Enhancing Mobile Aerosol Monitoring with Two-Wavelength Polarization Micropulse Lidar

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Understanding aerosols' spatiotemporal distribution and their impact on various scales is crucial for accurate assessment of their radiative effects. Lidar and photometer are essential tools for aerosol monitoring, especially when integrated into networks. However, fixed-site laboratories are limited by local conditions and their position relative to aerosol sources. Mobile laboratories, deployed on ships, airplanes, or cars, address these limitations. Thus, we coupled the lightweight CIMEL CE376 micropulse lidar, measuring at 532 nm, 808 nm and depolarization at 532 nm, with the CE318-T sun/sky/moon photometer for enhanced mobile aerosol monitoring.

Instrumental assessments were conducted at the ATOLL (ATmospheric Observatory of liLLe) platform, operated by the Laboratoire d'Optique Atmosphérique (LOA), in Lille France. Selected case studies under different aerosol types (e.g., Saharan dust, smoke, sulfates) showcased the lidar's capabilities for aerosol typing. Comparisons against a Raman lidar were performed, demonstrating good agreement in aerosols properties with relative differences of up to 12 % on the depolarization measurements. Additionally, during the FIREX-AQ (Fire Influence on Regional to Global Environments and Air Quality) field campaign in summer 2019 over the Northwestern USA, on-road measurements enabled studies of smoke aerosols near fire sources.

This work provides a comprehensive discussion on the recent advances on mobile aerosol monitoring, highlighting the CE376 lidar's capabilities and limitations in filling observational gaps within networks. Moreover, we provide insights on the future implications, including ship-borne lidar measurements.

References

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