5.1. McMurdo Station (08/17/10 – 05/01/11)

Solar data of the SUV-100 spectroradiometer discussed in this quality control summary report encompass the period 08/17/10 – 05/01/11. There are no SUV-100 data available for the period 2/16/10 – 8/16/10 because of a problem with the system's "Spectralink I/O card," which interfaces the instrument with the control computer. The module was replaced in August 2010 and data collection resumed thereafter. For various reasons, SUV-100 data for the following dates are not available: 10/28/10, 12/02/10 , 12/05/10, 12/06/10, 12/10/10, 12/11/10, 12/12/10, 01/23/11, 01/27/11, 01/30/11, 02/07/11, 02/08/11, 02/09/11, 02/10/11, 02/13/11, and 02/14/11.

Data from the GUV-511 radiometer are available for the period 02/16/10 – 05/01/11. GUV data have a gap between 11/07/10 and 12/12/10 when the instrument was not logging data. There are also no data available for the polar night period, 05/16/10 – 08/17/10.

A site visit took place in early February 2011. At this time, the site irradiance standards were compared with a traveling standard and the system was serviced.

5.1.1. Irradiance Calibration

The site irradiance standards for the McMurdo 2010/11 season were the lamps M-543, 200W011, and 200W019. Lamp 200W017 was used as traveling standard in February 2011. There were no lamp comparisons in 2010.

<u>Traveling standard</u>
Lamp 200W017 has been originally calibrated by Optronic Laboratories in March 2001. It has been recalibrated in June 2007 at BSI against a set of four 1000-W FEL lamps, which in turn had been calibrated by the U.S. Central UV Calibration Facility (CUCF) in Boulder, Colo. This calibration procedure was complicated by the fact that the irradiance scale of the four FEL lamps refers to the detector-based scale of the National Institute of Standards and Technology established in 2000 (NIST2000; Yoon et al., 2002), whereas all solar data of the NSF UVSIMN refer to the source-based NIST scale from 1990 (NIST1990, Walker et al., 1987). The NIST2000 scale is about 1.3% larger than the NIST1990 scale. Data of certificates issued by the CUCF were converted to the NIST1990 scale before the calibration was transferred to 200W017.

<u>On-site standards</u>
Lamp 200W011 was put into service at McMurdo in January 2008 and at this time calibrated against the traveling standard M-763. It serves as a long-term standard for McMurdo and was only used three times between January 2008 and February 2011. During the site visit in February 2011, the lamp was compared with the traveling standard 200W017. The two lamps agreed to within ±0.5% (Figure 1). The good agreement mutually confirms the reliability of the two lamps.

Lamps M-543 and 200W019 have been in service for a long time and have been recalibrated several times since their first use. They were recalibrated against lamps 200W011 and 200W017 using the season closing scans of the 2011 site visit. Figure 5.1.1 shows a comparison of the two lamps with 200W017 using their new calibration.

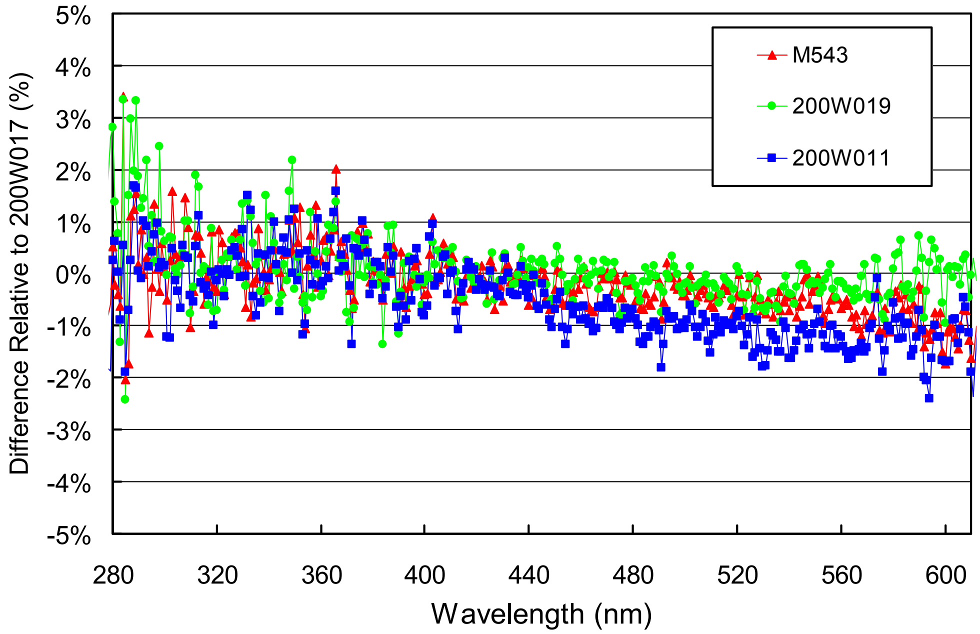

Figure 5.1.1. *Comparison of McMurdo lamps M-543, 200W019 and 200W011 with the BSI traveling standard 200W017 on 02/02/11. The calibration of lamp 200W011 was established in 2008 while lamps M543 and 200W019 were calibrated against a weighted average of lamps 200W011 and 200W017.*

