



CARO-LIM as a Regional Hub for Aerosol–Cloud–Radiation Interactions in the Eastern Mediterranean and Middle East

2nd International Conference on
Applications of Air Quality in Science and Engineering Purposes 9–11 February 2026, Kuwait

“How is this presentation aligned with the conference focus?”

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³ Leibniz Institute for Tropospheric Research (TROPOS), Leipzig, Germany

CONSORTIUM



AFFILIATED ENTITIES



This project has received funding from the European Union's "Horizon 2020 Research and Innovation Programme" under Grant Agreement No 857510*.



This project has received funding from the Government of the Republic of Cyprus through the "Directorate General for European Programmes, Coordination and and Development".



This project is co-funded by the Cyprus University of Technology.

Upfront Message

The Cyprus Atmospheric Remote Sensing Observatory (CARO) is a state-of-the-art multi-instrument infrastructure equipped with modern technologies, strategically located at the crossroads of Europe, the Middle East, and North Africa.

CARO actively seeks scientific cooperation and partnership opportunities across the EMMENA to advance regional atmospheric research and environmental monitoring.

Effective mitigation and adaptation require strong **monitoring networks** built on scientific **research.**

WHO WE ARE?

Overview of the ECoE Centre

- In 2020 ERATOSTHENES Centre of Excellence (ECoE) of the Cyprus University of Technology (CUT) has been established through the EXCELSIOR H2020 Widespread Teaming Phase 2 project (Grant Agreement No. 857510),
- Journey begin from 2007,
- 2016 >>>> 2020: EXCELSIOR different phase implemented



WHO WE ARE?

Overview of the ECoE Centre

EXCELSIOR Consortium

Cyprus University of Technology

DEC
DEPARTMENT OF ELECTRONIC COMMUNICATIONS

ΕΘΝ. ΑΣΤΕΡΟΟΡΘΟΝ ΑΝΩΤΕΡ. ΟΡΓ. ΑΕΡΟΝΑΥΤ. ΕΡΕΥΝΑΣ ΚΑΙ ΧΡΗΜΑΤΟΔΟΤΗΣΗΣ

IAASARS

DLR
Deutsches Zentrum für Luft- und Raumfahrt
German Aerospace Center

TROPUS
Leibniz Institute for Tropospheric Research

Affiliated partners

For more information visit: <https://excelsior2020.eu/> and <https://eratosthenes.org.cy/>

WHO WE ARE?

Departments of the ERATOSTHENES Centre of Excellence (ECoE).

CARO coordinates with the Atmospheric Cluster



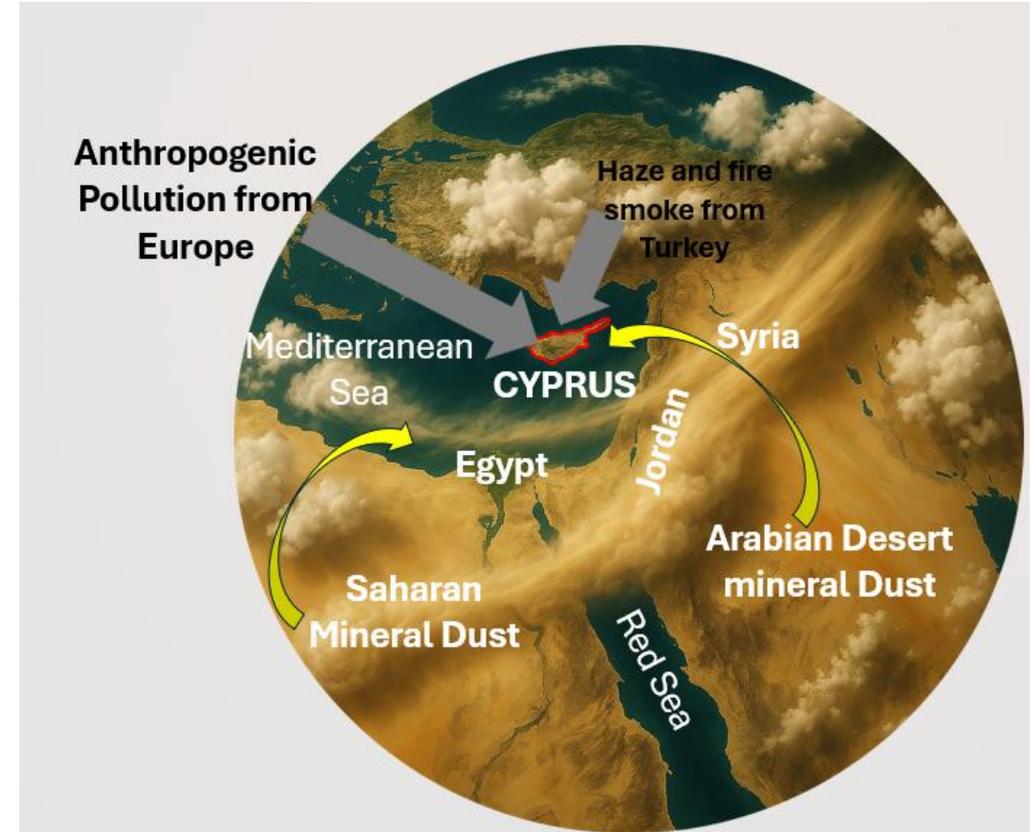
Overview of the CARO,

Main advantages

- ❑ Unique geographical location
- ❑ State-of-the-art multi-instrument infostructure.

References

- Mamouri, R. E., et al, Atmos. Chem. Phys., 2023
- Ansmann , A. et al, Atmos. Chem. Phys., 2019
- Mamouri, R. E., Ansmann , Atmos. Chem. Phys., 2016 and 2017.
- Nisantzi, A. et al, Atmos. Chem. Phys., 2015 2016



Overview of the Cyprus Atmospheric Remote Sensing Observatory (CARO)

- CARO-LIM is multi-instrument infrastructure to perform continuous measurements of aerosols, clouds, radiation, and precipitation.



CUT-TEPAK
AERONET Sun-
photometer





WHO WE ARE?



Overview of the Cyprus Atmospheric Remote Sensing Observatory (CARO)

- CARO-LIM is multi-instrument infrastructure to perform continuous measurements of aerosols, clouds, radiation, and precipitation.
- CARO is an ACTRIC national facility.



