


Updates on ground-based aerosol remote sensing data provision from ACTRIS/EARLINET

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ICAP 2026 Meeting
Bonn, 10-12 June 2026

Agenda

ACTRIS – ARES overview

Data workflow and quality controls

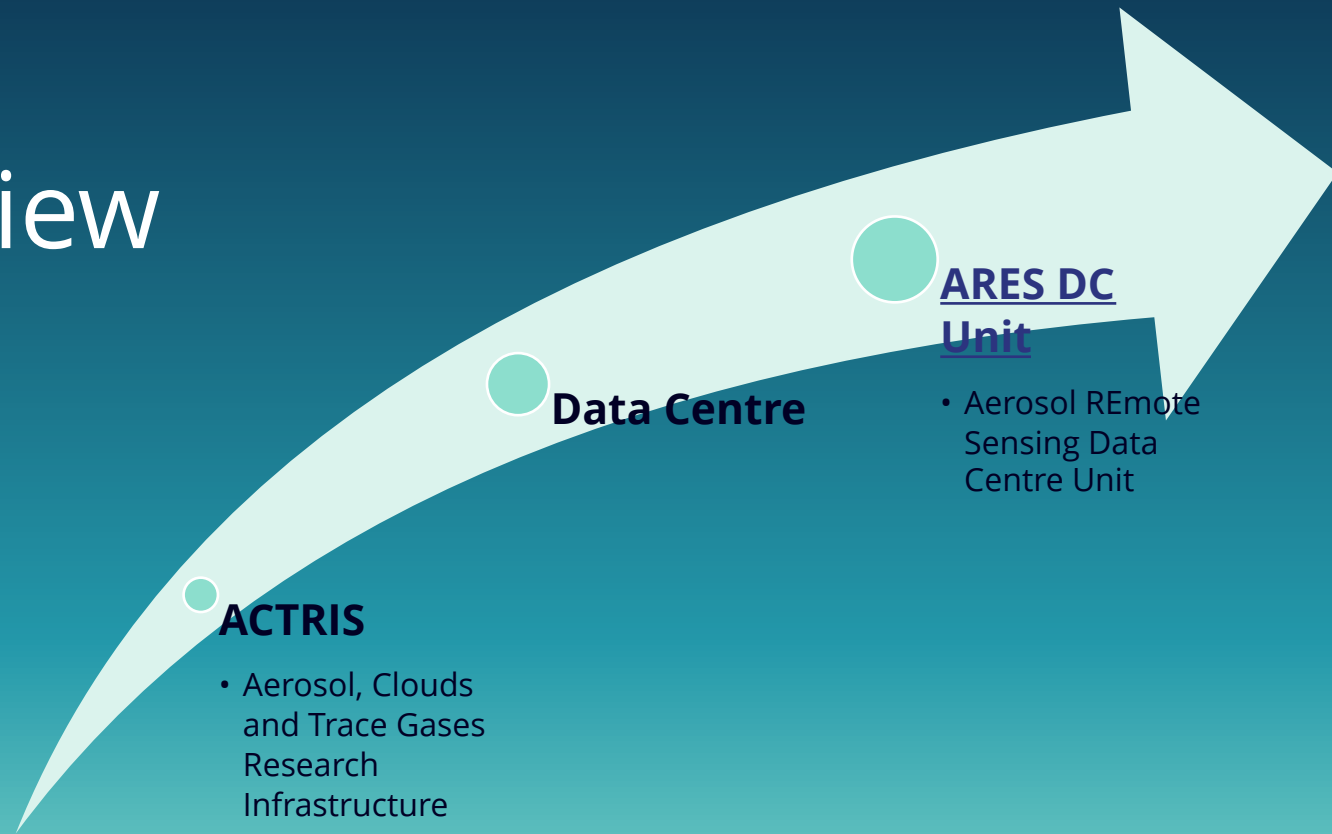
Data products

Access to data

Use cases

Final remarks

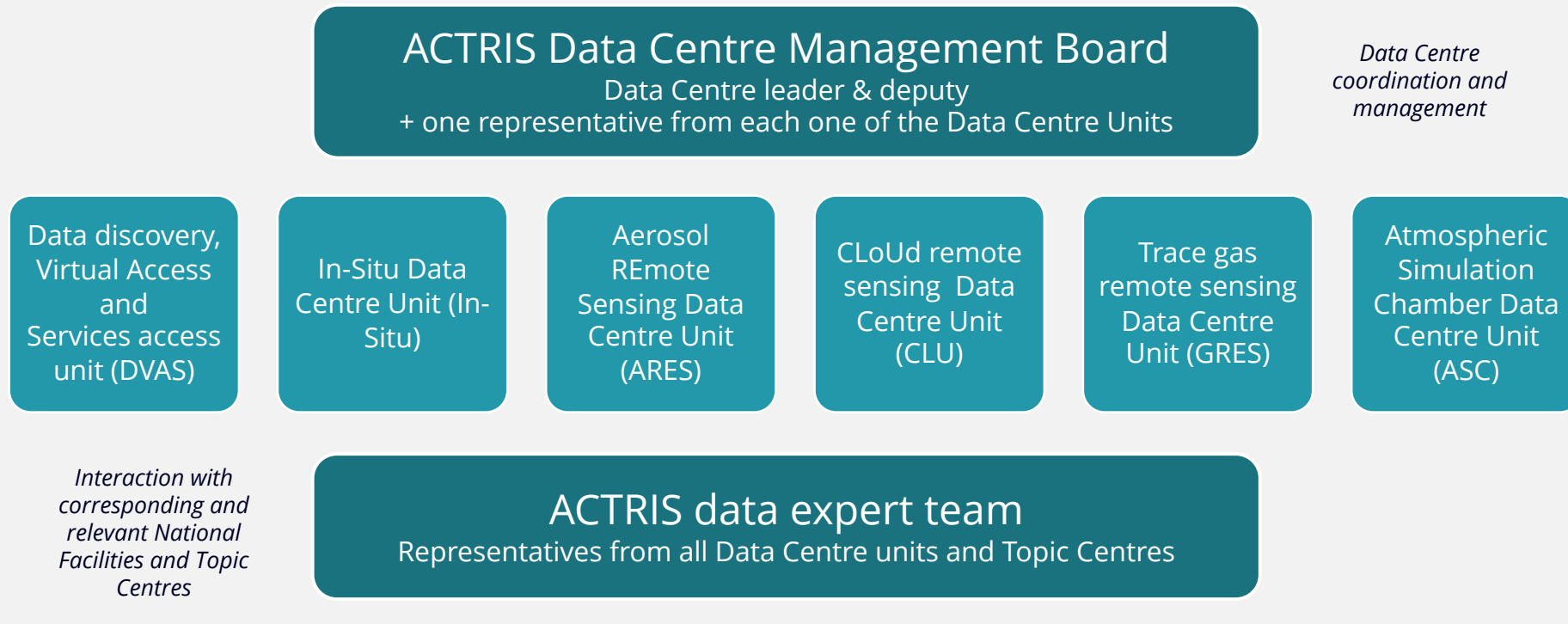
ACTRIS – ARES overview



ACTRIS structure

+ Governance (ACTRIS ERIC)
+ Head Office

ACTRIS Data Centre



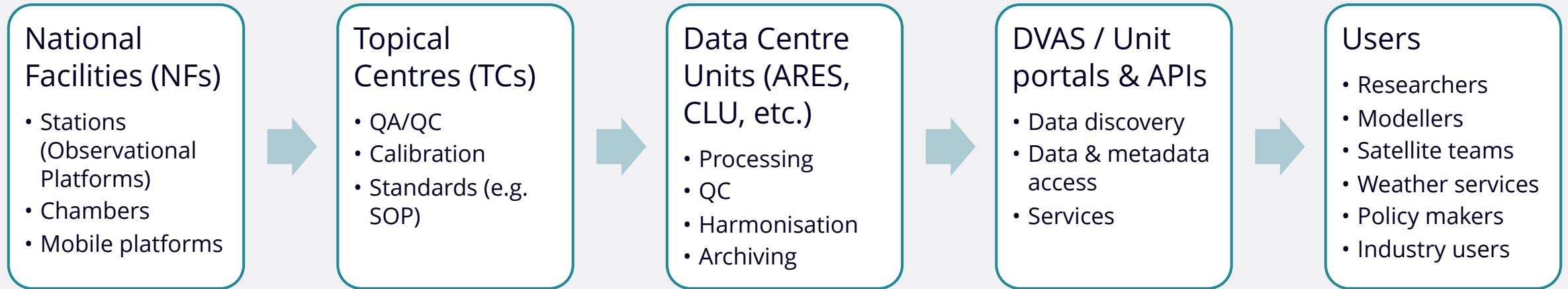
National Facilities

*Provide standardized and harmonised data.
The extent of data contributions varies for each National Facility*

Topic Centres

Ensure compliance with ACTRIS requirements on data quality, methods, etc. Examples: calibration, quality assurance tests, instruments characterization.

ACTRIS data flow



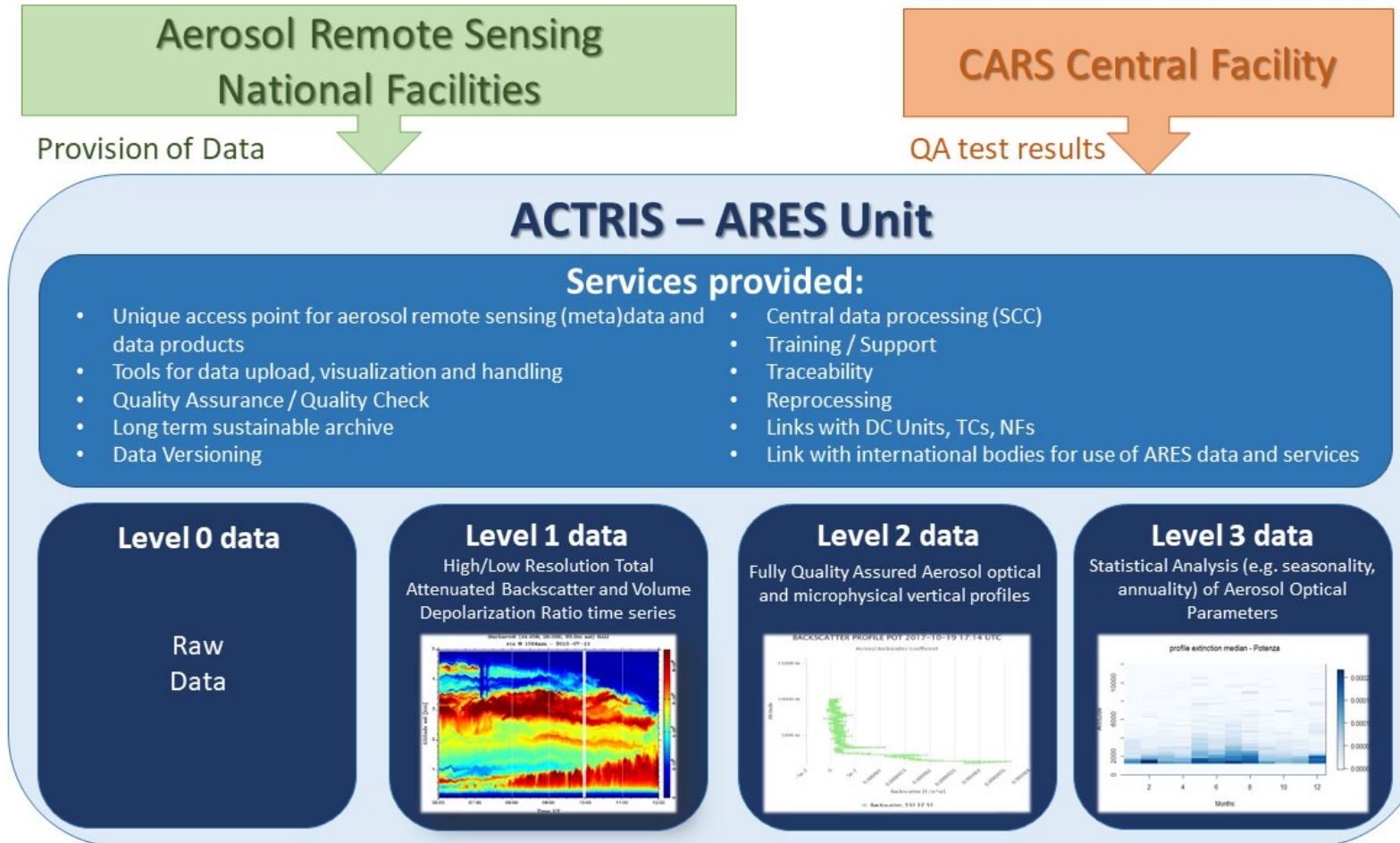
ARES concept

- To assure **standardisation, traceability** and **reprocessing capability** for aerosol remote sensing data coming from lidar and photometer observations
- Database and services include:
 - Centralized data processing
 - On-the-fly quality controls
 - Standardisation
 - Full traceability (versioning, PIDs/DOIs)
 - FAIR compliance and CF conventions
 - Automated workflows → NRT data provision
 - Single access point
- ARES's mandate is to serve the ACTRIS aerosol remote sensing community, but it also serves the EARLINET-not ACTRIS stations
- Node physically hosted at CNR-IMAA (Potenza, Italy). CNRS (Lille, France) is responsible for the combined lidar-photometer processing.

