CCRES workshop

ACTRIS / PROBE / E-profile

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L. Pfitzenmaier (U. Köln)

Spring CCRES / Community Workshop Agenda

Date: 26 May 2023

09:00-09:30 Introduction, presentation of ACTRIS organization, presentation of E-PROFILE, state of data in ACTRIS Cloud Remote Sensing Data Center (CLU)

09:30-12:00 Update on ACTRIS / E-profile / PROBE instrument working groups

- ALC Task Group (calibration, optical overlap data format consistency, aerosol profiling) – Simone, Ina
- MWR Task Group (data format consistency, MWRpy implementation,) - Bernhard
- DL Task Group (data format, user experience, retrievals/scans/No. lidars, …) - Markus, (Ewan & Maxime Not available)
- DCR Task Group (monitoring with disdro, scanning strategy, …) – Jean-Charles, Lukas, Felipe.

14:00-17:00.

- Reports from TGs
- Discussion on advanced and multi-instrument products
- CRS NF Labelling: identify which stations are ready to start step 1A
- Scientific highlights
- EarthCare Cal/Val activities

Generic topics to be discussed in Task Group breakout

- List proposed activities, conducted within ACTRIS, PROBE, E-PROFILE.
  - SOPs – incl. scanning and scheduling requirements
  - Data format (« RAW2L1-like »)
  - Calibration
  - Corrections / pre-processing
  - Quality control (Housekeeping variables, Geophysical variables)
  - Single-instrument products
  - Necessary ancillary data (if any)
- List available resources (repositories for codes, documents, …)
- Identify contributions towards PROBE / ACTRIS / E-PROFILE deliverables
- List needs for PROBE support grants (in-person visits STSM; virtual mobility grants VMG)
- Calendar of activities
- Identify areas that lack activity
- Propose specific workshops and training

Specific topics to be discussed in DCR Task Group breakout

- List proposed activities, conducted within ACTRIS, PROBE, E-PROFILE.
  - **SOPs – incl. scanning and scheduling requirements**
  - Data format (« RAW2L1-like »)
  - **Absolute calibration**
  - **Monitoring of the DCR calibration**
  - Corrections / pre-processing
  - **Quality control (Housekeeping variables, Geophysical variables)**
  - Single-instrument products
  - Necessary ancillary data (if any)
- List available resources (repositories for codes, documents, …)
- Identify contributions towards PROBE / ACTRIS / E-PROFILE deliverables
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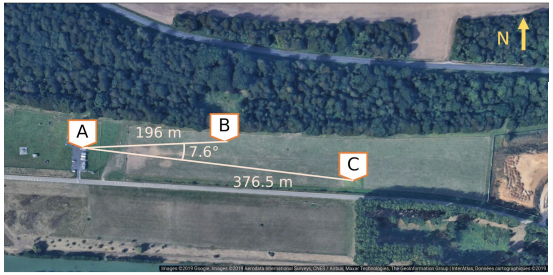
Specific topics to be discussed in DCR Task Group breakout

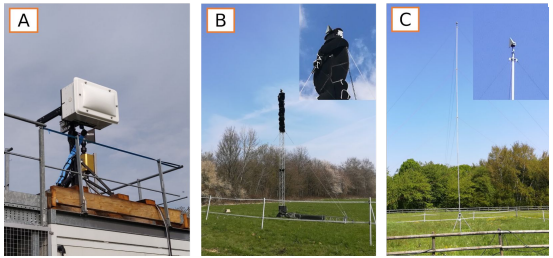
- Standard Operating Procedures (SOP) : physical set-up and data acquisition
  - Doppler Cloud Radar (DCR, inc. scanning and scheduling requirements)
    - minimum requirement for zenith vertical pointing mode : 50% of the time, maximum gap, minimum duration, Z and DV
    - technical data available
  - Disdrometer (DD)
    - 1min sampling without obstacle
    - technical data available
  - Weather Station station (WS)
    - 1min sampling
    - tipping bucket rain gauge (Can non-tipping bucket rain gauge be qualified?)
    - to be representative of the local environment

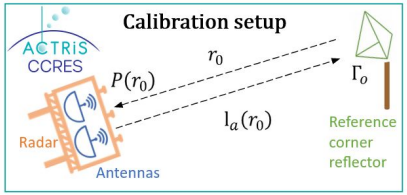
=> collocated measurements for DCR/DD/WS

Specific topics to be discussed in DCR Task Group breakout

- DCR absolute calibration methods
  - Metallic target / mast
  - Calibration Transfer







Toledo, F., Delanoë, J., Haeffelin, M., Dupont, J. C., Jorquera, S., & Le Gac, C. (2020). **Absolute calibration method for frequency-modulated continuous wave (FMCW) cloud radars based on corner reflectors**. Atmospheric Measurement Techniques, 13(12), 6853-6875.

Uncertainty sources:

Antennas properties
- Beam lobe shape
- Beam overlap
- Beam width

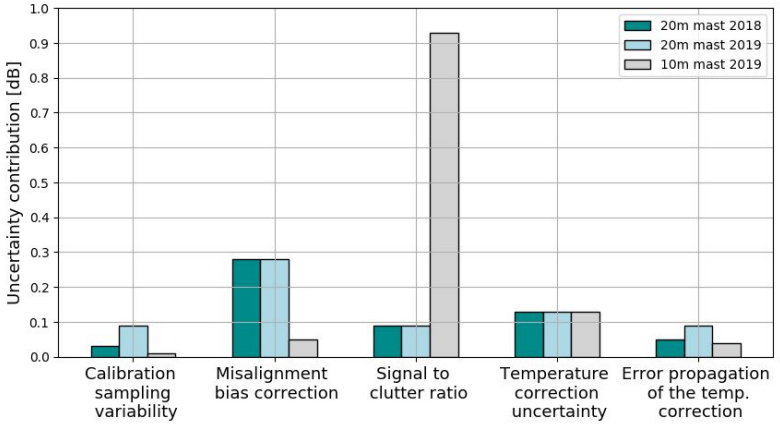
Radar

Radar gain variations
- Impact of temperature
- Non ideal IF filters

$P(r)$: Sampled power
- Receiver compression

Reference corner reflector

Γ_o: Reference target Radar Cross Section (RCS)
- Theoretical value
- Clutter
- Alignment



