MISR Multi-angle Imaging Spectro-Radiometer

**Jet Propulsion Laboratory** **Interoffice Memorandum**

MISR SDFM #114

November 5, 1997

To: Carol Bruegge

From: Nadine Lu Chrien

Subject: Comparison of Thuillier and WCRP solar irradiance databases

A comparison of the Thuillier[1] and WCRP[2] exo-atmospheric solar spectrum databases. The sampling intervals of the original data are listed in Table 1.

**Table 1: Solar spectrum database sampling intervals**

| WCRP | |
|---|---|
| wavelength region | sampling |
| 200 nm-309.5 nm | 1 nm |
| 310 nm-330.4 nm | 0.4 nm |
| 330.5 nm-629.5 nm | 1 nm |
| 631 nm-999 nm | 2 nm |
| 1002.5 nm-2997.5 nm | 5 nm |
| 3005 nm-9995 nm | 10 nm |
| 10025 nm-20025 nm | 50 nm |

| Thuillier | |
|---|---|
| wavelength region | sampling[a] |
| 199.12 nm - 344.38 nm | ≈ 0.4 nm |
| 345.46 nm - 876.86 nm | ≈ 1 nm |

a.approximate interval: sampling is not uniform

To enable a difference comparison the data were resampled to a common wavelength range (200 nm to 877 nm) and sampling interval (0.5 nm) via linear interpolation. The data were also smoothed via convolution with a 5 nm wide square band function or a 5 nm FWHM (full-width at half-maximum) gaussian kernel whose area equaled one. These kernel functions are illustrated in the figures. Also, illustrated is the original data although the WCRP data is only shown over the range for which Thuillier data was available: it actually extends much farther. The top two plots in the figures show the resampled and smoothed data and the percent difference between the two datasets. A notation of the total integrated irradiance is also given for each of the solar spectrums illustrated.

The solar spectrum convolved with the gaussian is smoother than that convolved with the square band; however, both show the same basic shapes. The respective percent differences show the same behavior. Figure 2 is plotted from 400 nm to 900 nm to emphasize the spectral region in which MISR is most interested. The MISR bands are at 446 nm, 558 nm, 672 nm, and 866 nm: the corresponding percent differences in solar spectral irradiance are 2%, -0.3%, 0.2%, and 4.3%. For MISR bands 1 and 4 in particular this is can have a significant impact on the absolute radiometric calibration, so the

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1. Solar Physics, 171:283-302, 1997. Electronic data provided by Stuart F. Biggar, Remote Sensing Group, Optical Sciences Center, University of Arizona.
2. World Climate Research Programme (WCRP) Publication Series No. 7, WMO ITD-No. 149, pp 119-126, October 1986. The data was compiled by Christoph Wehrli, World Radiation Center (NRC), Davos-Dorf, Switzerland under WRC Publication No. 615, July 1985.

choice of solar spectrum is an important consideration.

