CIMEL

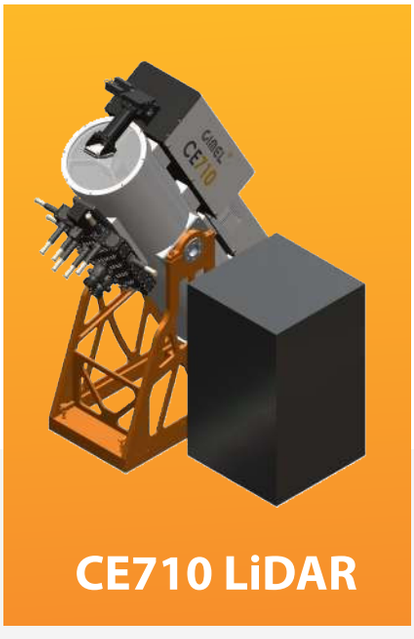
EXPLORE THE CLIMATE

ACTRIS
Exploring the Atmosphere

CE710

HIGH POWER MIE-RAMAN FLUORESCENCE LIDAR

Climate Science / Satellite / Air Quality / Meteorology



CE710 LiDAR

Understanding the atmosphere to understand the Earth

Atmospheric aerosols and gases have a major impact on human health and on climate change through their complex interactions with solar radiation and with clouds, as well as their role in atmospheric chemistry and dynamics.

To address these challenges, the scientific community and environmental monitoring agencies (space agencies, meteorological services, air quality networks…) require consistent, long-term multi-scale observations — from local to global — to better understand atmospheric processes.
This approach, supported by an expanding network of observation sites, enables the collection of comprehensive data to model climate and air quality, detect hazardous events, and improve early warning systems and weather forecasting.

High-power LiDARs have become, in complement to in-situ and satellite instruments, an invaluable tool for analyzing atmospheric properties, including the vertical distribution of aerosols, clouds and gases.

Designed with scientists at the frontiers of technology

Our CE710 LiDAR range is the fruit of a long term collaboration between CIMEL and the Laboratoire d'Optique Atmosphérique (LOA) within the joint laboratory AGORA-Lab.

It meets the most stringent requirements for data quality and operational robustness, notably complying with the guidelines established by the pan-European Research Infrastructure ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure).

Offering up to 15 channels, our LiDAR can profile an exceptional range of key atmospheric parameters: aerosol extinction, backscatter and depolarization, aerosol multi-spectral fluorescence, water vapor and trace gases.

Our unique modular design enables flexible configurations, easy maintenance, and scalable capabilities

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Key features

- ACTRIS compliant
- Up to 15 detection channels (Mie-Depolarization-Raman-Fluorescence)
- Easily upgradable (additional channels)
- Integrated system, including calibration tools and remote control
- Easily transportable (compact design)
- Thermal enclosure (in option)
- Complete data processing software (AUSTRAL)

ACTRIS
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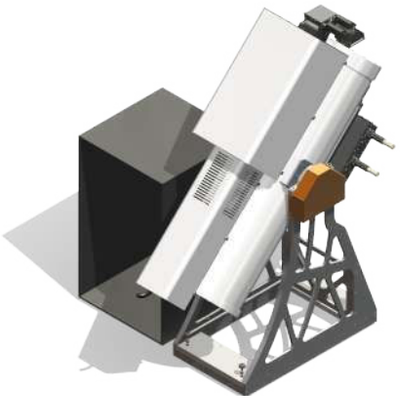
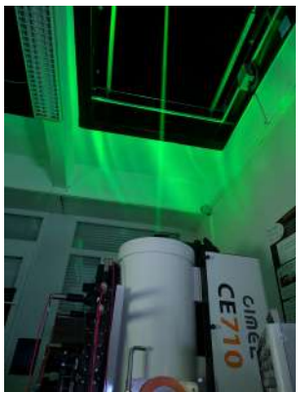
Compliant with ACTRIS guidelines ARS-OPs-v02-rev01

Configuration of your LIDAR

Contact us to define together the configuration best suited to your scientific needs and budget.





