Contribution ID: **24** Type: **not specified**

Impact of seeder-feeder cloud interaction on precipitation formation over the Swiss plateau: a case study and statistics based on extensive remote-sensing, in situ and model data

Thursday 20 March 2025 14:00 (15 minutes)

The PolarCAP (Polarimetric Radar Signatures of Ice Formation Pathways from Controlled Aerosol Perturbations) project makes use of a large set of remote-sensing and in-situ measurement devices in an ideal natural laboratory in the center of Switzerland. Targeted scenarios are so-called Bise weather situations, when north-easterly winds advect moist near-surface air masses over the Swiss Plateau such that there is a frequent chance to observe slightly supercooled low-level stratus clouds in an environment with very low INP concentrations. PolarCAP is implemented in close collaboration with the external ERC research project CLOUDLAB of ETH Zurich. CLOUDLAB makes use of these ideal natural requirements and conducts controlled seeding experiments.

Within the PolarCAP project, the remote sensing equipment of LACROS (Leipzig Aerosol and Cloud Remote Observations System) was installed in Eriswil, Switzerland during two winter campaigns between 2022 and 2024. Techniques for Doppler peak separation, and multi-wavelength analysis, and retrievals of ice-crystal size distributions and particle habits, all based on scanning polarimetric cloud radar observations, were combined with fall-streak tracking and liquid-water retrievals to obtain a comprehensive picture of the cloud evolution. Evaluation data was obtained with ground-based in-situ VISSS (Video In Situ Snowfall Sensor) and 2DVD (two-dimensional video disdrometer). These were used to challenge the remote-sensing-based retrievals.

This presentation focuses on a seeder-feeder case study on 8 Jan 2024, when a moist warm-frontal cloud system, which was advected from southerly direction, interacted with the prevailing low-level Bise cloud deck. The PolarCAP/CLOUDLAB setup was ideal to apply several advanced remote-sensing techniques and retrieval algorithms, including fall streak tracking, Doppler peak separation, and dual-wavelength applications. Results indicated that a large portion of the ice mass was rimed, attributed to the persistent coexistence of falling ice seeds within low-level supercooled liquid water layers. Only the interaction of the seeder and feeder clouds resulted in a significant precipitation enhancement. A comparison with ICON NWP simulations revealed that seeding efficiency was underestimated in the model, whereas the model setup overestimated precipitation production in the Bise cloud. In addition to the detailed case study, we present a statistics and relevance of all seeder-feeder scenarios which were observed during the PolarCAP/CLOUDLAB winter experiments in 2022/2023 and 2023/2024.

VAT

Session

From Classical to Integrated Remote Sensing: New observation strategies for clouds and precipitation (multi-frequency, spectral polarimetry, multi-sensor)

Preferred Contribution Type

Oral Presentation

Presenting Author

Kevin Ohneiser

Email Address of Presenting Author

ohneiser@tropos.de

Affiliation of Presenting Author

TROPOS

Address of Presenting Author

Permoserstr. 15, 04318 Leipzig

Authors: ANSMANN, Albert (TROPOS); MILLER, Anna (ETHZ); SKUPIN, Annett (TROPOS); KÖTSCHE, Anton (LIM); FUCHS, Christopher (ETHZ); ALTHAUSEN, Dietrich (TROPOS); SENF, Fabian (TROPOS); RAMELLI, Fabiola (ETHZ); GRIESCHE, Hannes (TROPOS); KALESSE-LOS, Heike (LIM); BAARS, Holger (TROPOS); ZHANG, Huiying (ETHZ); HENNEBERGER, Jan (ETHZ); HOFER, Julian (TROPOS); OHNEISER, Kevin (TROPOS); HAJIPOUR, Majid (TROPOS); RADENZ, Martin (TROPOS); MAAHN, Max (LIM); OMANOVIC, Nadja (ETHZ); MAHERNDL, Nina (LIM); SEIFERT, Patric (TROPOS); SPIRIG, Robert (ETHZ); ENGELMANN, Ronny (TROPOS); VOGL, Teresa (LIM); GAUDEK, Tom (TROPOS); LOHMANN, Ulrike (ETHZ); ETTRICHRÄTZ, Veronika (LIM); SCHIMMEL, Willi (TROPOS)

Presenter: OHNEISER, Kevin (TROPOS)