Cyprus Atmospheric Remote Sensing Observatory



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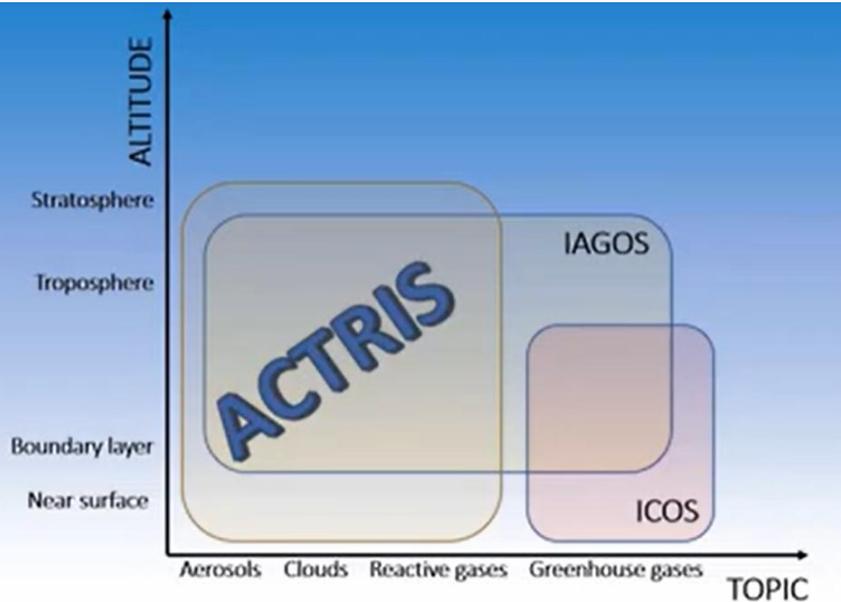
Overview of the Cyprus Atmospheric Remote Sensing Observatory (CARO)

What is the relevance of CARO for this conference?

ACTRIS- Aerosol, Clouds and Trace Gases Research Infrastructure
(<https://www.actris.eu/>)

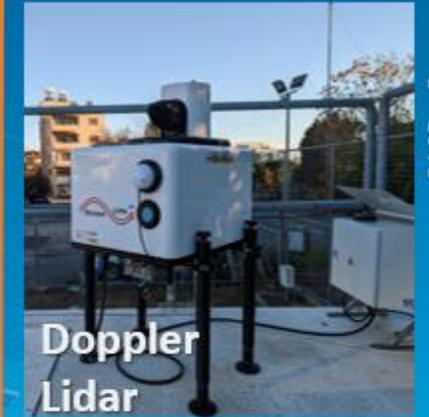
IAGOS- In-service Aircraft for a Global Observing System
(<https://www.iagos.org/>)

ICOS- Integrated Carbon Observation System:

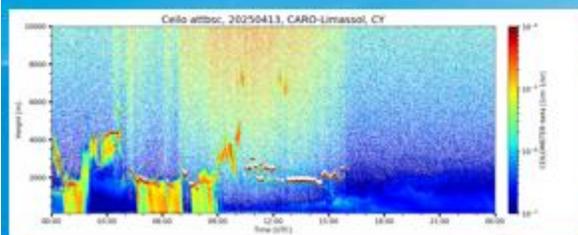
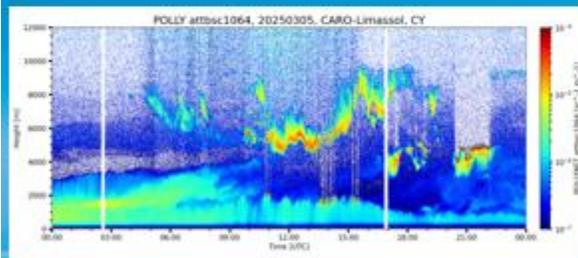


CARO
Cyprus Atmospheric Remote Sensing Observatory

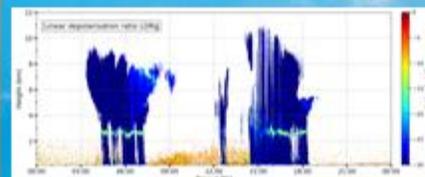
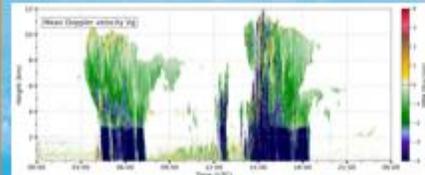
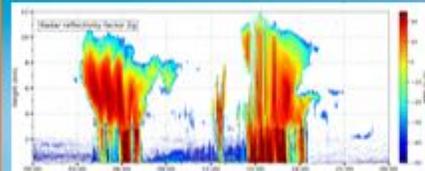
CARO Instruments and Measurements



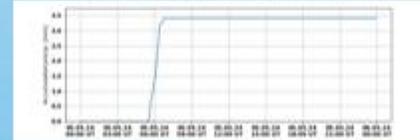
Aerosols



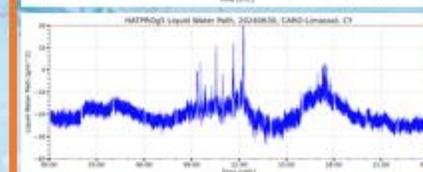
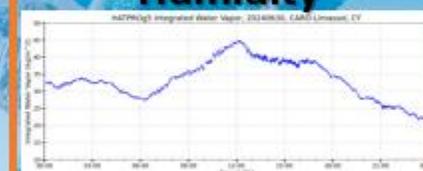
Clouds



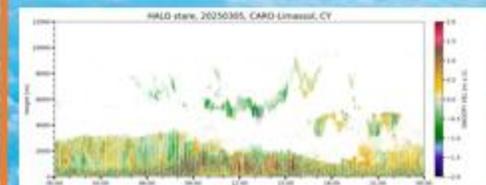
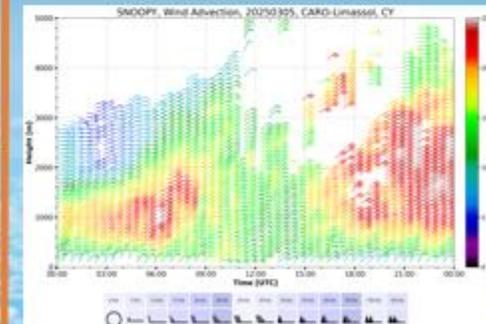
Precipitation



