



# ACTRIS CCRES

## DCR Calibration Transfer Campaigns Previous & Future

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

# A two step DCR Calibration strategy

**Error of 1dB** in horizontal reflectivity → **bias** in ice content by about ~ **15-20%** (Protat et al., 2009 ; Protat et al., 2026 ; Ewald et al., 2019)

**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)

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

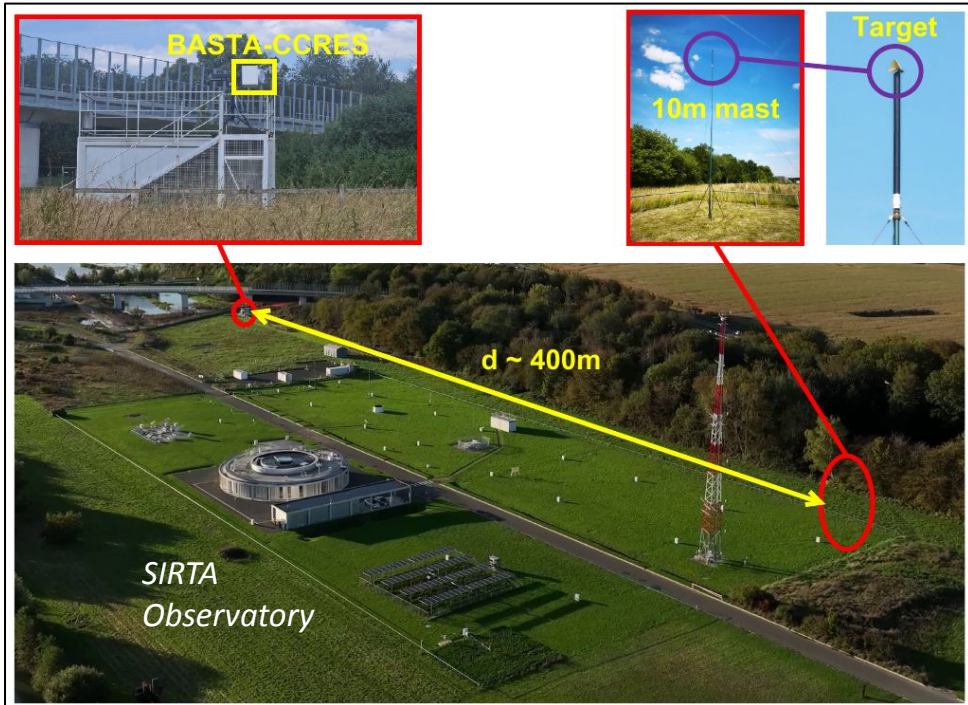
# Main steps for a CCRES DCR calibration campaign

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**

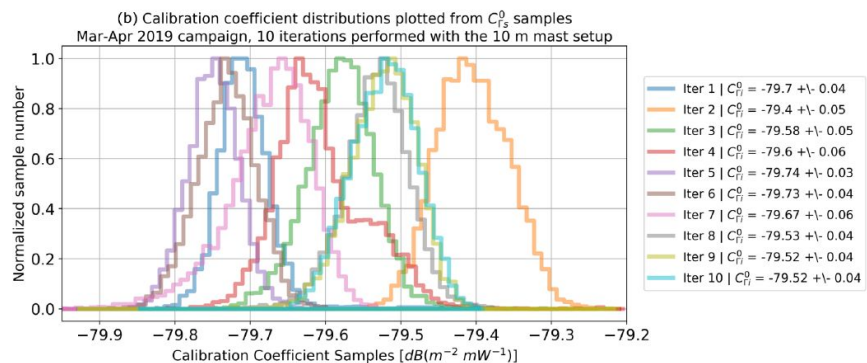
# Step 1: BASTA-CCRES absolute calibration (Toledo et al., 2020)

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



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** characterized in an **anechoic chamber** to ensure calibration quality : *dec. 2022 & nov. 2025* ✓
- Preparation of an **official report** for each absolute calibration (ongoing)
- Make the **results** available on the **CCRES website** (soon)