5.1.2. Instrument Stability

The temporal stability of the spectroradiometer was assessed by comparison with data of the collocated GUV-511 radiometer and model calculations that are part of "Version 2" data processing. Figure 5.1.2 shows the ratio of GUV-511 (340 nm channel) and final SUV-100 measurements. The latter were weighted with the spectral response function of the GUV's channel. The ratio is normalized and should ideally be one. The graph indicates that GUV and SUV measurements are consistent to within about ±6%; the standard deviation of the ratio is 2.7%. Times when the calibration changed are indicated by vertical lines. Of note, the comparison indicates that the SUV-100 collector was shaded on 10/20/10, likely by snow. Ratios are systematically large by about 7% on 01/15/11 due to wavelength shift of the SUV's monochromator. This shift is corrected in Version 2 data.

Fourteen calibrations were applied for processing of solar data from the reporting period. More information on these calibrations is provided in Table 5.1.1. Figure 5.1.3 shows ratios of the calibration functions applied during Periods P1B – P5 relative to the function of Period P1. These calibrations encompass the period before the site visit in February 2011. Similarly, Figure 5.1.4 shows ratios of the calibration functions applied during Periods P6B – P8 relative to the function of Period P6. These calibrations encompass the period after the site visit. The ratios for both periods increase over time, which is indicative of a gradual contamination within the optical system.

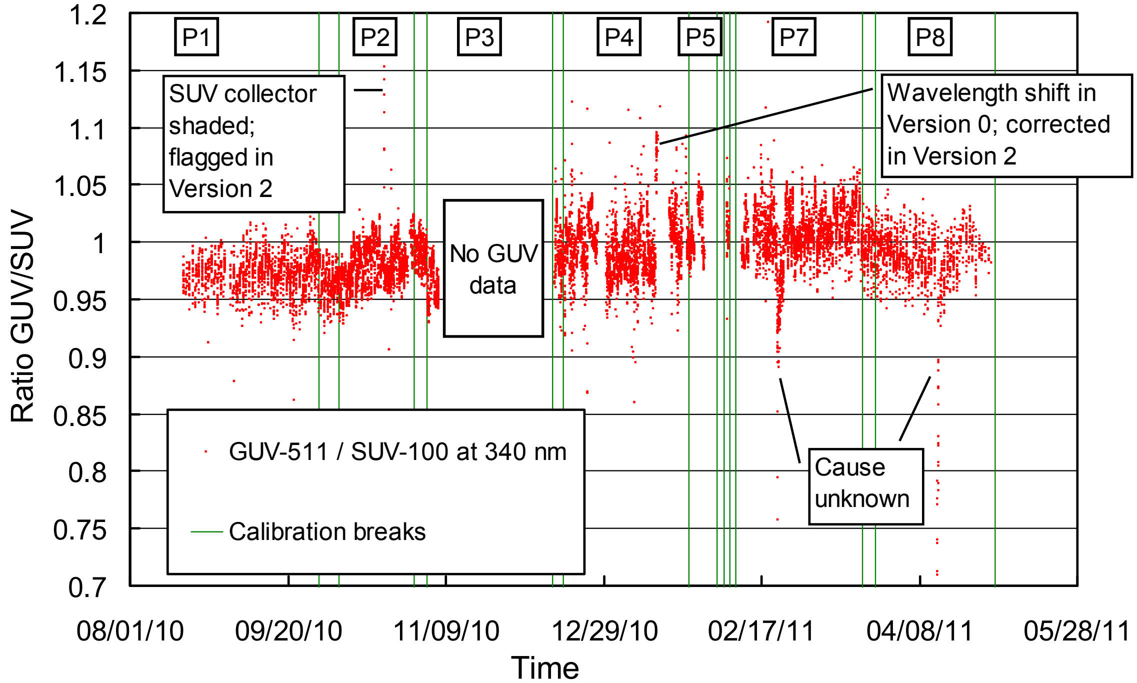

Figure 5.1.2. *Ratio of GUV-511 measurements of its 340 nm channel with final SUV-100 measurements that were weighted with the spectral response function of this channel.*

Table 5.1.1: Calibration periods for McMurdo Volume 20 data.

