A big thank you to all NFs for their warm welcome !

Doppler Cloud Radar calibration
Status of campaigns and reports

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A two step DCR Calibration strategy

CCRES objective is to guarantee a network of **high-quality observations** (consistency, comparability, …)

→ Needs of **standardized** and **repeatable** calibrations methods

1) **Absolute calibration : Toledo et al., 2020 → BASTA-CCRES**
   a) Very reliable method but is work intensive & hard to carry out
   b) Does not work with all DCRs : signal saturation with RPG & Metek

1) **Calibration transfer: Jorquera et al., 2023**

   BASTA-CCRES goes to every NF to calibrate their instruments (focus on ice clouds)

   a) Much simpler method to implement than absolute calibration
   b) Works between any radar models and both 35-94GHz

Main steps for a CCRES DCR calibration campaign

Step	Duration	Action
1	1 week	Absolute calibration of the BASTA-CCRES radar (reference) at SIRTA (Toledo et al., 2021)
2	1 week	Preparation of the two transport cases (radar + equipment) + discussion with the transport company + cases departure
3	0.5 week	CCRES team journeys for BASTA-CCRES set-up
4	8 weeks	Data collection + Real-time data transfer to Cloudnet + remote monitoring of the BASTA-CCRES to ensure everything is running smoothly
5	0.5 week	CCRES team journeys for BASTA-CCRES removal
6	1 week	Absolute calibration of the BASTA-CCRES radar (reference) at SIRTA
7	1-2 week-s	Data analysis and calibration report

- Total ~ 3.5 months for one calibration campaign

- Time consuming if properly planned, CCRES has the capacity to conduct 3 to 4 campaigns/year

Step 1: BASTA-CCRES absolute calibration (Toledo et al., 2020)

Absolute calibration perform **before** and **after** each transfer calibration campaign to ensure good quality

BASTA-CCRES

Target

10m mast

d ~ 400m

SIRTA Research Observatory
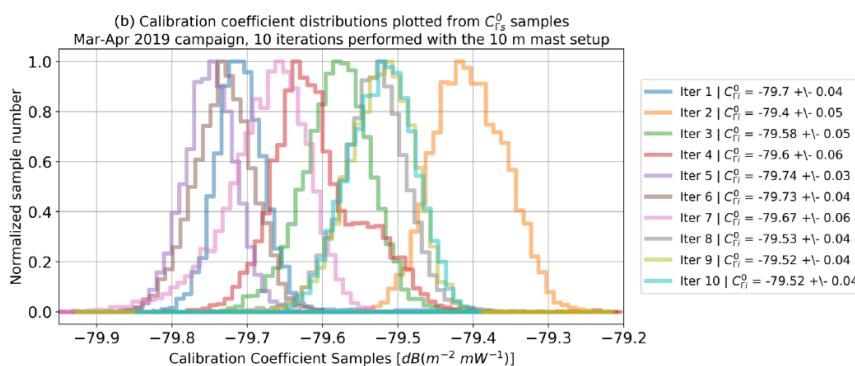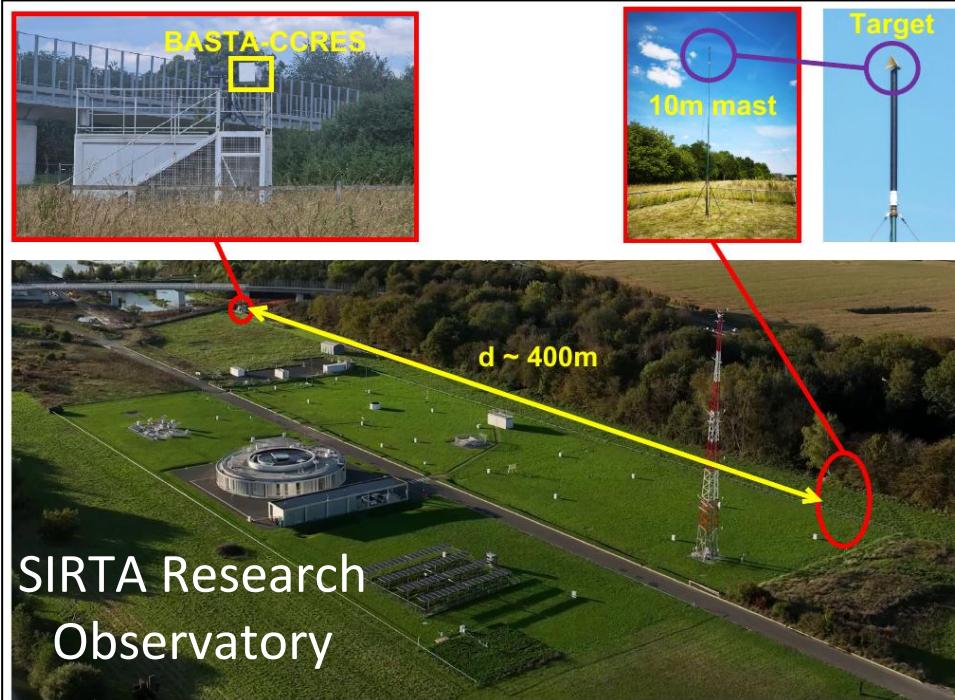
Reference radar mode	Eq. Reflectivity Calibration constant	Reference radar calibration uncertainty
25m	-181.5 dB	0.8 dB