1 Laser

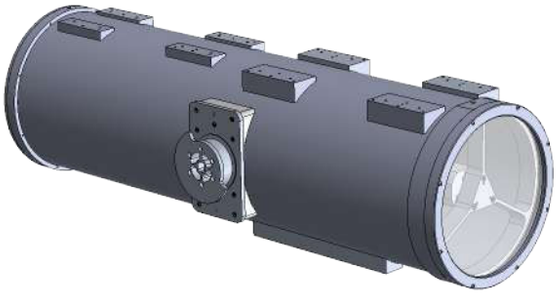
Choose from several Nd:YAG laser options to suit your detection needs:

Laser type	Diode or pumped Nd:YAG (flash lamp / DPSSL)
Emission	Combinations of 355, 532 and 1064 nm
Operating mode	Pulsed
Repetition rate	Up to 200 Hz
Power range at 355 nm	Up to 24 W

2 Telescope

Adjust the high and low ranges on our large, stable and robust telescope.

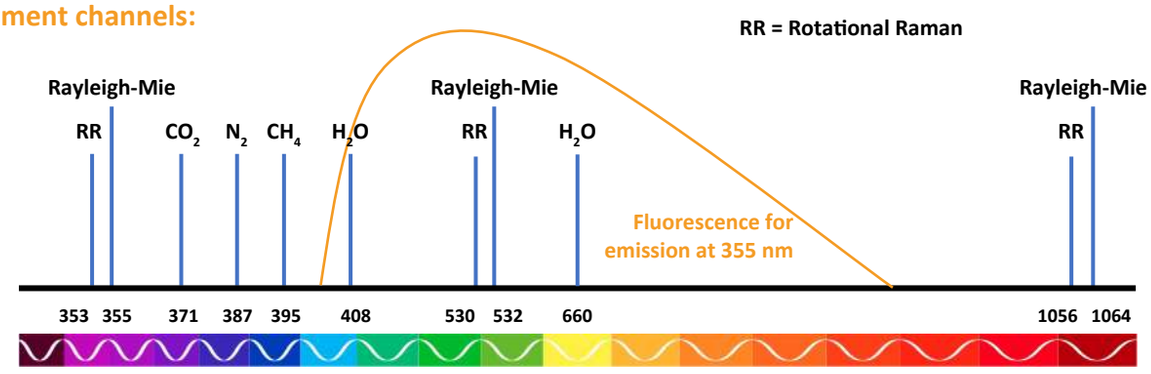
Diameter	400 mm
Type	Newton
Material	Carbon fiber
Adjustable FOV	0.25-1.5 mrad



3 DETECTION CHANNELS / RETRIEVED PARAMETERS

Our CE710 is a powerful tool to obtain profiles of aerosols, clouds, water vapor and trace gases.

Measurement channels:



Specific Raman channels are used to measure water vapor and trace gases like CH_4 and CO_2.

Several Mie, Raman, depolarization and fluorescence channels may be combined to obtain information on the aerosols:

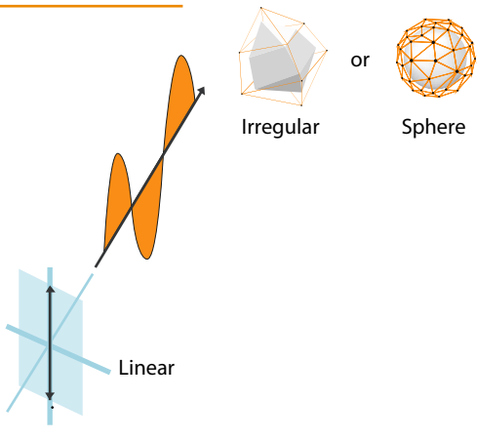
Channel type	Wavelengths	Measured parameters
Mie backscatter	355, 532, 1064 nm	Backscatter coefficient (β)
Raman (vibrational, rotational)	387, 353, 408, 530 nm	Extinction coefficient (α)
Depolarization	355, 532, 1064 nm	Linear depolarization ratio (δ)
Fluorescence	415-520 nm	Fluorescence capacity

Having more channels enables to retrieve profiles for a broader and more advanced set of parameters:

Configuration	Retrieved microphysical parameters
3β + 2α	Volume/Surface/Number density Effective radius SSA
+ 1δ	Spherical / Non spherical Classification of aerosols: Dust/smoke
+ 1 Fluo	Discrimination of organics (smoke, pollen) Aerosol typing
+ 1β WV	Water vapor mixing ratio

Depolarization channels

Linear depolarization ratio measured at several wavelengths allows to distinguish cloud phase, to identify irregularly-shaped particles (dust, pollen, ash) and can be used for particle classification.