Period name	Period range	Number of Absolute Scans	Remarks
P1	06/21/10 - 09/29/10	4	
P1B	09/30/10 - 10/05/10	0	Average of period P1 and P2
P2	10/06/10 - 10/29/10	2	
P2B	10/30/10 - 11/02/10	0	Average of period P1 and P2
P3	11/03/10 - 12/12/10	3	
P3B	12/13/10 - 12/15/10	0	Average of period P1 and P2
P4	12/16/10 - 01/24/11	3	
P5	01/25/11 - 02/02/11	6	
P6	02/03/11 - 02/04/11	4	Site visit period - no solar data
P6B	02/05/11 - 02/06/11	0	Scaled from period P6 and P7
P6C	02/07/11 - 02/08/11	0	Scaled from period P6 and P7 - no solar data
P7	02/09/11 - 03/20/11	3	
P7B	03/21/11 - 03/24/11	0	Average of period P7 and P8
P8	03/25/11 - 05/01/11	1	

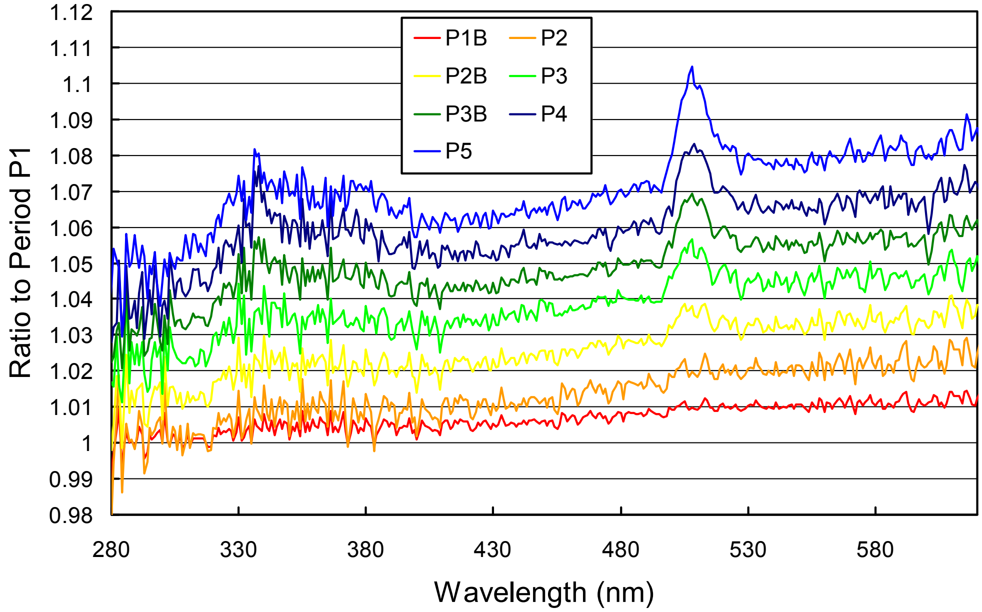

Figure 5.1.3 *Ratios of irradiance assigned to the internal reference lamp during periods P1B – P5, relative to Period P1. Changes from period to period are typically smaller than 2%.*

