Name of research institute or organization:

Federal Office of Meteorology and Climatology MeteoSwiss, Payerne

Title of project:

Global Atmosphere Watch Radiation Measurements

Part of this programme:

GAW

Project leader and team:

Dr. Laurent Vuilleumier, project leader
Dr. Giovanni Martucci
Mr. Gilles Durieux

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 2015, the mechanical infrastructure and the data acquisition (DAQ) electronics were renewed during the month of July. These efforts included the installation of a new measurement bench on the Sphinx terrace and the update of all the DAQ systems. Such renewals are essential to preserve the quality of the measurement system infrastructure on the long term, especially at a location where meteorological conditions are as harsh as at Jungfraujoch. Despite the fact that the measurement system was completely stopped during two weeks in July, and the subsequent debugging of the DAQ during the following months, an overal data availaibility of 94% was achieved in 2015, including the time when the system was stopped. Redundancy and continuity tests showed that the quality of the data was preserved. The success of this renewal relied on a very strict preparation and the usual constant efforts to sustain the highest achievable accuracy, stability and continuity in the measurements.

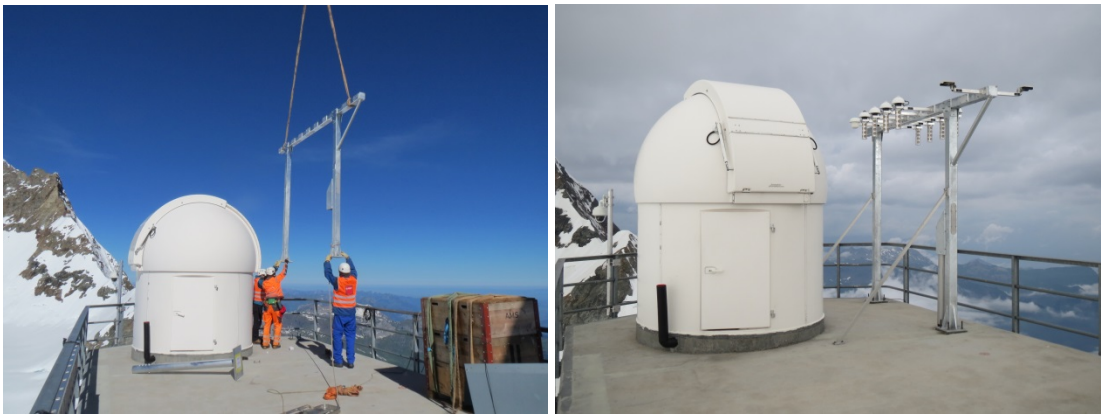

Figure 1. Installation of the new measurement bench on the Sphinx terrace (left) and Jungfraujoch SACRaM station after completion of the renewal. The new measurement bench holds more available positions than the previous one, and all cabling are now located within the metallic structure and are thus protected from the harsh meteorological conditions.

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.

In collaboration with and under the lead of the Laboratory of Atmospheric Chemistry from the Paul Scherrer Institute, MeteoSwiss participated to the analysis of aerosol size distribution measurements. In this framework, the analysis used the long-term series of meteorological and radiation measurements by MeteoSwiss for determining what the conditions prevailing at Jungfraujoch were and allowed giving results that considered these different conditions. Specifically, the long-wave (thermal infrared) radiation data were used to determine whether the aerosol size distribution data were taken when Jungfraujoch was within a cloud or out of the cloud. Such distinctions allow a better undestanding of the role of aerosol in cloud nucleation.

Key words:

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

Internet data bases:

http://wrdc-mgo.nrel.gov/ (World Radiation Data Centre – WRDC)

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 2015:

Refereed journal articles and their internet access

Herrmann, E., E. Weingartner, S. Henne, L. Vuilleumier, N. Bukowiecki, M. Steinbacher, F. Conen, M. Collaud Coen, E. Hammer, Z. Jurányi, U. Baltensperger and M. Gysel, Analysis of long-term aerosol size distribution data from Jungfraujoch with emphasis on free tropospheric conditions, cloud influence, and air mass transport, J. Geophys. Res. Atmos., **120**, 9459–9480, doi: 10.1002/2015JD023660, 2015. http://onlinelibrary.wiley.com/doi/10.1002/2015JD023660/abstract

Wacker, S., J. Gröbner, C. Zysset, L. Diener, P. Tzoumanikas, A. Kazantzidis, L. Vuilleumier, R. Stöckli, S. Nyeki and N. Kämpfer, Cloud observations in Switzerland using hemispherical sky cameras, J. Geophys. Res. Atmos., **120**:D2, 695–707, doi: 10.1002/2014JD022643, 2015. http://onlinelibrary.wiley.com/doi/10.1002/2014JD022643/abstract

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