UNIVERSITÄT LEIPZIG

TROPOS
Leibniz Institute for Tropospheric Research

Polarimetry Influenced by CCN aNd INP in Cyprus and Chile (PICNICC)

An assessment of hemispheric contrasts in polarimetric Doppler cloud radar observations and its relation to differences in aerosol load

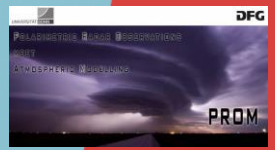
SPP meeting, October 15, 2020

PIs: Heike Kalesse, Patric Seifert, Johannes Quaas

PhD students: Teresa Vogl (Uni Leipzig), Audrey Teisseire (TROPOS)

Collaborators: Rodanthi Mamouri (Cyprus University of Technology, Limassol, Cyprus), Boris Barja (University of Magallanes, Punta Arenas, Chile)
Many other PhDs and researchers at TROPOS and LIM

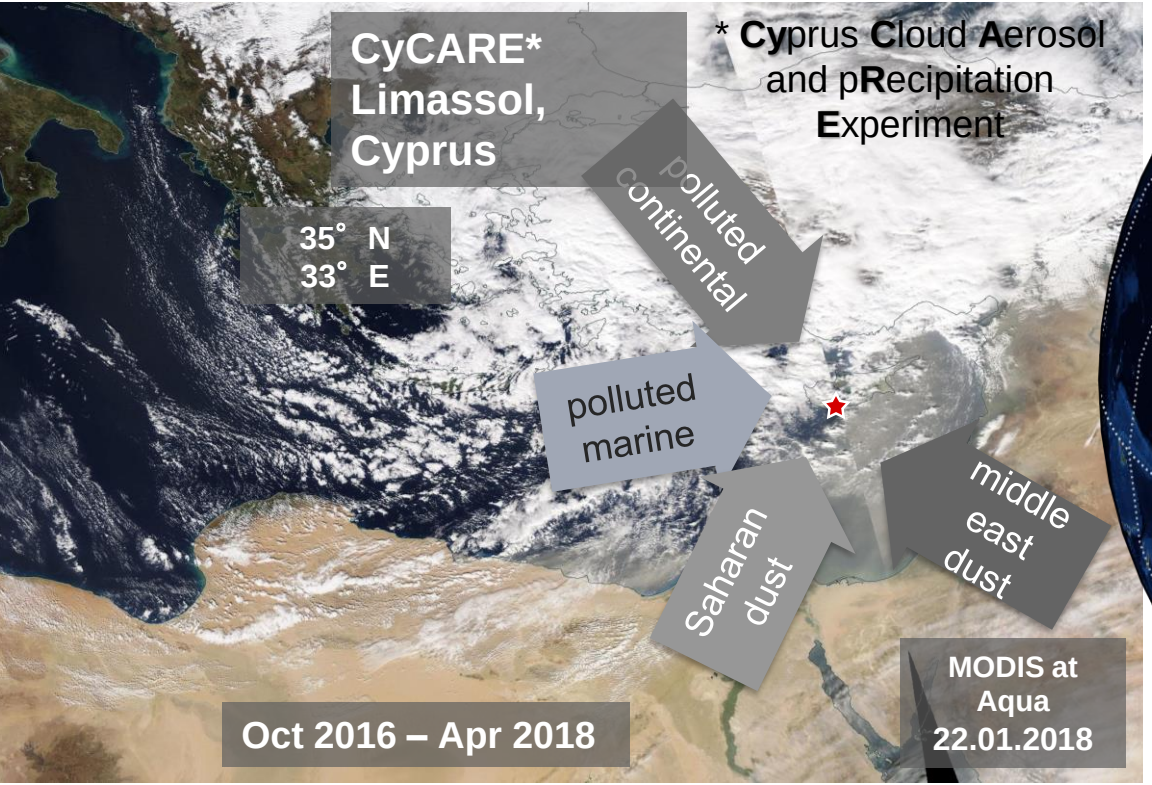
DACAPO PESO
Dynamics, Aerosol, Cloud and Precipitation Observations in the Pristine Environment of the Southern Ocean

