

Characterization of recent Aerosol Events occurring in the Subtropical North Atlantic region using a CIMEL CE376 GPN micro-Lidar

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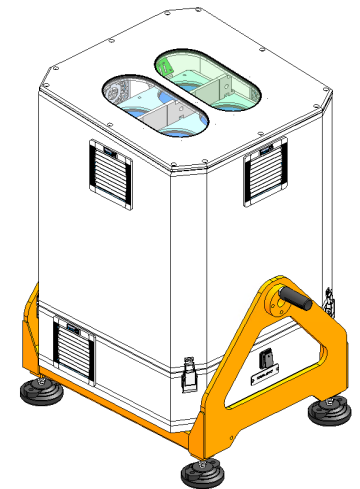
The CIMEL CE376-GPN micro-Lidar at Izaña Site

Motivation

Low-cost polarization LiDARs are emerging tools to monitor the distribution and properties of aerosols at regional and global scales. We present the performance of a compact CE376 micro-pulse LiDAR for aerosol characterization in the low free troposphere.

Specifications of the CE376-GPN micro-Lidar

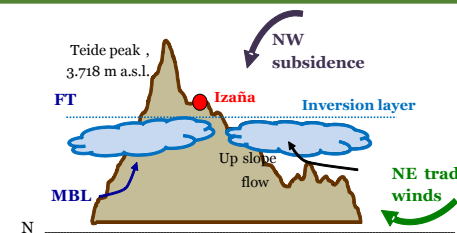
- Eye-safe LiDAR compact elastic backscatter LiDAR
- Two pulsed lasers at **532 nm** and **808 nm**
- Biaxial system. Field of view:
 - **532 nm**: 50 μ rad for emission and 120 μ rad in reception
 - **808 nm**: 230 μ rad for emission and 260 μ rad in reception
- 15 m range resolution and 1 minute integration time
- Backscattered signal: from 8 km during day to > 20 km at night
- Depolarization channel at **532 nm**
- Instrumental corrections:
 - Afterpulse, deadtime, overlap, background subtraction, range correction



Scheme of CE376-GPN

The Site

- The CE376 is installed at 2368 m a.s.l. at the Izaña Atmospheric Research Center (Tenerife, Canary Islands, Spain)
- Site representative of low free troposphere conditions of the Subtropical North Atlantic Region.
- On the top of a mountain platform on a dorsal ridge



