

20 years of Cloudnet observations at Lindenberg and future directions to gain Cloudnet data consistency

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Sophisticated infrastructure for processing and distribution of cloud remote sensing data

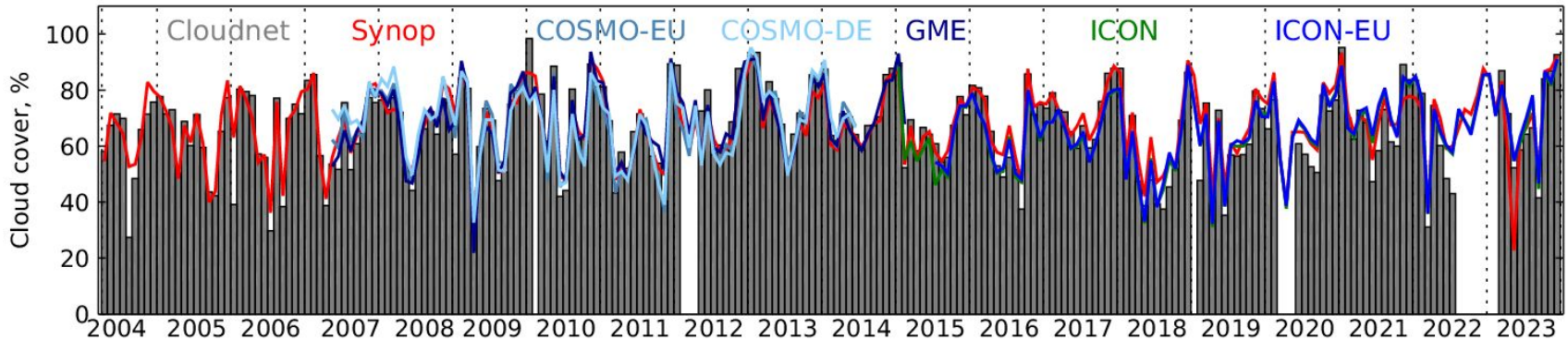
- Cloudnet has become one key element of ACTRIS
- developed @CLU (cloud remote sensing data unit) <https://cloudnet.fmi.fi/>



20 years of observations at the Lindenberg Observatory

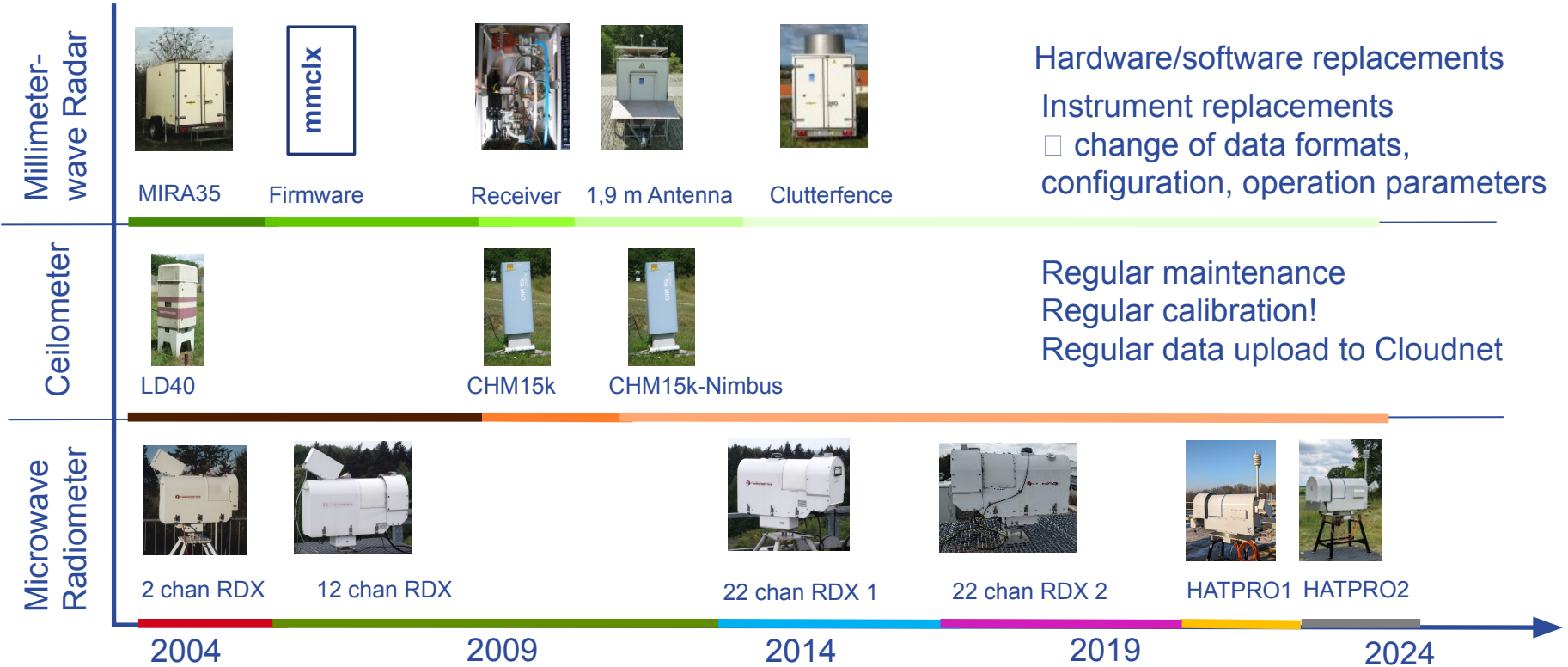
- long-term dataset of cloud macrophysical and microphysical properties