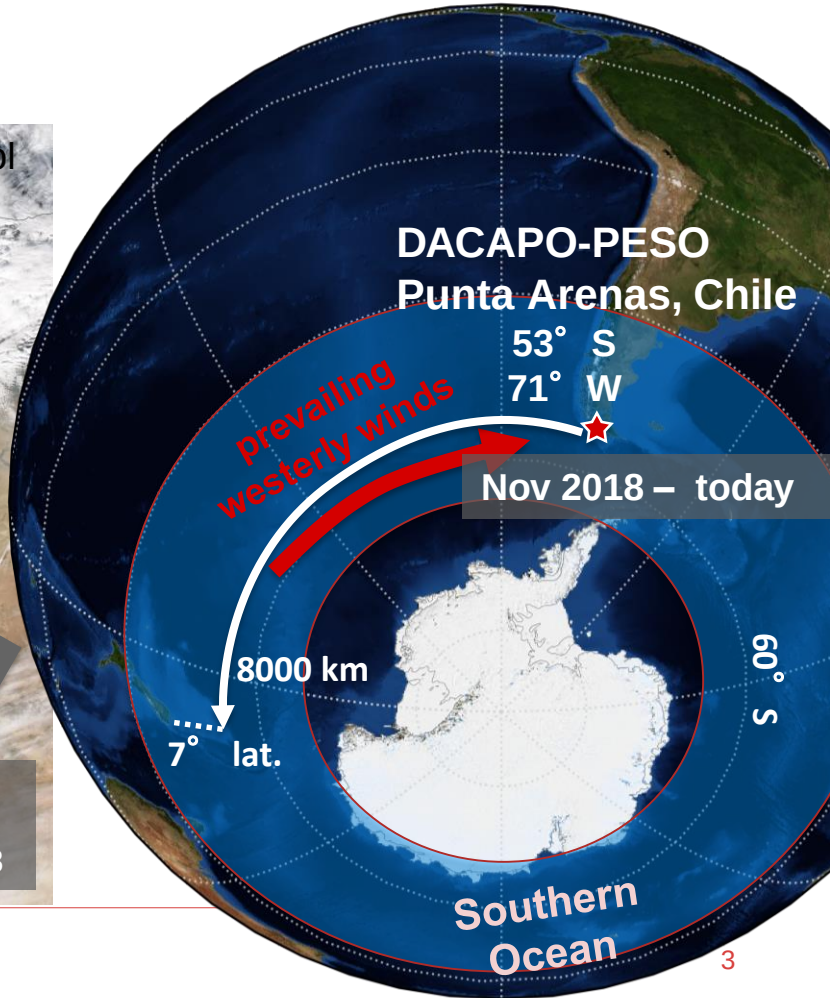


OUTLINE

1. Motivation + Hypothesis + field campaigns
2. Status Report PhD1 – Teresa Vogl
3. Status Report PhD2 – Audrey Teisseire

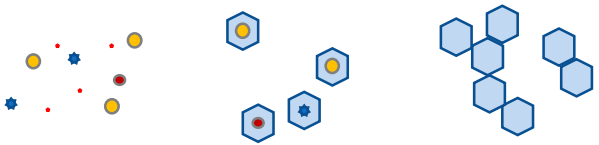
CHARACTERIZING MIXED-PHASE CLOUD MICROPHYSICS IN CONTRASTING AEROSOL CONDITIONS



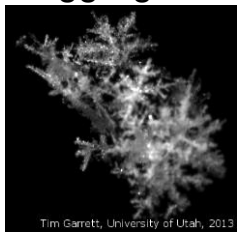


HYPOTHESIS: MICROPHYSICAL GROWTH PROCESSES IN MIXED-PHASE CLOUDS ARE SUSCEPTIBLE TO AEROSOL PERTURBATIONS

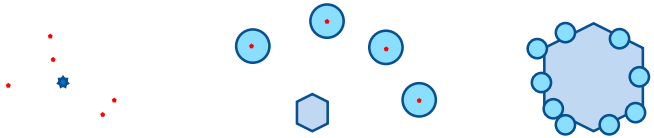
1. High aerosol loads and high INP concentrations → higher ice crystal concentrations → more aggregation



