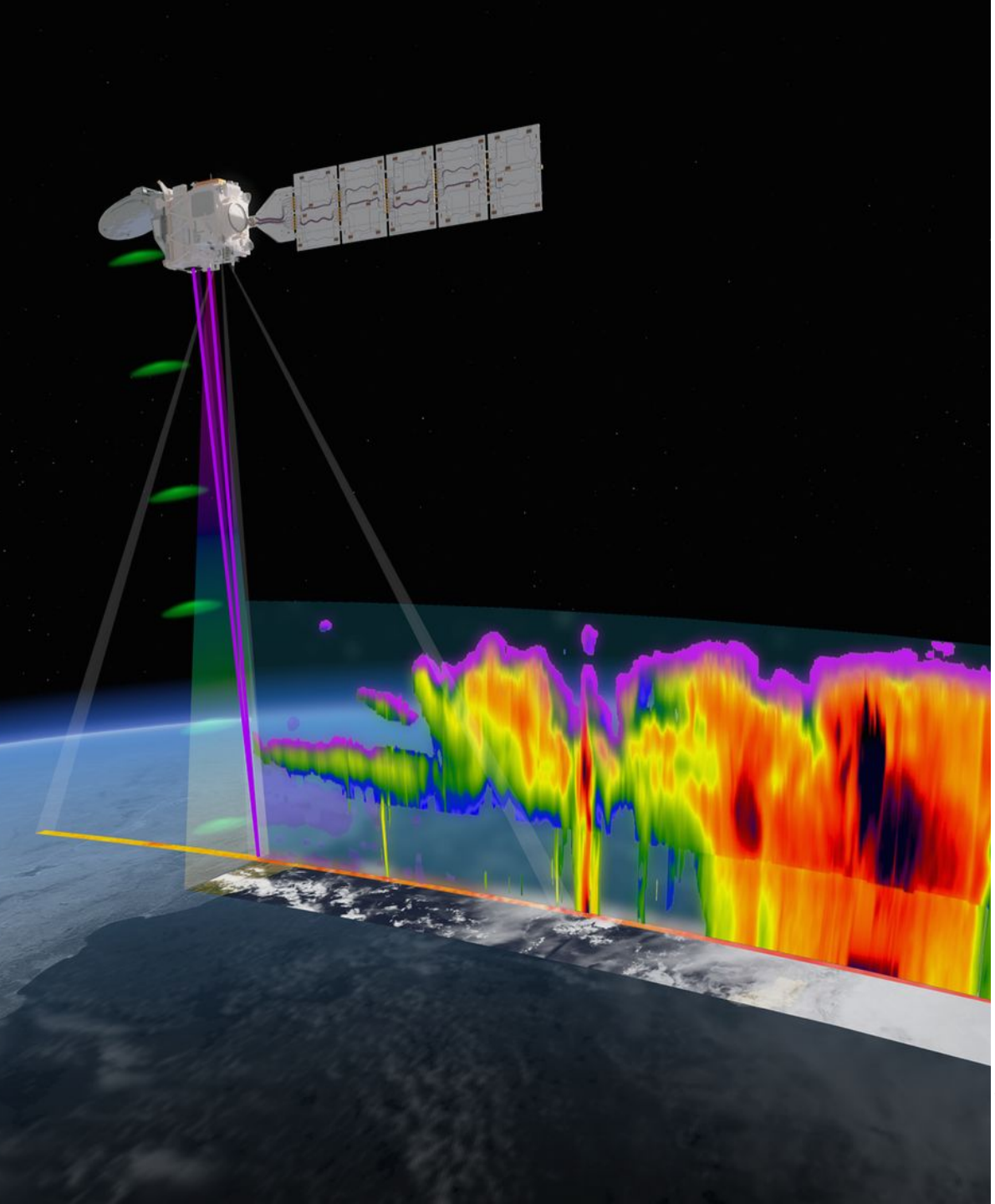

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EarthCARE Cal/Val campaign preparation

June 2024

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EarthCARE Cal/Val Preparation, March 6, 2024

