



## **2015 Sun-Climate Symposium –**

Our focus topic for this 3.5-day meeting is “*Multi-Decadal Variability in Sun and Earth during the Space Era.*” Sponsors are the SORCE mission and the Sun-Climate Research Center – a joint venture between NASA GSFC and LASP at the University of Colorado.

**Registration & Hotel Reservations  
Cut-off Date: Friday, Oct. 9**

We encourage your participation and hope that you will share this announcement. Please mark your calendar to join us for a great meeting in a beautiful location!



### **Sessions and Presenters**

Below are the eight sessions and the speakers within each session (as of 10/12/2015). A detailed description of each session can be found on the meeting website. You will also find the individual abstracts on the meeting website.

### **Tuesday, November 10**

#### **Symposium Kick-off Keynote**

**Gary Rottman**, LASP, Univ. of Colorado, Boulder  
*Validity of Today's Solar Irradiance Measurements to Future (100 Years) Climate Studies*

#### **Session 1. Total Solar Irradiance (TSI) Measurements and Modeling**

**Kok Leng Yeo**, Max Planck Institute, Göttingen, Germany  
*SATIRE-S Reconstruction of TSI and SSI since 1974*

**Frédéric Clette**, WDC – SILSO, Royal Observatory of Belgium, Brussels  
*New Re-Calibrated Sunspot Numbers and the Past Solar Output*

**Stijn Nevens**, Royal Meteorological Institute of Belgium  
*TSI Reconstruction over the Last 300 Years*

**Gary Chapman**, San Fernando Observatory, California State Univ., Northridge  
*Modeling TSI Variations using Photometric Images from the San Fernando Observatory*

**Odele Coddington**, LASP, Univ. of Colorado, Boulder  
*A New Record of Total Solar Irradiance from 1610 to Present*

**Claus Fröhlich**, Davos Wolfgang, Switzerland  
*TSI and Ly- $\alpha$  Reconstruction Back to 1915 Based on Sunspot Area from RGO, Ca-II Data from Mt. Willson and the 4-Component Proxy Model Calibrated 1978-2015*

**Werner Schmutz**, PMOD / World Radiation Center, Davos, Switzerland  
*The PREMOS/PICARD TSI Record: Comparison to other instruments and the 2013/2014 TSI-composite*

**Thierry Dudok de Wit**, LPC2E, CNRS and University of Orléans, France  
*Making of Composites out of Multiple Observations: The New TSI and MgII Index Composites*

**Greg Kopp**, LASP, Univ. of Colorado, Boulder  
*Wanted: A TSI Measurement Record*

**Steven Dewitte**, Royal Meteorological Institute of Belgium  
*The Value of the Solar Constant*

#### **Session 2. Sun-Climate Connection: Top-down and bottom-up couplings**

**Anne K. Smith**, Atmospheric Chemistry Observations & Modeling/ NCAR, Boulder, CO  
*Interpreting Correlation and Multi-Regression Analyses of Solar Cycle Impacts*

**Andrew Kren**, NOAA, Global Systems Division (GSD), Boulder, CO

*The Response of the Stratosphere to the 11-Year Solar Cycle, the Quasi-Biennial Oscillation, and the Pacific Decadal Oscillation*

**Chihoko Cullens**, Univ. of California, Berkeley, CA  
*The 11-Year Solar Cycle Signature on Wave-Driven Dynamics in WACCM*

**Kalevi Mursula**, ReSoLVE CoE, Space Physics Unit, University of Oulu, Finland  
*Why Does the Positive Phase of NAO Pattern Appear Preferentially in the Declining Phase of the Solar Cycle?*

**James Russell III**, Center for Atmospheric Sciences, Hampton University, VA  
*Validation of the Global Distribution of CO<sub>2</sub> Volume Mixing Ratio in the Mesosphere and Lower Thermosphere from SABER*