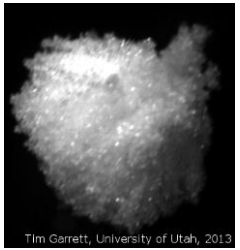
aggregate



2. Low aerosol loads and scarcity of INP → thicker/ more persistent supercooled liquid layers → more riming



rimed ice particle

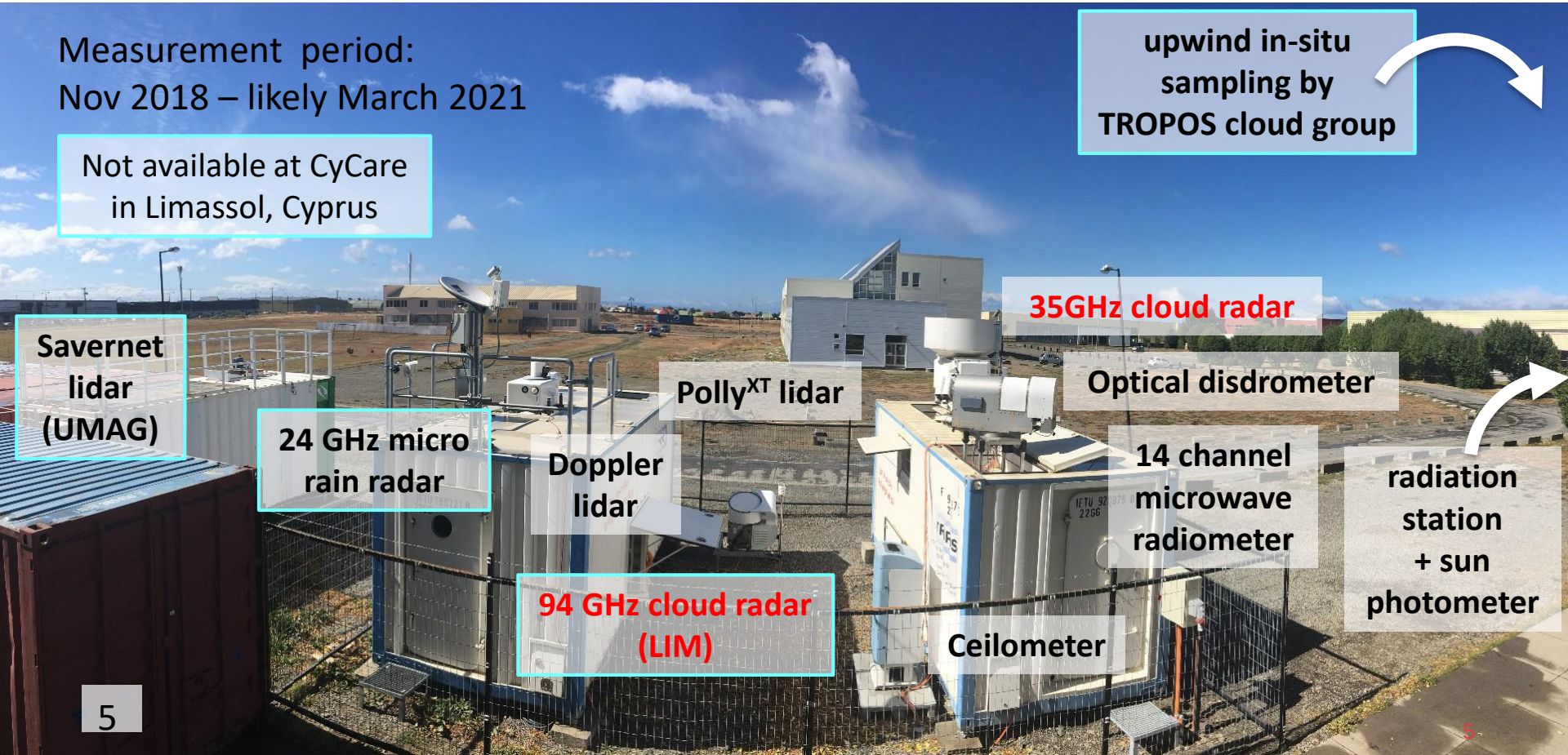


www.inscc.utah.edu/~tgarrett/Snowflakes/Gallery/

LACROS at Punta Arenas, Chile

LACROS: Leipzig Aerosol and Cloud Remote Observation System

DACAPO PESO — Dynamics, Aerosol, Cloud and Precipitation Observations in the Pristine Environment of the Southern Ocean



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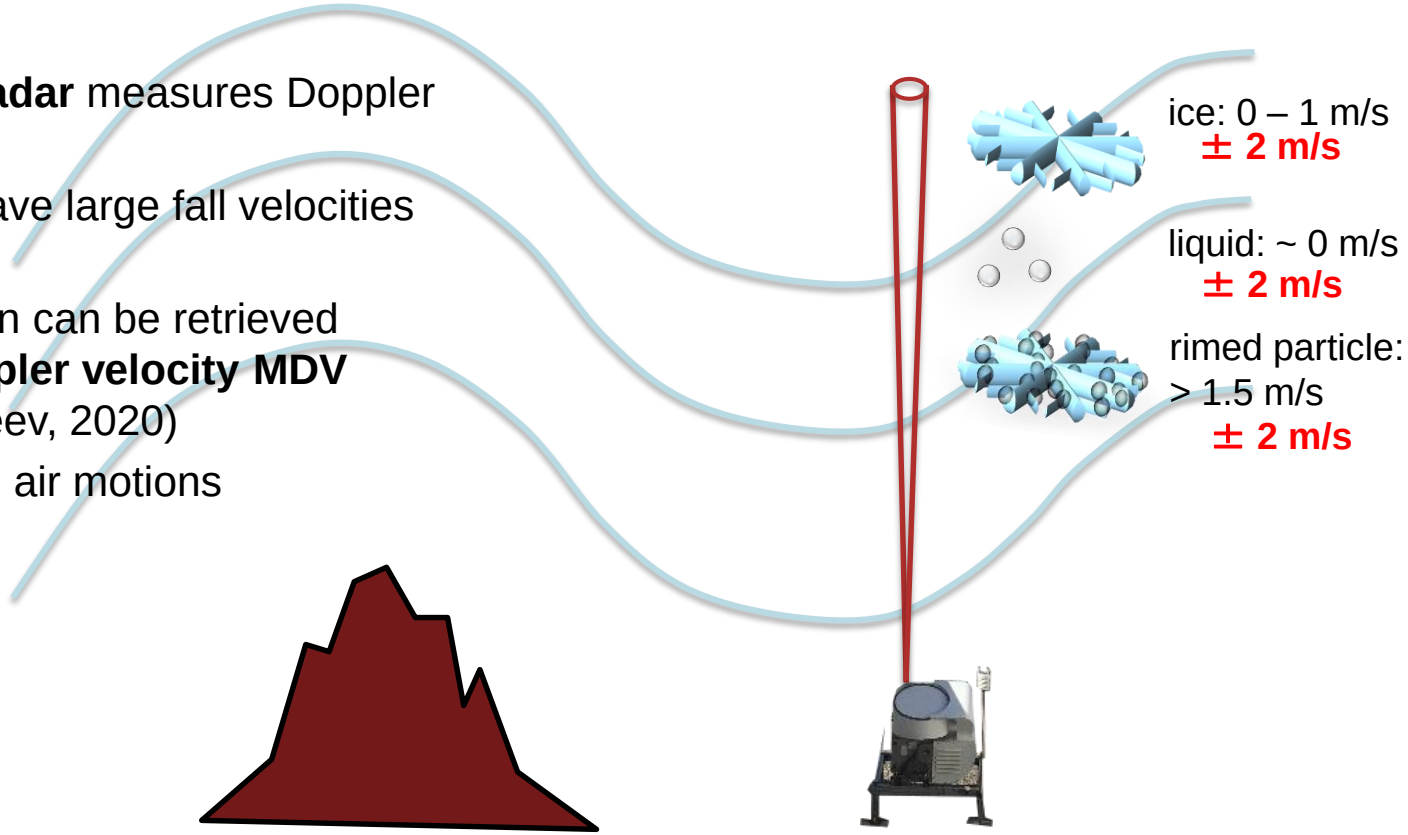
Investigating hemispheric differences in aerosol signatures in mixed-phase cloud processes with spectral polarimetric cloud radar observations

