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CCRES SOPs for EarthCARE Cal/Val measurements

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Overview of current and planned EarthCARE Cal/Val Activities

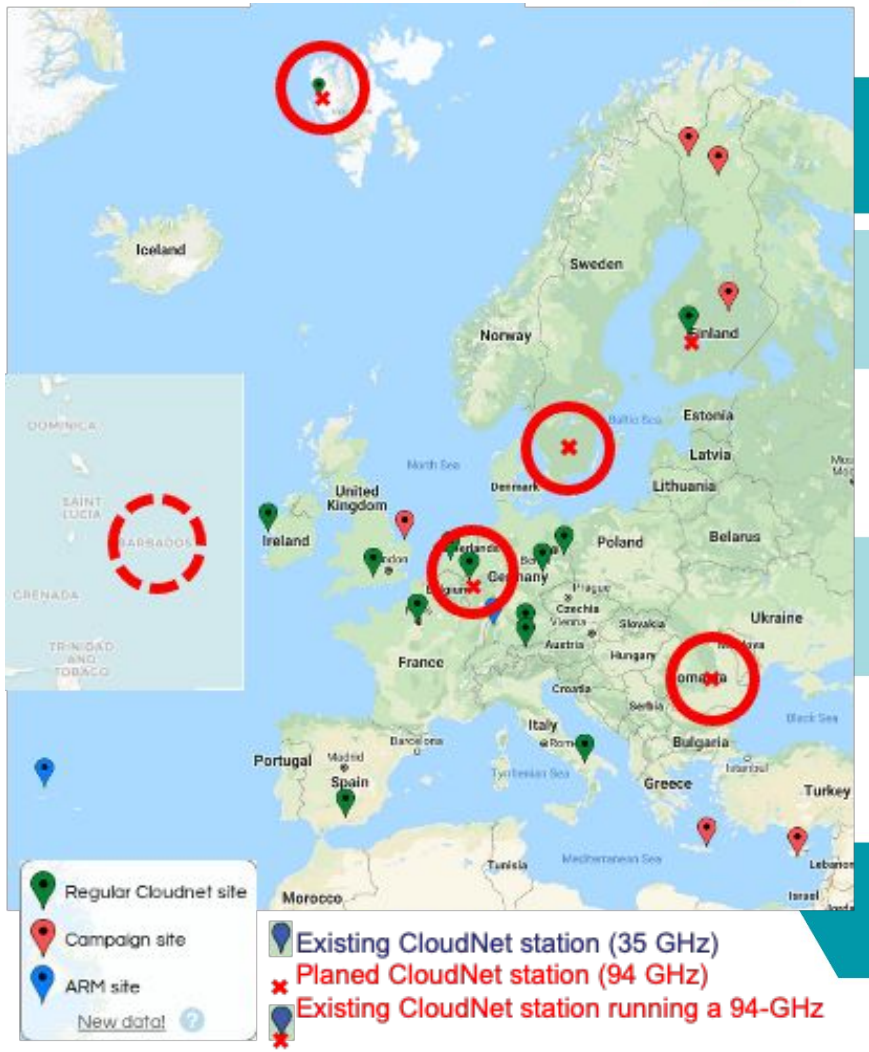
FRM4Radar (continuation planned)

- ESA funded project to pave the way towards Fiducial Reference Measurements (FRM) standards for Radars
  - traceable reproducible quality standards for Radar measurements
- Set up a miniature network of w-band radars to close gaps in ACTRIS network

Results of the project

- GEOMS data format for ground based radars
- Ze-monitoring for ground based radars
- off-zenith antenna pointing monitoring - Doppler velocity QA check and correction
- Recommendations for radar users and Chirp table definition
- Developement of a CPR forward simulator based on ground based radar measurements