**Jia Yue**, Center for Atmospheric Sciences, Hampton University, VA  
*Increasing Carbon Dioxide Concentration in the Upper Atmosphere Observed by SABER*

**Ales Kuchar**, Charles University in Prague, Czech Republic; and Institute for Atmospheric and Climate Science ETH, Zurich, Switzerland  
*Attribution of the 11-year solar cycle in lower-stratospheric temperature and ozone*

**Guoyong Wen**, NASA GSFC and Morgan State University, Baltimore, MD  
*Surface Temperature and Planetary Albedo Responses to Total and Spectral Solar Forcing on Multi Decadal Time Scales in GISS GCMAM*

**Yukihiro Takahashi**, Dept. of CosmoSciences, Hokkaido University, Sapporo, Hokkaido, Japan  
*Relationship Between Solar Parameters and Typhoon/Thunderstorm Occurrences with One-Month Periodicity*

## Wednesday, November 11

### **Session 3. Climate Changes during the Space Era**

**Drew Shindell**, Duke University, Durham, NC  
*Solar Forcing of Industrial Era Climate Change*

**Norm Loeb**, NASA Langley Research Center, Hampton, VA  
*Earth's Radiation Imbalance Observed from Space*

**Alex Ruzmaikin**, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA  
*Solar Forcing of the Earth's Climate on Multi-Decadal Time Scales*

**Nov. 10-13, 2015 \* Savannah, GA**  
**Meeting Website:**

<http://lasp.colorado.edu/home/sorce/news-events/meetings/2015-sun-climate-symposium/>

**Join us!**

**Pavle Arsenovic**, Institute for Atmospheric and Climate Science, ETH, Zurich, Switzerland  
*Climate and Ozone Layer in the Future: Implications of Grand Solar Minimum*

**Rolando Garcia**, Atmospheric Chemistry Observations & Modeling/NCAR, Boulder, CO  
*Trends and Solar Cycle Signals of CO and CO<sub>2</sub> in the MLT*

**John Emmert**, Naval Research Laboratory (NRL), Washington, DC  
*Past and Future Climate of Thermospheric Density: Solar and anthropogenic influences*

### **Session 4. Solar Spectral Irradiance (SSI) Measurements and Modeling**

**William Ball**, PMOD / WRC, Davos, Switzerland  
*New Results on the Stratospheric Ozone Response to Solar Spectral Irradiance Variability*

**Jerald Harder**, LASP, Univ. of Colorado, Boulder  
*Construction of a SORCE-Based Solar Spectral Irradiance (SSI) Record for Input into Chemistry Climate Models*

**James Butler**, NASA GSFC, Greenbelt, Maryland  
*SSI Requirements for Earth Observing Sensors Operating in the UV to Shortwave*

**Matthieu Kretzschmar**, LPC2E, CNRS and University of Orléans, France  
*On the Stability of Solar Spectral Irradiance Records*

**Ken Tapping**, National Research Council, Herzberg Inst. of Astrophysics D.R.A.O., Penticton, BC, Canada  
*Using F10.7 and Other Activity Indices to Examine Continuity of Solar Activity Cycles*

**Scott McIntosh**, High Altitude Observatory/NCAR, Boulder, CO  
*Quasi-Periodic Variations in Radiative Output Driven By Activity Band Interactions*

**Sergey Marchenko**, Science Systems and Applications Inc. (SSAI), Lanham, MD; and NASA GSFC  
*Spectral Irradiance Changes in Cycle 24: Inter-comparing Aura/OMI, SORCE SIM, and SORCE SOLSTICE*

**Gerard Thuillier**, Laboratoire Atmosphères, Milieux, Observations Spatiales (LATMOS), France  
*SOLSPEC onboard the International Space Station: Absolute Solar Spectral Irradiance in the Infrared Domain and Comparison with Recent Solar Models*

**Courtney Peck**, LASP, Univ. of Colorado, Boulder  
*Demonstrating the Sensitivity of Long-Term Photometric Trends to the Center-to-Limb Profile*