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EarthCARE Cal/Val : update

- New SOPs for the CalVal are ready.
  - windscans are included for sites with scanning radars.
  - manual from TU Delft for RPG radars (to be released at the CCRES website)
  - implementation of the Wind retrieval at CLU still missing
- The writing of guides to set up radar measurements is in progress.
- A study on the overpasses frequency has been done for ACTRIS/Cloudnet sites
  - very low number of close range overpasses on ACTRIS sites
  - skipped common scanning for ACTRIS CCRES Cloud radars

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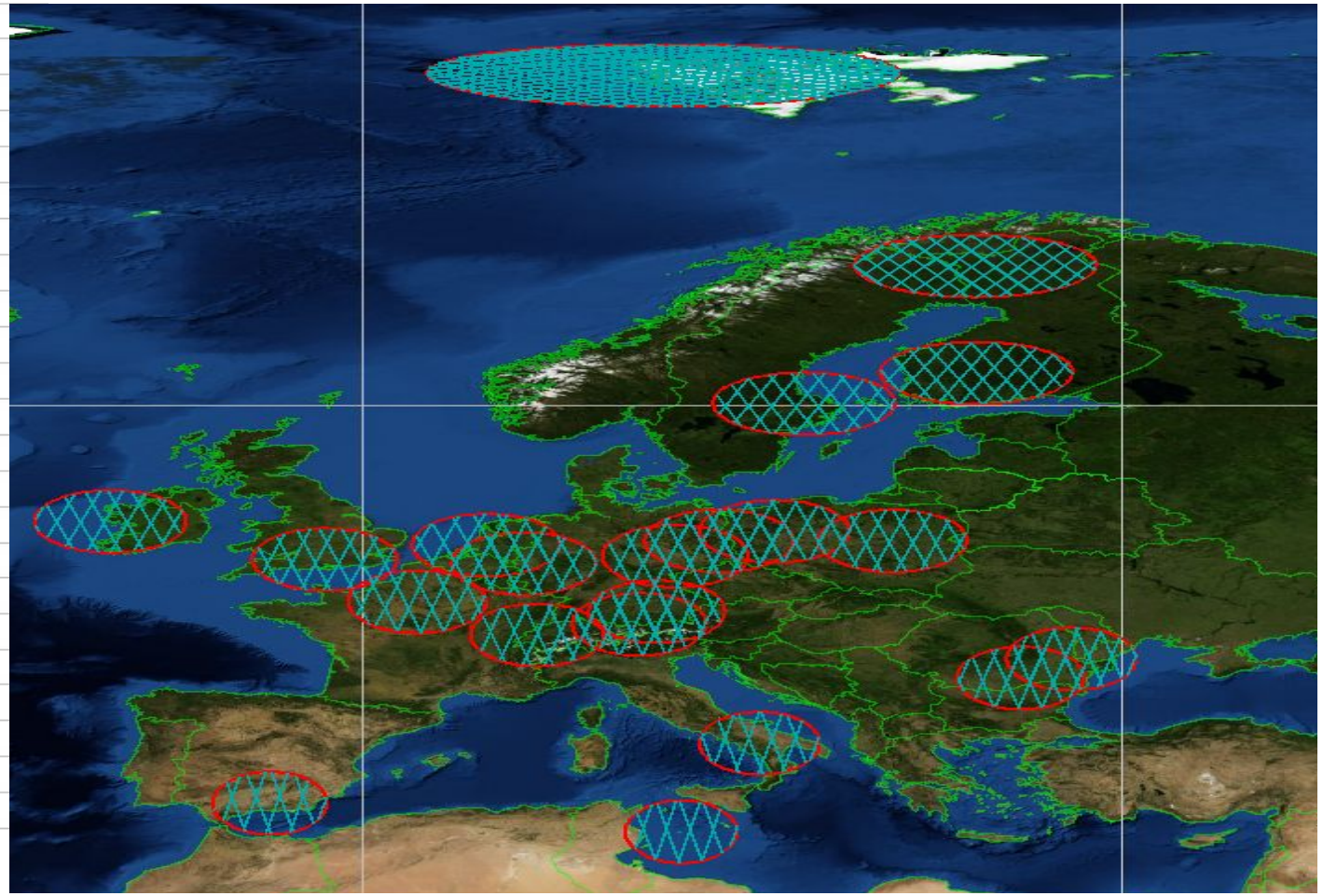
EarthCARE Cal/Val : SOPs