Temperature & Humidity

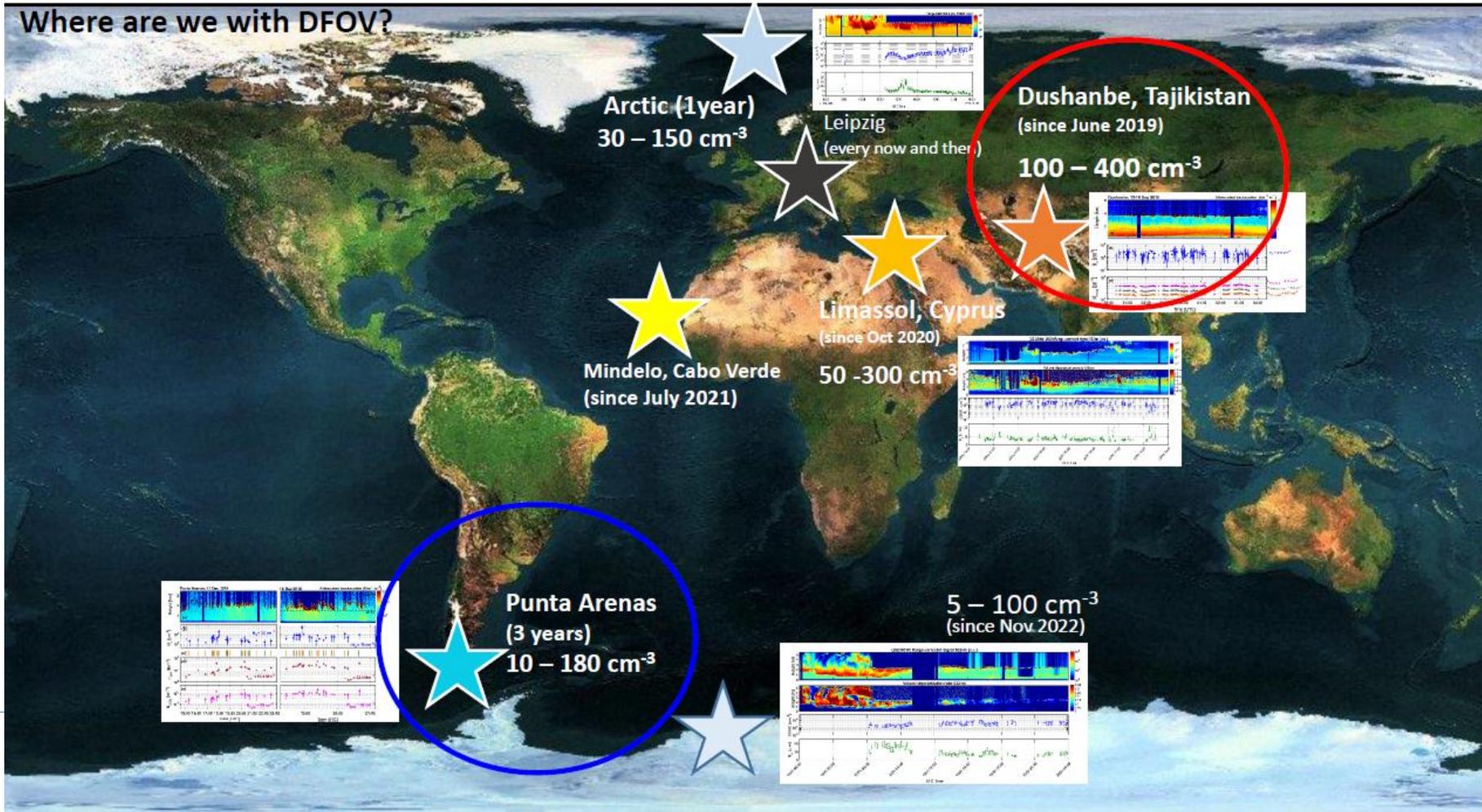


Dynamics

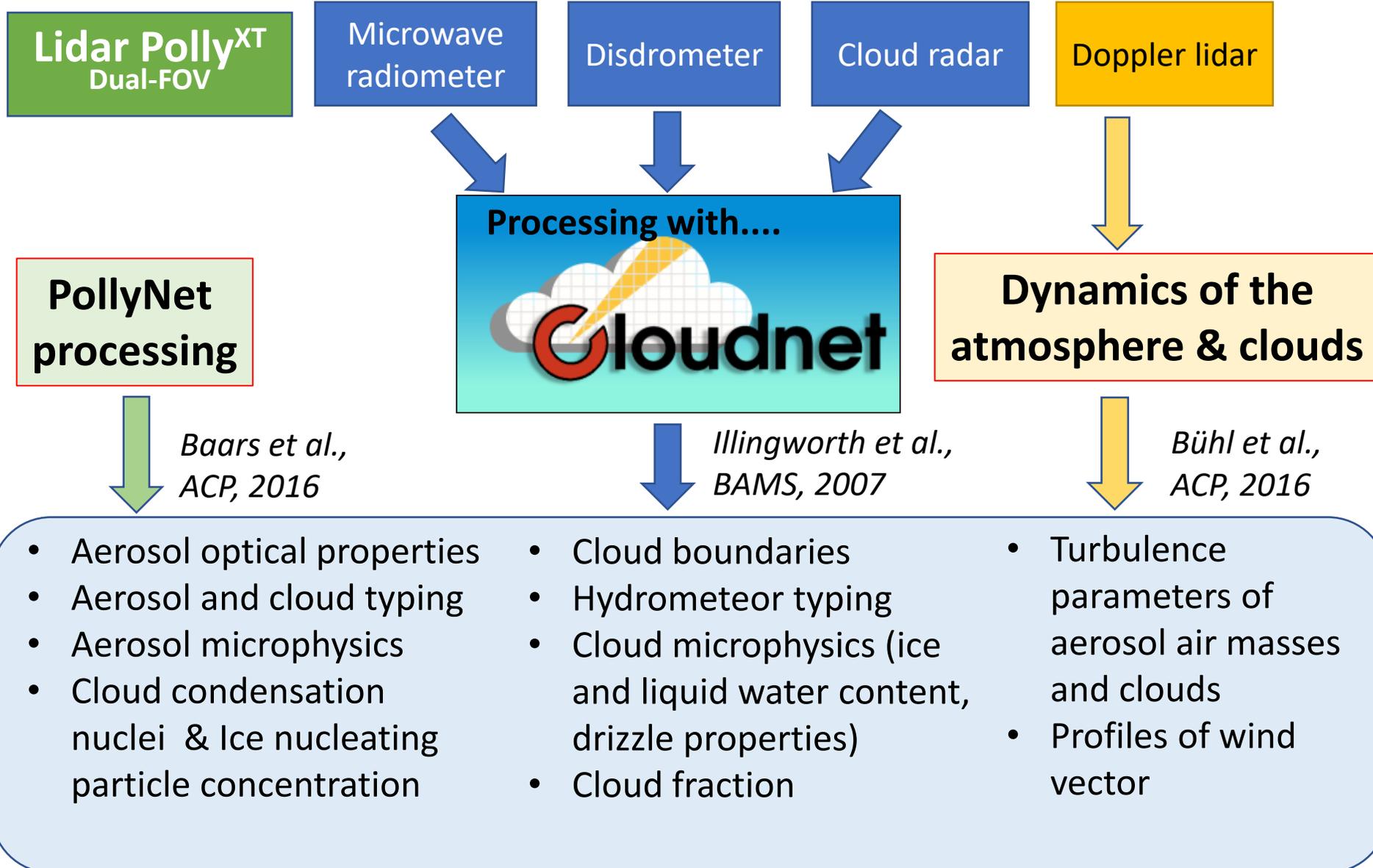


WHO WE ARE?

