TWO-WAVELENGTH POLARIZATION MICRO-PULSE LIDAR AND PHOTOMETER SYNERGETIC MOBILE MEASUREMENTS FOR AEROSOLS MONITORING

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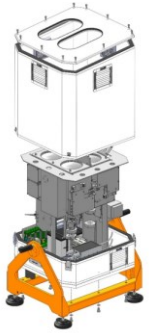
Introduction

The lidar-photometer synergetic observations are widely used for monitoring of atmospheric aerosols properties. In particular, measurements of both remote sensing instruments on board mobile platforms offer the capability to study the spatio-temporal variability of aerosols in an extensive range of scenarios.

CIMEL CE376 micro-pulse lidar providing measurements at **532 nm** and 808 nm, depolarization at 532 nm, coupled with sun/moon photometers providing spectral Aerosol Optical Depth (AOD) were integrated for mobile monitoring of aerosols properties during field campaigns.



CIMEL CE376 micro-pulse lidar

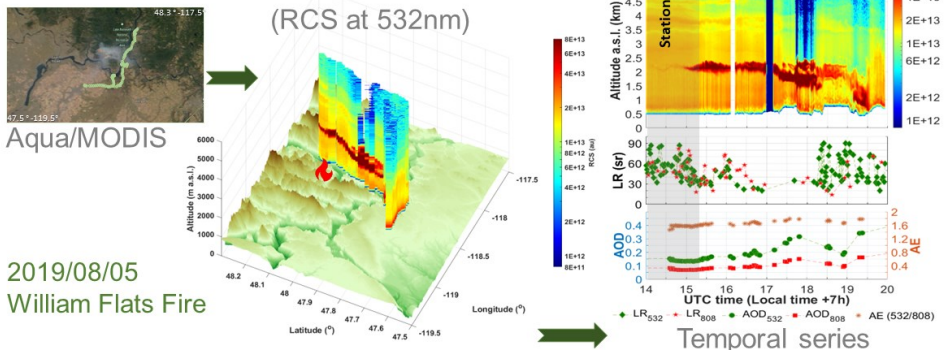
FIREX-AQ campaign: Spatio-temporal monitoring of smoke aerosols

A first collocated CIMEL CE376 lidar– photometer database on a mobile platform called DMU (Dragon Mobile Unit) was obtained during the field campaign FIREX-AQ (Fire Influence on Regional to Global Environments and Air Quality) organized over the Northwestern US in summer 2019 (1).

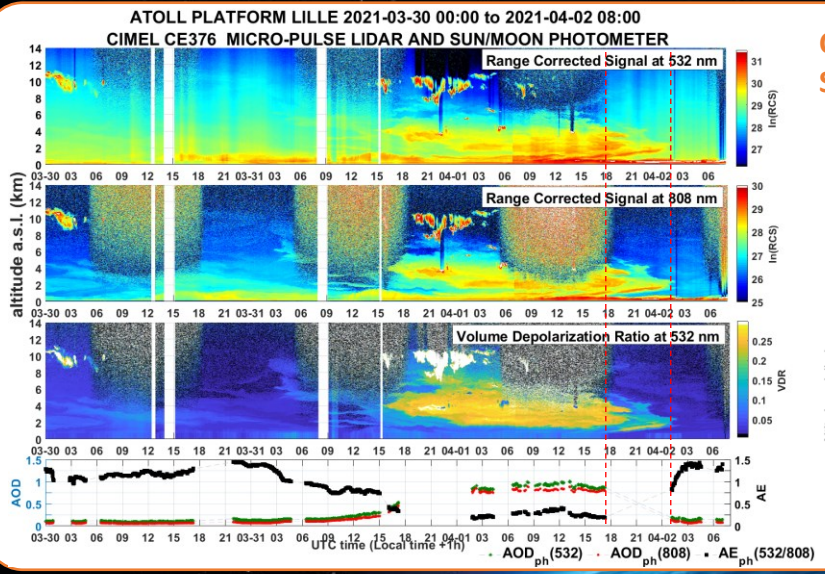
The installation followed the design of MAMS (Mobile Aerosol Monitoring System) described in Popovici *et al.* (2). The campaign allowed also to monitor the instruments performance under extreme conditions:

- High temperatures
- Complex terrain
- Difficult roads
- Thick smoke plumes

Study Case: Crossing a smoke plume

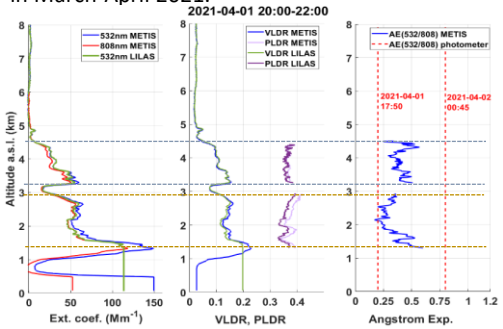


Previous studies of fresh smoke transported one day far from source reported LR of 60-85 sr for 532 nm (3,4,5)



Continuous observations at ATOLL platform in Lille-France: Study case of Saharan dust transport

METIS, an operational CIMEL CE376 lidar, continuously performing and co-located with photometers and with LILAS, a lidar part of EARLINET-ACTRIS, are considered for test and data validation, prior to mobile campaigns. We present (figures to the left) the continuous measurements from METIS during an event of Saharan dust transport in March-April 2021.



For data validation: Aerosols retrievals obtained with a two-wavelength lidar klett inversion based on BASIC algorithm (6) for METIS and LILAS.

VLDR profiles from METIS show differences up to 0.02 related to differences on the lidar systems.

Conclusions

CE376 micro-pulse lidar offers more capabilities for aerosol studies (VLDR, PLDR at 532 nm, AE 532/808). Considering the limitations and capabilities encountered during FIREX-AQ campaign (in 2019), the current version have been improved and future versions will be more robust. So for future campaigns on mobile vectors, we are positive on obtaining more valuable information on aerosols optical properties. Further work will include uncertainties assessment. Several projects will support these efforts.

References

(1) FIREX-AQ White Paper, 2019, available at https://www.esrl.noaa.gov/csl/projects/firex-aq/whitepaper.pdf
(2) Popovici et al., Description and applications of a mobile system performing on-road aerosol remote sensing and in situ measurements.*Atmospheric Measurement Techniques*, *11*(8), 4671-4691,2018.
(3) Alados-Arboledas et al., Optical and microphysical properties of fresh biomass burning aerosol retrieved by Raman lidar, and star-and sun-photometry. *Geophys. Res. Letters*, 38 (1), 2011.
(4) Tesche et al., Profiling of Saharan dust and biomass-burning smoke with multiwavelength polarization Raman lidar at Cape Verde. *Tellus B: Chemical and Physical Meteorology*, *63*(4), 649-676, 2011.
(5) Balis et al., Raman lidar and sunphotometric measurements of aerosol optical properties over Thessaloniki, Greece during a biomass burning episode.*Atmospheric Environment*,*37*(32), 4529-4538, 2003.
(6) Mortier, Tendances et variabilites de l'aerosol atmospherique a l'aide du couplage Lidar/Photometer sur les sites de Lille et Dakar (Doctoral dissertation, Lille 1, 2013).