Workshop on "Recent advancements in remote sensing and modeling of aerosols, clouds and surfaces",
GRASP ACE Summer school,
Lille, France, May 22-26, 2023

Potential of using degree of linear polarization and/or polarized radiances in AERONET operational processing

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Recent research developments have emphasized the importance of using polarization measurements to improve accuracy of aerosol retrievals from both satellite and ground-based observations [1]. For ground-based observation, CIMEL CE318-NP dual polar wheel sun photometer can provide measurements of sky radiances and polarization at seven channels: 380, 440, 500,675,870,1020 and 1640 nm. Earlier publications have shown that combining radiance and polarization measurements results in increasing accuracy of the retrievals of the real part of refractive index for fine mode dominated aerosols and aerosol particles shape.

In this presentation we summarize the results of sensitivity studies on potential of using polarization measurements in AERONET operational processing. We consider two polarization characteristics: degree of linear polarization (DOLP) and polarized radiance (PR). The advantage of using PR is that it depends on radiance only though multiple scattering and is less sensitive to biases in radiometric calibration and surface reflectance. We present results of inverting combinations of both DOLP and PR with sky radiance measurements under conditions when biases in radiometric calibration and surface reflectance are present. Sensitivities are done for three major aerosol types: mineral dust, biomass burning and urban industrial. We show that employing polarization measurements allows decreasing of the AERONET level 2 AOD threshold to 0.1 at 440 nm for the real part of refractive index. We also confirm the previous findings by other authors that adding polarization does not improve accuracy of retrieved aerosol absorption.

References

[1] Dubovik, O., ZQ Li, M. I. Mishchenko, et al., 2019: Polarimetric remote sensing of atmospheric aerosols: Instruments, methodologies, results, and perspectives. JSQRT, 224, 474-511.