

Retrieval of aerosol properties from zenith sky radiance measurements

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The need to monitor atmospheric aerosols in order to account for their impact on climate change is well recognized. AERONET (AERosol RObotic NETwork; Holben et al., 1998) network, dedicated to the study of aerosols, employs the CE318 photometer as its standard instrument for precise retrieval of aerosol properties. This instrument takes direct sun measurements and sky radiance measurements to provide aerosol properties. Nevertheless, this type of instrument may not be available at all stations.

A new robust and affordable instrument for aerosol and water vapor monitoring, the ZEN-R52 radiometer, is proposed by Almansa et al. (2020). This device measures sky radiance at the zenithal direction (ZSR) simultaneously at five different wavelengths in the visible and near-infrared regions, offering a high temporal data availability since it is continuously operating.

In this study we aim to calibrate the ZEN-R52 radiometer and use its calibrated ZSR to infer aerosol properties using the GRASP algorithm (Dubovik et al., 2021).

The ZEN-R52 installed by the Group of Atmospheric Optics of the University of Valladolid (GOA-UVA) on their instruments platform in Valladolid (Spain) since 2018 was employed. For the calibration the forward module of GRASP was employed, which required ancillary information from aerosol and gas extracted from a collocated CE318 photometer belonging to AERONET, in order to simulate ZSR. The simulated ZSR were compared to simultaneous ZEN-R52 measurements in analogic-to-digital units to determine a calibration coefficient for each channel. A correction for dark current and temperature was included. After, the GRASP inversion module was used to invert all the calibrated ZSR from the ZEN-R52 to retrieve the aerosol properties, such as AOD and size distribution properties.

Retrieved values, such as AOD and size distribution properties, have been compared against the ones provided by AERONET, finding a high correlation between both data series.

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Keywords: retrieval algorithm, aerosol, sky radiances, GRASP.

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