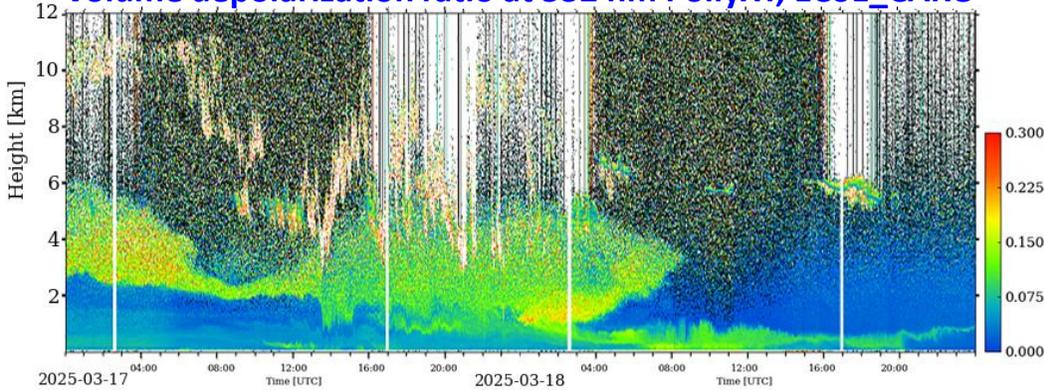
Overview of the Cyprus Atmospheric Remote Sensing Observatory (CARO)



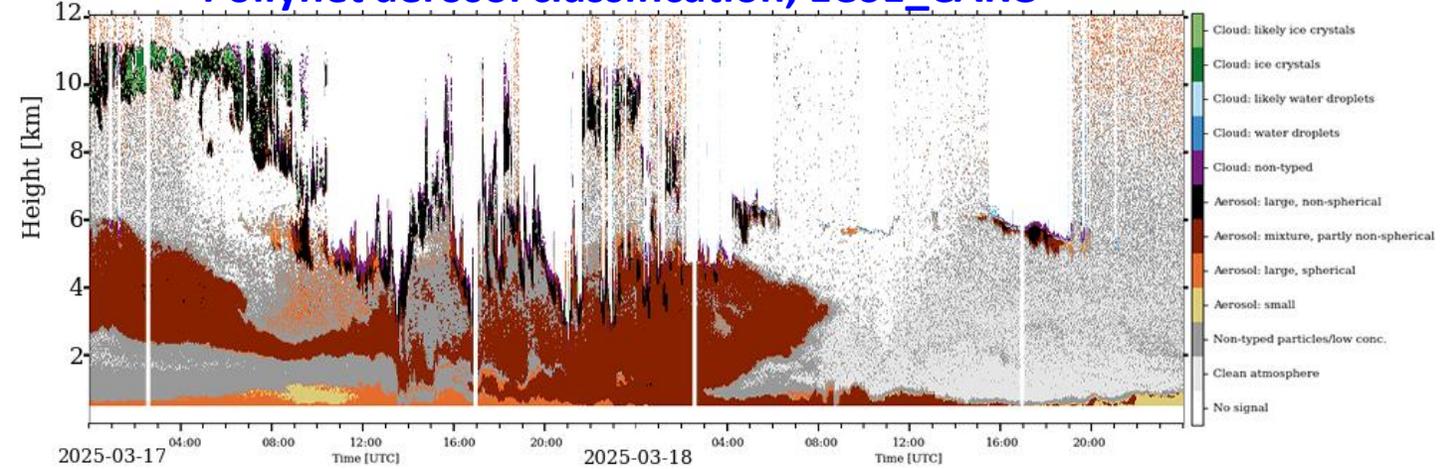
CARO aerosol-cloud-dynamics investigating



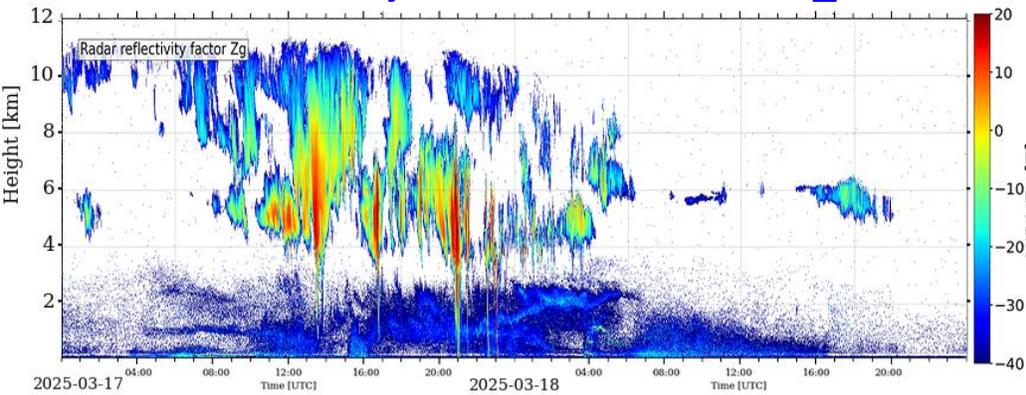
Volume depolarization ratio at 532 nm PollyXT, ECoE_CARO



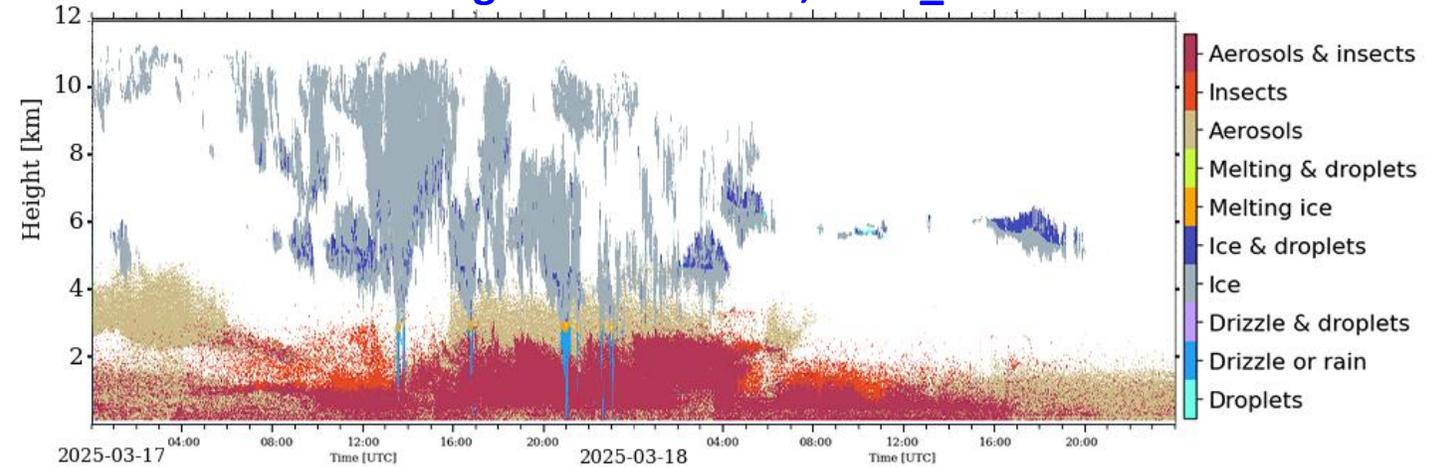
Pollynet aerosol classification, ECoE_CARO



Radar reflectivity factor, Mira35, ECoE_CARO



Cloudnet Target classification, ECoE_CARO



Cyprus Observation for EarthCARE validation (CORAL) Project

EVID39 CORAL Consortium includes CARO-ECOE and CARE-C of the Cyprus Institute

“How much will our climate change this century?”

- The biggest uncertainty for the predictions of **future climate changes** lies in the impact of clouds and aerosols.
- EarthCARE is the first joint mission between **ESA and JAXA** in the field of Earth observation.



