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Updates on cloud radar stability monitoring with disdrometer

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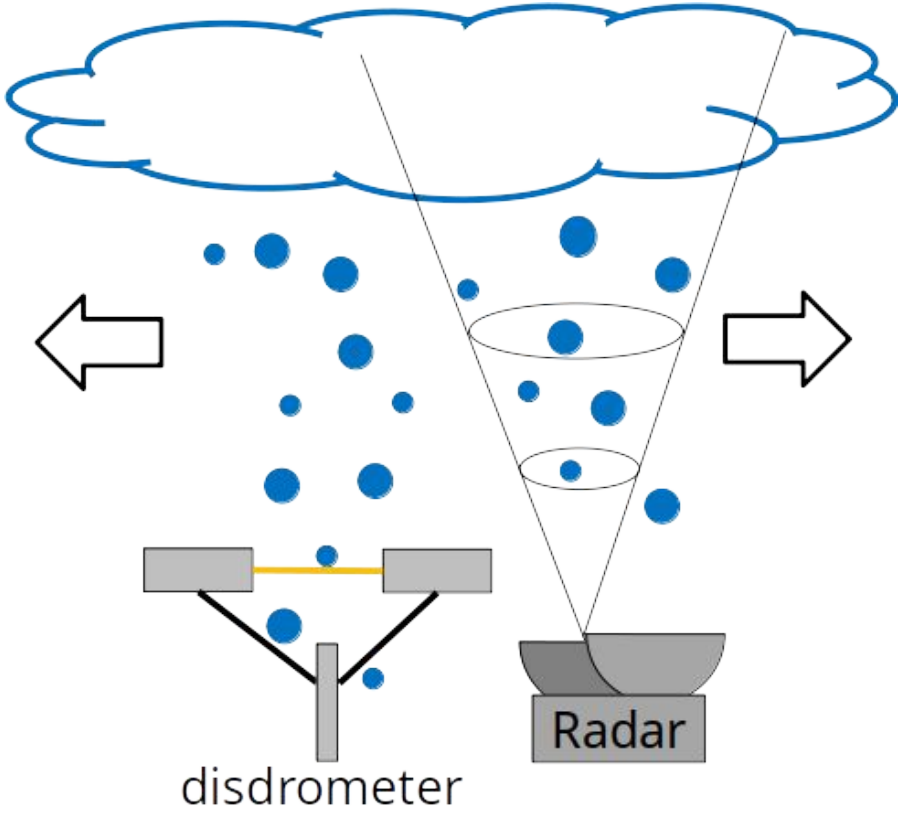
Reminder about the methodology

Doppler Cloud Radar calibration monitoring based on Disdrometer and radar reflectivity comparison method *

* *Kollias et al., 2019, AMT*
Myagkov et al., 2020, AMT
Chellini, et al., 2022, JGR Atmos

<u>Disdrometer:</u> Optical particle counter, provides N(D) i.e. the droplet size distribution during a rain.

- Forward modeling of **Ze** based on measured **N(D)**
- Compare forward simulated **Z_e(dis)** to **radar Z_e**



*<u>Radar :</u> Measures reflectivity (**Z_e**) of all drops in a volume*
***Z_e ~ N(D) D^6** (6th moment of the droplet size distribution)*

- Correction of **Z_e** for attenuation
- Compare **Z_e** to **Z_e(dis)** got from disdrometer data

The aim is not to provide information about the absolute calibration, but to monitor the calibration constant over time : identify potential changes due to breakdowns or retrieve modification of the radar setup

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Reminder about the methodology