Site	Country	200 km radius N° of overpasses	15 km radius N° of overpasses
Bucharest	Romania	12	0
Cabauw	Netherlands	13	1
Chilbolton	United Kingdom	12	0
Galati	Romania	12	0
Granada	Spain	10	0
Hyytiala	Finland	17	1
Julich	Germany	14	2
Kenttarova	Finland	22	2
Lampedusa	Italy	10	0
Leipzig	Germany	12	1
Lindenberg	Germany	13	1
Mace	Ireland	14	0
Mindelo	Cabo Verde	8	0
Munich	Germany	12	0
Norunda	Sweden	16	0
Ny-Alesund	Norway (Svalbard)	54	4
Palaiseau	France	12	0
Payerne	Switzerland	10	2
Potenza	Italy	11	0
Rzecin	Poland	13	1
Schneefernerhaus	Germany	12	1
Warsaw	Poland	14	2
Total		323	18
Mean		12	1



Overpasses for a cycle of orbits. (25 days, 389 orbits)

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EarthCARE Cal/Val : Radar SOPs

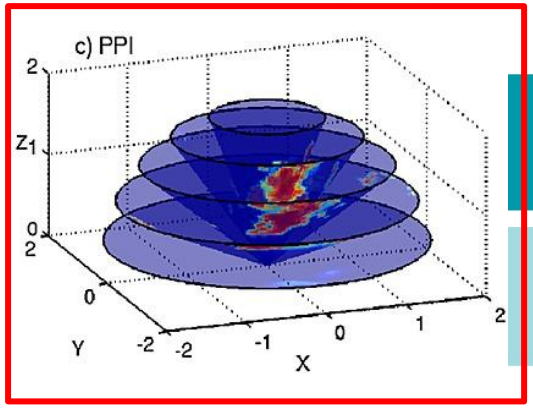
- **Non-scanning radar:**
  - Vertical profiles must be available at least within +- 1 hour from the overpass time.
  - Sampling parameters follow the standard ACTRIS SOPs for DCRs, make sure that the entire troposphere is being observed.

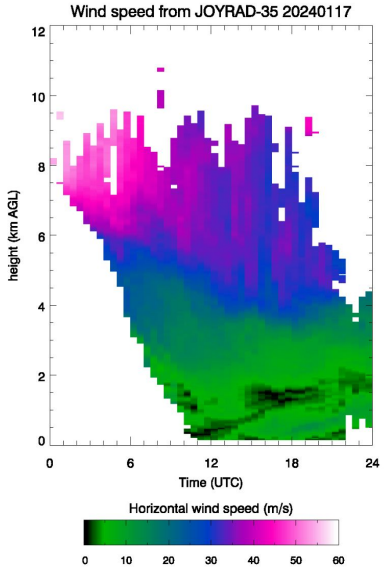
- **Scanning radars:**
  - Wind scans to be performed every 30 minutes, starting **N** minutes after the full hour. The value of **N** changes for each site, a list can be found in the CalVal SOPs.
  - The rest of the time the radar remains vertical.