Specific topics to be discussed in DCR Task Group breakout

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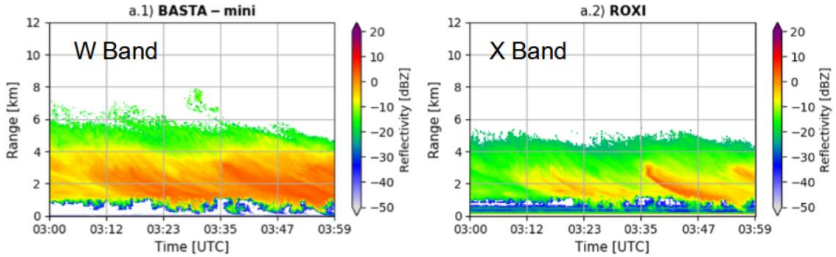


Reference radar

Uncalibrated radar

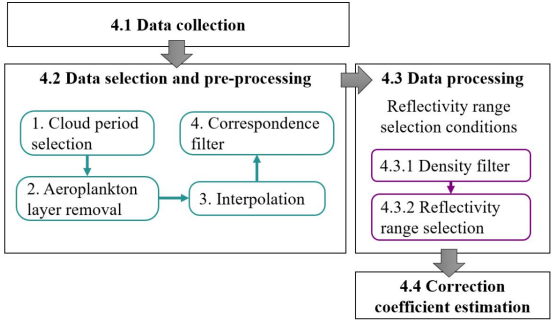
$$Z_r(r) = Z_u(r) + CC$$

Reference radar reflectivity

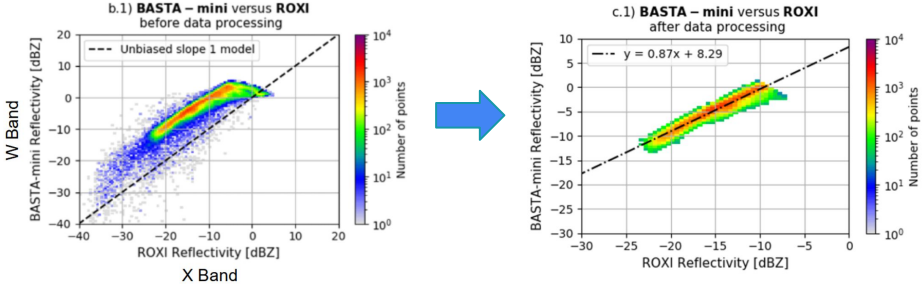
Uncalibrated radar reflectivity

Radar correction coefficient

Methodology to identify comparable data between different frequency radars



Jorquera, S., Toledo Bittner, F., Delanoë, J., Berne, A., Billault-Roux, A., Schwarzenboeck, A., Dezitter, F., Viltard, N., & Martini, A. (2023). **Calibration transfer methodology for cloud radars based on ice cloud observations**, Journal of Atmospheric and Oceanic Technology (published online ahead of print 2023). doi: https://doi.org/10.1175/JTECH-D-22-0087.1



After data processing is done, a slope-1 fit is used to estimate the CC

Specific topics to be discussed in DCR Task Group breakout

- Perspectives CCRES-FR
  - 2023:
    - Calibration of the CCRES-FR reference radar (BASTA mini)
    - Calibration transfer to the ACTRIS radars from:
      - SIRTA, France
      - JOYCE, Germany
  - 2024:
    - Multifrequency calibration transfer test (10, 35 et 95 GHz)
      - Closure
      - Closure with disdrometers (DSD, Thies, Parsivel)

Specific topics to be discussed in DCR Task Group breakout

- **DCR calibration constant monitoring**
  - Objective
  - Instrumental set-up
  - Pre-processing requirement / CLU-DC status
  - “Good” rain event cases / quality flag
  - Disdrometers comparisons at Joyce
  - SIRTA long-term results

Specific topics to be discussed in DCR Task Group breakout

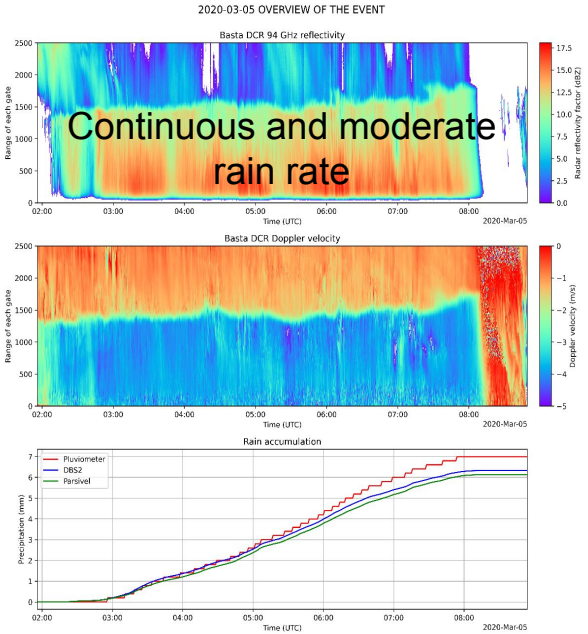
- **DCR calibration constant monitoring**
  - **Objective** : develop a method to compare reflectivity (Ze) (1) measured by the Doppler Cloud Radar (DCR) with (2) derived from disdrometers to frequently monitor in time shifts, drifts and deviations of the DCR Calibration Constant (CC)
  - **Instrumental set-up** : rain gauge, disdrometers, Doppler Cloud radar

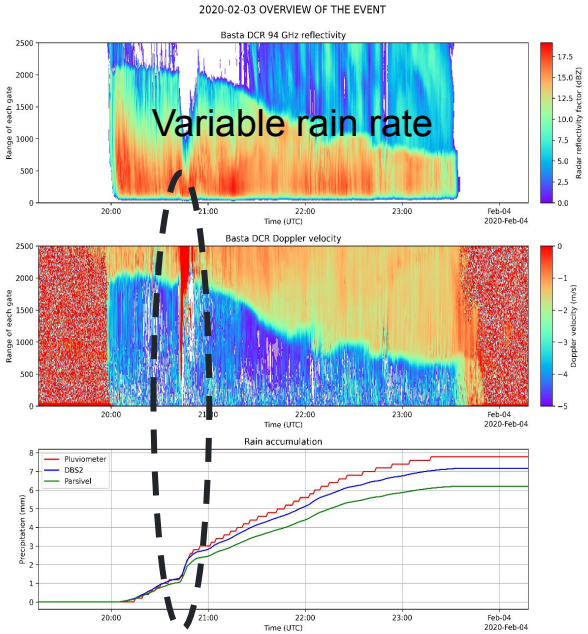
Specific topics to be discussed in DCR Task Group breakout

