File Revision Date:
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Data Set Description:

PI: P. Werle
Instrument: UV Spectrometer (Bentham DTM300 system)
Site(s): Garmisch, Germany (47.48 N, 11.07 E, 730m) since April 1994
Zugspitze, Germany (47.42 N, 10.98 E, 2962 m) since July 1995

Measurement Quantities:

Spectral irradiance on a horizontal surface (cosine weighted) of UV 280-420 nm at 0.25 nm resolution. Scans are taken approximately every ten minutes. Spectra of global and direct horizontal irradiance are taken alternately.
Scans are from sunrise - approx. 1 hour to sunset + approx. 1 hour.

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Reference Articles:

Seckmeyer G. and Bernhard G., "Cosine error correction of spectral UV irradiances", in Atmosheric Radiation, edited by K. Stamnes, SPIE Proc. Int. Soc. Opt. Eng., 2049, 140-151,1993

Seckmeyer et al., "High Accuracy Spectroradiometry of Solar UV Radiation", Metrologia 32, 1996, pp 697-700

Bernhard G. and Seckmeyer G., "New Entrance Optics for Solar Spectral UV Measurements", Photochemistry and Photobiology, 1997, 65(6): 923-930

Mayer B. and Seckmeyer G., "Systematic long-term comparison of spectral UV measurements and UVSPEC modeling results", Journal of Geophysical Research, Vol. 102, No. D7, pages 8755-8767, april 20, 1997

Bernhard G. and Seckmeyer G., "Uncertainty of measurements of spectral solar UV irradiance", Journal of Geophysical Research, Vol. 104, No. D12, pages 14,321-14,345, june 27, 1999

Instrument Description:

Bentham DTM300. NDSC standard (2400 g/mm, 0.6 nm fwhm)

QA/QC Description:

Quality assurance and quality control of spectral irradiance data measured at the stations "Garmisch" and "Zugspitze"

1. Data acquisition

a) Daily system check (spectroradiometer, calibration unit and ancillary instruments):

* Check if running correctly.
* Online comparison to a RBM.
* Check of time and date of the system.
* Cleaning entrance optic if necessary (routinely only once a week at Zugspitze).
* Temperature stability check of instrument environment. (only weekly at Zugspitze).

b) Absolute calibration:

* Calibration of a working and control standard once every 3 to 4 years using a set of three 1000 W lamps from PTB as reference standard.
* Determining the spectral sensitivity of the spectroradiometer using a working standard once or twice every two weeks ("absolute calibration of the system").
* Aging-check of the working standard (100 W, halogen) using a control standard (100 W, halogen) twice a year ("lamp shift").

c) Wavelength alignment:

* Daily coarse check using Fraunhofer lines (Ca).
* Checking twice a year using a HgNe penray lamp.

d) Measuring the slit function once a year using a HeCd-Laser.

e) Instrument intercomparison:

* Once every two to three years using a mobile spectroradiometer system.
* Using this mobile system to check the stationary systems.

f) Using ancillary instruments:

* RB-meter measures erythemally weighted irradiance every minute for checking the spectroradiometer data
* Pyranometer measures total global irradiance every minute to decide if it has clear sky or not
* Pyrheliometer measures total direct irradiance every minute to decide if it has direct sun or not
* Luxmeter measures illuminance every minute to decide if it has clear sky or not
* Sun-tracker for direct irradiance measurements
* Cloud camera takes pictures every 10 minutes for deriving cloud cover and cloud form

2. Data evaluation

a) Monthly:

* Global irradiance: cosine correction, linearity correction and review of diurnal variation of irradiance at 400 nm, ozone column and comparison of erythemally weighted spectra to RBM.

* Direct irradiance: linearity correction, diurnal variation at 400 nm, aerosol optical depth and ozone column.

b) Yearly (global and direct irradiance):
* Wavelength shift correction using modelled clear sky spectra.
* Lamp shift correction using check of working standard.
* Comparison of resulting data to modelled spectra.
* Determining aerosol optical depth and ozone column again after the correction procedures.

Expected Precision/Accuracy of Instrument:
+/- 6.7% to 10.3% (+/- 2 Sigma) at 400 nm depending on atmospheric conditions,
+/- 9.7% to 15.5% (+/- 2 Sigma) at 300 nm depending on atmospheric conditions,
+/- 7.5% (+/- 2 Sigma) for erythemally weighted irradiance,
see Bernhard et al., 1999.

Instrument History:
Dates and description of significant changes in instrument or algorithm

middle of 1999 Zugspitze: sun tracker broken.
Feb 2001 Garmisch: driver and amplifier electronics exchanged.
August 2001 Garmisch: sun tracker broken.
January 2001 Zugpitze: station is temporay deactivated
April 2002 Garmisch: new sun tracker installed.
November 2002 Garmisch: station is temporay deactivated
April 2003 Zugspitze: station is reactivated
April 2004 Zugspitze: new online software for ancillary instruments installed