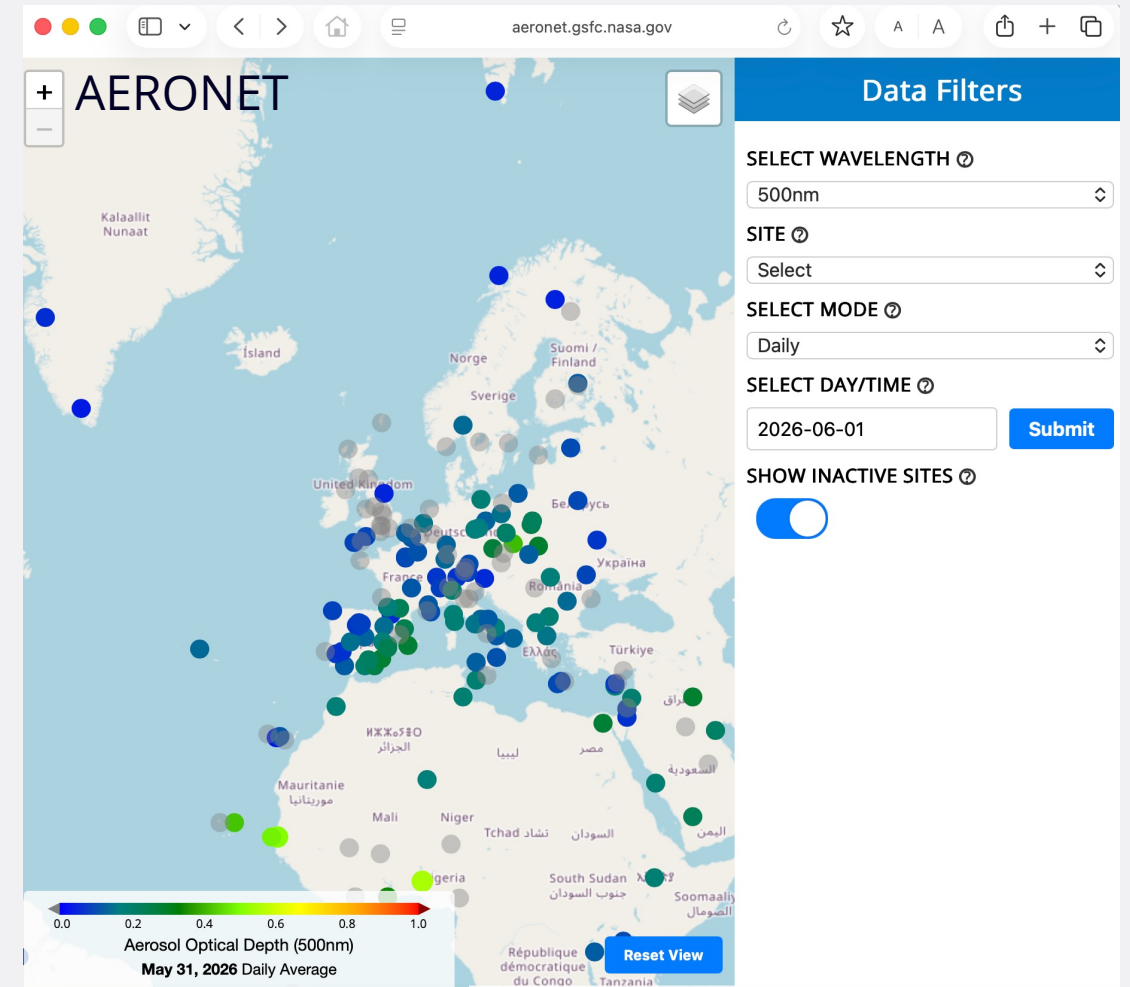
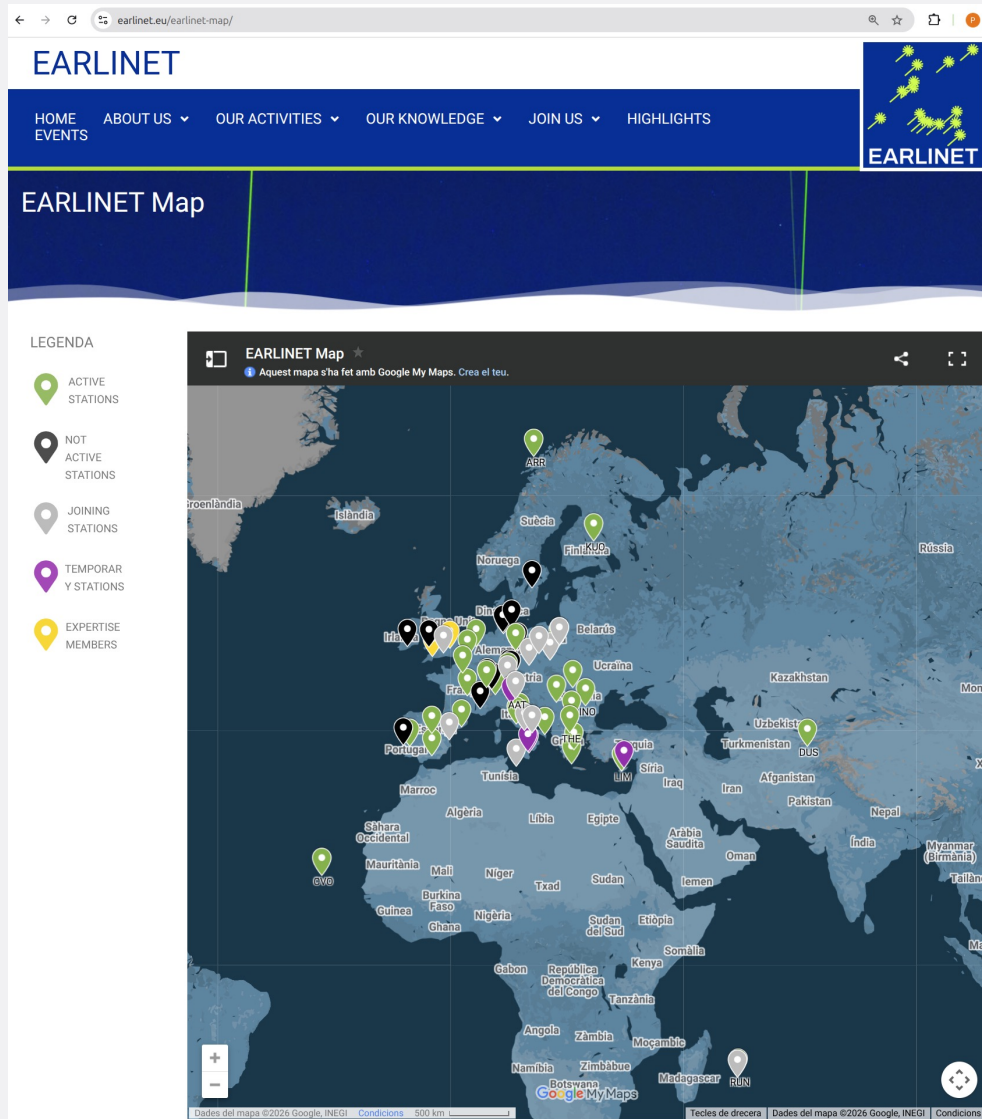


Main responsibilities of ARES

(meta)data curation, data processing, data quality controls and (meta)data provision of Aerosol Remote Sensing observations



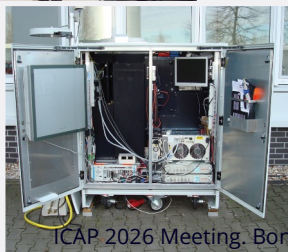
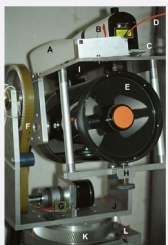
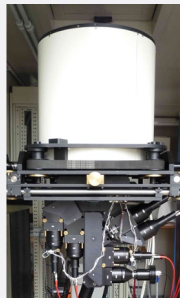
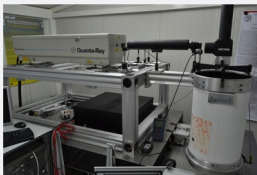
Aerosol remote sensing scientific community



ACTRIS ARES Standardization

Challenges

- Standardization of ACTRIS/EARLINET products is difficult
- EARLINET was born as Research Lidar Network
- Lidar systems are often highly customized or fully home-made → differences in laser sources, telescopes, detection and acquisition systems



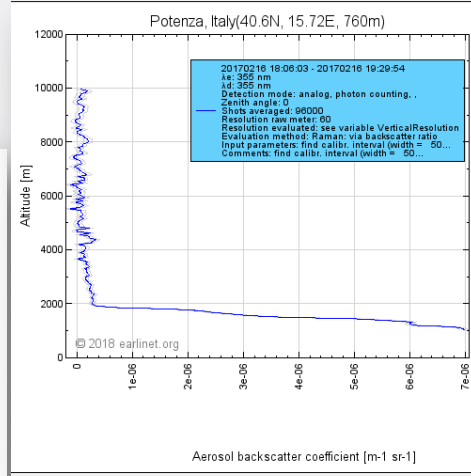
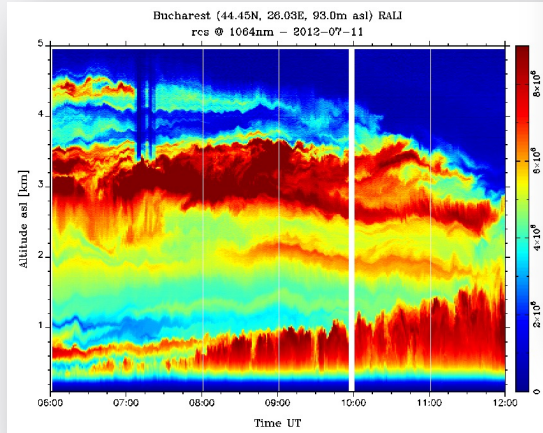
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Approach

- Define quality control procedures to be applied on both hardware and software levels
- Several inter-comparison campaigns
- Definition of a standard format for all the data products including raw data (NetCDF)
- Development of an automatic and centralized processing chain (Single Calculus Chain – SCC)
- Storage of all the processing parameters in persistent way

Data workflow and quality controls

ARES Data Level Structure



ACTRIS data level 0
Raw sensor output. Native resolution, metadata necessary for next level

Established format and content

ACTRIS data level 1
Calibrated and quality assured data with minimum level of quality control.

Potential NRT release

ACTRIS data level 2
Approved and fully quality controlled ACTRIS data product or geophysical variable

Potential NRT release

ACTRIS data Level 3
Elaborated ACTRIS data products derived by post-processing of ACTRIS Level 0 -1 -2, and data from other sources. The data can be gridded or not.

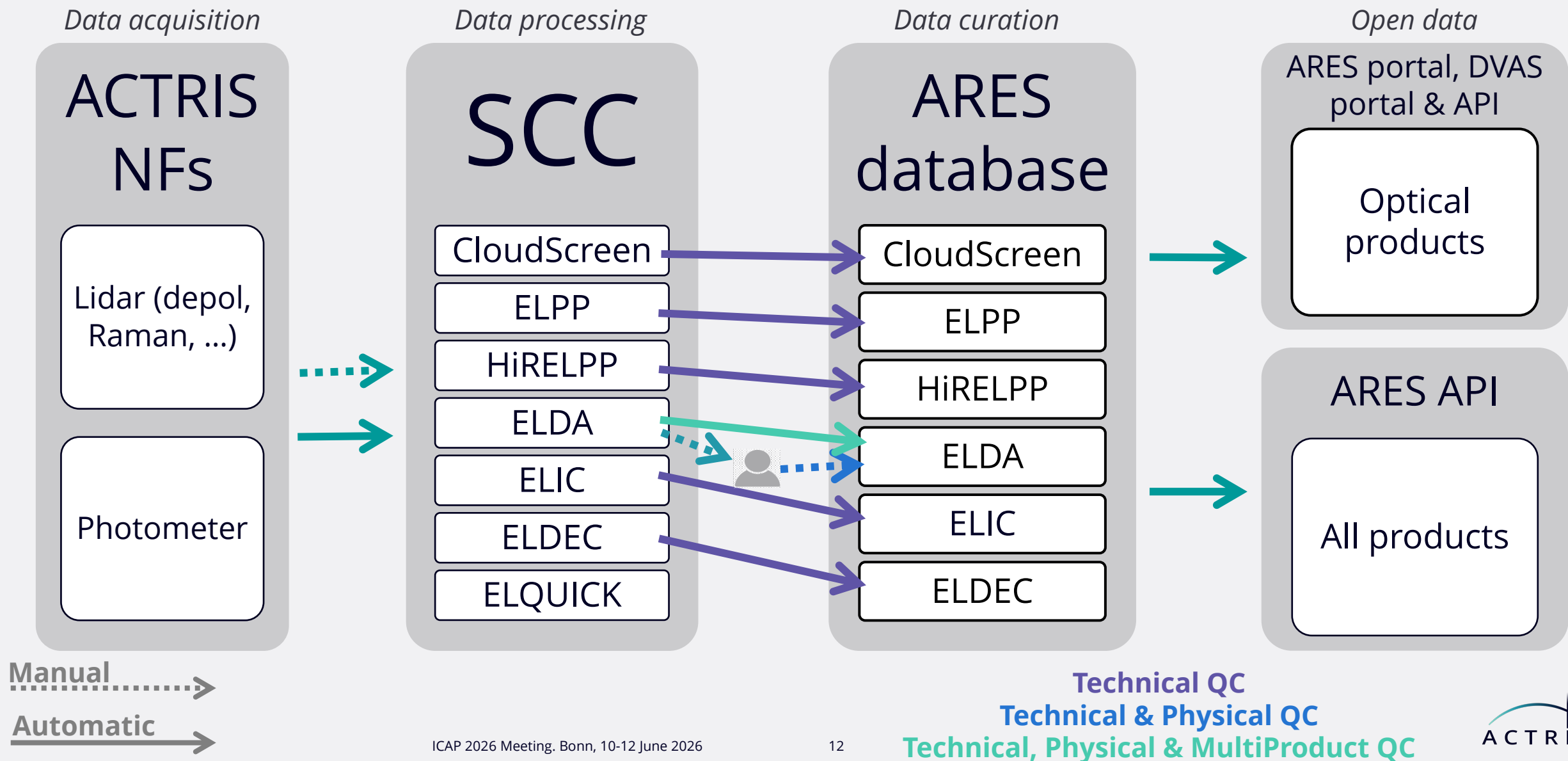
Level 3 climatological

Pre-processed signals
High Resolution products
High quality profiles
Layering/Typing products
ACTRIS/EARLINET-AERONET combined data
Multi-wavelength

Synthesis products
Data products not under direct ACTRIS responsibility from e.g. research activities, citizen science, for which ACTRIS offers repository and access.

QC procedures

ACTRIS ARES Data Centre workflow



Quality Controls

The quality controls applied are:

Centralized and automatic

Traceable and reproducible (even if they cannot spot everything)

Based on expertise on working with data from many stations

There are 3 types of QC procedures:

Basic/Technical (BQC)

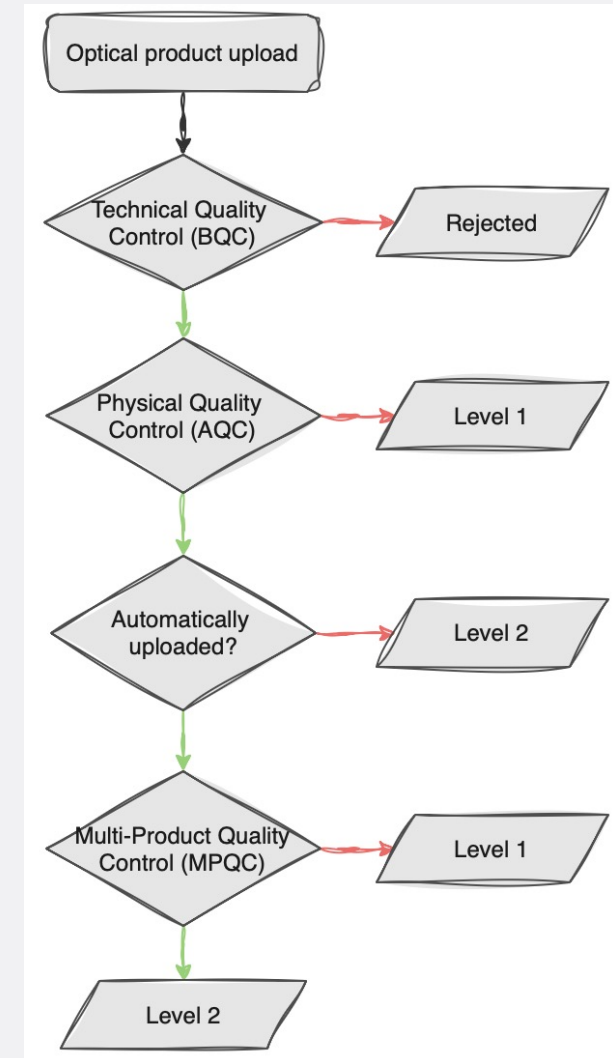
- checks on file format, completeness and metadata consistency

Advanced/Physical (AQC)

- checks on the physical quantities (e.g. AOD, IB, lidar ratio) and on the SCC experimental / operational configuration (approval by CARS)

Multi-Product (MPQC)

- consistency checks across multiple products



Data product levels

Level 1 data

- Partially quality controlled (basic/technical QC applied)

Level 2 data

- Fully quality controlled data. It needs to meet all these criteria at the same time:
 - Data acquired with fully CARS QA lidar system
 - Data acquired following all Standard Operating Procedures
 - Data obtained using the standardized processing system (SCC)
 - Data obtained using the Operational configuration in SCC for that system at that time (linked to CARS QA)
 - Data compliant with all automatic quality control procedures implemented at ARES

Level 3 data

- Higher-level products derived from Level 2 data
- Generated by aggregation, reprocessing, or advanced analysis
- Provide harmonised and long-term datasets (e.g. climatologies, reanalysis)
- Designed for scientific studies, trend analysis, and applications

QC report example: b-file, level 1

data.earlinet.org/earlinet/landingPage.zul?pkind=1&id=189104&ver=1

Summary Visualisation **Quality Report**

QUALITY CONTROL REPORT

Technical Quality Control	Executed	Execution Date	Passed
Check if file contains data	✓	08/11/2024 14:32:00	✓
Check Coordinates Consistency	✓	08/11/2024 14:32:00	✓
Check for Undefined Variables and Global Attributes	✓	08/11/2024 14:32:00	✓

« < 1 / 2 > » [1 - 10 / 11]

Physical Quality Control	Executed	Execution Date	Passed
Checks for Negative Errors	✓	08/11/2024 14:32:00	✓
Negative peaks	✓	08/11/2024 14:32:00	✓
Check on AOD	-	08/11/2024 14:32:00	-
Check on IB	✓	08/11/2024 14:32:00	✓
Check on LidarRatio	-	08/11/2024 14:32:00	-
Check on Volumedepolarization	✓	08/11/2024 14:32:00	✓
Check on Particledepolarization	✓	08/11/2024 14:32:00	✓
Check on Watervapormixingratio	✓	08/11/2024 14:32:00	✓
Check on atmospheric_molecular_calculation_source	✓	08/11/2024 14:32:00	✓
Check on old cirrus product	✓	08/11/2024 14:32:00	✓

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Physical Quality Control	Executed	Execution Date	Passed
Check on SCC product type	✓	08/11/2024 14:32:00	✗