e.g., total cloud cover



What challenges arise in long-term operation of remote sensing instruments for achieving harmonized, high-quality data?

Challenges in Continuous Operation



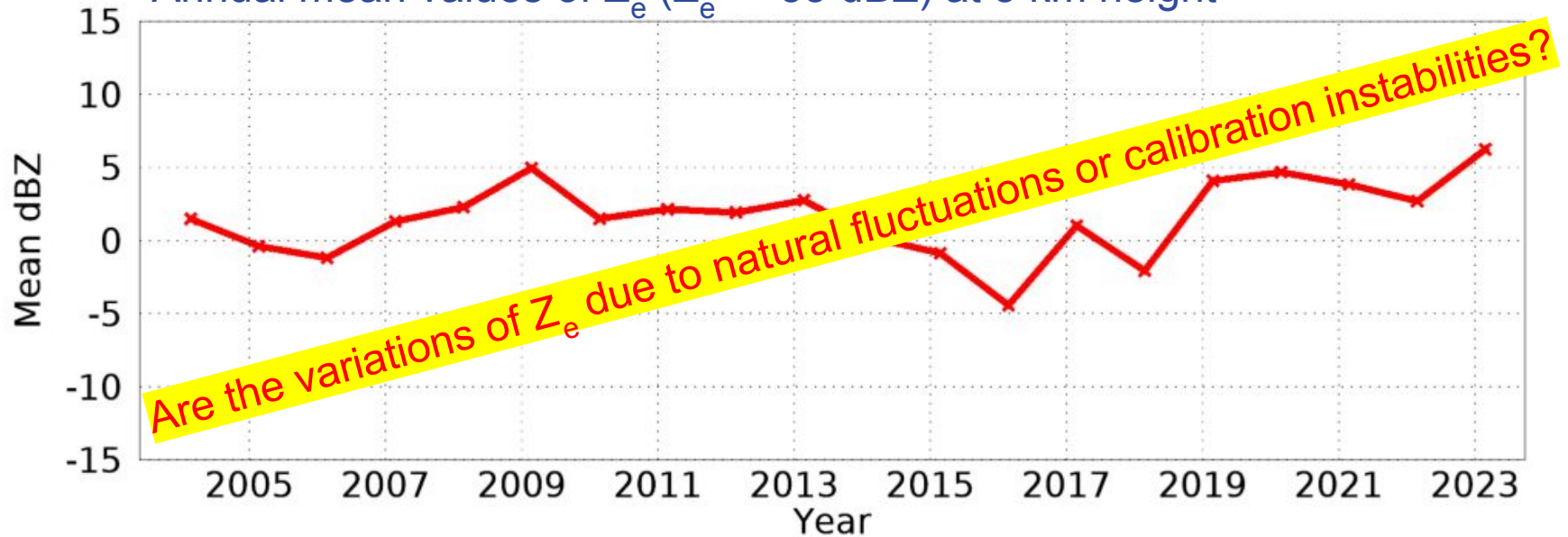
Hardware/software replacements
 Instrument replacements
 change of data formats, configuration, operation parameters