Instruments required for the computation of the calibration monitoring method

Disdrometer

Weather station

Radar

Reminder about the methodology

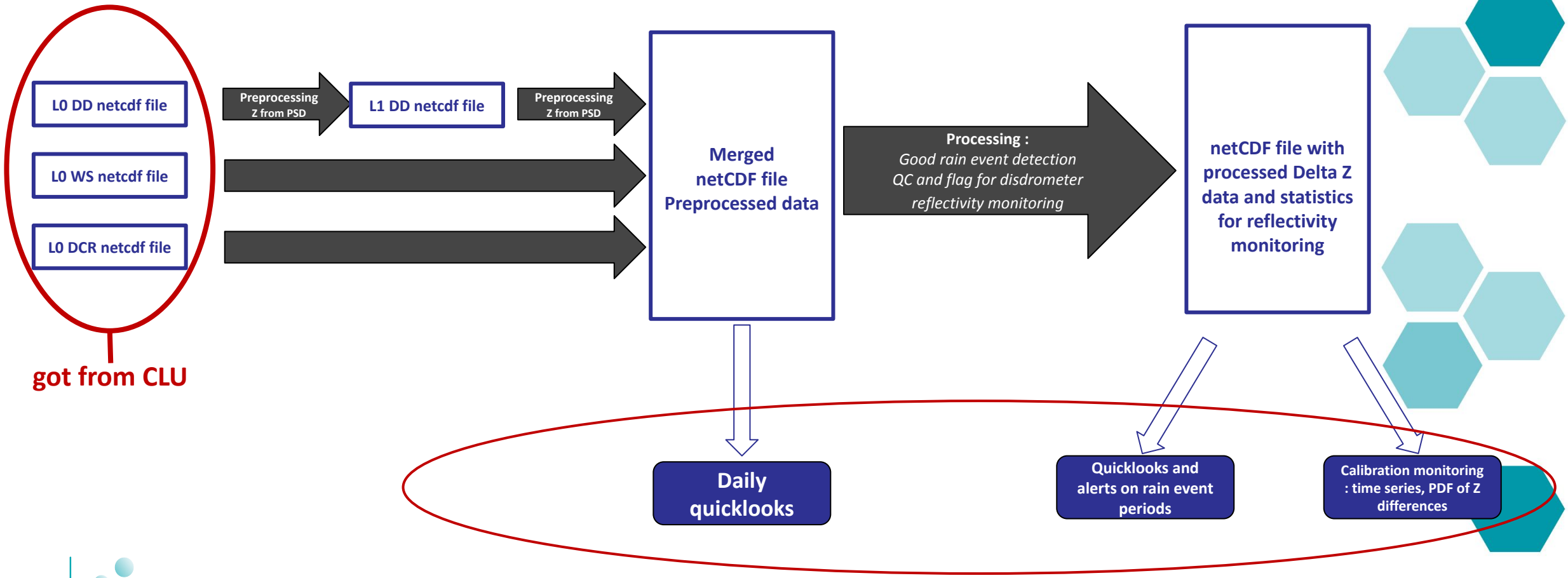
Disdrometer : DSD + algorithm —preprocessing→ forward modeled reflectivity

Weather station :

- Compare to disdrometer data to get an idea on how good the disdrometer measurements are (S. Kneifel will talk about further analysis on disdrometer data with the same goal later)
- Quality control on the respect DCR/DD comparison : control the respect of the assumptions using temperature, wind speed, wind direction…

Current progress : we focus on the couple of instruments **disdrometer / DCR,** *weather data will be integrated to the method later* (there are still discussion with CLU on how the NFs should provide the weather data)

Simplified functional diagram of the developed code



Available for NFs, on CCRES website

Availability of the code

- Link to the project :
https://github.com/ACTRIS-CCRES/ccres_disdrometer_processing

Documentation will soon be added. We want to make the code as transparent as possible and available for all.
Any remark or suggestion for improvement is welcome !

- Marc-Antoine built a package with a first stable version of the code, that can be installed via Pip (instructions are given in the link)

- A project containing the configurations used for the processing for the NFs accepted for labeling step 1A are available in this project :
https://github.com/ACTRIS-CCRES/ccres_disdro_config

