5.2. Palmer Station (3/1/09 – 9/30/10)

This sections describes quality control of solar data recorded at Palmer Station between 3/1/09 and 9/30/10. There were no site visit in 2009 and 2010 and no comparisons with traveling standards. The system performed normal during the reporting period with the exception of the lamp power supply, which failed on 8/21/09. It was replaced with a spare supply on 8/26/09. Response scans could not be executed during this period. The Volume 19 period resulted in a total of 26663 solar scans.

5.2.1. Irradiance Calibration

The site irradiance standards for 2009-2010 were the lamps 200W007, M-765, and M-700. Lamp M-765 was (re-)calibrated by comparison with lamp 200W017 using absolutes scans performed on 4/14/06 ("closing scans" Volume 15) and 4/28/06 ("opening scans" Volume 16). Lamps M-700 and 200W007 were (re-)calibrated against the traveling standards 200W017 and 200W038 using absolute scans performed on 5/10/08 ("closing scans" of the Volume 17 period).

The three site standards were also compared with each other on 7/3/09, 9/26/09, 12/22/09, 3/26/10, 6/30/10, and 9/24/09. Measurements agreed to within ±1.5% on all occasions. The good agreement gives confidence that the calibration of solar data collected in 2009 and 2010 is accurate even though no comparison with traveling standards was performed. Figure 5.2.1 shows an example of the comparison performed on 9/26/09.

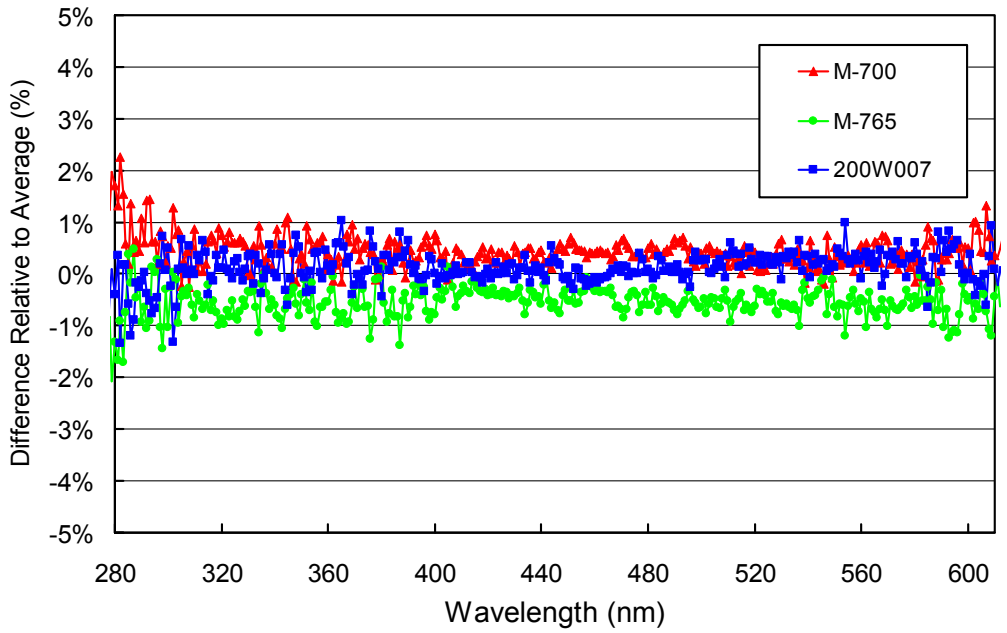

Figure 5.2.1. *Comparison of lamps M-700, M-765, and 200W007 on 9/26/2009.*

5.2.2. Instrument Stability

The stability of the spectroradiometer over time was assessed by comparison with data of the collocated GUV-511 radiometer and model calculations that are part of "Version 2" data processing. Figure 5.2.2 shows the ratio of GUV-511 (340 nm channel) and final SUV-100 measurements, which were weighted with the spectral response function of this channel. The ratio is normalized and should ideally be one. The graph indicates that GUV and SUV measurements are consistent to within ±3.3% (±1σ). Periods with somewhat larger differences, which can be caused by show contamination of the SUV collector, are listed in Table 5.2.2. The ratio of the two data sets shows no significant trend.

Seven calibrations were applied (P1 – P7) to data of the reporting period. Times when the calibration changed are indicated by vertical lines in Figure 5.2.2. More information on these calibrations is provided in Table 5.2.1. Figure 5.2.3 shows ratios of the calibration functions applied during Periods P2 – P7, relative to the function of Period P1. Changes in calibration functions are typically smaller than 2%, except between Periods P3 and P4, when an abrupt change of 8-10% was observed. The reason of the change is unclear, but there is no effect on solar data as the calibration was adjusted appropriately.

