Sunday 28th August, 8:30 am to 5:30 pm.

Venue: Palacinema, Locarno, Switzerland

Course title: Polarimetric microphysical fingerprints in observations and Numerical Weather Prediction Model

Prerequisites:

Participants should have:

- Some familiarity with Python programming language, Fortran, Netcdf, Linux shell scripts.
- Basic understanding of radar observations and electromagnetic wave propagation.

Participants need a notebook (onsite) or any computer (online) with a VirtualBox installation. We will provide a Linux VirtualBox for the course work.

Learning objectives:

1. Gain insights into the value of radar polarimetry for numerical model evaluation and improvement
2. Know about signatures of microphysical processes (“fingerprints”) in polarimetric and/or Doppler radar measurements
3. Know how to apply the Doppler spectra analysis techniques peakTree and PEAKO to vertically-pointing Doppler cloud radar observations
4. Perform radar simulations with the polarimetric forward operator EMVORADO from ICON model forecasts, manipulate its setup, and analyze its output

Course description:

This short course is targeted towards observational and theoretical cloud microphysics researchers. It covers 1) aspects of polarimetric radar observations and 2) aspects of cloud microphysics parameterizations in NWP models and associated forward operators for synthetic observations. The two parts of the course are technically independent, but participants are welcome to take part in both.

Cloud and precipitation processes are still a main source for uncertainties in weather prediction and climate change projections, and radar observations available at different frequencies including Doppler and polarimetric capabilities are a primary resource to improve our understanding of precipitation generating processes and for optimizing NWP models on a national scale. The course gives insights in microphysical process fingerprints inherent in volumetric polarimetric weather radar measurements as well as vertically-pointing cloud radar observations and provides hands-on experience with an efficient polarimetric forward operator

for in-depth NWP model evaluation in observation space as well as with state-of-the-art cloud-radar Doppler spectra analysis techniques for deeper insights into ice-microphysical processes.

Teachers: Silke Trömel (chair) - Ulrich Blahak - Heike Kalesse-Los - Jana Mendrok - Martin Radenz - Patric Seifert - Teresa Vogl

Program:

Time	Content	Speaker/Chair	Duration
08:30	Course registration		*30 mins*
09:00	Introduction on microphysical fingerprinting (20 min) Introduction on cloud radar Doppler spectra (40 min)	Silke Heike, Patric	*1 hour*
10:00	Coffee break		*30 min*
10:30	Doppler spectra hands-on session in VirtualBox environment - Accessing and obtaining the Python packages peakTree and Peako from Github - Obtaining the training datasets from Mira-35 and RPG-94-FMCW cloud radars - Application of peakTree and PEAKO to the training datasets - Processing and visualization of the output from peakTree and PEAKO	Heike, Martin, Patric	*2 hours*
12:30	Lunch break		*1h*
13:30 *14:00*	Wrap up of Doppler spectra session Introduction on polarimetric forward modeling with EMVORADO - Design and capabilities of EMVORADO - Licensing and installation EMVORADO Hands-on session (Part 1) - Setting up and running EMVORADO from ICON/COSMO output - Defining the radar measurements (station location, wavelength, scanning pattern)	Heike, Patric Uli, Jana Uli, Jana	*2 hours*

15:30	Coffee break		*30 min*
16:00	EMVORADO Hands-on session (Part 2) - Modifying EMVORADO setup to analyze forward operator assumptions/uncertainties (e.g., hydrometeor melting, hydrometeor shape, effective medium assumptions on dielectric properties) - Visualize EMVORADO output and analyze according microphysical fingerprints	Uli, Jana	*1.5 hours*
17:30	Closing time.		

References

- Kalesse-Los et al., 2019, Development and validation of a supervised machine learning radar Doppler spectra peak-finding algorithm, AMT, https://doi.org/10.5194/amt-12-4591-2019
- Radenz et al., 2019, peakTree: a framework for structure-preserving radar Doppler spectra analysis, AMT, https://doi.org/10.5194/amt-12-4813-2019
- Blahak and de Lozar, 2021, EMVORADO - Efficient Modular VOlume scan RADar Operator. A User's Guide, Deutscher Wetterdienst, http://www.cosmo-model.org/content/model/documentation/core/emvorado_userguide_dualpol.pdf