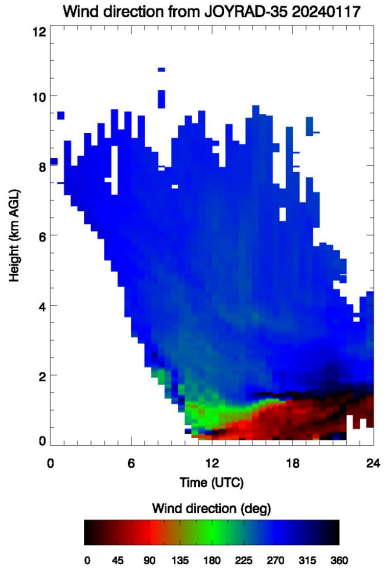
    - **Wind scans:**
      - PPI scan at a single fixed elevation to retrieve the wind field
      - Synergetic with scanning doppler wind lidars (if Doppler lidar available)
      - A guide for RPG and MIRA radars is currently developed. To be released on the CCRES website

- Launch of EarthCARE on 28th of May - First CPR data 4-6 weeks after
- Cal/Val observations should start in July 2024!
- Check if Radomes are intact, otherwise change! Also clear antenna drains.
- Dry Radomes highly required! Radomes should be dried at most 30 min. after a precipitation event.

Fielding et al., 2013, JGR Atmos.







EarthCARE Cal/Val : Other Remote sensing Instrument SOPs

For the other ACTRIS cloud remote sensing instruments:

- **MWR:** Scans every 15 or 30 minutes. Regular calibration of MWR needed.
- **DL:** Wind scans at least every 15 minutes. Coordinated with the radar or 05', 20', '35 and 50' after the full hour if the radar cannot scan (check the CalVal SOPs).
- **ALC:** Must operate continuously for the identification of pure Ice Clouds.

Additional points:

- There is a need of a working Disdrometer for the Radar monitoring
  - The definition of the data format is in progress. Suggestion for the recording software (python, csv-files) in final steps - release soon after final testing.

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Recording Parsivel2 and Thies data

CCRES offers support and documentation for the Disdrometer data recording:

- pyAtmosLogger: Python Code to directly record Disdrometer data on the PC (Linux or Windows)
  - https://github.com/ACTRIS-CCRES/pyAtmosLogger
  - software produces CLU conform data files

- CCRES also has documentation for OTT Parsivel2/Thies LPM and data recording using the software
  - https://www.actris.eu/topical-centre/ccres/disdrometer

For more information contact CCRES: jean-charles.dupont@ipsl.fr

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Outlook

- Windscans
  - implementation of the Wind retrieval at CLU to be implemented
  - discussion needed
- Upload support material on the CCRES webpage!
  - should come soon!
- Doppler velocity and antenna pointing accuracy:
  - Work in progress
  - Experiment planned at Joyce to study how to retrieve a MIRA radar misalignment with respect to the vertical
  - Adaptation of the intercomparison algorithms to be used with Doppler

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Thank you

EarthCARE Cal/Val : Discarded case

Third case (discarded): **Scanning + vertically pointing radars at the same site.**

- The idea was to perform PPIs scans at different elevations with the scanning radar, while another remained vertical to retrieve the doppler velocity profile.

