

Name of research institute or organization:

Federal Office of Meteorology and Climatology 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:

Long-term monitoring of surface radiation flux at the Jungfraujoch in the framework of the GAW Swiss Alpine Climate Radiation Monitoring program (SACRaM) was conducted in 2012 with a high degree of data availability considering the challenging conditions at Jungfraujoch. In average, the data availability for radiation parameters reached 99%. Such continuous monitoring implies a constant effort to sustain the highest achievable accuracy, stability and continuity in the measurements.

The measurement program includes short-wave (solar spectrum) and long-wave (infrared thermal) broadband measurements as well as UV broadband measurements. Short- and long-wave measurement series are important for climate research, while UV measurements are of interest for both public health and exploring the relationship between the evolution of the ozone layer and radiation. Broadband radiation is measured both as global downward hemispheric irradiance and as direct sun irradiance. In addition, direct spectral irradiance is also measured, which allows the total column of several atmospheric constituents to be determined.

At the end of 2012 a Delta-T SPN1 instrument was installed at Jungfraujoch. This instrument has a special design that allows it to measure global and diffuse radiation and still be a very robust instrument able to resist harsh meteorological conditions. These measurements are less precise than measurements made with pyranometers, but until now it was not possible to implement diffuse short-wave measurements at Jungfraujoch. This new instrument will allow complementing the global and direct short-wave measurements that are already implemented at Jungfraujoch.

In 2012, a re-analysis of aerosol optical data from 2 stations of the SACRaM network (Jungfraujoch and Davos) and from one station in Southern Germany (Hohenpeissenberg) was concluded. This updated and re-homogenized data is for the period 1995–2010. Trend analysis revealed weak or non significant AOD trends ($\lambda = 500$ nm): Jungfraujoch (JFJ; +0.007 per decade), Davos (DAV; +0.002 per decade) and Hohenpeissenberg (HPB; -0.011 per decade). When correcting for a recently available stratospheric AOD time series, accounting for Pinatubo (1991) and more recent volcanic eruptions, the 1995–2010 AOD trends decreased slightly at DAV and HPB (0.000 per decade and -0.013 per decade, respectively). The JFJ 1995–2005 AOD time series similarly decreased to -0.003 per decade.

SACRaM AOD data from Jungfraujoch were also included in a combined analysis of aerosol optical properties around the high-alpine site Jungfraujoch headed by the Laboratory of Atmospheric Chemistry of the Paul Scherrer Institute.

Key words:

Solar irradiance, ultraviolet, visible, infrared, spectral irradiance, precision filter radiometer (PFR), pyranometer, pyrhelimeter, UV biometer, total aerosol optical depth (AOD), integrated water vapor (IWV)

Internet data bases:

<http://wrdc-mgo.nrel.gov/> (World Radiation Data Centre – WRDC)
<http://www.iapmw.unibe.ch/research/projects/STARTWAVE/database/> (IWV STARWAVE data)

Collaborating partners/networks:

Radiation data submitted to the World Radiation Data Centre (WRDC, St. Petersburg, Russian Federation) within the framework of the Global Atmosphere Watch.
Study of solar photometry (aerosol optical depth) and long-wave infrared radiative forcing in collaboration with the "Physikalisch-Meteorologisches Observatorium Davos" (PMOD) World Radiation Center (WRC).

Scientific publications and public outreach 2012:

Refereed journal articles and their internet access

Nyeki, S., C. H. Halios, W. Baum, K. Eleftheriadis, H. Flentje, J. Gröbner, L. Vuilleumier, and C. Wehrli, Ground-based aerosol optical depth trends at three high-altitude sites in Switzerland and southern Germany from 1995 to 2010, *J. Geophys. Res.*, **117**, doi: 10.1029/2012JD017493, D18202, 2012.
<http://dx.doi.org/10.1029/2012JD017493>

Zieger, P., E. Kienast-Sjögren, M. Starace, J. von Bismarck, N. Bukowiecki, U. Baltensperger, F.G. Wienhold, T. Peter, T. Ruhtz, M. Collaud Coen, L. Vuilleumier, O. Maier, E. Emili, C. Popp and E. Weingartner, Spatial variation of aerosol optical properties around the high-alpine site Jungfrauoch (3580 m a.s.l.), *Atmos. Chem. Phys.*, **12**, doi:10.5194/acp-12-7231-2012, 7231-7249, 2012.
<http://dx.doi.org/10.5194/acp-12-7231-2012>

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