2. Palmer Station (10/31/10 – 12/31/11)

This sections describes quality control of solar data recorded at Palmer Station between 10/31/10 and 12/31/11. The system was inspected and serviced in March 2011. At this time, on-site standards of spectral irradiance were compared with traveling standards. The system performed normal during the reporting period and was very stable. The period resulted in a total of 26024 solar scans.

2.1. Irradiance Calibration

The site irradiance standards for the reporting period were the lamps 200W007, M-765, and M-700. 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). Lamp M-765 was rotated in its holder sometime between 6/6/11 and 7/4/11. Absolute scans of the three lamps performed before 6/6/11 agreed to within ±1% with each other, while scans of lamp M-765 performed after June 2011 were systematically different by 3% relative to results of the other two lamps. Lamp M-765 was recalibrated using measurements of the other two site standards on 12/17/11, and the new calibration was used for the processing of solar data measured after July 2011.

The three site standard were compared with the traveling standard 200W017 on 3/28/11 (Figure 1). At this time, the calibrations of the three site standards agreed to within ±0.5% with each other but there is a 1-2% bias relative to the measurements of the traveling standard. This discrepancy is still within the combined uncertainty of lamp calibrations and a recalibration of the site standards was therefore not attempted.

To confirm the irradiance scale of solar measurements of the SUV-100 spectroradiometer of the reporting period, the GUV-511 radiometer that is collocated with the SUV was vicariously calibrated against SUV measurements. The calibration factors that were calculated with this method were compared with similar calibration factors established during previous seasons. The analysis showed that calibration factors of the years 2006 - 2011 are in agreement at the ±1% level. This result confirmed the excellent consistency of SUV calibrations.

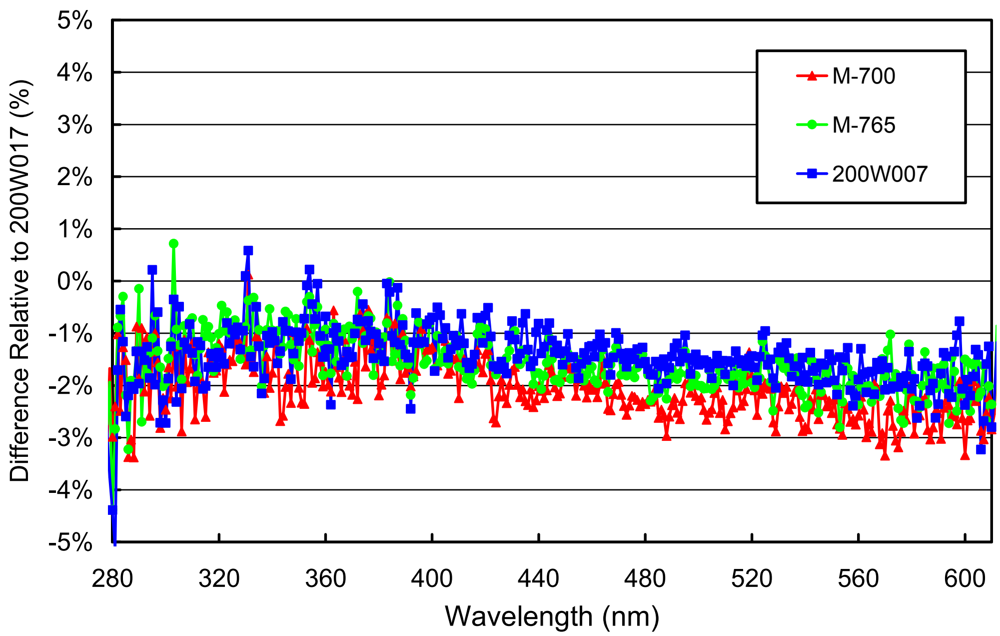

Figure 1. *Comparison of lamps M-700, M-765, and 200W007 with traveling standard 200W017 on 3/28/11.*

2.2. Instrument Stability

The stability of the spectroradiometer during the reporting period was assessed by comparison with data of the collocated GUV-511 radiometer and model calculations that are part of "Version 2" data processing. Figure 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 ±3.9% (±1σ).

Three calibrations were applied (P1 – P3) to data of the reporting period. Period P1 is the period before the March 2011 site visit. Period P2 is a three-day period following the site visit (It has been observed previously, that the SUV-100 tends to need a few days after instrument service visit to regain full stability). Period P3 encompasses the rest of the reporting period. Figure 3 shows ratios of the calibration functions applied during Periods P2 and P3, relative to the function of Period P1. The relative large change (8% in the UV-B) of the calibration function between Periods P1 and P2 is caused by the service performed during the site visit.