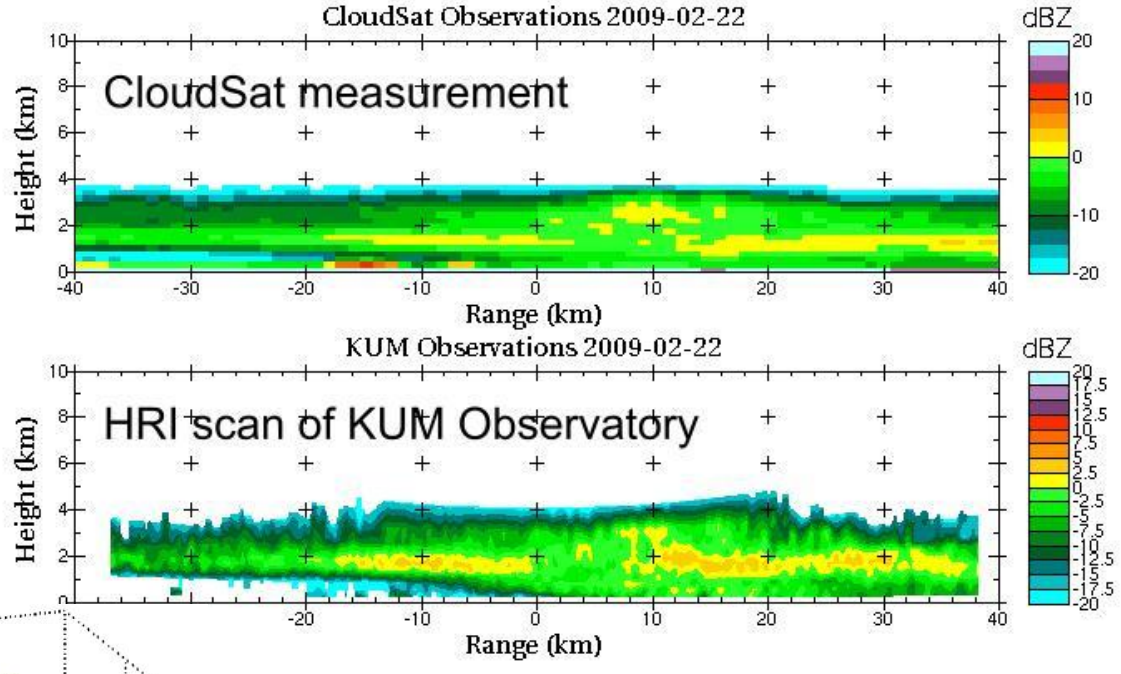
Following an Idea/study from Dmitri Moisseev et al.

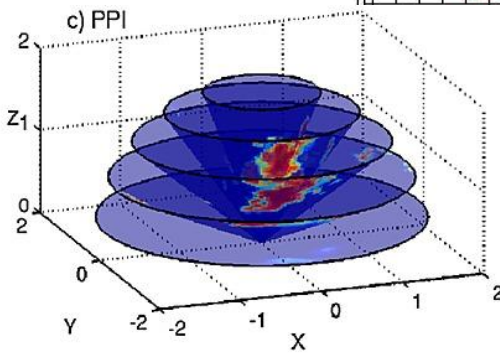
- Example from Weather Radar Data
- Try to scan with Cloud radars if EarthCARE passing close by the site

After an evaluation of the positionner capabilities:

- **MIRA** can do half-dome PPI scans within overpasses
- RPG positioners are too slow for this scan type

- **Important limitation:** Cloud radar range very limited compared to weather radar, especially at low angles (~15 km)





Participating stations - State of readiness

Facility	cloudnet id	Type	DCR	Radar type	Scanning strategy
PAY	payerne	Observational	No DCR installed yet		
Pallas	sodankyla	Observational	Non-scanning		
MOL -RAO	lindenberg	Observational	Non-scanning	MIRA	Vertical
JOYCE	juelich	Observational	Scanning	MIRA+RPG W/Ka	Wind + PPI
Norunda	norunda	Observational	Non-scanning	RPG W	Vertical
Ny-Alesund	ny-alesund	Observational	Non-scanning	RPG W	Vertical
RADO-Bucharest	bucharest	Observational	Scanning	MIRA+RPG W	Wind + PPI
RADO-Galati	galati	Observational	Non-scanning	RPG W	Vertical
Ruisdael Observatory	cabauw	Observational	Scanning	RPG W/Ka	Wind
SIRTA	palaiseau	Observational	Non-scanning	BASTA	Vertical
SMEAR II	hyytiala	Observational	Non-scanning	RPG W	Vertical
Chilbolton	chilbolton	Observational	Non-scanning	MIRA ?	?
LACROS	leipzig	Mobile	Non-scanning	MIRA+RPG W	?
AGORA		Observational	Scanning	RPG W/Ka+ RPG W	Wind (+PPI)?
CIAO Potenza		Observational	Scanning	MIRA	Wind
Munich		Observational	Scanning	MIRA+RPG W	Wind + PPI
Lampedusa		Observational	Non-scanning	MIRA	Vertical
Rzecin		Observational	Non-scanning	BASTA	Vertical
CARO-Limassol	limassol	Mobile	Scanning		
Mindelo ?					
Neumayer ?					
OCEANET		Mobile			
FComLab		Mobile			
LIMMACO		Mobile			
KLOCX		Mobile			

