Polarimetric measurements for characterization of aerosol properties with CIMEL instruments: photometer and lidars

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CIMEL is well known for its CE318 photometer, equipping AERONET network. The polarized sun/sky/lunar photometer (CE318-TP) is maybe less known, but it offers polarization measurements in 9 channels in a wide spectral range (340-1640 nm) and it has been shown to improve the retrieval of the real part of the refractive index, the fine mode of the size distribution and the particle shape parameter, especially for small particles, and to reduce inversion errors by 30% [1,2]. If polarizers alignment issues have been observed in the mechanical setup before, on older instruments, these have been addressed, leading to improved polarization measurements accuracy in current instruments. We believe that commercial polarized photometers such as the CE318-TP can be a key tool for ground-based validation of future polarimetric space missions.
On the vertical scale of the atmosphere, lidars equipped with polarization channels offer insights into the discrimination of aerosol types vertically: dust, ash, smoke etc. We produce two types of polarization lidars. The CE376-GPN lidar (GP stands for Green Polarized, N for near-infrared channel), which is a compact, eye-safe, automatic dual-wavelength, polarization lidar, demonstrating its capability to distinguish dust from smoke in several observations in Lille, France [3] and the CE710 high power lidar, a multi-wavelength polarization, fluorescence lidar, giving access to advanced aerosol research in complex scenarios, with 3 depolarization channels at 355, 532 and 1064 nm and which allowed to study the depolarization of aerosol fluorescence and water vapor Raman backscatter [4].
Finally, a 360°x180° linearly polarized filter-based fisheye camera funded by ESA is being developed in order to help the satellite community with instantaneous sky and sun measurements.
In this work, we propose to present examples of real measurements from our panel of polarimetric instruments and what added value they bring to the aerosol community and for future polarimetric space missions.

References

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