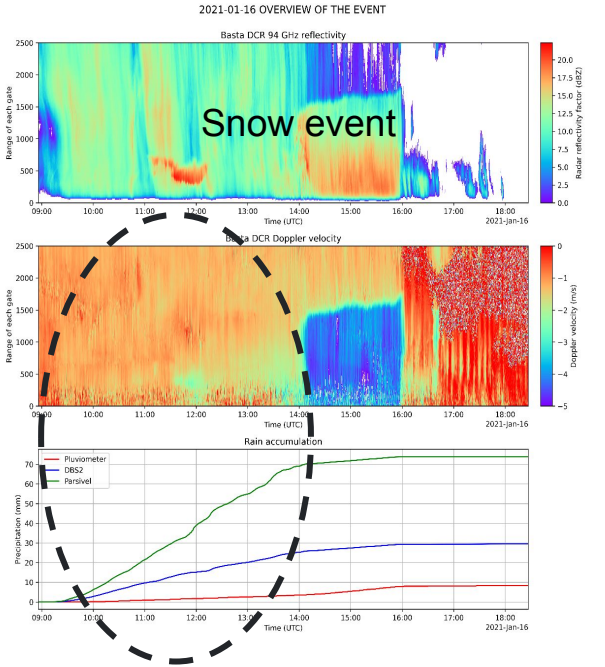
- **DCR calibration constant monitoring**
  - Pre-processing requirement / CLU-DC status
    - Objective : have homogeneous dataset for the ACTRIS sites concerning the input data required for the monitoring.
    - Input data :
      - weather station variables (T/RH, wind, and **rain rate**)
        - ready for SIRTA (1 ascii => 1 netcdf) ✓
        - almost ready for Lindenberg (2 ascii => 1 netcdf) ✓
        - not ready for JOYCE (pb with time) ✗
      - disdrometer variables (**PSD**, fall velocity)
        - ready for SIRTA, Lindenberg and JOYCE (1 ascii => 1 netcdf) ✓
      - Doppler cloud radar (**Z**, DV)
        - ready for all ✓

Specific topics to be discussed in DCR Task Group breakout

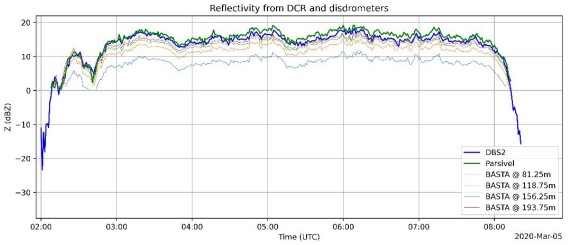
- **DCR calibration constant monitoring**
  - “Good” rain event cases / quality flag
    => automatic daily figures generated by Yanis python code

