Validation of EarthCARE ATLID and CPR products using Cabauw measurements: preliminary results (EVID14)

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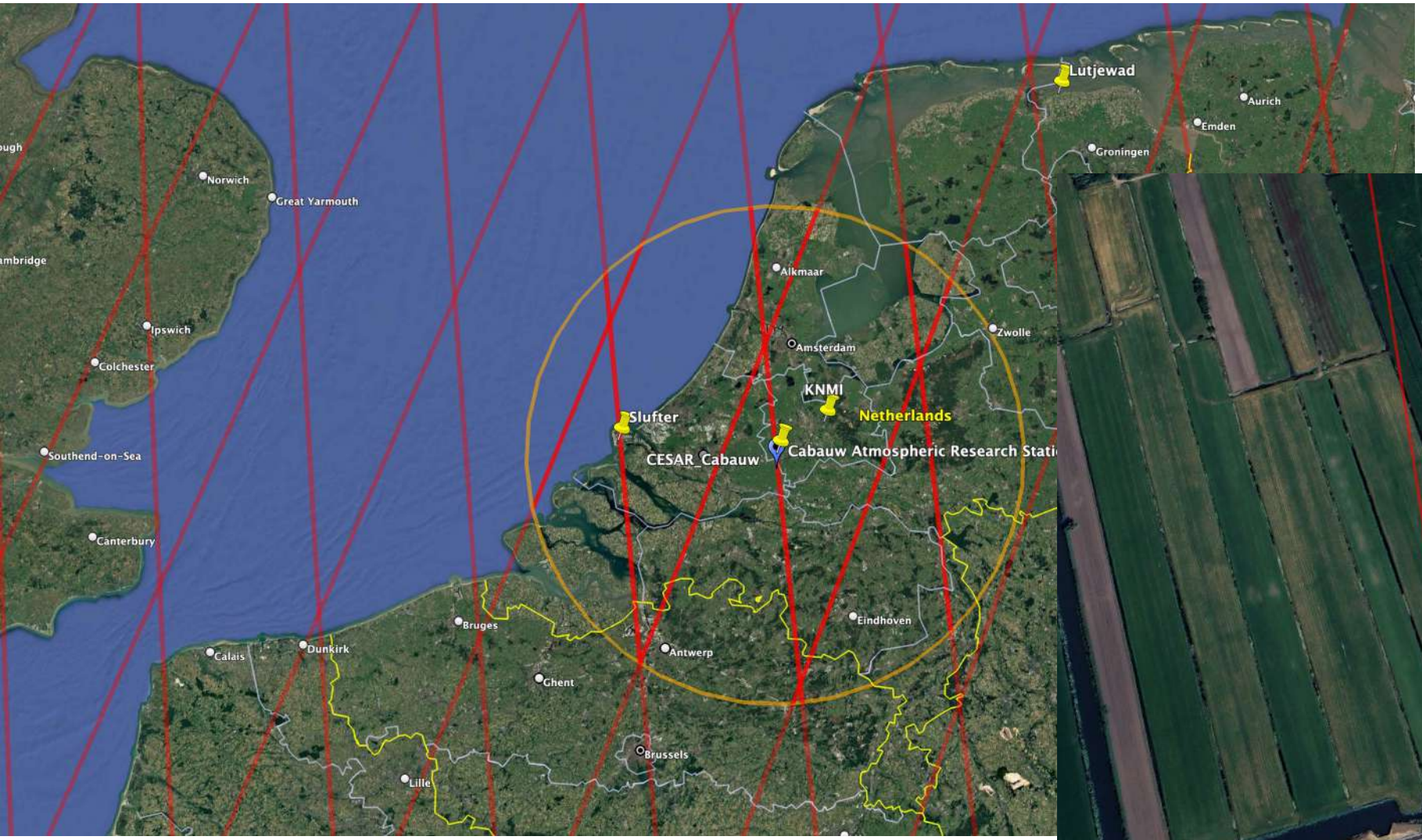
2nd ESA-JAXA EarthCARE In-Orbit Validation Workshop

17 – 20 March 2025 | ESA-ESRIN | Frascati (Rome), Italy

Cabauw



- 25 days repeating cycle
- 2 overpasses per week (< 100 km) around 1 utc and 14 utc

Cabauw Atmospheric Research Station

Royal Netherlands Meteorological Institute
Ministry of Infrastructure and Water Management

Surveillance Drizzle X-band Radar

Since 1972
- Continuous observation programme
- Studies of processes boundary layer and soil/atmosphere interaction
- Model development and verification of weather models
- Earth observation satellites: validation and calibration
- Training

'Supersite'
- Measuring mast 213m high, remote sensing instruments and in-situ measurements at a single location
- Large variation in and combinations of measured parameters
- Wide range of space and time scales and resolutions

Scanning K_a/W Doppler polarimetric cloud radar

Multiwavelength Raman Lidar

UV-depolarization-Raman lidar

Ceilometer

Scanning Wind Lidar

Staring Wind Lidar

213 m

Long path scintillometer

In-situ observations
- meteorology
- trace gases
- greenhouse gases
- aerosols
- fluxes
- deposition