**Gene Avrett**, Harvard-Smithsonian Center for Astrophysics, Boston, MA  
*Modeling of the Solar Atmosphere: Spectral Irradiance Synthesis for the Period 2010-2015*

**Cassandra Bolduc**, Physikalisch-Meteorologisches Observatorium / WRC, Davos, Switzerland  
*NLTE Calculation of the Solar spectrum with CRoss-influence of solar ATmospheric structures (SOCRAT)*

**Tom Woods**, LASP, Univ. of Colorado, Boulder  
*A Different View of Solar Spectral Irradiance Variations: Modeling Total Energy over Six-Month Intervals*

**Jae Lee**, Univ. of Maryland, Baltimore County; and NASA GSFC, Greenbelt, MD  
*Solar Rotational Modulations of Spectral Irradiance and Correlations with the Variability of Total Solar Irradiance*

## **Thursday, November 12**

### **Session 5. Societal Impacts from Climate Change and Solar Variability**

**Bruce Wielicki**, NASA Langley Research Center, Hampton, VA  
*Climate Change Accuracy: Observing Requirements and Economic Value*

**Dean Hardy**, Univ. of Georgia, Athens  
*Georgia Barrier Island Residents' Knowledge and Understanding of Vulnerability to Sea-Level Rise*

**Robert Cahalan**, Johns Hopkins University, Applied Physics Lab (APL), Laurel, Maryland  
*Examples of Societal Impacts from Climate Change*

### **Session 6. Variability of the Sun-like Stars**

**Jeff Hall**, Lowell Observatory, Flagstaff, AZ  
*The Art of Science and the Physics of Sun-Like Stars*

**Hugh Hudson**, Space Sciences Laboratory (SSL), Univ. of California, Berkeley  
*The Sun and the Kepler Solar-Type Stars: Quiescence and Flaring*

**Phil Judge**, High Altitude Observatory/NCAR, Boulder, CO  
*Heinrich Schwabe's Holistic Detective Agency*

**Tom Ayres**, Center for Astrophysics & Space Astronomy (CASA), Univ. of Colorado, Boulder  
*The Ups and Downs of Alpha Centauri and Friends*

**Wes Lockwood**, Lowell Observatory, Flagstaff, AZ  
*Photometric Variations of 290 Sun-Like Stars 1993-2015*

### **Session 7. Challenges and Opportunities in Solar Observations**

**Luc Damé**, Laboratoire Atmosphères, Milieux, Observations Spatiales (LATMOS), France  
*SUITS/SWUSV: A Solar-Terrestrial Space Weather & Climate Investigation*

**Martin Snow**, LASP, Univ. of Colorado, Boulder  
*The EUV and X-ray Irradiance Sensors (EXIS): GOES-R and Beyond!*

**Marek Stęślicki**, Space Research Centre, Polish Academy of Sciences, Warsaw, Poland  
*Bragg Soft X-rays Spectrometers: Our future missions*

**Serena Criscuoli**, National Solar Observatory, Boulder, CO  
*Modeling Solar Irradiance with DKIST*

**Candace Carlisle**, NASA GSFC, Greenbelt, MD  
*Total and Spectral solar Irradiances Sensor (TSIS) Project Overview*

**Erik Richard**, LASP, Univ. of Colorado, Boulder  
*A Compact Solar Spectral Irradiance Monitor for Future Small Satellite and CubeSat Science Opportunities*

**William H. Swartz**, Johns Hopkins University, Applied Physics Lab (APL), Laurel, MD  
*The RAVAN CubeSat Mission: Progress toward a new measurement of Earth outgoing radiation*

**Tom Sparn**, LASP, Univ. of Colorado, Boulder  
*Continuous Constellation for Total and Spectral Solar Irradiance in the next 35 Years*

