

JOYCE-CF **Jülich Observatory for Cloud** **Evolution.**

A core facility for
long-term cloud and precipitation
observations

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What is JOYCE-CF?



- JOYCE-CF is an advanced setup of ground-based remote sensing observations with the focus on clouds and precipitation processes
- Cooperation of the Universities of **Bonn** and **Cologne** and the **Research Center Jülich**

Why JOYCE-CF?

Lack of understanding: from water vapor → aerosol
→ clouds → precipitation under different
atmospheric & surface conditions



Equally important for

- climate research
- forecasting applications

JOYCE-CF includes 3 Sites..

BoXPol: polarimetric X-band radar in Bonn

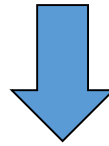
JuXPol: polarimetric X-band radar Sophienhöhe
(close to Jülich)

JuCol: extended column observations at Jülich



DFG Core Facility

DFG portal RIsources (RI = Research Infrastructure)



<http://risources.dfg.de/>

provide researchers with **information** on instrumentation offerings, scientific services, libraries, data repositories and scientific collections.

Goals of JOYCE-CF:

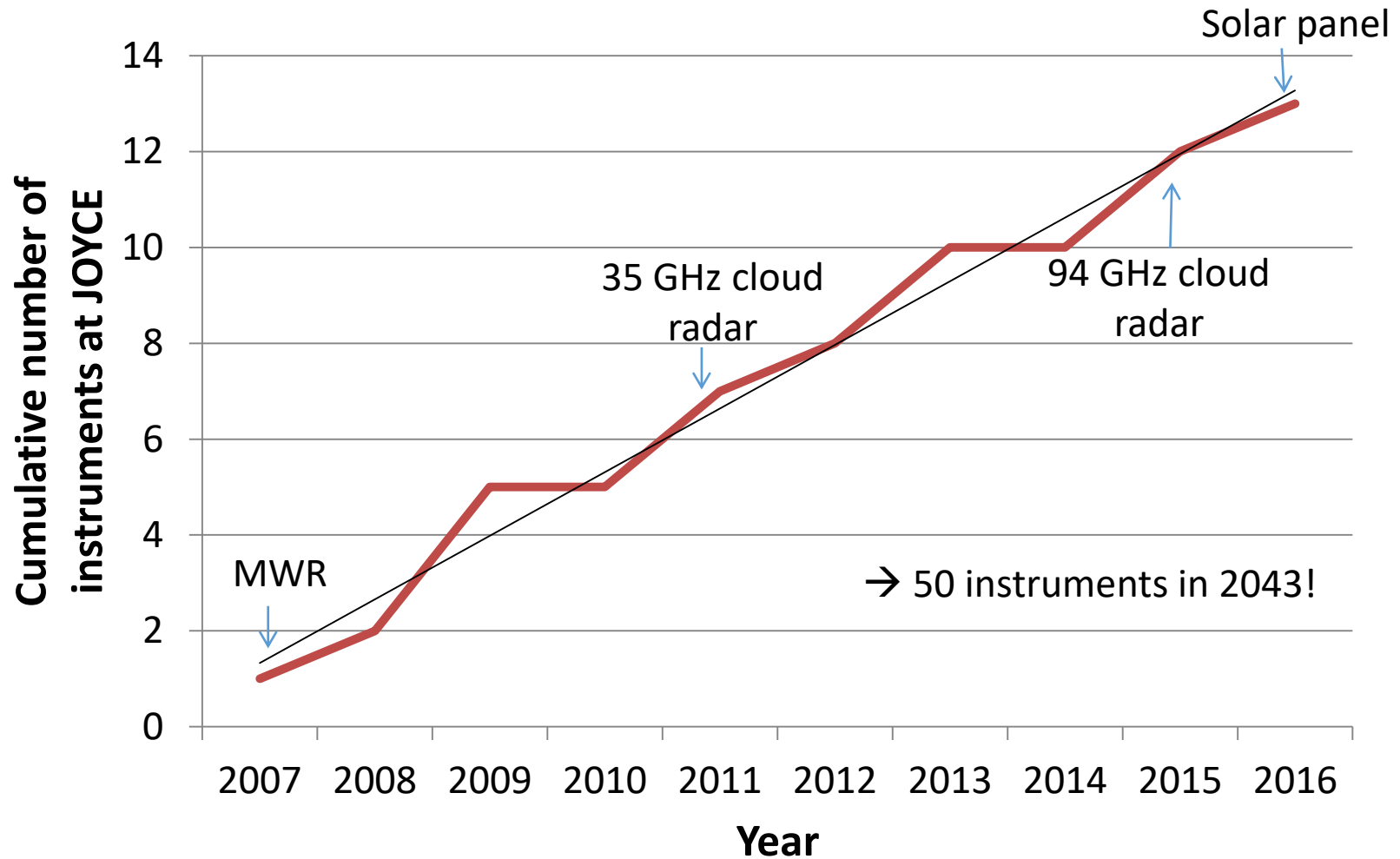
Provide sustainable infrastructure for ground-based remote sensing of clouds and precipitation, with high quality long-term reference observations, open to external users

