Deutscher Wetterdienst
Wetter und Klima aus einer Hand

Universität zu Köln

PROM - IMPRINT

Understanding Ice Microphysical Processes by combining multi-frequency and spectral Radar polarImetry aNd super-parTicle modelling

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Motivation and Objectives

Main Goal:

Develop strategy to improve understanding of key **ice microphysical process** (Depositional Growth, Secondary Ice Production, Riming, Aggregation) using rich information provided by polarimetric observations

Strategy and Working Areas:

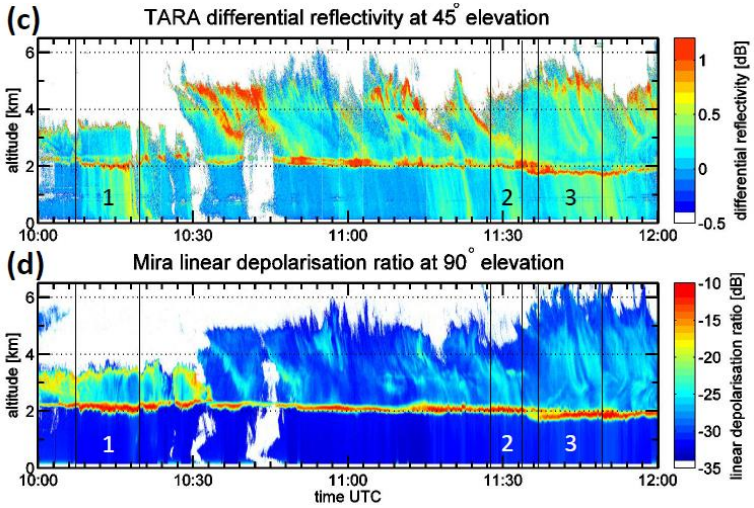
- **WA 1: Novel Polarimetric Observations**
- **WA 2: Monte-Carlo Lagrangian Particle Model (McSnow)**
- **WA 3: Polarimetric 1D Radar Forward Operator (PAMTRA-pol)**

Team:

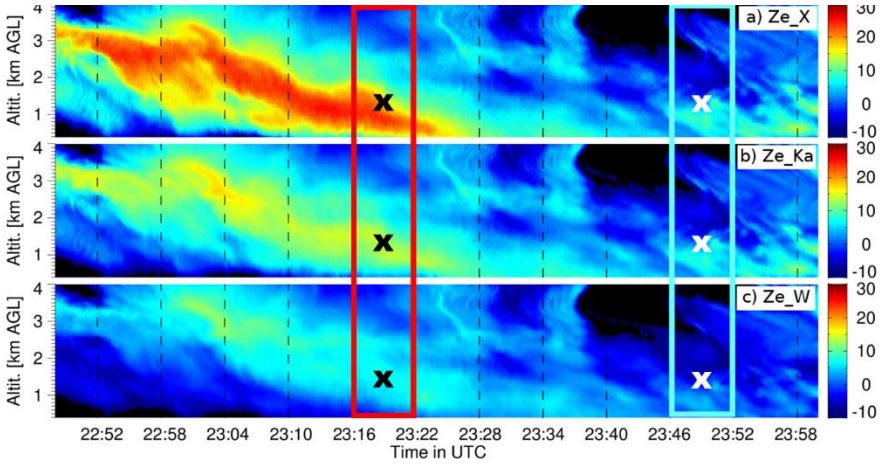
- 1 PostDoc (Christoph Siewert, DWD), 1 PhD (N.N., Uni Cologne)

Common radar approaches to explore IMP

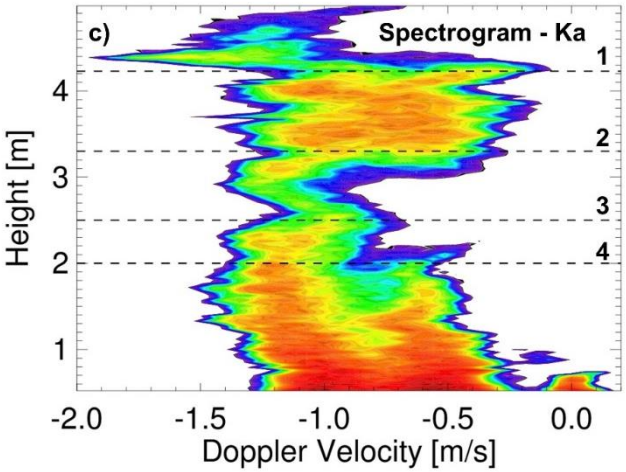
Polarimetry



Multi-frequency



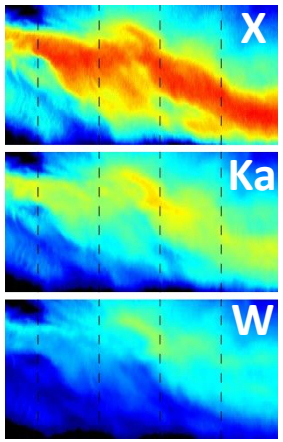
Doppler Spectra



Combination of different radar methods is probably most promising to really narrow down IMPs.