- Monitoring of the **calibration** constant **several times per year**

- The **calibration target** is currently being re-characterized in an **anechoic chamber** to ensure calibration quality *(previous dec. 2022, next nov. 2025)*

- Preparation of an **official report** for each absolute calibration

- Make the **results** available on the **CCRES website**

(b) Calibration coefficient distributions plotted from C_{rs}^0 samples
Mar-Apr 2019 campaign, 10 iterations performed with the 10 m mast setup

Iter 1 | C_{ri}^0 = -79.7 +\- 0.04
Iter 2 | C_{ri}^0 = -79.4 +\- 0.05
Iter 3 | C_{ri}^0 = -79.58 +\- 0.05
Iter 4 | C_{ri}^0 = -79.6 +\- 0.06
Iter 5 | C_{ri}^0 = -79.74 +\- 0.03
Iter 6 | C_{ri}^0 = -79.73 +\- 0.04
Iter 7 | C_{ri}^0 = -79.67 +\- 0.06
Iter 8 | C_{ri}^0 = -79.53 +\- 0.04
Iter 9 | C_{ri}^0 = -79.52 +\- 0.04
Iter 10 | C_{ri}^0 = -79.52 +\- 0.04

Normalized sample number

Calibration Coefficient Samples [$dB(m^{-2}\ mW^{-1})$]

ACTRIS CCRES

Step 2: Transfer calibration campaigns (Jorquera et al., 2023)