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Cyprus Observation for EarthCARE validation (CORAL) Project

CARO performs ground-based atmospheric measurements comparable to the EarthCARE satellite mission

- PollyXT (355 nm) providing observations analogous to ATLID.
- MIRA-35 cloud radar offering measurements similar to the EarthCARE Cloud Profiling Radar (CPR).
- Solar radion instruments are useful to measure earth radiation and comparable with BBR.
- Aeronet AOD comparable with MSI.

02 | EarthCARE satellite and its instruments

ATLID
Atmospheric Lidar (Active)
Vertical structure of Aerosols

CPR
Cloud Profiling Radar (Active)
Vertical structure of Clouds
Vertical motion inside Clouds

MSI
Multi-Spectral Imager (Passive)
Horizontal structure of Clouds and Aerosols

BBR
Broad-Band Radiometer (Passive)
Radiations from/to Earth

4 instruments Synergistic Observations

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Cyprus Observation for EarthCARE validation (CORAL) Project

EVID39 CORAL Consortium includes CARO-LIM and CARE-C of the Cyprus Institute

CARO EarthCARE comparison performs continuously in daily bases

Observation calendar interface showing location (Limassol), year (2026), and total number of days (38 Polly in operation, 20 EarthCARE overpasses).

Calendar color codes

- Polly data available
- Polly data and EarthCARE overpass available
- EarthCARE overpass available

2016 2017 2018 2020 2021 2023 2024 2025 2026

January

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

February

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

March

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

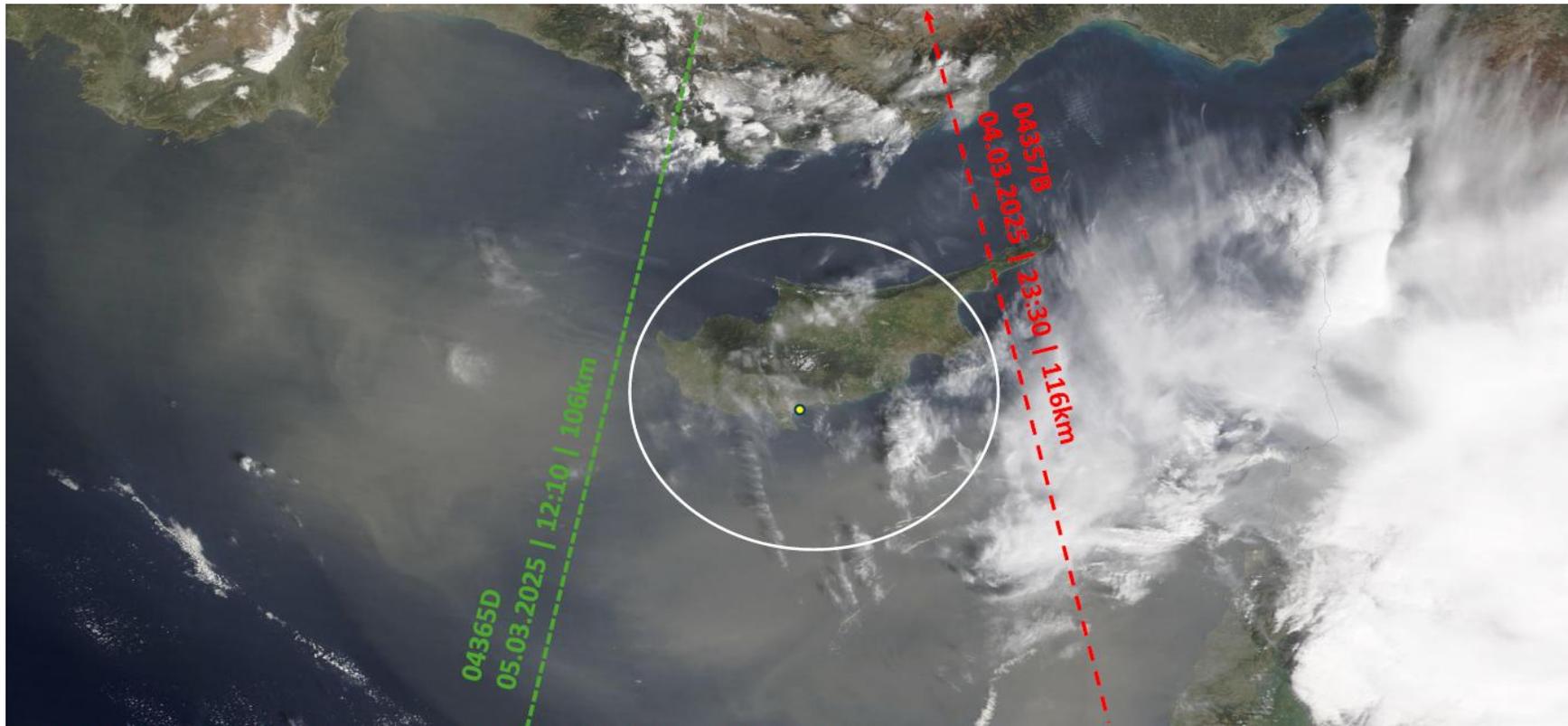
April

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

2016 2017 2018 2020 2021 2023 2024 2025 2026

Cyprus Observation for EarthCARE validation (CORAL) Project

Golden-case: Dust erusion case from Sahara and Middle east.



2nd ESA-JAXA EarthCARE In-Orbit Validation Workshop | 17 – 20 March 2025 | ESA-ESRIN | Frascati (Rome), Italy

