Description of Version 2 Data Format NSF UV Monitoring Network: Integrals and dose-rates, including Vitamin D weighted dose-rates

Filename: SITE_vX.2_DB3_TYPE_new2.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
DB3 is identifier of data type
TYPE is "meas", if contents are based on measurements
"clear", if contents were modeled assuming clear sky
"cloud", if contents were modeled taking cloud attenuation into account

This data product was already part of Volume 0, and is known as "Database 3" (hence the identifier "DB3"). The format of the Version 2 style Database 3 is similar to the original version but provides better time resolution.

Files with the suffix _meas.csv are cosine corrected measurements.

Files with the suffix _clear.csv are based on calculations with the radiative transfer model UVSPEC/libRadtran, assuming clear sky. Parameters used for modeling can be found in associated files with the suffix _model_log.csv.

Files with the suffix _cloud.csv were modeled taking cloud attenuation into account. For these calculations, cloud optical depth was estimated by comparing measured values at 450 nm with the associated clear-sky model value. The derived cloud optical depth was then used as additional input parameter in the model. No cloud-model value are given for wavelengths below 340 nm since total ozone was set to a constant value of 300 DU in the cloud-model. Also note that cloud-model data do not take the sphericity of the Earth into account. Model spectra for solar zenith angles larger than 75° therefore underestimate the true spectrum significantly.

See next page for column assignment.

Column Assignment

Label	Description	Unit	Remark
Filename	Filename of spectral scan		1
Site	1=McMurdo; 2=Palmer; 3=South Pole; 4=Ushuaia; 5=San Diego; 6=Barrow; 7=Summit		
Volume	Volume label; ".2" indicates Version 2		
Dataset	Either "Measurement", "Clear_sky_model", or "Cloud_model"		2
Time start scan	Time in UT at start of scan	Days since 1-Jan-1900	3
Time at 310 nm	Time in UT when SUV scanned at 310 nm	mm/dd/yy hh:mm:ss	
Time at 360 nm	Time in UT when SUV scanned at 360 nm	mm/dd/yy hh:mm:ss	
Time at 500 nm	Time in UT when SUV scanned at 500 nm	mm/dd/yy hh:mm:ss	
SZA at 310 nm	Solar zenith angle when SUV scanned at 310 nm	degree	4
Azimuth at 310 nm	Solar azimuth angle when SUV scanned at 310 nm	degree	5
Flags	Problem identifier (manual entry)		
Sky condition	"CS", if spectrum was measured during clear skies		
Shift at 310 nm	Calculated wavelength error (shift) at 310 nm	nm	6
Minimum useable wavelength 1	Minimum useable wavelength before normalization and regridding of spectrum	nm	7
Minimum useable wavelength 2	Minimum useable wavelength after normalization and regridding of spectrum	nm	
E290-315	Integral of spectral irradiance between 290 and 315 nm	µW/cm²	8
E290-320	Integral of spectral irradiance between 290 and 320 nm	µW/cm²	8
E320-340	Integral of spectral irradiance between 320 and 340 nm	µW/cm²	8
E340-400	Integral of spectral irradiance between 340 and 400 nm	µW/cm²	8
E315-400	Integral of spectral irradiance between 315 and 400 nm	µW/cm²	8
E320-400	Integral of spectral irradiance between 320 and 400 nm	µW/cm²	8
E315-360	Integral of spectral irradiance between 315 and 360 nm	µW/cm²	8
E320-360	Integral of spectral irradiance between 320 and 360 nm	µW/cm²	8
E340-360	Integral of spectral irradiance between 340 and 360 nm	µW/cm²	8
E360-400	Integral of spectral irradiance between 360 and 400 nm	µW/cm²	8
E400-600	Integral of spectral irradiance between 400 and 600 nm	µW/cm²	8
E289.855-294.118	Integral of spectral irradiance between 289.855 and 294.118 nm	µW/cm²	8
E294.118-298.507	Integral of spectral irradiance between 294.118 and 298.507 nm	µW/cm²	8
E298.507-303.03	Integral of spectral irradiance between 298.507 and 303.03 nm	µW/cm²	8
E303.03-307.692	Integral of spectral irradiance between 303.03 and 307.692 nm	µW/cm²	8
E307.692-312.5	Integral of spectral irradiance between 307.692 and 312.5 nm	µW/cm²	8
E312.5-317.5	Integral of spectral irradiance between 312.5 and 317.5 nm	µW/cm²	8
E317.5-322.5	Integral of spectral irradiance between 317.5 and 322.5 nm	µW/cm²	8
E322.5-327.5	Integral of spectral irradiance between 322.5 and 327.5 nm	µW/cm²	8