  → pre launch data set generation



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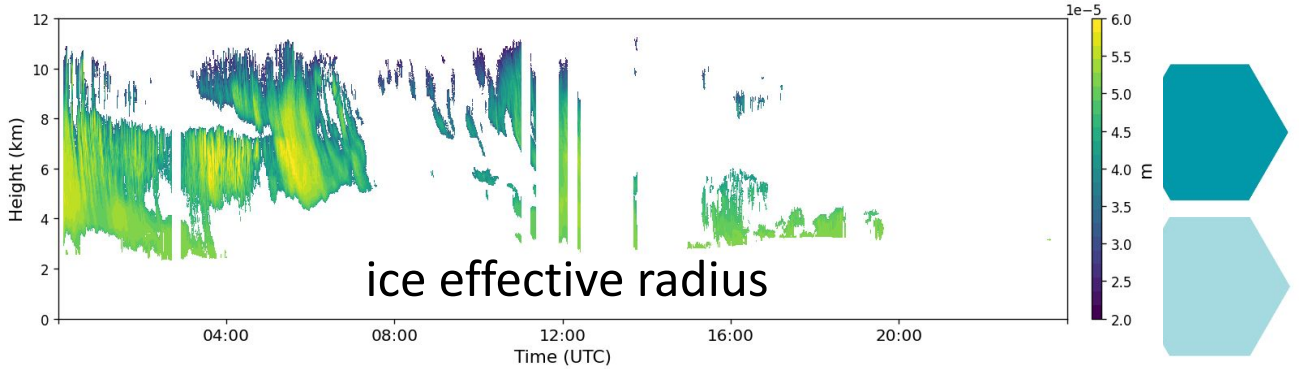
ATMO ACCESS (running)

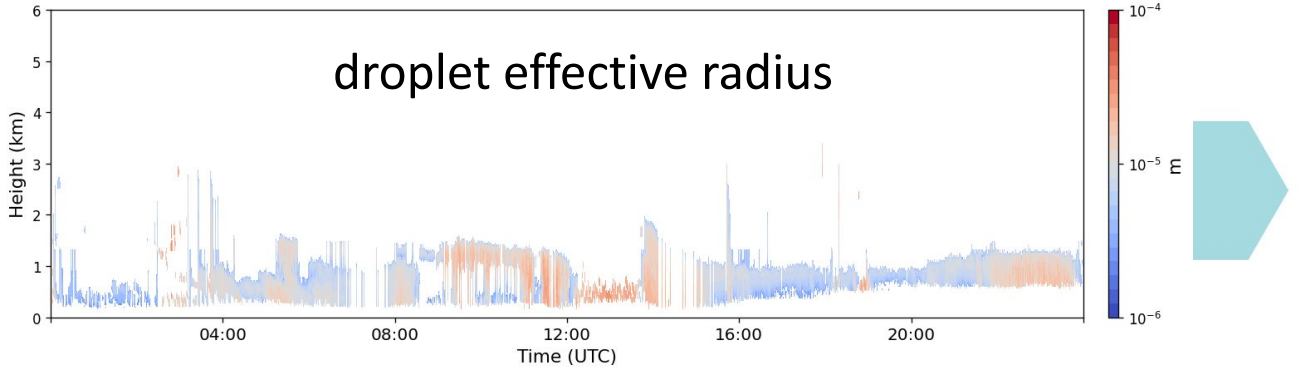
Access to ACTRIS data and products for ESA and EuMetSat

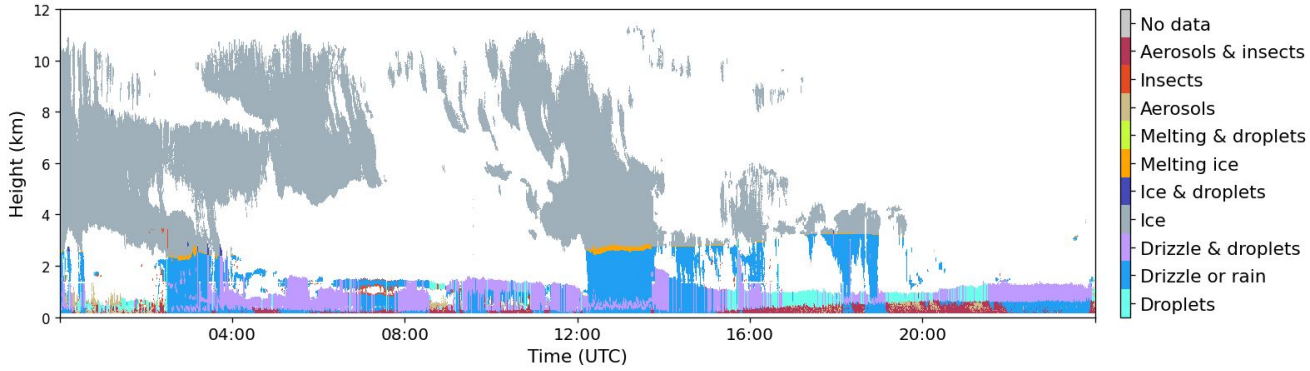
- Develop products to evaluate Satellite data and cloud and aerosol product based on ACTRIS measurements and data products
- start with the Cal/val of ESAs EarthCARE mission
- planned to extend to other missions (EuMetSat)
- define new products,
  - e.g. cloud base and top detected from ground
- interest in profiles of atmospheric variables - t, humidity, wind

