Joint Center for Satellite Data Assimilation

Office Note (unassigned)

CRTM: Solar Irradiance data used in SpcCoeff generation

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Change History

Date	Author	Change
2009-02-18	P.van Delst	Initial release.

1 Original Data

The solar irradiance data used in the CRTM spectral coefficient (SpcCoeff) data files are that of R.L. Kurucz [1992] that are supplied with the AER Line By Line Radiative Transfer Model, LBLRTM [Clough et al., 2005]. Figure 1.1(a) shows the actual irradiance data and figure 1.1(b) shows the spectral variation in the frequency grid.

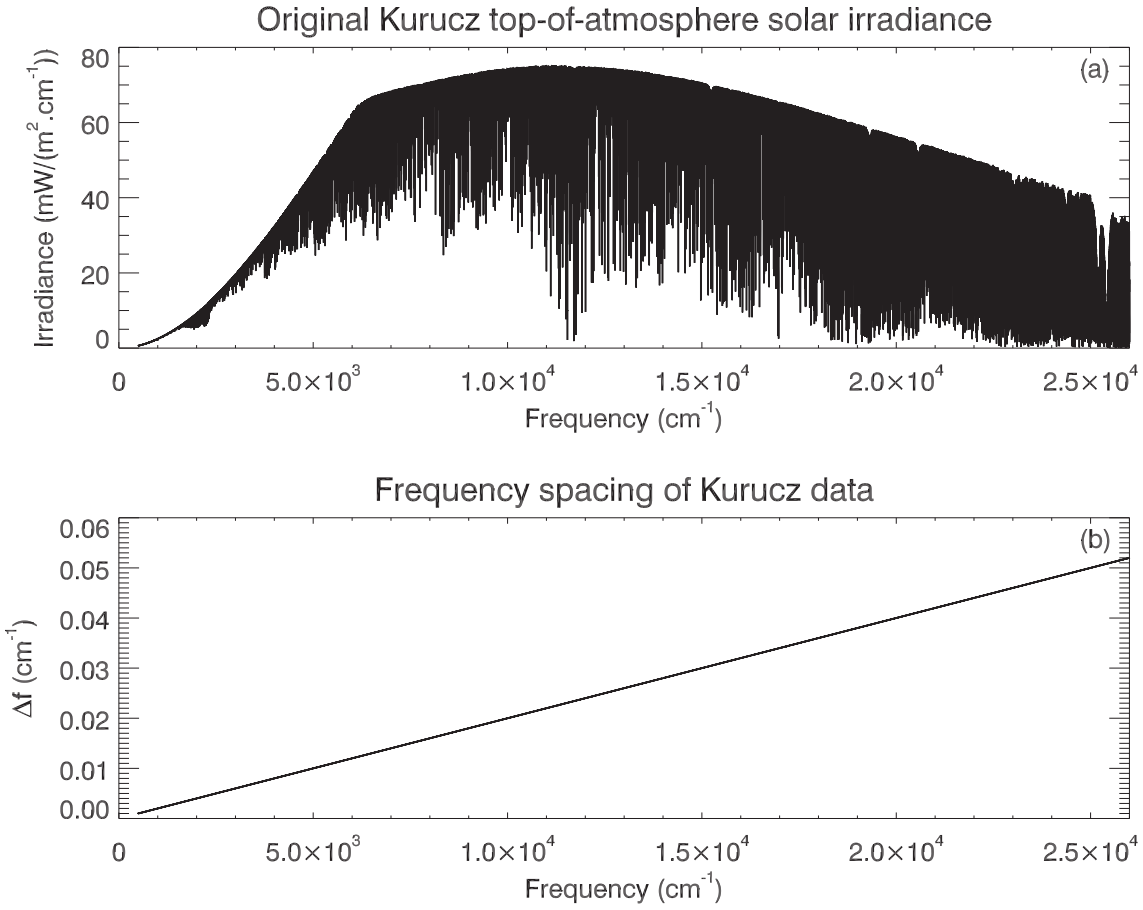

Figure 1.1: (a) Original Kurucz solar irradiance data. **(b)** Frequency spacing of data.

2 Processed Data

For use with infrared and visible broadband channel spectral reponse functions (SRFs), the Kurucz data is resampled via boxcar averaging at the same frequency spacing as the SRFs. Because the frequency spacing of the original data varies with frequency, both interpolation and boxcar-averaging to $\Delta f = 0.1\text{cm}^{-1}$ was performed. Both results are shown in figure 2.1(a) with the difference shown in figure 2.1(b). As expected, the averaged results are at a lower spectral resolution – evidenced by the smaller magnitude of the absorption peaks in figure 2.1(a) – but the difference spectrum is well distributed about zero. The impact of convolving either the interpolated or averaged irradiance with a sensor SRF is shown in table 2.1.

