

Low-Power versus High-Power Lidars: Allies with the Same Purpose, the Vertical Atmospheric Sounding

**I. Popovici⁽¹⁾, S. Victori⁽¹⁾, L. Proniewski⁽¹⁾, Q. Hu⁽²⁾,
P. Goloub⁽²⁾, T. Podvin⁽²⁾, F. Ducos⁽²⁾, I. Veselovskii⁽³⁾**

i-popovici@cimel.fr

⁽¹⁾ R&D Department, CIMEL Electronique, 75011 Paris, France

⁽²⁾ Univ. Lille, CNRS, UMR8518 -LOA–Laboratoire d'Optique Atmosphérique, 59000 Lille, France

⁽³⁾ Prokhorov General Physics Institute, Moscow, Russia

Lidars have been designed to visualize the atmospheric processes, to record time histories of the evolution of these processes and to measure the various properties of atmospheric particles and molecules. Whether we speak about elastic (Mie), automatic micro-lidars or elastic-Raman multi-wavelength research lidars, each has its own advantages, limitations and preferred applications. But at the end of the day, both low-power automatic lidars and research high-power lidars have the same goal, to help researchers understand the vertical atmospheric variability and dynamics and to study the aerosol properties.

The CIMEL CE376 micro-pulse lidar is a compact (<1 m height, <50 kg), bi-axial, dual-wavelength (532 nm and 808 nm) lidar for continuous, automatic operation. Several sites in France and in Europe are equipped with this type of lidar providing Automatic Aerosol Monitoring Solution (AAMS) along with a CIMEL photometer. Combined automatic lidar (CE376) and photometer (CE318-T) measurements, providing a more comprehensive automatic monitoring solution, were performed during a summer campaign in Caillouël-Crépigny, North of France in 2019. They allowed studying two heat-wave events impacting this background, rural site. The continuous measurements of the CE376 atmospheric backscatter and depolarization at 532 nm allowed to clearly identify the arrival of dust layers up to 6000 m altitude and descending down to the surface, explaining the presence of Ca and K in the ground-based in-situ data, which were otherwise not explained. The low overlap of the 808 nm channel allowed observing the dust layers going down to the surface and impacting the measurements, which was valuable information for researchers involved in the campaign.

On the other hand, more performant, high-power research lidars allow more precise and in-depth analysis of aerosol properties at several wavelengths, using elastic, Raman and even fluorescence channels. A dust event in Lille, North of France, was observed on the night of 2-3 of March 2021 simultaneously by the LILAS high power lidar, part of the ACTRIS (European atmospheric infrastructure) and a CIMEL CE710 high-power lidar (532 nm with polarization, but modulable system). Both LILAS and CE710 lidars were operating at that time at ATOLL (ATmospheric Observatory of lILLe) platform operated by Laboratoire d'Optique Atmosphérique, University of Lille/CNRS, France. The results showed excellent agreement between the two systems, with extinction coefficient of $0.1 \pm 0.04 \text{ km}^{-1}$ at 532 nm and volume linear depolarization ratios in the range of 0.11-0.2 at 532 nm for the dust layers between 2300 m and 7400 m altitude.

The two case studies observed by low-power and high-power lidars will be presented. This work is performed in the frame of AGORA-Lab, a joint LOA/CIMEL laboratory (<https://www.agora-lab.fr/>).