Estimating absorption and scattering efficiencies for particulates PM10 at urban site

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The role of atmospheric aerosols on climate is a major environmental issue nowadays. Contrary to the greenhouse gases, which are widespread and well mixed globally, the distribution of aerosols is quite patchy and depends on the presence of natural and anthropogenic sources. So, the knowledge of aerosols is crucial to evaluate their impact on climate, specially the scattering and absorption properties have been reported for several locations (Pereira et al., 2008, Elias et al., 2006; Li et al., 2007; Lyamani et al., 2010). However, despite significant progress in understanding aerosol effects on climate there are still significant uncertainties due to the lack of information on the temporal and spatial variability of aerosol particles and their associated properties.

The objective of this work is to determine the scattering and absorption efficiencies for PM10 particulates at urban site of Eastern of Spain (Granada, 37.18°N, 3.58°W, 680 m a.s.l), from February 2006 until December 2007. The instrumentation used was an integrating nephelometer (TSI, model 3563) to obtain the aerosol scattering coefficient at 450, 550 and 700 nm (σ_{sp}), and an Absorption Photometer (MAAP) operating by single-wavelength (670 nm) to derive the aerosol absorption coefficient(σ_{ap}), this last instrument provides absorption coefficient with high accuracy. A detailed description of the instrumentation and experimental site can be found in Lyamani et al. (2010). The data were analysed in terms of aerosol mass density and scattering and absorption properties. From these the scattering, $\alpha_{sp,}$ and absorption efficiencies, α_{ap}, were estimated for PM10 particulates, defined as the ratio of the scattering and absorption coefficient to the mass density.

The minimum and maximum values of PM10 mass density were 15 and 194 μg/m^3, respectively, but only in exceptional cases the values exceed the value of 100 μg/m^3. Pereira et al. (2008) have found similar values in the range 5 and 99 μg/m^3 at Évora (Portugal). The largest values of PM10 mass concentration and the scattering coefficient were achieved under influence of desert dust.

Figure 1 shows the monthly averages of α_{ap} for the analyzed period. There is a clear seasonal pattern, with largest values during cold and wet months and lowest values during dry months. Similar patterns, but less pronounced, has been encountered for α_{sp}. On the other hand, these seasonal variations occur also for the scattering and absorption coefficients (Lyamani et al., 2010). Table 1 shows a simple statistical for both efficiency parameters. This range of values is in good agreement with values ranging from 0.21 to 1.05 m^2/g for α_{sp} at different locations (Vrekoussis et al., 2005).

Table 1. Statistical parameters for the absorption and scattering efficiencies (σ=standard deviation)

Parameter	Mean value±σ	Range
α_{ap}(m^{2}g^{-1})	0.51±0.22	(0.12,1.02)
α_{sp}(m^{2}g^{-1})	1.30±0.50	(0.24,2.97)

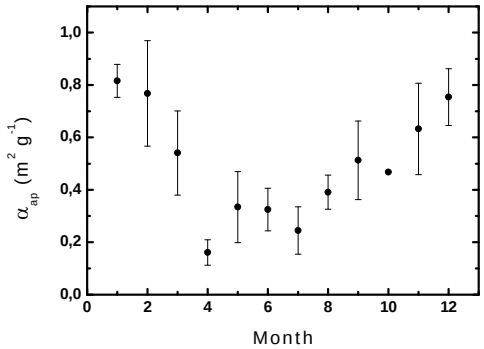

Figure 1. Monthly averages of absorption efficiency for the analysed period.

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Elias et al. (2006). *J. Geophys. Res.,* 111, D14204.
Li et al. (2007). *J. Geophys. Res..,* 112, D22S04.
Lyamani et al. (2010)*Atmos.Chem. Phys.,*10, 239-254.
Pereira et al. (2008) *Atmos.Environ. ,* 42, 7623-7631.
Vrekoussis et al. (2005) *Atmos.Environ.,*39, 7083-7094.