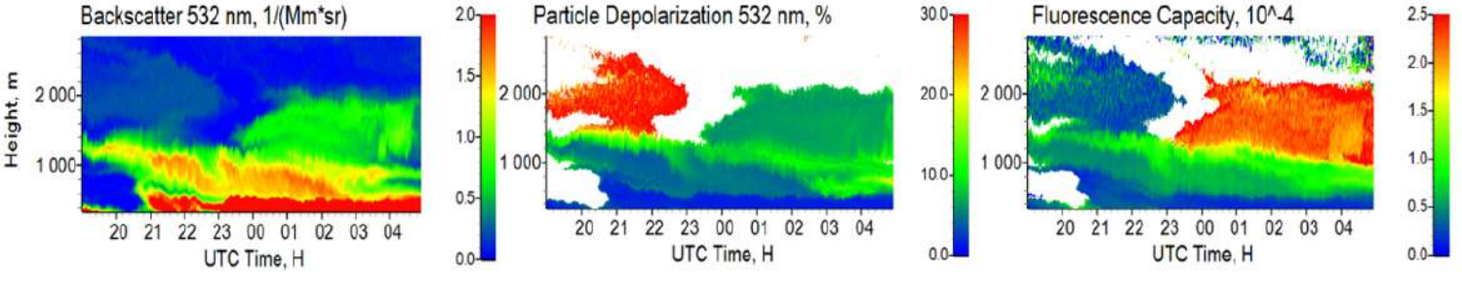


Fluorescence channels

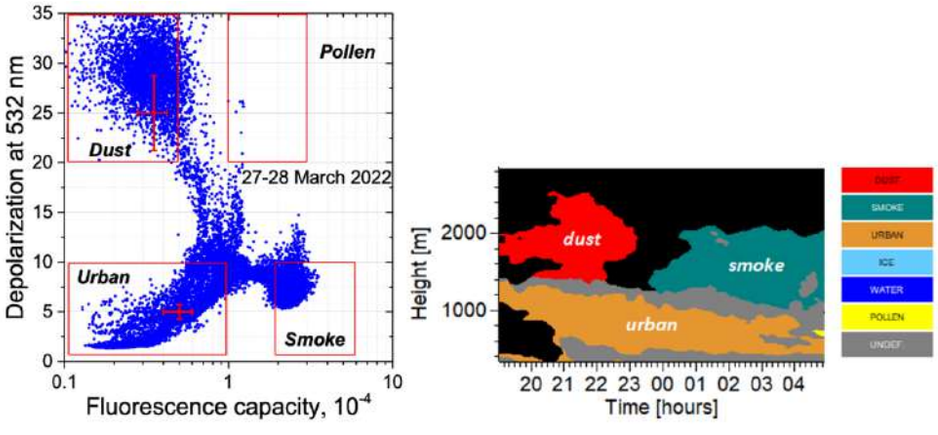
Fluorescence spectroscopy is a highly sensitive technique, widely used for the in-situ monitoring of atmospheric organic particles. By adding the fluorimetry into our LiDARs, we extend this information to vertical profiles.
The fluorescence spectrum is sensitive to aerosol type and composition, therefore making their identification possible.
Multi-wavelength fluorescence detection by the CE710 LIDAR allows for the separation of complex aerosol mixtures. Organic carbon, black carbon, mineral dust, and combustion-related particles emit distinct fluorescence spectra, enabling improved aerosol source attribution and understanding of their transport and transformation in the atmosphere.

Aerosol typing

Spectral fluorescence channels in CE710 LIDAR, along with the depolarization channels, add a powerful dimension for aerosol typing, improving aerosol classification accuracy, supporting real-time environmental monitoring, and enhancing our ability to assess aerosol impacts on climate, health, and ecosystems.