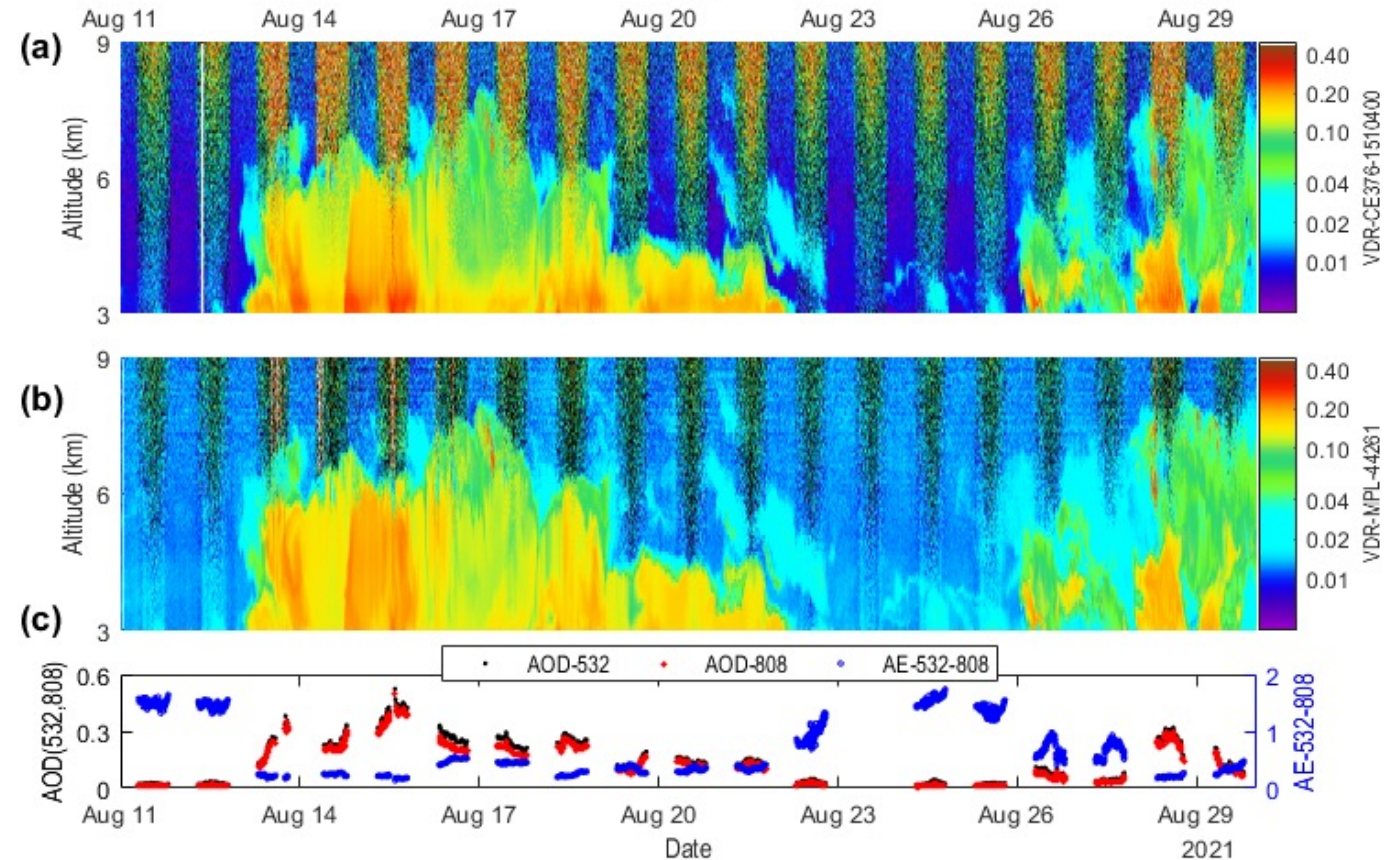
Location of Izaña site

Volume depolarization ratio from CE376. Comparison with MPL-4B

- In August 2021, the CE376 overlapped at Izaña with a MPL-4B from MPLNET (<https://mplnet.gsfc.nasa.gov>).
- The volume depolarization ratio (VDR) product of the CE376 and MPL-4B were compared:
 - A general good agreement, with differences $< 1\%$ 1min-VDR profiles, was observed.
 - Only in the region of incomplete overlap, at $VDR > 0.15$, differences up to 5% were observed.