Microwave radiometer

Scintillometer

MaxDOAS, Pandora

BSRN, Aeronet, Sky camera

Micro rain radar, disdrometer

Soil

Meteorology

Energy balance

Infrasound array

North

ICOS INTEGRATED CARBON OBSERVATION SYSTEM

ACTRIS

NDACC

PGN

GRUAN

GEWEX

WCRP World Climate Research Programme

EUMETNET

GLOBAL ATMOSPHERE WATCH

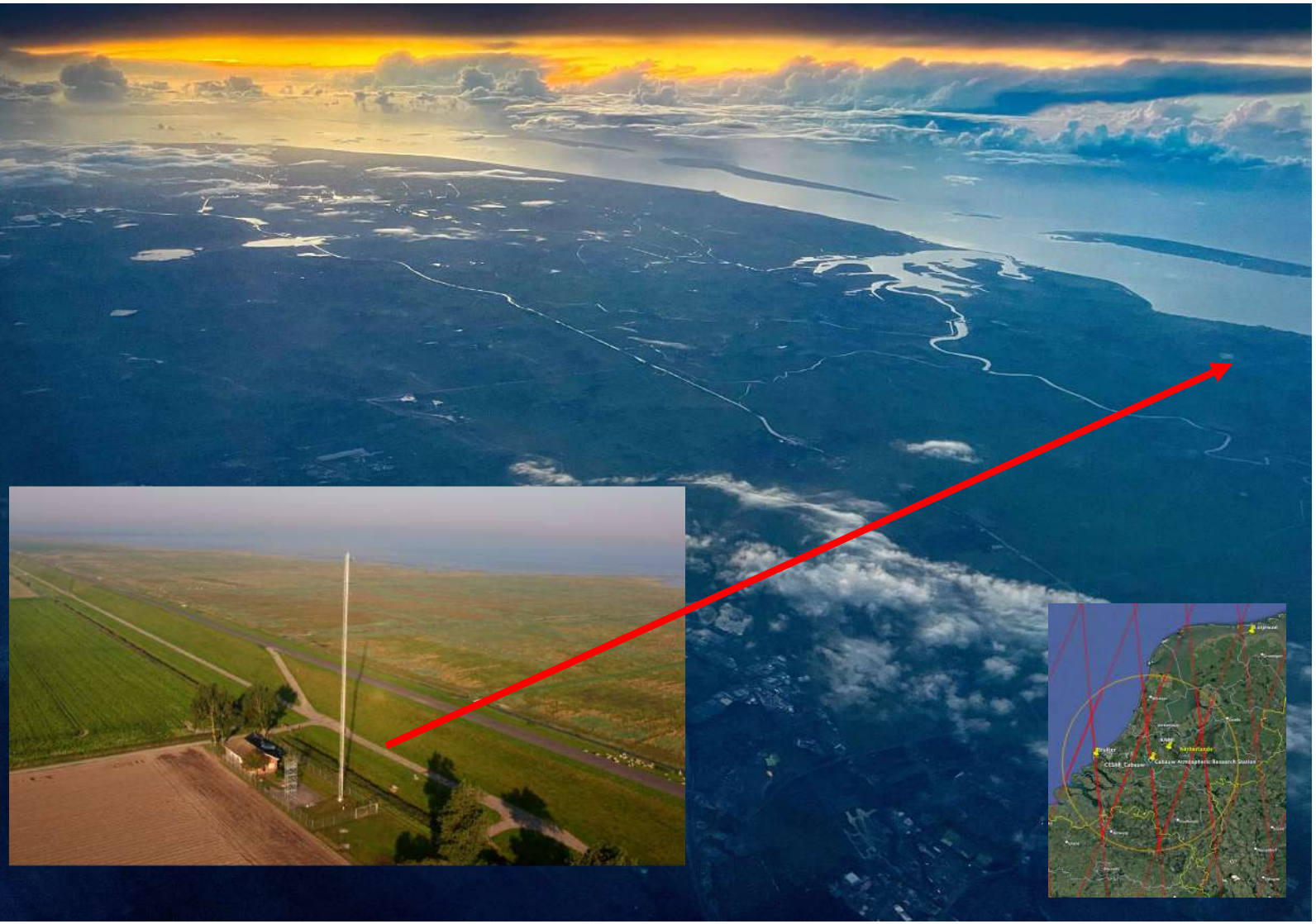
WORLD METEOROLOGICAL ORGANIZATION

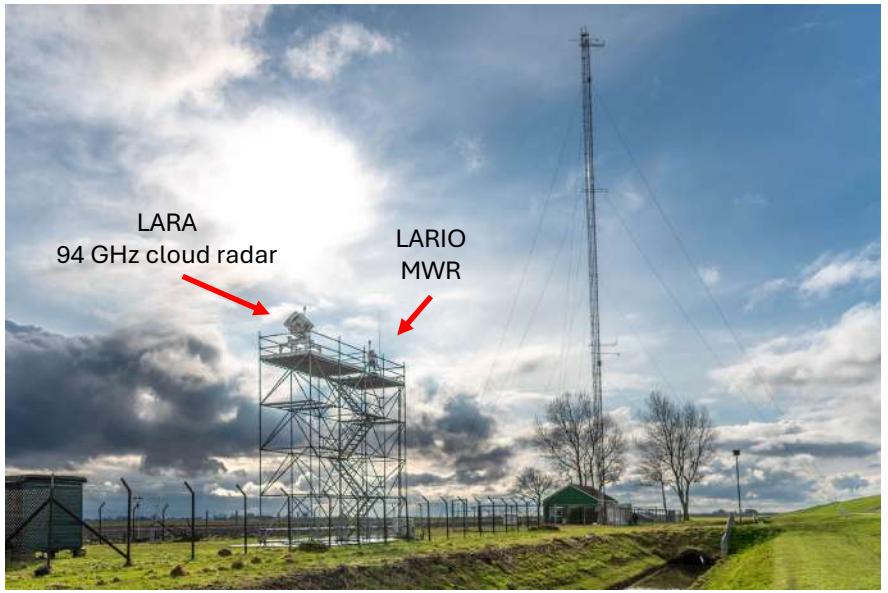
Ruisdael observatory

TNO TU Delft VU Vrije Universiteit Amsterdam university of groningen University of Twente NWO