QUALITY CONTROL INFORMATION

Quality Control procedure: EARLINET Quality Control V3.0 - Partially Passed ⚠

This product was checked with the latest version of the Quality Control procedure ✅

QC report example: e-file, level 2

data.earlinet.org/earlinet/landingPage.zul?pkind=1&id=105036&ver=1

Summary Visualisation **Quality Report**

QUALITY CONTROL REPORT

Technical Quality Control	Executed	Execution Date	Passed
Check if file contains data	✓	28/04/2021 10:58:00	✓
Check Coordinates Consistency	✓	28/04/2021 10:58:00	✓
Check for Undefined Variables and Global Attributes	✓	28/04/2021 10:58:00	✓

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Physical Quality Control	Executed	Execution Date	Passed
Checks for Negative Errors	✓	28/04/2021 10:58:00	✓
Negative peaks	✓	28/04/2021 10:58:00	✓
Check on AOD	✓	28/04/2021 10:58:00	✓
Check on IB	-	28/04/2021 10:58:00	-
Check on LidarRatio	✓	28/04/2021 10:58:00	✓
Check on Volumedepolarization	✓	28/04/2021 10:58:00	✓
Check on Particledepolarization	✓	28/04/2021 10:58:00	✓
Check on Watervapormixingratio	✓	28/04/2021 10:58:00	✓
Check on atmospheric_molecular_calculation_source	✓	28/04/2021 10:58:00	✓
Check on old cirrus product	✓	28/04/2021 10:58:00	✓

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Physical Quality Control	Executed	Execution Date	Passed
Check on SCC product type	✓	28/04/2021 10:58:00	✓

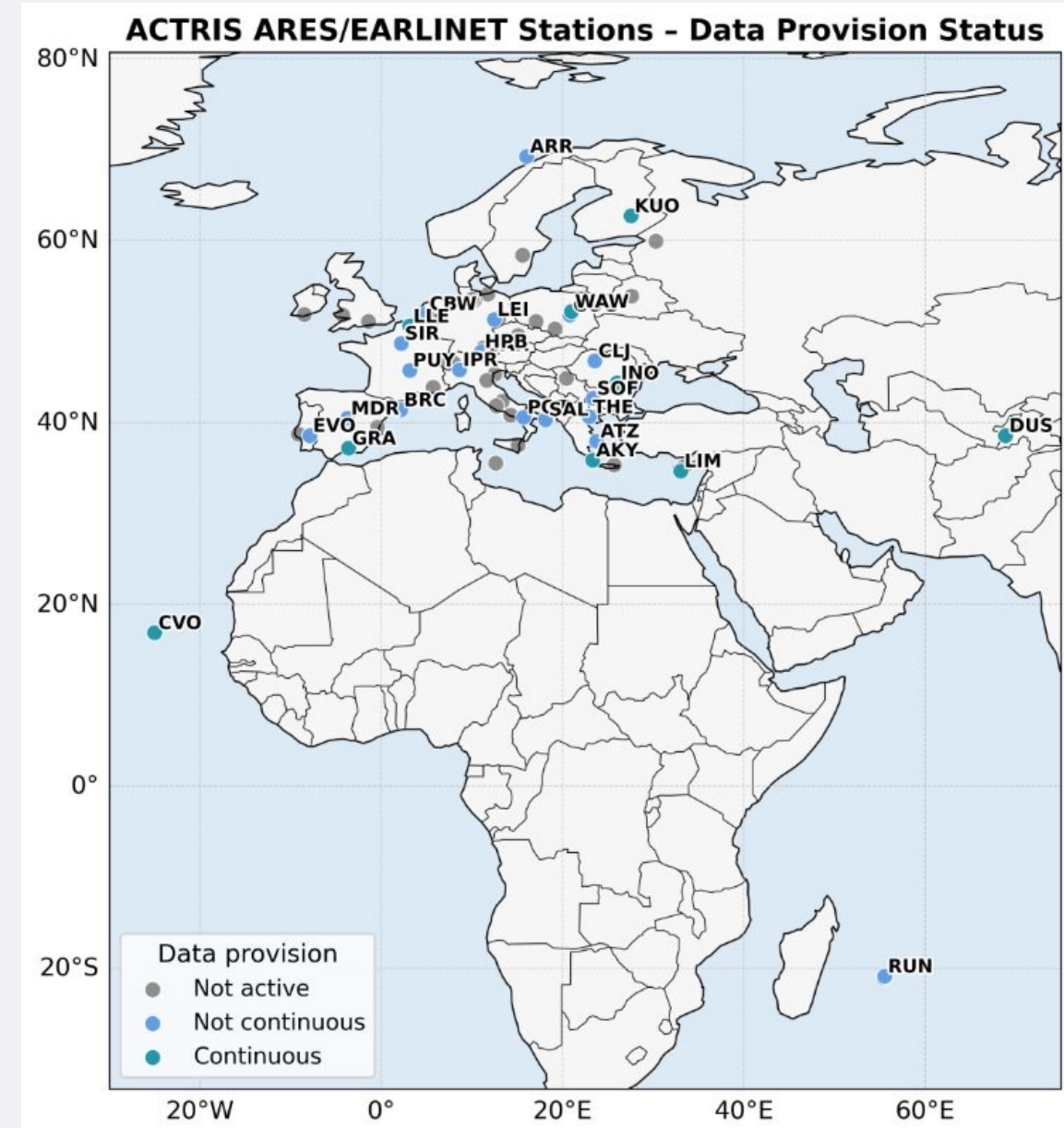
QUALITY CONTROL INFORMATION

Quality Control procedure: EARLINET Quality Control V3.0 - Fully Passed ✓

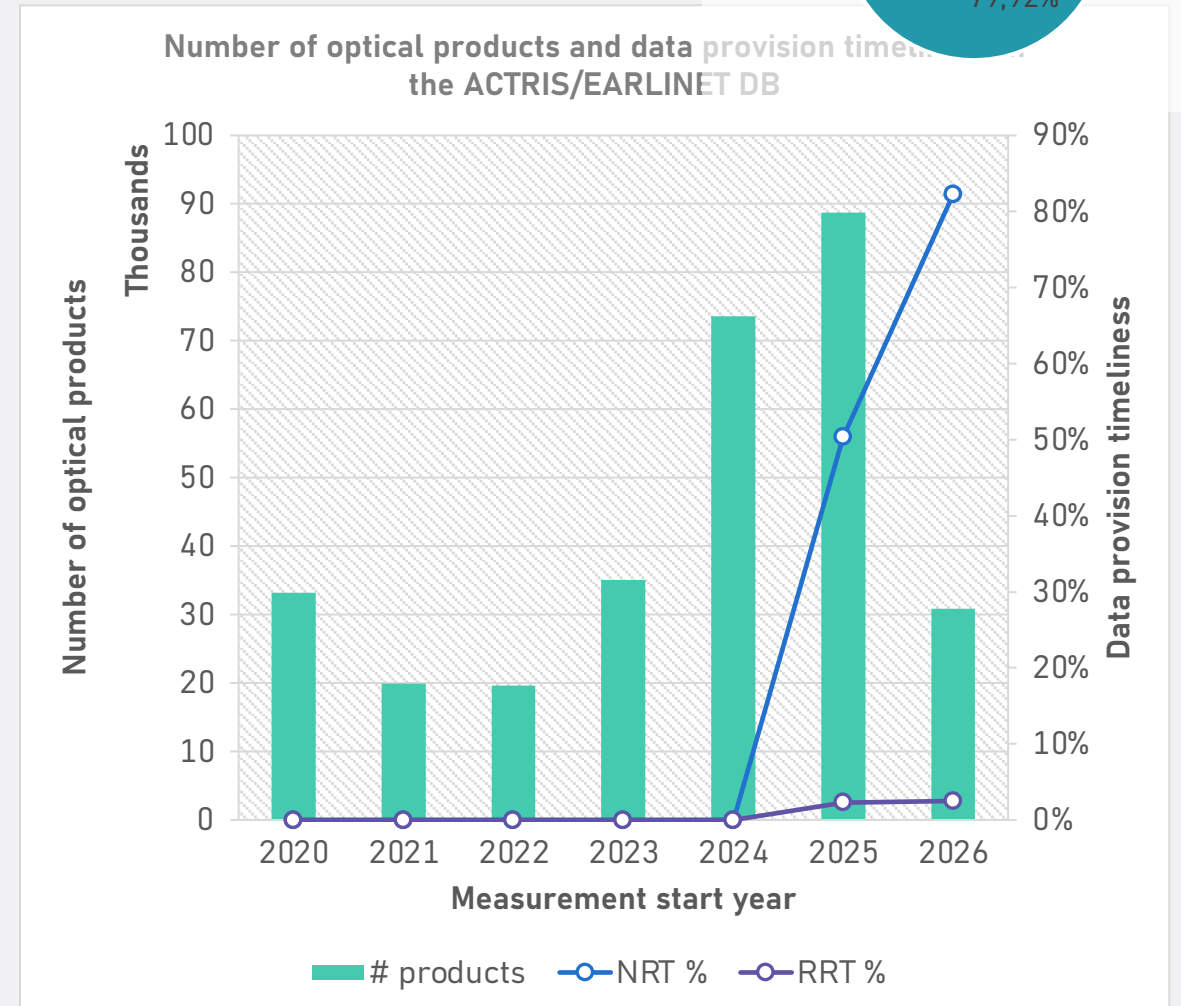
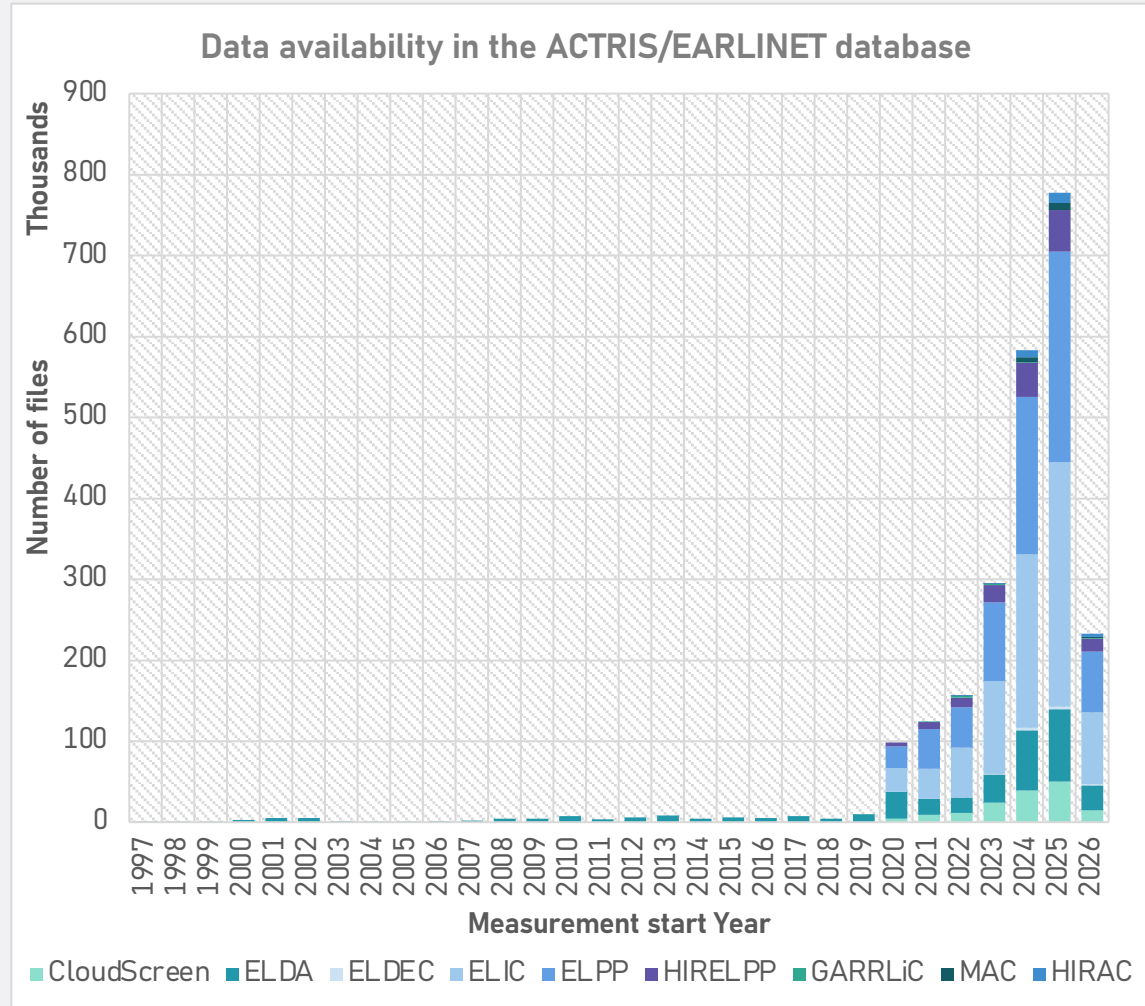
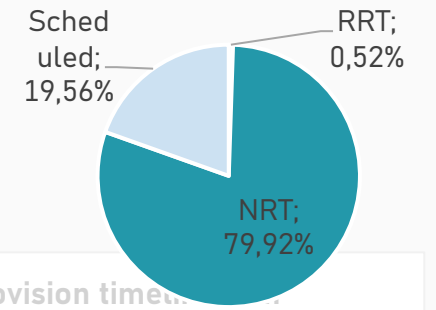
This product was checked with the latest version of the Quality Control procedure ✓

ACTRIS ARES station operation modes

- **All the data is quality controlled** (on-the-fly QC)
- Stations provide measurements in different modes:
 - **Scheduled measurements:** regular observations following ACTRIS Protocols (5x / week)
 - **Campaign-based measurements:** intensive operation during specific events
 - **Continuous measurements:** a subset of stations (9) operate continuously. These stations:
 - Deliver automated measurements with high temporal coverage
 - Provide data in near-real-time (NRT) via SCC/ARES
 - Support operational applications (e.g. CAMS, aviation, alerts)
- Network performance highlights:
 - Increasing number of fully automated systems
 - Some with continuous operation capability
 - Timeliness of data provision:
 - Most data in NRT (< 72 h)
 - Increasing data in RRT (< 3 h)



Data availability and timeliness



Data products

Data products available in the ACTRIS/EARLINET database

SCC products:

- Profiles of aerosol optical properties / ELDA*
- CloudScreen
- ELPP (pre-processed data, low resolution)
- HiRELPP (pre-processed data, high resolution)
- ELIC (pre-processed data, calibrated, low & high resolution)
- ELDEC (calibration products)

[Additional information & documentation](#)

* can be associated to specific datasets (e.g. *Climatol*, *CALIPSO*, *EarthCARE*)

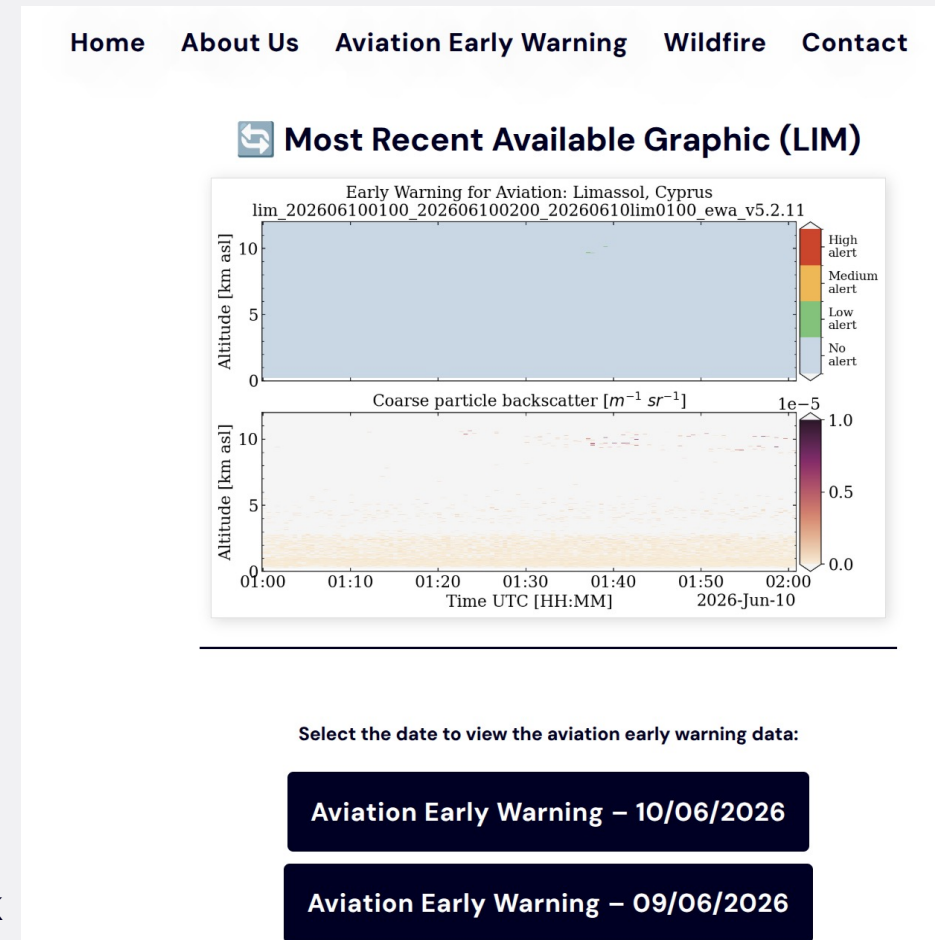
**optical profiles resolution

Additional products:

