

Impact of Saharan dust intrusions on air quality at León (Spain) during the summer of 2016

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The Iberian Peninsula is commonly affected by Saharan dust intrusions due to its location. These events occur most frequently in summer, when dust transportation is governed by the anticyclone over the East or Southeast of the Iberian Peninsula (Rodríguez et al., 2001). In Spain, the daily limit value of the PM₁₀ mass concentration (DLV of Directive 2008/50/CE, 50 µg/m³) is usually exceeded as a consequence of Saharan dust outbreaks (Rodríguez et al., 2001). Some studies have reported the effects of coarse particles on total daily mortality during Saharan dust intrusions and their negative impact on climate, biogeochemistry and air quality (Perez et al., 2008).

This study aims to analyse the Saharan dust outbreaks that reached León (Spain) in summer (July, August, September) 2016. Sampling was carried out at the University of León, Spain (42° 36' 50" N, 5° 33' 38" W, 846 m asl), between 1 July and 30 September 2016. Different instruments were used: *i*) an optical particle counter (PCASP-X) and a high resolution nanoparticle sizer (SMPS Model 3938) for the continuous monitoring of particle size distributions, *ii*) a low volume sampler (TECORA, ECHOPM) operated with 47 mm diameter teflon filters and *iii*) a high volume sampler (CAV-A/Mb) equipped with 150 mm diameter quartz filters. Quartz filters were used for determining PM₁₀ (by gravimetry). Teflon filters were used for the analysis of water soluble ions (ion chromatography) and trace elements (PIXE). In addition, an automatic weather station located in the sampling site recorded temperature, wind speed and direction, relative humidity and precipitation data. The most frequent weather type was identified with a Circulation Weather Types classification (CWTs) (Lamb, 1972). Air masses were analysed using back trajectories from HYSPLIT model. The intrusion data reports by the Spanish Ministry of Agriculture, Food and the Environment (<http://www.mapana.gob.es>), were used.

In summer 2016 a total of five episodes of African dust intrusion reached León, according to information provided by MAPAMA: *i*) between 4 and 7 July; *ii*) between 19 and 21 July; *iii*) 30 July; *iv*) 27 August; *v*) between 3 and 7 September. The hourly evolution of the aerosol size distribution was obtained. In addition, the inhalable, thoracic, tracheobronchial and respirable fractions were also evaluated for healthy adults and high risk groups, following the Spanish standard UNE 77213.

The back trajectories confirmed that there was an air mass from North Africa that arrived at the Iberian Peninsula and the circulation weather type during these episodes was mostly northerly anticyclonic. The evolution of temperature and relative humidity showed an increase and a decrease in their values, respectively, during the days in which Saharan dust intrusions were reported, reaching highs of 25.7 °C and 34% on 19 July. PM₁₀ levels showed an increment with a maximum on 19 July (40 µg/m³), followed by 6 September (38 µg/m³), not exceeding the DLV. Also, an increase in Al, Mg, Ti, Si, Ca, K and Fe concentrations was observed. These elements have mostly crustal origin and confirm that there is an important contribution from desert dust. On 27 August, the sulphate concentration registered a very significant increase, reaching the highest value of the entire summer (7.9 µg/m³), mainly due to the African dust intrusion reported on this day.

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