**Matt DeLand**, Science Systems and Applications Inc. (SSAI), Lanham, MD; and NASA GSFC  
*Overview of the NASA Solar Irradiance Science Team (SIST) Program*

**4:30 – 6:30 pm POSTER Session**  
*(Presentations are listed after the oral sessions.)*

## **Friday, November 13**

### **Session 8. Next Generation Observing Systems for Climate Records**

**Hank Revercomb**, Univ. of Wisconsin – Madison  
*The CLARREO Climate Benchmarking Mission: The Absolute Radiance Interferometer (ARI) is a proven prototype for the Infrared portion of the full observing capability*



**Peter Pilewskie**, LASP, Univ. of Colorado, Boulder  
*The Earth Climate Hyperspectral Observatory: Advances in Climate Change Detection, Attribution, and Remote Sensing*

**Martin Mlynczak**, NASA Langley Research Center, Hampton, VA  
*Long-Term Observations of the Upper Atmosphere*

**David Crisp**, NASA Jet Propulsion Laboratory (JPL), Pasadena, CA  
*Early Results from the First Year of Operations of the OCO-2 Mission*

**Graeme Stephens**, NASA JPL and California Institute of Technology, Pasadena  
*An Active Approach to Climate Data Records*

**Alexander Marshak**, NASA GSFC, Greenbelt, MD  
*Looking at the Entire Sunlit Earth from the L1 Point; The very first results*

**Ricky Egeland**, High Altitude Observatory, NCAR, Boulder, CO  
*Century-Long Monitoring of Solar Irradiance and Earth's Albedo Using a Stable Scattering Target in Space*

**Dong Wu**, NASA GSFC, Greenbelt, MD  
*What Spatiotemporal Sampling is Needed to Determine Earth Radiation Imbalance from GEO-MEO-LEO Constellation?*

**Cheryl Yuhas**, NASA Headquarters, Washington, DC  
*Overview of the Current and Future Missions for NASA's Earth Science Division*

## **Poster Session Presentations**

***(Thursday, Nov. 12, 4:30 – 6:30 pm)***

**Binod Adhikari**, Tribhuvan University, Kahmandu, Nepal  
*Study of Polar Cap Potential and Merging Electric Field during High Intensity Long Duration Continuous Auroral Activity*

**Stéphane Beland**, LASP, Univ. of Colorado, Boulder  
*The Latest SORCE SIM Degradation Model and the Resulting SSI Measurements from 2003 to 2015*

**Sarah Blunt**, Brown University, Providence, RI  
*Intensity Contrasts of Bright Solar Surface Features in Continuum and Absorption Bands at Disk Center*

**Angela Cookson**, San Fernando Observatory, California State University, Northridge  
*Sunspots: SFO Areas vs. SILSO's Revised Sunspot Numbers*

**Serena Criscuoli**, National Solar Observatory, Boulder, CO  
*Relation between Intensity Contrast and Magnetic Field for Active and Quiet Regions Observed on the Solar Photosphere*

**Thierry Dudok de Wit**, LPC2E, CNRS Univ. of Orléans, France  
*Forecasting Solar Forcing Up to 2300: Why, and How?*

**Wolfgang Finsterle**, PMOD / WRC, Davos, Switzerland  
*The Calibration of the CLARA Radiometer*

**Claus Fröhlich**, Davos, Switzerland  
*Improved Level-0 to 1 Evaluation of PMO6V of VIRGO/SOHO*

**Jenny Marcela Rodriguez Gómez**, INPE, San Jose dos Campos, Brazil  
*Modeling Electron Density, Temperature Distribution in the Solar Corona Based on Solar Surface Magnetic Field Observations*

**Linda A. Hunt**, SSAI, Hampton, VA  
*A Combined Solar and Geomagnetic Index for Thermospheric Climate*

**Greg Kopp**, LASP, Univ. of Colorado, Boulder  
*The Four Flight Total Irradiance Monitors*

**Jae Lee**, Univ. of Maryland, Baltimore County; and NASA GSFC, Greenbelt, MD  
*Comparison of OLR Datasets from AIRS, CERES, and MERRA2*