- Combination with sun photometer data:
 - GARRLiC (combined lidar-photometer algorithm for retrieving aerosol properties and profiles)
- Aerosol typing products:
 - HIRAC (High Resolution Aerosol Classification)
 - MAC (Mahalanobis aerosol classification)**
 - HETEAC-flex (Harmonized European Typing of Aerosol Categories – flexible)**
- Aerosol layering products:
 - LTOOL (automatic layer detection)**

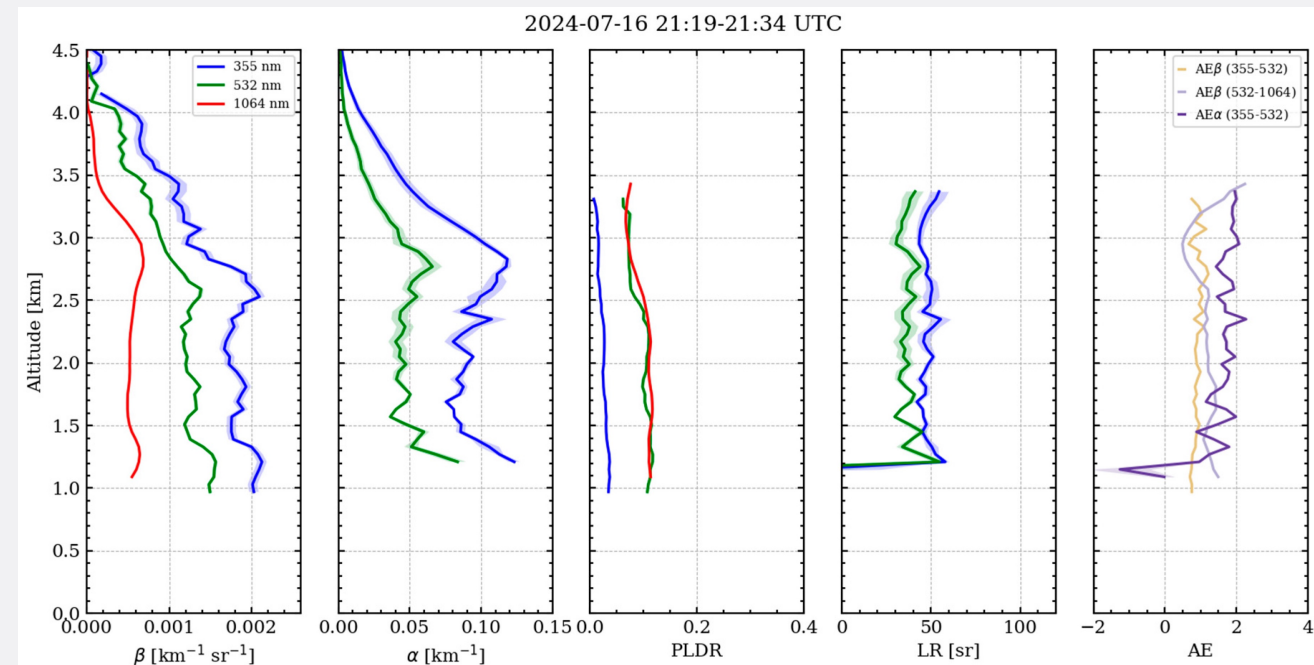
Additional ARES products (not in database/API)

- [Level 3 climatological products](#)
 - Long-term, harmonised datasets derived from multiple observations for trend and climate studies
- Tailored products and campaigns (e.g. [Eyjafjallajökull volcanic cloud over Europe observed by EARLINET](#))
 - Custom datasets generated for specific events or field campaigns, addressing targeted scientific or operational needs
- [Early Warning for Aviation](#)
 - Near-real-time products supporting detection and monitoring of hazardous aerosol layers (e.g. volcanic ash) for aviation safety
- [Quicklooks interface](#)
 - Web-based visualisation tool providing rapid previews of measurements and products for quick inspection and quality check



Profiles of aerosol optical products

- Height-resolved aerosol optical properties from ground to upper troposphere/lower stratosphere
- Multiple wavelengths (UV, visible, IR), enabling spectral characterization
- Derived from (multi-wavelength) (Raman) lidar measurements
- Extensive properties (aerosol quantity):
 - aerosol backscatter coefficient
 - aerosol extinction coefficient (Raman lidar systems, nighttime)
- Intensive properties (aerosol type):
 - lidar ratio (extinction-to-backscatter ratio)
 - particle linear depolarization ratio (aerosol type indicator)
 - Ångström exponent



Multi-wavelength optical products (ELDAmwl)

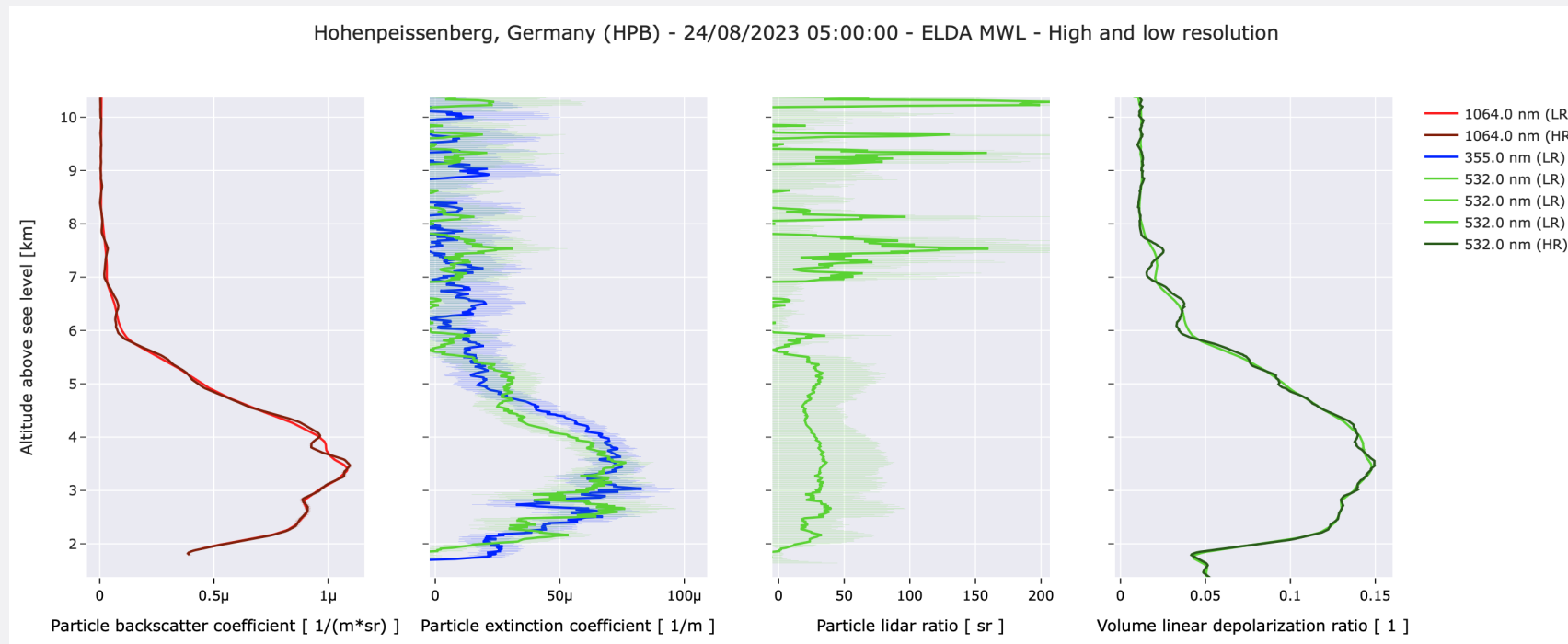
Currently data file are single product oriented (one backscatter/extinction, single wavelength)



Multiwavelength product with all available aerosol optical property profiles at the same vertical-temporal resolution currently **available in experimental mode**



Multiwavelength product will allow for more robust aerosol layering and typing products



GARRLiC: Generalized Aerosol Retrieval from Radiometer and Lidar Combined data

- Simultaneous inversion of multi-wavelength LIDAR and photometric measurements to retrieve microphysical and derive optical properties of aerosols:
 - Vertically resolved: volume concentration, extinction coefficient, ...
 - Column integrated variables: size distribution, RI, AOD, LR, SSA, r_{eff} , ...
- Dedicated [visualization tool](#)
- Scientific developments:
 - Univ. Lille/CNRS-LOA: <http://www-loa.univ-lille.fr>
 - GRASP-OPEN: <https://www.grasp-open.com>
- Data available since January 2021:
 - 20 stations
 - 6.4k products available

Sun-photometer :

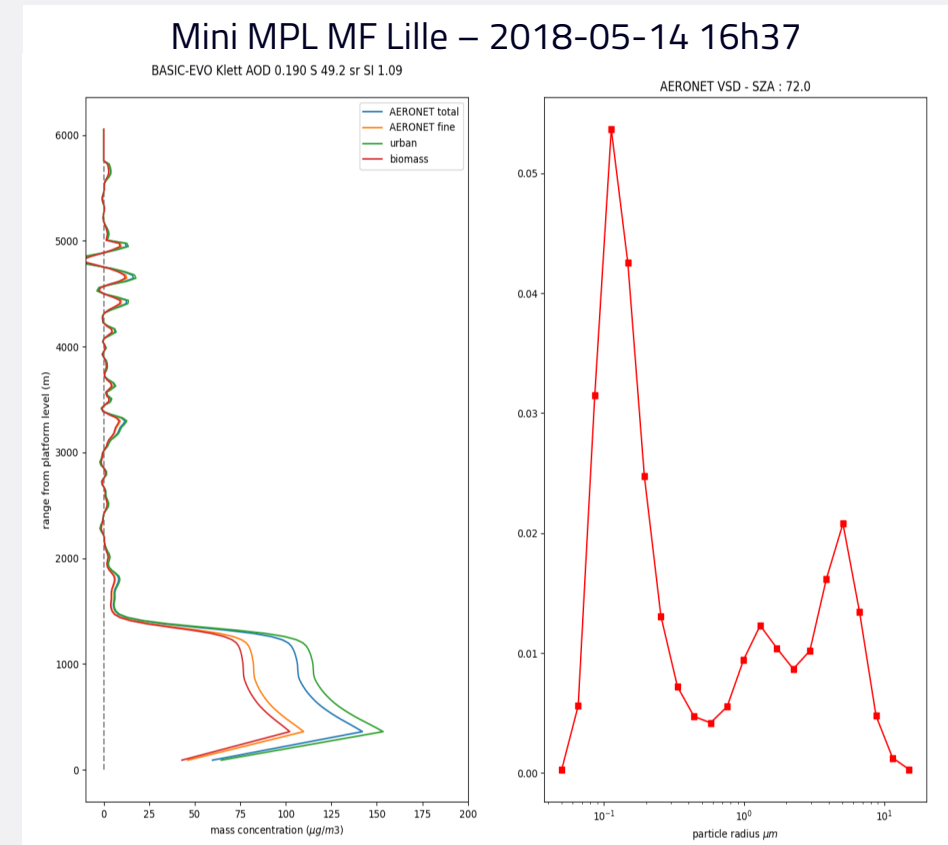
- AOD
- Total spectral radiances at 440, 670, 870 and 1020 nm and multiple angles

LIDAR :

- Altitude resolved attenuated backscatter at 355, 532, 1064 nm

GRASP/GARRLiC
Run and stored in
AERIS ICARE

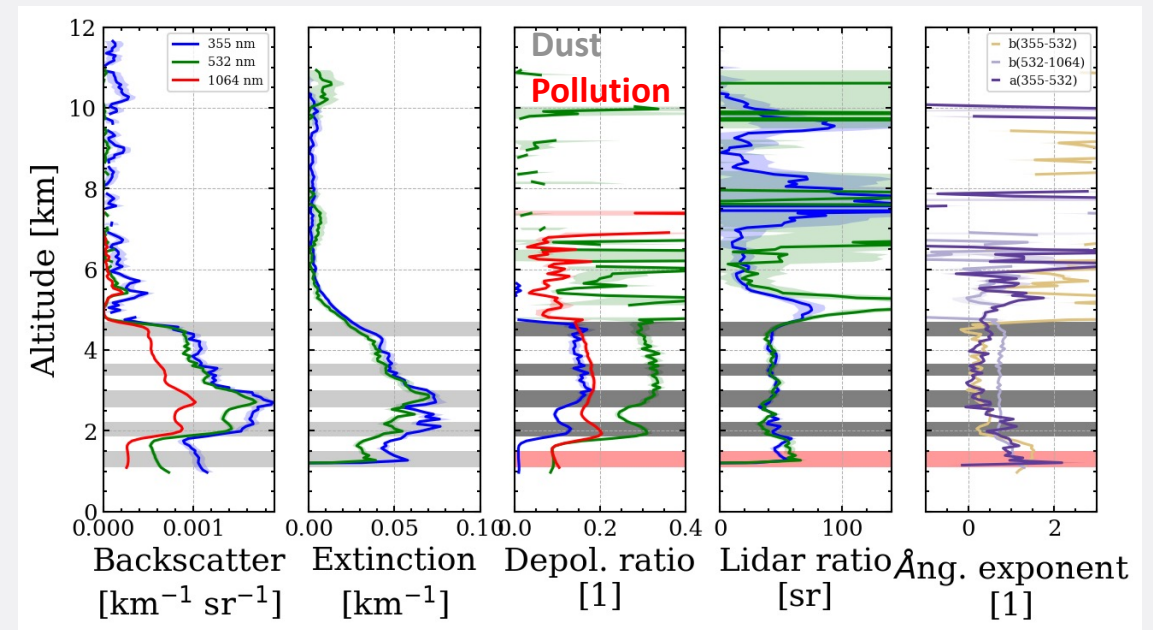
ACTRIS/
EARLINET
database



Aerosol typing products

- High resolution aerosol typing:
 - HIRAC: High Resolution Aerosol Classification
- Low resolution aerosol typing*:
 - MAC: Mahalanobis aerosol classification (Papagiannopoulos et al. 2018)
 - HETEAC-flex: Harmonized European Typing of Aerosol Categories – flexible (Floutsi et al. 2023)
- All running operationally in the ARES postprocessing server
- NRT provision

Product	Starting	# stations	# products
HIRAC	01/2024	19	31830
MAC	01/2024	22	17077
HETEAC-flex	06/2026	7	321



* The low-resolution typing makes use of the LTOOL layering products

Aerosol typing products

HiRAC: High Resolution Aerosol Classification

- Its goal is to provide an aerosol class mask using calibrated lidar signals (ELIC: 532/1064 nm attenuated backscatter + 532 nm depolarization ratio)
- The aerosol classification can be readily available night/day.
- The aerosols are classified by their physical features (shape and size) into 4 classes:
 - small
 - large, spherical
 - large, non-spherical
 - mixed, partly non-spherical


MAC: Mahalanobis aerosol classification

- Its goal is to provide an aerosol class mask using multi-parameter lidar optical properties (e.g. backscatter, extinction, lidar ratio, depolarization)
- The aerosol classification can be applied when retrieved optical products are available (typically Raman/night-time conditions)
- The method is based on statistical distance (Mahalanobis distance) to predefined aerosol classes
- The aerosols are classified into reference aerosol types:
 - Dust
 - Smoke / biomass burning aerosol
 - Marine aerosol
 - Continental / Urban pollution
 - Clean continental / background aerosol
 - Mixtures
- Allows probabilistic and robust classification based on similarity to known aerosol clusters