Zenith pointing radars

Use a measurement setting that covers the whole troposphere at your site

MIRA radars with scanner

- MIRA scanner can be used for fast PPI scans
- Wind scans as standard product

RPG radars with scanner

- RPG positioner generally slower than MIRA scanner
- Parameters for standard wind scans under study

Participating stations - State of readiness

Stations implied in EarthCARE Cal/Val campaigns :

Payerne
Pallas
MOL -RAO
JOYCE
Norunda
Ny-Alesund
RADO-Bucharest
RADO-Galati
Cabauw
SIRTA
SMEAR II
Chilbolton
CARO-Limassol
LACROS
Lampedusa
Rzecin
Munich
Potenza
CARO-Limassol
AWACA (from 2025)

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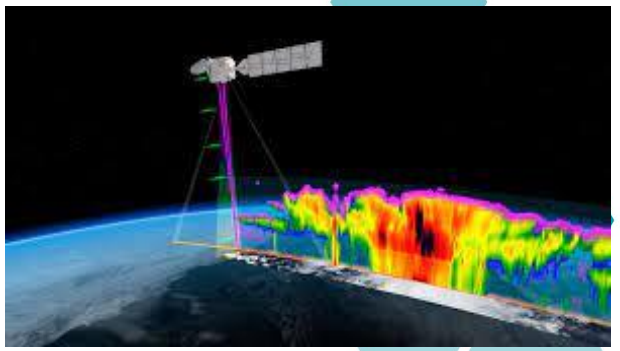
EarthCARE Cal/Val : SOPs motivation



Earthcare launch in May 2024

Use the ACTRIS Cloud Remote Sensing instrumentation to collect data sets to validate EarthCARE measurements (EarthCARE Cal/Val)

ACTRIS Network advantages:

- Geographical coverage
- Quality control of the data, common processing and quality control
- Absolute calibration strategy
- Calibration tracking, disdrometers
  -> Potential for an homogeneous dataset adapted for statistical analyses

The ACTRIS CCRES Sat Cal/Val SOPs are proposed to generate the best EarthCARE Cal/Val dataset for

- L1 validation - single instrument (MWR, Radar, Lidars)
- l2 validation - instrumental synergy to generate classification