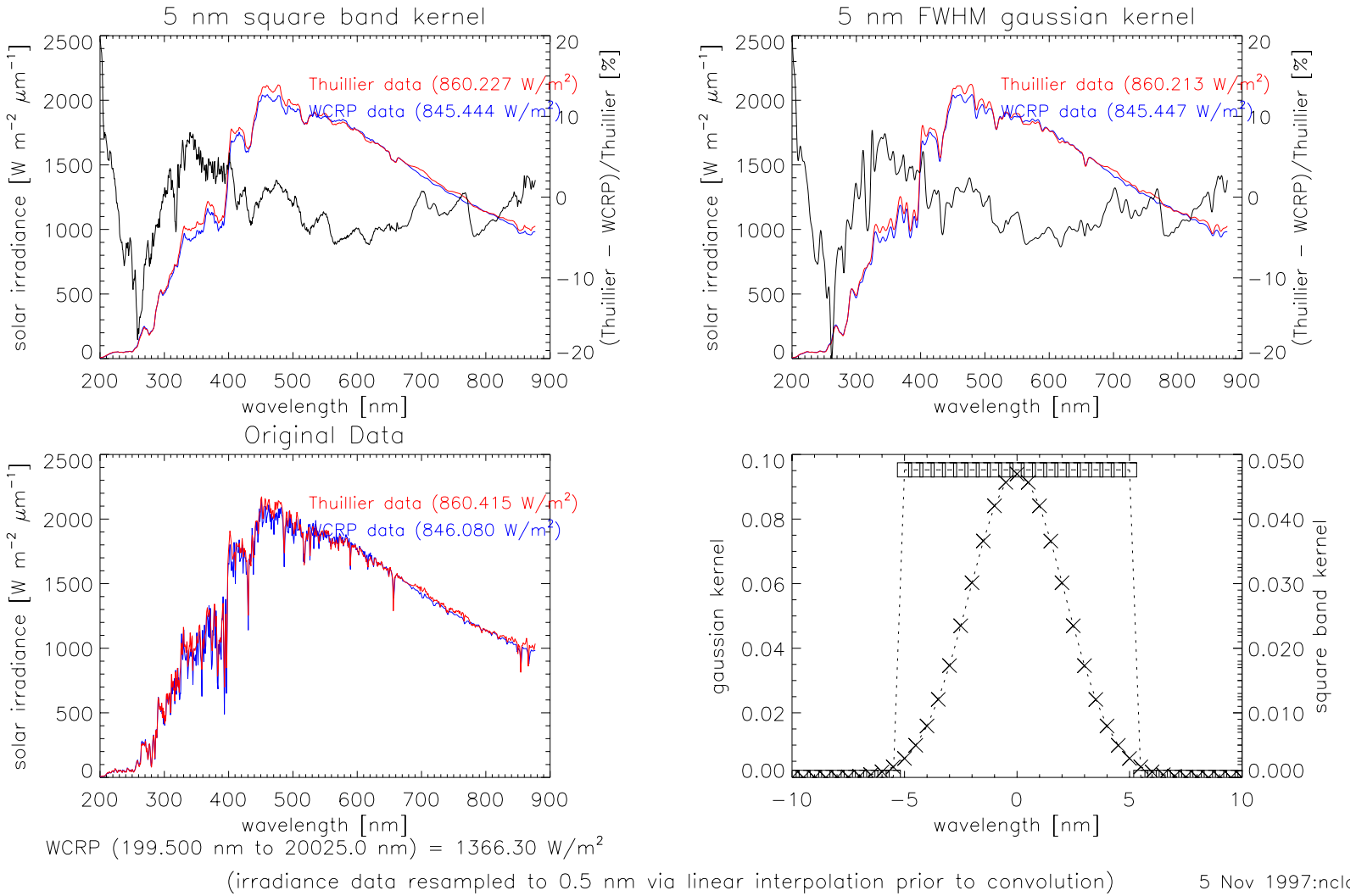


Figure 1. Comparison for full range of Thuillier data (200 nm to 877 nm)