Aerosol typing products

HETEAC-flex: Harmonized European Typing of Aerosol Categories – flexible

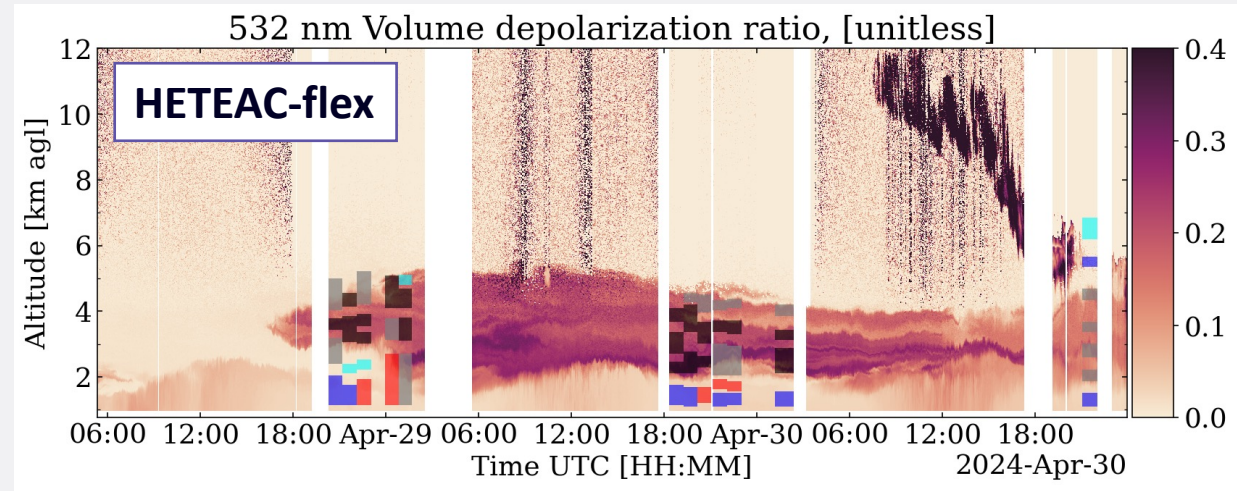
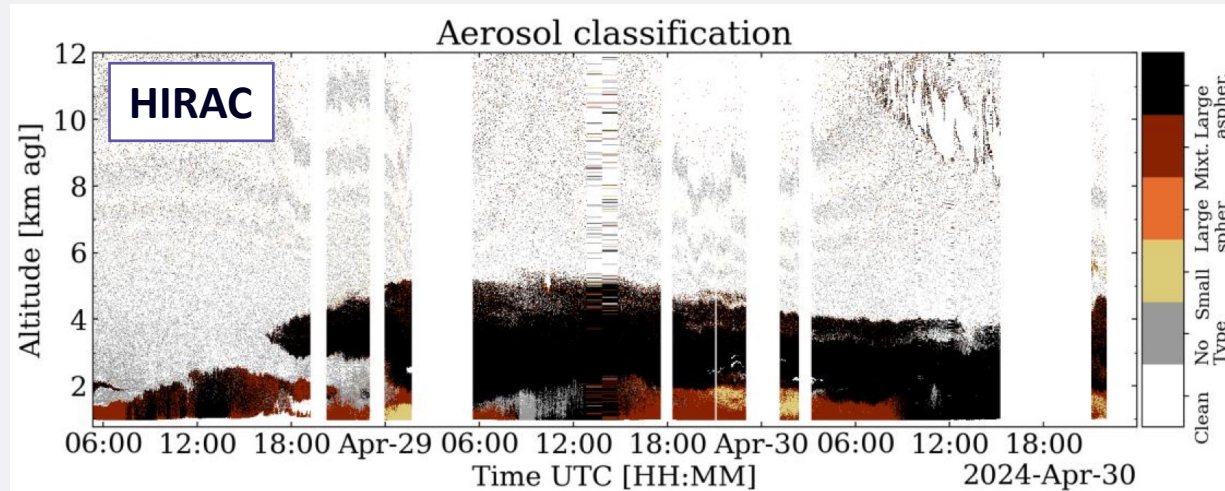
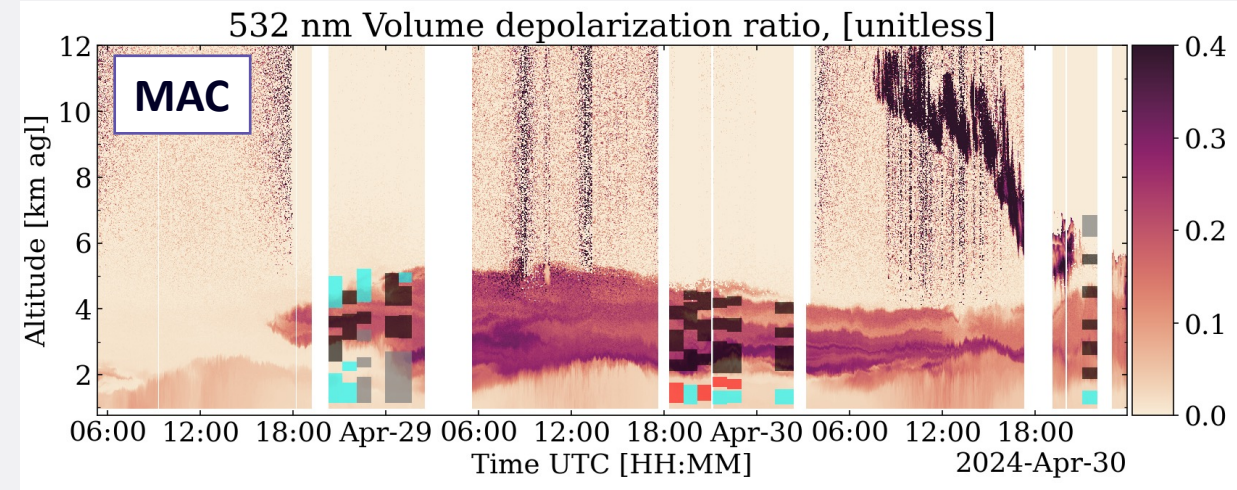
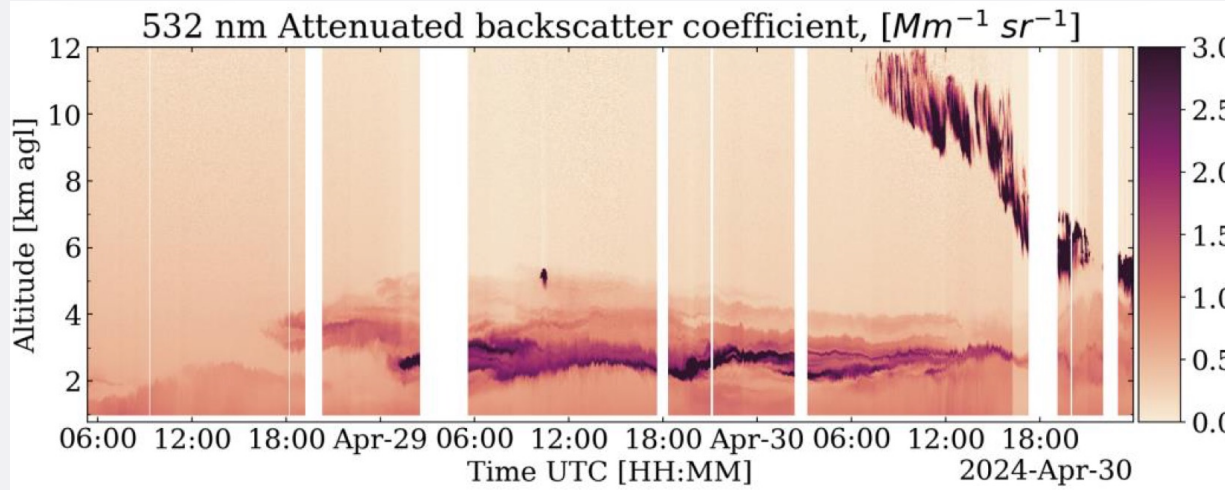
- Its goal is to provide a harmonised aerosol typing using lidar-derived intensive optical properties
- The aerosol classification can be applied with flexible input availability (adapted to available wavelengths/products)
- The method follows a common ACTRIS/EARLINET decision scheme for consistency across the network
- The aerosols are classified into standard aerosol types:
 - dust
 - smoke
 - marine
 - continental/pollution
 - mixtures
- Enables consistent and comparable aerosol typing across stations and instruments

Retrieval modes	Input parameters
1	δ_{355}, S_{355}  EarthCARE
2	δ_{532}, S_{532}
3	$\delta_{355}, S_{355}, \dot{A}_{355/532}$
4	$\delta_{532}, S_{532}, C_{\beta 532/1064}$
5	$\delta_{355}, S_{355}, \delta_{532}, S_{532}$
6	$\delta_{355}, S_{355}, \dot{A}_{355/532}, \delta_{532}, S_{532}, C_{\beta 532/1064}$

ACTRIS/EARLINET
observations

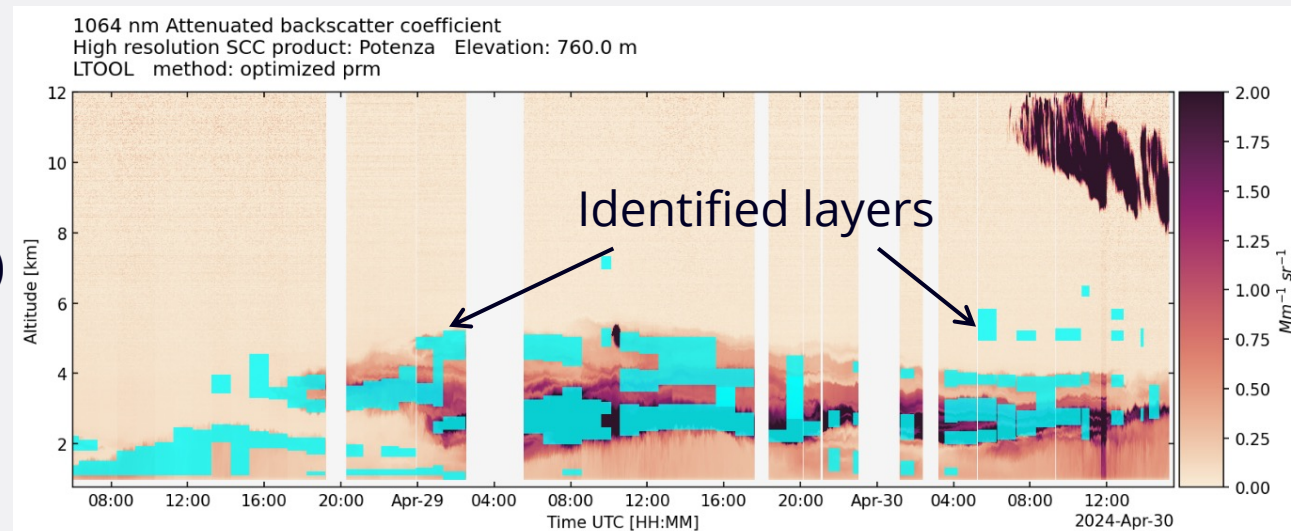
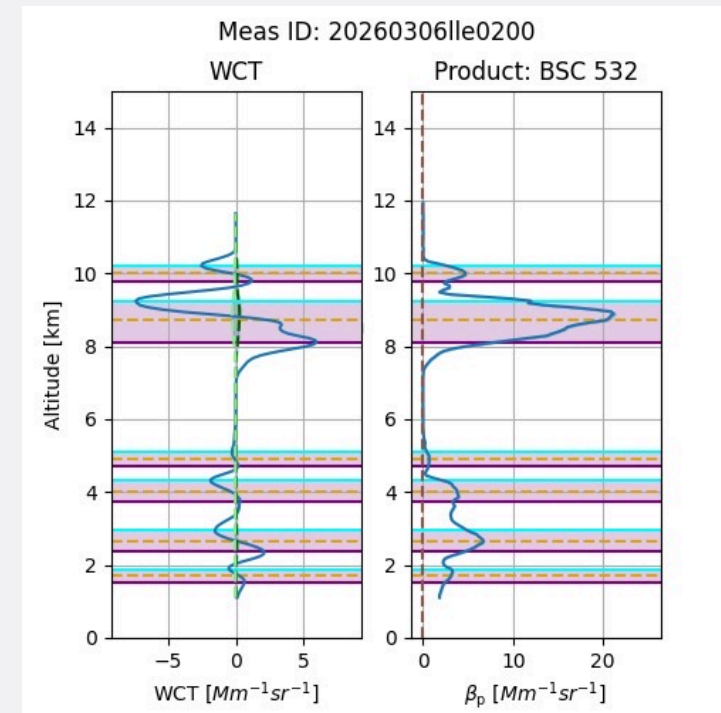
Typing example: BELLA campaign at CIAO (Spring 2024)

Dust Dust mixtures Pollution Marine Not typed



Aerosol layering: LTOOL

- The [LTOOL](#) goal is to provide an automatic detection and classification of atmospheric layers using lidar signals
- Method:
 - based on analysis of signal gradients and spectral/optical features
 - WCT (Wavelet Covariance Transform) applied on backscatter profile (all available wavelengths)
 - Potential features (bases/tops) identified
 - Layers are defined by matching bases with tops
- Integrated in the automatic data flow (day&night)
- Products available since March 2026, NRT
- 13186 products for 24 stations so far



Level 3 climatological datasets

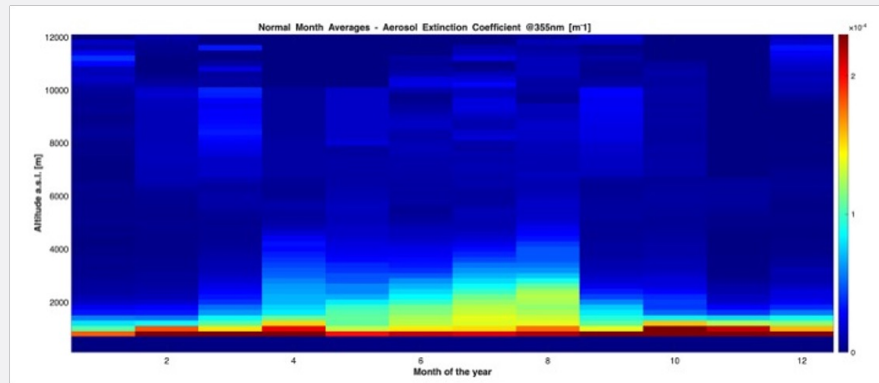
ACTRIS/EARLINET climatological datasets are **produced centrally and automatically** by the ACTRIS ARES Data Centre unit at CNR, guarantying **harmonized procedures** on the datasets.

- Covered period: 2000-2021
- Based on L2 (QC v04) available in Feb 2025
- 36 stations included in the dataset

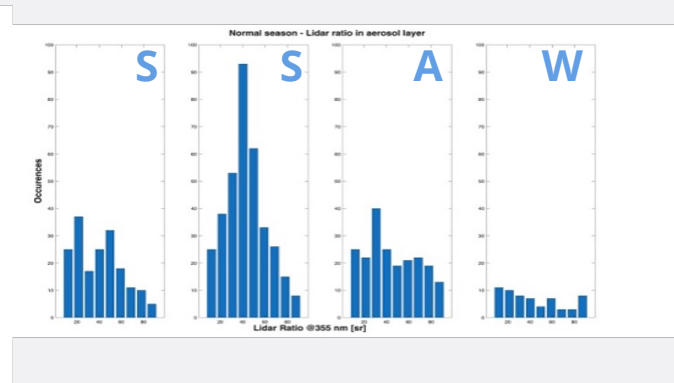
Level 3 products are **obtained from fully quality controlled products** adopting specific aggregation methods for avoiding biases in aggregating not continuous ACTRIS/EARLINET data.