Dennis Manda - Mandaproductions

Lutjewad

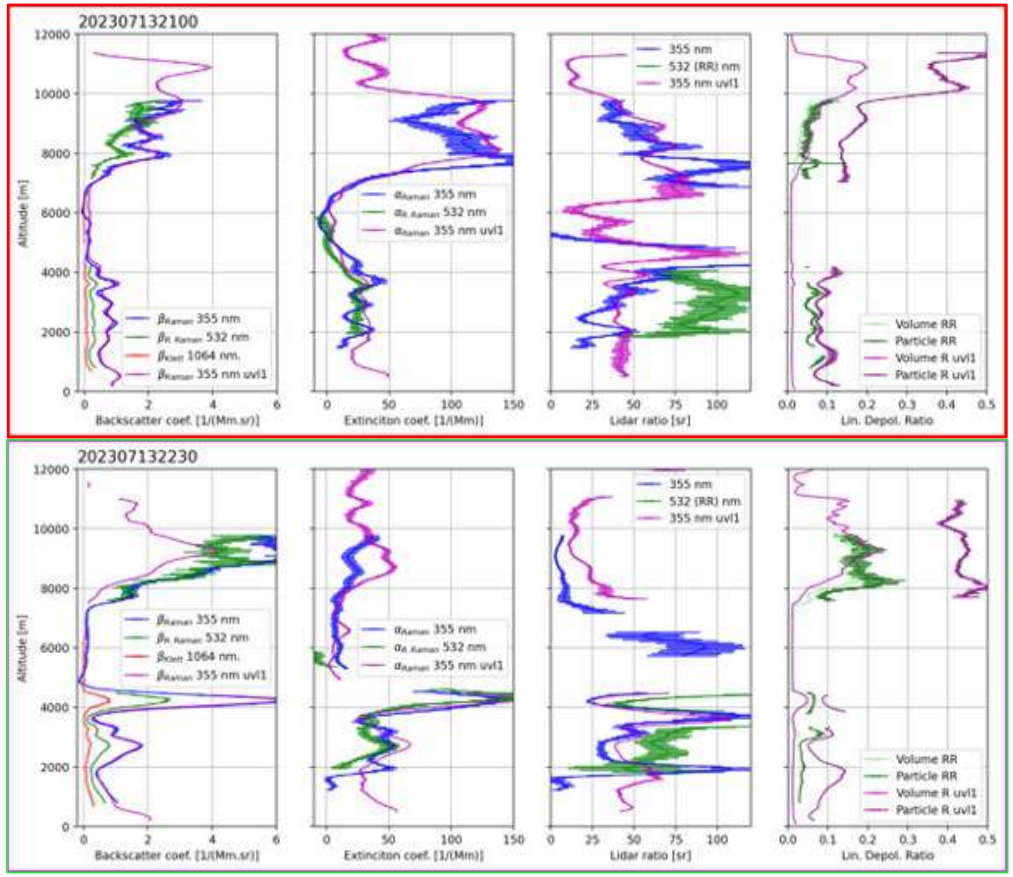


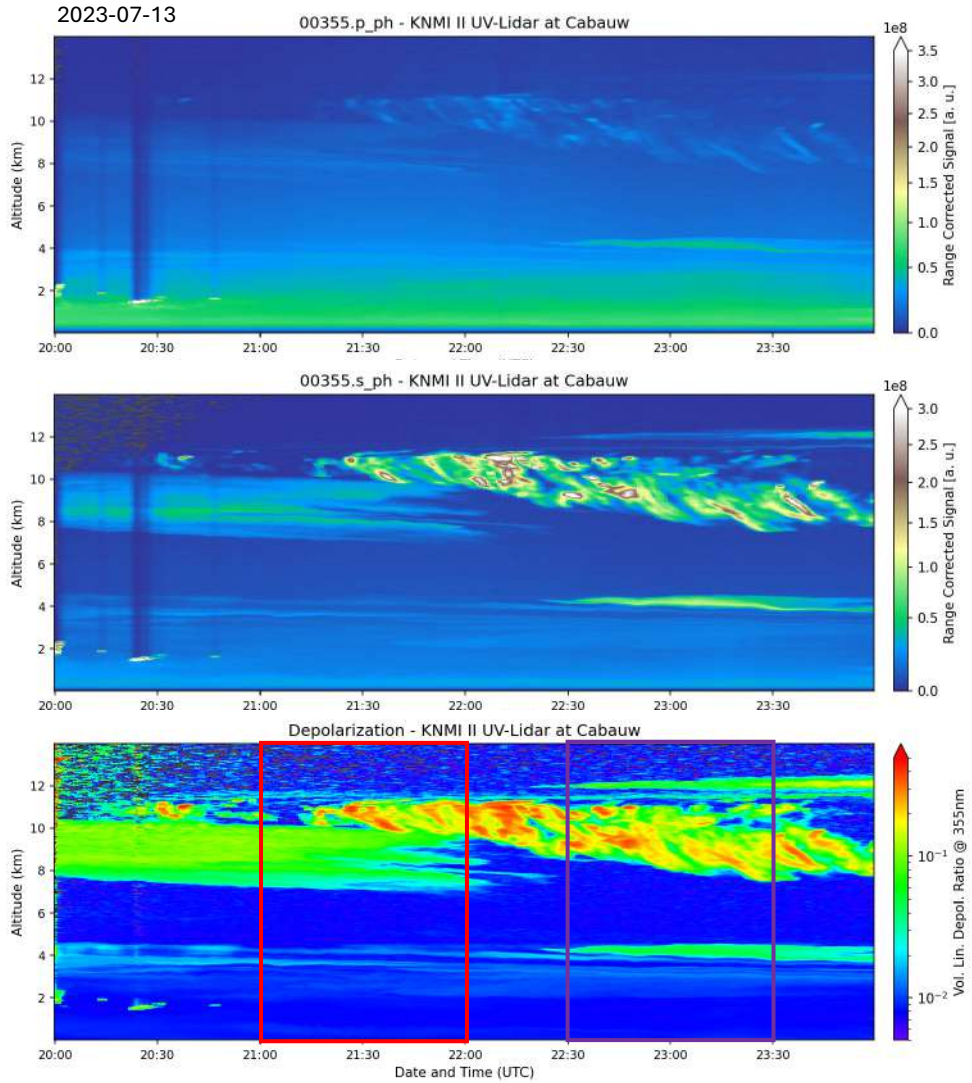


ACTRIS ICOS INTEGRATED CARBON OBSERVATION SYSTEM Ruisdael observatory

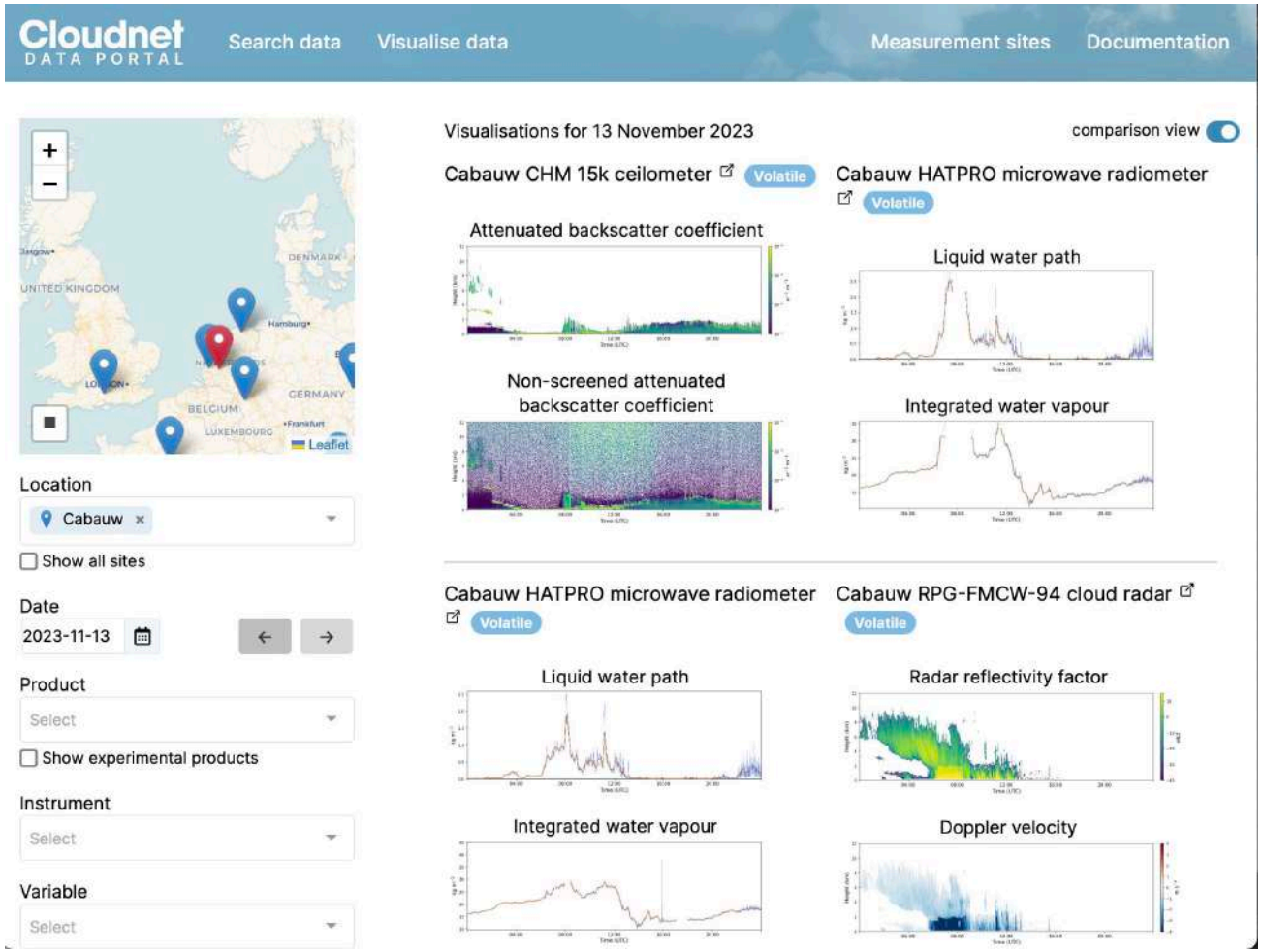
ACTRIS processing – SCC retrievals: Caeli + UV-lidar

