

Name of research institute or organization:

**Physikalisch-Meteorologisches Observatorium Davos,
World Radiation Center**

Title of project:

Longwave Infrared radiative forcing trend assimilation over Switzerland (LIRAS)
Cloud Climatology and Surface Radiative Forcing over Switzerland (CLASS)

Project leader and team:

Julian Gröbner
Stefan Wacker
Edgar Schmucki
Niklaus Kämpfer

Project description:

A long-term trend analysis of all-sky and cloud-free down-welling long-wave and short-wave radiation, screen-level temperature and specific humidity was performed for Jungfraujoch. While the all-sky long-wave and short-wave radiation have decreased by 4 and 2.5 Wm^{-2} within the last 15 years, screen-level temperature and specific humidity have increased by 1 $^{\circ}\text{C}$ and 0.2 gkg^{-1} , respectively. The long-wave decrease is not consistent with the observed increase of temperature, humidity and greenhouse gas concentrations and might be explained by a change in the radiative effect of clouds. Indeed, the long-wave cloud-effect describing the effect of all cloud types on the long-wave radiation budget has decreased by 11 Wm^{-2} .

The cloud-free analysis revealed a total long-wave increase of 0.5 Wm^{-2} which is considerably lower compared to the 5.5 Wm^{-2} increase observed at Locarno-Monti, Payerne and Davos. A monthly analysis yielded negative trends in winter, whereas an upward tendency can be observed in summer except in August. The cloud-free long-wave trends are consistent with the corresponding temperature and humidity trends. By combining cloud-free long-wave models and measurements, we showed that the cloud-free long-wave trends which cannot be explained by temperature and humidity trends and rising greenhouse gas levels might be caused by a decrease of the radiative effect of cirrus clouds in some single months.

However, the deduced trends in the cloud-effect need to be studied more precisely. Thus, the follow-up project Cloud Climatology and Surface Radiative Forcing over Switzerland (CLASS) has been initiated in 2010. The project aims at quantifying the effect of clouds on the surface radiation budget since 1995 by differentiating between cloud types and cloud coverage using ancillary instrumentation and datasets. A new algorithm is currently being developed to determine cloud fraction and cloud type from long-wave and short-wave measurements. This algorithm will be validated using hemispherical cloud cameras which are being installed at Locarno-Monti, Payerne, Davos and Jungfraujoch.

Key words:

Radiation, Climate change

Collaborating partners/networks:

Meteoswiss, Univ. Bern - Institute of Applied Physics (IAP)

Scientific publications and public outreach 2010:

Wacker, S., LIRAS – Long-wave Infrared Radiative forcing trend Assimilation over Switzerland, PhD Thesis, Universität Bern, 2010.

Address:

PMOD/WRC
Dorfstrasse 33
7260 Davos Dorf

Contacts:

Julian Gröbner
Tel.: +41 814175157
Fax: +41 814175100
e-mail: julian.groebner@pmodwrc.ch
URL: <http://www.pmodwrc.ch>