# Aerosol properties retrieved from sky radiance at the Principal Plane for non-spherical particles

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Because of its proximity to the African continent, the Iberian Peninsula is a gateway for the masses of desert dust. It's therefore a suitable place for the study of optical and microphysical properties of the desert dust before its mixing with anthropogenic aerosol from the European continent. As one of major uncertainties in global climate changes, desert dust aerosol has been investigated widely by means of ground-based measurements. Many authors have used sky radiance measured in the almucantar plane in combination with direct irradiance measurements to retrieve aerosol size distribution, single scattering albedo and asymmetry factor, but very few authors have obtained these aerosol properties by the inversion of sky radiance measured in the principal plane.

Here, we present aerosol optical properties obtained during Saharan dust events observed over southern Iberian Peninsula during the time interval 2005-2008. The aerosol optical depth, Angström exponent, volume size distributions, single scattering albedo, phase function and asymmetry parameter were simultaneously retrieved from sun photometer measurements, according to the method described by (Olmo et al., 2008). This method utilizes solar extinction and sky radiance measured in the solar principle plane to retrieve the aerosol optical properties.

Measurements were performed in the AERONET station of Granada (37.18ºN, 3.58ºW, 680m a.m.s.l). Granada is a non-industrialized, medium-sized city, located in south-eastern Spain and is at a short distance, about 200 km away from the African continent. The measurements presented here were obtained by a CE 318-1 CIMEL sun/sky sun photometer. This instrument provides direct irradiance measurements at 340, 380, 440, 670, 870 and 1020 nm, together with sky radiance measurements in almucantar and principle plane at 440, 670, 870 and 1020 nm. The dates of the Saharan dust intrusions were supplied by CALIMA (www.calima.ws).

The aerosol optical depth at 440 nm ranged from 0.04 to 1.75 with mean values of 0.30±0.16. On the other hand, Angström parameter was found in the range 0.02-1.67 with mean values of 0.53±0.33, indicating a significant contribution of large particles during Saharan dust intrusions. The aerosol size distributions presented two distinct modes. The average fine radius mode was 0.19±0.49 μm, while the coarse radius mode was 3.14±0.57 μm. These values are similar to those found in east Asia by Kim et al,.(2004), which obtained the fine mode around 0.2μm and coarse mode between 2μm and 5 μm. the average volume concentration of fine mode was 0.02±0.01 $\mu m^3/\mu m^2$ and the volume concentration of coarse mode was 0.18±0.12 $\mu m^3/\mu m^2$. These values are within the range obtained by Dubovik et al. (2002) for desert dust. The average $V_{coarse} / V_{fine}$ ratio was around 12±7 confirming the large predominance of coarse particles during Saharan dust intrusions. In general, the single scattering albedo showed a slight increasing trend with wavelength (Figure1). The average single scattering albedo was, 0.90, 0.91, 0.92, 0.93 in 440, 670, 870 and 1020 nm respectively. However, this value is below the obtained by Dubovik et al. (2002), probably due the presence of urban-type pollution. The average asymmetry parameter was 0.69, 0.66, 0.65, 0.66 in 440, 670, 870 and 1020 nm respectively.

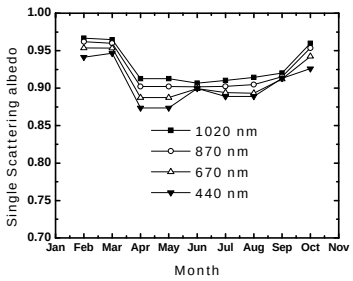


Figure1. Monthly average Single Scattering albedo obtained during Saharan dust events.

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