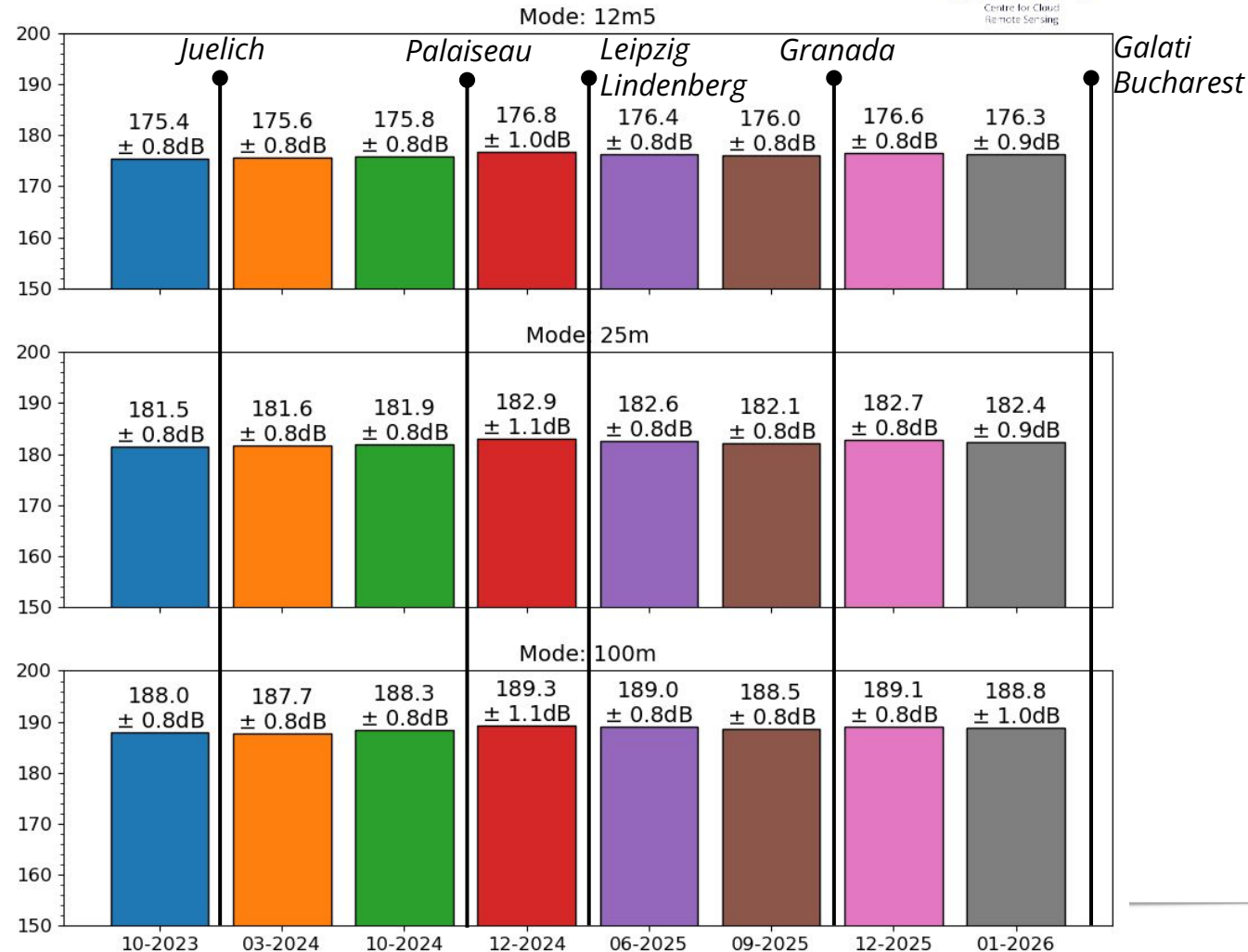
# Validation of the reference radar calibration