*BASTA-CCRES (calib.) & MIRA (uncalib.) Zh measurements*

Zh measured by both DCR (calib. & uncalib.) before/after data processing
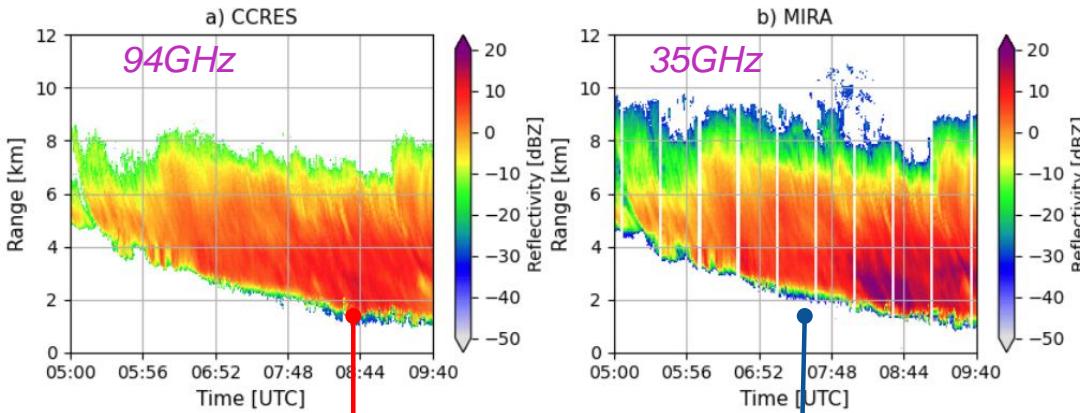
2024 calibration campaign at Jülich
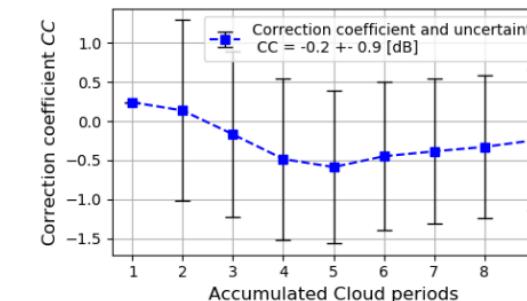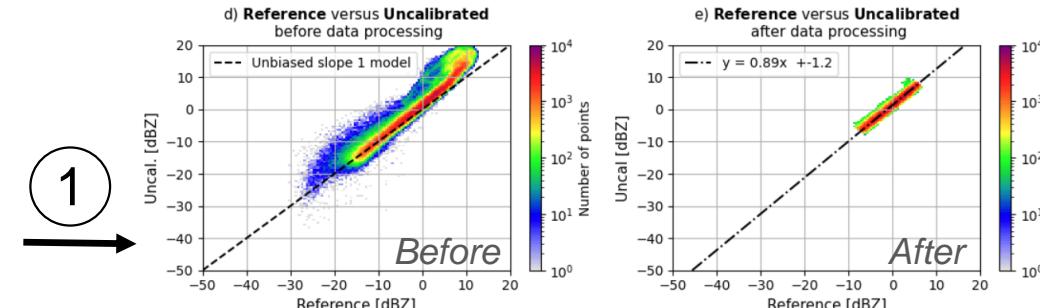
Final calibration result

Correction coefficient (Reference - MIRA)	Uncertainty
- 0.2 dB	0.9 dB

Calibration transfer report & CC transmitted to CLU Data Center
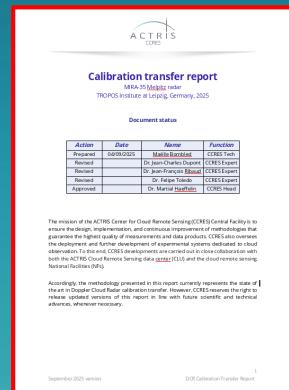
DCR Calibration Transfer Campaign schedule

Previous campaigns
Current campaigns
Future campaigns

Site (NF)	Radar	Calibration period
Juelich (JOYCE)	MIRA 35 GHz	dec 2023 - feb 2024
Palaiseau (SIRTA)	BASTA 94 GHz	dec 2024
Leipzig (TROPOS) / Melptiz	2 RPG 94 GHz + 2 MIRA 35 GHz	jan-feb 2025
Lindenberg (MOL-RAO) / Rzecin	MIRA 35 GHz + RPG 94 GHz + BASTA 94 GHz	mar-may 2025
Granada (AGORA)	RPG 35-94 GHz	~ oct-dec 2025
Bucharest (RADO)	RPG 94 GHz + MIRA 35 GHz	~ jan-feb 2026
Cluj (RADO)	RPG 94 GHz	~ mar-may 2026
Galati (RADO)	RPG 94 GHz	~ may-jul 2026
???	???	Fall 2026
? Lampedusa ?	Metek 35 GHz	Spring 2027