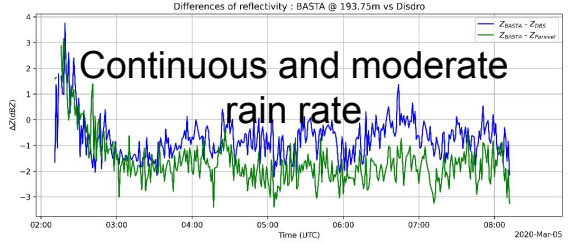




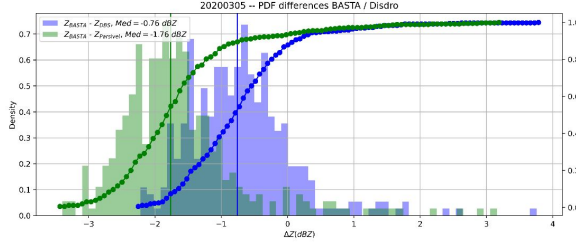


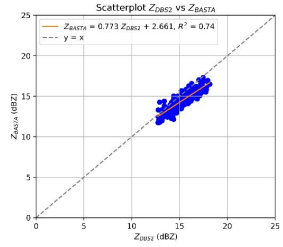
2020-03-05 REFLECTIVITY

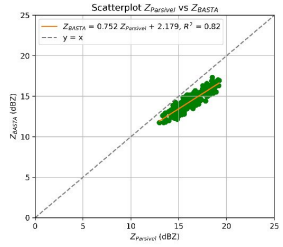




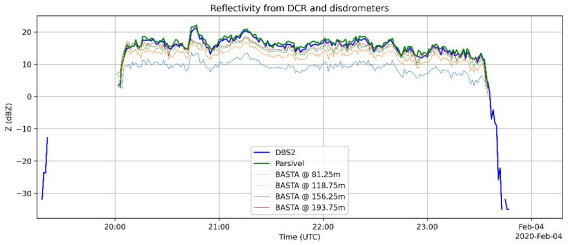
Continuous and moderate rain rate

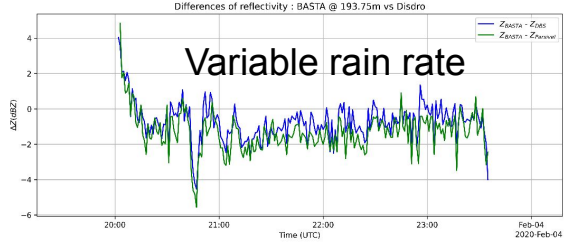




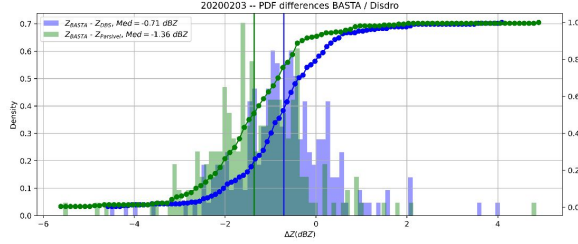


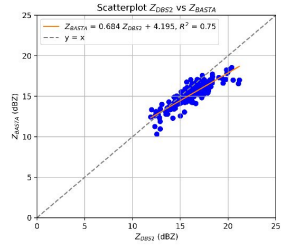
2020-02-03 REFLECTIVITY

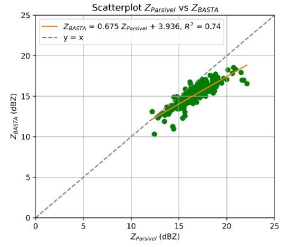




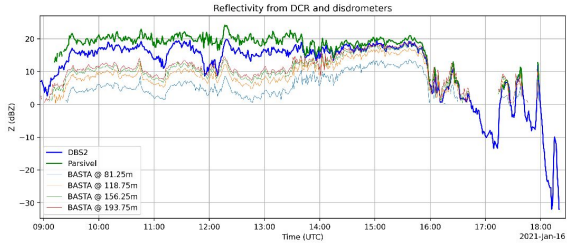
Variable rain rate

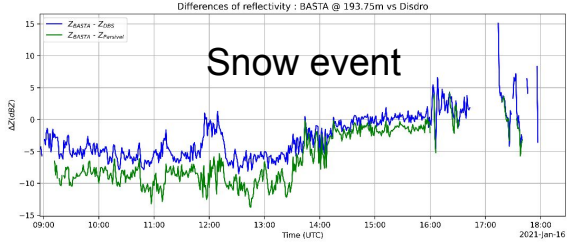




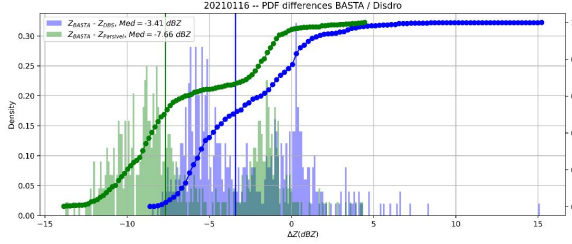


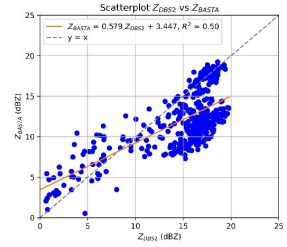
2021-01-16 REFLECTIVITY

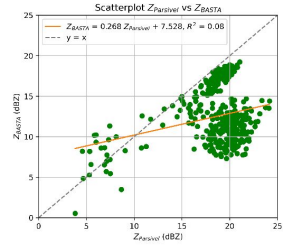




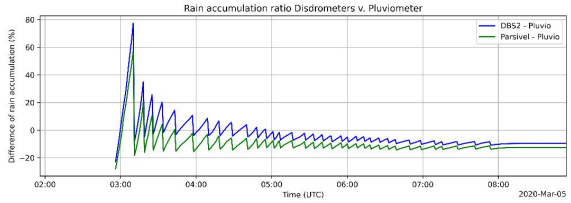
Snow event

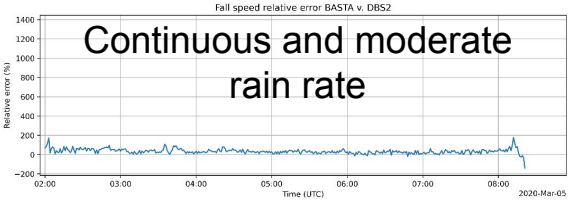


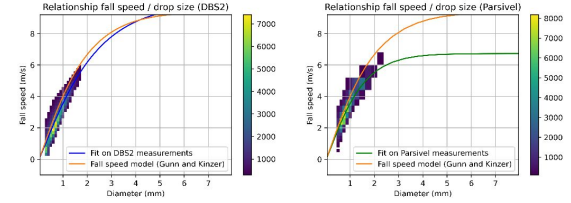


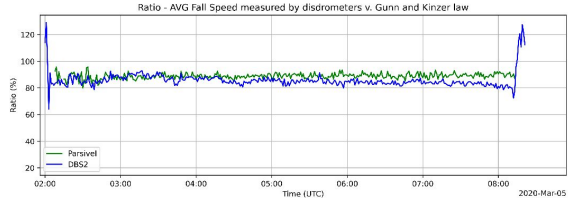


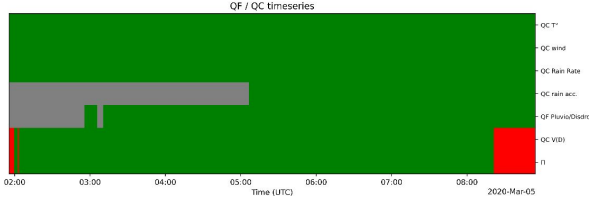
2020-03-05 Quality check