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



Calibration constant  
of the reference  
**BASTA-CCRES**

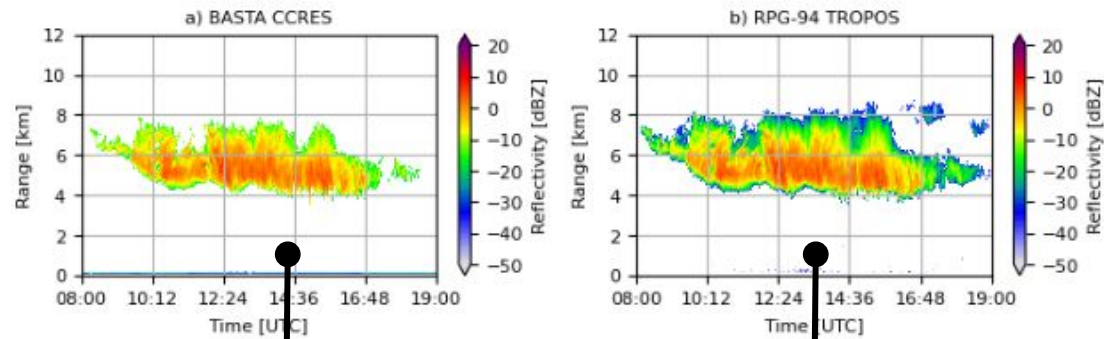
→ **very stable** over  
time



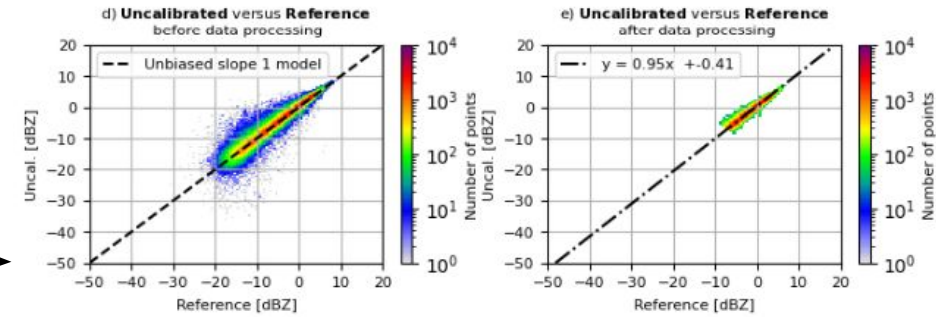
# Step 2: Transfer calibration campaigns (Jorquera et al., 2023)

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

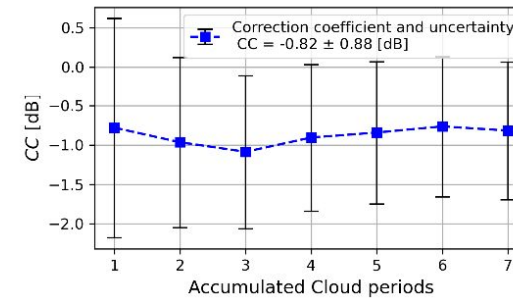
Code available on Github:  
<https://github.com/ACTRIS-CCRES/dcr-calibration-transfer>