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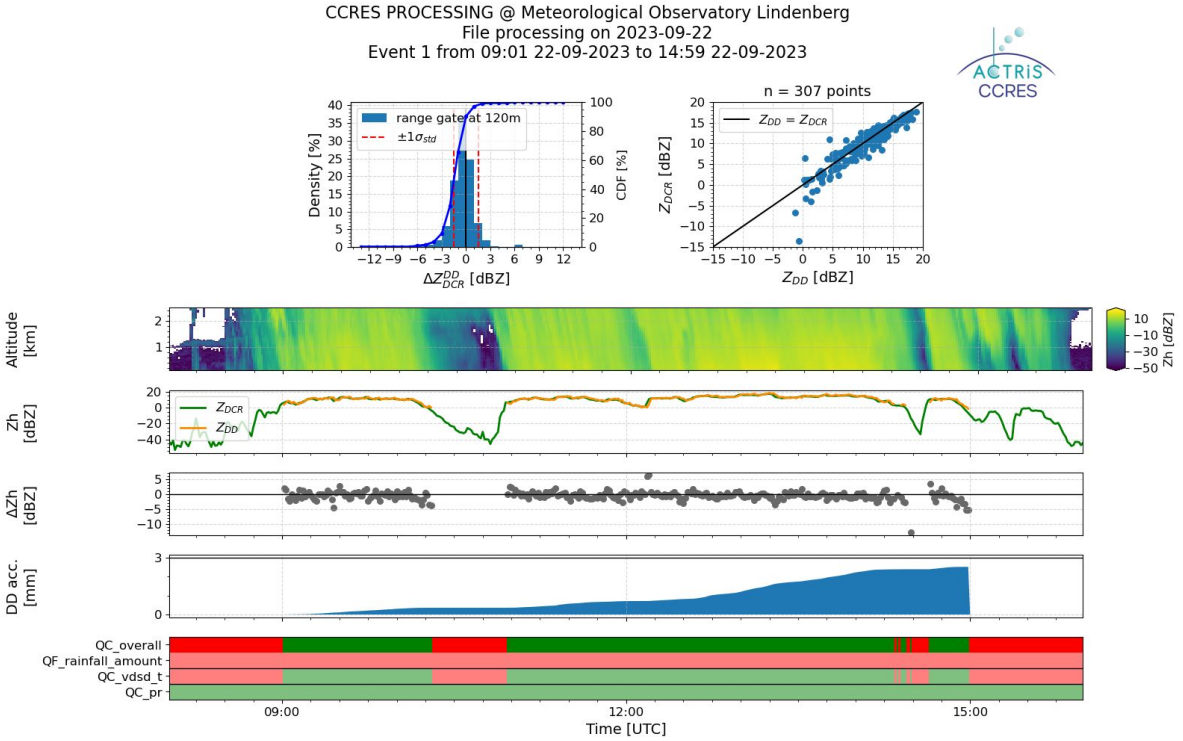
First results for stations accepted for labeling step 1A

There are several DCR/DD couples in the CCRES network on which we have to apply the methodology

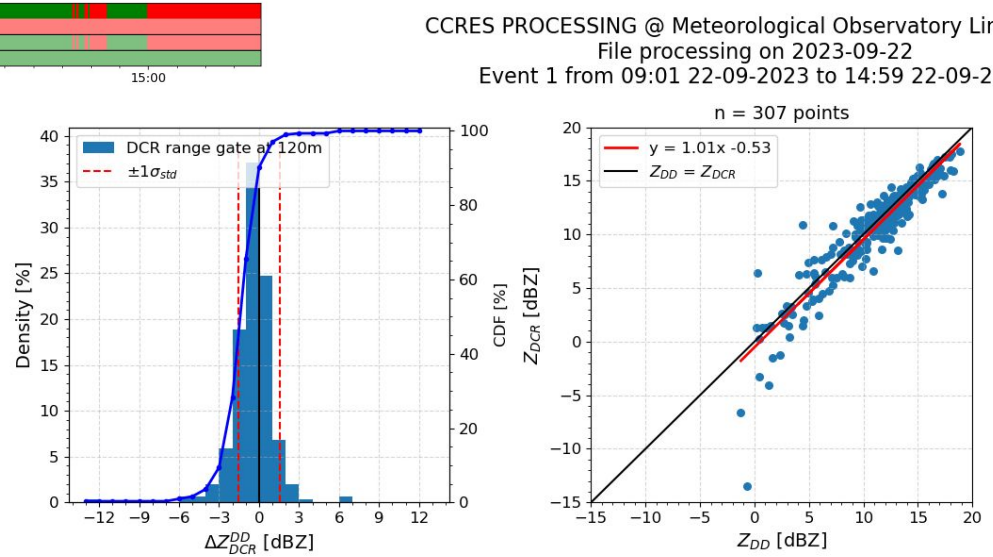
First results for stations accepted for labeling step 1A

Daily quicklooks have been put into production for 2024 data and are available in CCRES website : https://ccres.aeris-data.fr/en/data-visualization/

First results for stations accepted for labeling step 1A



Quicklooks from processing outputs, focusing on detected rain events, will be available soon