Currently:

- preperation campaign EarthCARE Cal/Val







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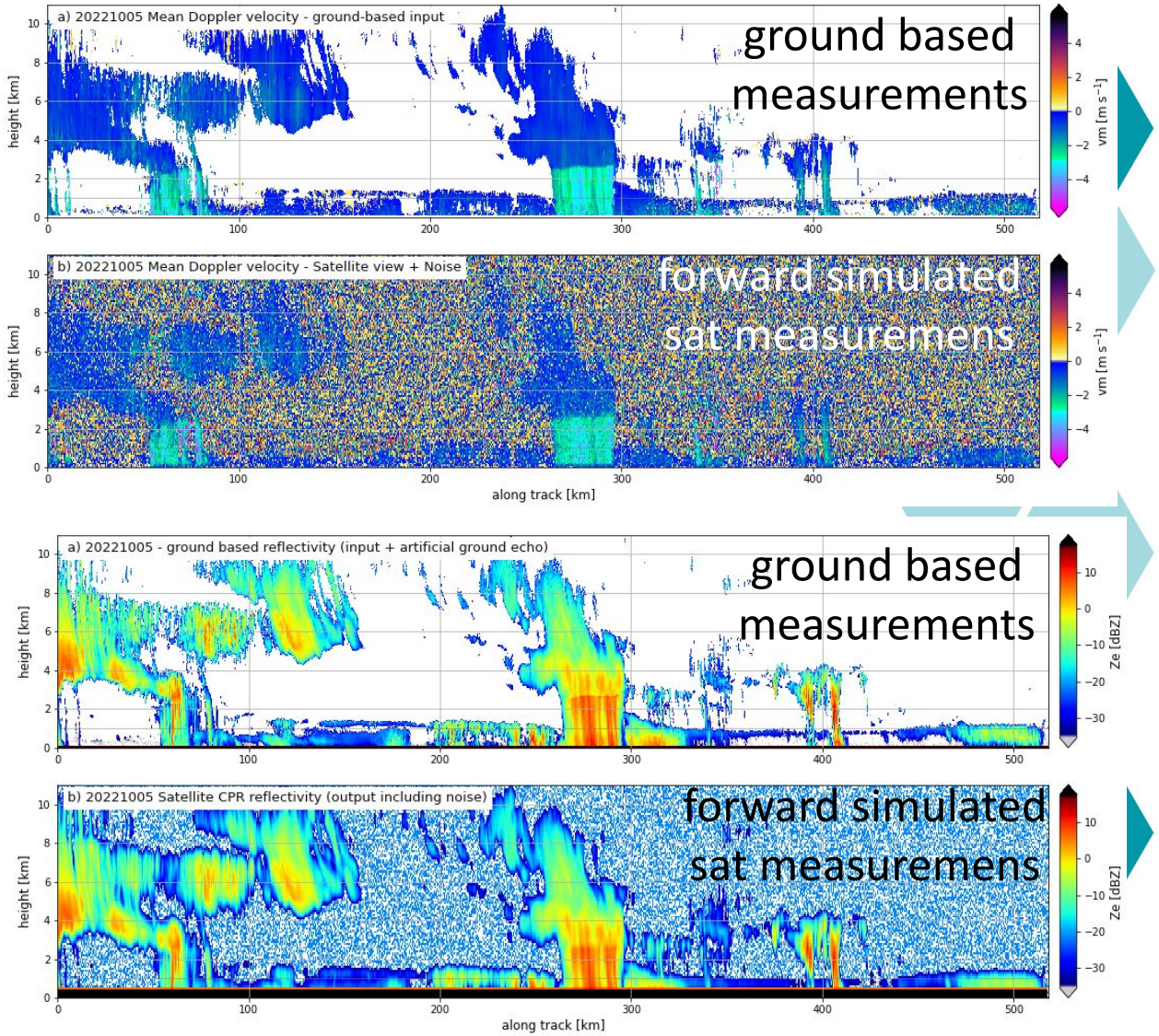
ACPV (running)

ESA funded project to define the best practive for Satellite Cal/Val

- best practice protocol for validation of Aerosol, Cloud and Precipitation Profiles (ACPV)
- best practice paper for Cal/Val for Satellites
- define gaps in Sat Cal/Val data sets

- plans: review and summary papers

- develop the CPR tool into a python package
- further implementation into ESA tool box



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German Initiative for Validation EarthCARE (GIVE, planned)