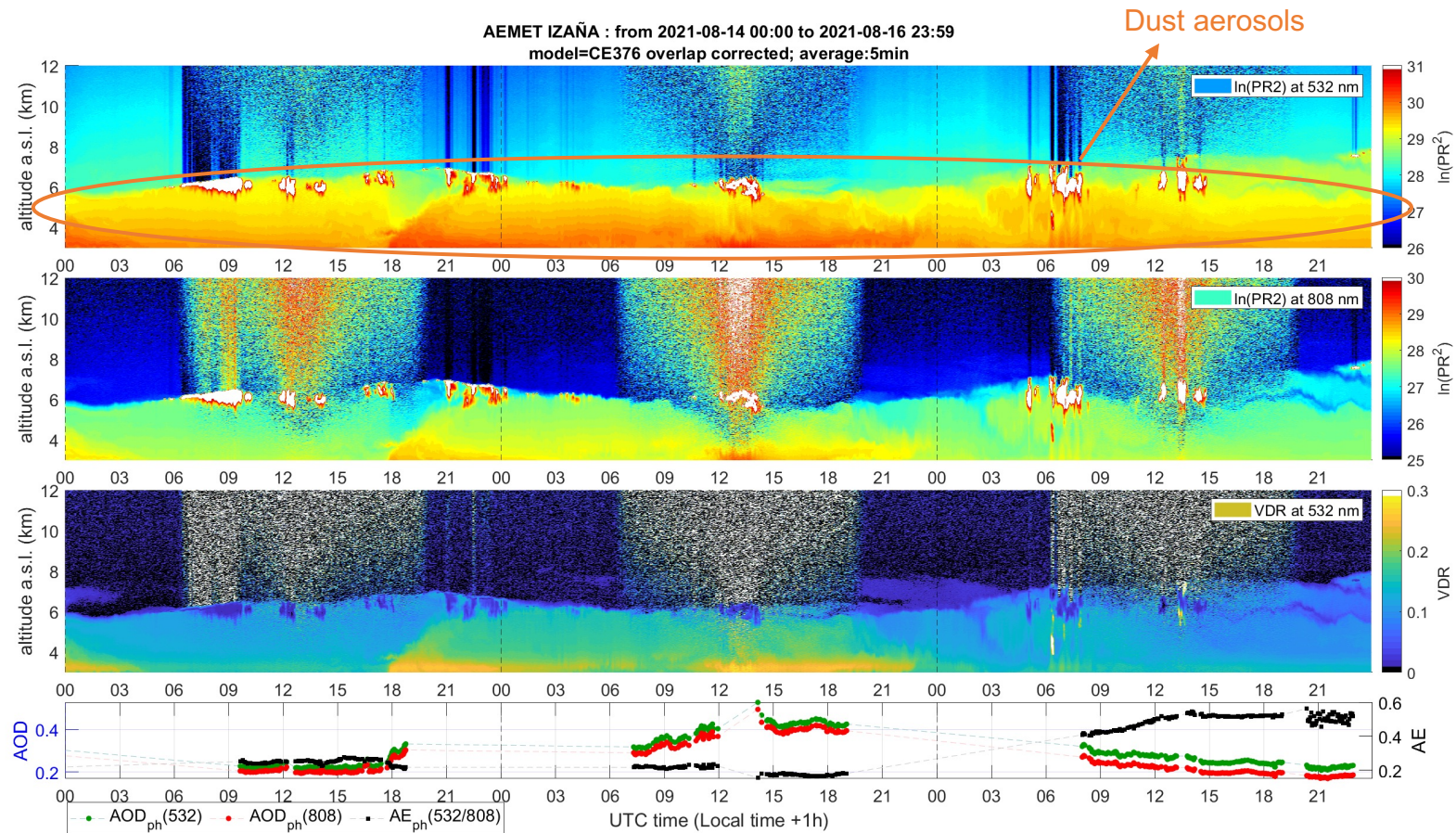
The LiDARs were located at 2268 m a.s.l., 223 m apart during the campaign.



VDR at 532 nm obtained with the a) CE376-1510400, b) the MPL-44261, c) AOD at 532nm and 808 nm and AE at 532-808 nm computed from AERONET.

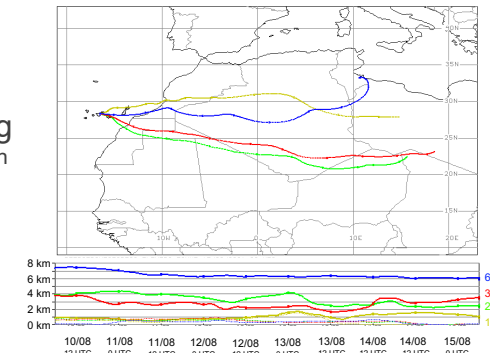
Case 1. Retrieved aerosol properties during Saharan dust events

During August 2021, Izaña was frequently impacted by Saharan dust particles. Between the 14th and 19th of August the Saharan Air Layer reached up to 7.5 km height.

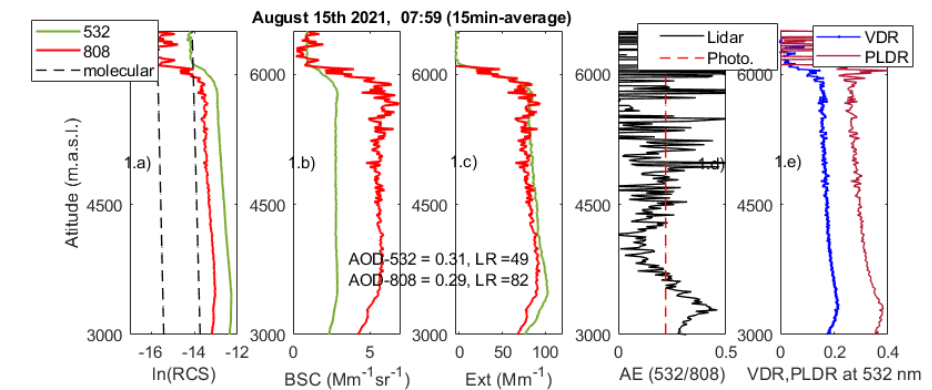


Range corrected signals (RCS) at 532nm and 808 nm, volume depolarization ratio (VDR) at 532 nm from the CE376, and AOD at 532nm and 808 nm and AE at 532-808 nm computed from AERONET on 14th-16th Aug. 2021.

