

Name of research institute or organization

MeteoSwiss, Payerne

Title of project:

Global Atmosphere Watch Radiation Measurements

Project leader and team:

Dr. Laurent Vuilleumier, project leader

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Project description

During 2001, MeteoSwiss continued operating a station from the Swiss Atmospheric Radiation Monitoring network (CHARM) at the Jungfraujoch scientific station. In the framework of the Global Atmosphere Watch (GAW) program of the World Meteorological Organization, the CHARM network is aimed at monitoring radiation at the ground, covering a spectrum from the ultraviolet to the infrared. Both total and direct solar radiation is measured, and both broadband and spectral measurements are included. Instruments measuring direct solar radiation are an absolute cavity radiometer PMO6 (PMOD/WRC), a pyrheliometer CH1 (Kipp & Zonen), a Uvee Biometer (Solar Light Co) mounted in a tube for the measurement of the direct component and one set of Precision Filter Radiometers (PMOD/WRC) measuring at 16 wavelengths from 305 to 1024 nm. Instruments measuring total radiation are a Uvee Biometer, a UV-A Biometer, a pyranometer CM21 (Kipp & Zonen) and a pyrgeometer PIR (Eppley) upgraded by PMOD/WRC for more accurate measurements. More details about the instruments and measurements are given in the 2000 report¹ to the International Foundation HFSJG.

In 2001, the set of instrument used remained identical to those used in 2000. A careful operation and maintenance program allowed good data availability. Instruments measuring direct radiation are located in a dome protecting the sun tracking system, which opens only when meteorological conditions allow. A failure of the operating system prevented good operation of the dome for about 15% of the time in 2001. This precluded data acquisition for the instruments located in the dome. A temporary solution was applied to fix the dome operating system, and a new upgrade is now being installed. For the instruments located outside the dome, data were successfully retrieved for 93-95% of the time.

Data from the radiation monitoring instruments at Jungfraujoch are made available to the scientific community by MeteoSwiss and contribute to various scientific studies. Spectral direct irradiance data were used to compute total aerosol optical depth and total water vapor column in the framework of a Ph.D. thesis² at the University of Bern. Shortwave (visible) and longwave (IR) total irradiance measurements from the Jungfraujoch station are also included in the Alpine Surface Radiation Budget

¹ A. Heimo, A. Vernez, A. Lehmann, B. Hoegger, R. Philipona, C. Marty, C. Wehrli and T. Ingold. *The Jungfraujoch Station as part of the Swiss Atmospheric Radiation Monitoring CHARM program*. 2000 report to the International Foundation HFSJG.

² Ingold T., 2000. Monitoring atmospheric parameters from ground-based remote sensing networks in Switzerland. *Ph.D. thesis*, Bern University, Institute of Applied Physics, Sidlerstrasse 5, CH-3012 Bern, Switzerland.

(ASRB) network under the responsibility of the World Radiation Center/Physikalisch-Meteorologisches Observatorium Davos. They were used for computation of surface radiation flux in the framework of a study of the relationships between surface radiation, cloud forcing and greenhouse effect for a Ph.D. thesis³ at the Swiss Federal Institute of Technology Zurich. UV direct and total irradiance as well as aerosol total optical depths derived from direct spectral irradiance measurements were used in a study of the ground irradiance of the part of the UV spectrum that affects the most the human body (erythemally-weighted UV). This research was also conducted in the framework of a Ph.D. thesis⁴ at the Swiss Federal Institute of Technology Zurich.

Key words

Solar irradiance, ultraviolet, visible, infrared, spectral irradiance, filter radiometer, pyranometer, pyrheliometer, UV biometer, total aerosol optical depth, total water vapor column, total ozone column.

Collaborating partners/networks:

Data shared with the Alpine Surface Radiation Budget network under the responsibility of the World Radiation Center/Physikalisch-Meteorologisches Observatorium Davos.

Scientific publications and public outreach 2001:

Ingold T., 2000. Monitoring atmospheric parameters from ground-based remote sensing networks in Switzerland. *Ph.D. thesis*, Bern University, Institute of Applied Physics, Sidlerstrasse 5, CH-3012 Bern, Switzerland.

Marty, C. A., 2000. Surface radiation, cloud forcing and greenhouse effect in the Alps. *Ph.D. thesis*, Swiss Federal Institute of Technology Zurich, Institute for Atmospheric and Climate Science, Winterthurerstrasse 190, CH-8057 Zurich, Switzerland.

Lehmann, A., 2001. Direct and diffuse components of erythema irradiance: measurements and modelling for clear-sky conditions. *Ph.D. thesis*, Swiss Federal Institute of Technology Zurich, Institute for Atmospheric and Climate Science, Winterthurerstrasse 190, CH-8057 Zurich, Switzerland.

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³ Marty, C. A., 2000. Surface radiation, cloud forcing and greenhouse effect in the Alps. *Ph.D. thesis*, Swiss Federal Institute of Technology Zurich, Institute for Atmospheric and Climate Science, Winterthurerstrasse 190, CH-8057 Zurich, Switzerland.

⁴ Lehmann, A. A., 2001. Direct and Diffuse Components of Erythema Irradiance: Measurements and Modeling for Clear-Sky Conditions. *Ph.D. thesis*, Swiss Federal Institute of Technology Zurich, Institute for Atmospheric and Climate Science, Winterthurerstrasse 190, CH-8057 Zurich, Switzerland.