Synergistic observations at/around JOYCE-CF

Proposed polarimetric, multi-frequency, Doppler spectra radar campaign setup at JOYCE-CF



80 km

200 m

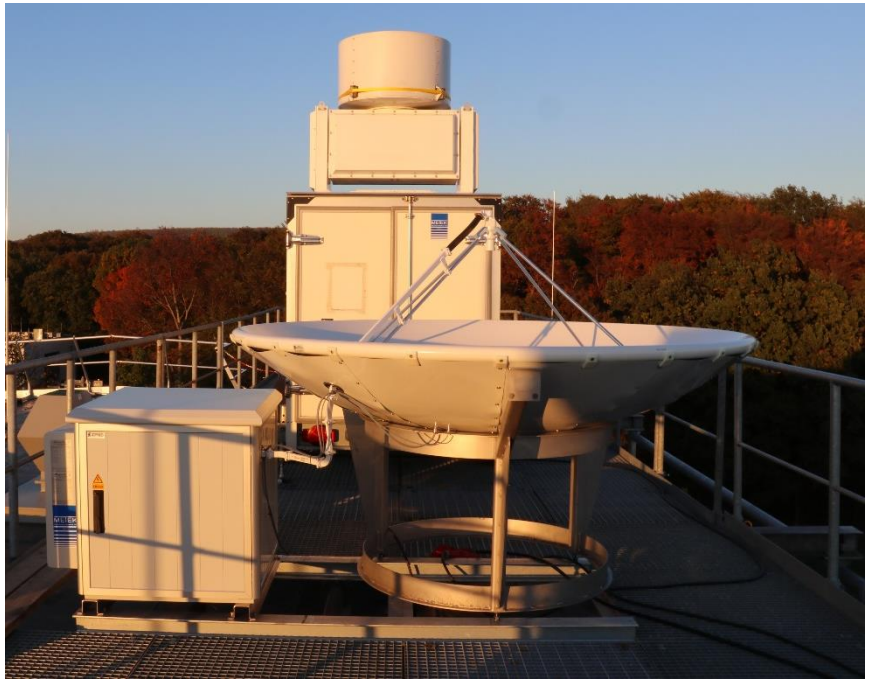
50 km

Jülich Column (JuCol) ⟷ 3.8 km ⟷ Sophienhöhe

Radar	Band	Polarimetry	Spectra	Beam-width	Scanning	Resolution
Joyrad-10	X	**No**	Yes	1°	No	30m
Joyrad-35	Ka	**LDR**	Yes	0.6°	Yes	30m
RPG-94-DP	W	**Full**	Yes	0.6°	Yes	5..30m
Ju/BoXPOL	X	**Full**	No	1°	Yes	100m
DWD-Essen	C	**Full**	No	1°	Yes	250m/1km