Regular maintenance
 Regular calibration!
 Regular data upload to Cloudnet

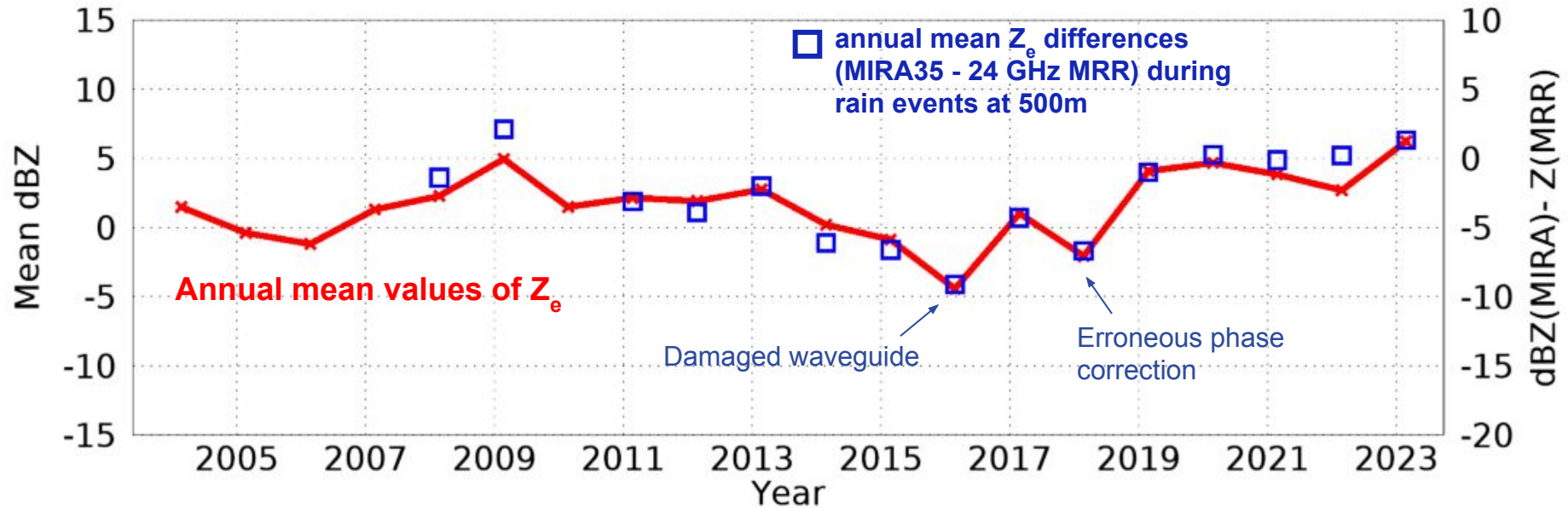


Cloud Radar calibration stability

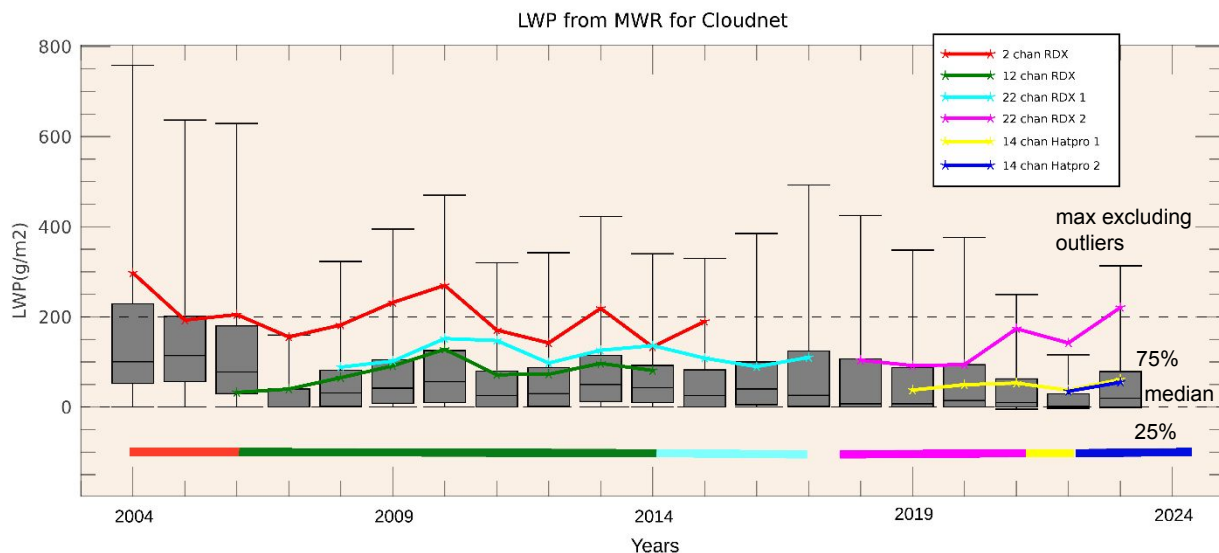
Annual mean values of Z_e ($Z_e > -55$ dBZ) at 5 km height



Cloud Radar Calibration Stability



- high correlation (MIRA-MRR) indicate cloud radar calibration instabilities □ bias correction!!
- developments for calibration @CCRES Cloud radar units (FR, NL, UK)