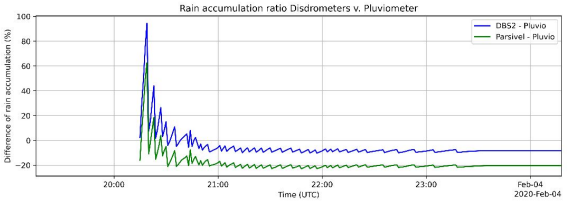


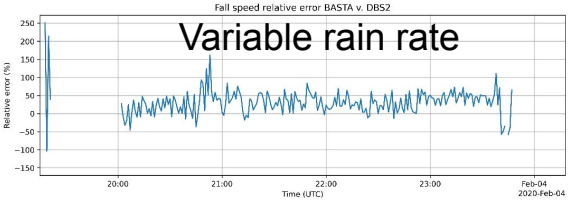


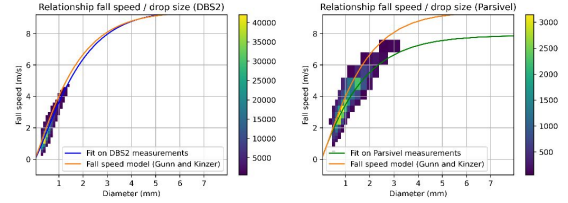


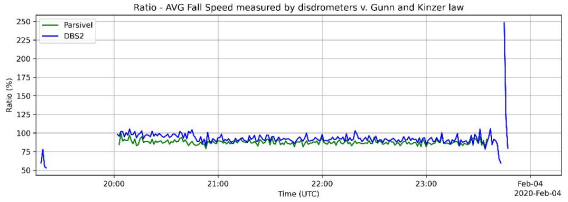


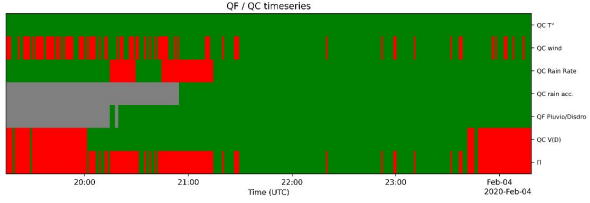
2020-02-03 Quality check



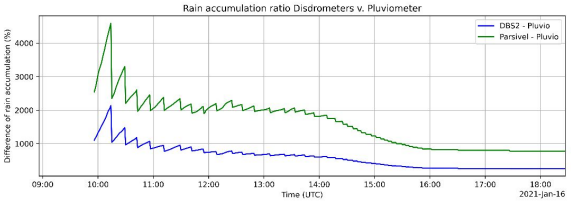


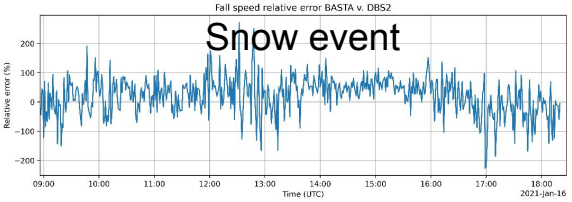


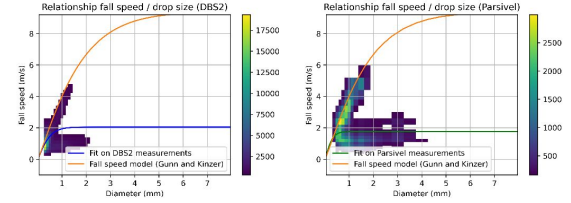


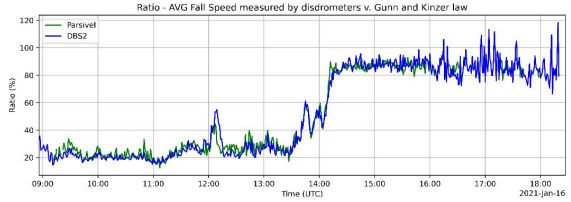


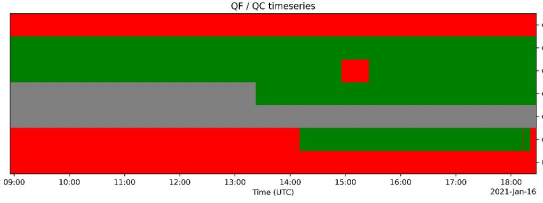
2021-01-16 Quality check











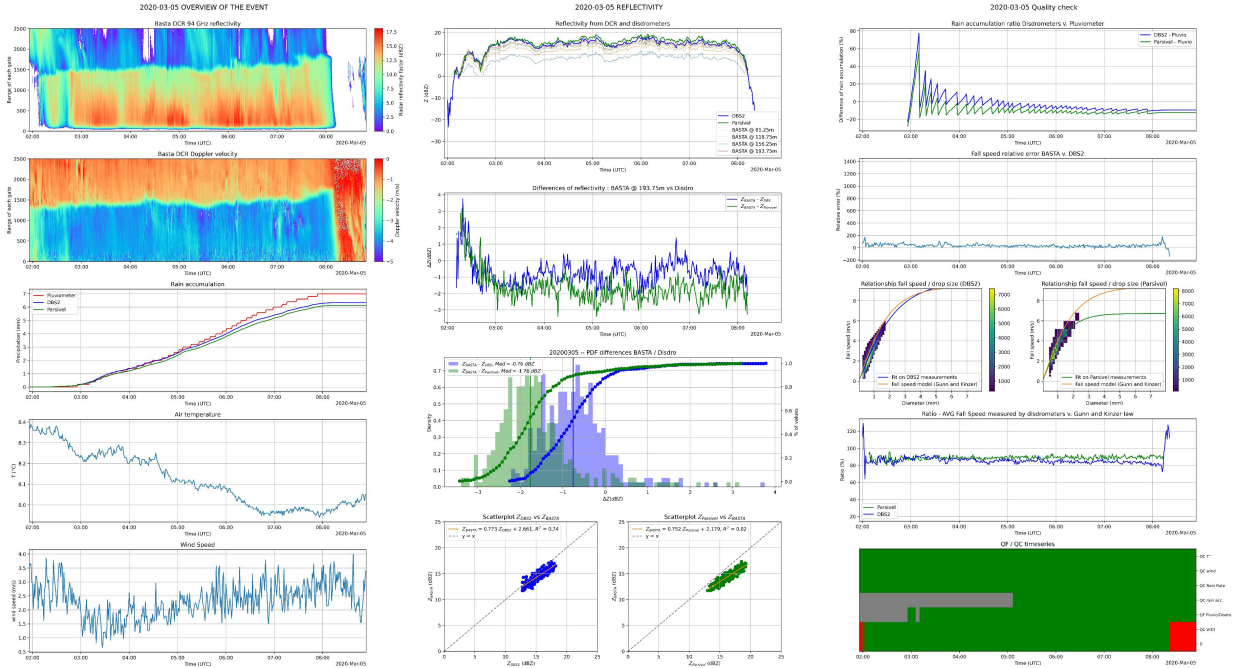
Specific topics to be discussed in DCR Task Group breakout

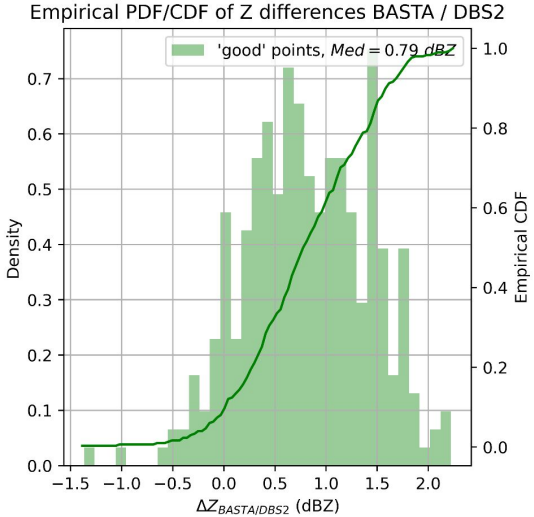
- **DCR calibration constant monitoring**

  => automatic daily/monthly figures available for each NF site

  => generated by python codes installed at CCRES-DC

  => define alert / warning based on DZ value variability





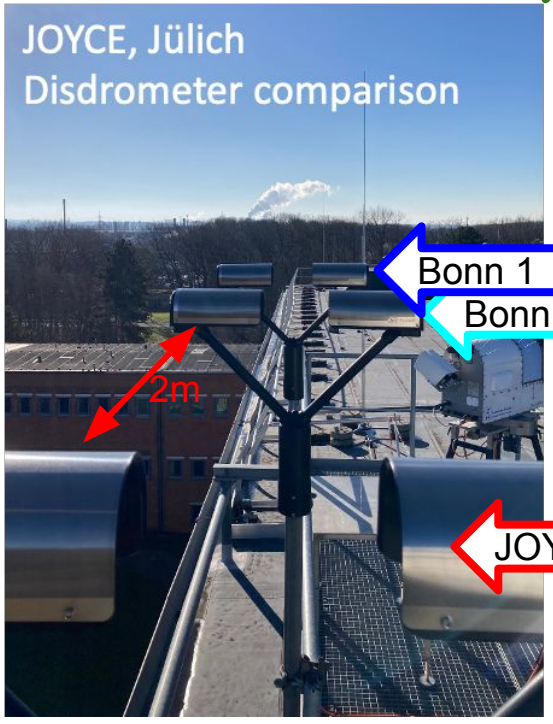
Specific topics to be discussed in DCR Task Group breakout