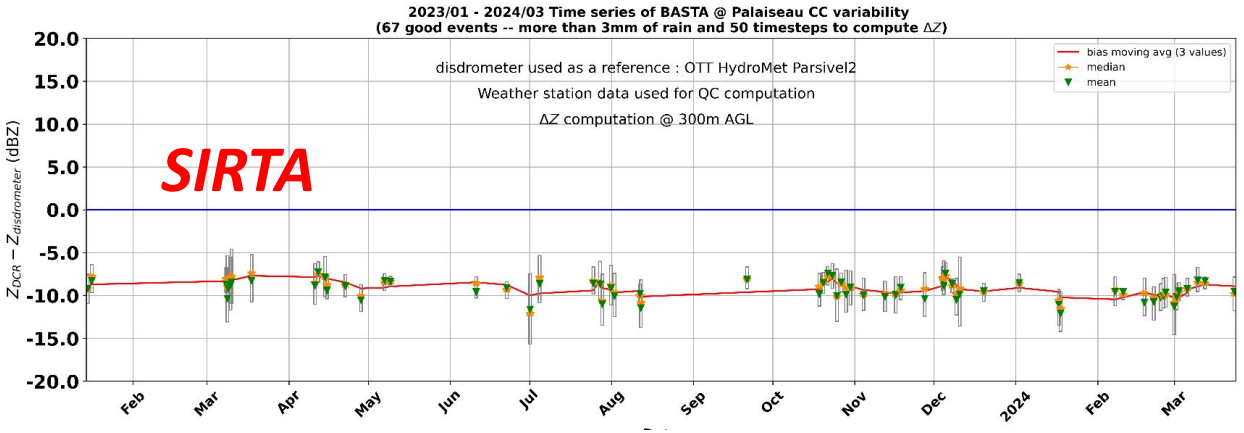


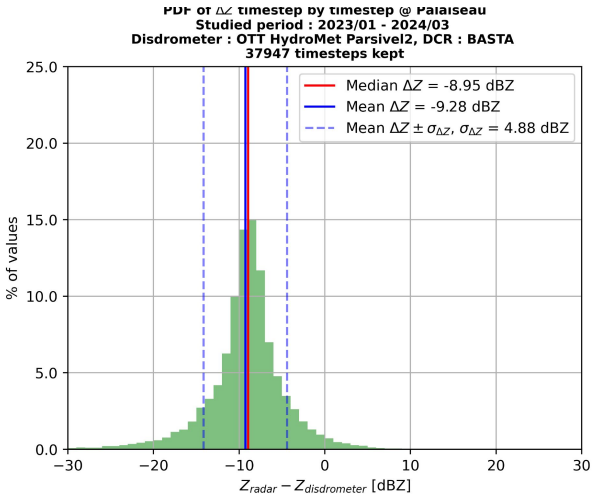
Event duration : 359 minutes

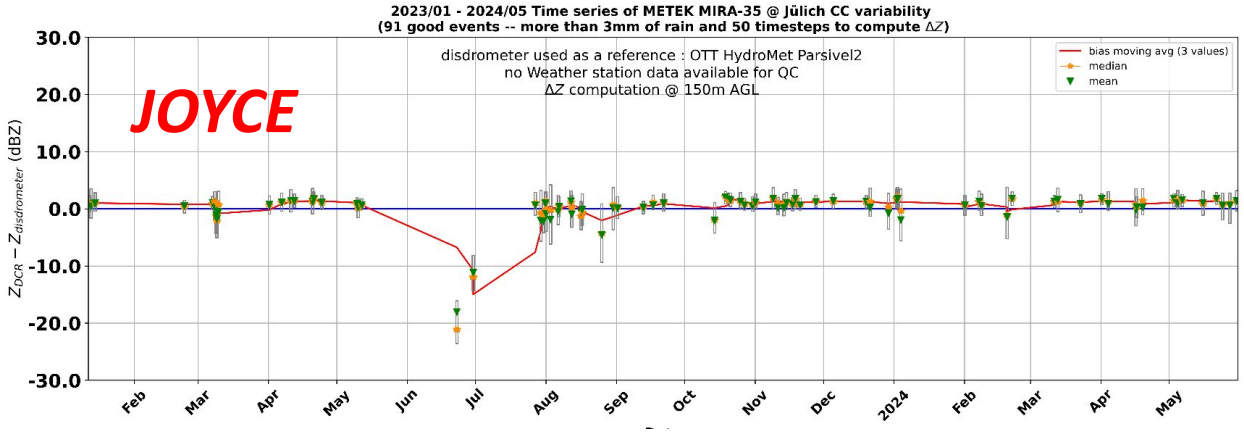
Rainfall accumulation : 2.51mm

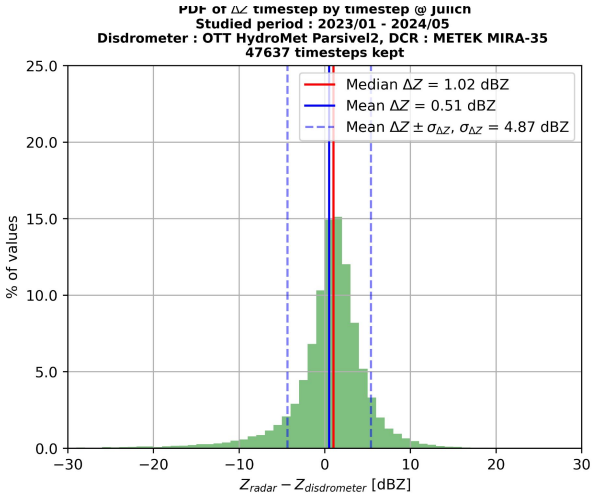
Mean ΔZ^{DD}_{DCR} : -0.47dBZ

First monitoring results (stations accepted for labeling step 1A)