1



2



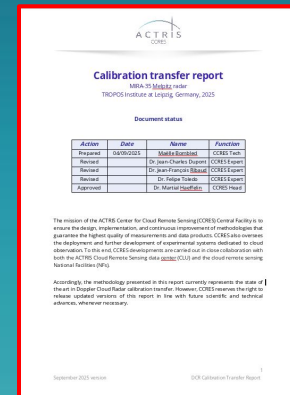
3

Correction coefficient (Reference - RPG-94)	Uncertainty
-0.8 dB	0.9 dB

RACE-LE (Leipzig) Campaign  
Winter 2025



Calibration transfer report & CC transmitted to CLU Data Center



4

# DCR Calibration Transfer Campaign schedule



Previous campaigns

Current campaigns

Future campaigns

#	Site (NF)	Radar	Calibration period
1	Juelich (JOYCE)	1 MIRA 35 GHz	dec 2023 - feb 2024
2	Palaiseau (SIRTA)	1 BASTA 94 GHz	dec 2024
3	Leipzig (TROPOS) / Melptiz	2 RPG 94 GHz + 2 MIRA 35 GHz	jan-feb 2025
4	Lindenberg (MOL-RAO) / Rzecin	1 MIRA 35 GHz + 1 RPG 94 GHz + 1 BASTA 94 GHz	mar-may 2025
5	Granada (AGORA)	1 RPG 35-94 GHz	oct-dec 2025
6	Galati (RADO)	1 RPG 94 GHz	jan-mar 2026
7	Bucharest (RADO) & Cluj (RADO)	2 RPG 94 GHz + 1 MIRA 35 GHz	~ mar-Jul 2026
8	Payerne	1 RPG 94 GHz	~ oct-nov 2026
9	? Lampedusa ?	1 MIRA 35 GHz	? Spring 2027 ?
/	? Palaiseau ?	BASTA-CCRES → <b>Refurbishment</b>	? Spring/Summer 2027 ?
10	? Potenza / L'aquila ?	1 RPG 94 GHz + 1 MIRA 35 GHz	End 2027 ? Beginning 2028 ?