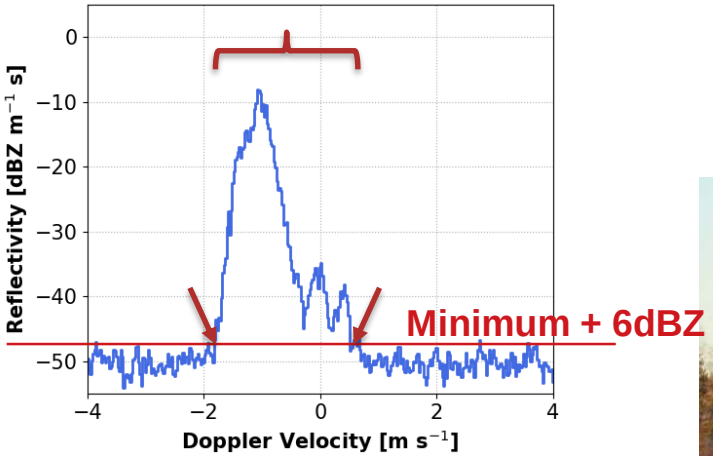
PhD student (1) : ***Teresa Vogl***
Supervisors : *Heike Kalesse, Patric Seifert*
& lots of help from: *Stefan Kneifel, Maximilian Maahn, Dmitri Moisseev*

FIRST STEP: DETECTING RIMING… WITHOUT USING MDV

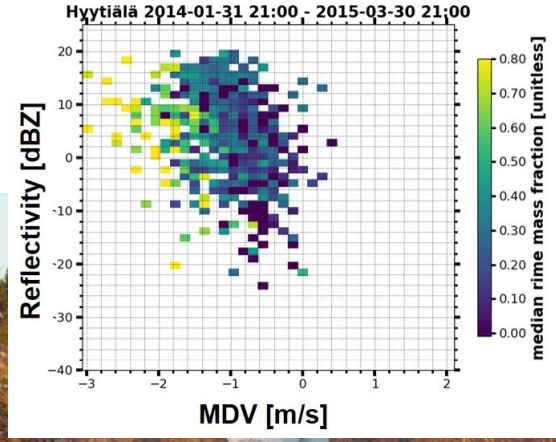
- **ground-based radar** measures Doppler velocity
- rimed particles have large fall velocities **> 1.5 m/s**
- rime mass fraction can be retrieved using **mean Doppler velocity MDV** (Kneifel & Moisseev, 2020)
- **Problem**: vertical air motions

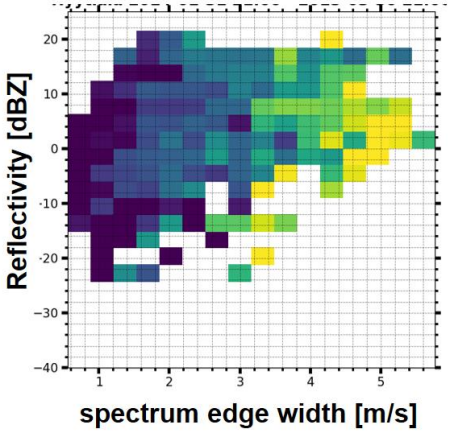


FIRST STEP: DETECTING RIMING… WITHOUT USING MDV



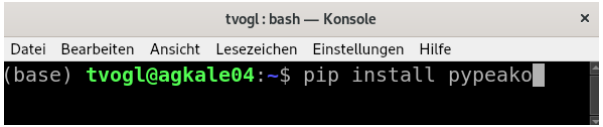
Newly defined measure of width of the spectrum: „spectrum edge width“



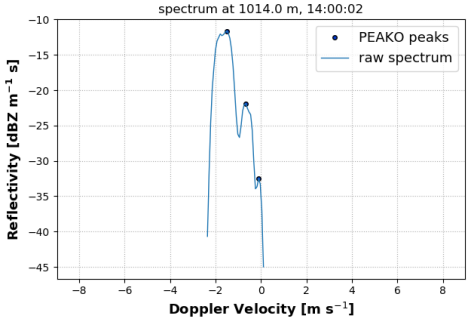


NEXT STEPS…

- **Comparison of riming detection to existing methods; application year-long data sets**



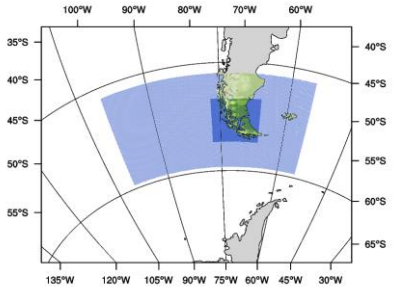
PEAKO : supervised machine learning peak detection utility