JuCol Instrumentation today

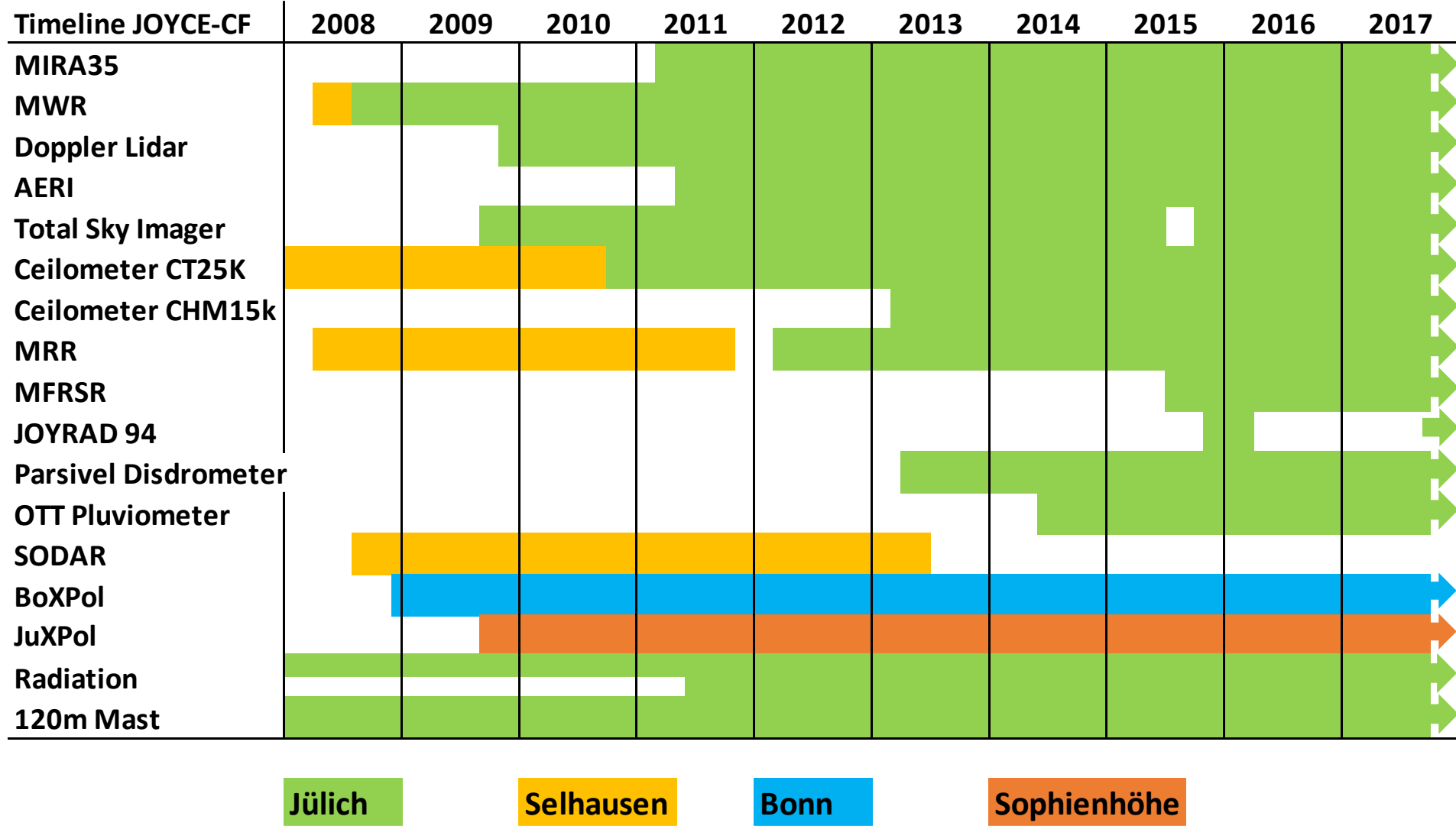
- Scanning 35 GHz cloud radar MIRA¹
- Scanning 14 channel microwave radiometer² with IR pyrometer³
- Scanning Doppler wind lidar⁴
- Atm. emitted radiance interferometer⁵
- Total Sky Imager TSI⁶
- Laser ceilometer CT25K and CHM15k⁷
- Micro Rain Radar⁸, 94-GHz radar⁹
- Cimel sun photometer
- Max-DOAS¹⁰ ,Radiation sensors¹¹
- 120 m meteorological mast¹² including eddy covariance station