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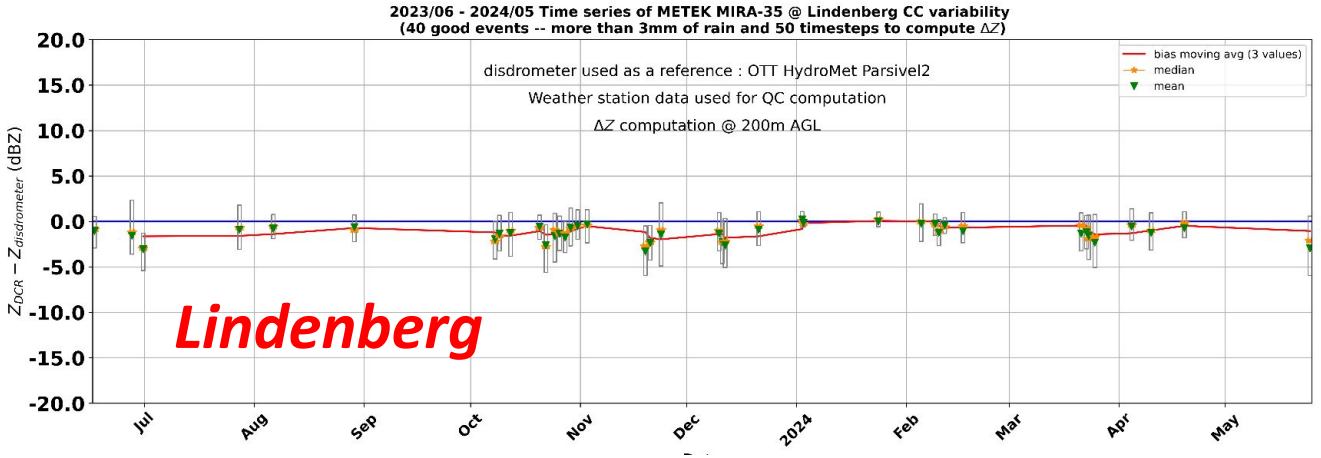