- **Publishing PEAKO Python package on PyPI**

Kalesse, Vogl, Paduraru and Luke (2019):
Development and validation of a supervised machine learning radarDoppler spectra peak-finding algorithm

- **First ICON runs with additional tracer variables for rime mass added by Axel Seifert**



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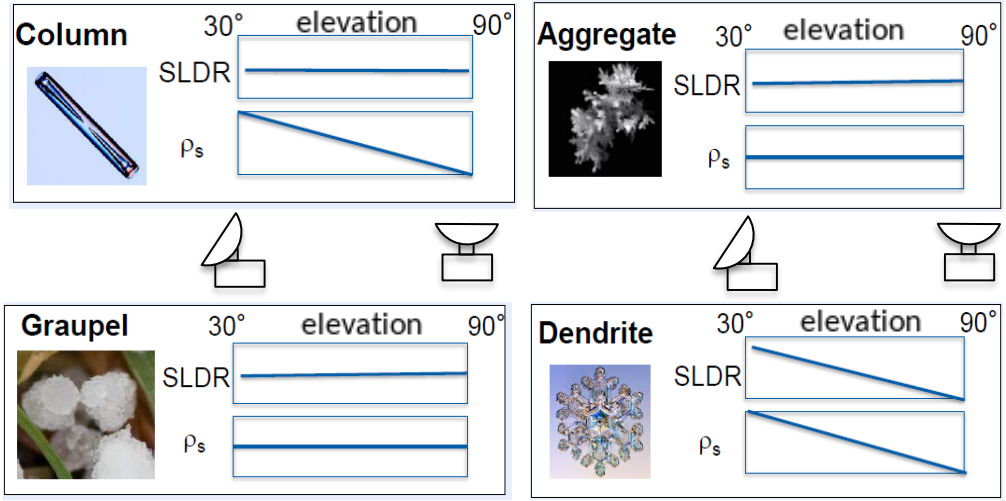
Investigation of the susceptibility of mixed-phase cloud processes to aerosol perturbations with scanning SLDR-mode cloud radar

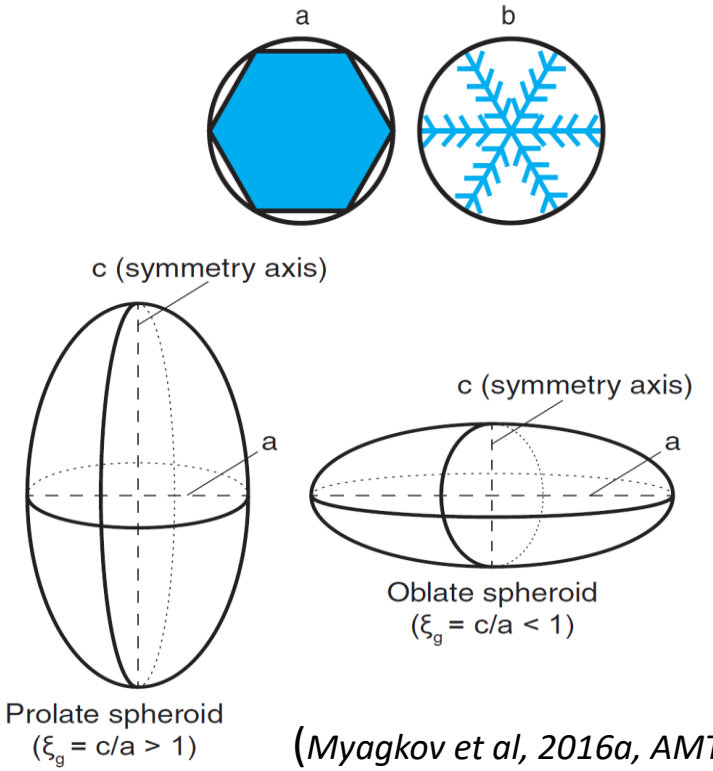
PhD student (2) : ***Audrey Teisseire***
Supervisors : *Patric Seifert, Heike Kalesse*

Shape estimation of particles

Unique relationship between: SLDR, ρcx antenna elevation angle and particle shape