JOYCE: Continuous, Linear Growth



Timeline JOYCE-CF since 2008



Jülich

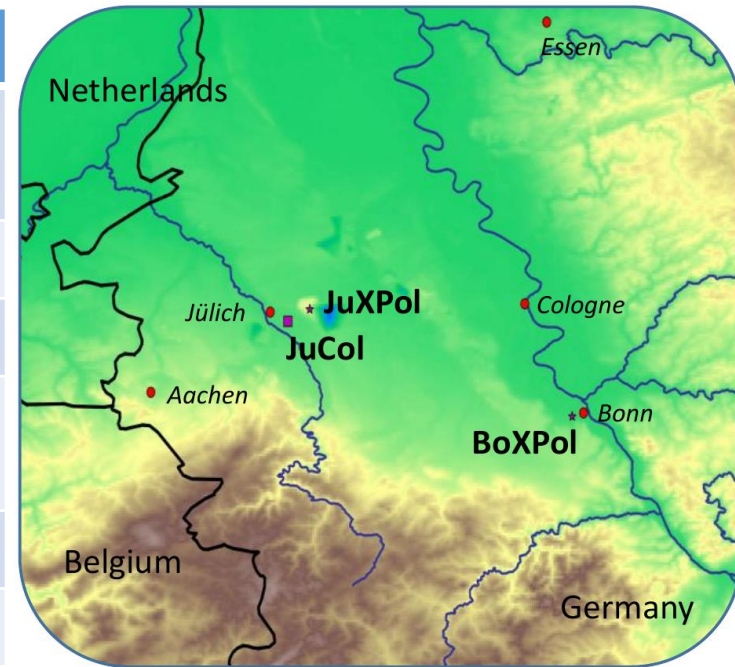
Selhausen

Bonn

Sophienhöhe

Core Instruments – BoXPol and JuXPol

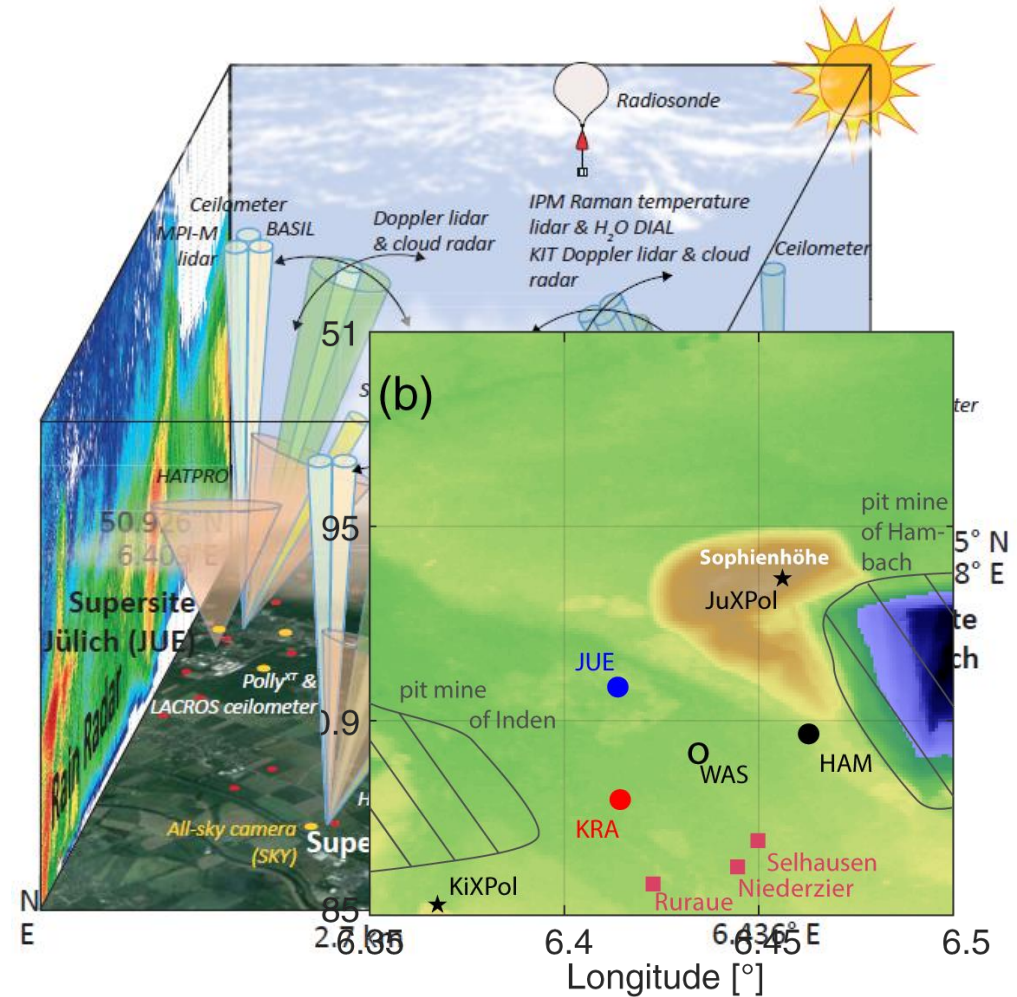
	BoXPol	JuXPol
Location (Lat./Lon.)	50.73052° / 7.071663°	50.92750° / 6.45626°
Height (m)	99	310
Frequency (GHz)	~ 9.3	~ 9.3
Type	EEC (DWSR-2001-X-SDP)	EEC (DWSR-2001-X-SDP)
Elevation	0° - 90°	0° - 90°
3-dB beamwidth	~ 1.05°	~ 1.1°
Signal Processor	Enigma3 Enigma4	Enigma3 Enigma4
Max range (km)	150	150
Special	Without radom	With radom



- 48 km distance between BoXPol and JuXPol
- JuXPol on artificial hill (open-pit-mining, industry)
- BoXPol in urban area (partial and full beam-blockage)

Projects and Campaigns at JOYCE-CF

- **HOPE – HD(CP)² Observation Prototype Experiment** (*Macke et al., 2017*) – 2 months intensive observations
- Observation of small-scale variability in the area around Jülich for model evaluation
- Deployment of instruments from other institutions (in total 3 supersites including TROPOS, KIT)
- Variability of solar radiation with pyranometer network
- Frequent radiosoundings



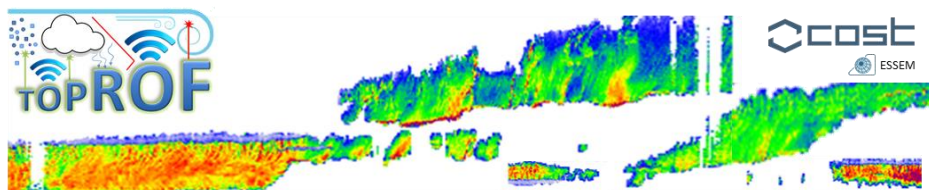
Ongoing projects at JOYCE-CF

- HD(CP)² Phase 2 – Supersite coordination
- TR32
- ET-CC (Energy Transition and Climate Change) -> cloud variability
- ACTRIS2 (Cloudnet), ACTRIS-PPP
- COST TOPROF
- Hans Ertel Zentrum (HErZ)