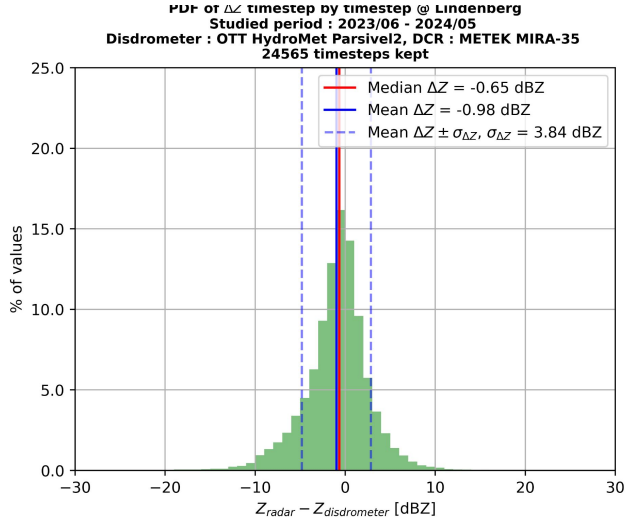

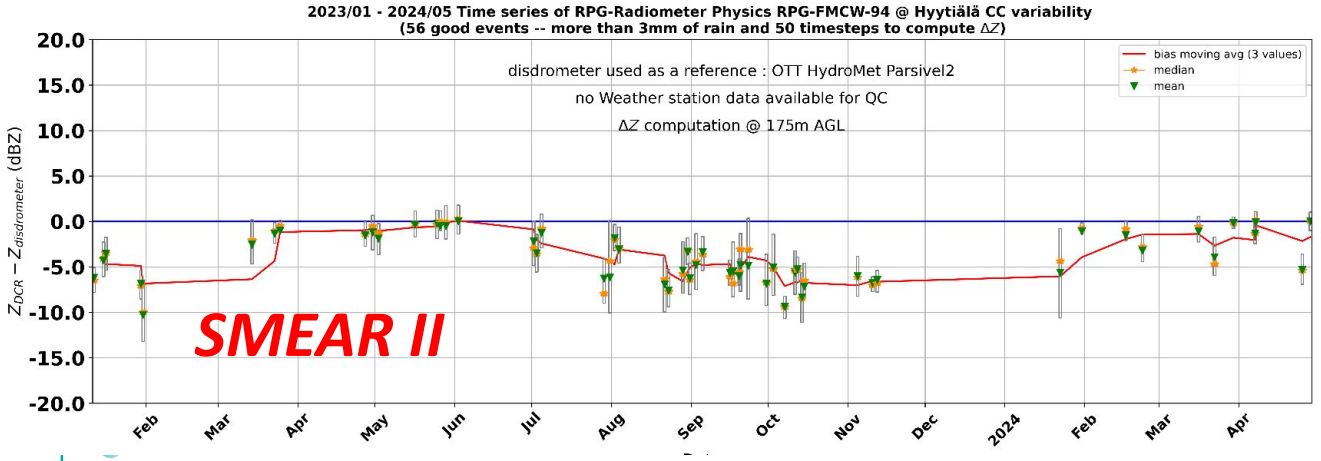

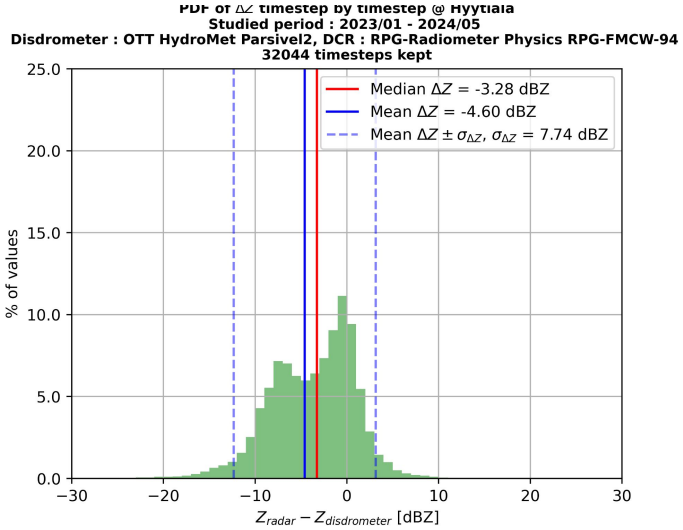

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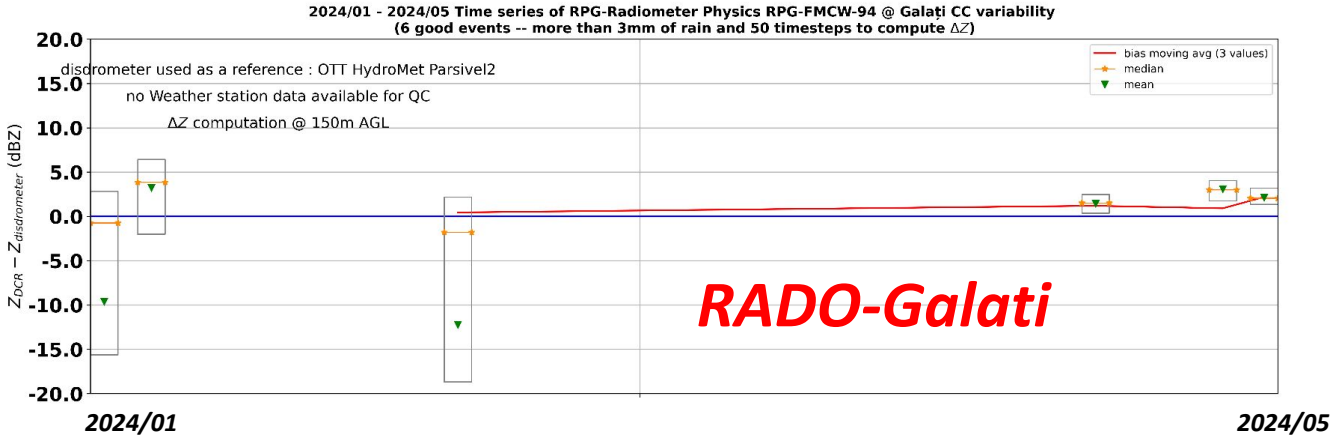