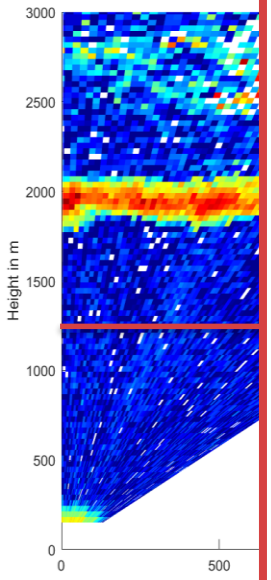
Particle shape assumed to be spheroidal

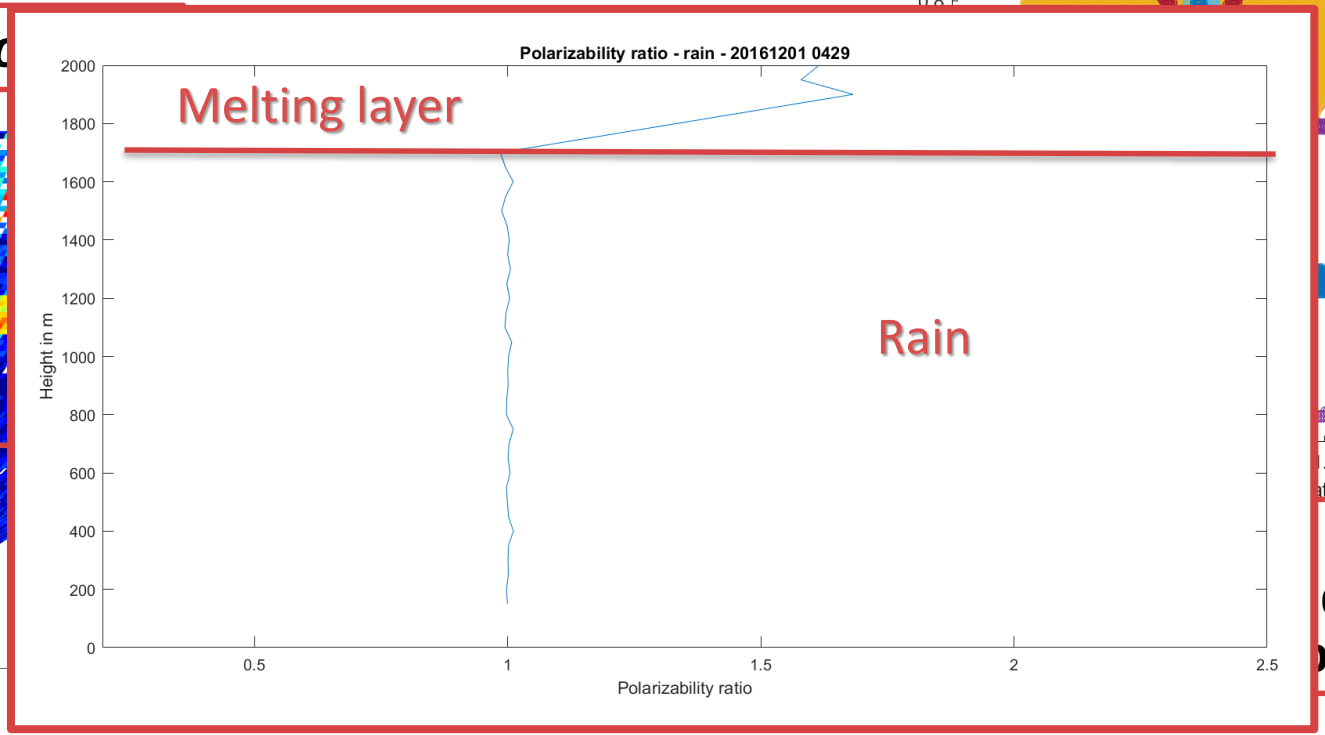


(*Myagkov et al, 2016a, AMT*)

Calibration and testing done: Shape estimation of particles

RHI scan of SLDR from 1 December 2016, 04:29 UTC, Limassol, Cyprus





center on 1
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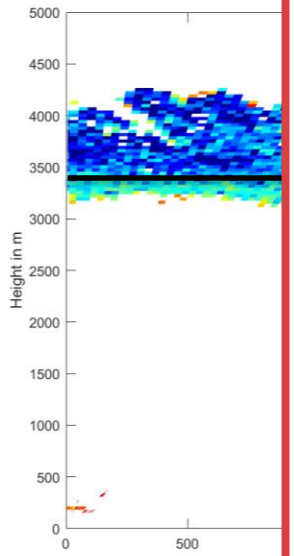
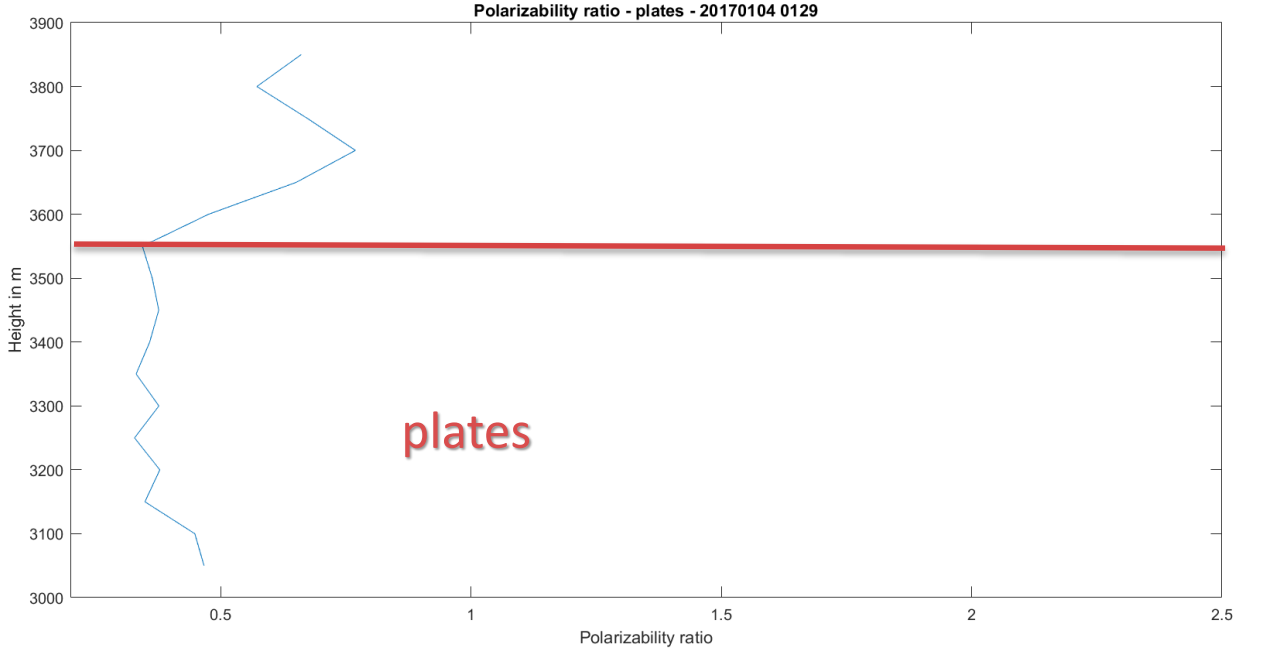
particles