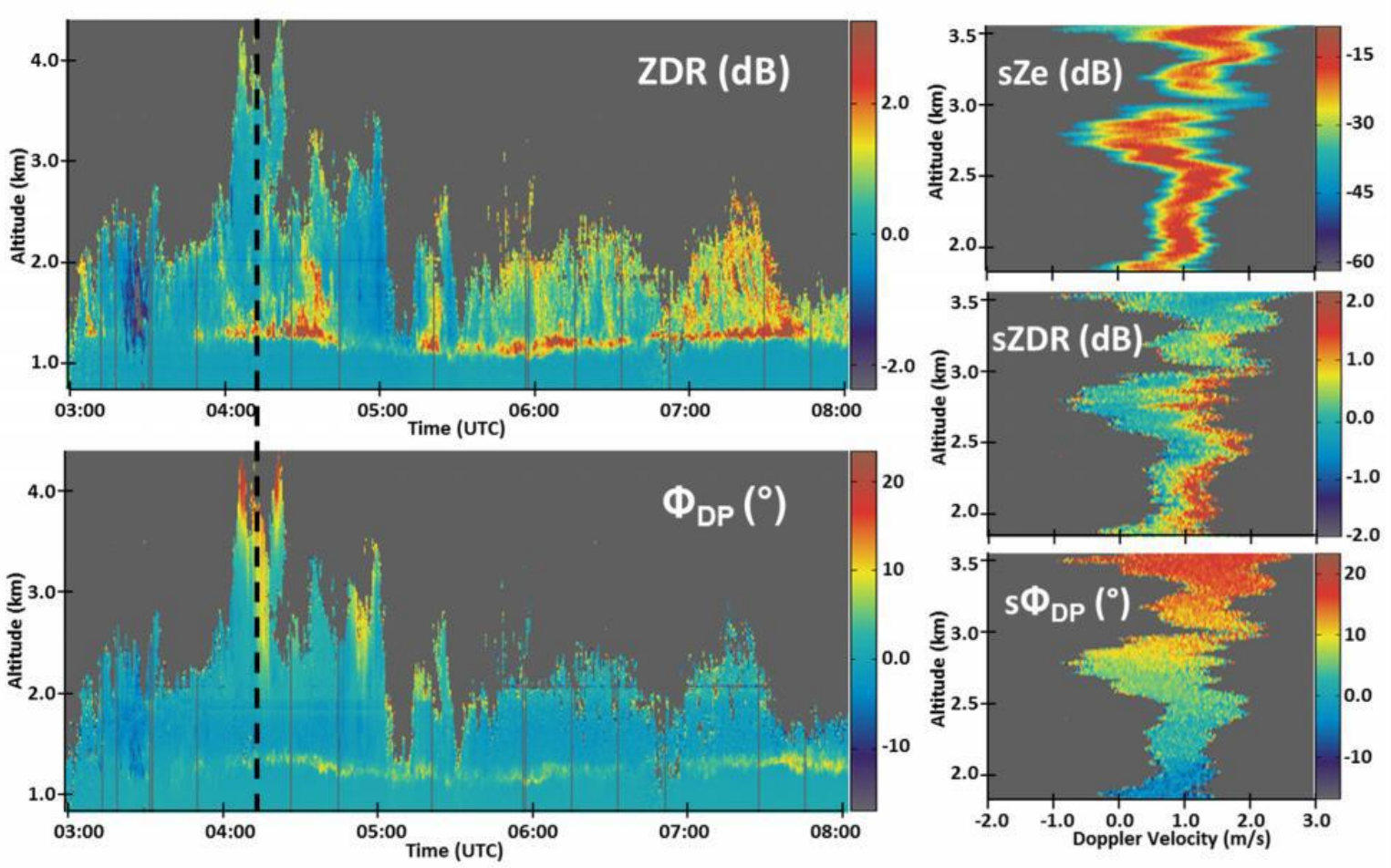
Synergistic field campaigns

- First of two campaigns already planned for Nov. 2018 – March 2019, full setup!
- X-Band Profiler (JOYRAD-10) just installed last week



Example: Spectral polarimetry

- Detection of **particle mixtures**
- **Mapping of polarimetric signal** to particle sizes/populations

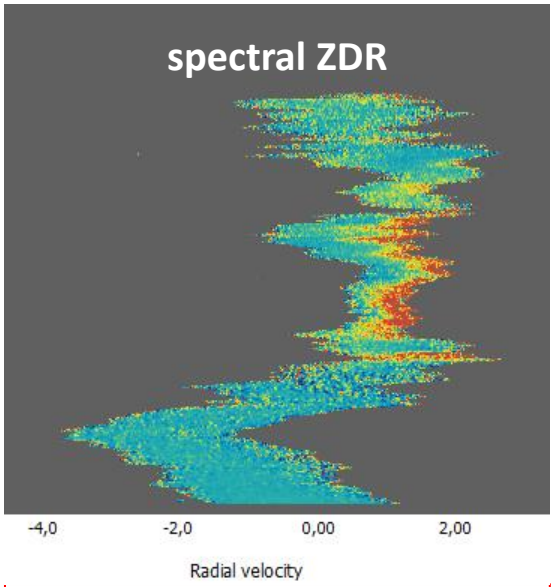


Forward operator and realistic scattering properties (Uni Cologne)

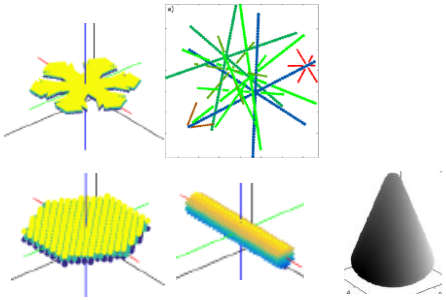
McSnow 1D model output

detailed ice µ-phys

PAMTRA – 1D spectral (polarimetric) radar forward operator



Synthetic Multi-frequency polarimetric radar Doppler spectra and moments



Realistic scattering properties

- Start with T-Matrix (easy to handle, widely used)
- Later include Lu et al., 2017 Database
- DDA simulations for what is missing