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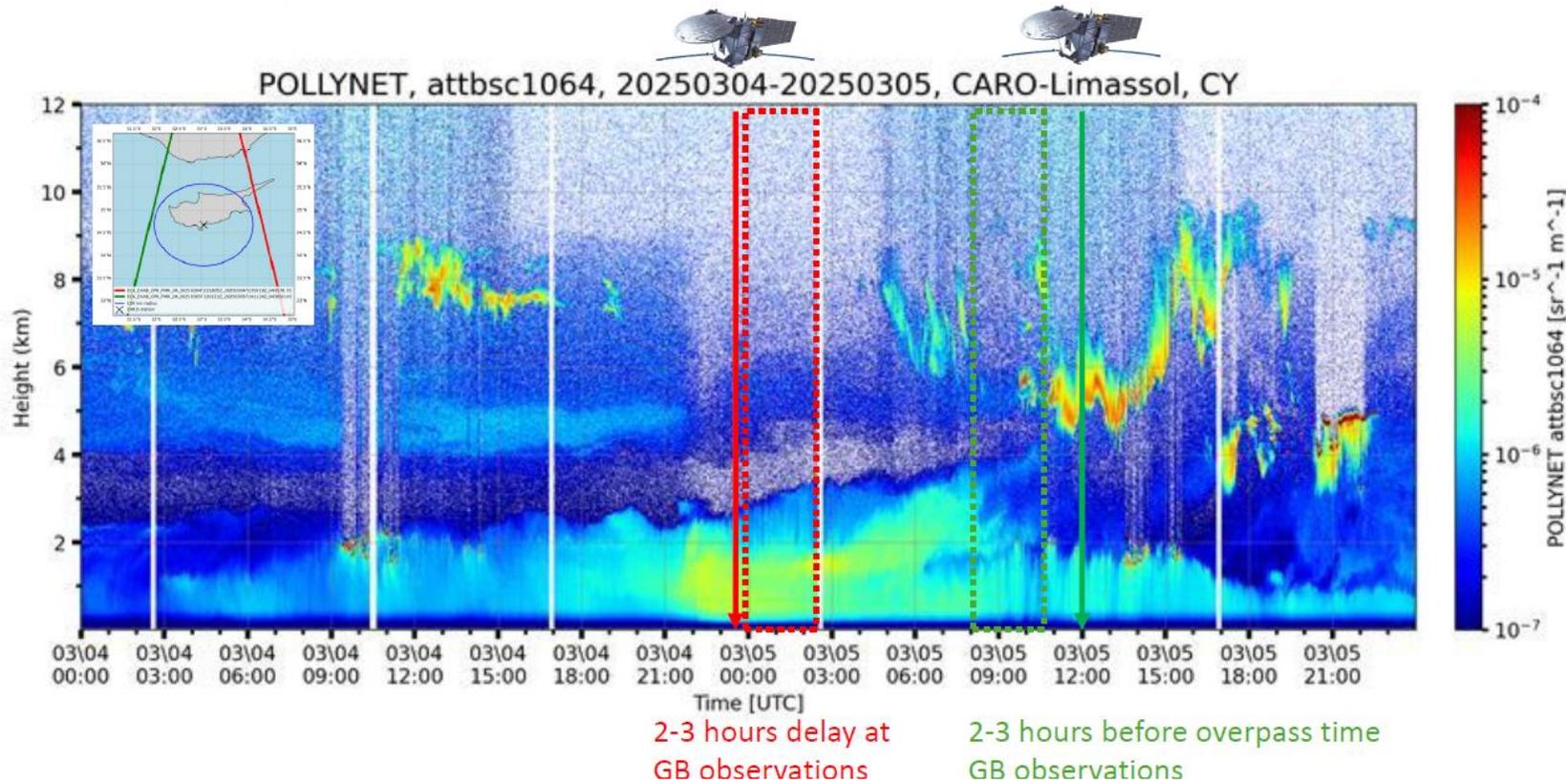
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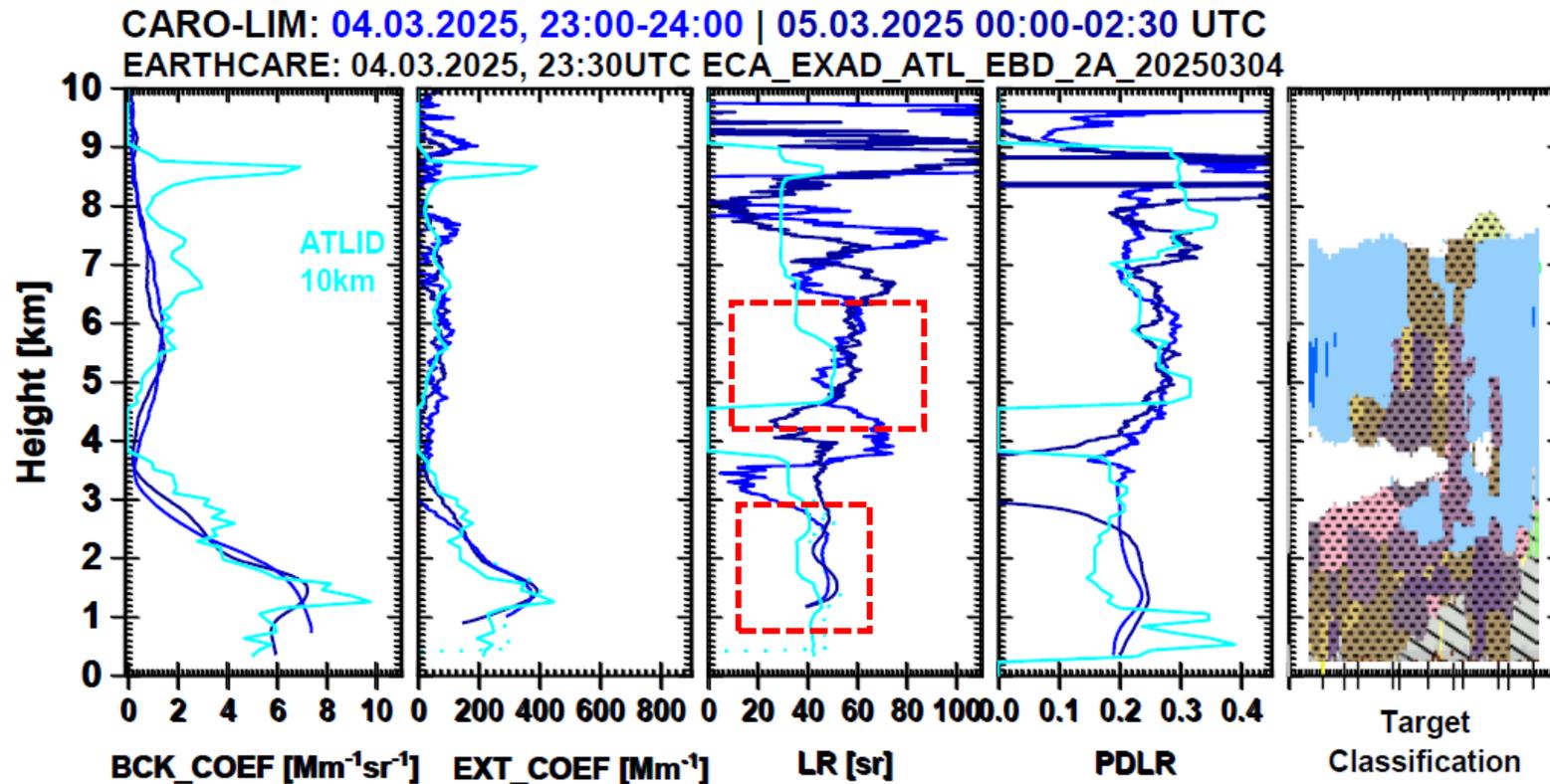
Cyprus Observation for EarthCARE validation (CORAL) Project

Golden-case: Dust erosion case from Sahara and Middle east.



Cyprus Observation for EarthCARE validation (CORAL) Project

Golden-case: Dust erosion case from Sahara and Middle east.