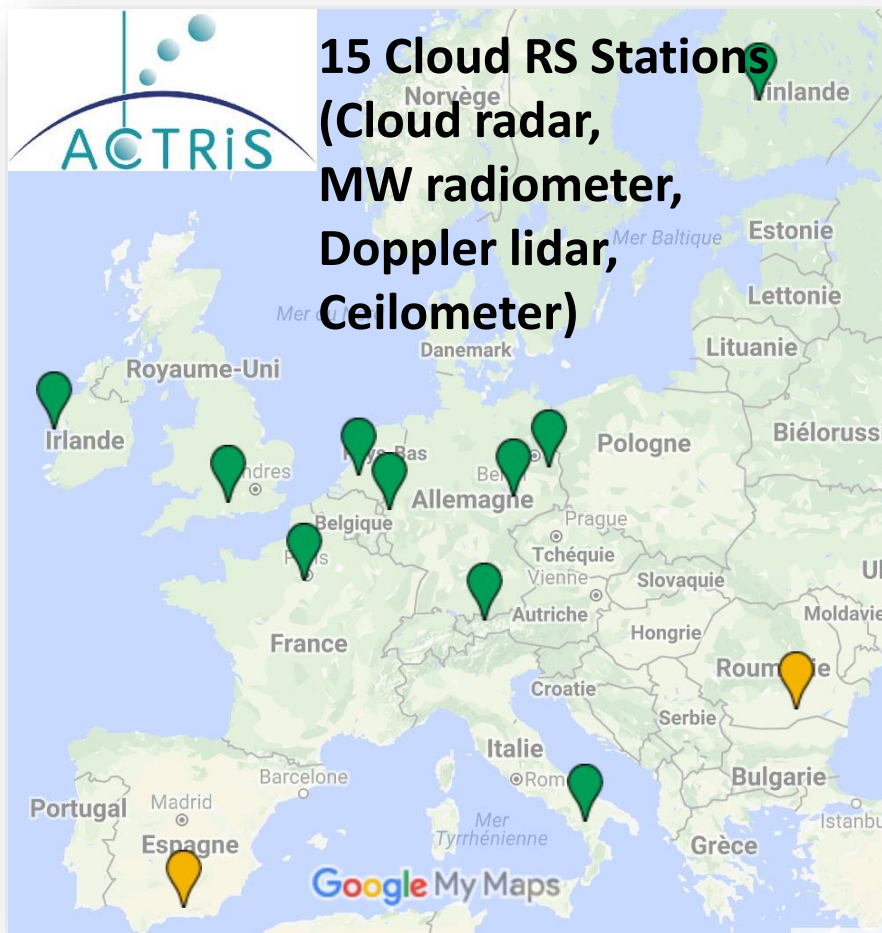


HD(CP)²

High definition clouds and precipitation
for advancing climate prediction

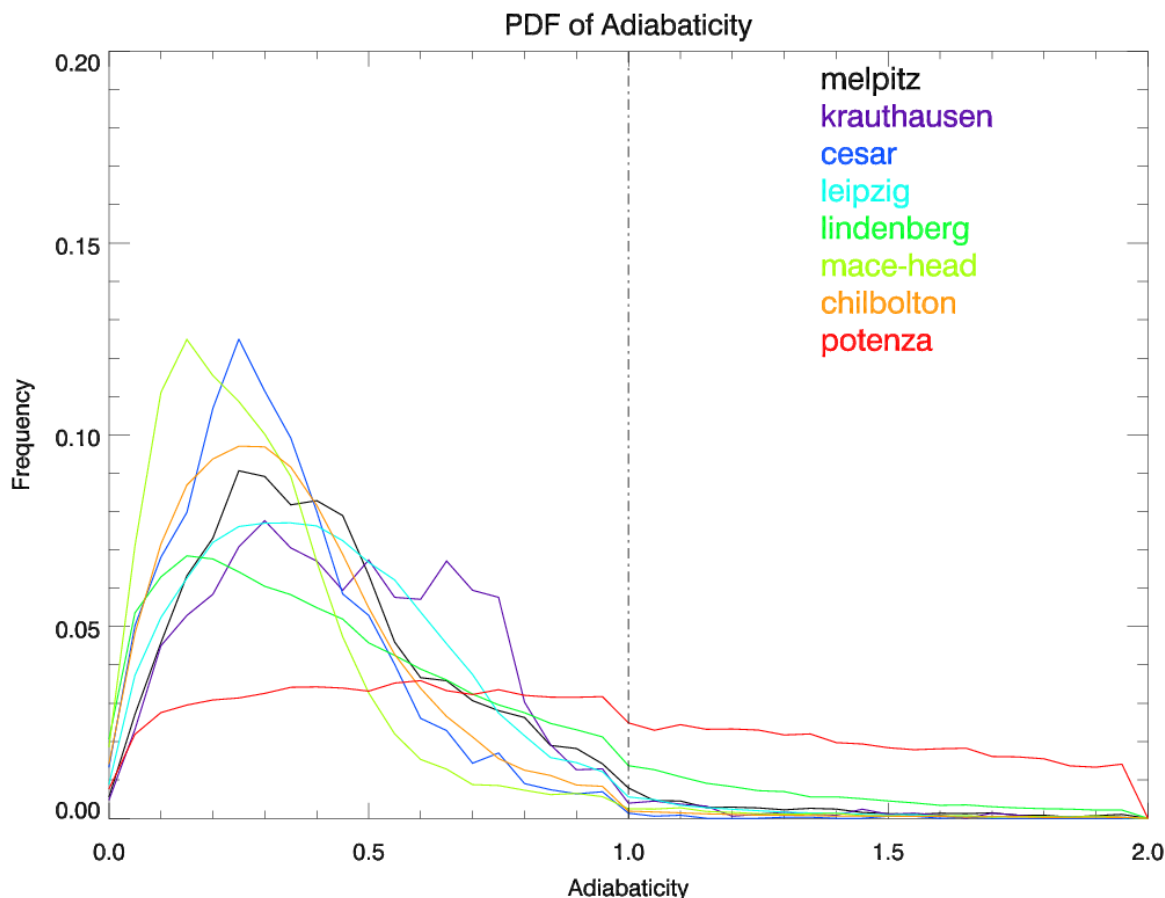


Networks (Cloudnet/ACTRIS)