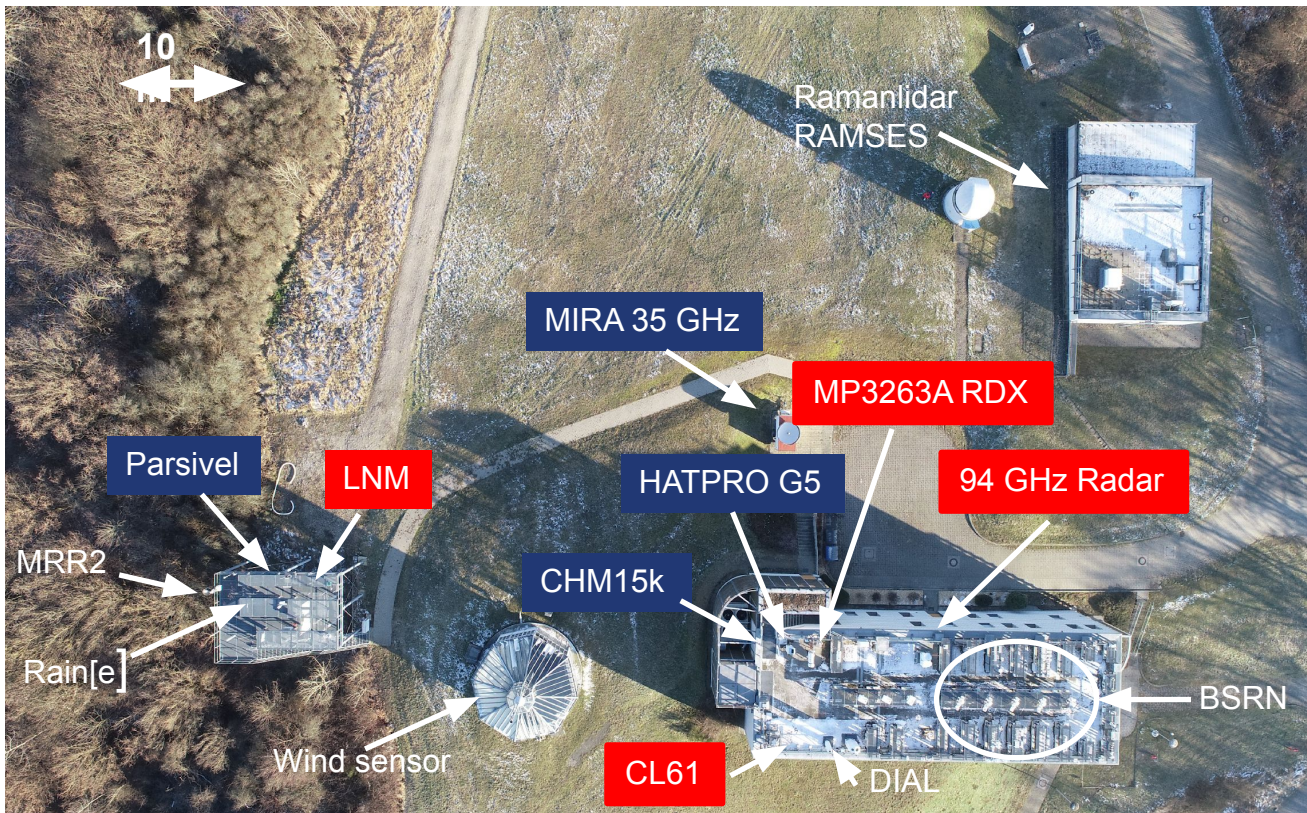
DIFFERENT MWR

- manufacturers (RDX, RPG)
- receiver techniques
- channels and numbers
- retrieval techniques
- absolute calibration

- biases in absolute LWP values (partly factor of 2)
- yearly variability mostly similar

- in progress LWP harmonization using consistent retrieval algorithm (neural net)
- developments @CCRES MWR unit (DE), see B. Pospichal