Level 3 climatological dataset: Bucharest example

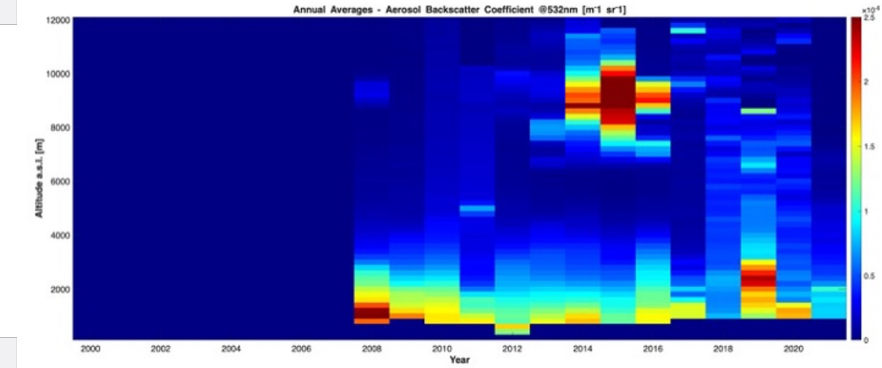
Normal Month
Extinction @355nm



Normal Season
Lidar ratio in layer @355 nm



Annual Average
Backscatter @532 nm



- ❑ Typical **increase** in intensity and height **during summer**
- ❑ **Less pronounced in Continental Europe**
- ❑ Significantly **higher** close to the **ground** in **LEI** and **INO**
- ❑ **Anomaly at GRA in February** (dust?)

- ❑ **Large variability** in number of **detected layers** (due to SNR and atmospheric situations)
- ❑ Extreme **low number of cases** in **Winter**
- ❑ **pdf wider in Autumn**
- ❑ **multi-peak** distribution in **Summer**

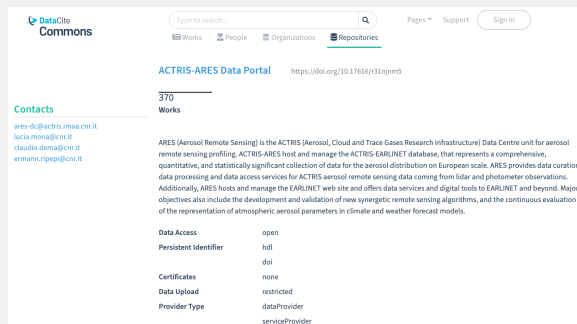
- ❑ Over the year **decreasing** in low altitude **backscatter** values and **in max altitude** where the aerosol is confined
- ❑ **Different speeds** and **intensity** decrease

Traceability: PIDs and DOIs

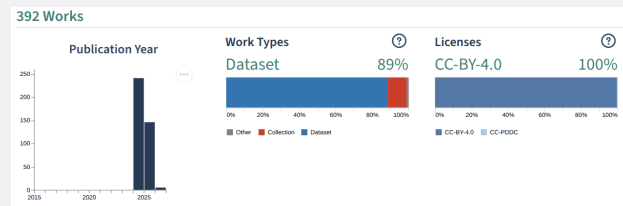
- PID and DOI are associated to each product/collection for full traceability:
 - PID for small granularity
 - DOI for larger datasets
- First ARES DOI release:
 - 2000-2019 climatological DOIs release: [collection](#)

Annual datasets (e.g. 2025)

- [ACTRIS-EARLINET 2025 Annual Collection](#)
 - This dataset collects **all the aerosol optical property profiles** collected in 2025 at **all the aerosol remote sensing stations**
- A **collection** containing all the single variable datasets for each station
 - Example: [“aerosol optical property profiles over AKY Antikythera - Greece”](#)
- An **annual dataset** DOI has been created for each physical variable for each station
 - Example: [“aerosol backscatter profiles at 355nm over AKY”](#)





The screenshot shows the DataCite Commons interface for the ACTRIS-ARES Data Portal. The URL is <https://doi.org/10.17616/31njm5>. It displays 370 works and provides contact information for Lucia Mona, Claudio Dema, and Ermann Ripepi. A table lists metadata: Data Access (open), Persistent Identifier (hdl, doi), Certificates (none), Data Upload (restricted), and Provider Type (dataProvider, serviceProvider).



ACTRIS-EARLINET 2025 aerosol optical property profiles
Lucia Mona, Claudio Dema, Giuseppe D'Amico, Ina Mattis, Pilar Gumà-Claramunt, Ermann Ripepi, Vito Salvia, Michele Volini & ACTRIS ARES Data Centre
Version 1 of Collection published 2025 in ACTRIS-ARES Data Portal

ACTRIS-EARLINET 2025 aerosol optical property profiles. This dataset collects all the aerosol optical property profiles collected in 2025 at aerosol remote sensing stations. This dataset is incremental: data collected in 2025 are added as soon as a new observation is collected in 2025 and added to the ACTRIS/EARLINET database.

DOI registered August 22, 2025 via DataCite.

[Collection](#) [Earth and related environmental sciences](#) [English](#)

<https://doi.org/10.57837/actris-ares/hj8h-qk42>

Access to data

Access to data products & metadata



ACTRIS ARES Data Portal(s)



ACTRIS ARES REST-API



ACTRIS Data Portal



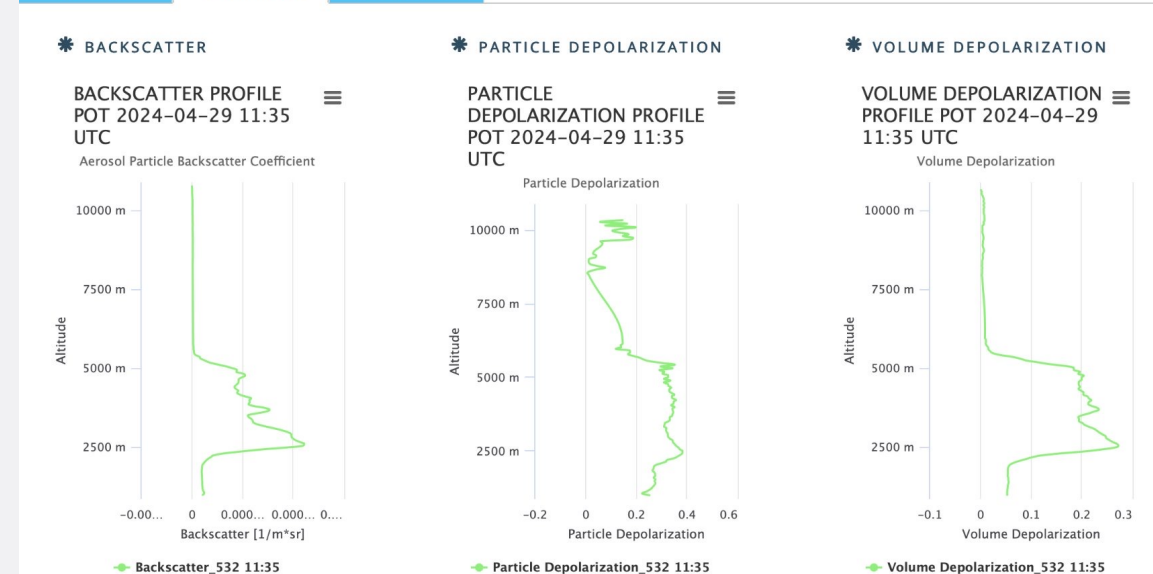
ACTRIS REST-API (in development)

ACTRIS ARES Data Portal(s)

Optical products are available through the <https://data.actris-ares.eu/> web interface:

The screenshot shows the 'ACTRIS-EARLINET Data Portal' search interface. It features a search bar with a magnifying glass icon and the text 'SEARCH DATA'. Below the search bar are three main sections: 'DATASETS', 'QUICKLOOKS', and 'ADVANCED SEARCH'. The 'ADVANCED SEARCH' section contains several input fields: 'Date Minimum (YYYY-MM-DD)' with a calendar icon, 'Date Maximum (YYYY-MM-DD)' with a calendar icon, 'Daytime Minimum' and 'Daytime Maximum' with dropdown arrows, 'Stations' with a dropdown arrow, 'Emission Wavelengths' with a dropdown arrow, 'File Types' with a dropdown arrow, and 'Levels' with a dropdown arrow. A 'Q SEARCH' button is located at the bottom right of the search area.

The screenshot shows the 'ACTRIS-EARLINET Data Portal' summary page. It features a navigation bar with 'Summary', 'Visualisation', and 'Quality Report' tabs. Below the navigation bar are two buttons: 'VIEW METADATA' and 'DOWNLOAD DATA'. The main content area is divided into three columns, each with a star icon and a title: 'BACKSCATTER', 'PARTICLE DEPOLARIZATION', and 'VOLUME DEPOLARIZATION'. Each column contains a profile plot showing the relationship between altitude and a specific optical property.



Other data portals:

- Early Warning for Aviation: <https://tools.actris-ares.eu/aviation-early-warning/>
- SCC: <https://scc.imaa.cnr.it/>
- Quicklooks interface: <https://quicklooks.actris-ares.eu>

The screenshot shows the 'ACTRIS / EARLINET Quicklook Interface'. It features a map of Europe with several stations marked. The main content area is a large plot showing 'EARLINET aky GR 2026-05-27 Tot_Att_Backscatter 1064nm'. The y-axis is 'Altitude and [km]' ranging from 0 to 20. The x-axis is 'Time UT' ranging from 18:00 to 00:00. The plot shows a color-coded backscatter profile. To the right of the plot are three smaller plots for 'Lille LILAS_QS450 Attenuated Backscatter 1064' and 'Kuopio PollyXT-FM12 Attenuated Backscatter 1064'. At the bottom, there is a 'Quicklook start time' section with a time range from 00:00 to 18:00.

ACTRIS ARES REST-API

- All the products and metadata are openly available through the REST API: <https://api.actris-ares.eu/api/swagger-ui/>
- Several methods available

Select a method



Try it out



Enter parameters



Execute



Download (curl/URL/click)

Swagger /api/services/restapi/swagger.json Explore

ACTRIS-EARLINET v1

[Base URL: /api/services/restapi/]
/api/services/restapi/swagger.json

ACTRIS-EARLINET REST API
Apache 2.0 License

Schemes
HTTPS

GET /products/downloads Method to download a zip containing products

Parameters Cancel

Name	Description
kind array[string] (query)	OPTICAL GARRLIC HIRAC MAC
fromDate string (query)	The format is: yyyy-MM-dd 2026-01-01
toDate string (query)	The format is: yyyy-MM-dd 2026-02-01
stations string (query)	Stations: (es: POT, PUT) POT

Execute Clear

Responses Response content type: application/octet-stream

Curl

```
curl -X 'GET' \  
  "https://api.actris-ares.eu/api/services/restapi/products/downloads?kind=OPTICAL&fromDate=2026-01-01&toDate=2026-02-01&stations=POT" \  
  -H 'accept: application/octet-stream'
```

Request URL

```
https://api.actris-ares.eu/api/services/restapi/products/downloads?kind=OPTICAL&fromDate=2026-01-01&toDate=2026-02-01&stations=POT
```

Server response

Code	Details
200	Response body Download file

Swagger /api/services/restapi/swagger.json Explore

ACTRIS-EARLINET v1

[Base URL: /api/services/restapi/]
/api/services/restapi/swagger.json

ACTRIS-EARLINET REST API
Apache 2.0 License

Schemes
HTTPS

default

- GET /datasets/id/{id}
- GET /datasets/id/{id}/downloads
- GET /datasets/pid/{pid}
- GET /datasets/pid/{pid}/downloads
- GET /download/stats Method to retrieve download statistics.
- GET /emissionwavelengths
- GET /filetypes
- GET /levels
- GET /opticalproducts
- GET /opticalproducts/downloads
- GET /opticalproducts/filename/{filename}
- GET /opticalproducts/filename/{filename}/downloads
- GET /opticalproducts/id/{id}
- GET /opticalproducts/id/{id}/downloads
- GET /opticalproducts/id/{id}/previousversions
- GET /opticalproducts/id/{id}/previousversions/downloads
- GET /opticalproducts/id/{id}/previousversions/{versionid}
- GET /opticalproducts/id/{id}/previousversions/{versionid}/downloads
- GET /products/downloads Method to download a zip containing products
- GET /products/downloadsGarrLic Method to download a zip containing EIPP products
- GET /products/metadata/{kind} Method to retrieve metadata for a specific product

ACTRIS data portal, API* and VRE

<https://data.actris.eu/search>

[ACTRIS VRE](#)

The screenshot shows the ACTRIS data portal search page. On the left, there are several filter sections: 'Data Search' showing 165115 results, 'Variable matrix' with a search box, 'Facility types' with a dropdown menu, 'Variables' with a dropdown menu, 'Object of interest' with a search box, 'ACTRIS National Facility - In Progress' with a dropdown menu, 'Other Facilities' with a dropdown menu, 'Countries' with a search box, and 'Timeliness' with search boxes for start and end dates. On the right, there is a map of Europe with markers for various facilities. A legend at the bottom of the map identifies 'Facilities' and 'ACTRIS National Facility - In Progress'.

The screenshot shows the ACTRIS VRE interface. On the left, there is a file browser showing a directory structure with files like 'static', 'Search with ACTRIS...', 'Explore ACTRIS Nat...', 'Access ACTRIS In-Sit...', 'Access ACTRIS Clou...', and 'Access ACTRIS Aero...'. The main area displays a notebook titled 'ACTRIS DC' with the subtitle 'Access ACTRIS Aerosol Remote Sensing data'. The notebook content includes an introduction, 'Import libraries' section with code for pathlib, datetime, netCDF4, numpy, matplotlib, and ipywidgets, and a 'Download' section with instructions on how to use the ARES REST API to search and download netCDF4 files.

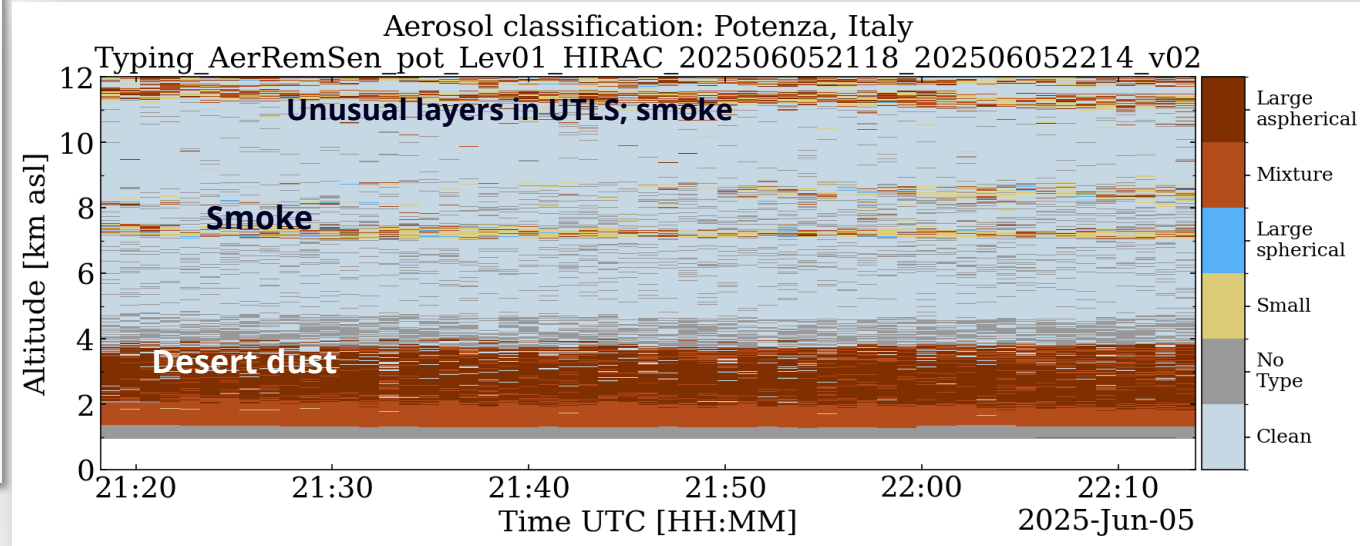
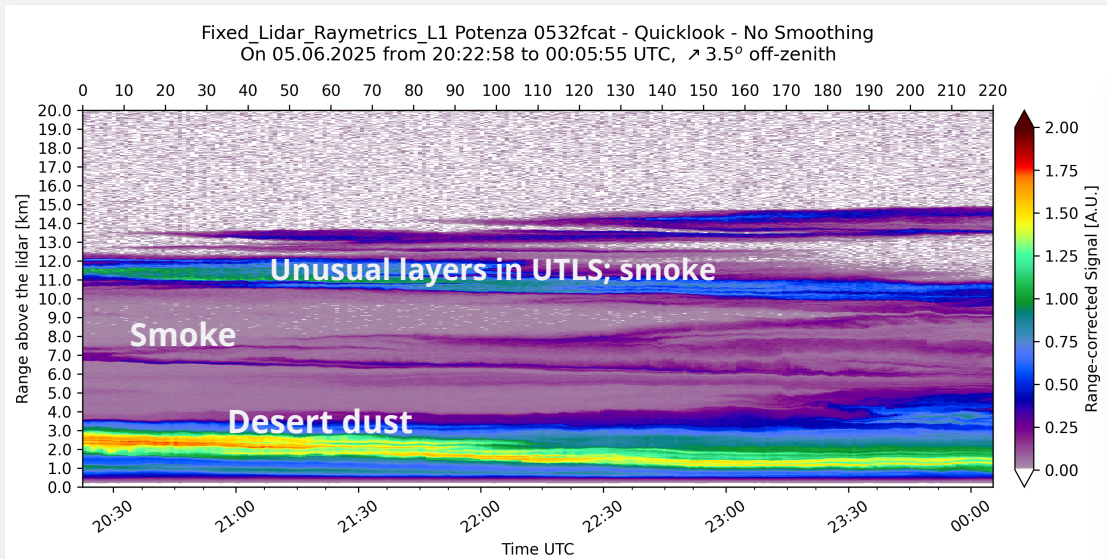
The screenshot shows a Jupyter notebook with two plots. The first plot, titled 'Aerosol Particle Light Extinction Coefficient @532nm at Potenza, Italy at 2024-04-28 20:16: 2024-04-28 21:11 UTC', shows a line plot of altitude (m asl) vs. Aerosol Particle Light Extinction Coefficient (1/m). The second plot, titled 'Aerosol Particle Backscatter Coefficient @532nm at Potenza, Italy at 2024-04-28 20:16: 2024-04-28 21:11 UTC', shows a line plot of altitude (m asl) vs. Aerosol Particle Backscatter Coefficient (1/m^{sr}). The notebook code includes comments and code for choosing variables, plotting the data, and displaying the plots.

