

Photometric-polarimetric system for aerosol observations with data cross-validation

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We present a system that combines two imaging polarimeters operating at 555 nm and 865 nm, and a sun photometer, the CIMEL CE318, to improve the reliability of atmospheric aerosol parameter retrieval and enable cross-validation of the obtained data. The field of view of both polarimeters is $60\times 60^\circ$, enabling simultaneous coverage of a significant portion of the celestial sphere and improving the efficiency of monitoring the spatial distribution of atmospheric polarization characteristics. The operation of the polarimeters is based on a division-aperture approach (DoA), which provides an instantaneous determination of the parameters of linear polarization of radiation [1], thereby minimizing errors associated with temporal instability of atmospheric processes and variations in observation conditions.

While the software for acquisition and processing of data from the sun photometer is well established and successfully used for atmospheric state analysis [2] at the photometer location, an original set of instruments and procedures for calibration and analysis of the acquired data has been developed and is being further improved for the aforementioned polarimeters. Special attention has been paid to the problem of accurately aligning polarimeters with respect to the celestial sphere. For this purpose, the positions of their detector matrix pixels along the optical axes of the polarimeters, coinciding with the zenith direction, have been determined. That enables correct spatial referencing of the measurement results and improves the accuracy of subsequent polarimetric data analysis and their cross-validation with data obtained by a photometer.

Future work will focus on further automating the described measurement complex, expanding the system's functionality, and applying it to the validation of aerosol parameters retrieved from both ground-based and satellite remote sensing instruments.

References

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