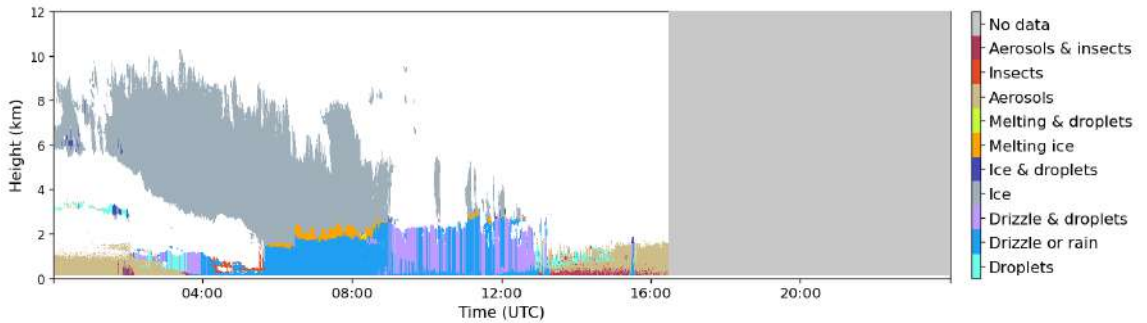
- Caeli: $3\beta + 2\alpha + \delta_{532}$ above ~ 800 m
- UV-lidar: β_{355}, α_{355}, δ_{355} above ~ 300 m (24/7)
- **Mind the gap**: Depolarization at UV and VIS, but from different instruments

