Description of Version 2 Data Format NSF UV Monitoring Network: Flags

Filename: SITE_vX.2_flags.csv

where SITE is MCM for McMurdo Station, Antarctica
PAL for Palmer Station, Antarctica
SPO for South Pole, Antarctica
USH for Ushuaia, Argentina
SAN for San Diego, California
BAR for Barrow, Alaska
SUM for Summit, Greenland
X is volume identifier (1, 2, 3, …)
.2 is identifier for Version 2

Several quality indicators ("flags") are calculated for every spectrum, allowing to quantify distortions in measured spectra. The flagging procedure is similar to that implemented in the European UV Database, available at www.muk.uni-hannover.de/~seckmeyer/EDUCE/database.html

Column Assignment

Label	Description	Unit	Remark
Filename	Filename of spectral scan		1
Time	Time in UT at start of scan	mm/dd/yy hh:mm:ss	
SZA	Solar zenith angle at start of scan	degree	2
Flags	Problem identifier (manual entry)		
Sky condition	"CS", if spectrum was measured during clear skies		
Ratio Meas/Mod at 340 nm	Ratio of measurement and model at 340 nm		
Criterion start irradiance 1	Criterion for determining minimum useable wavelength *before* normalization of spectrum		3
Start wavelength 1	Minimum useable wavelength *before* normalization of spectrum	nm	3
Irradiance at start wavelength 1	Irradiance at minimum useable wavelength *before* normalization of spectrum	μW/(cm² nm)	3
Criterion start irradiance 2	Criterion for determining minimum useable wavelength *after* normalization of spectrum		3
Start wavelength 2	Minimum useable wavelength *after* normalization of spectrum	nm	3
Irradiance at start wavelength 2	Irradiance at minimum useable wavelength *after* normalization of spectrum	μW/(cm² nm)	3
Max-min-ratio Ca-lines	Quantification of the wavelength dependence of the ratio measurement/model in the vicinity of the strong absorption features in the Sun's spectrum between 391 and 398 nm, known as the Calcium Fraunhofer lines		4
Spikes < 315 nm	Quantification of the difference of the ratio measurement/model at two neighboring wavelengths for wavelengths below 315 nm		5
Spikes 315-340 nm	Quantification of the difference of the ratio measurement/model at two neighboring wavelengths in the interval 315-340 nm		5

Spikes 340-400 nm	Quantification of the difference of the ratio measurement/model at two neighboring wavelengths in the interval 340-400 nm		5
Spikes 400-600 nm	Quantification of the difference of the ratio measurement/model at two neighboring wavelengths in the interval 400-600 nm		5
shiftwww	Wavelength shift at wavelength www, as determined with Fraunhofer line correlation algorithm	nm	6

Remarks

1 - Filename convention of spectral scans:
sCyyhhmm.jjj

where
s = Site identifier (A=McMurdo; B=Palmer; C=South Pole; D=Ushuaia; E=San Diego; F=Barrow; J=Summit)
C = Always C
yy = Year
hh = Hour (UT)
mm = Minute
jjj = Day of Year

2 - Solar zenith is the true solar zenith angle, i.e. the angle between the zenith and the Sun if the Earth had no atmosphere. Due to refraction of the Earth's atmosphere, the Sun appears to an observer, who is standing at the surface of the Earth, at a smaller angle.

3 - Below a certain wavelength, measurements are affected by noise and should not be used. To determine this wavelength λ_n, the following procedure was implemented:

- Criterion 1: When model values are available (i.e., when solar zenith angle is smaller than 92°), the start irradiance λ_n is the shortest irradiance where five consecutive ratios of two subsequent spectral measurements are within 25% of the associated modeled ratios:

$$|\{[m(\lambda_i)/c(\lambda_i)]/[m(\lambda_{i+1})/c(\lambda_{i+1})]\}-1|<0.25 \quad \text{for } i=n, \quad n+1,...., \quad n+4$$

where $m(\lambda_i)$ is measured spectral irradiance at wavelength λ_i and $c(\lambda_i)$ is modeled spectral irradiance at wavelength λ_i.