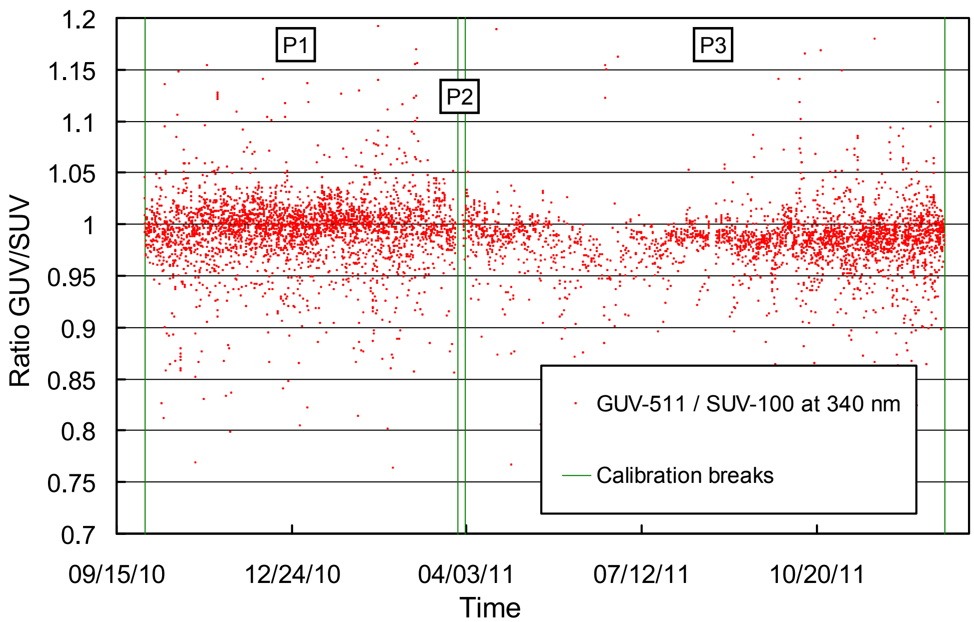

Figure 2. *Ratio of GUV-511 measurements of its 340 nm channel with final SUV-100 measurements that were weighted with the spectral response function of this channel.*

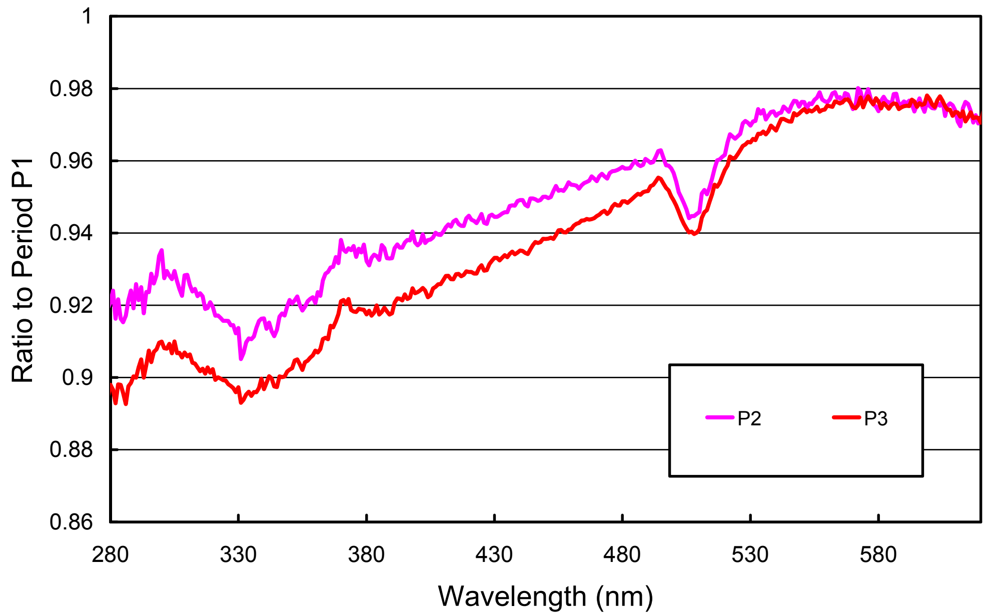

Figure 3. *Ratios of spectral irradiance assigned to the internal reference lamp for periods P2 and P3, relative to Period P1.*

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 4 shows the correction function calculated with this algorithm. Figure 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 0.023 nm). A few outliers occur at short wavelengths and small solar elevations when the correlation is affected by signal noise. The wavelength accuracy was further improved as part of the production of Version 2 data. For example, the small step changes at 2/13/11 and 4/1/11 have been removed.