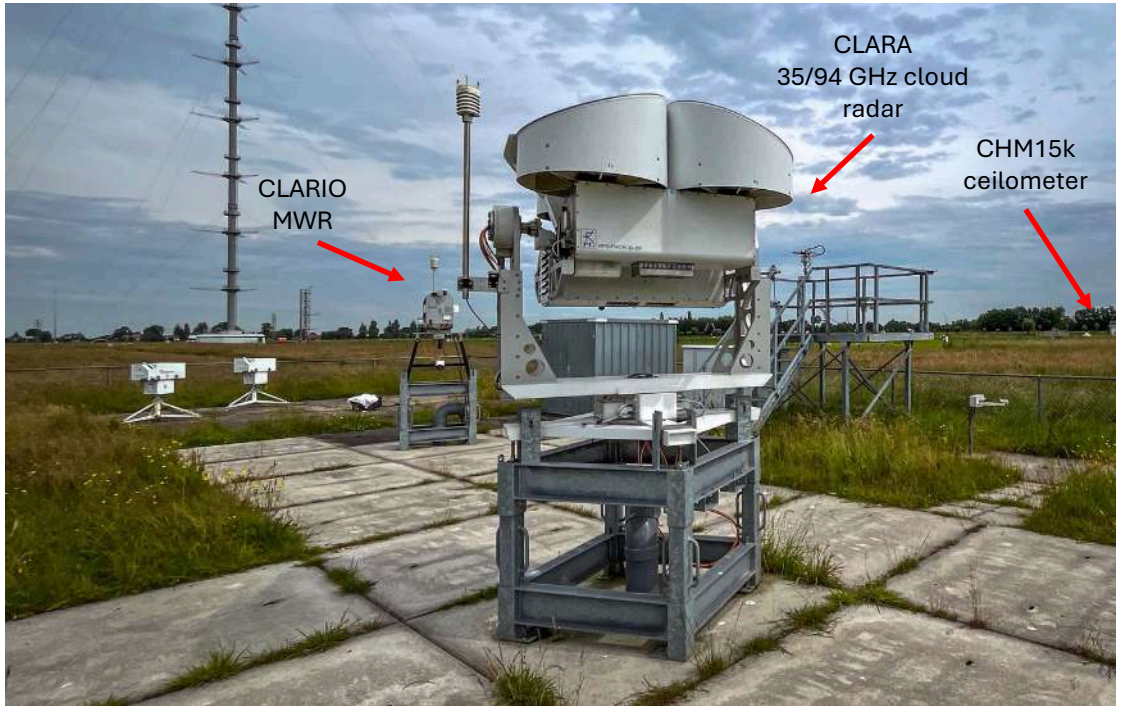




Cloudnet processing – 94 GHz CPR, MWR + CHM15k

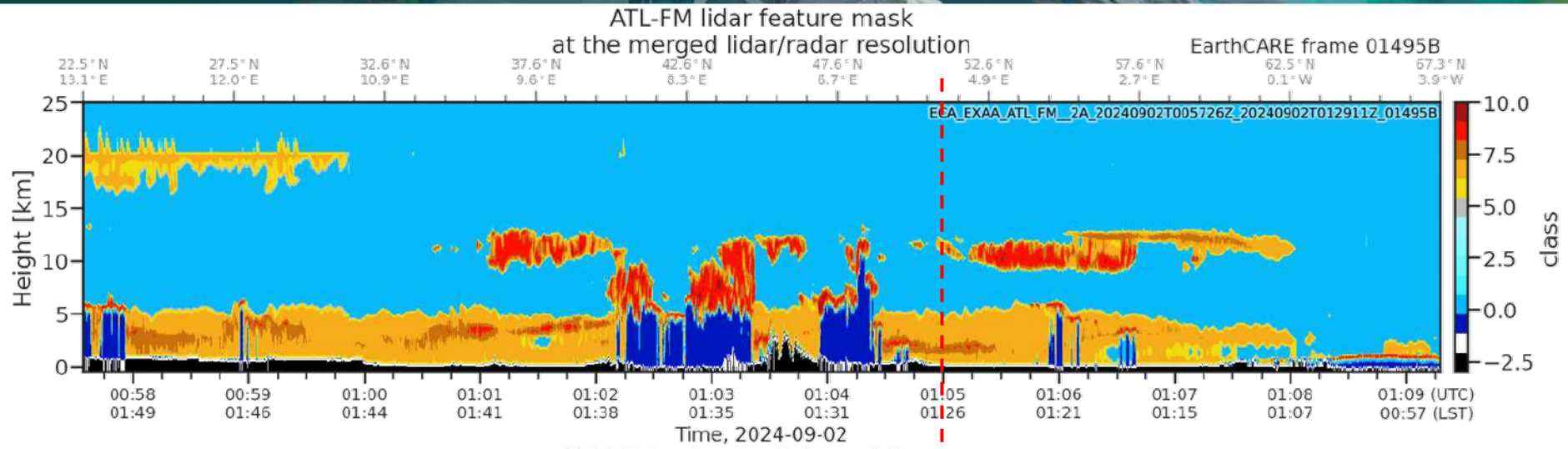


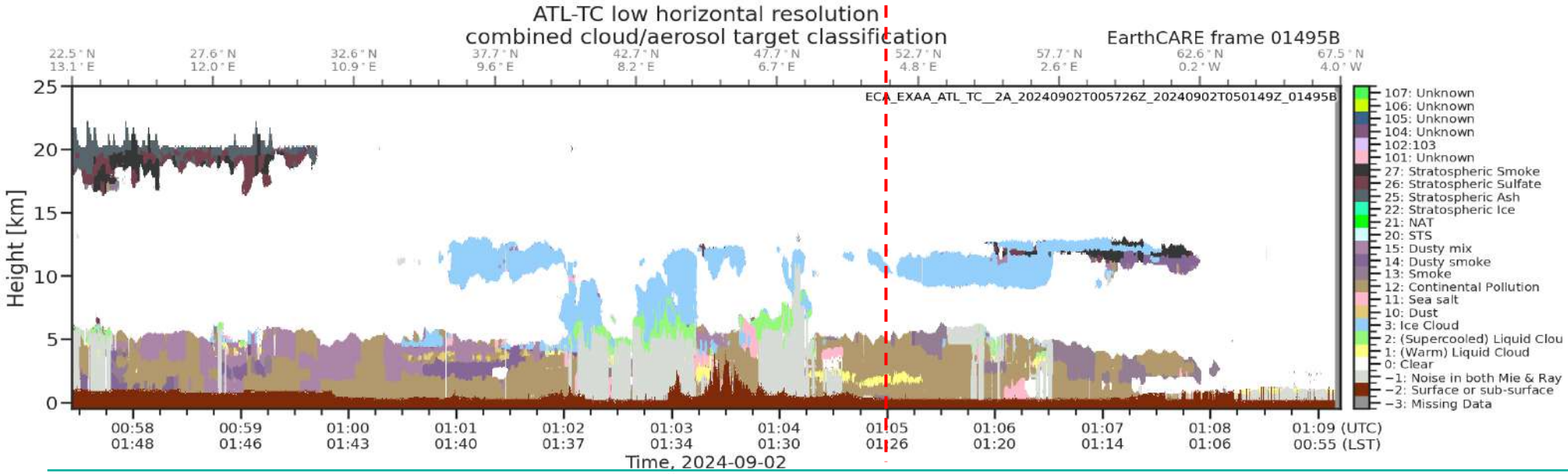




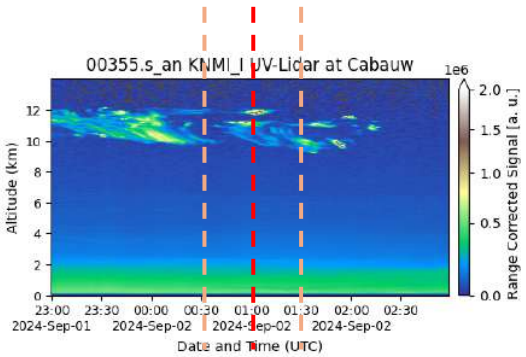
Christine Unal, Rob Mackenzie, Herman Russchenberg (TU-Delft)

20240902 Frame 01495B – Feature mask

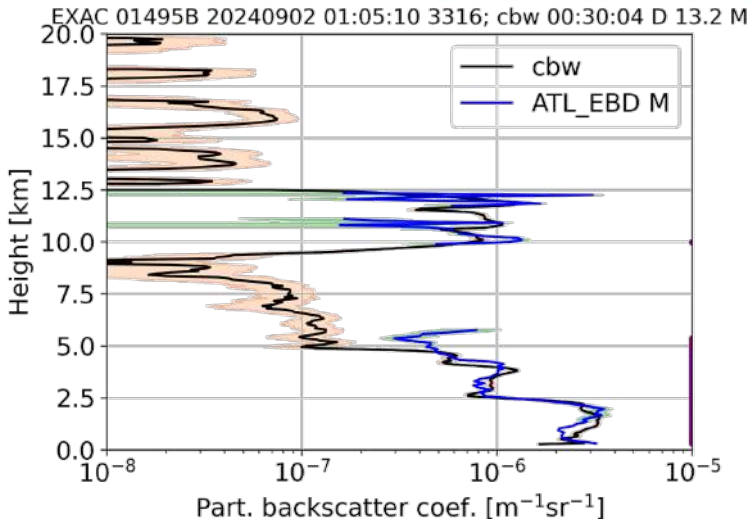


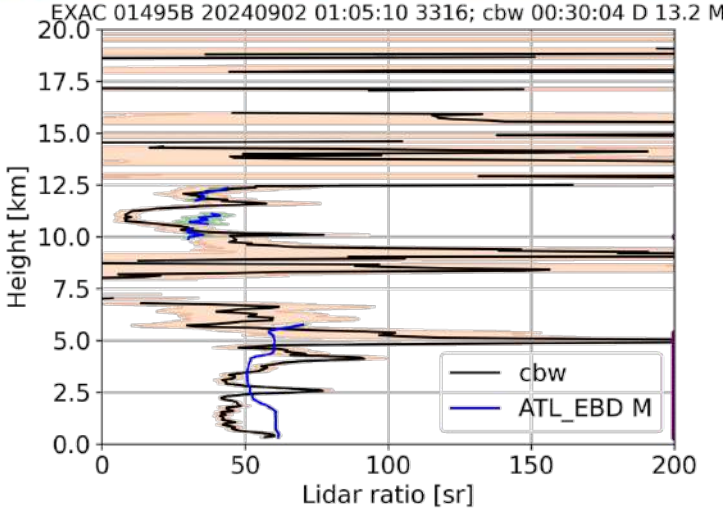


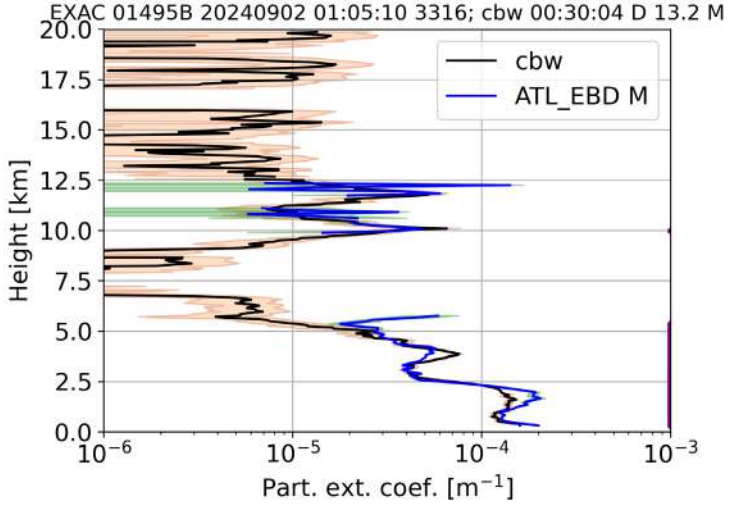
Overpass at 01:05 UTC
at Cabauw
Night time frame