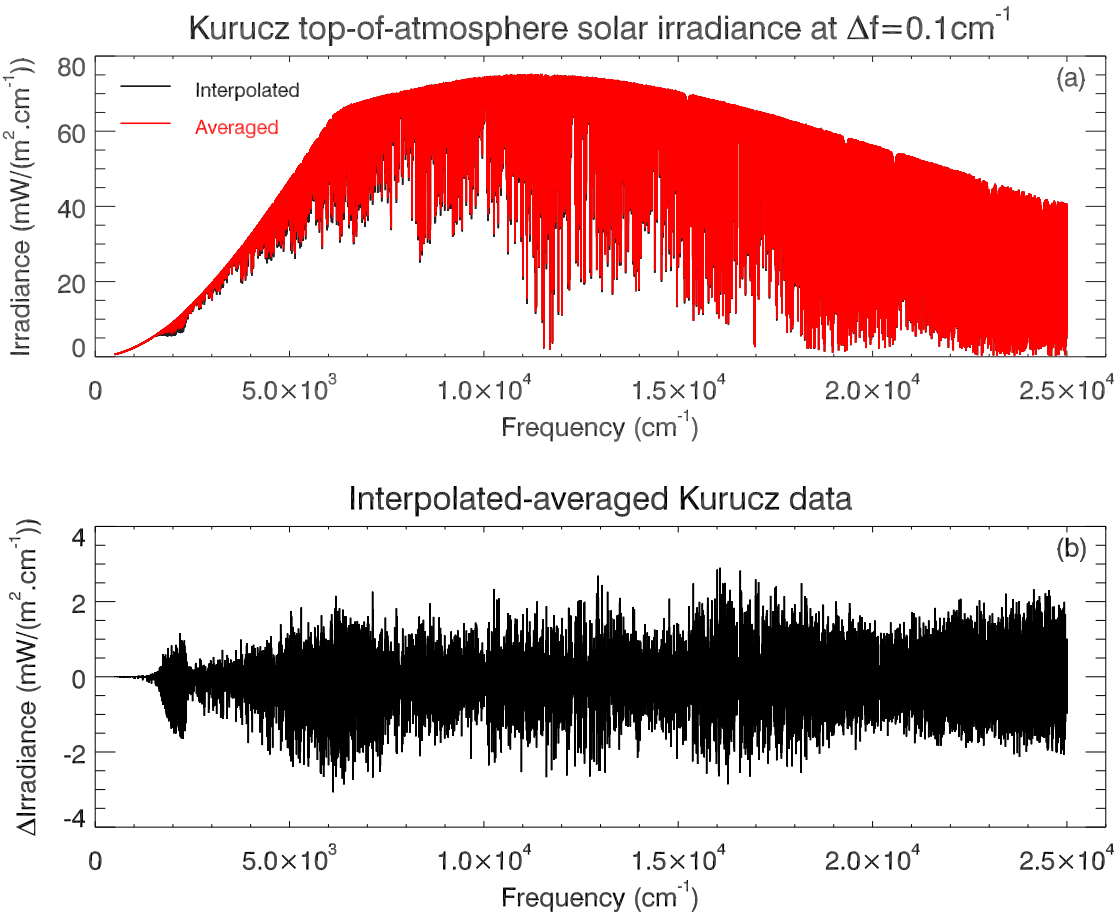

Figure 2.1: **(a)** Original Kurucz solar irradiance data interpolated and averaged to $0.1\mathrm{cm}^{-1}$ frequency spacing. **(b)** Difference between the interpolated and averaged solar irradiance data.

Sensor	Channel	Interpolated ($mW/(m^2.cm^{-1})$)	Averaged ($mW/(m^2.cm^{-1})$)	Difference (%)
HIRS/4	1	1.10858275698263630	1.10866351598035706	-7.28e-03
	2	1.15079368806780535	1.15077606592176739	1.53e-03
	3	1.18004534060217025	1.18004267483969593	2.26e-04
	4	1.22799824621161834	1.22800185804646067	-2.94e-04
	5	1.26439535427395388	1.26439462571735084	5.76e-05
	6	1.32487833258853626	1.32486693207386840	8.61e-04
	7	1.39178666458440658	1.39178147425172738	3.73e-04
	8	1.98961684438544006	1.98957482344496972	2.11e-03
	9	2.57923716144076342	2.57944413221971480	-8.02e-03
	10	1.58160613225902002	1.58155236738516857	3.40e-03
	11	4.44893794503619677	4.44914627456187172	-4.68e-03
	12	5.54583604355146331	5.54563490444953721	3.63e-03
	13	10.12785526452585749	10.15620852588738998	-2.79e-01
	14	10.31783506913986770	10.29967168123845056	1.76e-01
	15	10.60864568505230032	10.60570363692216311	2.77e-02
	16	10.73681456441526905	10.72539119188912693	1.07e-01
	17	13.14133514666552927	13.13825396027710823	2.35e-02
	18	14.07449197010368991	14.07840484387444135	-2.78e-02
	19	15.60461010867800269	15.60394088060967022	4.29e-03
AVHRR/3	1	65.92492445299077986	65.92331782150506569	2.44e-03
	2	72.25298702951161545	72.25274953120639054	3.29e-04
	3A	62.81728889722613474	62.81711632897867048	2.75e-04
	3B	15.64859793656921383	15.64762481332486033	-6.22e-03
	4	2.10938960294082944	2.10938768223147343	-9.11e-05
	5	1.71052718051786256	1.71052741075749237	1.35e-05

Table 2.1: Differences in the convolved solar irradiance for the NOAA-18 HIRS/4 and AVHRR/3 sensors between using the interpolated and boxcar-averaged solar irradiance of figure 2.1(a).

References

S.A. Clough, M.W. Shephard, E.J. Mlawer, J.S. Delamere, M.J. Iacono, K. Cady-Pereira, S. Boukabara, and P. D. Brown. Atmospheric radiative transfer modeling: a summary of the AER codes, Short Communication. *J. Quant. Spectrosc. Radiat. Transfer*, 91:233–244, 2005.

R.L. R.L. Kurucz. Synthetic infrared spectra. In D.M. Rabin, J.T. Jeffries, and C. Lindsey, editors, *Infrared Solar Physics, Proceedings of the 154th Symposium of the International Astronomical Union*. IAU, Kluwer Academic, Norwell MA, March 1992.