- Network of operational MWR in Europe getting denser
- Within ACTRIS, every Cloudnet station needs to have a MWR
- For network activities, common calibration procedures and data quality important
- Calibration was not considered being the crucial issue until now > JOYCE-CF part of ACTRIS as topical center for MWR

Example: Cloudnet liquid water statistics



PDFs of cloud adiabaticity depend highly on accurate LWP from microwave radiometer

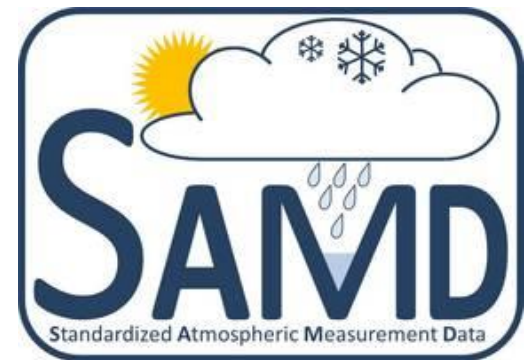
Potenza?
Lindenberg?

Common calibration and retrieval development needed!

Statistics over many years of Cloudnet obs., only single-layer non-drizzling and purely liquid clouds chosen!

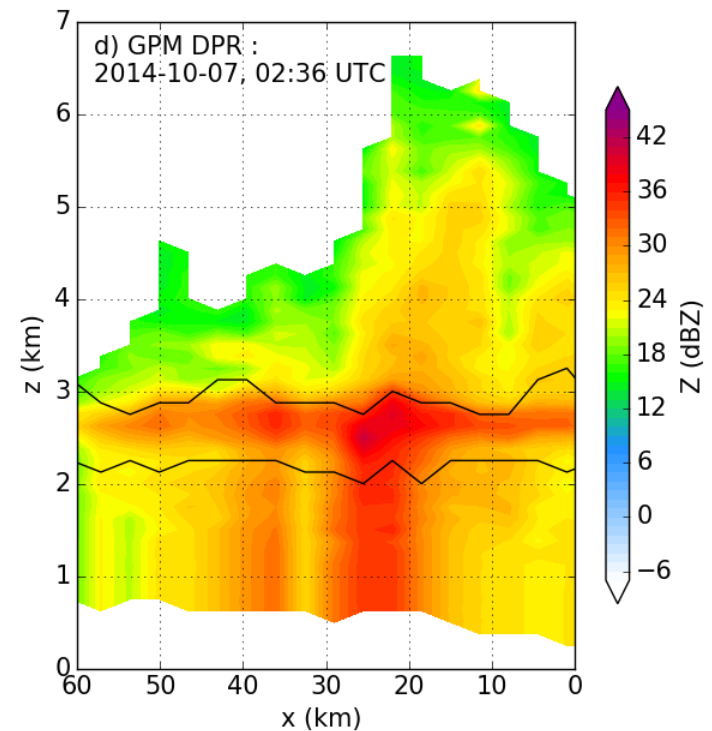
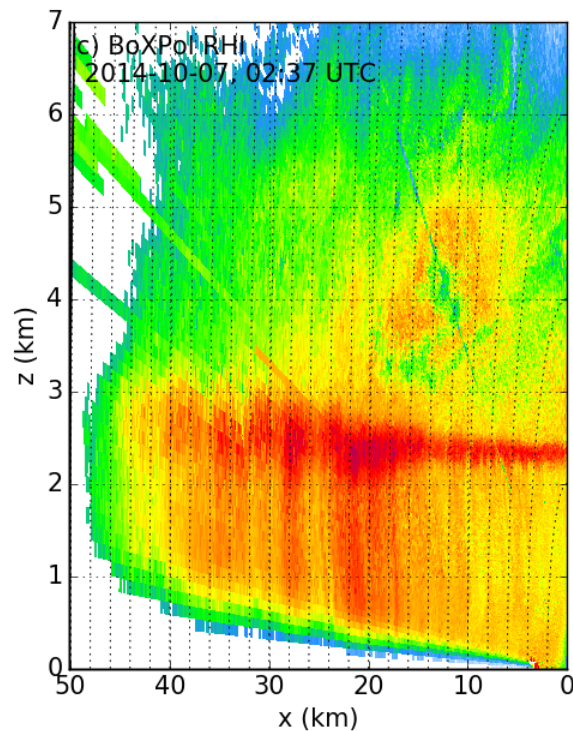
Access to data

- Data access is currently partly done via the SAMD portal (Standardized Atmospheric Measurement Data)
<https://icdc.cen.uni-hamburg.de/index.php?id=samd>
- In future all standardized products will be available via this data base
- Website <http://joyce.cloud> will list all data products and their access options
- Raw data (e.g. Radar spectra) will be available on request, also linked from higher level products on SAMD



State of the art studies

- Polarimetric synergy (Trömel et al. (2017))
- 3D Komposit
- River catchments
- GPM



Example: JOYCE & Radar Common Application

Multisensor Characterization of Mammatus

SILKE TRÖMEL,^a ALEXANDER V. RYZHKOV,^b MALTE DIEDERICH,^a KAI MÜHLBAUER,^a
STEFAN KNEIFEL,^c JEFFREY SNYDER,^b AND CLEMENS SIMMER^a