Validation of the EarthCARE satellite mission

- start 2024
- 7 German institutes
- validation of all sensors
- single sensor and product evaluation and validation

- Cal/Val of the CPR performance due to Boundary Layer Clouds
  - Detection limits of low clouds
  - Precipitation estimation in the blind zone
  - JOYCE and NyAlesund data for method development
  - method development using CPR simulations

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EarthCARE cloud remote sensing CalVal using the ACTRIS network

One year Research Engineer position funded by CNES. Objectives:

- Implementation of calibration transfer algorithms between ground-based Earthcare satellite radar
- Quality control of level 1 data:
  - Closure studies between ACTRIS sites and Earthcare measurements
- Antenna pointing characterization to best compare doppler velocity from ground to Earthcare retrievals
  - Attenuation and antenna aiming corrections done using FRM4Radar tools
- Preparation of CalVal algorithms for Antarctica cloud radars

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Discussion of CalVal operating procedures (SOPs)

Motivation:

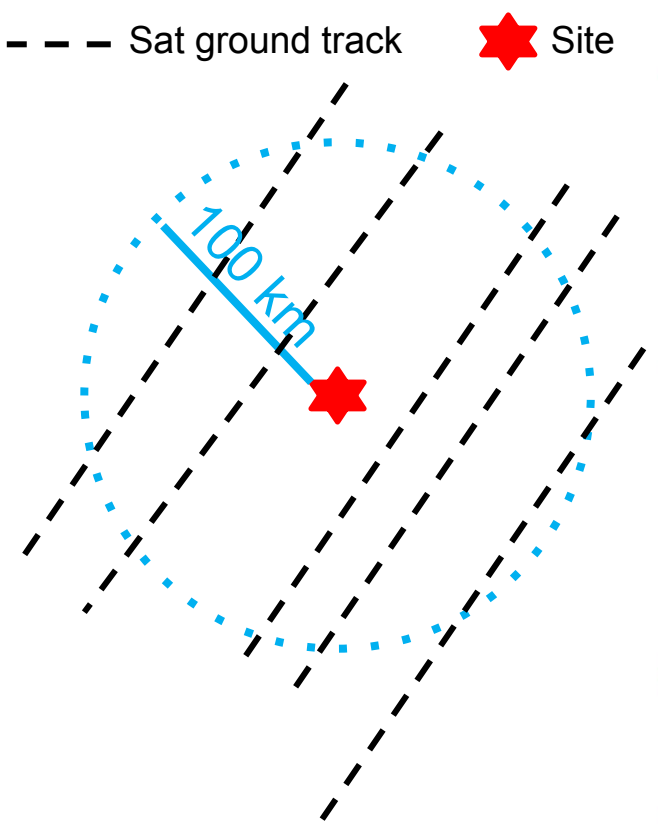
EarthCARE cloud remote sensing CalVal using the ACTRIS network

- ACTRIS provides:
  - Continuous, near real time measurements
  - Cloud and aerosol products
- Large number of sites in different climate zones
- Calibration and data quality control strategy:
  - SOPs
  - Homogeneous quality control
  - Enables inter-site comparisons
- These characteristics make ACTRIS a strong infrastructure, instrumental network for satellite CalVal activities

Motivation:

How ACTRIS could be used:

- Potential to deliver excellent EarthCARE Cal/Val data sets to be used for:
  - **Cal/Val of single sensor data**
  - **Cal/Val of combined products for EarthCARE**



- Statistical comparison of ground and space data sets [1]
  - Zenith measurements +/- 1.5 h around the overpass
  - Generally a big number of samples is required

