

Global Atmosphere Watch radiation measurements

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Part of this programme: GAW

Keywords: solar irradiance; ultraviolet, visible, infrared and spectral irradiance; precision filter radiometer (PFR); pyranometer; pyrhelimeter; UV biometer; aerosol optical depth (AOD); integrated water vapour (IWV)

1. Project description

The goal of the Global Atmosphere Watch Radiation Measurement program at Jungfraujoch is providing long-term monitoring of surface downward radiation fluxes. It is conducted in the framework of the GAW Swiss Alpine Climate Radiation Monitoring program (SACRaM), which applies operational guidelines similar to those of the international Baseline Surface Radiation Network, except for the daily maintenance requirements due to the remote nature of the site. In 2021, the degree of data availability continued to be excellent, especially considering the challenging conditions at Jungfraujoch. As during the previous year, the data availability for radiation parameters reached 99% on average in 2021. Achieving this level of data availability for continuous automatic monitoring at Jungfraujoch implies a constant effort to sustain the highest achievable accuracy, stability and continuity in the measurements.

The measurement program includes shortwave (solar spectrum) and longwave (infrared thermal) broadband measurements as well as UV broadband measurements. Short- and longwave 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 aerosol optical depth (AOD) and integrated water vapour (IWV) column to be determined. In association with the WMO GAW Precision Filter Radiometer (PFR) network, MeteoSwiss operates such sun photometers at the four SACRaM stations measuring the direct irradiance in 16 narrow spectral bands within the range 305-1024 nm since 1998. One of the four sites is Jungfraujoch, characterized by an alpine environment and partial free tropospheric conditions. At nine wavelengths, aerosol optical depth (AOD) is computed at times when no clouds are in the path of the direct solar beam.

Since the instruments for direct spectral irradiance (AOD and IWV determination) are in use since more than 20 years, MeteoSwiss decided a renewal of the measurement infrastructure in the

framework of its instrument lifecycle management program. Because these measurements are performed within the GAW PFR network, the decision was made, following an evaluation project, to use the same instrument model, but in its renewed 2019 version. After parallel testing of the old and new (2019) PFR model, the performance of the instruments were found to be equivalent, although a reduced noise level was achieved with the new instrument model. Because of the similarity of the new and old type of instrument, the likelihood of inhomogeneity introduced by the instrument change is considered extremely low. After the initial evaluation and choice phase was concluded in 2021, the renewal of the instrument will be progressively implemented between years 2022 to 2024. This renewal will not only be implemented at the Jungfraujoch station, but also at the other SACRaM stations of Davos, Locarno-Monti and Payerne.

Internet data bases

<http://www.meteoswiss.admin.ch/home/measurement-and-forecasting-systems/atmosphere/strahlungsmessnetz.html>
<http://wrdc.mgo.rssi.ru/>

Collaborating partners / networks

Dr. S. Nyeki, Dr. J. Gröbner, "Physikalisch-Meteorologisches Observatorium Davos" (PMOD) World Radiation Center (WRC)
Dr. D. Vernez, Dr. J.-L. Bulliard, "Centre universitaire de médecine générale et santé publique, Unisanté, Lausanne"

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