^a *Meteorological Institute, University of Bonn, Bonn, Germany*

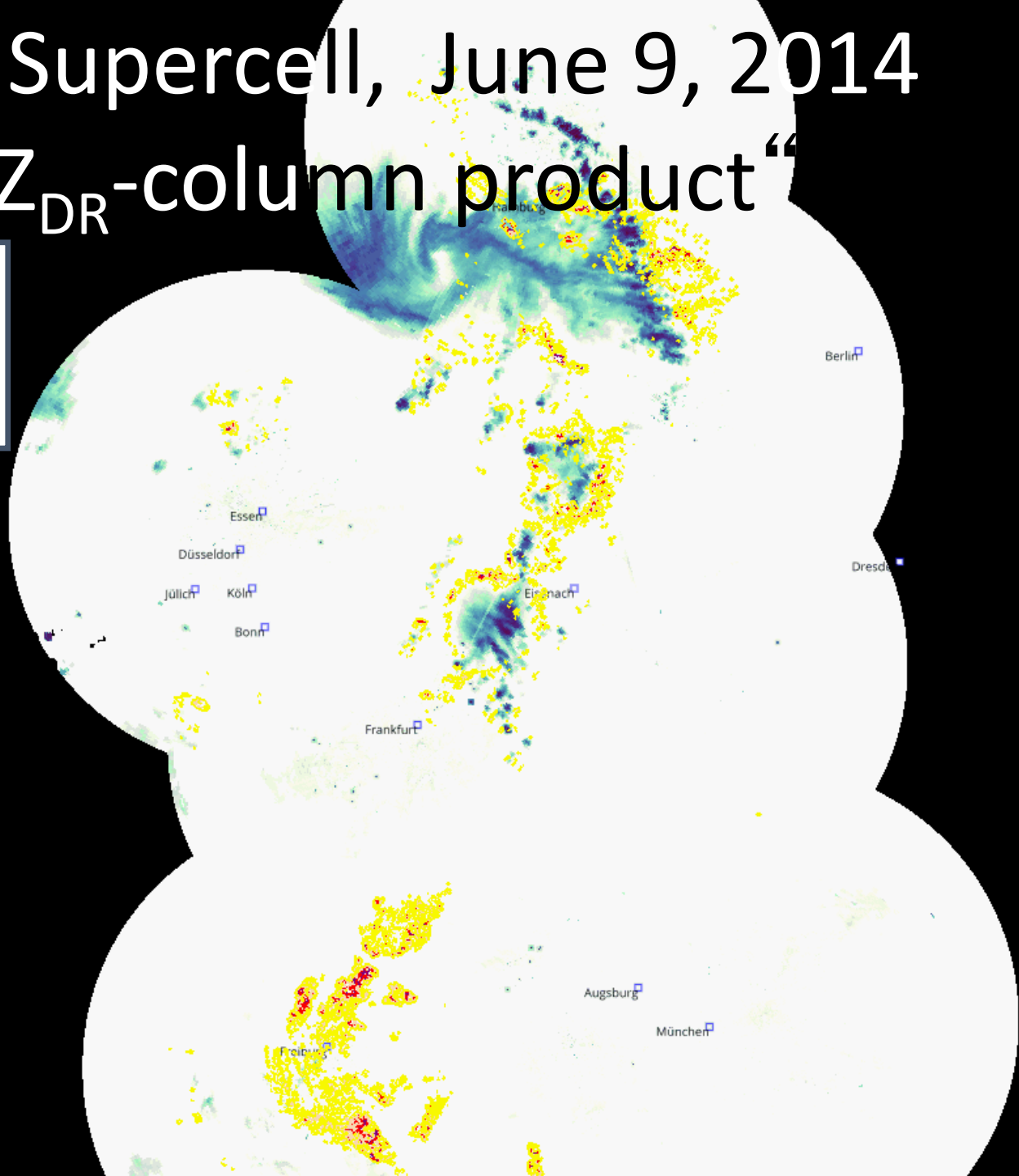
^b *Cooperative Institute for Mesoscale Meteorological Studies, University of Oklahoma, and NOAA/OAR/
National Severe Storms Laboratory, Norman, Oklahoma*

^c *Institute for Geophysics and Meteorology, University of Cologne, Cologne, Germany*