**Janet Machol**, CIRES, Univ. of Colorado, Boulder; and NOAA National Centers for Environmental Information (NCEI), Boulder, CO  
*Exospheric Hydrogen Density Determined from Lyman- $\alpha$  Irradiance*

**Mustapha Meftah**, Laboratoire Atmosphères, Milieux, Observations Spatiales (LATMOS), France  
*Evolution of the TSI during the Rising Phase of SC 24*

**Andrés Muñoz-Jaramillo**, Georgia State Univ., Atlanta  
*Vitalizing Four Solar Cycles of Kitt Peak Synoptic Magnetograms*

**N. Brice Orange**, Orange Wave Innovative Science, LLC; and Univ. of the Virgin Islands  
*Magnetic Energy Coupling Across Broad Solar Atmospheric Plasma Conditions and Temperature Scales*

**Alexander Shapiro**, Max Planck Institute, Göttingen, Germany  
*Connecting Solar and Stellar Brightness Variations*

**Martin Snow**, LASP, Univ. of Colorado, Boulder  
*SORCE Undergraduate Researchers*

**Luis Eduardo Antunes Vieira**, INPE, San Jose dos Campos, Brazil  
*Preliminary Design of the Brazilian Experiential Broadband Radiometer*

**Benjamin Walter**, PMOD / WRC, Davos, Switzerland  
*Terrestrial Solar Irradiance Measurements with a Cryogenic Solar Absolut Radiometer*

**Tom Woods**, LASP, Univ. of Colorado, Boulder  
*Technology Advances Enable Science-Oriented CubeSat Missions*

## *Solar Physics Paper –*

Tom Woods recently had a paper accepted for publication to *Solar Physics* on solar spectral irradiance energy. “A Different View of Solar Spectral Irradiance Variations: Modeling Total Energy over Six-Month Intervals” was co-authored by Marty Snow, and Jerald Harder from CU/LASP; and Gary Chapman and Angela Cookson from the San Fernando Observatory at California State University Northridge.

**Abstract:** A different approach to studying solar spectral irradiance (SSI) variations, without the need for long-term (multi-year) instrument degradation corrections, is examining the total energy of the irradiance variation during six-month periods. This duration is selected because a solar active region typically appears suddenly and then takes five to seven months to decay and disperse back into the quiet Sun network. The solar outburst energy, which is defined as the irradiance integrated over the six-month period and thus includes the energy from all phases of active region evolution, could be considered the primary cause for irradiance variations. Because solar cycle variation is the consequence of multiple active region outbursts, understanding the energy spectral variation may provide a reasonable estimate of the variations for the 11-year solar activity cycle. The moderate-term (6-month) variations from the Solar Radiation and Climate Experiment (SORCE) instruments can be decomposed into positive (in-phase with solar cycle) and negative (out-of-phase) contributions by modeling the variations using the San Fernando Observatory (SFO) facular excess and sunspot deficit proxies, respectively. These excess and deficit variations are fit over 6-month intervals every 2 months over the mission, and these fitted variations are then integrated over time for the six-month energy. The dominant component indicates which wavelengths are in-phase and which are out-of-phase with solar activity. The results from this study indicate out-of-phase variations for the 1400-1600 nm range, with all other wavelengths having in-phase variations.

## *Upcoming Meetings / Talks –*

*SORCE* scientists will present papers or attend the following 2015-2016 meetings/workshops:

**Sun-Climate Symposium (SORCE/SCRC Mtg),**  
Nov. 10-13, Savannah, GA

AGU Fall Meeting, Dec. 14-18, San Francisco, CA  
ISSI Team “Solar Heliospheric Lyman Alpha Profile Effects (SHAPE)”, January 2016, Bern, Switzerland

