Updates to AATSR In-Band Solar Irradiances

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Introduction

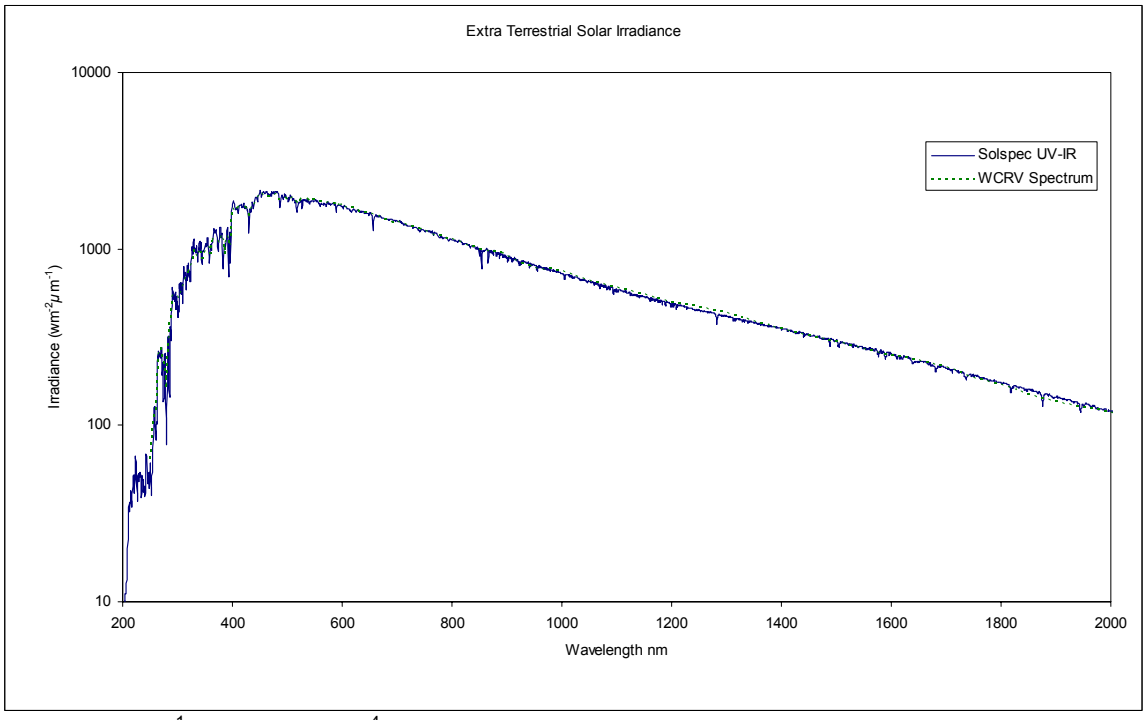

Figure 1: WCR[1] and SOLSPEC[4] Solar Irradiance Spectra for wavelength range 200nm to 2000nm.

Extraterrestrial solar irradiance values for the AATSR visible/near infrared channels are included in the Auxiliary data files used by the prototype and operational processors. The data are included in the VC1 files for reference only as they are not used in the calibration of level 1b products which is converted to top-of-atmosphere normalised radiances. However data users can convert the L1b products to extra-solar radiances by using the solar irradiance values provided.

The current version of the solar irradiances is based on the WRC solar spectrum produced by Frolich and Wherli in 1981[1]. This was most up-to date spectrum available at the time and was constructed from a number of observations. These observations were mainly carried out from high altitude observatories or aircraft to limit atmospheric affects. However it was still necessary to make corrections for absorption in the stratosphere and as a result there were still some discrepancies, particularly in the UV region.

In 1992 the SOLSPEC instrument was flown on the ATLAS1 mission to measure the solar spectrum over the wavelength range 200nm to 3000nm[2,3,4]. The new spectrum is an improvement over previous data as it was measured in space and therefore does not depend on modelled atmospheric corrections and is at a higher spectral resolution allowing spectral features to be resolved. The full spectrum was made available in late 2002[4] is shown in figure 1.

The results from the mission are being used as the solar reference for MERIS on ENVISAT. In some instances users will wish to convert AATSR products to top-of-atmosphere radiances to allow synergy of MERIS and AATSR products. To avoid the potential propagation of errors due to the slight differences in the solar spectrum it is necessary to regenerate the AATSR values using the SOLSPEC spectrum as this is considered to be the most accurate.

Solar Irradiance at AATSR wavelengths

The calculation of the solar irradiance values weighted over the AATSR wavelengths, $I_{0,\lambda}$ is defined by

$$I_{0,\lambda} = \int I_0(\lambda)R(\lambda)d\lambda \Big/ \int R(\lambda)d\lambda \ \text{mWcm}^{-2}\mu\text{m}^{-1}$$

where $R(\lambda)$ is the instrument spectral response at wavelength λ. The integrated solar irradiance in mWcm^{-2} is then given by

$$= I_{0,\lambda}\Delta\lambda \ \text{mWcm}^{-2}$$

The revised weighted solar irradiance and integrated solar irradiance values for AATSR are given in table 1 below:

Table 1: Solar irradiance values computed from solar spectrum measured by SOLSPEC. The highlighted values should replace the existing irradiance values in the Aux files.

		Revised Values using SOLSPEC		Pre-Launch Values using WRC	
Mid Wavelength (nm)	**Bandwidth (nm)**	**Weighted Solar Irradiance $\text{mWcm}^{-2}\mu\text{m}^{-1}$**	**Integrated Irradiance mWcm^{-2}**	Solar Irradiance $\text{mWcm}^{-2}\mu\text{m}^{-1}$	Integrated Irradiance mWcm^{-2}
560	20.79	**1819.54**	**3.7828**	1885.0	3.9189
660	20.13	**1521.89**	**3.0635**	1555.0	3.1302
863	20.14	**950.683**	**1.9147**	1032.8	2.0801
1594	62.88	**254.484**	**1.6002**	247.03	1.5533

References

1. Iqbal M., 'An Introduction to Solar Radiation', Academic Press, 1983

2. Thuillier G., Herse M., Simon P.C, Labs D., Mandel H., Gillotay D. and Foujols T, "The Visible Solar Spectral Irradiance from 350 to 850nm as measured by the SOLSPEC Spectrometer During the Atlas 1 mission" Sol Phys 177: 41-61, 1998

3. Thuillier G., Herse M., Simon P.C, Labs D., Mandel H. and Gillotay D., "Observation of the UV Solar Spectral Irradiance from 200 to 350nm as measured by the SOLSPEC Spectrometer During the Atlas 1 mission" Sol Phys 171: 283-302, 1997

4. Thuillier G., Hersé M., Labs D., Foujols T., Peetermans W., Gillotay D., Simon P.C., and Mandel H., "The Solar Spectral Irradiance from 200 to 2400 nm as Measured by the SOLSPEC Spectrometer from the Atlas and Eureca Missions" Sol Phys 244, 1-22, 2003