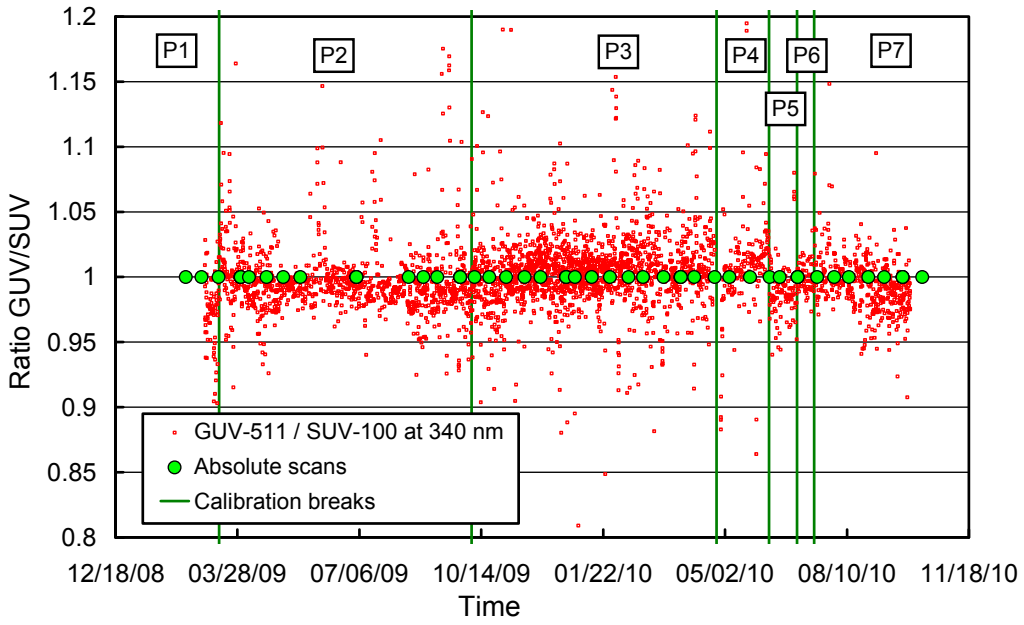

Figure 5.2.2. *Ratio of GUV-511 measurements of its 340 nm channel with final SUV-100 measurements that were weighted with the spectral response function of this channel.*

Table 5.2.1. Calibration periods for Palmer Volume 19 data.

Period name	Period range	Number of absolute scans
P1	03/01/09 – 03/12/09	1
P2	03/13/09 – 10/05/09	11
P3	10/06/09 – 04/24/10	16
P4	04/25/10 – 06/06/10	2
P5	06/07/10 – 06/29/10	3
P6	06/30/10 – 07/13/10	2
P7	07/14/10 – 09/30/10	16

Table 5.2.2. Periods when the ratio of GUV/SUV is either large or small.

Time	Direction
03/21/09	large
09/17/09 - 09/18/09	large
09/25/09	small
10/22/09 12:00	large
11/0709 09:15-12:00	large
12/12/09 21:00 - 12/12/09 00:00	large
02/01/10	large
02/03/10	small
03/04/10	small

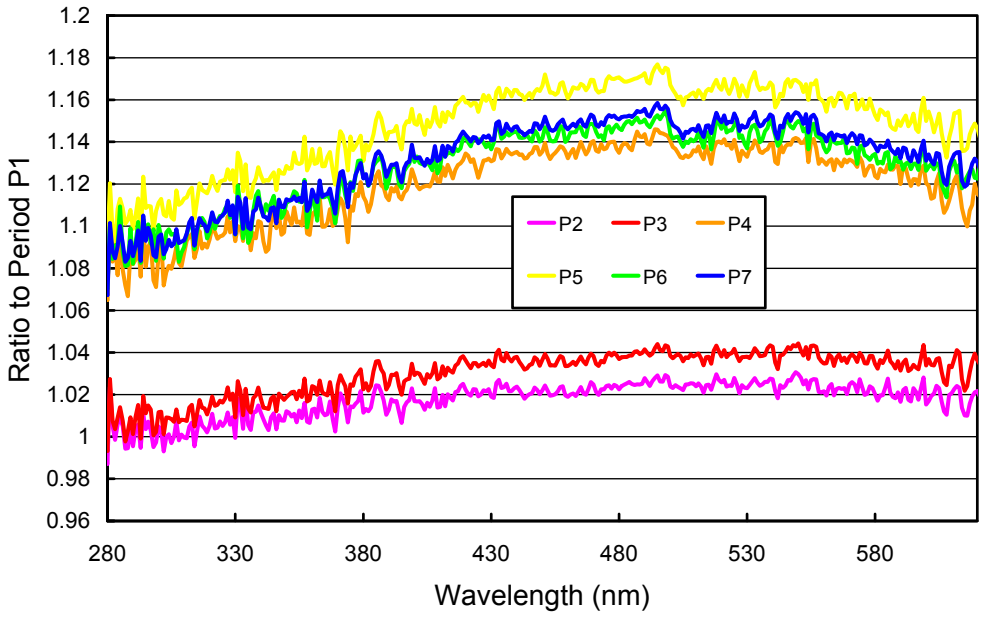

Figure 5.2.3. *Ratios of spectral irradiance assigned to the internal reference lamp for periods P2 – P7, relative to Period P1.*

5.2.3. 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 5.2.4 shows the correction function calculated with this algorithm. Figure 5.2.5 indicates the wavelength accuracy of final Version 0 data for five 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 average standard deviation for the wavelength range 305-400 nm is 0.021 nm). A few outliers occur at short wavelengths and small solar elevations when the correlation is affected by signal noise.