E327.5-332.5	Integral of spectral irradiance between 327.5 and 332.5 nm	µW/cm²	8
E332.5-337.5	Integral of spectral irradiance between 332.5 and 337.5 nm	µW/cm²	8
E337.5-342.5	Integral of spectral irradiance between 337.5 and 342.5 nm	µW/cm²	8
E342.5-347.5	Integral of spectral irradiance between 342.5 and 347.5 nm	µW/cm²	8
Dose1	Spectral irradiance weighted with erythema action spectrum by *Komhyr and Machta*, 1973	µW/cm²	8, 9
Dose2	Spectral irradiance weighted with erythema action spectrum by *Diffey*, 1987	µW/cm²	8, 9
CIE	Spectral irradiance weighted with CIE erythema action spectrum (This is the most widely used erythema action spectrum)	µW/cm²	8, 9
UVIndex	UV Index		8, 9, 10
Erythema_Anders	Spectral irradiance weighted with erythema action spectrum by *Anders*, 1995	1/s	8, 9
RBM501	Spectral irradiance weighted with RBM response function	µW/cm²	8, 9
SetlowBSI	Spectral irradiance weighted with action spectrum for DNA damage by *Setlow*, 1974; BSI parameterization	µW/cm²	8, 9
SetlowBSI_300	Spectral irradiance weighted with action spectrum for DNA damage by *Setlow*, 1974; BSI parameterization normalized at 300 nm	µW/cm²	8, 9
SetlowTUV	Spectral irradiance weighted with action spectrum for DNA damage by *Setlow*, 1974; TUV parameterization	µW/cm²	8, 9
SetlowNDSC	Spectral irradiance weighted with action spectrum for DNA damage by *Setlow*, 1974; NDSC parameterization	µW/cm²	8, 9
SCUP-h	Spectral irradiance weighted with action spectrum for skin cancer in mice corrected for human skin by *Gruijl et al*., 1993	µW/cm²	8, 9
SCUP-m	Spectral irradiance weighted with action spectrum for skin cancer in mice by *Gruijl et al*., 1993	µW/cm²	8, 9
Caldwell	Spectral irradiance weighted with action spectrum for generalized plant response by *Caldwell*, 1971	µW/cm²	8, 9
Flint	Spectral irradiance weighted with action spectrum for plant growth by *Flint and Caldwell*, 2003	µW/cm²	8, 9
Hunter	Spectral irradiance weighted with action spectrum for northern anchovy by *Hunter*, 1979	µW/cm²	8, 9
Boucher	Spectral irradiance weighted with action spectrum for inhibition of phytoplankton carbon fixation by *Boucher et al*., 1994	(mg C) / (mg chl s)	8, 9
Cullen_ phaerodactylum	Spectral irradiance weighted with action spectrum for inhibition of phytoplankton photosynthesis of phaeodactylum by *Cullen et al*., 1994		8, 9
Cullen_ prorocentrum	Spectral irradiance weighted with action spectrum for inhibition of phytoplankton photosynthesis of prorocentrum by *Cullen et al*., 1994		8, 9
Neale_Antarctic	Spectral irradiance weighted with action spectrum for inhibition of photosynthesis by *Cullen and Neale*., 1997		8, 9
TSI-weighting	Spectral irradiance weighted with TSI response function	µW/cm²	8, 9
Lesser	Spectral irradiance weighted with action spectrum for DNA damage in embryos of sea urchin *Sterechinus neumayeri* from the Antarctic	µW/cm²	8, 9