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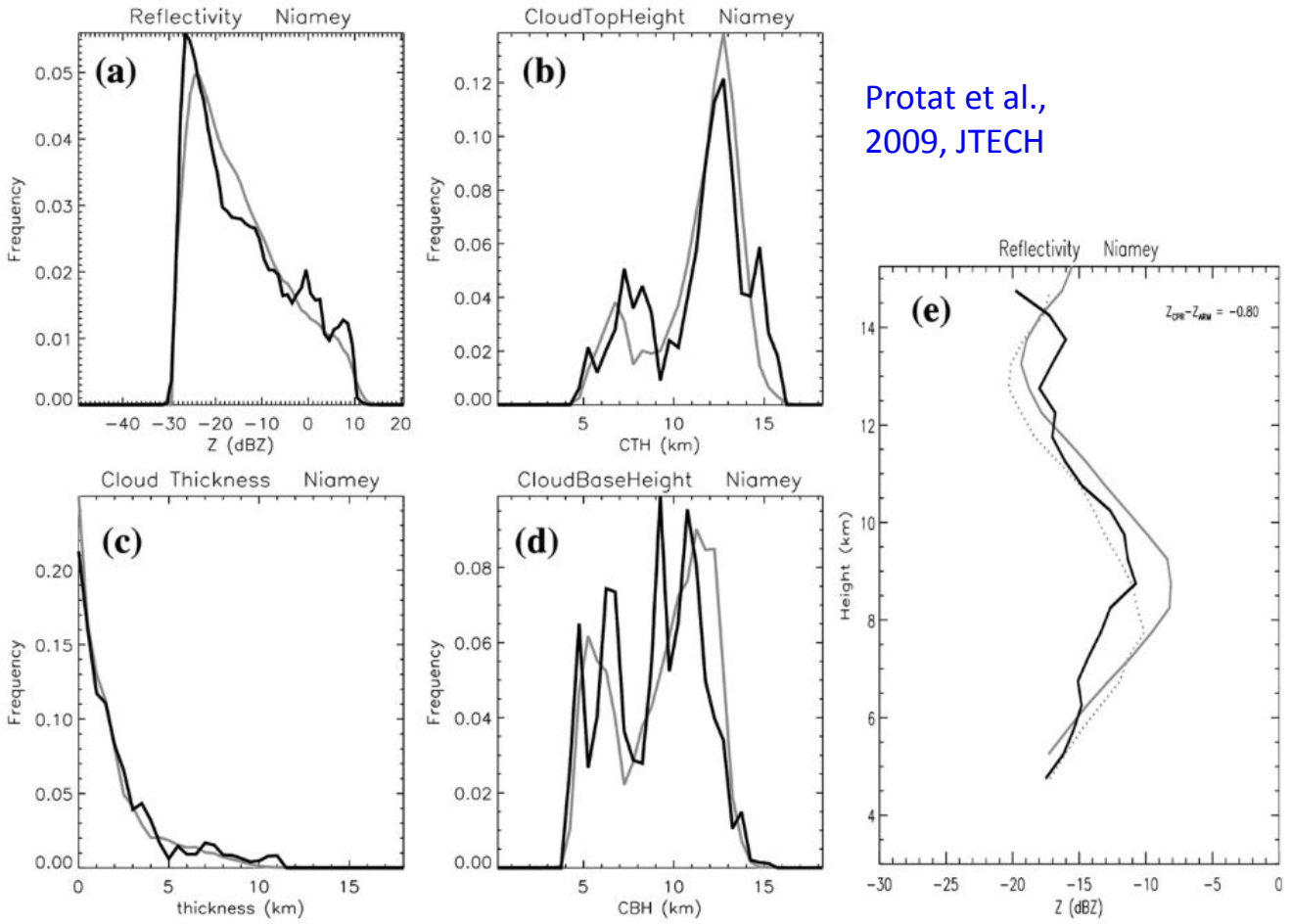
EarthCARE Cal/Val : Approach

The homogeneous dataset from ACTRIS will enable the statistical comparison of ground vs space based cloud radar measurements, e.g.:

- Protat et al., 2009, 2010
- Kollias et al. 2019

Space and time constraints to restrict comparable data:

- From ground based: Data from +- 1 hour around the overpass time
- From the satellite: data sampled within a circle of 200 km radius around the ground based radar site.



Protat et al., 2009, JTECH

FIG. 10. Statistical comparisons over the Niamey ARM mobile facility between ground-based-derived (gray) and Cloudsat-derived (black) ice cloud morphology: PDFs of (a) radar reflectivity, (b) cloud-top height, (c) cloud thickness, (d) cloud-base height, and (e) mean vertical profile of radar reflectivity. The dotted curve on the mean vertical profile in (e) is for when a ±1-h time window around the Cloudsat overpass time is used to bin the ground-based observations.

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EarthCARE Cal/Val : new SOPs

First some comments:

- Previous SOPs for DCR, MWR, DL, ALC and Disdrometers must be in place. The new SOPs extend the procedures for Earthcare CalVal.

- **Definition of an overpass**: time when the satellite enters a 200 km radius circle centered at a national facility.

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Overpasses in a 15 km range from CloudNet sites, every orbital cycle (~25 days)

Assessment of possible sites for the half-dome scan:

- Assessment based on ESAs orbit tool to forecast EarthCARE orbits:
- Search for sites with close enough overpasses +/-15 km
- Only JOYCE, LMU Munich and INOE Bucharest would be viable stations for this case considering overpasses and equipment.
- Due to the low number of sites, no general SOP or recommendation is proposed
- Experiments on this scan type may be carried out at JOYCE.

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