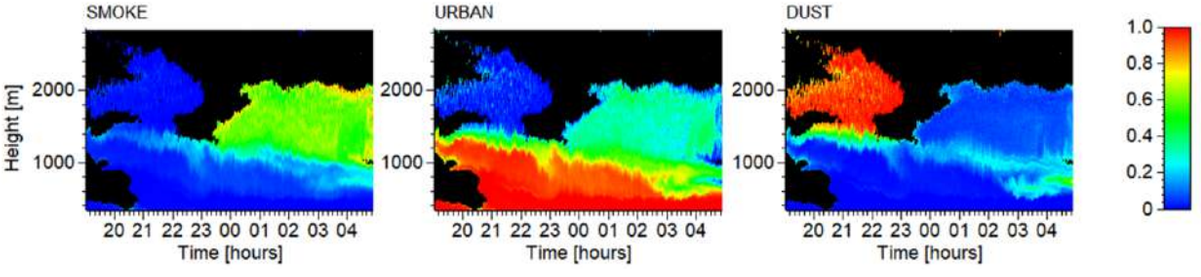


Aerosol type	δ_{532} (%)	G_F ($\times 10^{-4}$)
Dust	20–35	0.1–0.5
Pollen	15–35	0.8–3.0
Urban	1–10	0.1–1.0
Smoke	2–10	2.0–6.0
Ice	> 40	< 0.01
Water	< 5	< 0.01



Igor Veselovskii et al. https://doi.org/10.5194/amt-15-4881-2022

It is possible to quantify the proportion of each component in the mixture composition of each layer by its relative contribution to the backscatter signal.



Water vapor profiling and heavy rainfall hazards

The CE710 LIDAR enables precise vertical profiling of atmospheric water vapor by using Raman channels corrected for aerosol-induced fluorescence and depolarization effects. This allows for accurate discrimination between vapor and particulate signals, even in complex or humid environments.
Such high-resolution humidity measurements are essential for very early warning systems aimed at anticipating heavy rainfall and flood risks.
By detecting moisture buildup in the lower and mid-troposphere, the CE710 supports improved forecasting of convective weather events and hydrometeorological hazards.

Cloud-seeding monitoring

The CE710 is also highly suited for cloud-seeding operations, offering real-time assessment of pre-seeding atmospheric conditions, such as hygroscopic aerosol concentrations and vertical humidity structure.
Post-seeding, the system can monitor the operational meteorological outcomes, helping evaluate the impact and effectiveness of weather modification strategies through continuous observation of atmospheric responses.

Very early warning systems:
Heavy rainfall & flood risk

Cloud-seeding monitoring

4 THERMAL ENCLOSURE

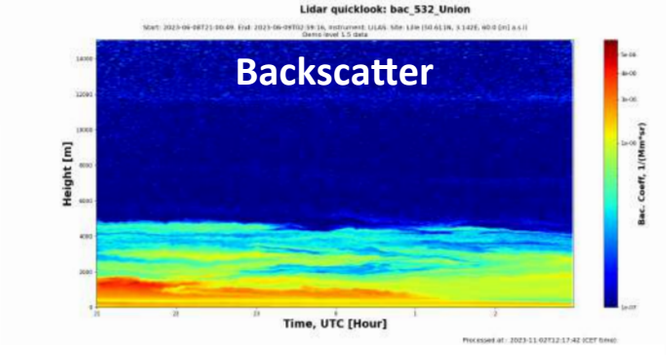
The CE710 LiDAR must operate in a controlled environment: 23 ± 5°C with < 40% relative humidity.
An enclosure is proposed as an option if your site is not equipped with a dedicated room.
The enclosure is equipped with a high transmission window, a rain detector and an automatic hatch, for continuous operation.