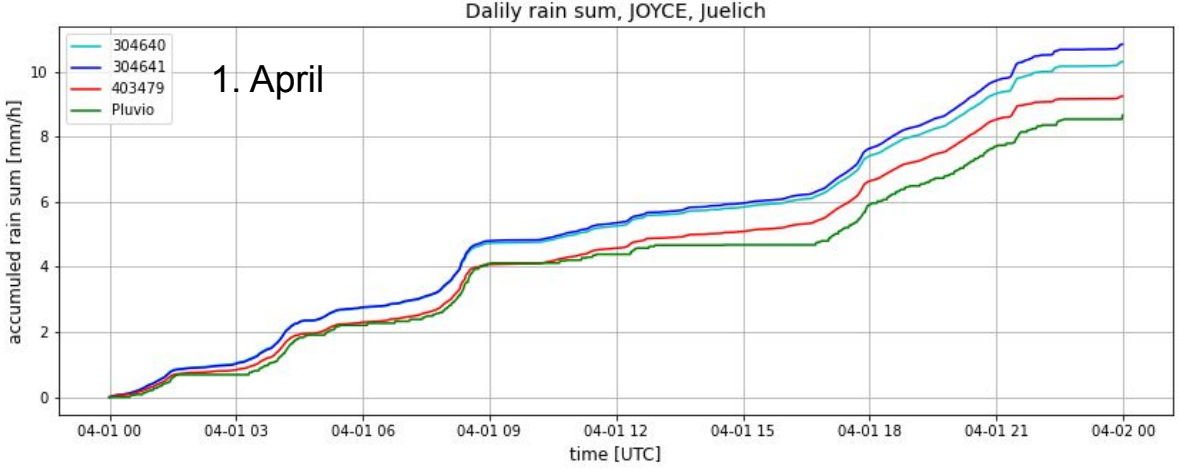
- **DCR calibration constant monitoring**
  - Disdrometers comparisons at Joyce

Comparing 3 Parsivel2 since mid Feb 2023

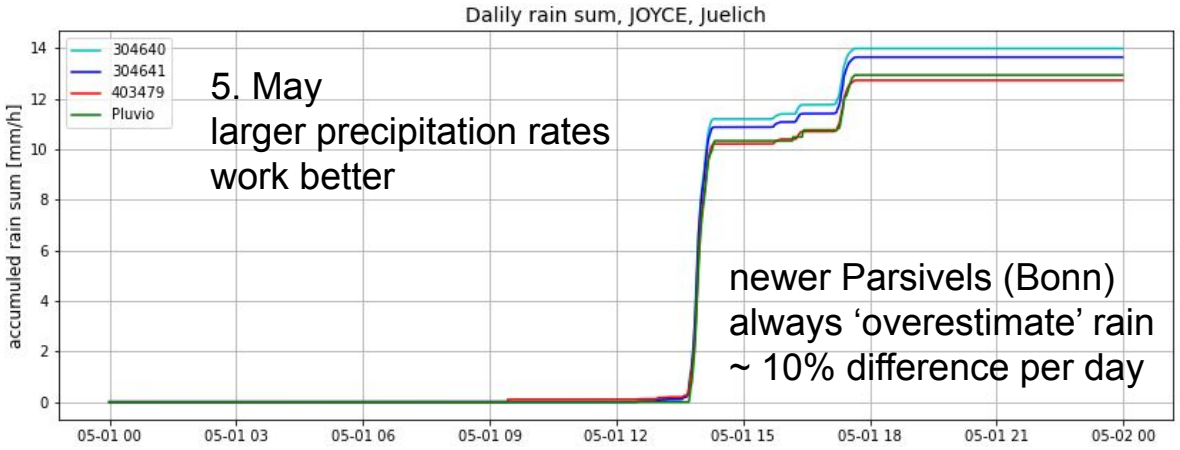
- How good do they match?
- If you know one instrument can you easily replace it with a ‘new’ one?
- about 2 month data