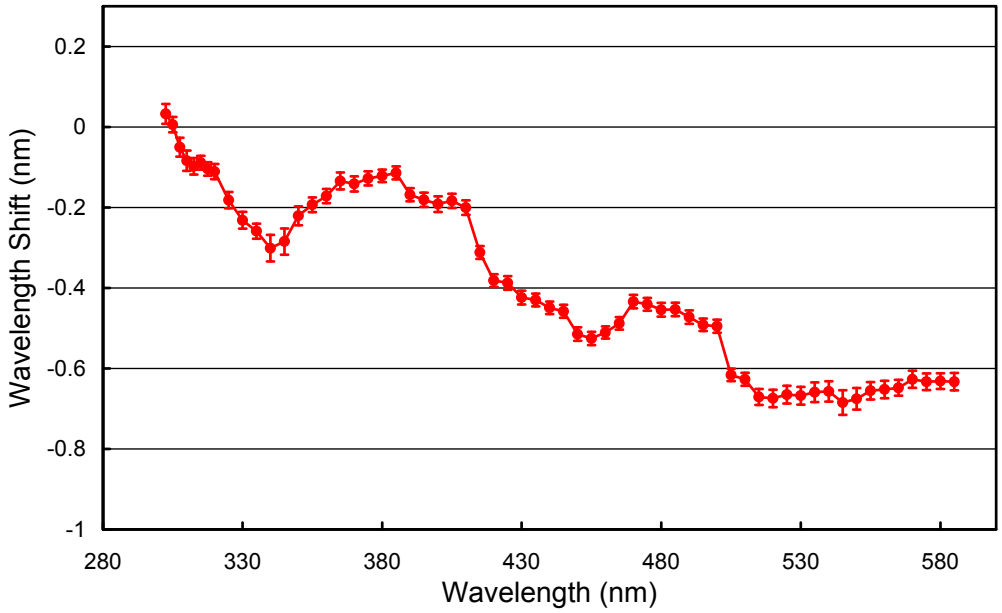

Figure 5.2.4. *Monochromator mapping function.*

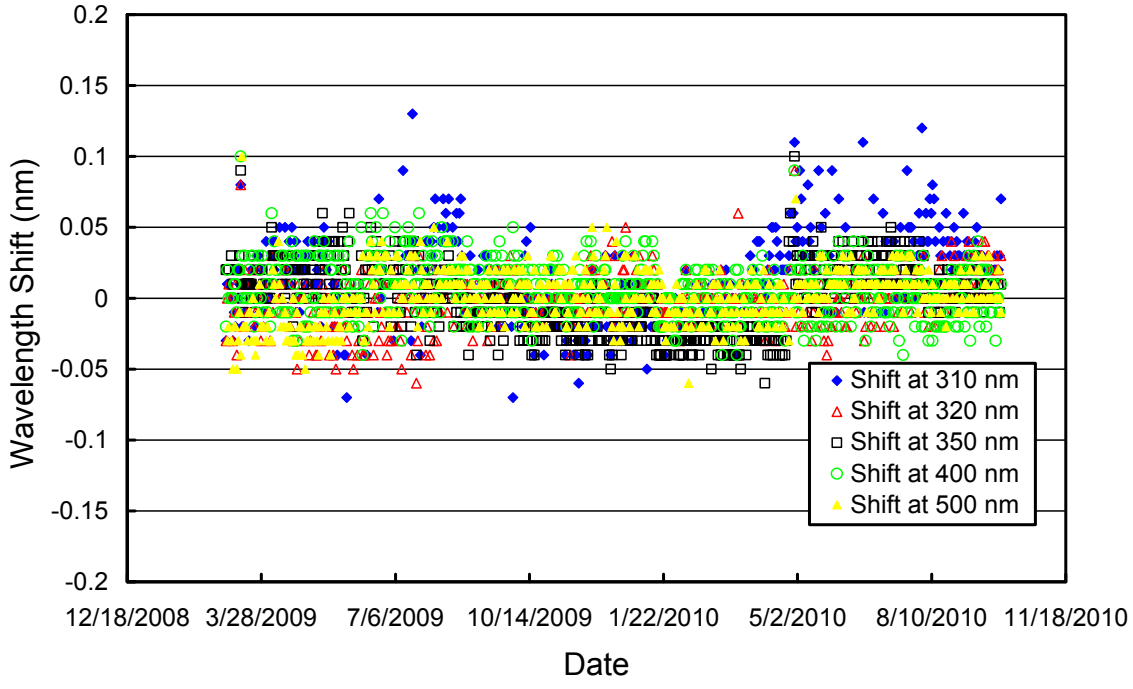

Figure 5.2.5. *Wavelength accuracy check of the final data at five wavelengths by means of Fraunhofer-line correlation. Noontime measurements from every day of the year have been evaluated.*