Name of research institute or organization:

Environmental Remote Sensing Laboratory, École polytechnique fédérale de Lausanne, LTE – EPFL

Title of project:

Study of snowfall by means of remote sensing and in-situ instruments

Part of this programme:

GAW

Project leader and team:

Prof. Alexis Berne, project leader
Jacopo Grazioli

Project description:

The Environmental Remote Sensing Laboratory (LTE) took part in the CLoud and Aereosol Characterization Experiment (CLACE) during the months of January and February 2014. During the campaign, LTE deployed a mobile X-band Doppler weather radar at the Kleine Scheidegg. The radar measurements allow to remotely characterize precipitation (snowfall) above the valley of Grindelwald and around the Jungfraujoch measurement site. 13 relevant precipitation events were recorded during the measurement period.

The main goal of the CLACE community is to study the formation of clouds as a function of the availability and type of cloud condensation nuclei and to investigate the transition between liquid and ice-phase clouds. In this context the participation of LTE in CLACE 2014 is providing an additional scale of observation: the transition from cloud particles (micrometer scale) to precipitation (millimeter scale).

The research of LTE aims at better understanding the role that supercooled liquid water i.e., liquid water existing at negative temperatures, plays on the formation and on the evolution of precipitation, and eventually on the accumulation of snow on the ground. The total presence of supercooled liquid water i.e., the liquid water content (LWC) of the clouds was measured continuously at the Jungfraujoch observatory during CLACE 2014.

The in-situ data and the data collected by a Doppler lidar belonging to the University of Manchester allow to detect and quantify supercooled liquid water in the clouds while the radar data are used to retrieve the larger scale characteristics for snowfall and to hypothesize which are the dominant microphysical processes affecting snowfall in each instance. The expected results will enrich the current understanding of winter precipitation in the Alps in mixed-phase cloud cases and they will contribute as well to the field of radar meteorology, for future interpretation of weather radar measurements in similar environmental conditions.

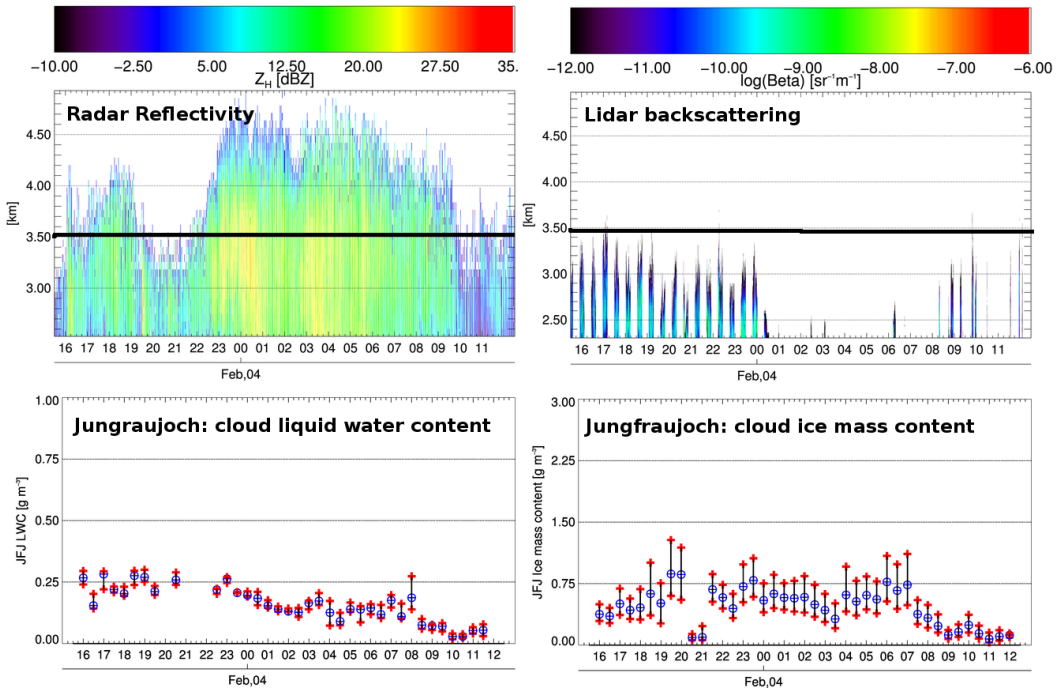

Figure 1. Complementarity of radar observations and lidar observations (both instruments pointing vertically), and in-situ (Jungfraujoch) cloud measurements. The altitude of the Jungfraujoch measurement site is indicated by a black line on the radar and lidar time-height plots.

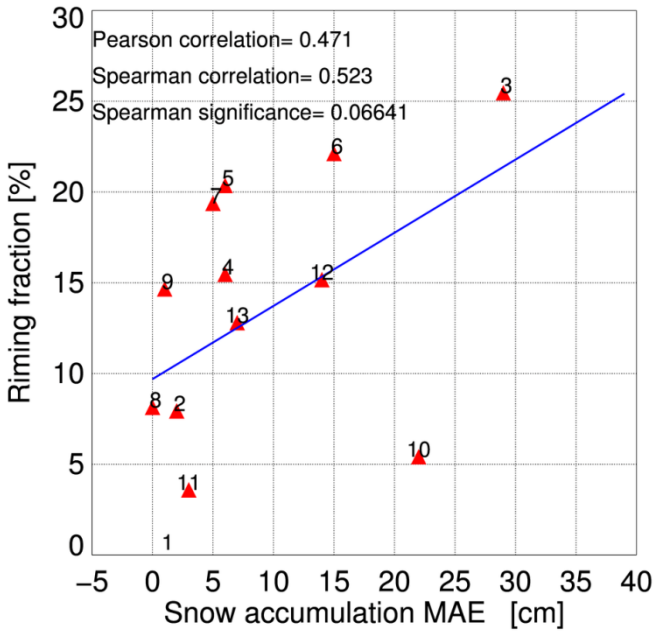

Figure 2. Relation between radar-retrieved fraction of rimed snow with respect to snow accumulation. Overall snow accumulation is higher when snowflakes are rimed.

Key words:

Snowfall, alpine precipitation, supercooled liquid water, radar meteorology

Collaborating partners/networks:

Karlsruhe Institute of Technology, Germany
University of Manchester, United Kingdom

Scientific publications and public outreach 2014:

Conference papers

Grazioli, J., D. Wolfensberger, T. Raupach, and A. Berne, Polarimetric radar observations of winter clouds and precipitation in the Alps – CLACE 2014, 8th European Conference on Radar in Meteorology and Hydrology, Garmisch-Partenkirchen, Germany, September 1-5, 2014.

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