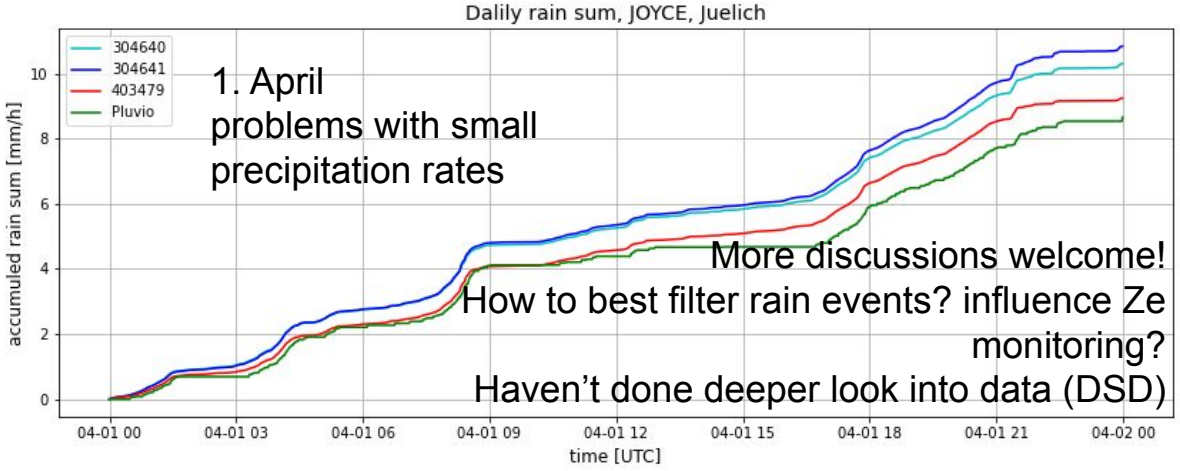
ca 10m Pluvio





Specific topics to be discussed in DCR Task Group breakout





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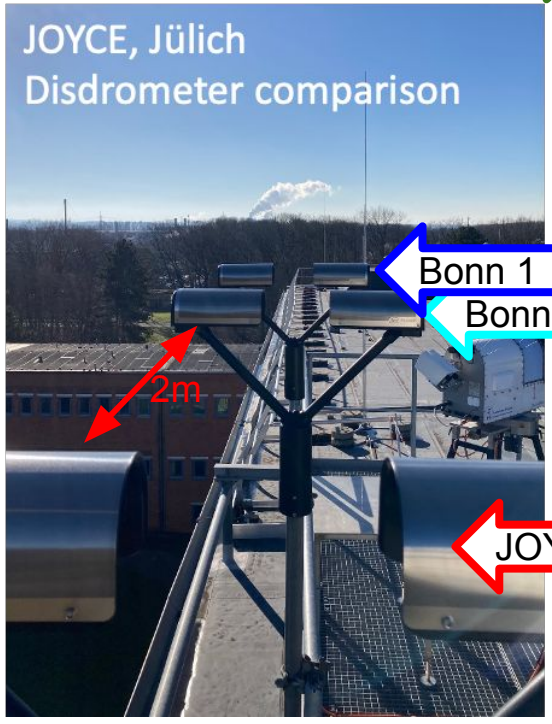
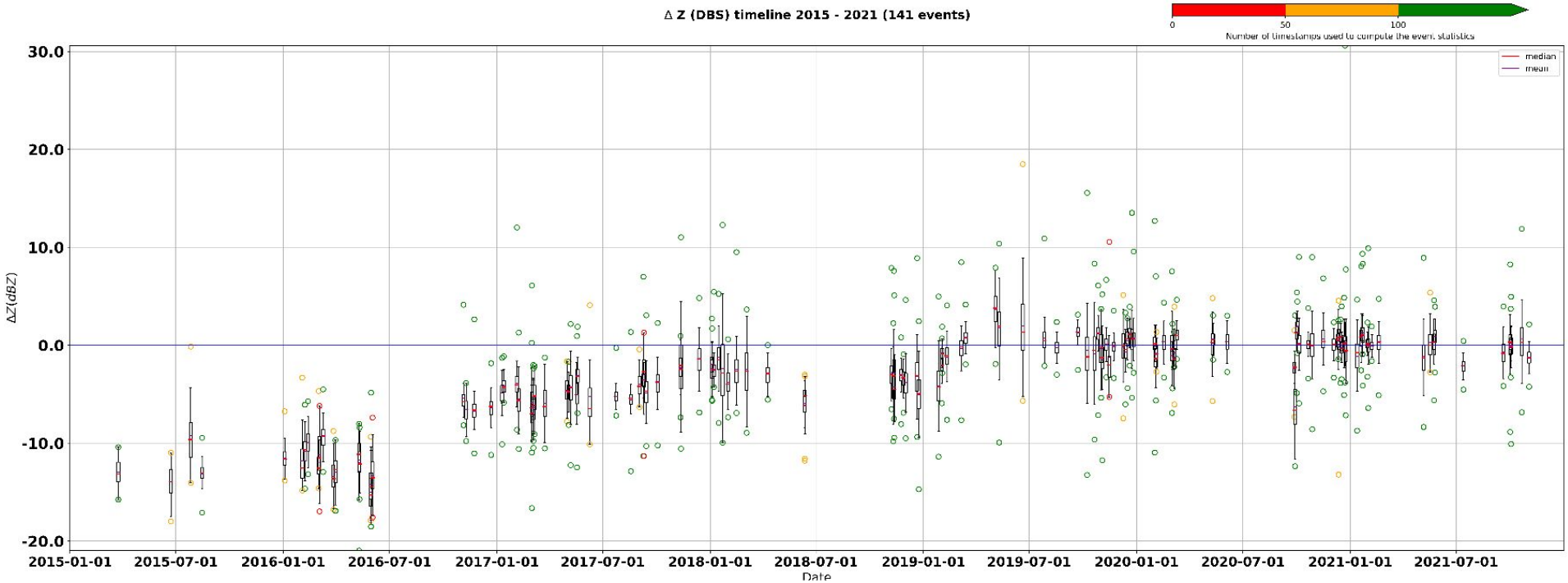


Specific topics to be discussed in DCR Task Group breakout

- **DCR calibration constant monitoring**
  - SIRTA long-term results

Figures by Yanis Grit



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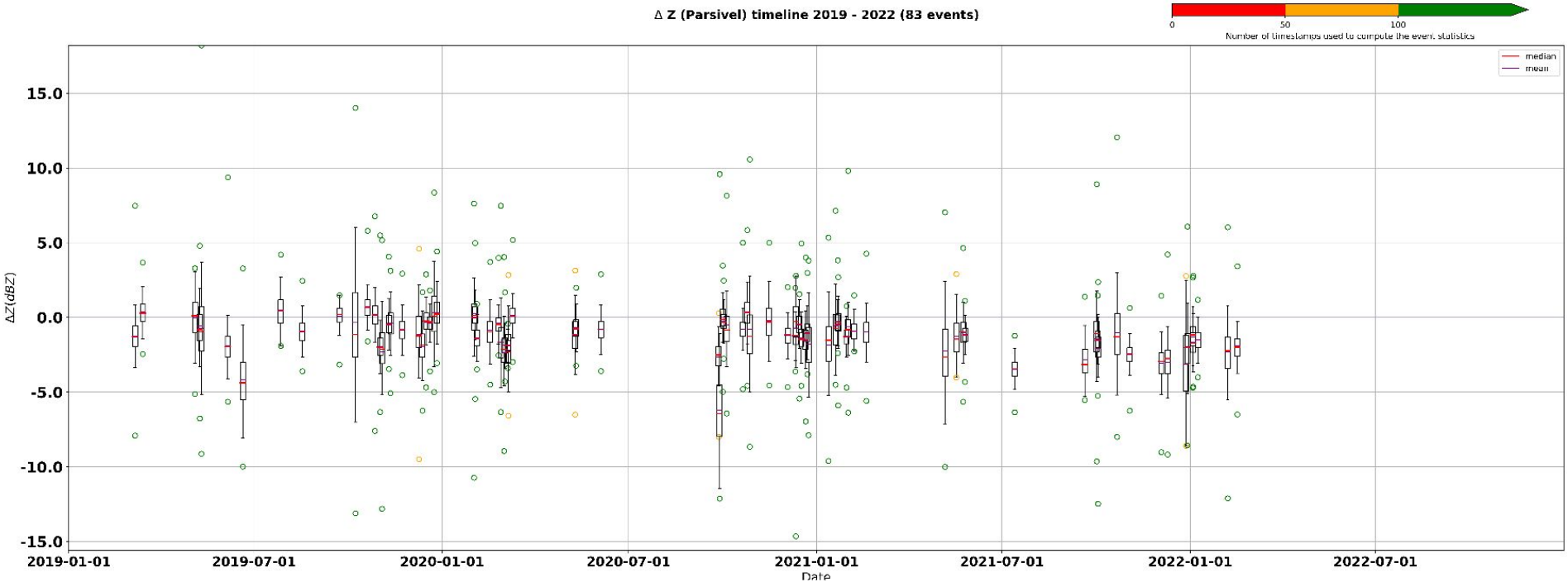