FLEXTRA-ERA5
backtrajectories arriving
to Tenerife on Aug. 15th
2021 at 6h UTC (C.
Marrero, AEMET).



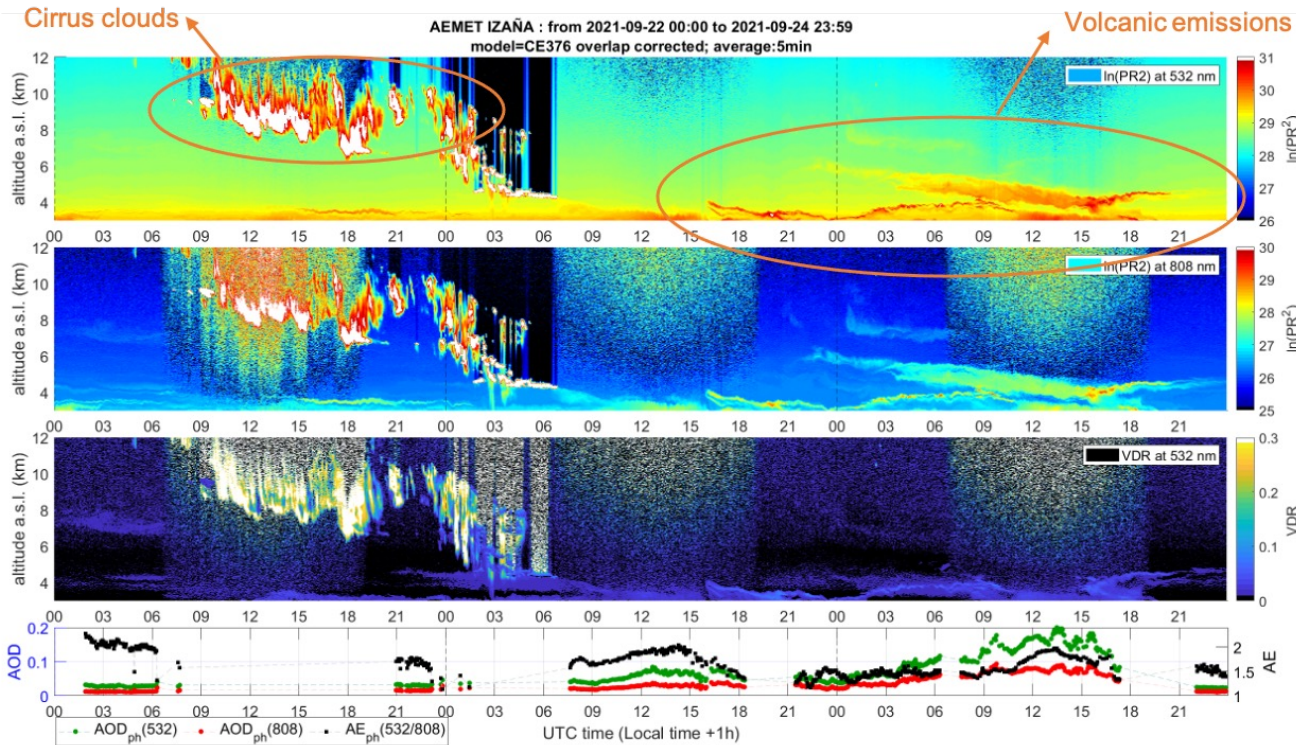
Inversion profiles are derived with Klett inversion
constrained by AOD



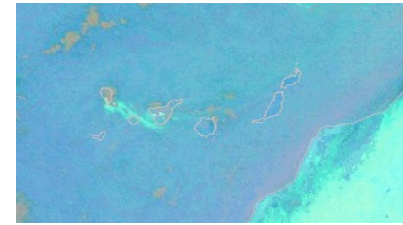
RCS, backscatter (BCS) and extinction coefficients (Ext) at 532 and 808nm, lidar AE at 532-808 nm, and VDR and particle linear depolarization ratio (PLDR) on Aug. 15th 2021 at 07:59 UTC.