Sensitivity and Reproducibility of Cloudnet Products



Two instrument complexes

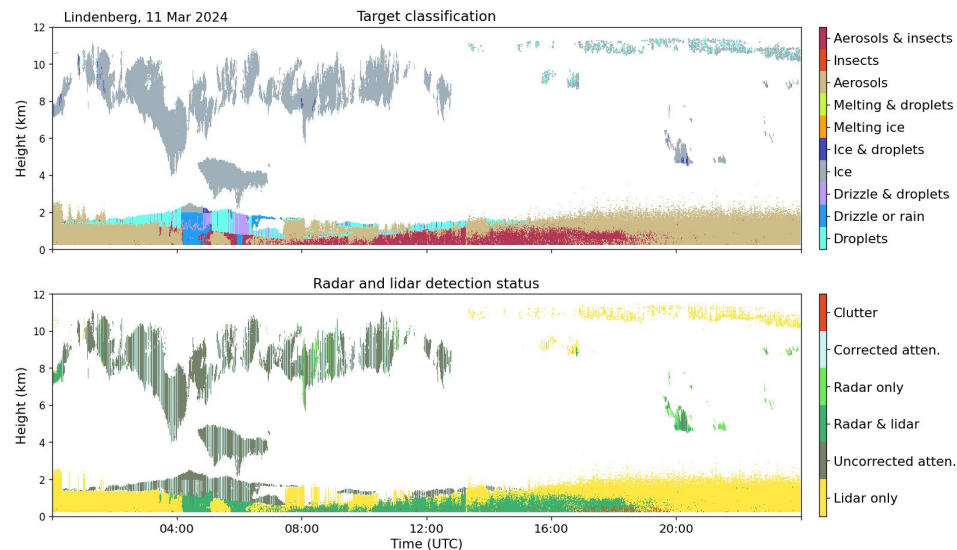
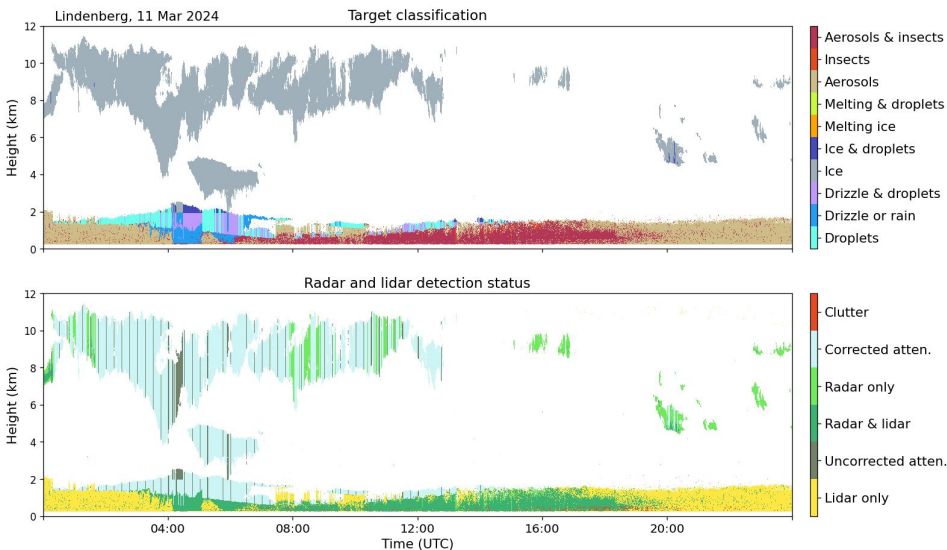
Station 1 (NF):
 35 GHz radar MIRA35
 HATPRO G5
 CHM15k
 Parsivel

Station 2:
 94 GHz radar RPG
 MP3263A RDX
 CL61
 LNM

Target Classification Case, e.g. 11/3/2024

Station 1: MIRA35, CHM15k, HATPRO

Station 2: 94 GHz RPG, CL61, RDX



thicker cirrus layer from 6 to 12 km due to 35 GHz Cloud radar

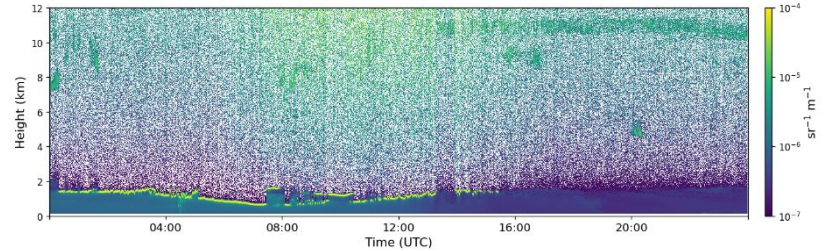
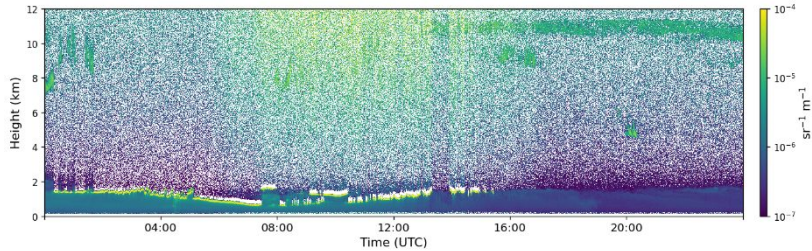
ice/droplet layer at 11 km height after 16 UTC due to CL61?