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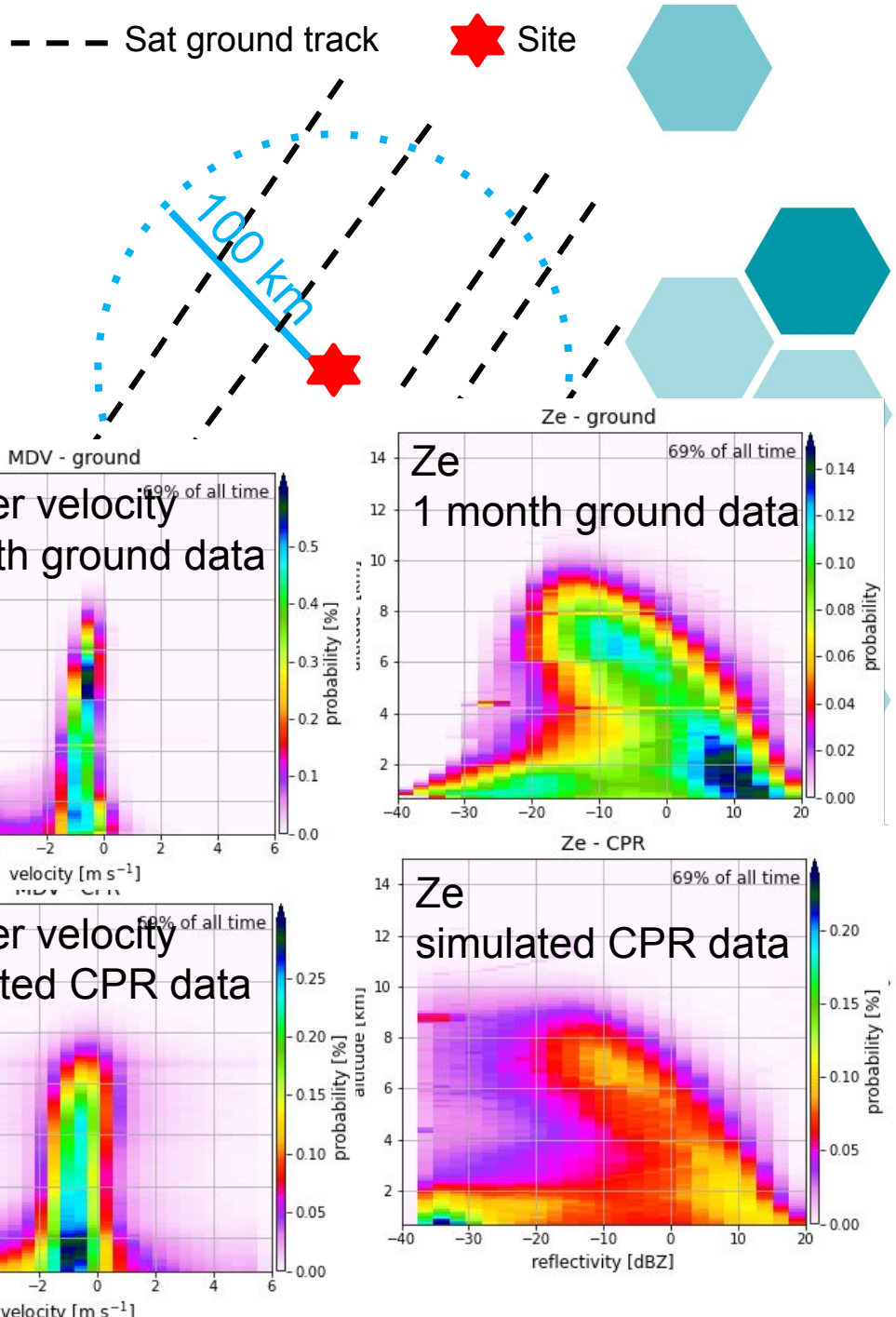
[1] Protat et al., 2009 https://doi.org/10.1175/2009JTECHA1246.1

Motivation:

- Statistical comparison of ground and space data sets [1]
  - Zenith measurements +/- 1.5 h around the overpass
  - Generally a big number of samples is required

- Statistical comparisons of:
  - Measurements (level 1)
  - Retrieved products (level 2)
  - Data from different sites

- SOPs are needed to increase data homogeneity and availability
  - Common CCRES Standard Operating Procedures (SOPs) for Satellite Cal/Val



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General points to consider:

- Data quality monitoring for cloud radars:
  - Ze-monitoring (Disdrometer SOPs!!!)
- Define minimum and recommended required operational modes for each radar:
  - Range resolution and min range
  - Doppler velocity nyquist range
  - Time resolution
- For example for the following radar requirements:
  - Report each radar sensitivity at 10 km (ideal sensitivity -30 dBz, hard to achieve)
  - Zenith measurements +/- 1.5 h around the overpass
  - RPG Radars: Chirp table optimised for Cal/Val, radome changes
  - MIRA: common range resolution for all the MIRAs?
  - BASTA: Chirp table optimised for Cal/Val

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General points to consider 2:

- MWR:
  - Common scanning pattern for ABL-Scans, similar vertical pointing constraints as the radar
  - Calibration regularly - radome change?
  - Follow CCRES MWR SOPs

- Further SOPs for:
  - Doppler Lidar, common scanning pattern?
  - ALCs nothing to change from standard SOPs?

- Overpass time varies -> Cal/Val time period shifts
  - CCRES will provide overpass tables to the involved sites in advance

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Thank you