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Aerosol scattering optical properties by nephelometer measurements at the El Arenosillo site (SW coastal area of Spain)

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Aerosol scattering "in situ" measurements were carried out at the monitoring station ESAT-El Arenosillo as part of the development of the "Laboratory of in situ aerosol measurements" in the frame of the scientific collaboration between INTA (National Institute of Aerospace Technology of Spain) and the "Atmospheric Optics Group" of the University of Valladolid (GOA-UVA). This station belonging to INTA is located on the Atlantic coast of the province of Huelva, (southwestern Spain), known as the Gulf of Cádiz. The present study analyzes the measurements carried out by a 3-wavelength commercial integrating nephelometer (450, 550 and 700 nm, TSI Company), between January 2006 and May 2008. This work adds a new and complementary insight on the global aerosol characterization in this area of study, where an extensive and detailed analysis of the columnar aerosol properties and "in situ" size distributions has been carried out in the last years.

Light scattering coefficient σ_{sp} and hemispheric back-scattering coefficient σ_{bsp} were measured continuously attempting to keep dry conditions (as recommended by WMO/GAW). Ångström exponent α has also been derived using the different pairs of wavelengths. The hemispheric fraction b is obtained from the ratio σ_{bsp}/σ_{sp}. All these parameters have been carefully analyzed to investigate their general characteristics and features, such as annual, seasonal and diurnal variability. Prior to performing this analysis, a careful and detailed evaluation of the measurements was performed to ensure high-quality data. After a visual inspection of the raw data, three levels of corrections have been applied: drift in the calibration constants, ambient conditions (humidity, precipitation) and angular correction. The influence of these corrections on the number of data and on the mean values of these scattering coefficients, have been evaluated.

For the whole period the average and standard deviation for the mentioned scattering aerosol coefficients are σ_{sp}(550 nm)= 48$\pm$38 Mm-1, α(450/700) =1.36$\pm$0.54 and b =0.122$\pm$0.020. To analyze these data, a cold and a warm season are considered (instead of the usual four seasons), so that the results show a consistent relation with the weather conditions characterizing this area. For all these parameters the highest values are obtained during the cool season and the lowest values during the warm months. The diurnal cycles of σ_{sp} and α do not typically follow those of thermodynamic variables as temperature or relative humidity. Instead, they appear to be governed by synoptic winds and land-sea breeze. In addition, expected normal values of the optical properties are frequently affected by the arrival of desert dust aerosol and also by re-circulations events, especially in summer.

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