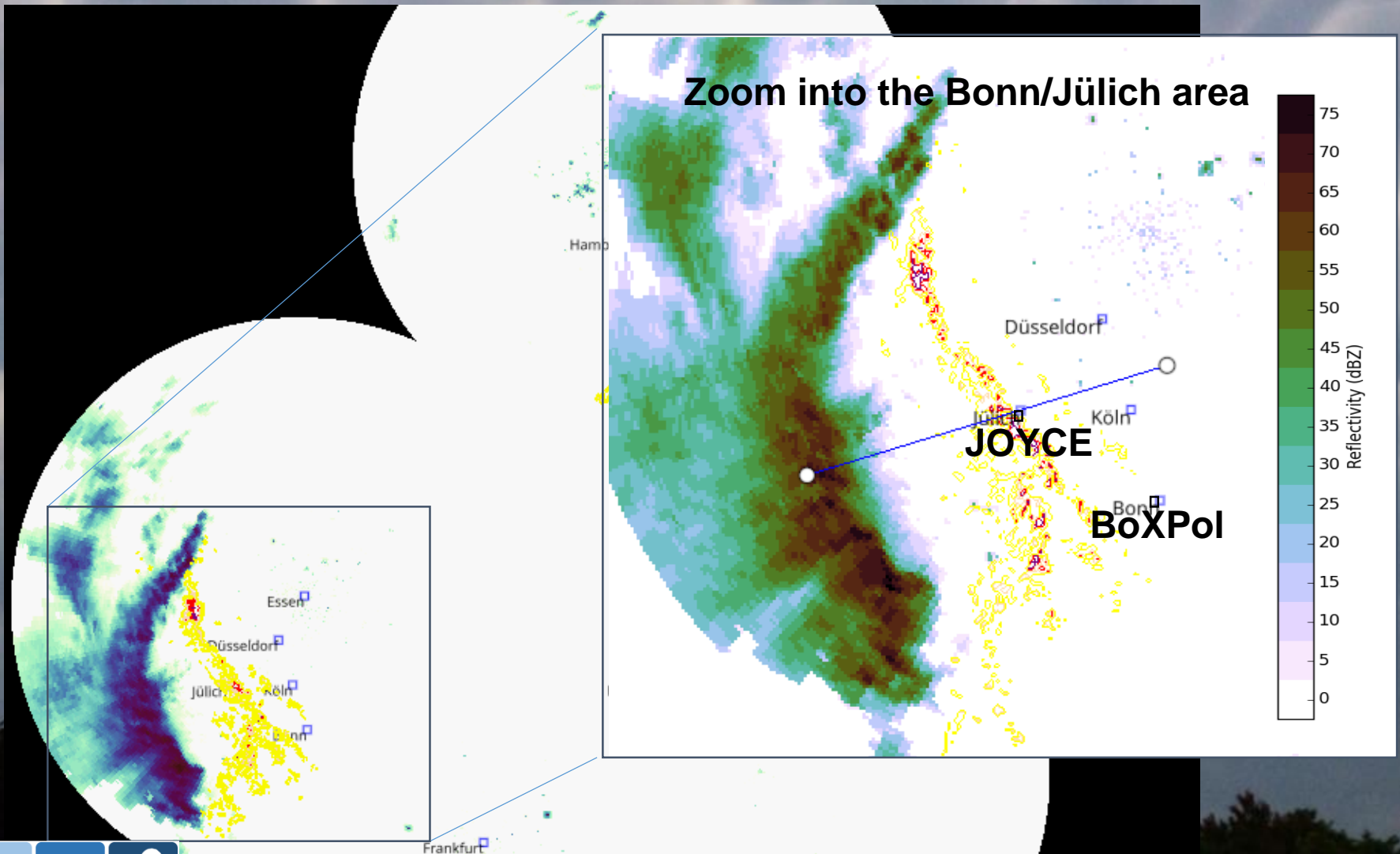
(Manuscript received 14 May 2016, in final form 28 August 2016)

Pentecost Supercell, June 9, 2014 and „Z_{DR}-column product“

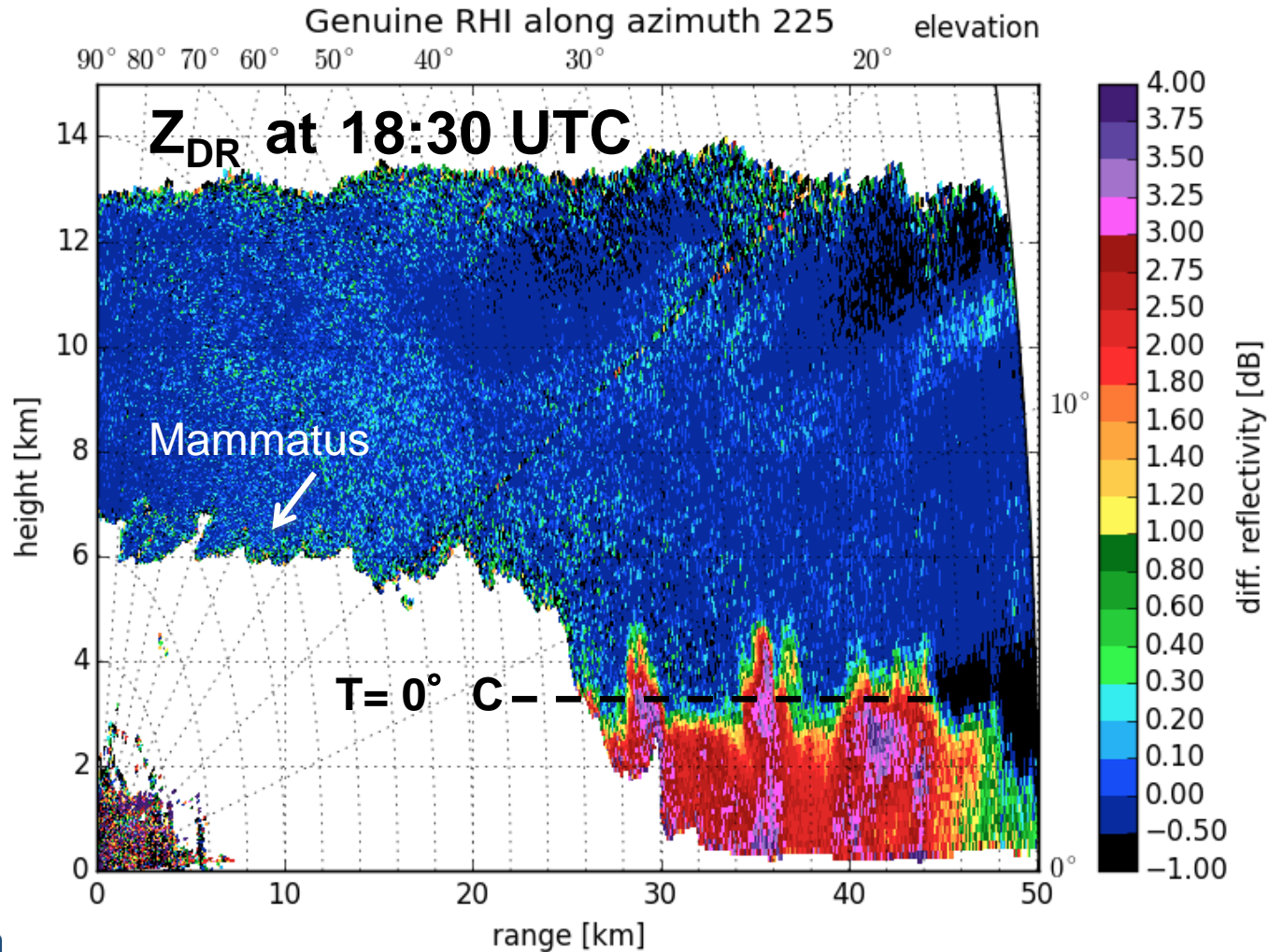
Surface Z_H: blueish colors
Z_{DR}-column: 3 (yellow)
5 (orange)
7 (red)



