Exploring clouds in the Alps to understand precipitation formation and snow deposition with the Davos2019 field campaign

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Precipitation forecasts in alpine regions are important for winter tourism, hydropower and hazard assessment, but current numerical weather models do not adequately include effects caused by the topography. The Davos2019 campaign uniquely combines cloud and snow research to improve the understanding of precipitation formation in clouds and snow deposition on the ground.

During the Davos2019 field campaign in February/March 2019, an extensive set of instruments are deployed in the Davos regions including aerosol, cloud, precipitation and snow measurements. The aerosol properties are measured in a valley and on a mountaintop site including cloud condensation nuclei and ice nucleating particle concentrations derived from different samples. Vertical profiles of cloud droplet and ice crystal number concentration and size are obtained using two holographic imagers on a cable car and on a tethered balloon system. In addition, multiple remote sensing instruments (Raman Lidar, Doppler Lidar, Cloud Radar, Wind profiler, Microwave Radiometer) probe the atmosphere up to higher altitudes. Locally, also snow transport close to the ground is measured. The resulting precipitation, snow deposition and snow height are measured at various sites on the surface. The measurements are contextualized by using regional numerical weather models for the atmosphere and high-resolution models for the snow deposition.

The goal of this joint research project is to create a unique dataset of orographic clouds and precipitation measurements for answering the following questions:
• Can we distinguish in-cloud from external ice enhancement processes and quantify their contributions to orographic precipitation?
• How does the distribution of cloud droplets and ice crystals influence the precipitation formation processes in mixed-phase clouds?
• Do anthropogenic aerosols noticeably change the microphysical and optical properties of MPCs and influence orographic precipitation?
• Can we improve orographic precipitation forecasts based on the results of our measurements?