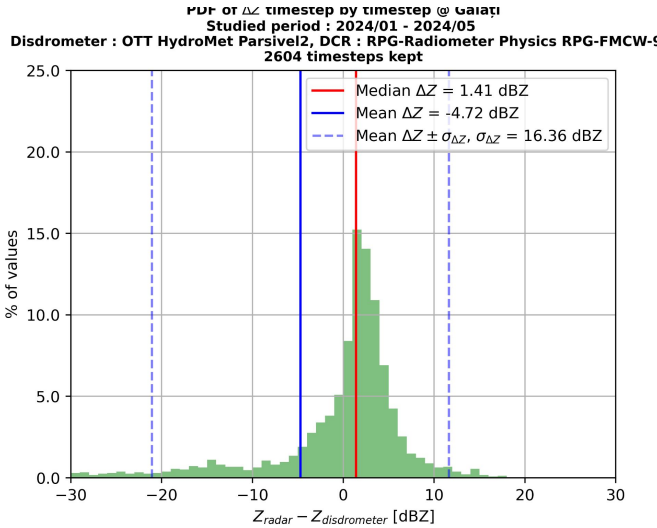

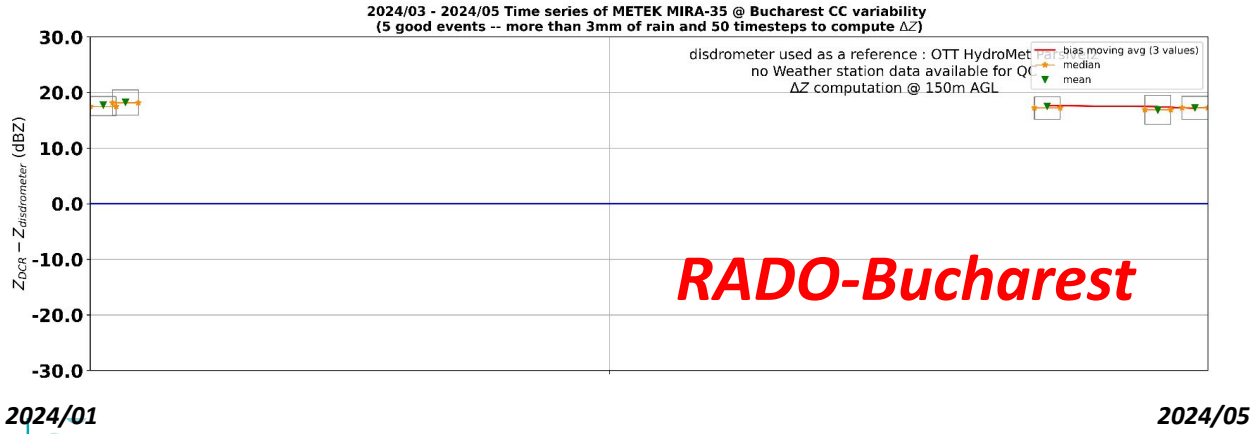

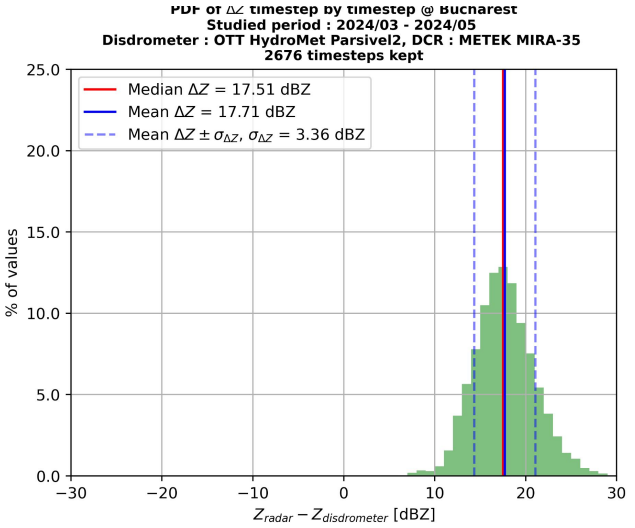

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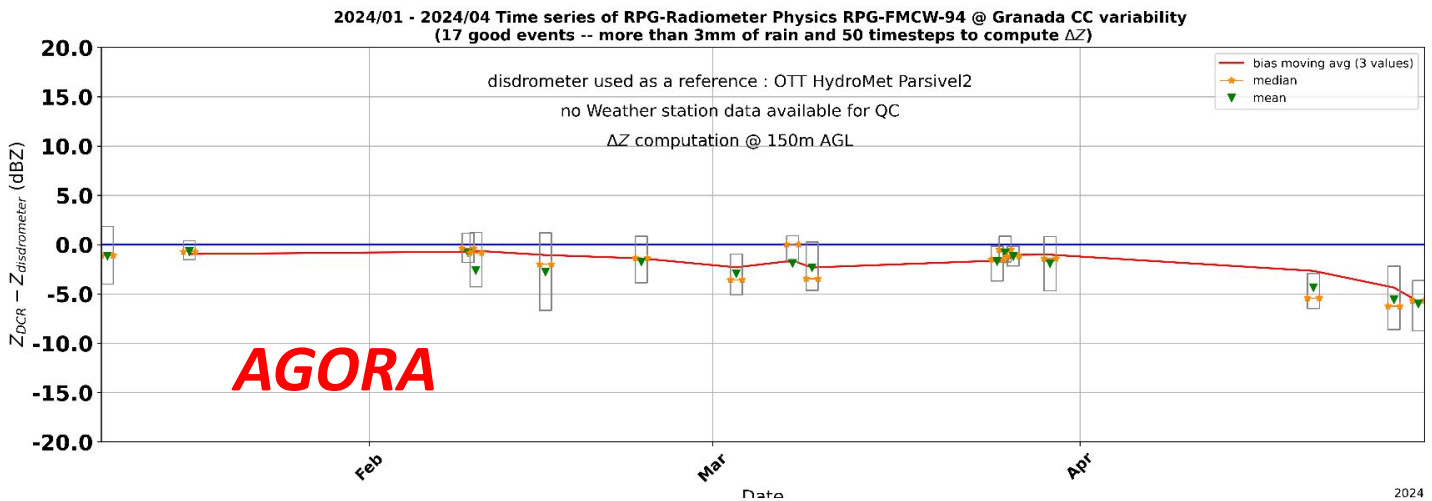

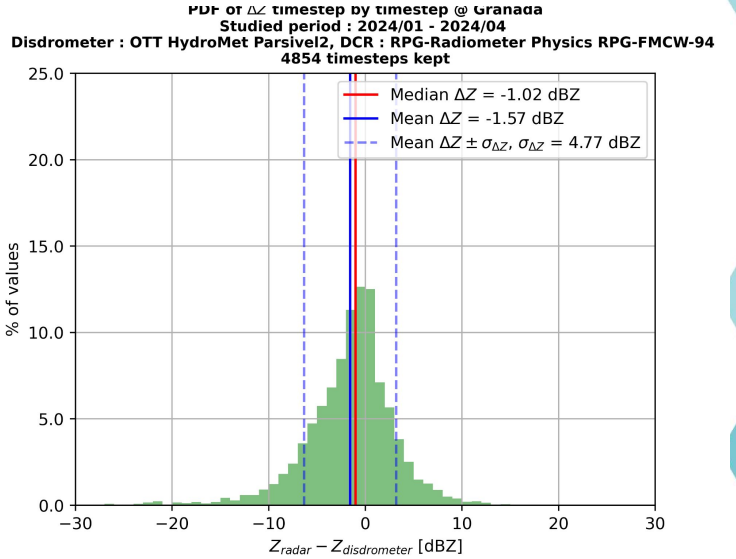

Perspectives

- Understand variability at RADO-Bucharest and SMEAR-II, possibly refine the configuration used for the processing of each station
- Include weather station data for the monitoring (QC + DD check) : work in progress at CLU-DC ; second version of the processing algorithm is currently being improved in parallel
- Make rain event QL and dynamical visualizations (long-term DCR-CC stability and statistical DCR-CC) available on the website and improve them*
- Enhance the processing algorithm

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Thank you

Criteria to select a « good » rain event : filters definitions

Variables	Limits	With WS and DD	Only with DD	Objectives
Temperature	> 2°C	✓	✗	Remove solid precipitations
Wind speed	Max < 10 m/s Average < 7 m/s	✓	✗	Ensure good quality of disdrometer measurements
Wind direction	Main wind + / - 45°	✓	✗	
Rain gap	< 1 hour	✓	✓	Ensure rain continuity
Rain rate	> 0 mm/h < 3 mm/h	✓	✓	Have “moderate” precipitations
Cumulated rain	> 3 mm	✓	✓	Have significant cumulative precipitation to ensure good statistics
Rain duration	> 3 hours	✓	✓	
Relationship fall speed / drop size	Difference with Gunn and Kinzer < 30%	✓	✓	Remove solid precipitations

Criteria to select a « good » rain event : Quality check

Variables	Limits	With WS and DD	Only with DD	Objectives
Relationship rain rate (rain gauge vs DD)	Difference < 30%	✓	✗	QC on DD acquisition
Cumulated rain rate on a long term period		✓	✗	Monitoring the DD stability