Cloudnet Classification Case, e.g. 11/3/2024

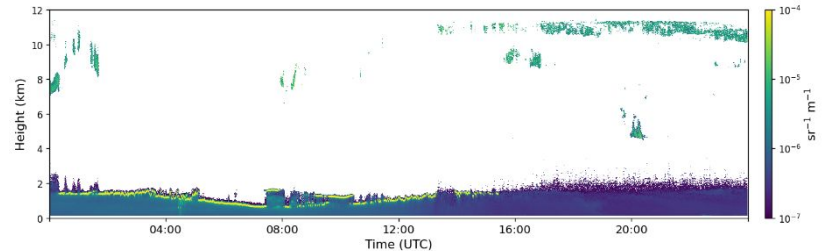
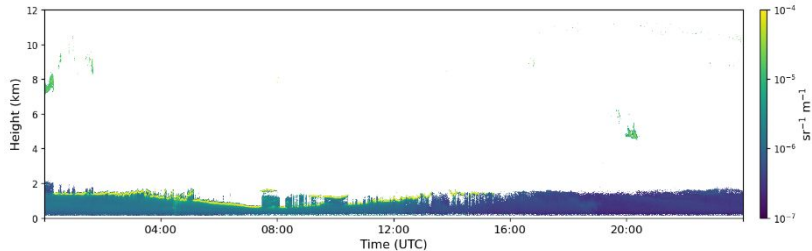
Station 1 (NF): CHM15k

Station 2: CL61

non-screened attenuated backscatter coefficient



Cloudnet SNR-screened attenuated backscatter coefficient

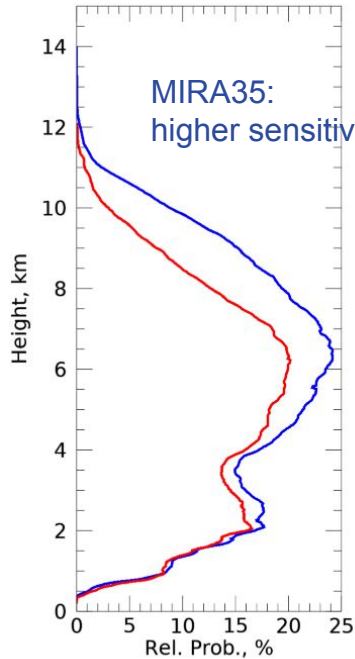


SNR threshold of 5 different noise characterization?

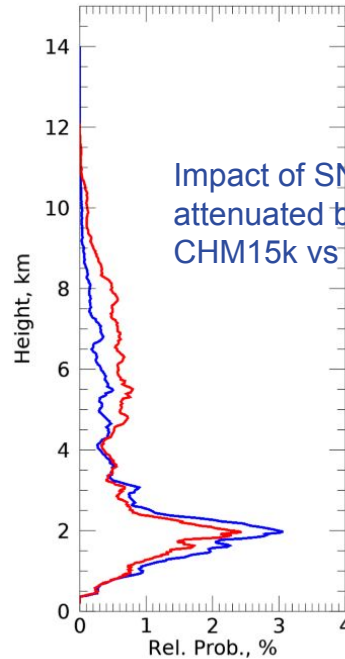
Mean classification differences (March/April 2024)

Station 1: MIRA35, CHM15k, HATPRO, Station 2: 94 GHz RPG, CL61, RDX

Ice

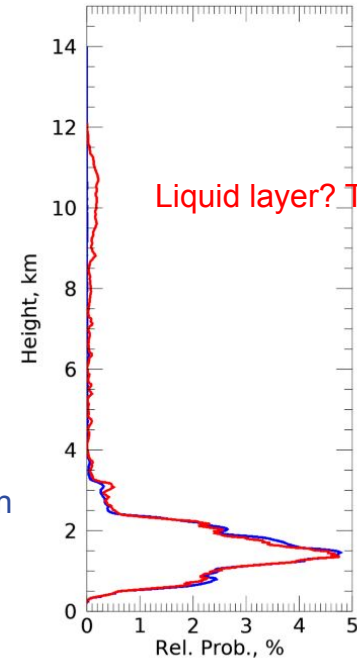


Ice + super c. dropl.