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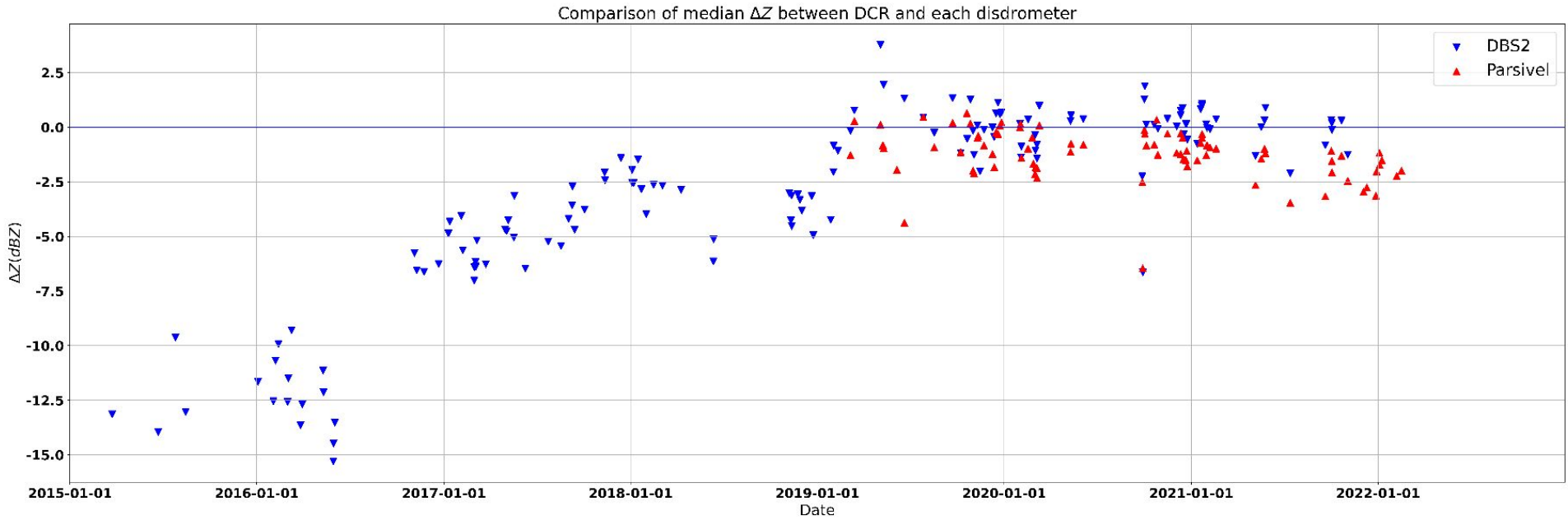

Specific topics to be discussed in DCR Task Group breakout

- HouseKeeping Data (HKD) definition (DCR).

Radar	Assignee(s)	status
LATMOS Basta	J.-C. Dupont & F. Toledo	**Done**
METEK MIRA 35(-s)	J.-C. Dupont & F. Toledo	**Todo**
RPG FMCW 94 (DP)	J.-C. Dupont & F. Toledo	**Ongoing**

  - RPG FMCW 94
    - HKD variables identified, alerts triggers to be completed
  - Metek MIRA
    - Meeting with METEK (M. Bauer-Pfundstein)
    - Software dedicated to extract HKD for ACTRIS-CCRES will be developed by METEK
    - 2 pilot stations have a MIRA (JOYCE and Lindenberg)

Specific topics to be discussed in DCR Task Group breakout

- HouseKeeping Data (HKD) definition (DD)

Instruments	Assignee(s)	status
OTT parsivel 2	J.-C. Dupont & L. Pfitzenmaier	**Done**
Thies LNM	J.-C. Dupont	**Done**

- HouseKeeping Data (HKD) definition (WS)
  - Low priority
  - Most instruments don’t have HKD
  - Perhaps later: monitoring of some rain gauge

Specific topics to be discussed in DCR Task Group breakout

- HKD code/flux
  - All codes to extract HKD from DCR and DD data need to be developped
  - RPG FMCW and basta use netCDF files.
    - Shouldn’t be too complicated
  - METEK MIRA should also have HKD in netCDF file

Specific topics to be discussed in DCR Task Group breakout

- Example monitoring for basta in SIRTA

Specific topics to be discussed in DCR Task Group breakout

- Geophysical data quality control
  - …
- Does the task group need support from
  - PROBE : virtual mobility grant to write a report, short term scientific missing any country in EU
  - ATMO ACCESS : Transnational access project to SIRTA
- Will the group propose training ? What , when ?

DCR Breakout session summary

- SOPs : Scanning radars
  - There is a need to define strict minimum requirements on vertical observations (model comparisons)
    - Frequency
    - Time coverage -> discuss within CLU to define minimum requirements of CloudNet
    - Discuss within CCRES after the meeting with CLU
  - Discuss common scanning strategies to harmonize standardized scans
    - Product development
    - Example: Wind profiles
    - How to fit into CLU, vertical observations considered
    - Install scan for wind retrievals at Rado (Standard scan strategy for Mira)
  - Discussed common scans windows with other scanning instrument grounds (MWR, Doppler Lidar) -> Broader discussion needed!
  - Experimental scans could be done outside the allocated time periods for vertical profiling and standard scans - new file name convention?
- Outcome:
  - Updated SOPs
  - Standard scans for Wind retrieval

DCR Breakout session summary

- Radar calibration, perspectives:
  - 2023:
    - Calibration of the CCRES-FR reference radar (BASTA mini)
    - Calibration transfer to the ACTRIS radars from:
      - SIRTA, France
      - JOYCE, Germany
  - 2024:
    - Multifrequency calibration transfer test at SIRTA (10, 35 et 95 GHz)
      - Closure
      - Closure with disdrometers (DSD, Thies, Parsivel)
    - Possible calibration transfer campaigns at:
      - INOE, Bucarest (Ka and W)
      - LMU, Munich (X, Ka, and W)
      - TROPOS, Leipzig (2 Ka and 3 W)

DCR Breakout session summary

- Calibration monitoring
  - Tracking works for SIRTA
    - Tested with the Parsivel disdrometer
    - **Users request: Ze-monitoring code to test with their own data sets - release a version v0?** - online training of the SIRTA/CCRES tool - release the tool for others to play around. Make a plan to get here.
  - Disdrometer comparison at JOYCE :
    - Investigate more time into Disdrometer calibration or validation of their data - uncertainty estimation
  - Weather station requirements
    - Discussion on the time resolution requirements, a sensitivity study is needed
    - Rain gauge needed to cross check the disdrometer data quality (1 min sampling time)
    - We'll begin by defining beta requirements, to be improved with experiments using the calibration tracking tool
  - Think about shorter time scales for the calibration monitoring ("real time monitoring")

DCR Breakout session summary

- Housekeeping
  - The software platform is ready and tested, variable definition is still missing for some instruments
  - MIRA radars require a HKD data output -> discuss within JOYCE and Metek
  - Use a similar framework for the calibration tracking?