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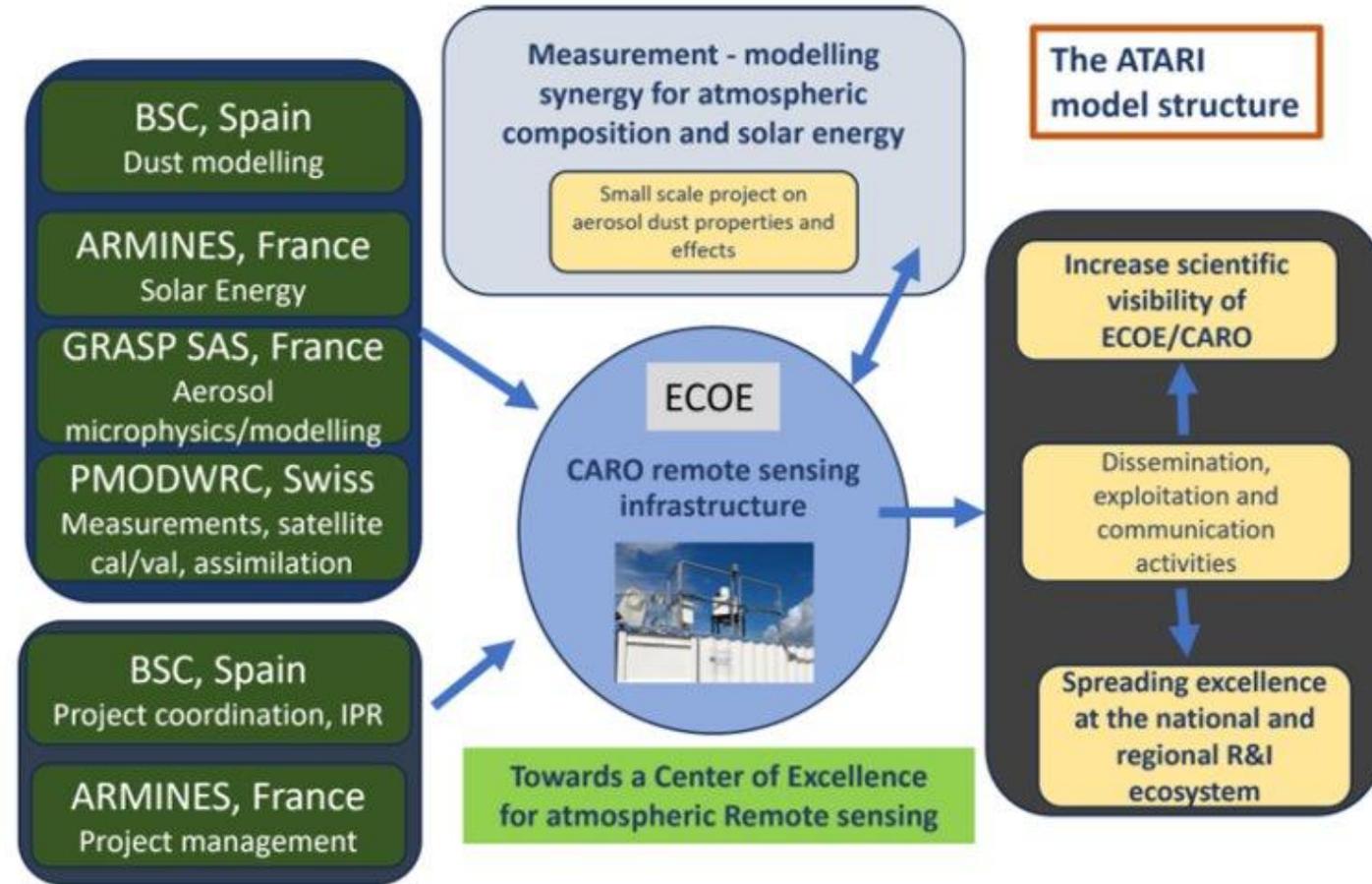
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CARO and ATARRI project

ATmospheric and solAR Research and Innovat in the Eastern Mediterranean

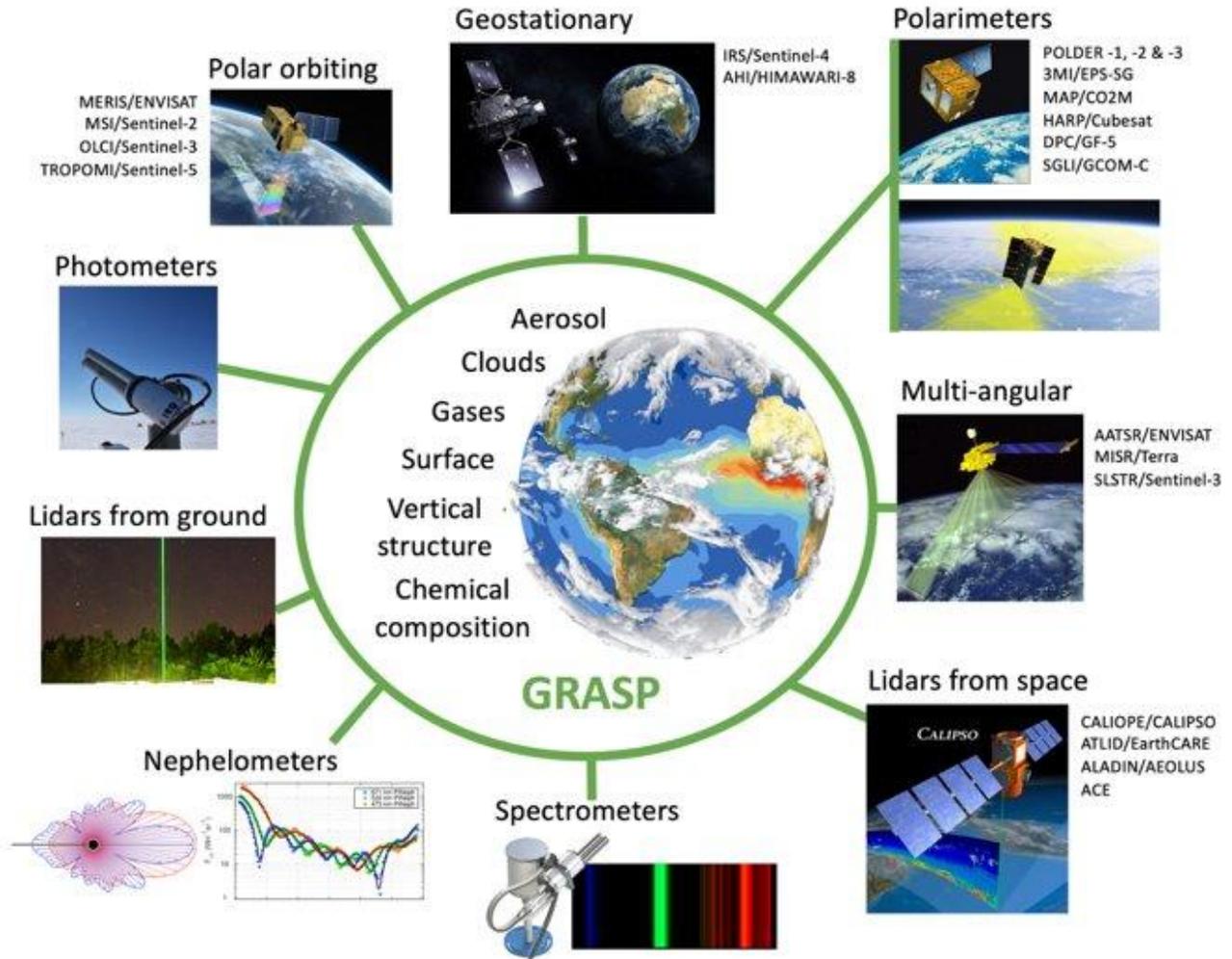
- CARO moves one step forward from atmospheric observation ...