Case 2. Retrieved aerosol properties during the eruption of Cumbre Vieja

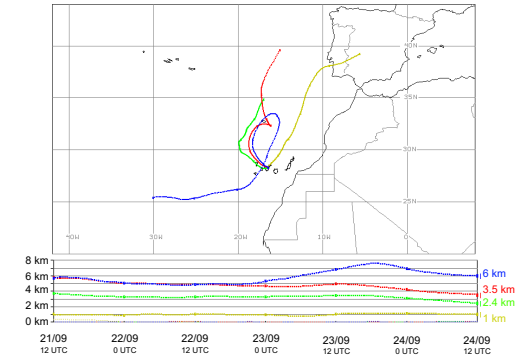
Izaña site also witnessed the eruption of the Cumbre Vieja volcano (La Palma, Canary Islands) last fall (2021).



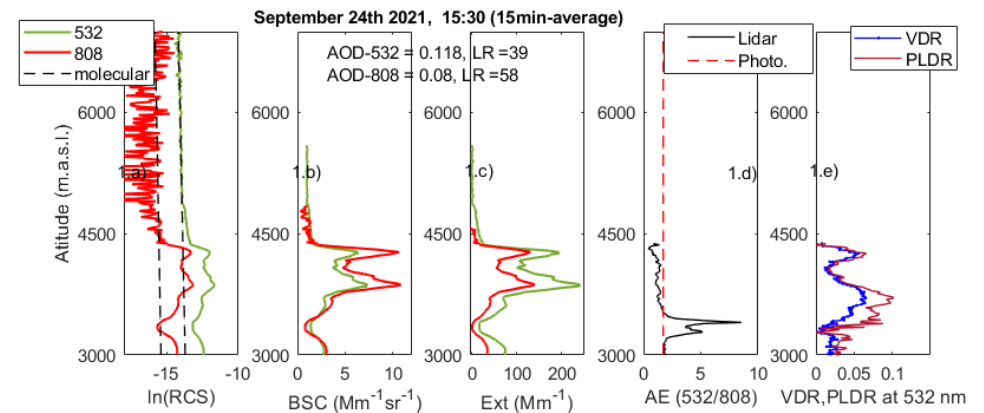
Range corrected signals (RCS) at 532nm and 808 nm, volume depolarization ratio (VDR) at 532 nm from the CE376, and AOD at 532nm and 808 nm and AE at 532-808 nm computed from AERONET on 22nd-24th Sep 2021.



Clouds of SO₂ from the RGB satellite travelling from Cumbre Vieja to Izaña (Sep. 24th, J.J. Bustos, AEMET).



FLEXTRA-ERA5 backtrajectories arriving to Tenerife on Sep. 24th 2021 12h UTC (C. Marrero, AEMET).



RCS, backscatter (BCS) and extinction coefficients (Ext) at 532 and 808nm, lidar AE at 532-808 nm, and VDR and particle linear depolarization ratio (PLDR) on Sep. 24th 2021 at 15:30 UTC.

Conclusions

- We present the first results on aerosol characterization at North Atlantic low free troposphere provided by the CIMEL CE376 GPN micro-LiDAR.
- We show two dust scenarios: Saharan dust particles and volcanic emissions from the Cumbre Vieja volcano.
- The VDR profiles from the CE376 and the MPL-4B from MPLNET showed good agreement (differences $<1\%$ in 1min-VDR profiles). Only in the region of incomplete overlap, at $VDR > 0.15$, differences up to 5% were observed.
- The VDR at 532 nm, aerosol backscatter and extinction at 532 and 808 nm, and AE for 532-808 nm retrieved profiles show the good performance of the micro-LiDAR CE376.
- Future work on the 808 nm channel will provide new insights of the possibilities of this instrument for atmospheric aerosol characterization in remote sites.

Questions? y-gonzalez@cimel.fr

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