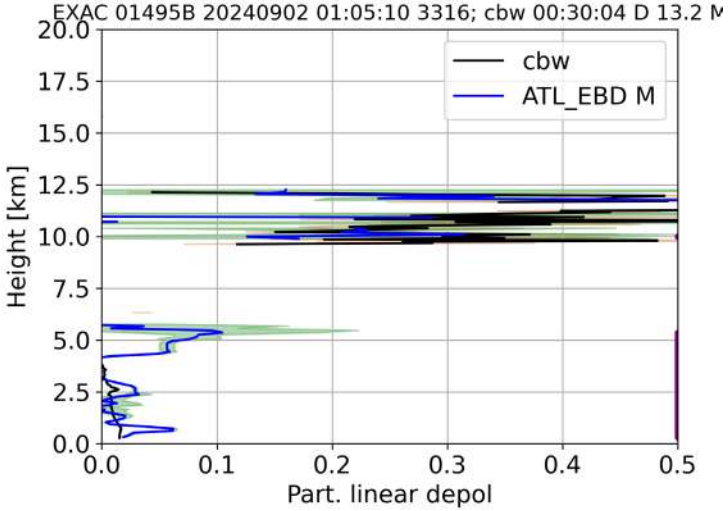


20240902 frame 01495B – AER at Cabauw (cbw)







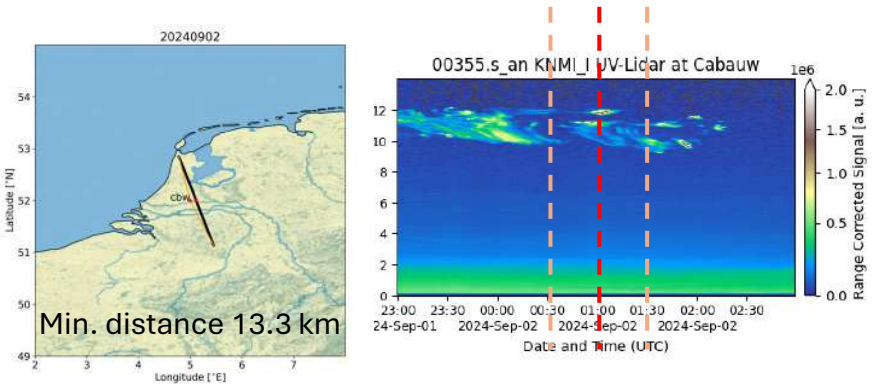


Single closest ATL_AER profile averaged for low signals in retrieval

Cabauw: black+orange
ATL: blue+green

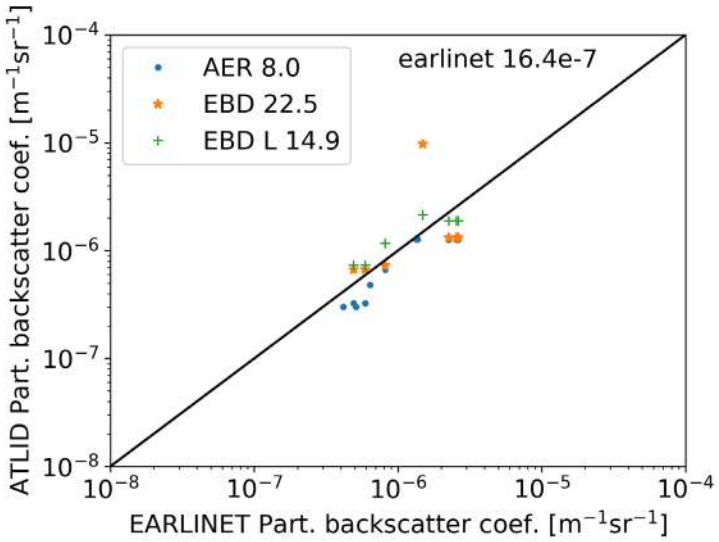
Good agreement for aerosols, also close to the ground.

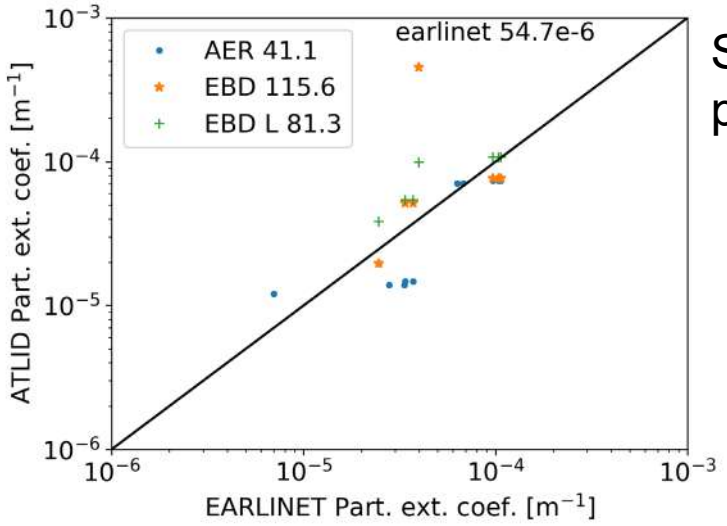
01:00 hour average



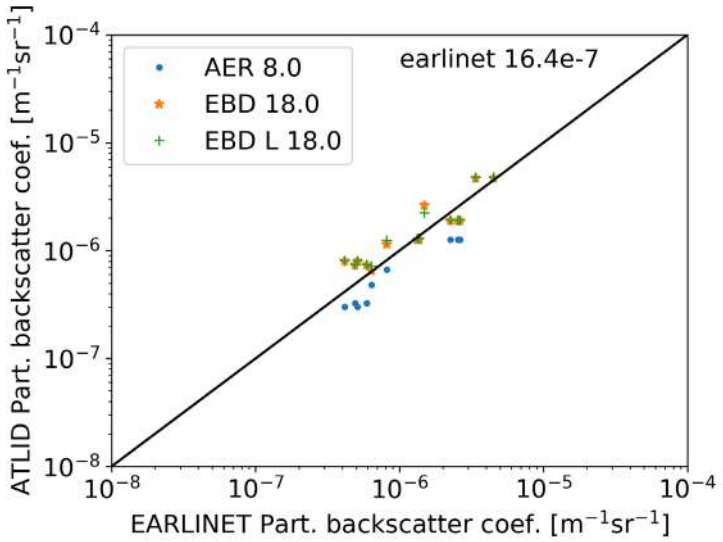
Ping Wang, “Validation of EarthCARE ATLID aerosol products using EARLINET measurements: preliminary results”, Day 3, 12:25