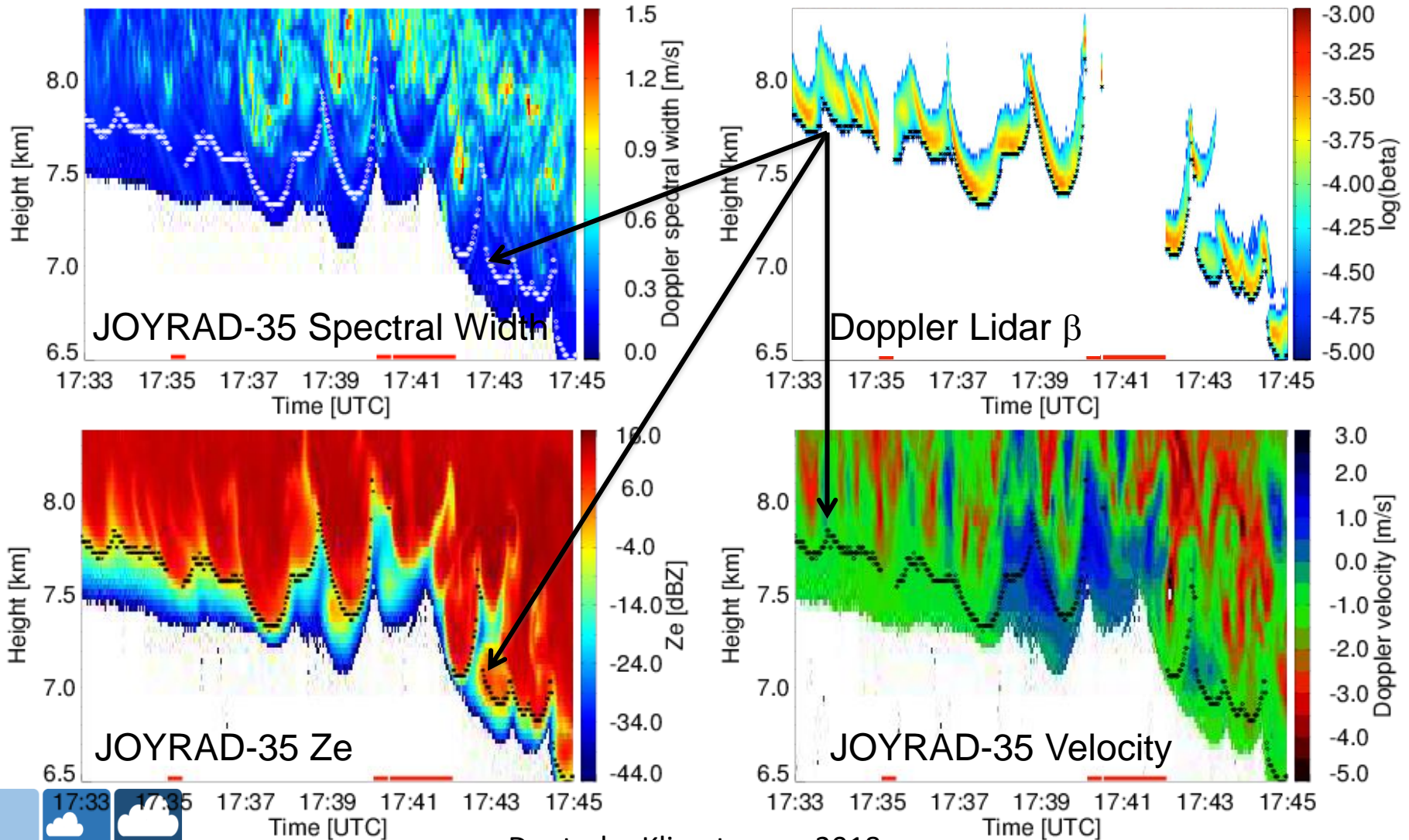
Snapshot at 17:40 UTC



RHI of the supercell observed with BoXPol



JOYRAD-35 and 1.5 μm Doppler Lidar



Deutsche Klimatagung 2018

Zusammenfassung

- JOYCE-CF ist eine sogenannte “Supersite” für die bodengebundene Fernerkundung von Wolken und Niederschlag
- Seit 2007 kontinuierlicher Aufbau von JOYCE-CF
- 2017: DFG Gerätezentrum (core facility) für langfristige, konsistente Beobachtungen > Klimazeitreihen
- Teilnahme an internationalen Netzwerken (ACTRIS), Referenzstation für Mikrowellenradiometrie



JOYCE - CF