- Criterion 2: When no model values are available (i.e., at very high solar zenith angles), the start irradiance λ_n is the shortest irradiance where the following criterion is met:

$$m(\lambda_{i+2})>m(\lambda_i) \quad \text{for } i=n, \quad n+1,...., \quad n+6$$

- Criterion 3: When neither Criterion 1 or 2 can be met, the start irradiance λ_n is the shortest irradiance where the following criteria are met:

$m(\lambda_n) > 0.2\mu\text{W}/(\text{cm}^2\text{nm})$ and $\lambda_n > 305\text{nm}$

- Criterion 4: When neither Criterion 1, 2, or 3 can be met, the start irradiance λ_n is the largest irradiance of the spectrum (This criterion implies that the spectrum cannot be used at all).

- Criterion 5: The criteria above can be manually overwritten. In this case, the start irradiance λ_n is the shortest irradiance where the following criteria are met:

  $m(\lambda_n) > E_{\min}$ and $\lambda_n > \lambda_{\min}$,
  where $E_{\min}$ and $\lambda_{\min}$ are manually set.

Normalization of measured spectral irradiance to a bandwidth of 1.0 nm FWHM tends to smooth noise. The minimum useable wavelength determined from normalized spectra is therefore slightly different from that of the original spectrum. The data file provides λ_n wavelengths calculated from both the original and normalized spectrum.

4 - The parameter "Max-min-ratio Ca-lines" , R_{CA}, is calculated as follows:

$$min_{393} = \min(m(\lambda)/c(\lambda)) \quad \text{for } 391\text{nm} < \lambda < 395\text{nm}$$
$$max_{393} = \max(m(\lambda)/c(\lambda)) \quad \text{for } 391\text{nm} < \lambda < 395\text{nm}$$
$$min_{397} = \min(m(\lambda)/c(\lambda)) \quad \text{for } 395.5\text{nm} < \lambda < 398\text{nm}$$
$$max_{397} = \max(m(\lambda)/c(\lambda)) \quad \text{for } 395.5\text{nm} < \lambda < 398\text{nm}$$

where $m(\lambda)$ is measured spectral irradiance at wavelength λ and $c(\lambda)$ is modeled spectral irradiance at wavelength λ.

$$maxmin_{393} = max_{393} / min_{393}$$
$$maxmin_{397} = max_{397} / min_{397}$$

$$R_{\text{CA}} = \max(maxmin_{393}, maxmin_{397})$$

This parameter is an indicator for wavelength shifts in the vicinity of the Sun's Calcium Fraunhofer lines.

5 - Values in the "spike"-fields of the data file quantify the maximum difference $S_{\max}$ of the measurement/model ratio of two consecutive wavelengths:

$$S_{\lambda_i} = |\{[m(\lambda_i)/c(\lambda_i)]/[m(\lambda_{i-1})/c(\lambda_{i-1})]\} - 1|$$
$$S_{\max} = \max(S_{\lambda_i}) \text{ for } \lambda_i \in I$$

Spike-values are calculated separately for the wavelength intervals I: $[\lambda_m, 315\text{nm}]$, $[315\text{nm}, 340\text{nm}]$, $[340\text{nm}, 400\text{nm}]$, $[400\text{nm}, 600\text{nm}]$. Here λ_m is the shortest wavelength for which the following criterion can be fulfilled:
$m(\lambda_n) > 0.1\mu\text{W}/(\text{cm}^2\text{nm})$

6 - Wavelength shifts in measured spectra were determined by correlating the Sun's Fraunhofer lines in measured spectra with the same structure in a reference spectrum. The method is described in the technical appendix to the paper introducing Version 2 data: G. Bernhard, 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. The paper is available at: http://www.biospherical.com/nsf/Version2/JGRpaper.asp.