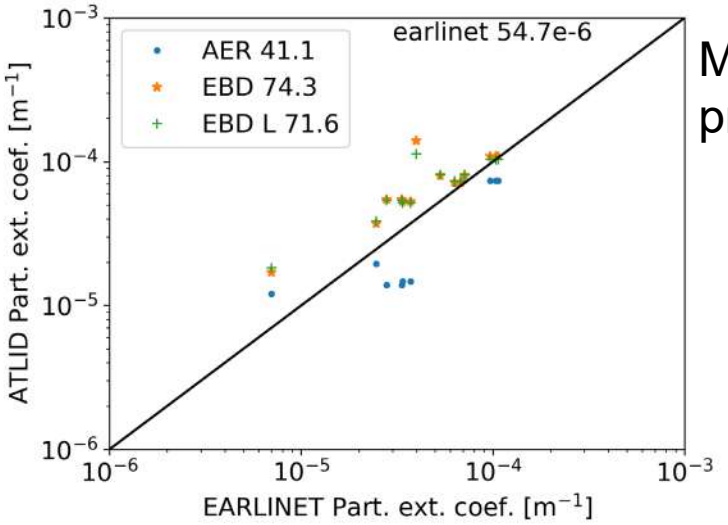
Statistics of collocated aerosol cases at Cabauw in 202408 – 202410





Single EBD profile





Mean EBD profile

14 collocated profiles in 7 days, all night time data

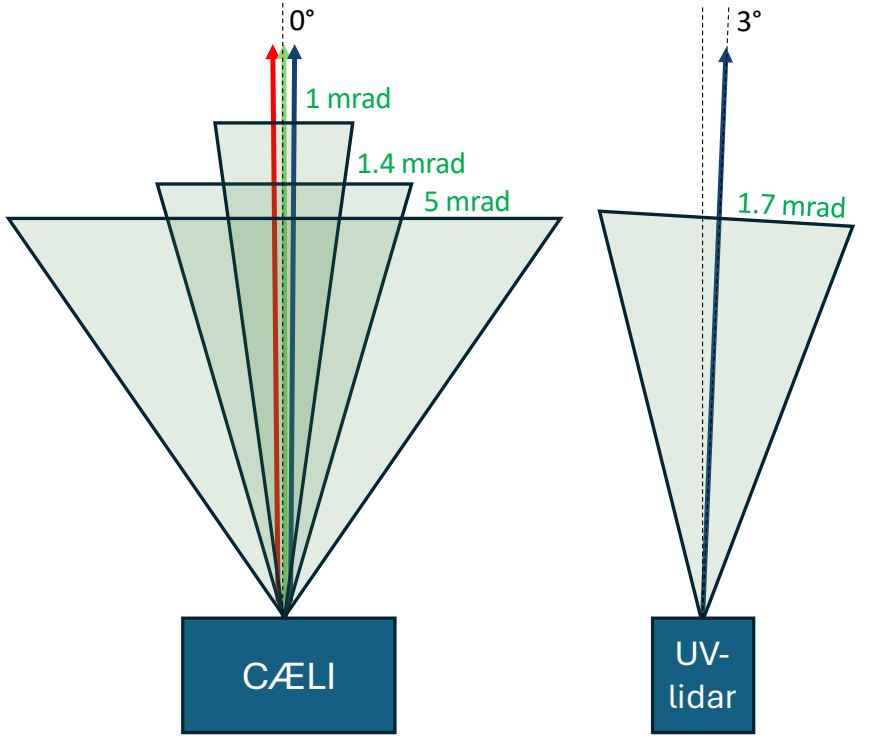
Mean values for backscatter (x1e-7) and extinction (x1e-6) are provided after the labels.

The mean EBD high resolution profile is more close to the EARLINET profile

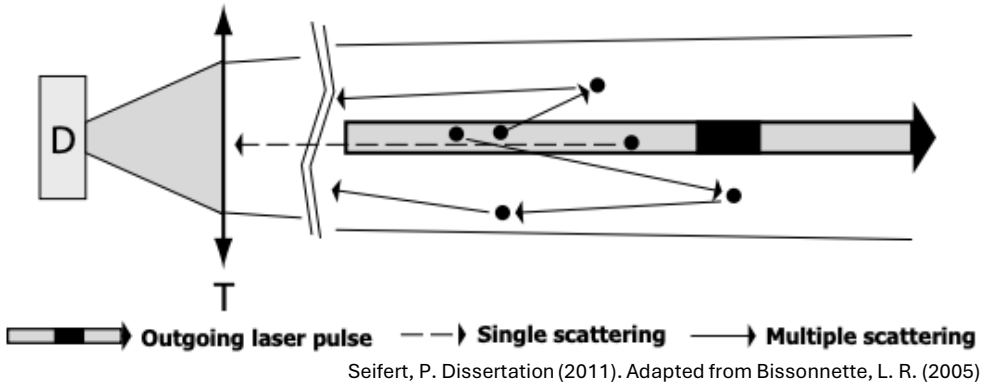
The depolarization ratios are also comparable but only 5 profiles.

Ping Wang, “Validation of EarthCARE ATLID aerosol products using EARLINET measurements: preliminary results”, Day 3, 12:25

Cirrus – Multiple Scattering



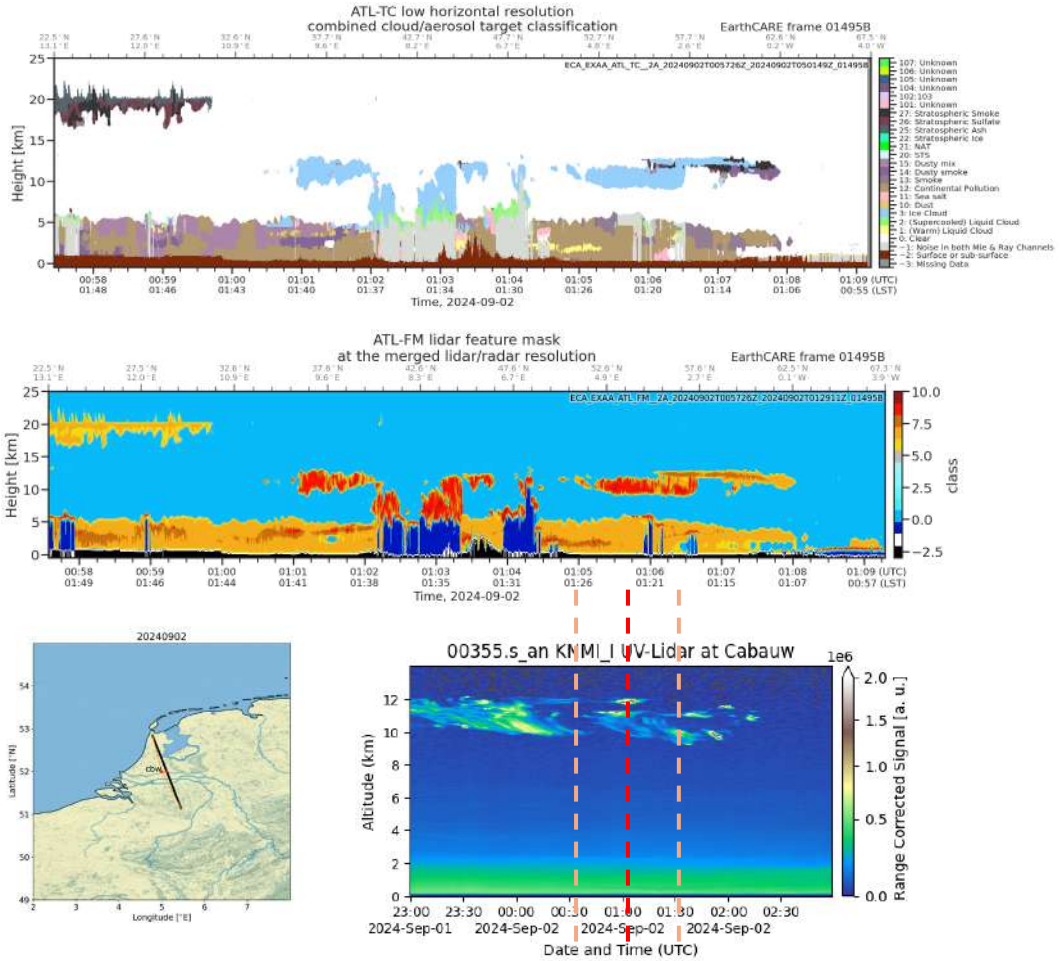
- Caeli: $3\beta + 2\alpha + \delta_{532}$ above ~ 800 m
  - Near Range Telescope (NRT): FOV = 1.4 mrad fw
  - Far Range Telescope (FRT): FOV = 1.0 mrad fw
  - Polarization Telescope (PolT): FOV = 5 mrad fw
  - Laser divergence = 0.2 mrad fw
- UV-lidar: β_{355}, α_{355}, δ_{355} above ~ 300 m (24/7)
  - Single Telescope (UVL T): FOV = 1.7 mrad fw
  - Laser divergency: 0.02 mrad fw

