America. Since then they have helped to establish many dendrochronology labs around the world. Dendrochronology is the dating and study of annual rings in trees, and scientists use tree rings to answer questions about the natural world and the place of humans in its functioning. Their research helps to: 1) put the present in proper historical context, 2) better understand current environmental processes and conditions, and 3) improve understanding of possible future environmental issues. Ring-counting alone does not ensure the accurate dating of each individual ring, which can lead to incorrect conclusions. One of the techniques used by the LTRR is call "cross-dating" using a skeleton plot to match ring growth characteristics across many samples. Through their work, LTRR is making significant contributions to understanding natural environmental variability in climate, hydrologic, geomorphic, and ecological systems.

The tour attendees were divided into groups of 30 for each tour. This group is visiting the Tree-Ring Laboratory.

More Tree-Ring Laboratory photos. Valerie Trouet from the TRLL gave a fascinating talk in Session 7 in the morning before the tour.

Random photos below, top left clockwise: Dong Wu and Jae Lee from NASA GSFC; SORCE Mission Operations heroes – Sean Ryan and Grace Baird; TSIS 2 manager Brian Boyle and Kathy Pilewskie, both from LASP; Tami and Marty Snow admiring the beautiful Saguaro cactus; and Laura Sandoval and Stéphane Béland from the LASP SORCE data processing group.

Poster Session fun!
There were 33 posters presented at this year's Symposium.
< < Bo Andersen and Greg Kopp chat during the Wednesday afternoon Poster Session.

Clockwise: > > Jamie Mothersbaugh (in orange), Emma Lieb, Veena Gupta, and Joel Tibbets.

V V Poster Reception smiles

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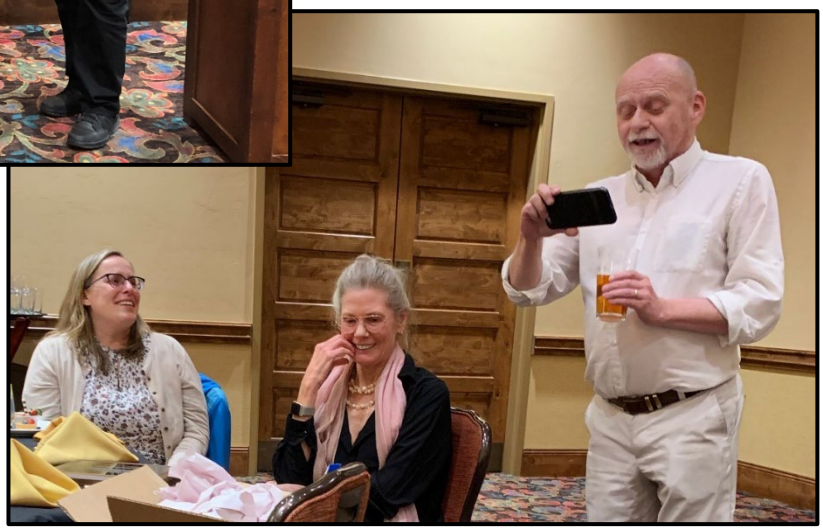
Science Dinner – *Hacienda del Sol*

Peter Pilewskie and Tom Woods presented Judith Lean a plaque to clebrate her recent retirement from NRL. The plaque featured a 1994 quote by Judith: "The highest priority and most urgent activity for determining solar influences on global change is to monitor the total and spectral solar irradiance from an uninterrupted, overlapping series of spacecraft radiometers employing in-flight sensitivity tracking." Following the presentation, Gary Rottman, Greg Kopp, and Odele Coddington said a few words of sincere appreciation to Judith for her solar research contributions.

After celebrating Judith, the festivities continued with Phil Judge leading everyone in a chorus of *Waltzing Matilda*, an Australian favorite. Nice job Phil!

Below left: Aimee Merkel, Wolfgang Finsterle, and Alberto Remesal.



Next Month's Feature – SORCE Decommissioning Update

The SORCE satellite was passivated (turned-off) on Feb. 25, 2020. This was a planned event with NASA HQ/GSFC now that the relatively new TSIS-1 mission has had its required overlap with SORCE. SORCE has provided more than 17 years of excellent solar irradiance measurements of the Total Solar Irradiance (TSI) and Solar Spectral Irradiance (SSI) for NASA's Earth Science Division and for the international Sun-Climate community.

The SORCE operations team at LASP will continue to monitor SORCE for any activity for two weeks (~March 10) before saying goodbye.

Upcoming Meetings / Talks –

TSIS/SORCE scientists are presenting papers or attending the following 2020 meetings/workshops:

2020

Space Weather Workshop, April 20-24, Boulder, CO
European Geosciences Union (EGU), General Assembly, May 3-8, Vienna, Austria
New Developments and Applications in Optical Radiometry (NEWRAD). June 23-26, Boulder, CO
International Radiation Symposium (IRS), July 6-10, Thessaloniki, Greece
Solar Irradiance Science Team Meeting (SIST), July 22-23, Boulder, CO