

## Periods with Increased Uncertainty

### Measurements

Version 2 Barrow measurements of several periods are affected by instrumental or operational problems and have larger (but usually difficult to quantify) uncertainties than those specified in the uncertainty budget of the main paper. Descriptions of some problems were adapted from Network Operations Reports and are indicated in the list below with the prefix “Operations Report.” Other problems were discovered during quality control of processed Version 2 data.

- **Volume 2 (1991):**
  - Operations Report: Data of the period 2/22/91 – 3/5/91 have increased uncertainty due to a failure of the instrument’s shutter and the inability to run response scans during daylight hours (1991-1992 Operations Report, page 111).
  - Operations Report: Data of the periods 3/6/91 – 4/17/91 have increased uncertainty due to a failure and eventual replacement of the internal 45-W lamp (1991-1992 Operations Report, page 112).
  - Operations Report: Differences between consecutive calibration files were as high as 4% in May and June 1991 (1991-1993 Operations Report, page 160).
  - Version 2 quality control: comparison of measurement and model: Measurements performed between summer and autumn of 1991 (June – September) are low by 5-15% compared to data other volumes. In particular the period 6/20/91 – 7/1/91 is affected. **Data of this period should not be used for trend analysis.**
- **Volume 3 (1992):**
  - Operations Report: The collector was not cleaned on a regular basis in 1992. In particular data collected during the second half of the year (mid-June – December) are affected. Systematic errors in the UV may be as high as 4% (1991-1993 Operations Report, pages 162-163).
- **Volume 4 (1993):**
  - Operations Report: The collector was not cleaned on a regular basis in 1993, in particular during the first half of the year (Feb – mid-June). Collector contamination may have reduced irradiance by as much as 7% at 300 nm, 4% at 350 nm, and 2% in the visible (1993-1994 Operations Report, page 121).
  - Version 2 quality control: comparison measurement and model: Data from March 1993 were high by 5-7% on average and suffered from a comparatively large uncorrected azimuth error. **Data from March 1993 should not be used for trend analysis.**
- **Volumes 2 – 4 (Start – 11/15/93):**

The cosine diffuser installed until 11/15/93 was partly transparent in the visible. The diffuser had a substantial, wavelength-dependent cosine error for wavelengths longer than 500 nm, which could not be corrected. Due to this problem, also the effect of the monochromator’s Wood’s anomaly at 505 nm was not corrected. **Data with wavelengths above 490 nm should not be used for any purpose.**

- **Volume 5A (1/27/94 – 6/9/94):**
  - Site visit report and Version 2 quality control: A different monochromator was installed during this period. The system's cosine-error with this monochromator in place was difficult to determine due to an insufficient number of clear sky spectra. Data analysis indicated that the cosine error of this period was significantly different from that of Volumes 5B – 9.
  - Version 2 quality control: Final Volume 5A spectra are consistent to within  $\pm 3\%$  with spectra of other volumes. However, there is a 3.5% step between 493 and 495 nm in Volume 5A spectra relative to spectra of other volumes. This step is partly an artifact of the insufficiently accurate correction of the monochromator's Wood's anomaly around 500 nm.
  - Version 2 quality control: Data measured between 2/15/94 and 2/26/94 appear to be too high in the visible and have some unexplained wavelength dependence. **Data of this period should not be used.**
  - Operations Report and site visit report: During the Volume 5A period, the instrument also suffered from excessive heat because hot air produced by the system's thermo-electric cooler (TECA) was not released from the room where the instrument is located. The efficiency of the cooler was therefore reduced, leading to high temperatures in the instrument enclosure. High temperature and its variability also affected response scans. Six calibrations were applied between 2/2/94 and 6/10/94 with 2-3% changes between individual calibrations.
  - Operations and site visit reports: Absolute scans showed relatively large drifts. The effect on solar data should be small because the instrument's calibration was adjusted accordingly.
  - Operations Report: The monochromator was re-positioned on 2/1/94. This should not affect solar data because the calibration was adjusted.
- **Volume 7 (1997-1998):**

Operations Report: Periods with increased uncertainty of Volume 7 include:  
5/18/98 – 6/5/98 (monochromator temperature high by 6°).  
6/23/98 – 7/18/98 (photomultiplier cooler defective).
- **Volume 9 (2000):**
  - Operations Report: Large drifts in responsivity were caused by changes in monochromator bandpath and by the accumulation of residue on the relay lens. The additional  $1\sigma$ -uncertainty of solar data remained below 2% due to frequent adjustment of calibration files (1999-2000 Operations Report, table 5.6.1).
  - Version 2 quality control: Measurements between 5/15/00 and 5/17/00 9:15 look suspicious. Spectra were calibrated with an interpolated calibration file.
- **Volume 10 (2001; first season with upgraded cosine collector):**

Operations Report: Large changes in responsivity were caused by abraded paint from the instrument's shutter. Due to frequent adjustment of calibration files, the drift-related uncertainty typically remained below 1.5% in the UV-B, but was as high as 2.9% during one period (2000-2001 Operations Report, table 5.6.1).

- **Volume 14 (2004/2005):**

Operations Report: The temperature inside the instrument enclosure frequently exceeded the set value of 28.5 °C by more than 5 °C. Likewise, the temperature of the monochromator was often more than 5 °C above the set point. (In normal operation, the temperature of the monochromator is stable to within ±0.5 °C). Excess temperature was caused by insufficient air-conditioning in the laboratory below the instrument.

Comparisons of SUV-100 measurements with the collocated GUV-511 multichannel radiometer indicated that SUV-100 measurements at 340 nm were low by up to 20% during periods with excess temperature. When the monochromator temperature was stable at 33±0.5 °C, GUV-511 and SUV-100 measurements typically agreed to within ±5%. When the temperature rose to 39.8 °C on 7/25/05, GUV-511 readings were 15% higher than SUV-100 measurements. **Affected data are indicated in Table 1. Associated Version 2 data were flagged and should not be used.**

**Table 1. Periods affected by systematic errors in SUV-100 data in 2004 and 2005.**

Period	Systematic error at 340 nm	Reason
05/17/04 13:00 - 05/20/04 16:00	SUV low by up to 14%.	High temperature
06/20/04 19:45 - 06/21/04 00:45	SUV low by up to 14%	High temperature
06/26/04 12:00 - 06/26/04 19:00	SUV low by up to 20%.	Unknown
06/28/04 03:30 - 06/28/04 12:30	SUV low by up to 9%	High temperature
07/04/04 23:30 - 07/05/04 09:00	SUV low by up to 9%.	High temperature
07/07/04 05:00 - 07/07/04 14:30	SUV low by up to 11%.	Unknown
07/24/04 23:15 - 07/25/04 23:45	SUV low by up to 15%.	High temperature
08/13/04 11:45 - 08/19/04 00:00	SUV low by up to 15%.	High temperature
04/29/05 20:00 - 04/30/05 09:00	SUV low by up to 16%.	High temperature

### Model Calculations

Model calculations of some periods were problematic due to an insufficient number of clear-sky days, which are required for calculating surface albedo. The following periods are affected:

- **Volume 2 (1991):**  
Model albedo problematic between 10/6/91 and 10/20/91.
- **Volume 5B (1994):**  
Model albedo likely too small between 9/28/94 and 10/15/94.
- **Volume 11 (2002):**  
Model albedo likely too small in January and March 2002.