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Aerosol characterization at El Arenosillo (Huelva, Spain) with an AERONET/PHOTONS Cimel sunphotometer

[1]**V. Cachorro**, [1]C. Toledano, [1]R. Vergaz, [1]A.M. de Frutos, [2]M. Sorribas, [2]J.M. Vilaplana, [2]B. A. de la Morena

[1]Grupo de Óptica Atmosférica. Universidad de Valladolid, GOA-UVA. C/ Prado de la Magdalena s/n, 47071 Valladolid, Spain, chiqui@baraja.opt.cie.uva.es
[2]ESAt-El Arenosillo. Instituto Nacional de Técnica Aeroespacial (INTA). Huelva, Spain

The 5-year data series of aerosol properties at El Arenosillo is used for aerosol characterization in the southwest of Spain. Since February 2000, a Cimel sunphotometer included in the AERONET/PHOTONS network (Holben et. al, 1998) operates at the INTA-El Arenosillo station (37.1^0 N, 6.7^0 W, Huelva, Spain).

The site El Arenosillo is in the south-west Atlantic coast of Spain, thus maritime aerosols are dominant, with industrial and continental influences, resulting in a mixed maritime aerosol. However the most relevant in the global characterization of aerosol properties in this area is the frequency of desert dust events which distorts the mixed maritime aerosols. The Cimel monitoring database at El Arenosillo has permitted the evaluation of climatological values for aerosol properties in this area, and also the detection, characterization and evaluation of the desert dust events arriving at the station.

The Cimel sunphotometer provides aerosol optical properties, such as aerosol optical depth (AOD), Ångström parameters and column water vapor via direct sun measurements, and inversion products (Dubovik and King, 2001) derived from the direct sun and sky radiance measurements, such as aerosol size distribution, single scattering albedo and refractive index.

Problems related to instrument calibration were detected during near two years and solved by developing a new correction method denominated KCICLO (Cachorro et al., 2004). The method provided in situ correction for aerosol optical depth measure-

ments. This method was applied to the AOD data at El Arenosillo and showed that the estimated AOD absolute error for AERONET field instruments (0.02) was exceeded during some periods.

Five Cimel instruments have been deployed consecutively at El Arenosillo, following AERONET protocols: instruments number #48, #114, #45, #50, and #45 up to now. Instruments #48 and #114 presented problems in 440nm and 670nm channels, with negative values or accused diurnal cycle due to calibration errors. The comparison between AERONET and KCICLO data bases shows absolute AOD systematic differences up to 0.03 during summer time (errors are modulated by airmass), what means 30% of error for a usual AOD=0.1. Opposite errors in Cimel#48 and #114 lead to compensation, so that differences between AERONET and KCICLO for the whole data series are smaller, around 0.012 at 440nm.

The correction applied has resulted in a more consistent AOD data series. Thus, the climatological evaluation is made with this data-base, parallel to that reported by AERONET. Average value for AOD at 440nm is 0.17(std. 0.13), decreasing with wavelength to 0.11(std. 0.09) at 670nm, 0.09(std. 0.08) at 870nm and 0.085(std. 0.080) at 1020nm. Average value for the alpha Ångström parameter is 1.04(std. 0.43). In this evaluation desert dust events are included. Now we are developing a method for desert dust detection in order to evaluate separately desert events and ordinary (maritime) conditions.

According to Smirnov (2003) pure maritime aerosol may present AOD at 500nm. smaller than 0.15 and Ångström exponent less than 1. Thus continental and anthropogenic influences result in a mixed maritime aerosol, as expected in a coastal site, with higher AOD and alpha than expected for pure maritime aerosol. In addition, frequent Sahara dust events (estimated around 15% of days) increase AOD average values at El Arenosillo, since AOD values above 1 at may occur. Note the high values for standard deviation in AOD and alpha, that result from the high variability of aerosol type and loading in this region.

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