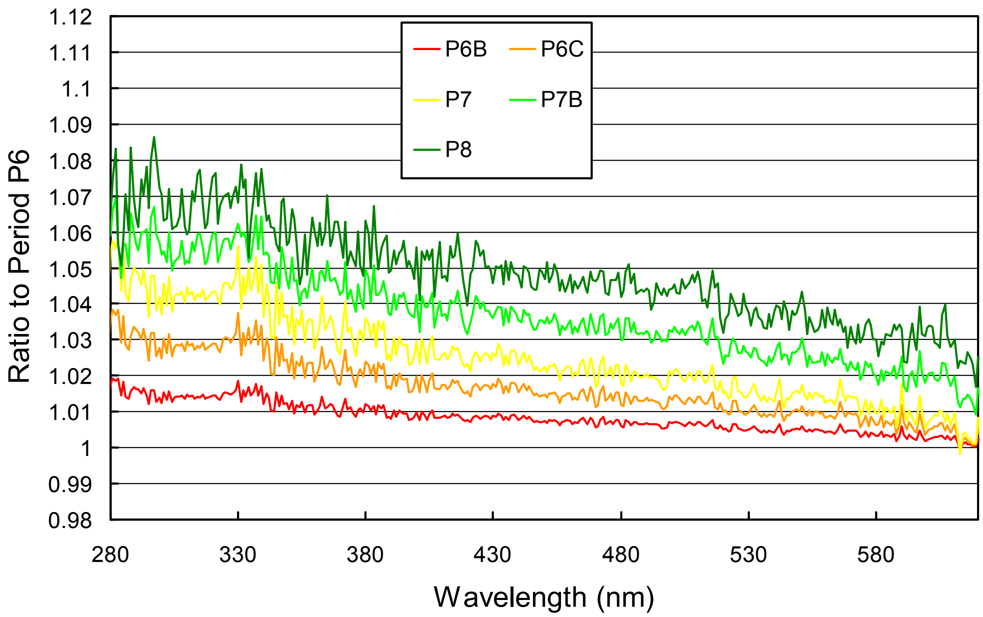

Figure 5.1.4 *Ratios of irradiance assigned to the internal reference lamp during periods P6B – P8, relative to Period P6.*

5.1.3. Wavelength Calibration

Wavelength stability of the system was monitored with the internal mercury lamp. Information from the daily wavelength scans was used to homogenize the data set by correcting day-to-day fluctuations in the wavelength offset. The wavelength-dependent bias of this homogenized dataset and the correct wavelength scale was determined with the Version 2 Fraunhofer-line correlation method (Bernhard et al., 2004). Figure 5.1.5 shows the correction functions calculated with this algorithm. One function was applied to solar data collected before the February 2011 site visit. The second function was applied to data collected after the visit. Figure 5.1.6 indicates the wavelength accuracy of final Version 0 data for six wavelengths in the UV and visible by running the Version 2 Fraunhofer-line correlation method a second time. Shifts are typically smaller than ±0.1 nm. The wavelength uncertainty was further improved as part of the Version 2 correction algorithms. Figure 5.1.7 shows the wavelength accuracy of final Version 2 data. Shifts are typically smaller than ±0.05. The standard deviation averaged over all wavelengths is 0.023 nm.

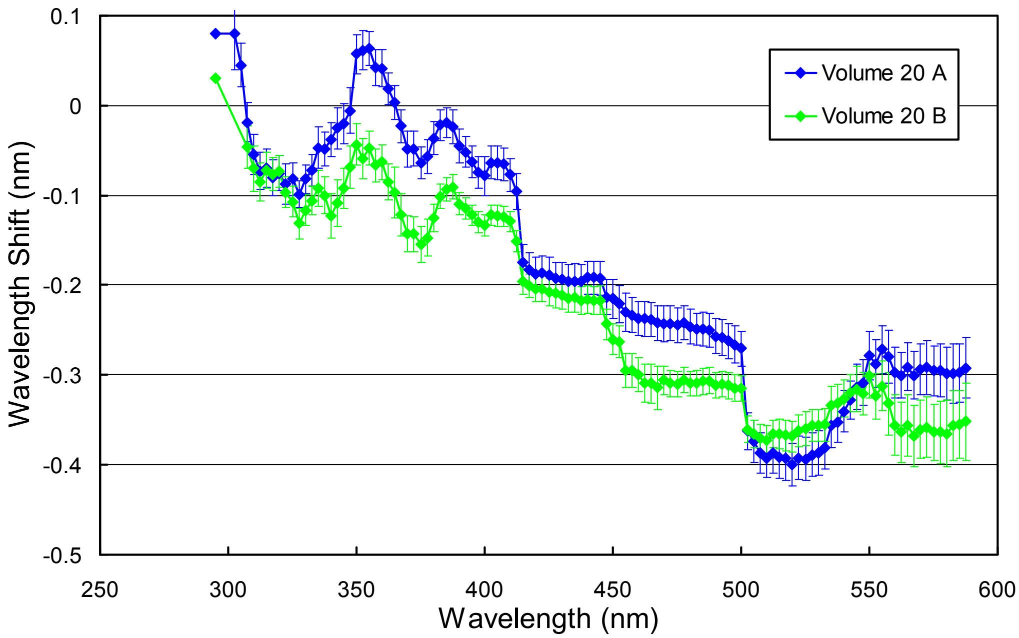

Figure 5.1.5. *Monochromator non-linearity correction functions. Error bars indicate the 1σ-variation. Period A (Period B) was applied to solar data recorded before (after) the February 2011 site visit. Instrument maintenance during this visit changed the correction function slightly.*

