

Influence of Mineral Dust Transport from North Africa in the Concentration and Size Distribution of Aerosol in León (Spain)

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During the summer months, the Iberian Peninsula is exposed to intrusions of mineral dust from North Africa. These intrusions lead to an alteration in the atmospheric particulate content, contributing to coarse sized particles mainly composed of minerals. Mineral dust makes the highest contribution to atmospheric particulate material at global level (IPCC, 2001), which means that characterising its properties is essential to understand its repercussions on the climate.

This study presents a series of particle measurements made in the city of León, in north western Spain, on the 28th and 29th of June 2012, during the final stage of an event involving the arrival of Saharan dust into the Iberian Peninsula.

In order to characterise the atmospheric particle content, a laser spectrometer (Passive Cavity Aerosol Spectrometer Probe, PMS Model PCASP-X) was set up in the north east of the city. This device makes it possible to measure discrete particle sizes ranging between 0.1 and 10 μm in 31 channels. During the study period, measurements were taken at 15-minute intervals each hour. As environmental particles present a different refractive index to that used for PCASP-X calibration (latex particles: 1.59 -0 i), raw size bins were corrected using a program based on Mie Theory. Different refractive indices were used: i) 1.59 -9 $\times 10^{-3}$ i for measurements affected by mineral dust intrusions (Kandler *et al.*, 2007) and ii) 1.574 -9.13 $\times 10^{-2}$ i for urban aerosol measurements not affected by dust intrusions and considering the relative humidity (Kim and Boatman, 1990).

The meteorological data used in this study were obtained from a weather station located next to the probe, which allowed us to gather one-minute measurements of the pressure, temperature, humidity, precipitation and wind speed and direction.

The PM₁₀ measurements recorded at the three air quality stations in the city of León were also taken into account.

This study examined the incidence of the mineral dust on the number of particles and their size distributions in the city of León, and the influence of meteorological variables in recovering the atmospheric particle content. An analysis was also made of the implications of this intrusion of Saharan dust on the legal air quality controls in relation to PM₁₀ concentrations.

On the 24th of June 2013, the first mass of Saharan dust of the summer entered the Iberian Peninsula from the south west, remaining until the 29th of June 2012. From the 27th of June onwards, this

intrusion began to affect the atmospheric particle content of the city of León. The highest particle concentrations were recorded on the 28th, with an average daily value of 535 \pm 220 particles cm⁻³. From the aerosol size distributions, it was observed that these particles corresponded to sizes in excess of 0.3 μm . This increase corresponds to the largest fraction of fine mode and coarse mode.

The recovery of the local particulate content was conditioned by the wind speed and direction recorded on the 28th. Between 1759 UTC and 1800 UTC, predominant winds from the WSW and W were recorded, with an average speed of 3.9 \pm 0.1 m s⁻¹. These winds blew the mineral dust towards the city, as a result of which the average number of particles for this time interval was very high: 790 \pm 210 particles cm⁻³. However, between 1800 UTC and 2300 UTC, the average wind speed was 2.6 \pm 1.1 m s⁻¹ from the WSW, allowing clean air to enter and facilitating the recovery of the local particulate content. During this time interval, an average number of particles of 420 \pm 80 particles cm⁻³ was recorded.

On the 29th of June, the local particulate content was fully recovered. During this day, the average number of particles recorded was 320 \pm 80 particles cm⁻³.

The arrival of this intrusion of Saharan dust in the city affected the legal controls of air quality. On the 28th of June it exceeded the daily PM₁₀ limit (defined in Royal Decree 102/2011 as 50 $\mu\text{g m}^{-3}$) in the three air quality stations of León City Council, with values of 122, 155 and 139 $\mu\text{g m}^{-3}$. On the 29th of June this value did not exceed 20 $\mu\text{g m}^{-3}$ in any of the air quality stations, which confirms the recovery that was observed in the numeric concentration of particles.

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