Good
agreements in
lower ranges

Clouds liquid droplets



(Lindenberg) Cloudnet long-term data interpretation requires further data harmonization due to: Instrument change, instrument types, calibration stability

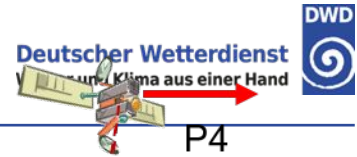
- Continuous instrument monitoring is key to maintain data quality – especially calibration
- Important developments @CCRES instrument units

Two Cloudnet complexes data supports investigating Cloudnet data comparability

First results on Cloudnet classification consistency:

- Differences due to instrument type: cloud radar, ceilometer, (MWR)
 - Differences due to Cloudnet pre-processing algorithm (data filtering, thresholds)
- Further evaluations and developments to archive comparability and realistic error bars

PhD position @Lindenberg

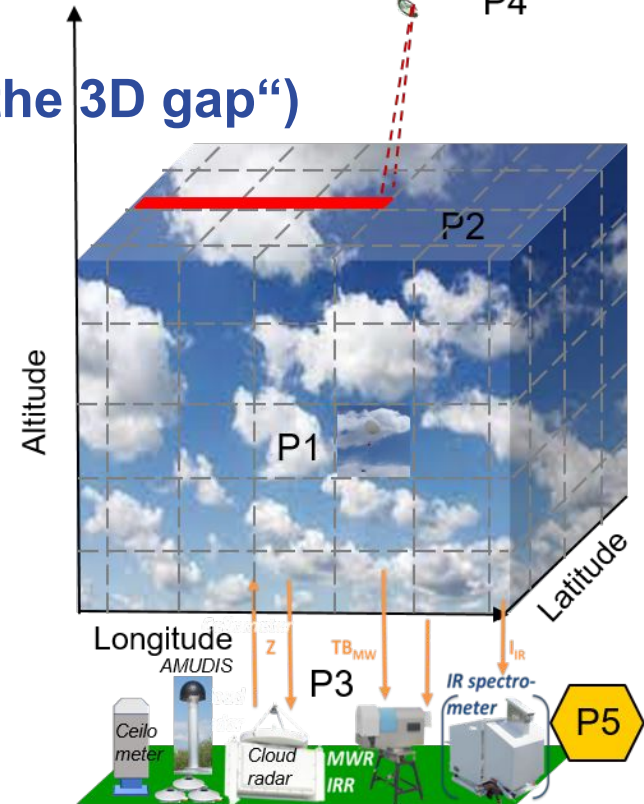


DFG founded interdisciplinary research unit :

C3SAR („Cloud Structure & Climate - Closing the 3D gap“)

- focus on 3D nature of cloud structure and the corresponding 3D cloud radiative effect
- comprehensive combination of cloud-resolving 3D modelling, existing and novel ground-based and satellite-based observations of clouds and radiation
- plus a synergetic final study in a large-scale field campaign

Position for 48 month, 75%, A13 TV EntgO Bund



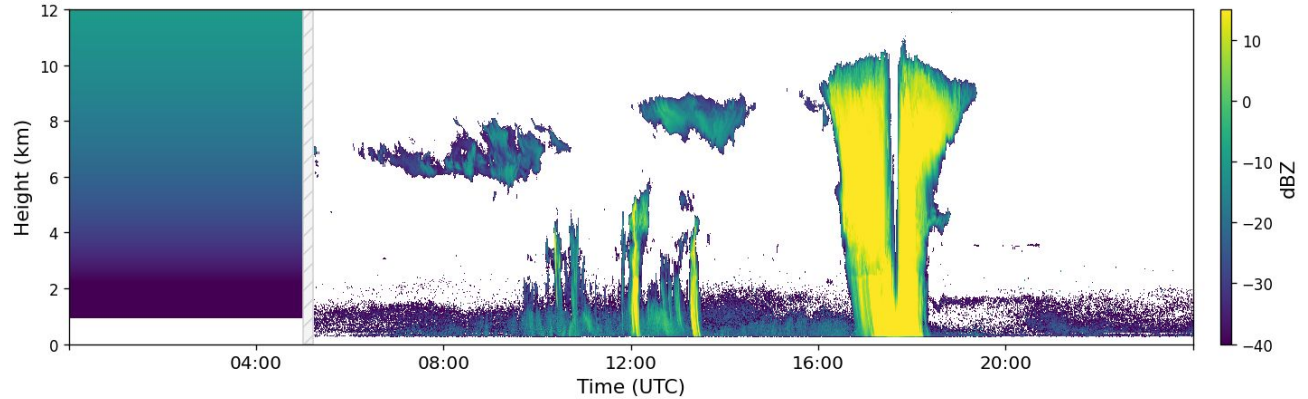
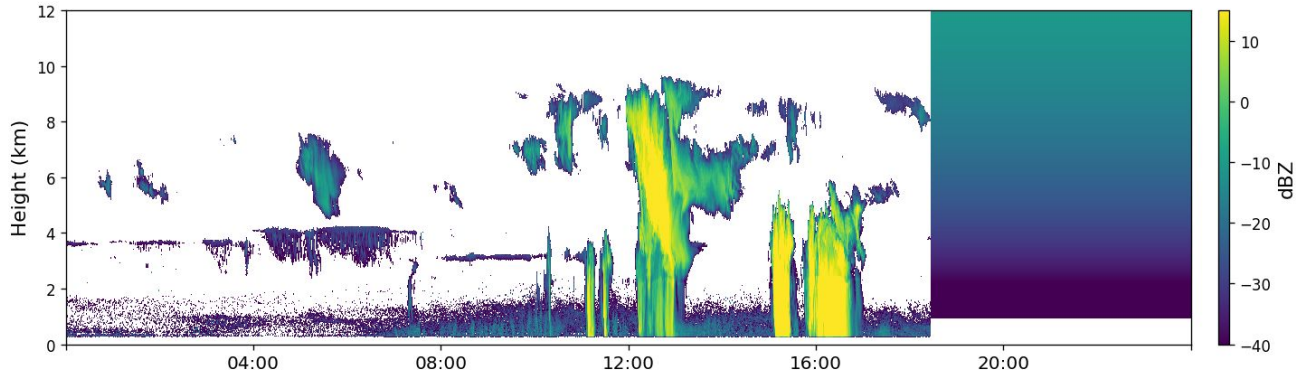
Thank you