9 radars calibrated so far

And 6 more coming soon

Overview of the CCRES DCR Calibration campaigns results

CCRES DCR Calibration Transfer Overview
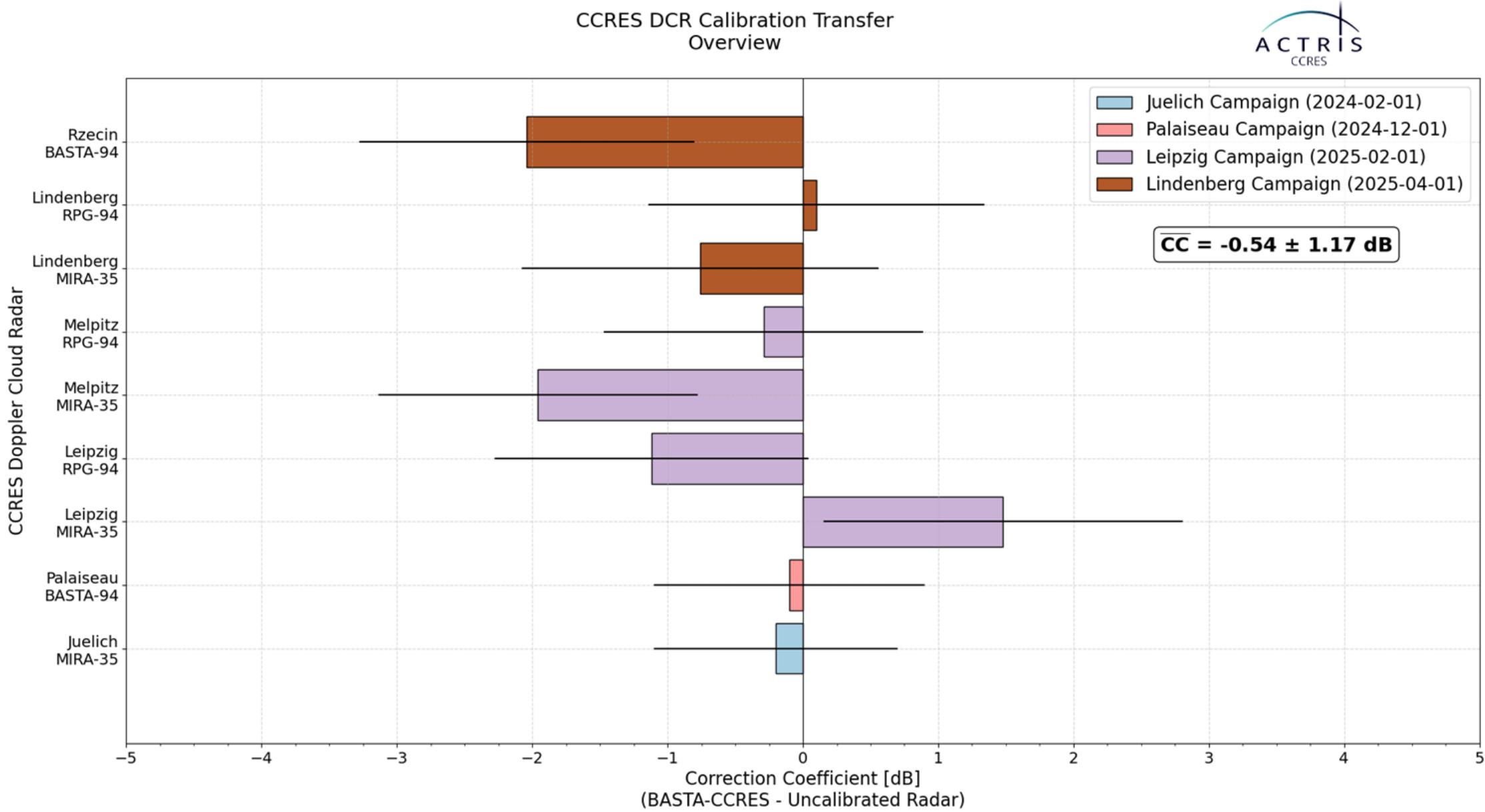
Validation of the reference radar calibration

