Relationship between ground-based remote sensing and in situ aerosols measurements: a 13-month study

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Atmospheric aerosols influence the radiative budget of the Earth-Atmosphere system, playing an important role in climate. Furthermore, they cause and/or exacerbate health problems. Several methods have been developed for monitoring atmospheric aerosols in order to estimate and reduce their impacts. Ground-based remote sensing and in situ aerosols measurements are complementary tools in the search for a link between aerosol properties and climate change. Aerosol optical properties depend on their chemical composition and mixing state as well as their size and shape (Luoma et al., 2019). The main aim of this study is to analyse the evolution of the aerosol optical properties retrieved from two AERONET sites and explore its relationship with ground-based in situ measurements of aerosol size distribution.

The study period was from February 2016 to March 2017. The mean particle number size distribution parameters (PNSD) have been recorded every 3 hours in León (Spain) using: i) a Scanning Mobility Particle Sizer spectrometer (TSI-SMPS Model 3938) to measure the Particle Number Concentration (PNC) between 14 and 736 nm in 110 channels; ii) an optical spectrometer Passive Cavity Aerosol Spectrometer Probe (PCASP-X) to obtain the coarse aerosol particle size distributions between 803 nm and 17.42 µm (after Mie theory correction). Also, several optical parameters have been obtained from the two AERONET sites closer to León (~100 km), located in Palencia (41°9'N, 4°7'W) and Valladolid (41°7'N, 4°7'W). Theses parameters were: single scattering albedo (*SSA*), absorption Ångström exponent (AAE), asymmetry parameter (*g*) and aerosol optical thickness (*AOT*) at four wavelengths (440, 675, 870 and 1020 nm).

Preliminary results indicate a positive relationship between PNC registered at León and *AOT* at Valladolid (R^2=0.55). The relationship of *AOT* between AERONET sites reported a R^2=0.79. However, *SSA* values between these sites were significantly different, with an opposite pattern during summer months (Figure 1). In León, the highest PNC was registered in February 2016, probably due to the emissions from traffic and heating devices, and during summer months because of new particle formation events and Saharan dust intrusions. Saharan outbreaks caused the maximum mean concentration of particles higher than 1000 nm in June 2016 (0.14 cm^{-3}), matching with the maximum SSA (0.96) at Valladolid.

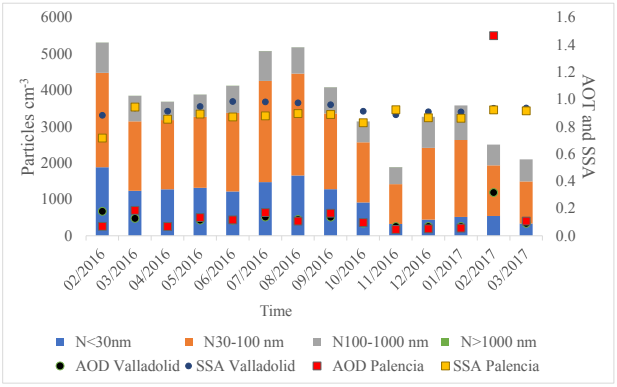

Figure 1. Evolution of optical parameters (*SSA* and *AOT* at 440 nm) at Palencia and Valladolid, and particle number concentration by size ranges in León.

The study of the relationship between aerosols parameters at ground level and those integrated in the vertical column may increase the knowledge about the effect of aerosol emissions on the radiative forcing. Thus, this information can be very useful for climate models.

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References

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