12 radars  
(wavelengths)  
already  
calibrated  
  
+ 3 radars  
ongoing

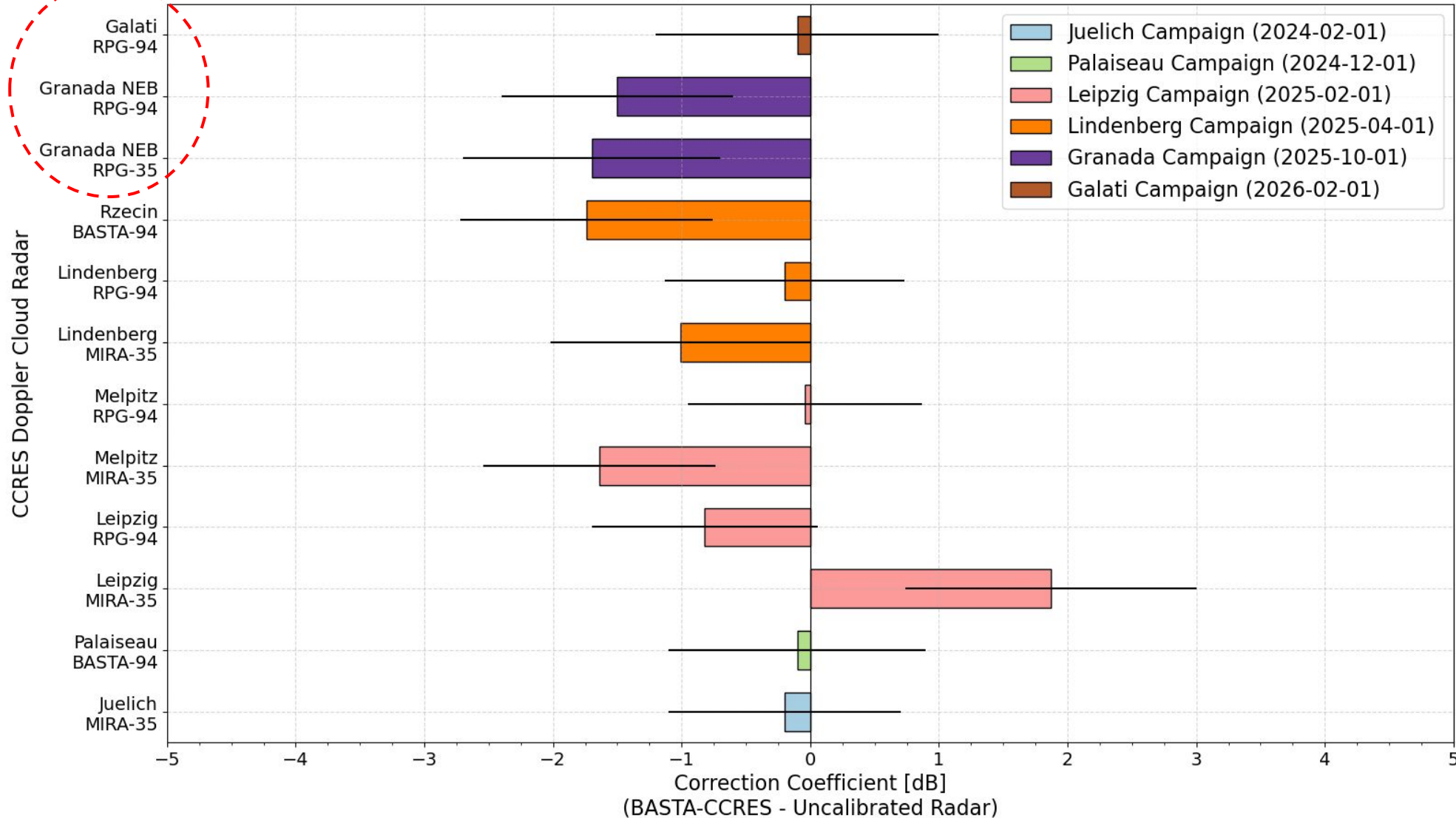


NEW

# Overview of the CCRES DCR Calibration campaigns results

Preliminary

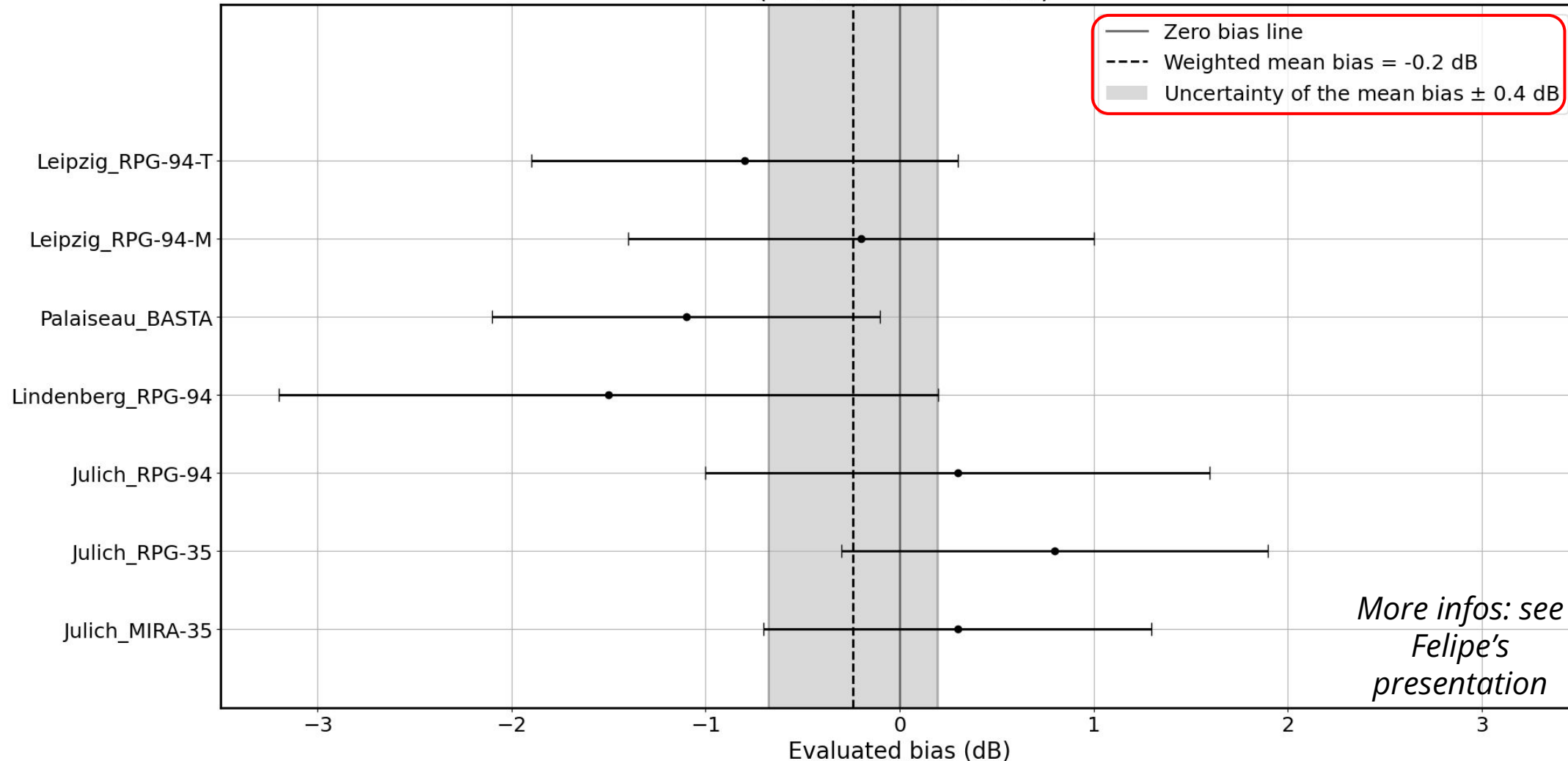
CCRES DCR Calibration Transfer Overview  
Version 2026-05-29



