Overview of the NASA Solar Irradiance Science Team (SIST) Program

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Background

• NASA requested proposals for “…the development of consistent multi-instrument/multi-platform space-based data sets of solar irradiance” in Fall 2014.

• The mission of the Solar Irradiance Science Team (SIST) program is to construct unified databases of spectral and total solar irradiance.

• Proposals were also solicited for Team Leader.
Awards

• Seven investigations were selected for funding in March 2015 *(alphabetical list).*
  – Matt DeLand (PI, Team Leader), Sergey Marchenko, Linton Floyd
  – Jerry Harder (PI), Stephane Beland, John Fontenla, Aimee Merkel
  – Greg Kopp (PI)
  – Judith Lean (PI), Peter Pilewskie, Gary Rottman, Karl Battams, Odele Coddington
  – Erik Richard (PI), Stephane Beland, Jerry Harder
  – Marty Snow (PI), Janet Machol, Tom Woods, Gary Chapman, Debi Prasad Choudhary
  – Richard Willson (PI)
DeLand – Improved Composite Solar Spectral Irradiance Product Using SBUV/2 and OMI Data

- *SSI data (full record).*
- Improve quality of existing composite SSI data set [DeLand and Cebula, 2008].
- Create corrected NOAA-16, NOAA-17 SBUV/2 data (using SUSIM reference spectra) to extend current product to 2009.
- Expand OMI irradiance product to contain daily spectra with full wavelength sampling.
- Incorporate OMI data to extend composite SSI data set to present.
- Fill spectral gaps with proxy-based data.
Harder – Construction of a SORCE-Based Solar Spectral Irradiance (SSI) Record for Input into Chemistry Climate Studies of Solar Cycle 23-24

• *SSI data + model (Cycles 23-24).*

• Generate broad spectral coverage SSI data set (110-10000 nm) over Cycles 23-24 for climate models.

• Primary input data are SORCE SOLSTICE and SORCE SIM measurements.

• Extend temporal coverage back to Cycle 23 maximum (2002) using Fontenla SRPM model.

• Model will also provide self-consistent irradiances for $\lambda > 2400$ nm.
Kopp – A TSI Community Consensus Composite Based on an Assessment of the Accuracies and Uncertainties of Space-Borne TSI Measurements

• *TSI data (full record).*

• Current ISSI team has agreed on recommended value of $S_0$, methodology for creating composite TSI record.

• Now want to implement approach and add time-dependent uncertainties.

• Establish system to distribute new TSI product and update as appropriate.
Lean – Participation in Solar Irradiance Science Team: How does the Sun’s Spectrum Vary?

- *SSI model (full record).*
- Improve characterization of irradiance variability for proxy model.
- Evaluate each available irradiance database for proxy relationships on monthly, solar cycle, multi-decadal time scales.
- Use improved SME database to get rotational → cycle scaling at UV wavelengths.
- Repeat process with TSI data (adjusted for sunspot darkening).
- Compare solar minima in 1996, 2008 to evaluate possible decadal changes.
- Provide uncertainties for variability.
Richard – The Analysis of Improved Laboratory Measurements in the Recalibration and Reevaluation of the SORCE SIM Data Record

• *SSI data* (*Cycles 23-24*).
• Review SORCE SIM calibration using new laboratory measurements and facilities developed for TSIS.
• Expanded studies of SORCE SIM materials and witness samples included.
• Additional characterization of thermal sensitivity will improve ability to evaluate later portion of SORCE data record, when temperatures are more variable.
Snow – Solar Spectral Irradiance: Lyman Alpha, MagnEsium II, and Sigma k ProxiEs (SSIAMESE)

- **Proxy data (full record).**
- Improve proxy records for Lyman $\alpha$, Mg II, visible variations.
- Lyman $\alpha$: Update corrections to current data, add GOES and SDO data.
- Mg II: Use ground-based Ca II data (Sigma-K) to identify satellite instrument trends, clean up artifacts.
- Visible: Develop proxy using solar continuum images as alternative approach to sunspot area.
- Develop SSI variability model using these proxy data sets.
Willson – Calibration of Scattering and Diffraction Effects for ACRIM1 and ACRIM2 Satellite TSI Experiments and Reprocessing/Archiving Final Results

- **TSI data (Cycles 21-23).**
- Characterize ACRIM1, ACRIM2 scattering and diffraction using LASP TSI Radiometer Facility (TRF).
- Anticipate finding similar absolute adjustment to correction derived for ACRIM3.
Other Recent Work

• **SOLID** – First European Comprehensive Solar Irradiance Data Exploitation.

• Integrated program to create reconstructed spectral irradiance and total irradiance data sets. Formal duration of project is December 2012 to November 2015.
  
  – Emphasis on filling temporal and spectral gaps using model products.

  – Specification of error and uncertainty estimates.

  – Outreach to potential users in climate community regarding content and format of data products.
Status

• All SIST teams have received Year 1 funding.
• Should the different projects within SIST be coordinated to complement the work that has been accomplished by SOLID?
• First annual SIST meeting/workshop planned for Summer 2016.
• Comments and suggestions are welcome: matthew.deland@ssaihq.com