Cataract	Spectral irradiance weighted with action spectrum for *in vitro* UV-induced cataract in porcine lenses	µW/cm²	8, 9
Vitamin_D	Spectral irradiance weighted with action spectrum for vitamin D production recommended by the CIE	µW/cm²	8, 9
VitaminD-315	Spectral irradiance weighted with action spectrum for vitamin D production recommended by the CIE truncated at 315 nm	µW/cm²	8, 9
TSI 290-315 nm	Average of TSI signal when SUV was scanning between 290 and 315 nm	volts	11
TSI 290-320 nm	Average of TSI signal when SUV was scanning between 290 and 320 nm	volts	11
TSI 320-360 nm	Average of TSI signal when SUV was scanning between 320 and 360 nm	volts	11
TSI 360-400 nm	Average of TSI signal when SUV was scanning between 360 and 400 nm	volts	11
TSI 400 600 nm	Average of TSI signal when SUV was scanning between 400 and 600 nm	volts	11
TSI 298.507-303.03 nm	Average of TSI signal when SUV was scanning between 298.507 and 303.03 nm	volts	11
TSI 303.03-307.692 nm	Average of TSI signal when SUV was scanning between 303.03 and 307.692 nm	volts	11
TSI 307.692-312.5 nm	Average of TSI signal when SUV was scanning between 307.692 and 312.5 nm	volts	11
TSI 322.5-327.5 nm	Average of TSI signal when SUV was scanning between 322.5 and 327.5 nm	volts	11
TSI 337.5-342.5 nm	Average of TSI signal when SUV was scanning between 337.5 and 342.5 nm	volts	11
TSIcv	TSI coefficient of variance		12
Processing_time	Time when scan was processed	mm/dd/yy hh:mm:ss	

Remarks

1 - Filename convention of spectral scans:
sByyhhmm.jjj

where
s = Site identifier (A=McMurdo; B=Palmer; C=South Pole; D=Ushuaia; E=San Diego; F=Barrow; J=Summit)
B = Indicator for Version 2 data
yy = Year
hh = Hour (UT)
mm = Minute
jjj = Day of Year

2 - "Measurement" for files suffixed "_DB2_meas.csv"; "Clear_sky_model" for files suffixed "_DB2_clear.csv"; "Cloud_model" for files suffixed "_DB2_cloud.csv"

3 - Date and time at the start of a scan are encoded into a single number where the integer part is the day number relative to January 1, 1900 (day 1 corresponds to 1/1/1900). The fractional part is the time of day. (For example, the fractional part multiplied with 24 gives the hour of the measurement). When the file is decoded by Microsoft Excel, the date value will automatically be translated into a correct date/time string, if the box "1904 date

system" of the "Tools -> Options -> Calculation"-menu is unchecked.

4 - 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.

5 - The solar azimuth is zero when the Sun is in the North (Grid North at the South Pole).

6 - See description of files with suffix "_wave_shift2.csv" for explanation of wavelength shift indicator.

7 - See description of files with suffix "_flags.csv" for explanation of minimum useable wavelength.

8 - Integrals and dose-rates $E_W(t)$ were calculated with:

$$E_W(t) = \int_{\lambda_L}^{\lambda_H} E(\lambda,t)\ W(\lambda)\ d\lambda$$

where $E(\lambda,t)$ is spectral irradiance at wavelength λ and time *t*. Note that spectral irradiance was normalized to a bandwidth of 1.0 nm before use in the integral.

$W(\lambda)$ is a weighting function (or action spectrum), describing the wavelength dependence of radiation on biological matter. For calculating integrals, $W(\lambda)$ was set to 1.

λ_L, λ_H are lower and upper integration limit as defined by the action spectrum (see Remark 9).

Integrals and dose-rate values are only part of the data file if the integral

$$E^*(t) = \int_{\lambda_L}^{\lambda_M} E(\lambda,t)\ W(\lambda)\ d\lambda,$$

is smaller than $0.2E_W(t)$. Here, the upper integration limit λ_M is the larger of two "Minimum useable wavelengths" given in columns 14 and 15 of the data file. Thus, integrals and dose-rates are not published if the contribution from wavelengths below the detection limit makes up more than 20% of $E_W(t)$. This prevents that false conclusions are drawn from data that are heavily affected by noise in the measurement (e.g. at very large solar zenith angles).

9 - For parameterization of action spectra see links in document http://UV.biospherical.com/Version2/description-Version2-Database3.html

10 - UV Index is a unit of measure of UV levels relevant to the effects on human skin. It serves as a vehicle to raise public awareness about the potential detrimental effects on health from solar UV exposure and to alert people of the need to adopt protective measures. The UV index is defined as erythemally (CIE) weighted irradiance, expressed in the units W/m², and multiplied by 40. Note that the UV Index is a dimensionless number. More information can be found here: http://UV.biospherical.com/Solar_Index_Guide.pdf

11 - TSI stands for "Total scene irradiance" and refers to a filtered photodiode that is integral to the SUV-100 spectroradiometer. The sensor is sensitive between 330 and 380 nm. Measurements of the sensor can be used to estimate the variation of radiation levels (for example due to changing cloud cover) during the period of a spectral scan.

12 - TSIcv is the standard deviation of all measurements of the TSI sensor performed during the period of a spectral scan.