# EarthCare vs ACTRIS-CCRES sites

Preprint (Feuillard et al. 2026)

Bias between EarthCARE and eight calibrated ACTRIS sites  
(EarthCARE - ACTRIS)



More infos: see  
Felipe's  
presentation

# Calibration reports

## DCR CALIBRATION REPORTS

<https://ccres.aeris-data.fr/en/>

### INSTRUMENTS AND DATA QUALITY CONTROL

Access to « DCR/DD Calibration and stability monitoring », « MWR stability monitoring » and « Monthly reports » for the different sites.

DCR/DD Calibration and Stability monitoring

DCR Calibration reports

MWR Stability

Monthly reports

NF	Instrument	Instrument PID	Campaign location	Campaign period	Calibration report
JOYCE (Jülich, Germany)	MIRA-35	<a href="https://hdl.handle.net/21.12132/3.0366fa69504f4bd6">https://hdl.handle.net/21.12132/3.0366fa69504f4bd6</a>	Jülich (Germany)	December 2023 – March 2024	
LACROS (Leipzig, Germany)	RPG-94	<a href="https://hdl.handle.net/21.12132/3.fa39ba9928544aae">https://hdl.handle.net/21.12132/3.fa39ba9928544aae</a>	Leipzig (Germany)	January – March 2025	
LACROS (Leipzig, Germany)	MIRA-35	<a href="https://hdl.handle.net/21.12132/3.ec09dc9c028c42d1">https://hdl.handle.net/21.12132/3.ec09dc9c028c42d1</a>	Leipzig (Germany)	January – March 2025	
Melpitz (Germany)	RPG-94	<a href="https://hdl.handle.net/21.12132/3.3809aae6fdb24f61">https://hdl.handle.net/21.12132/3.3809aae6fdb24f61</a>	Leipzig (Germany)	January – March 2025	
Melpitz (Germany)	MIRA-35	<a href="https://hdl.handle.net/21.12132/3.7ddef75d7fee4dba">https://hdl.handle.net/21.12132/3.7ddef75d7fee4dba</a>	Leipzig (Germany)	January – March 2025	
MOL-RAO (Lindenberg, Germany)	RPG-94	<a href="https://hdl.handle.net/21.12132/3.70dd09553d13484d">https://hdl.handle.net/21.12132/3.70dd09553d13484d</a>	Lindenberg (Germany)	March – May 2025	

# CRS network status & future perspectives

- **Current status:** CRS network well calibrated at present
- **Ongoing work:** closure study for comparing all calibration/monitoring CCRES methods for DCR to ensure result consistency → Key point
- **Open questions**
  - **When and how to apply calibration coefficients?**
    - Rule of thumb (?): if the coefficient is  $\sim 1$  dB, no action is needed (order of the method uncertainty)
    - Threshold for correction: should we apply adjustments for  $>1$  dB ? Or only for  $>2$  dB ?
  - **Timing & Consistency**
    - Apply corrections at the campaign date ? Retroactively ? How to ensure continuity of output products ?
  - → **Next Steps**
    - Test study required: compare datasets (with/without correction) across multiple radars/sites to quantify biases



Thank you !

# Implementation

## Correction Coefficient (CC)

- For each report :

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

- Z Measurements are corrected by adding CC:

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

- + new Z calibration uncertainty =  $\sigma_{CC}$

*Example of a calibration result*

*Table 1 : Calibration transfer results.*

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