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A comprehensive radiation flux assessment at different sites in Switzerland

Aebi Christine[1,2], Groebner Julian[1], Kaempfer Niklaus[2]
[1] Physikalisch-Meteorologisches Observatorium Davos/ World Radiation Center, Davos, Switzerland
[2] University of Bern, Bern, Switzerland

Radiative transfer calculations in the atmosphere and the influence of clouds on the radiation budget remain the greatest sources of uncertainty in the simulation of climate change. Lack of global quantitative surface measurements of radiation, the shortage of high quality satellite and surface-based observational records, inhomogeneities in the data and insufficient precision in measurements of small changes in cloudiness and radiation, which can have large impacts on the Earth's climate, are reasons for the aforementioned uncertainties. Consequently, in order to assess the radiative impact of clouds on the radiation budget and the corresponding changes, frequent and more precise radiation and cloud observations are necessary.
The focus of this project is on the measurement and analysis of specific radiation processes at selected sites in Switzerland. The combination of surface-based radiation flux measurements with radiative transfer calculations will allow a complete assimilation and closure study to be performed on the surface radiation budget at four different sites in Switzerland (Davos, Jungfraujoch, Locarno-Monti, and Payerne). At these different sites, the role of clouds and aerosols on longwave and shortwave surface radiation fluxes will be studied. Studies for clear-sky conditions have shown a high level of agreement between model calculations and measurements. Thus, the focus of this project is to analyse the radiation budget under overcast and broken cloud situations.
Visible all-sky camera systems in Davos, Jungfraujoch and Payerne detect and classify clouds on an automatic basis. In order to complement these measurements during the day, a thermal infrared all-sky camera system for night-time operation will be developed. By this means, the dependence of cloud radiative forcing on atmospheric composition and cloud type can be quantified. This study will be complemented by an assessment of measured and modeled radiation fluxes at the GCOS Reference Upper-Air Network (GRUAN) and the Baseline Surface Radiation Network (BSRN) station in Payerne, which hosts a large amount of remote-sensing instrumentation, to determine the atmospheric state.
Another part of the project focuses on the homogenisation and analysis of the 20-year long data set (1996-2016) of shortwave and longwave data fluxes at the four Swiss Alpine Climate and Radiation Monitoring (SACRaM) sites in Switzerland. This data set aims at determining the ongoing long-term changes of these components.