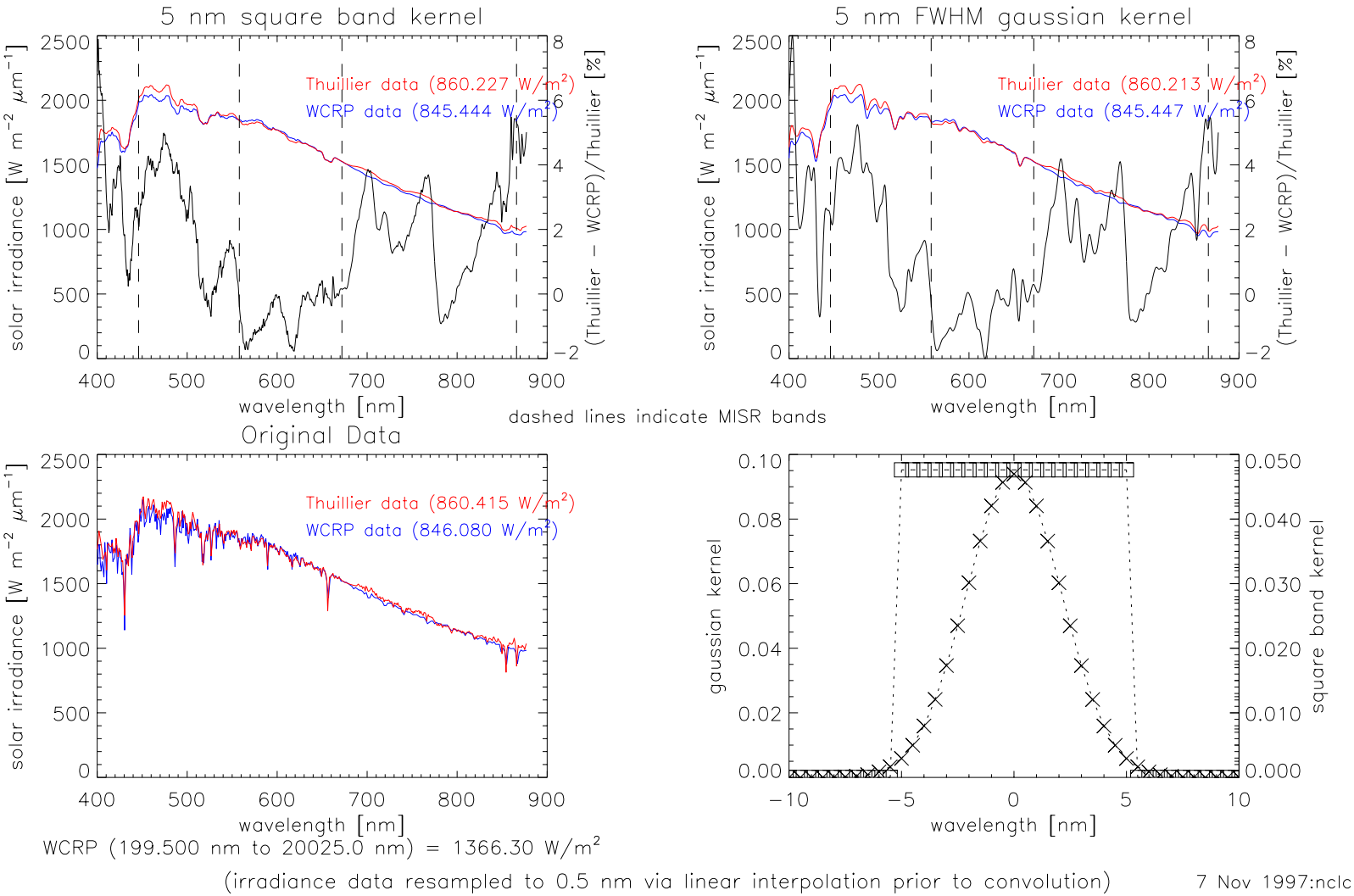


Figure 2. Comparison for range encompassing MISR bands (400 nm to 877 nm)

Date: Thu, 13 Nov 1997 14:49:40 +0100
To: Carol.J.Bruegge@jpl.nasa.gov
From: gerard.thuillier@aerov.jussieu.fr (Gerard Thuillier)
Subject: Re: Eo comparison

Dear Carol,

Thank you for your message. I can give you some informations :

- The version used by Stu Biggar is V8 from ATLAS 1 flight. I have shown V9 (ATLAS 1) which differs from V8 above 820 nm. V9 is better than V8 (above 820 nm) due to the dark current effect which I eliminated by using spectra in the coldest conditions of measurements. - the ATLAS 1 results are confirmed by ATLAS 2. In particular, the discrepancy with the Neckel and Labs'spectrum (1984) below 450 nm. You remember that this spectrum was obtained at the Jungfrauch observatory (about 3300 m). This discrepancy has been also found by some other authors from ground and space.

- the Wherli's spectrum is a compilation of existing spectra in particular using the Neckel and Labs'spectrum. If you have compared data below 450 nm, differences as large as 5% may be found.

- Comparing spectra measured at low resolution is a delicate excercise able to introduce some artificial differences because the instruments have never the same bandpasses and may also have a slight wavelength scale difference (for example an off-set of 0.1 nm may generate 1 to 2% difference even after a 5-nm running averaging which depends of the wavelength domain due to the presence of the Fraunhofer lines). The Labs and Neckel'data were obtained with rectangular slit function while SOLSPEC uses a Gaussian. Even by resampling, the bandpass effect remains. A way to correct that effect is using a high resolution spectrum irradiance (whole disk) in absolute scale which is presently not available. We have conducted some simulation of the bandpass effect; several percents differences may be found locally between measurements from instruments of rectangular and gaussian slit functions.

- I have been pleased by the Stu results showing a better agreement when using the V8 than Neckel and Labs'spectrum. You may have noticed that the discrepancy in the IR part is decreased when using V9.

I am interested by any comparison or studies as done by Stu.

If you wish I can send you the V9 version.

Best regards,

GERARD


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