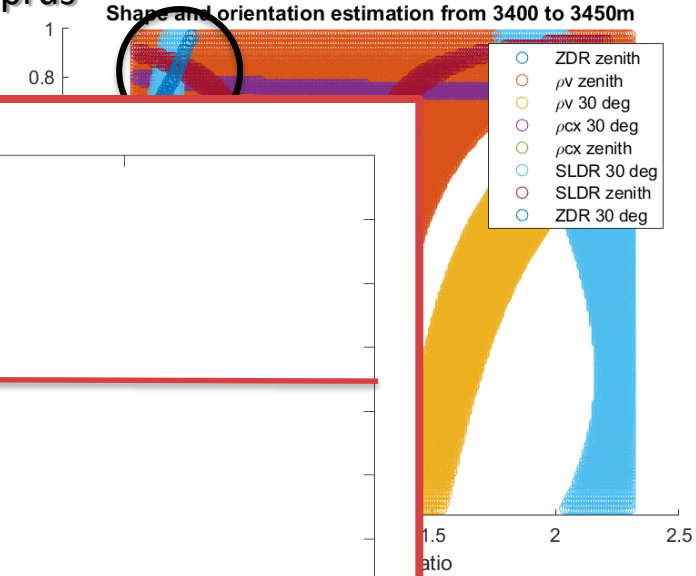
Calibration and testing done: Shape estimation of particles

RHI scan of SLDR from 4 January 2017, 01:29 UTC, Limassol, Cyprus

Dendritic







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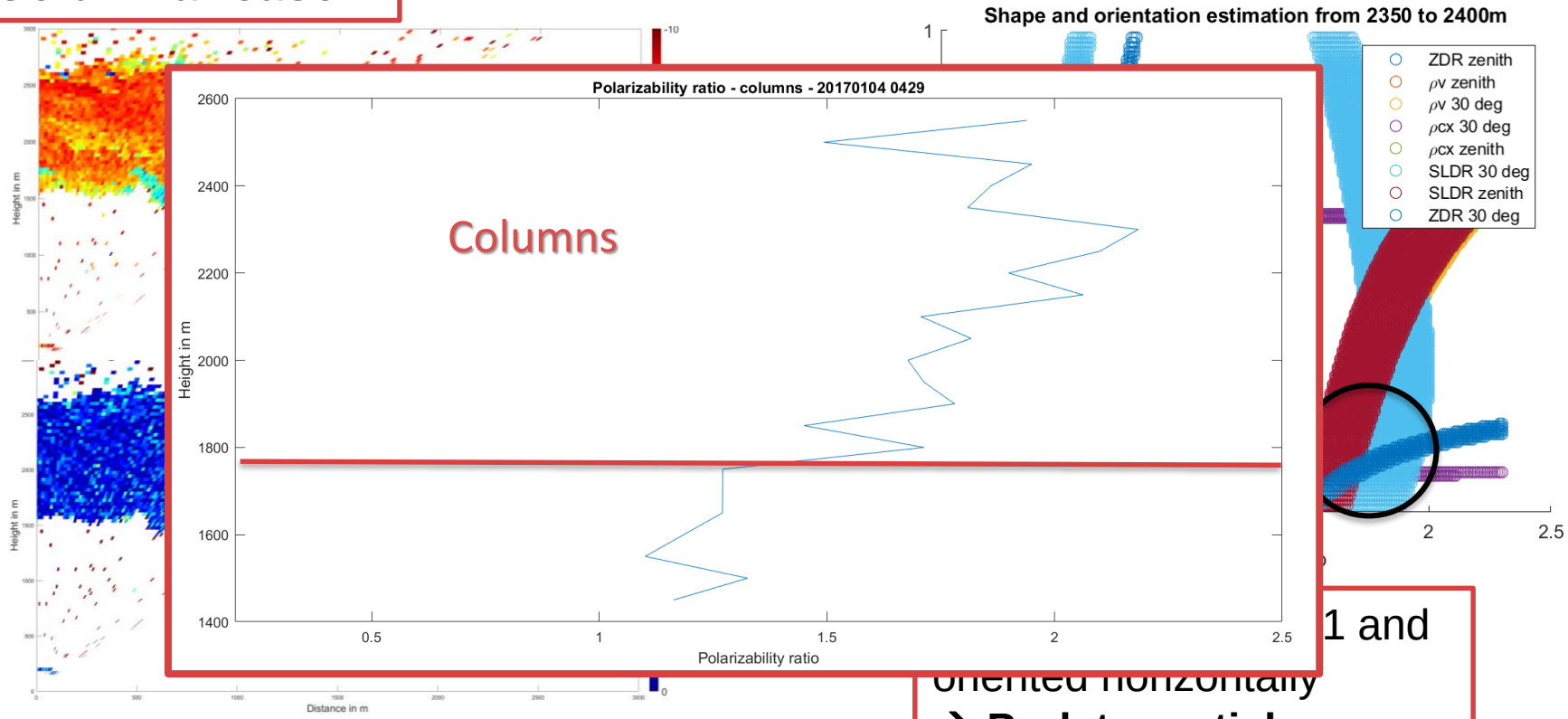
Calibration and testing done: Shape estimation of particles