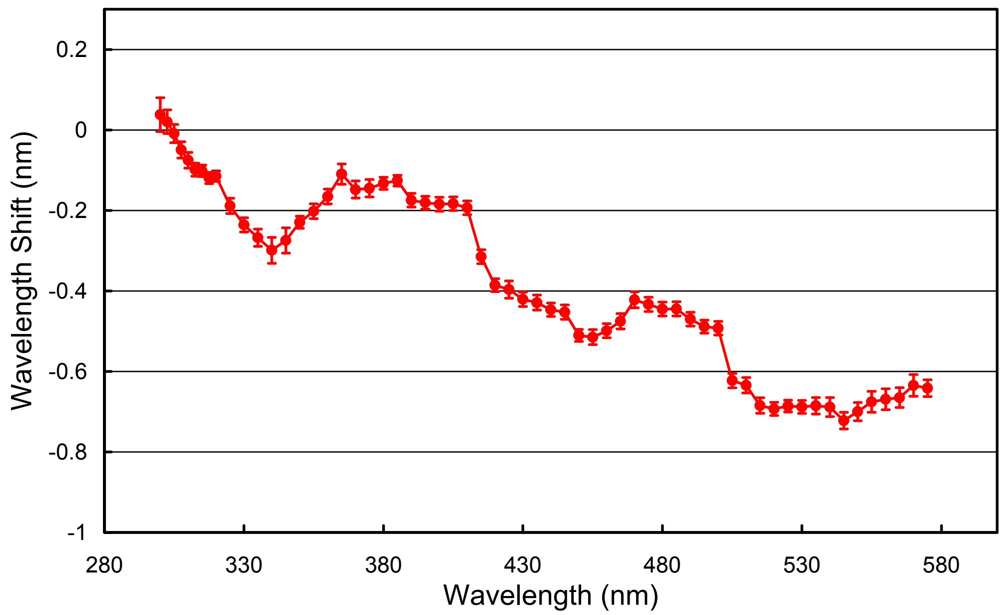

Figure 4. *Monochromator mapping function.*

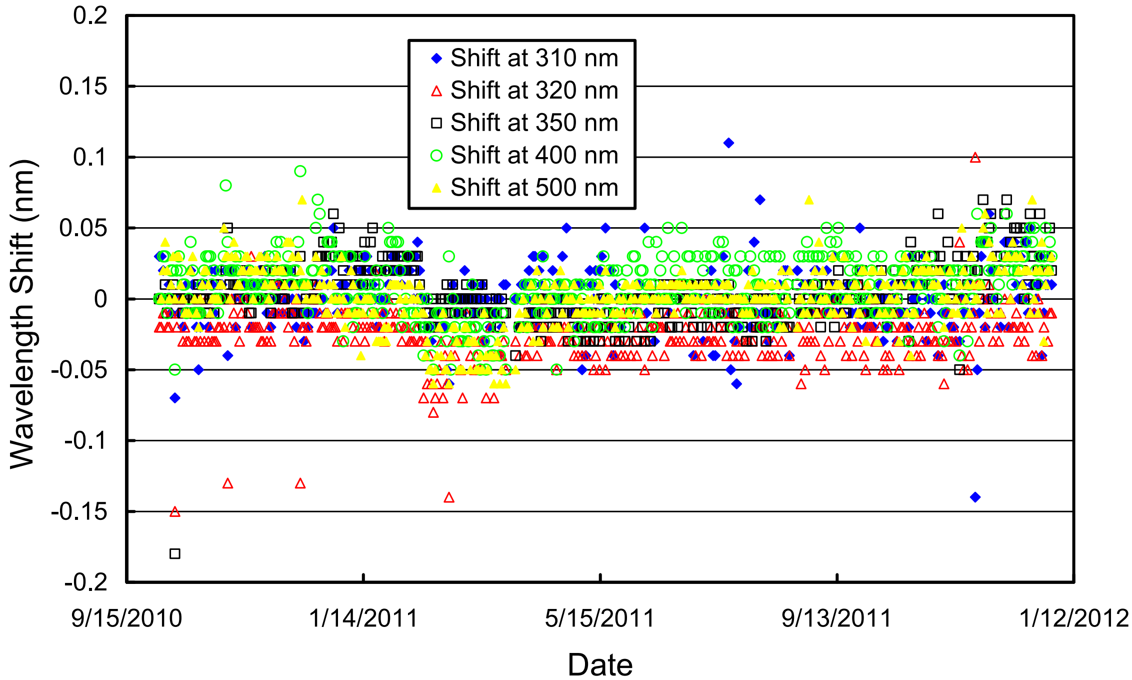

Figure 5. *Wavelength accuracy check of the final data at five wavelengths by means of Fraunhofer-line correlation. Noontime measurements from every day of the year have been evaluated.*