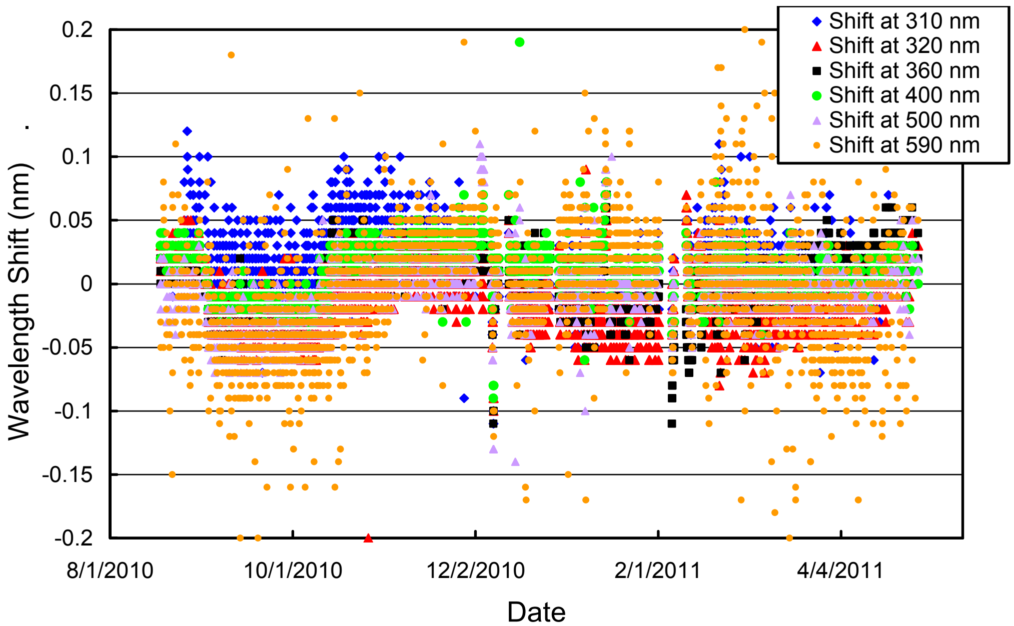

Figure 5.1.6. *Check of the wavelength accuracy of final* <u>*Version 0*</u> *data at six wavelengths by means of Fraunhofer-line correlation. The plot is based on data measured at the top of the hour.*

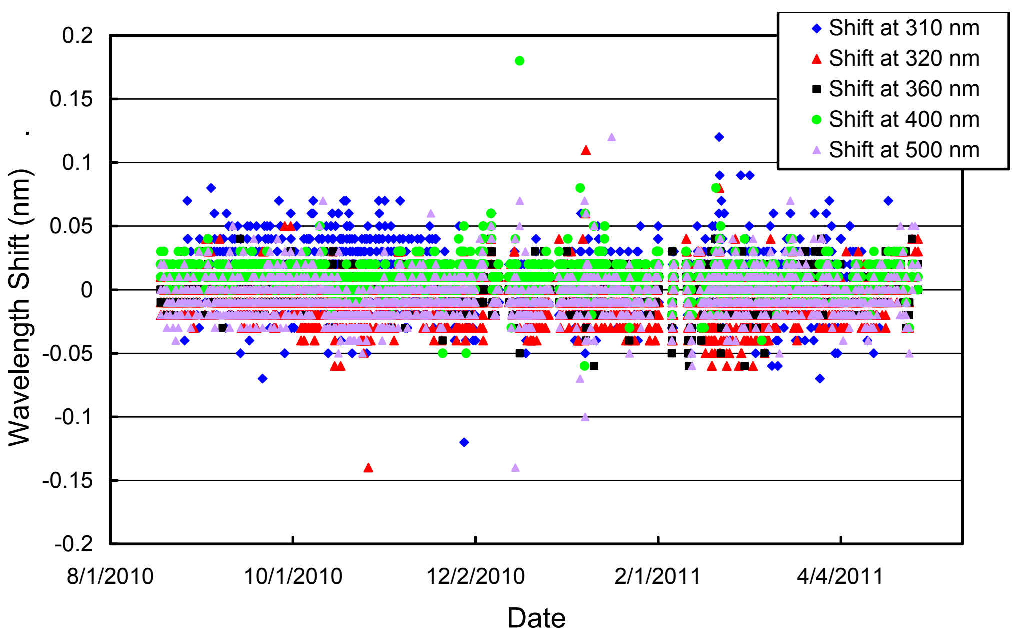

Figure 5.1.2. *Check of the wavelength accuracy of final* <u>*Version 2*</u> *data by means of Fraunhofer-line correlation. The plot is based on data measured at the top of the hour.*

References

Bernhard, G., C. R. Booth, and J. C. Ehramjian. (2004). Version 2 data of the National Science Foundation's Ultraviolet Radiation Monitoring Network: South Pole, *J. Geophys. Res., 109,* D21207, doi:10.1029/2004JD004937.

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