ATARRI concept and consortium



CARO and ATARRI project-GRASP

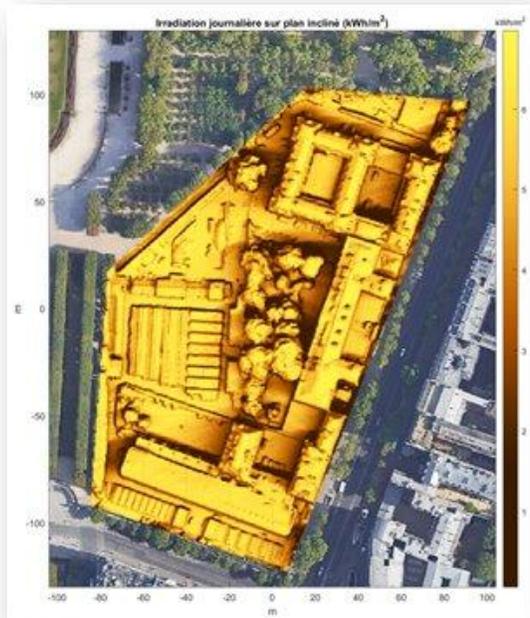
- Advanced aerosol microphysical retrievals,



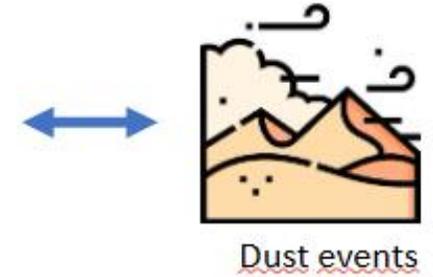
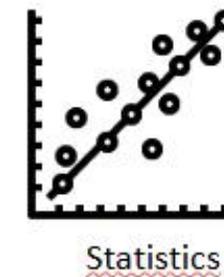
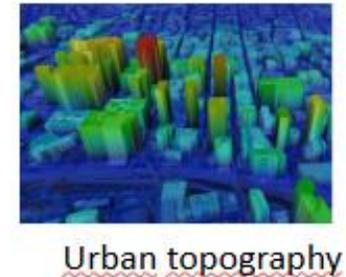
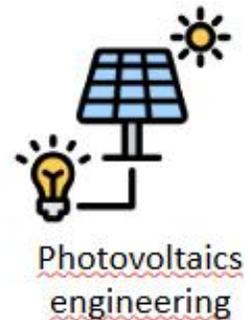
CARO and ATARRI project-Solar energy



- ☐ Assessments of aerosol impacts on photovoltaic systems



Urban PV



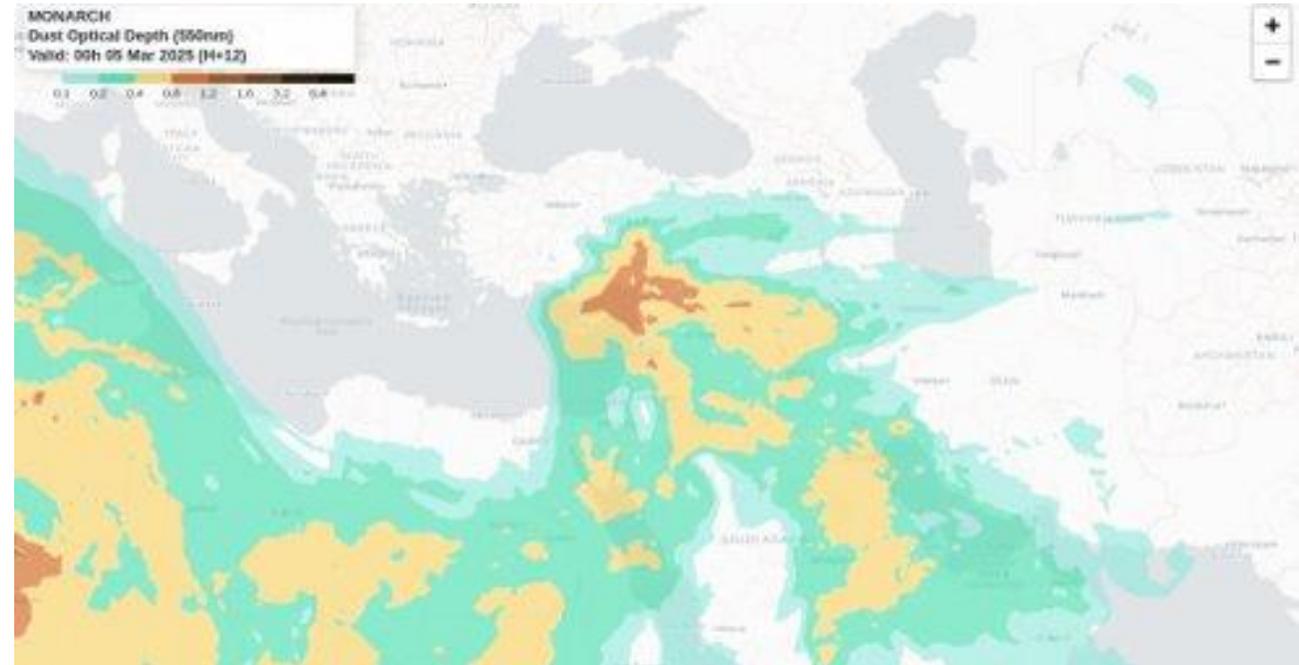
CARO and ATARRI project-BSC dust modeling

☐ Support for regional dust forecasting and modelling.

BSC and CARO team analyze example data of a dust event over Cyprus (spring 2025):

- MONARCH dust model outputs
- lidar observations.
- VIIRS satellite observations.
- AERONET ground observations.

Preparation of a virtual machine to host our learning platform.



conclusion

- CARO is a scalable and transferable observatory concept that can serve as a model for the establishment of similar advanced atmospheric monitoring facilities across the EMMENA region.
- Expanding such ground-based infrastructures would strengthen regional capacity for air-quality monitoring, dust early-warning systems, satellite validation, and climate adaptation planning.
- CARO like facility supporting both scientific advancement and operational environmental services.

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Thank you for your attention

More information contact with: Caro.info@eratosthenea.org.cy




ACKNOWLEDGEMENTS

This study supported by the ‘EXCELSIOR’: ERATOSTHENES: EXcellence Research Centre for Earth Surveillance and Space-Based Monitoring of the Environment H2020 Widespread Teaming project (www.excelsior2020.eu) and the EVID39 CORAL project as part of the CAL/VAL EarthCARE activities. The ‘EXCELSIOR’ project has received funding from the European Union’s Horizon 2020 research and innovation programme under Grant Agreement No 857510, from the Government of the Republic of Cyprus through the Directorate General for the European Programmes, Coordination and Development and the Cyprus University of Technology.

The authors also acknowledge the ATARRI project funded by the European Union’s Horizon Europe Twinning Call (HORIZON-WIDERA-2023-ACCESS-02) under the grant agreement No 101160258.



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