Columnar case

RHI scan of SLDR from 4 January 2017, 04:29 UTC, Limassol, Cyprus

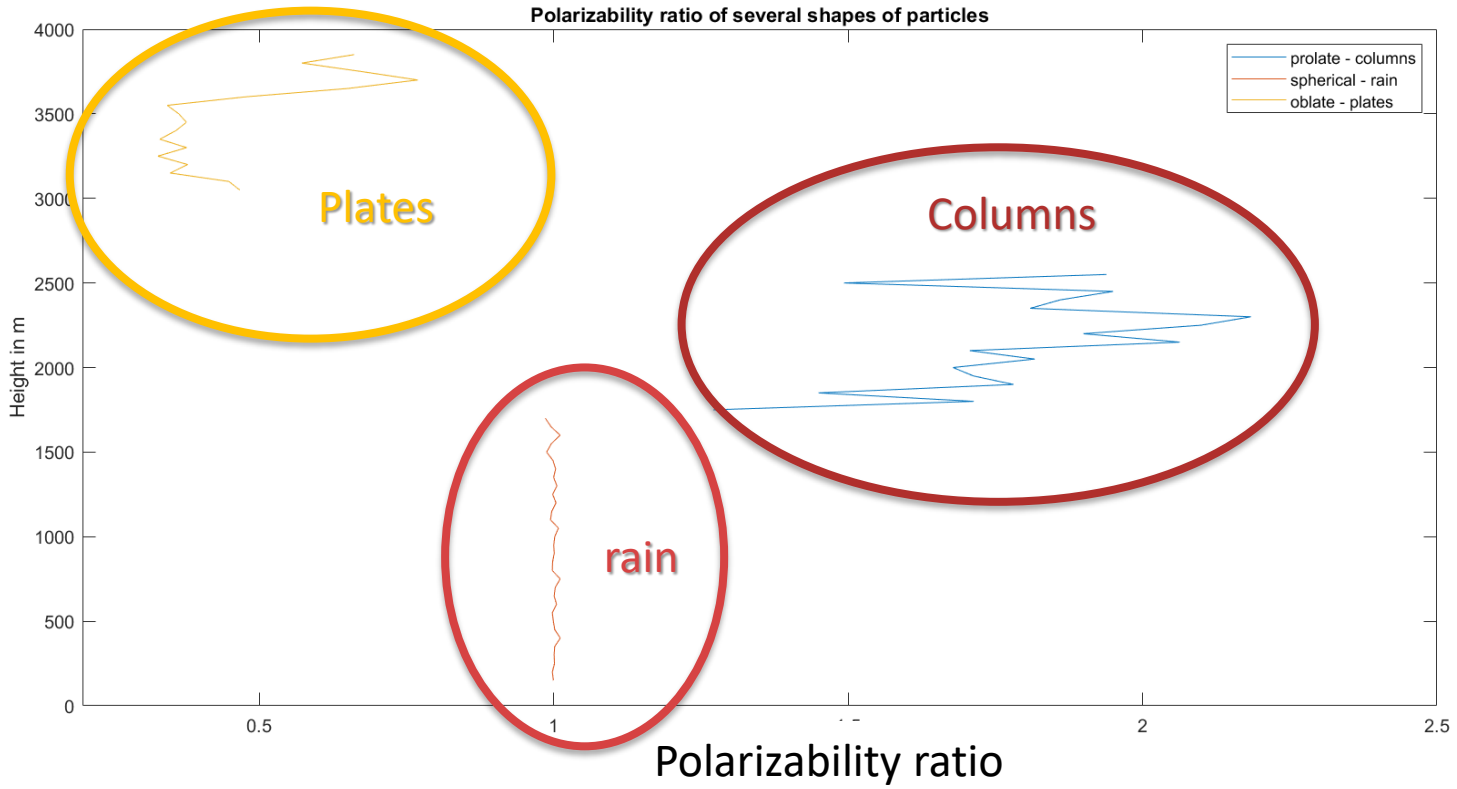


1 and

oriented horizontally

→ **Prolate particles**

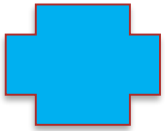
Calibration and testing done: Shape estimation of particles



Summary

DONE

- Calibration of level 0 data (Metek pdm files)
- Shape estimation algorithm



Current work

- Shape estimation algorithm evaluation
- Shape estimation algorithm automatization

Future work

- Statistics for CyCARE and DACAPO-PESO
- Riming and aggregation detection

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Thank you

Thanks a lot to Alexander Myagkov and Matthias Bauer for their support