Contact:

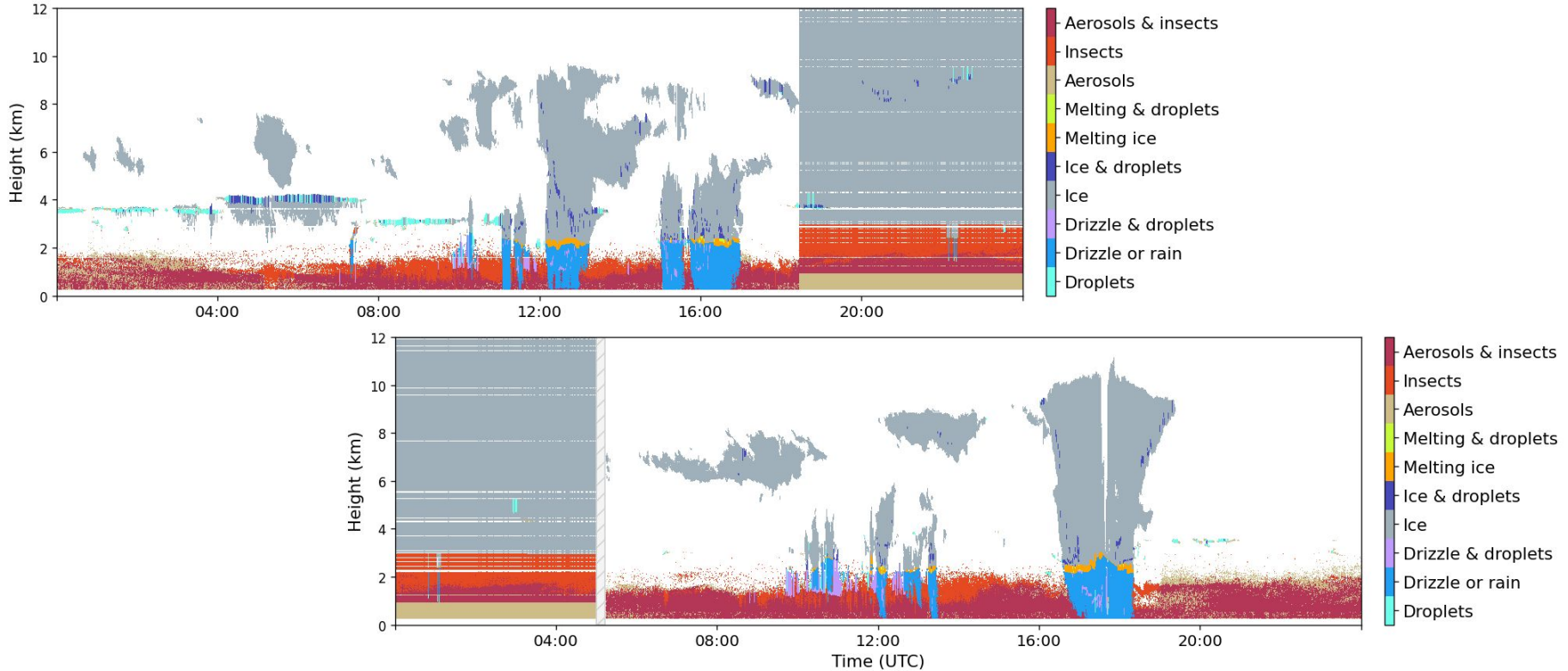
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19-20/05/2024: Cloud Radar Mira35



19-20/05/2024: Target classification



Communication failure between cloud radar and processing PC

- Cloudnet data quality checks for Z values?
- Data are stored at the data unit
- Reprocessing possible?

EMPTY