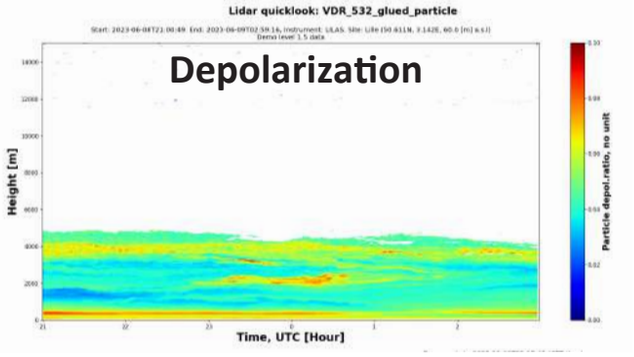
Operational environmental conditions

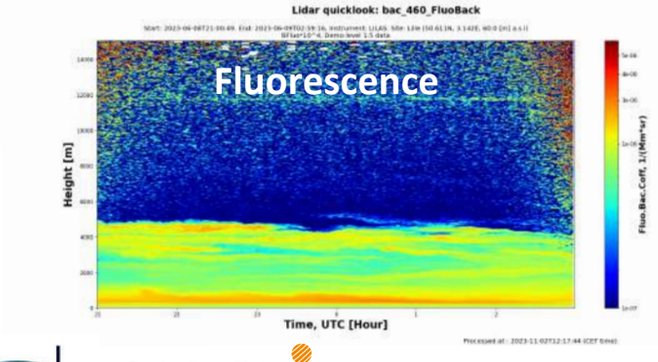
External temperature	Down to -10°C Up to 55°C
Weight	< 200 kg

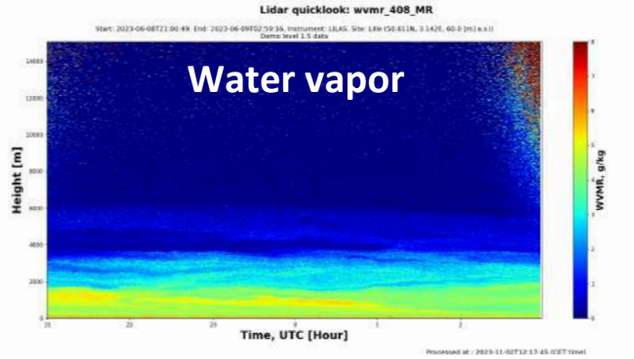
5 ADVANCED DATA ANALYSIS - AUSTRAL SOFTWARE

Our LiDAR comes with the advanced data analysis software **AUSTRAL** (**AU**tomated **S**erver for the **TR**eatment of **A**tmospheric **L**idars) developed by LOA within AGORA-Lab.
You can visualize and interpret the data collected by the instrument in real-time through Quicklooks of Range Corrected Signals (RCS), Volume Depolarization Ratio (VDR) as well as inversion results (extinction and backscatter, fluorescence coefficient and water vapor profiles).
This allows you to quickly and easily identify patterns and trends in the data, enabling you to draw more accurate insightful conclusions about atmospheric phenomena.









Combining technology and science, CIMEL develops reference optical remote sensing instruments to monitor the atmosphere, land and oceans, contributing to a deeper understanding of the Earth system and helping human activities adapt to the environment

TECHNICAL PARAMETERS

	Examples of configurations		
Parameters	**ACCESS**	**PRO**	**XPERT**
Channels	1β + 1α + 1δ at 355 nm OR 1β + 1α + 1δ at 532 nm	1β + 1α + 1δ at 355 nm and 1β + 1α + 1δ at 532 nm	1β + 1α + 1δ at 355 nm and 1β + 1α + 1δ at 532 nm and 1β + 1δ at 1064 nm
Elastic channels	355 OR 532 nm	355, 532 nm	355, 532, 1064 nm
Rotational Raman channels	353 OR 530 nm	353, 530 nm	353, 530, 1056 nm
Laser energy at 355 nm	100 mJ / 20 Hz	120 mJ / 20 Hz	100 mJ / 100 Hz
Laser energy at 532 nm	100 mJ / 20 Hz	100 mJ / 20 Hz	100 mJ / 100 Hz
Laser energy at 1064 nm	N/A	160 mJ / 20 Hz	200 mJ / 100 Hz
Height resolution		3.75 - 15 m	
Temporal resolution		≥ 10 s	
Overlap		≤ 500 m	
Acquisition electronics		Licel (Analog, PhC)	
Operating temperature		23 ± 5°C (w/o a thermal enclosure) -10°C to 55°C (with a thermal enclosure)	
Water vapor	○	●	●
Fluorescence	○	●	●

QA features - ACTRIS ready

Dark signal measurement	●	●	●
Alignment camera	●	●	●
Polarization calibration	●	●	●
Telecover	●	●	●
Pre-trigger	●	●	●

Scan to see the website

CIMEL

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