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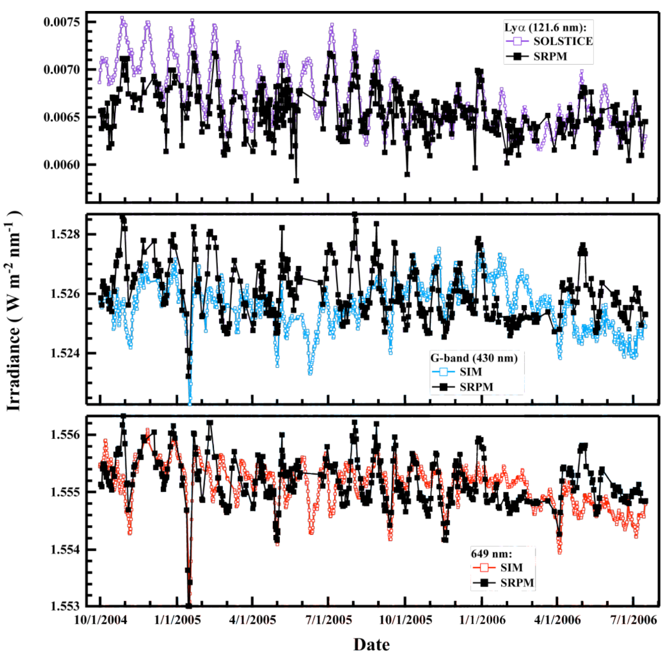
Solar Radiation and Climate Experiment Monthly Newsletter **February 2007**

Current SRPM Research –

By Juan Fontenla, LASP, Univ. of Colorado

Solar spectral irradiance modeling based on the Solar Radiation Physical Modeling (SRPM) provides some very important capabilities that are applicable to a wide variety of topics associated with both solar and earth-atmosphere research. Here is a summary of recent research applications that use SRPM.

Steve Platnick, NASA GSFC, and Juan Fontenla have written a paper called "Model Calculations of Solar Spectral Irradiance in the 3.7 m Band for Earth Remote Sensing Applications". It has been accepted for publication in the *Journal of Applied Meteorology and Climatology*, and the abstract for this paper appears at the end of this article.



The SRPM combines solar feature information with physics-based solar atmospheric spectral models at high spectral resolution to compute the emergent intensity spectrum. This modeled spectrum is then convolved with the SOLSTICE and SIM instrument functions and compared to the measured time series (right panel) to assess the sources of the irradiance variations and identify improvements needed for the model.

Solar spectral irradiance modeling based on SRPM has been compared with SOLSTICE Ly-alpha data and with SIM visible and near-infrared spectra for the last two years. These comparisons exhibit very good agreement over solar rotations and over longer term trends. However, improvements in the active network component of the model and consideration for small sunspots and pores are needed to match the solar rotation periods where activity exists without the presence of large sunspots. Next-generation models should replace semi-empirical estimates of the solar atmosphere temperature structure with calculations of the physical processes that describe magnetic heating/cooling that occur in the solar atmosphere. Work is already starting on such new generation models. The quality of agreement seen in the adjacent plot is enhanced by recent improvements in the understanding of the SORCE Solar Irradiance Monitor (SIM) on-orbit degradation correction. These corrections have improved the level of SIM precision to better than 0.1% over the four years of observations, and work is in progress to include these updated degradation analysis into the public released product.

Because no single instrument can cover the entire solar spectrum, standard reference spectra used for radiative transfer calculations are, by necessity, composites from multiple observations made under different conditions. Thus individual measurements that compose the reference spectrum comprise of different spectral bands, varying spectral and sampling resolution, differing sun-viewing fields that demand limb corrections, and telluric line corrections, just to name a few of the issues inherent in this task. To overcome some of these issues, a new quiet-Sun reference spectrum has been produced, based on the work reported by Fontenla *et al.* [2006, 2007]. This high resolution spectrum is a product of SRPM and improves upon previous spectra by implementing SORCE observations through refinements of the solar atmospheric composition and structure, atomic parameters from NIST and other sources, and full non-LTE computations critical at UV wavelengths and for deep solar Fraunhofer lines. Members of the SORCE science team are working with Gail Anderson to improve and update the reference spectra used as input to MODTRAN5, the most extensively distributed and used radiative transfer model for Earth Science applications. In addition, SRPM higher resolution reference spectra have been complied for use in line-by-line models, most notably the LBLRTM model distributed by S. Clough (A.E.R., Inc.).

Abstract:

Since the launch of the first Advanced Very High Resolution Radiometer (AVHRR) instrument aboard TIROS-N, measurements in the 3.7 μm atmospheric window have been exploited for use in cloud detection and screening,

cloud thermodynamic phase and surface snow/ice discrimination, and quantitative cloud particle size retrievals. The utility of the band has led to the incorporation of similar channels on a number of existing satellite imagers and future operational imagers. Daytime observations in the band include both reflected solar and thermal emission energy. Since 3.7 μm channels are calibrated to a radiance scale (via onboard blackbodies), knowledge of the top-of-atmosphere solar irradiance in the spectral region is required to infer reflectance. Despite the ubiquity of 3.7 μm channels, absolute solar spectral irradiance data comes from either a single measurement campaign (Thekaekara *et al.,* 1969) or synthetic spectra.

In this study, we compare historical 3.7 μm band spectral irradiance data sets with the recent semi-empirical solar model of the quiet-Sun by Fontenla *et al.* (2006). The model has expected uncertainties of about 2% in the 3.7 μm spectral region. We find that channel-averaged spectral irradiances using the observations reported by Thekaekara *et al.* are 3.2–4.1% greater than those derived from the Fontenla et al. model for MODIS and AVHRR instrument bandpasses; the Kurucz spectrum (1995), as included in the MODTRAN4 distribution, gives channel-averaged irradiances 1.2–1.5% smaller than the Fontenla model. For the MODIS instrument, these solar irradiance uncertainties result in cloud microphysical retrievals uncertainties comparable with other fundamental reflectance error sources.

SORCE Website Updated –

After several weeks of revising, the SORCE website is going "live" with its new look and updated features. Not only is it easier to navigate, but access to the science data from each instrument has been improved. Working side-by-side with the LISIRD database, the SORCE data products will have greater accessibility. Final enhancements will be available in just a couple weeks. Check it out – http://lasp.colorado.edu/sorce/.

How cool is this?!

300,610

Hits to the SORCE Website

(Since 4/21/03, As of 2/23/07)

The average hit rate for just the SORCE data products is over 800 per month!

SORCE Science Meeting Plans –

The next SORCE Science Team Meeting is in the planning stages. We will be meeting in Santa Fe, New Mexico in early 2008 (February or March). Watch this newsletter and the website for additional information coming soon.

SORCE Holding Red Team Review on the Senior Review Proposal –

SORCE scientists have been busy for several weeks preparing the SORCE Senior. Review Proposal for the SORCE extended mission. A Red Team panel will meet on Monday, March 5, to discuss the draft proposal and offer suggestions on it can be improved. The final proposal is due to NASA on March 16.

Upcoming Meetings / Talks –

SORCE scientists plan to present papers or attend the following 2007 meetings:

OSA (Optical Society of America) Fourier Transform Spectroscopy/ Hyperspectral Imaging and Sounding of the Environment Topical Meeting, Feb. 11-15, Santa Fe, NM

IUGG – July 2-13, Perugia, Italy

To submit information to this newsletter, please contact: vanessa.george@ lasp.colorado.edu.