*API currently in development

Use cases

Use case #1: Canadian Fire Summer 2025

Different observed variables show the presence of biomass burning emissions



The European atmospheric RIs captured the plumes emitted from Canadian fires and then partially transported over Europe (i.e. [ACTRIS](#), [IAGOS](#), [ICOS](#)).

Tools:

- https://iriscc.d4science.org/group/wildfires_in-europe
- <https://tool.actris-ares.eu/wildfire>

Mixing process investigation
Of interest for air quality, health and ecosystems

Home » News » ACTRIS Tracks Canadian Wildfire...

ACTRIS Tracks Canadian Wildfire Smoke Reaching Europe

Published: 30 June, 2025

OBSERVATION DES FEUX CANADIENS EN FRANCE - JUIN 2025

18 June 2025

Smoke plumes from North-American wildfires detected by ICOS stations in Europe

23 June 2025

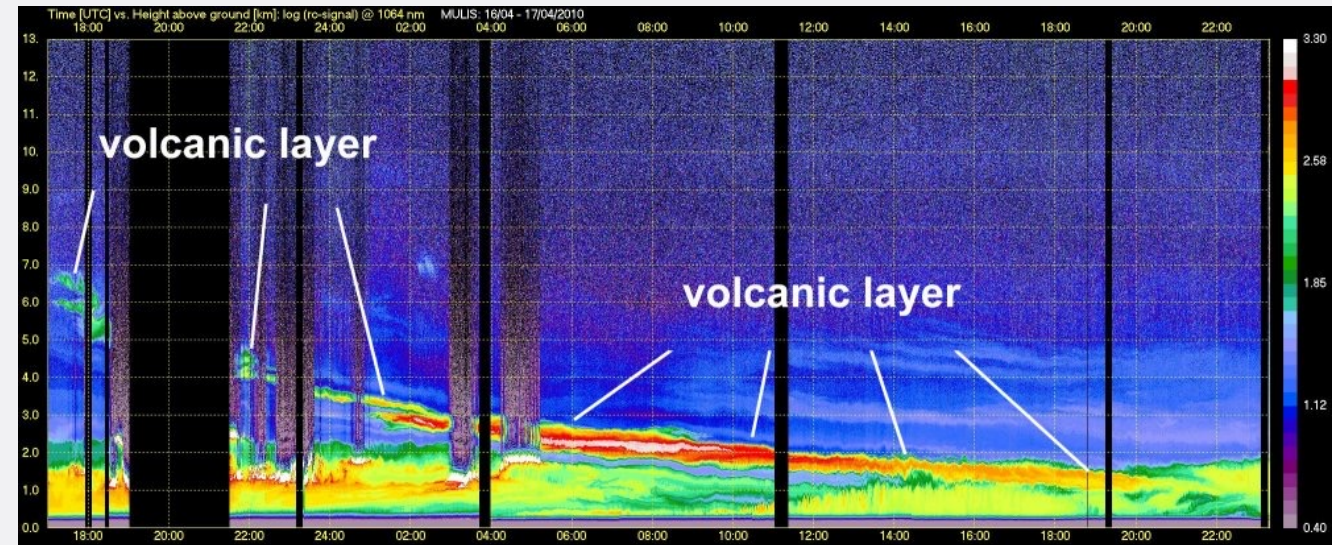
Since May 2025, wildfires occurring in Canada have emitted a humongous

ACTRIS

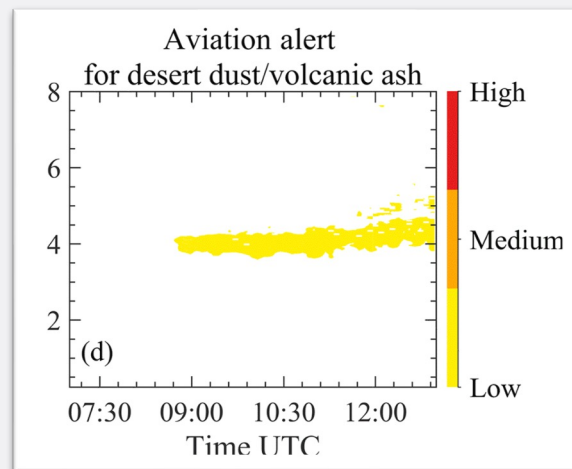
Use case #2: Extreme events characterization

Eyjafjallajökull eruption observation over Payerne

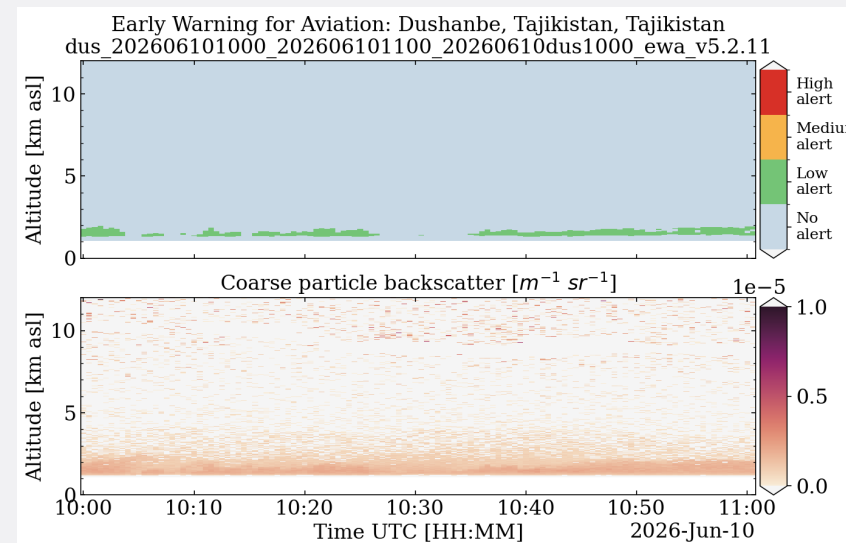
- Daily report to VAAC
- Database released
- Modification processes over Europe
- Advanced experimental product for EWS → potential ingestion in operational systems



Pappalardo et al., ACP, 2014



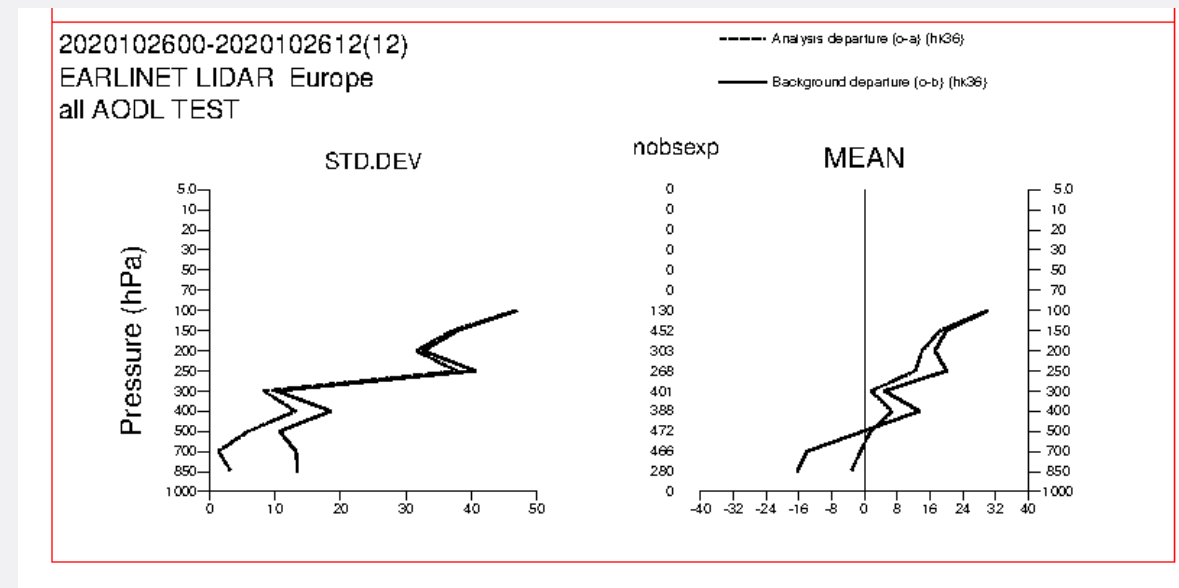
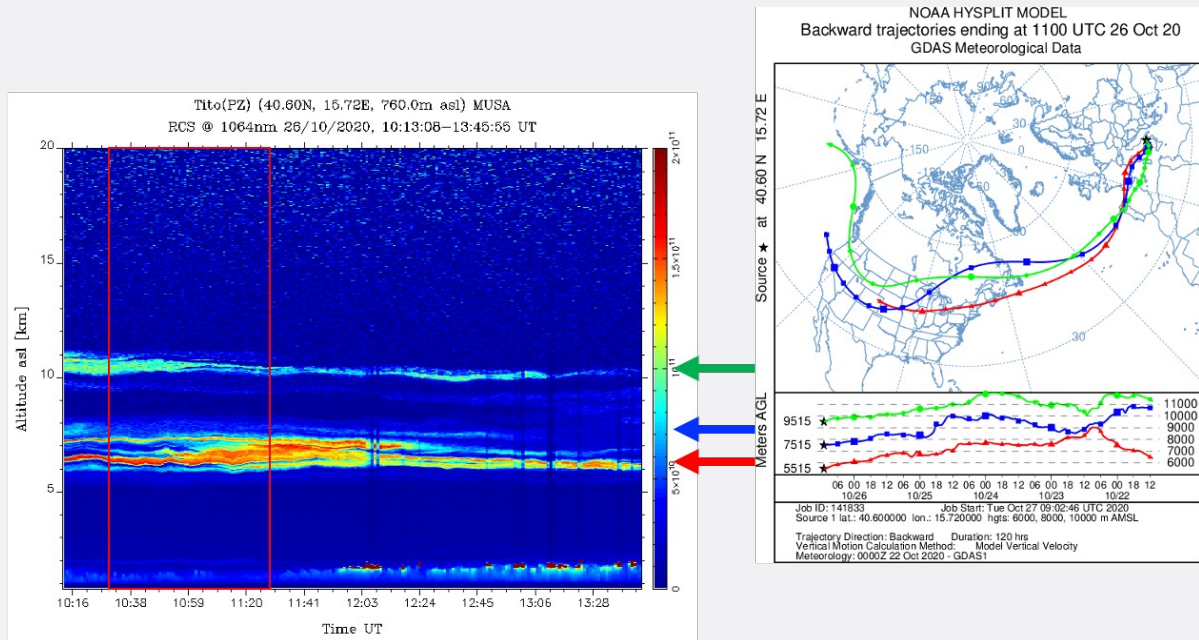
Papagiannopoulos et al., ACP, 2020



**Hazardous events
monitoring and impact
mitigations**

Use case #3: NRT provision and assimilation

- 11 stations providing data in NRT to CAMS under CAMS21b project (11/2023 – 09/2027)

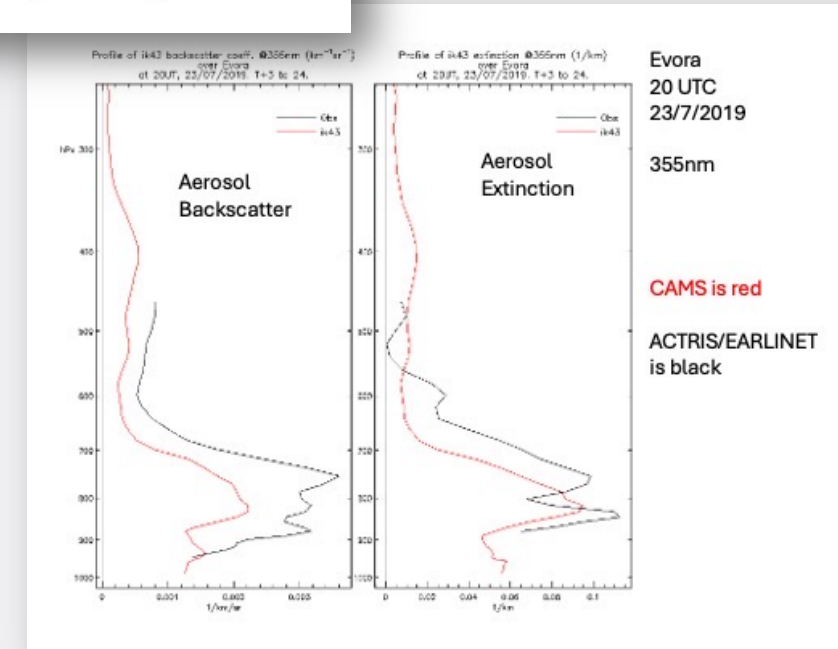
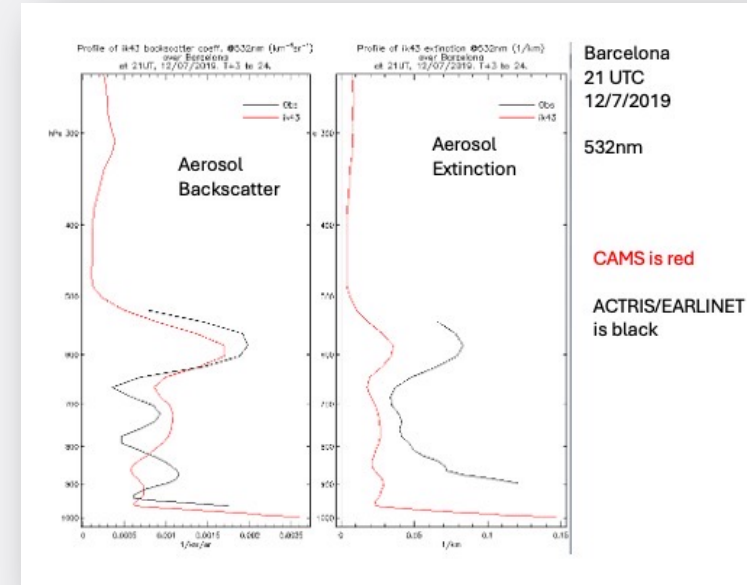


- Although few measurements at just one site were assimilated, impacts are visible in the vertical profiles