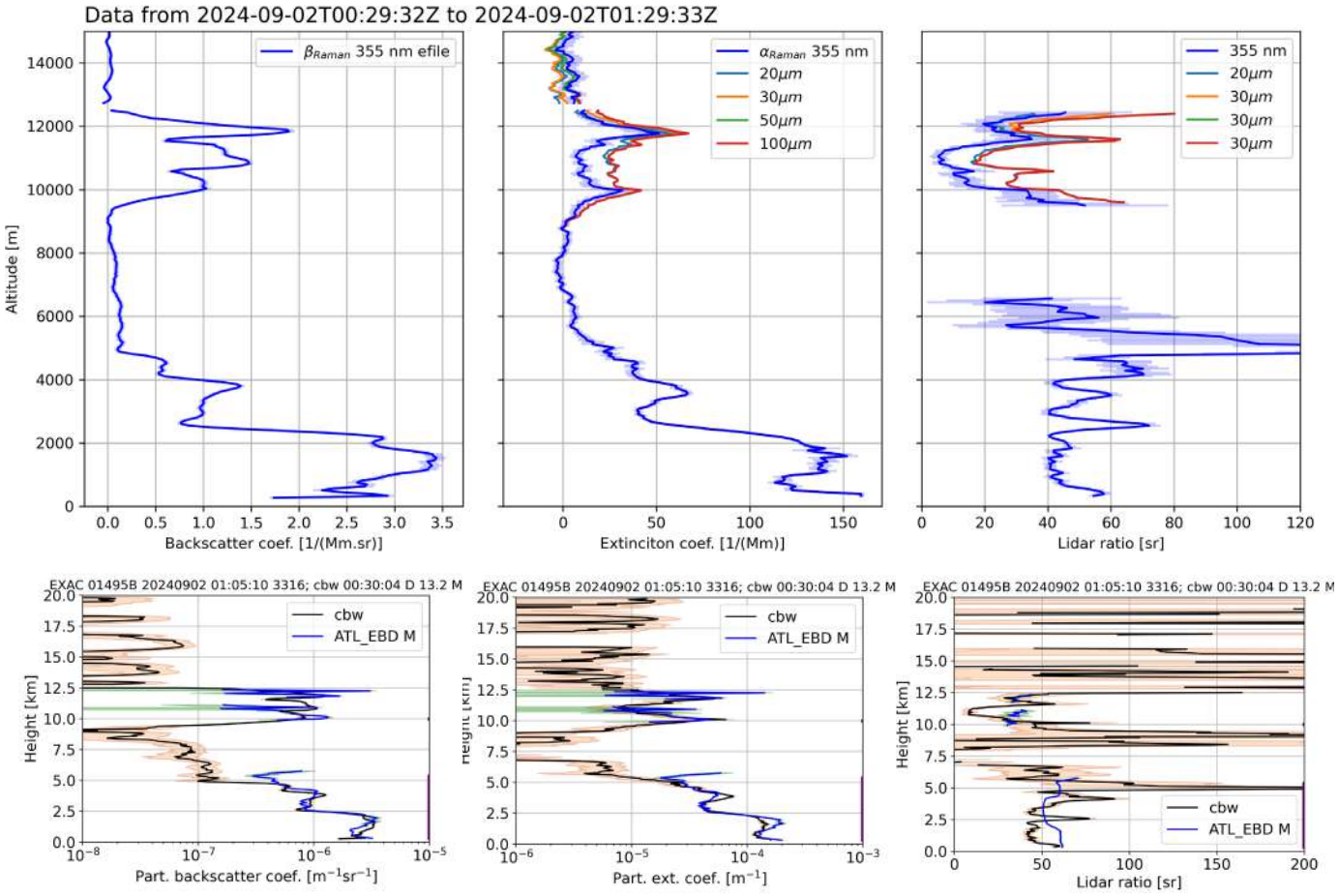


Seifert, P. Dissertation (2011). Adapted from Bissonnette, L. R. (2005)

Poster 22: “Effects of multiple scattering in cirrus clouds in ACTRIS-SCC retrievals for the validation of ATLID L2 optical products (EVID14”, Diego Alves Gouveia, et. al.

Cirrus – Multiple Scattering





MS correction not included in ACTRIS aerosol remote sensing single calculus chain

Poster 22: “Effects of multiple scattering in cirrus clouds in ACTRIS-SCC retrievals for the validation of ATLID L2 optical products (EVID14”, Diego Alves Gouveia, et. al.

Summary

- Cabauw site is delivering EarthCARE cal/val data through the ACTRIS aerosol remote sensing and cloud remote sensing data chains.
- Various cal/val studies for L1 and L2 products (using Cabauw data, among others) are under way with preliminary results underlining the excellent condition of EarthCARE.
  - Case studies
  - Build-up of statistics
  - Study of multiple scattering effects
- Opportunities for validating synergetic products using the extensive suite of observations in Cabauw
- A new Cloudnet station has become available recently in the coastal station Lutjewad

Thanks!


ESA | JAXA
earthcare
EarthCARE
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Access to Atmospheric Research Facilities
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Royal Netherlands Meteorological Institute
Ministry of Infrastructure and Water Management
ACTRIS
ICOS
INTEGRATED CARBON OBSERVATION SYSTEM
Ruisdael observatory
NWO