

Name of research institute or organization:

Institute for Medical Physics, University Innsbruck

Title of project:

Solar UV irradiance

Project leader and team:

Prof. Dr. Mario Blumthaler, project leader
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Project description:

Since 1980 variability and long-term trend of solar UV irradiance have been observed at the High Alpine Research Station Jungfraujoch in annual campaigns of about 8 weeks duration. Especially the biologically significant erythemally weighted UV-irradiance is of interest, as it can be taken as a general indicator of harmful reactions on humans. The erythema dose is measured with broadband detectors, and long-term variations are investigated within our long-term project.

Furthermore, spectral measurements of solar global irradiance between 280 nm and 500 nm with a resolution of 0.25 nm are carried out with a double-monochromator spectroradiometer. Total ozone column and spectral extinction by aerosols is derived from spectral measurements of direct sun irradiance. Close international cooperation guarantees high quality of the UV measurements.



In 2003, the measurements at Jungfraujoch took place between 14.10.2003 and 27.11.2003. During the whole period at least one scientific co-worker from the Institute for Medical Physics was taking care of the measurements at Jungfraujoch for continuous quality control and for manual ancillary measurements on clear sky days. With the spectroradiometer, for the first time systematic measurements of the degree of polarisation of the diffuse sky radiance in the UV wavelength range were carried out. On clear sky days, measurements of sky radiance in the vertical plane of the sun and in the almucantar were carried out for 320 nm, 350 nm and 450 nm with a field of view of about 1.6°. At each selected point on the sky, a UV-polarising filter in front of the input optics was rotated in 4 steps over 135°. These data will be analysed in combination with radiative transfer models to interpret the effect of sky polarisation in the UV range. The measurements at Jungfraujoch can serve as a base line for such measurements, as the amount of aerosols is extremely small and therefore their effect on polarisation can almost be neglected.

The photo shows the 3 input optics of the spectroradiometer (towards the top of the Mönch). The 3 heads allow 3 types of measurements: sky radiance of any point of the sky with the polarisation filter, global irradiance (blue head) and actinic flux (black head with the shadow ring). The heads are mounted on a pole to avoid too much disturbances by the couple of the telescope at the Sphinx terrace, and they are connected with quartz fibres (6 m) with the spectroradiometer.

Also in the following years the measurement campaigns at Jungfraujoch will be continued. Thereby further specific sensitivity studies on the influence of individual parameters on solar UV irradiance will be carried out. Furthermore, it will be of special interest, if in the next years a tendency for recovering of the ozone layer will really occur, which should be accompanied by decreasing levels of UV-B irradiance. Such conclusions can be drawn only from measurements carried out over many years, because otherwise any long-term trend may be masked by the natural high short-term variations of the various atmospheric parameters, which influence UVB-irradiance at the earth's surface.

Key words

UV, erythemal irradiance, ozone, aerosols, albedo effects, polarisation

Internet data bases:

<http://www.uibk.ac.at/projects/uv-index/index.html>

Collaborating partners/networks:

Close contact to MeteoSchweiz concerning radiation measurements and to BUWAL concerning ground level ozone measurements. International cooperation in several EC-projects concerning spectral UV measurements.

Scientific publications and public outreach 2003:

Refereed journal article:

Huber M., M. Blumthaler, J. Schreder, B. Schallhart and J. Lenoble, Effect of inhomogeneous surface albedo on diffuse UV sky radiance at a high altitude site, *J Geophys Res*, under review.

Conference paper:

Blumthaler M., Measurements and trends of UV-radiation in Alpine environments. Arctic-Alpine Ecosystems and People in a Changing Environment. 23.02.-01.03.2003, Tromso, Norwegen, (invited talk, paper in preparation as book chapter)

Edited books:

Blumthaler, M. and A. Webb, UVR climatology, in "UV effects in Aquatic Organisms and Ecosystems", Ed. E. W. Hekbling and H. Zagarese, Comprehensive Series in Photochemistry and Photobiology – Volume 1, Chapter 2, The Royal Society of Photochemistry, Cambridge, UK, ISBN 0-85404-301-2, 21-58, 2003.

Wengraitis, S., M. Blumthaler, J-P Cesarini, E. Chaney, P. Koepke, S. Madronich, J. Schwanda, D. Sliney, F. Urbach, A. Webb and U. Wester, Spectral weighting of solar ultraviolet radiation, Commission International de l'eclairage Technical Report 151:2003, ISBN 3-901-906-20-7, 1-30, 2003.

Kerr, J.B., G. Seckmeyer, A. Bais, G. Bernhard, M. Blumthaler, S. Diaz, N. Krotkov, D. Lubin, R. McKenzie, A. Sabziparvar and J. Verdebout, Surface Ultraviolet Radiation: Past and Future, in " Scientific Assessment of Ozone Depletion: 2002", WMO Report No 47, Chapter 5, World Meteorological Organisation, Geneva, Switzerland, 2003.

Thesis:

Schreder, J., Messung der räumlich verteilten solaren UV-Strahlung in Europa, PhD Thesis, University Innsbruck, 2003.

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