Stability over time

BASTA-CCRES calibration constante evolution (x-1)
Derived from absolute calibratrion operated at SIRTA Observatory
Palaiseau site (48.717N, 2.209E, 156 m)
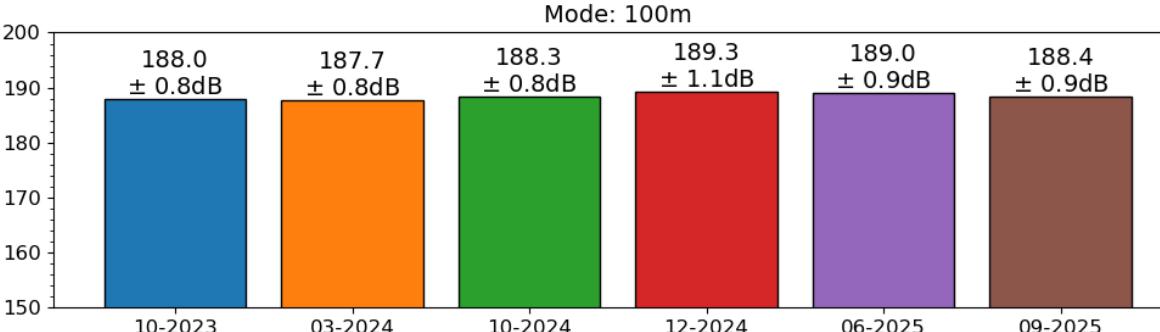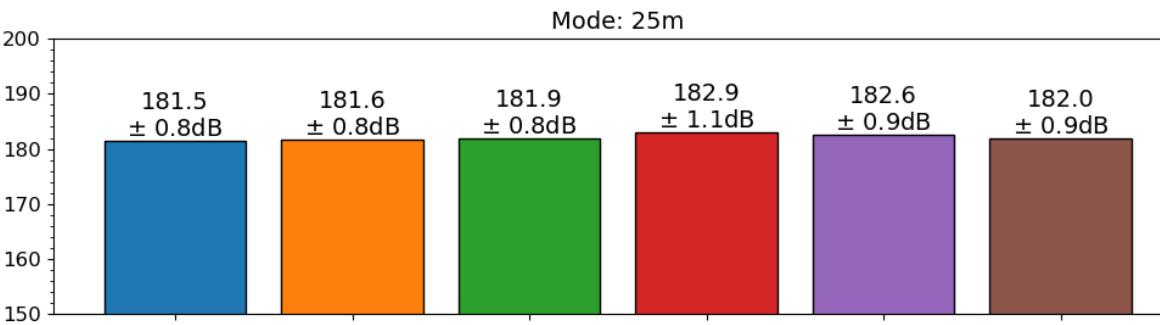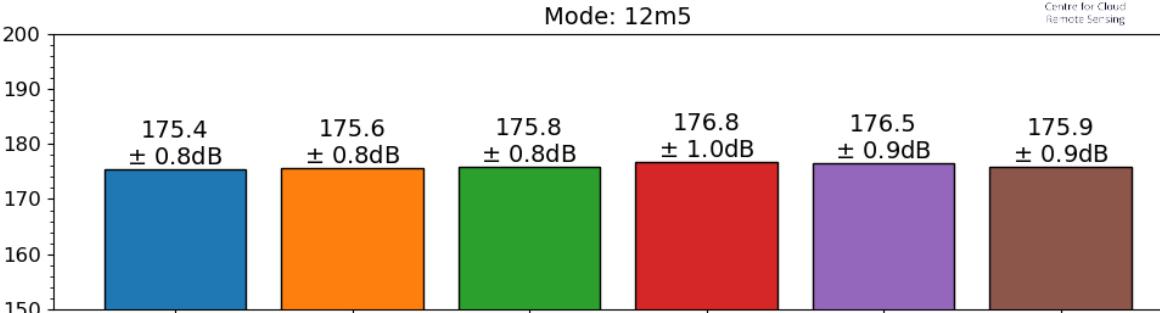
Calibration reports

Write a calibration transfer report for each campaign dedicated to calibrate the "uncalibrated DCR radar"

A **DOI is fixed** for each dataset

Each **calibration report** is sent for final review to the **relevant NFs** before the online availability on CCRES web page

Each **calibration report** and **Correction Coefficient** are transmitted to CLU Data Center https://cloudnet.fmi.fi/

Implementation

Correction Coefficient (CC)

- For each report :

$$CC \pm \sigma_{CC}$$

- Z Measurements are corrected by adding CC:

$$Z_{corr} = Z_{uncal} + CC$$

+ new Z calibration uncertainty = σ_{CC}

Example of a calibration result

Table 1 : Calibration transfer results.

Correction coefficient (Reference – MIRA-35)	Uncertainty
-2 dB	1 dB

Thank you !

CCRES/CLU Autumn Workshop, Evora, 22 October 2025