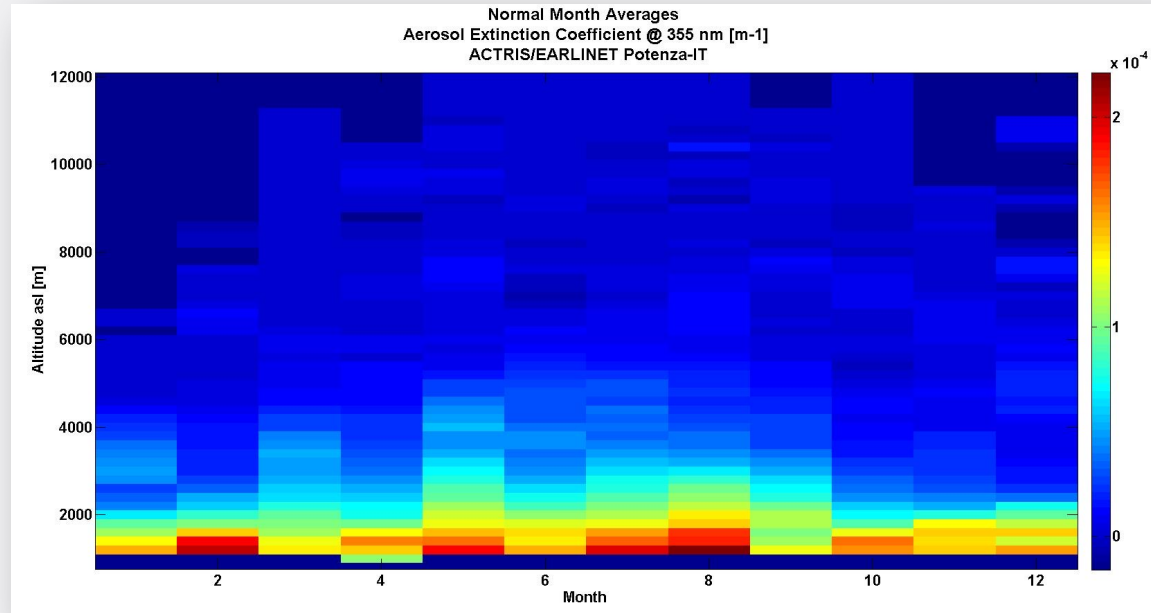
Model improvement through assimilation

ACTRIS/EARLINET data automatically into CAMS evaluation system

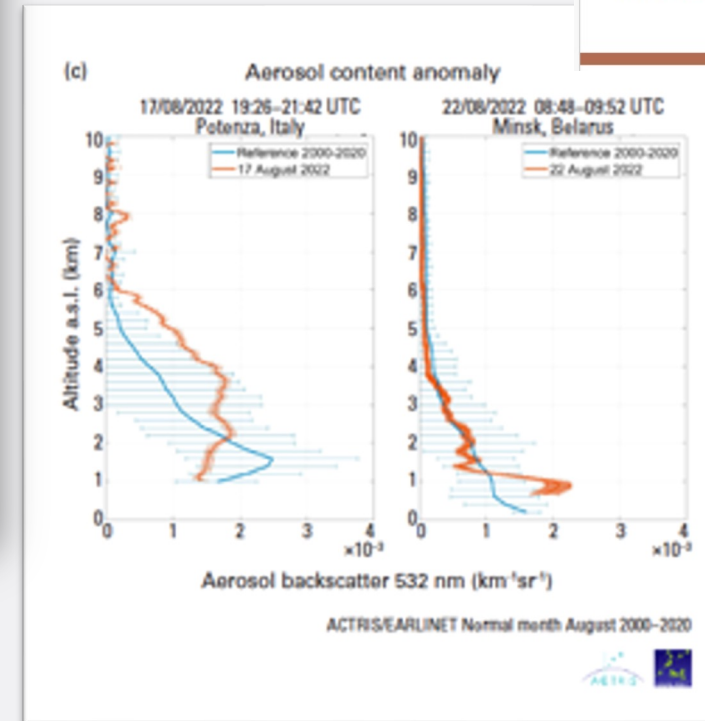
- Goal: optimizing the system in terms of reduction of distance from the target for the aerosol profiling provision in CAMS
- A daily retrieval script at ECMWF obtains ACTRIS/EARLINET data by checking for new files
- All the past ACTRIS/EARLINET data ingested
- Interactions for improving the methods for the evaluation
- The data is catalogued into based on different properties:
 - Raman or elastic-backscatter lidar
 - Whether extinction is present as well as backscatter
 - Wavelength of the lidar



Use case #4: Climatological investigation



Assessment of climatic models

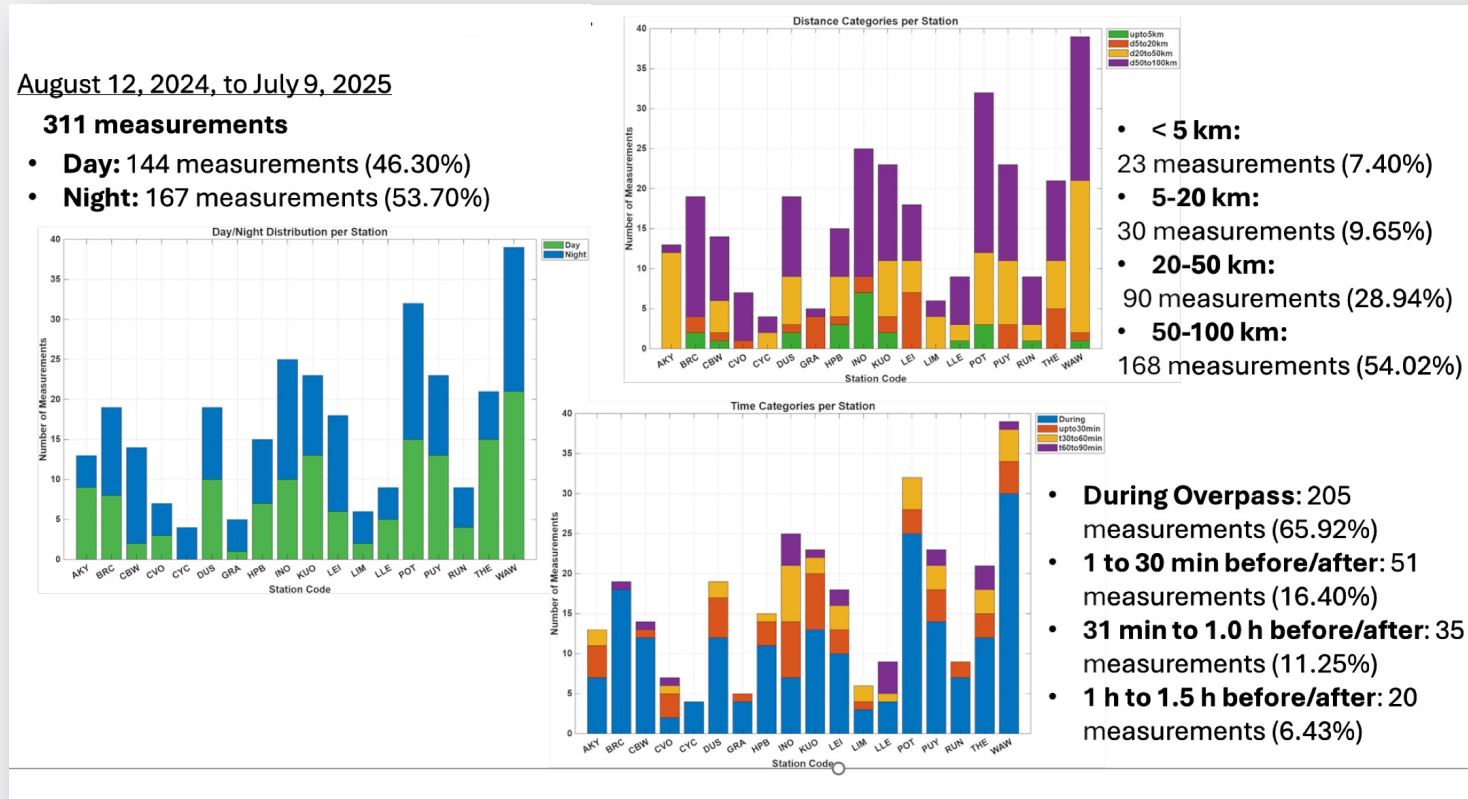


Anomalies identification



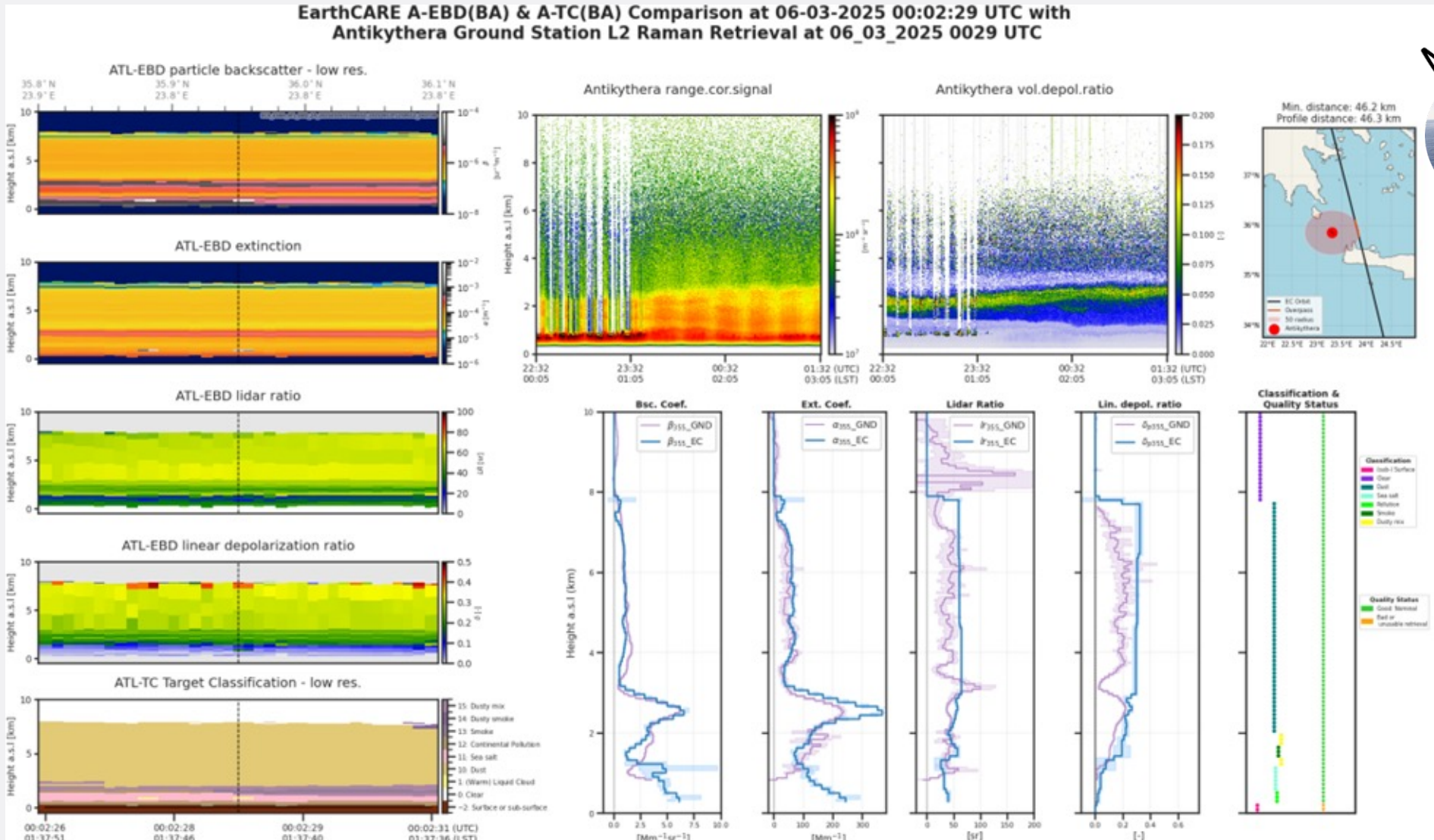
Use case #5: EarthCARE validation efforts

- ATMO ACCESS coordinated TNA involving stations, CARS and ARES
- Many correlative data collected and provided to EVDC
- Overpass coverage:
 - 24 ACTRIS/EARLINET stations
 - 1829 overpasses covered (47%)
 - 957 with optical products (25%)
- Tools have been developed at ACTRIS-ARES for centralized validation efforts
- Validation dataset:
 - Standardized output
 - Linked to the ACTRIS/EARLINET database



Papanikolaou et al. (2025), EarthCARE Science and Validation Workshop 2025. 1-5 December 2025. Tokyo, Japan

Case study: EarthCARE comparison with ground-based Raman retrievals at PANGEA-Antikythera



<https://bitbucket.org/smas/on/ectools>

https://github.com/NOA-ReACT/DISC_Tools.git

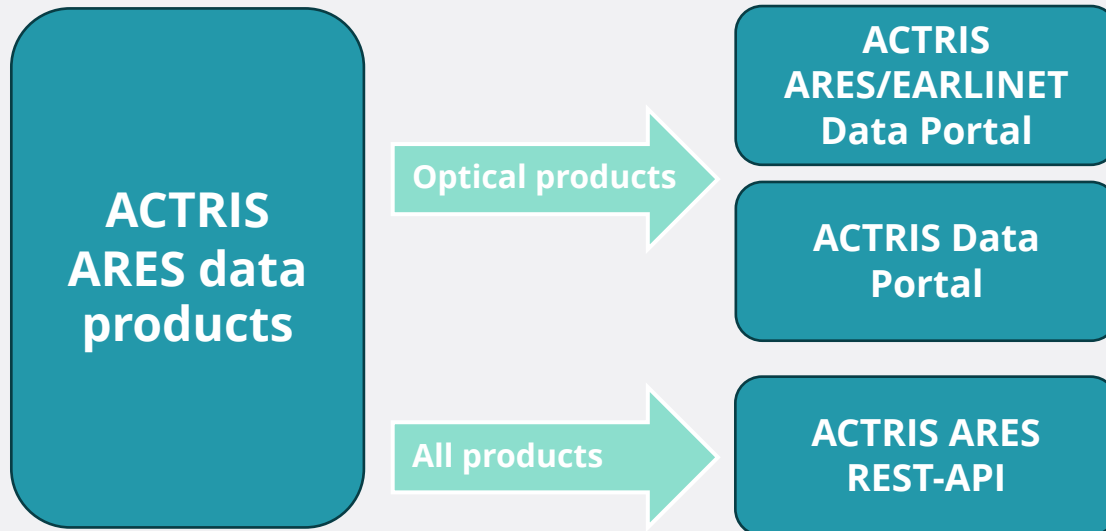
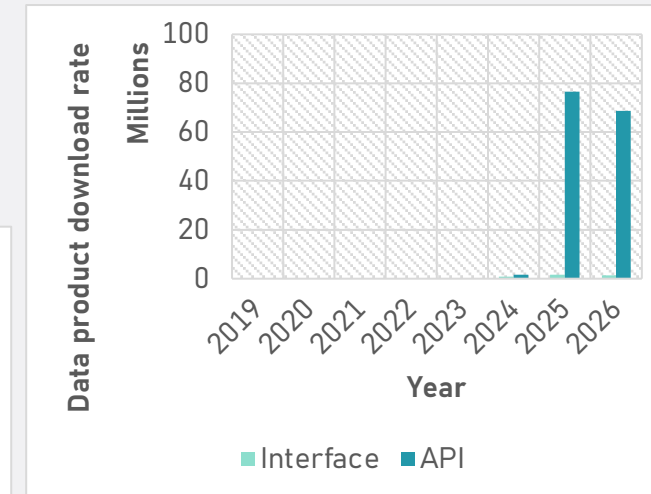
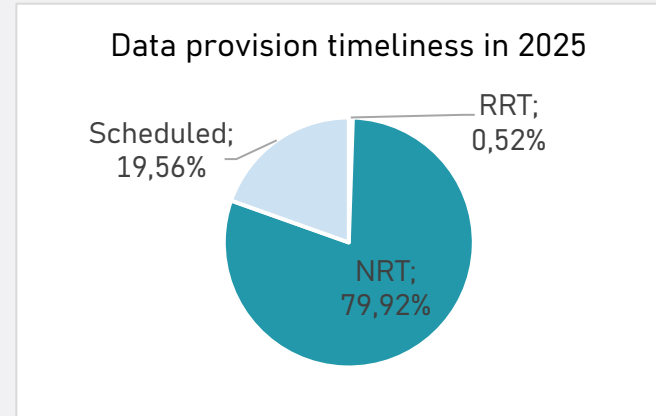
Vertical distribution and intensive parameters in good agreement

Voudouri et al. (2026), ACTRIS Science Conference. 20-23 April 2026. Oslo, Norway

Final remarks

Ground-based aerosol remote sensing data provision from ACTRIS/EARLINET

- All the ACTRIS ARES DC products are openly available
- All products are quality controlled
- Data provision in NRT; decreasing latency
- Contact: services@actris-ares.eu





Thank you!