IMPACT OF SAHARAN DUST INTRUSIONS ON AIR QUALITY AT LEÓN (SPAIN) DURING THE SUMMER OF 2016

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INTRODUCTION

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 PM_{10} mass concentration (DLV of Directive 2008/50/CE, 50 μg/m^3) is usually exceeded as a consequence of Saharan dust outbreaks (Querol et al., 2004). 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 analyze the Saharan dust outbreaks that reached León (Spain) in summer (July, August, September) 2016.

STUDY AREA

León city, belonging to the Province of León, is located in the northwest of the Iberian Peninsula. Sampling was carried out at the University Campus of León, Spain (42° 36' 50" N, 5° 33' 38" W, 846 m asl), between August 1 and September 10, 2016 (Fig. 1).

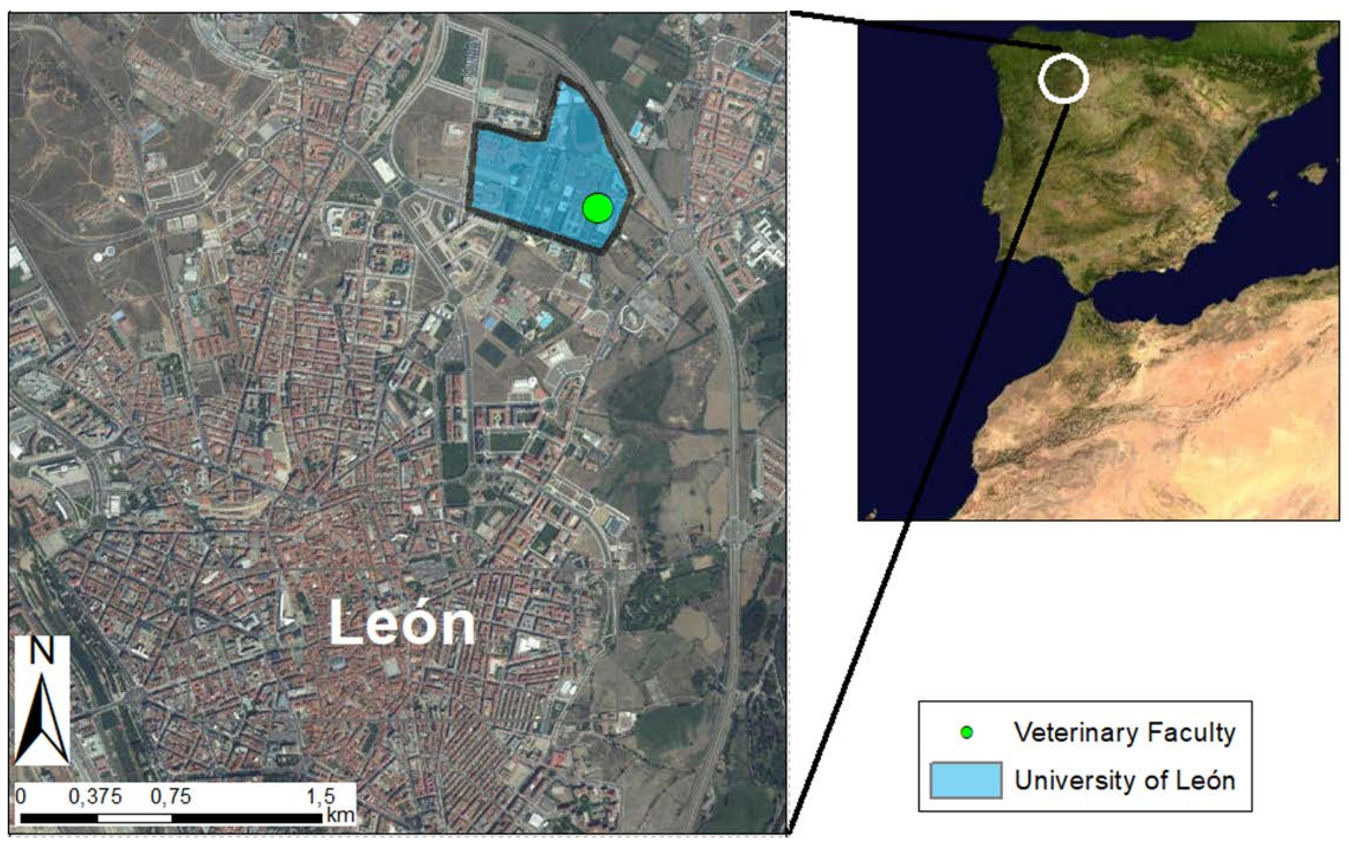


Fig. 1. Location of the sampling site

SAMPLING AND ANALYSIS

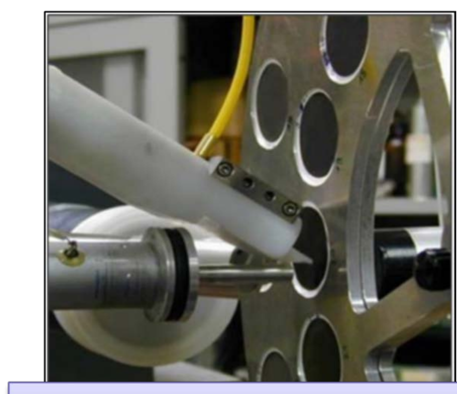
Automatic weather station recorded temperature, wind speed and direction, relative humidity

Optical particle counter (PCASP-X): Continuous monitoring of particle size distribution (0.1-10 μm)

High resolution nanoparticle sizer (SMPS): Continuous monitoring of particle size distributions (0.018-1 μm)

High volume sampler (CAV-A/Mb): Collection of PM_{10} (150 mm diameter

Thermo Scientific Dionex^{TM} ICS-5000 Ion Chromatography : Analysis of water soluble ions



PIXE (Particle-Induced X-ray Emission): For the analysis of major and trace elements

Low volume sampler (TECORA, ECHOPM): Collection of PM_{10} (47 mm diameter teflon filters)

Fig. 2. Sampling and analysis instrumentation

RESULTS AND CONCLUSIONS

- In summer 2016 a total of five episodes of African dust intrusion reached León, according to the 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 back trajectories confirmed that an air mass from North Africa arrived at the Iberian Peninsula..

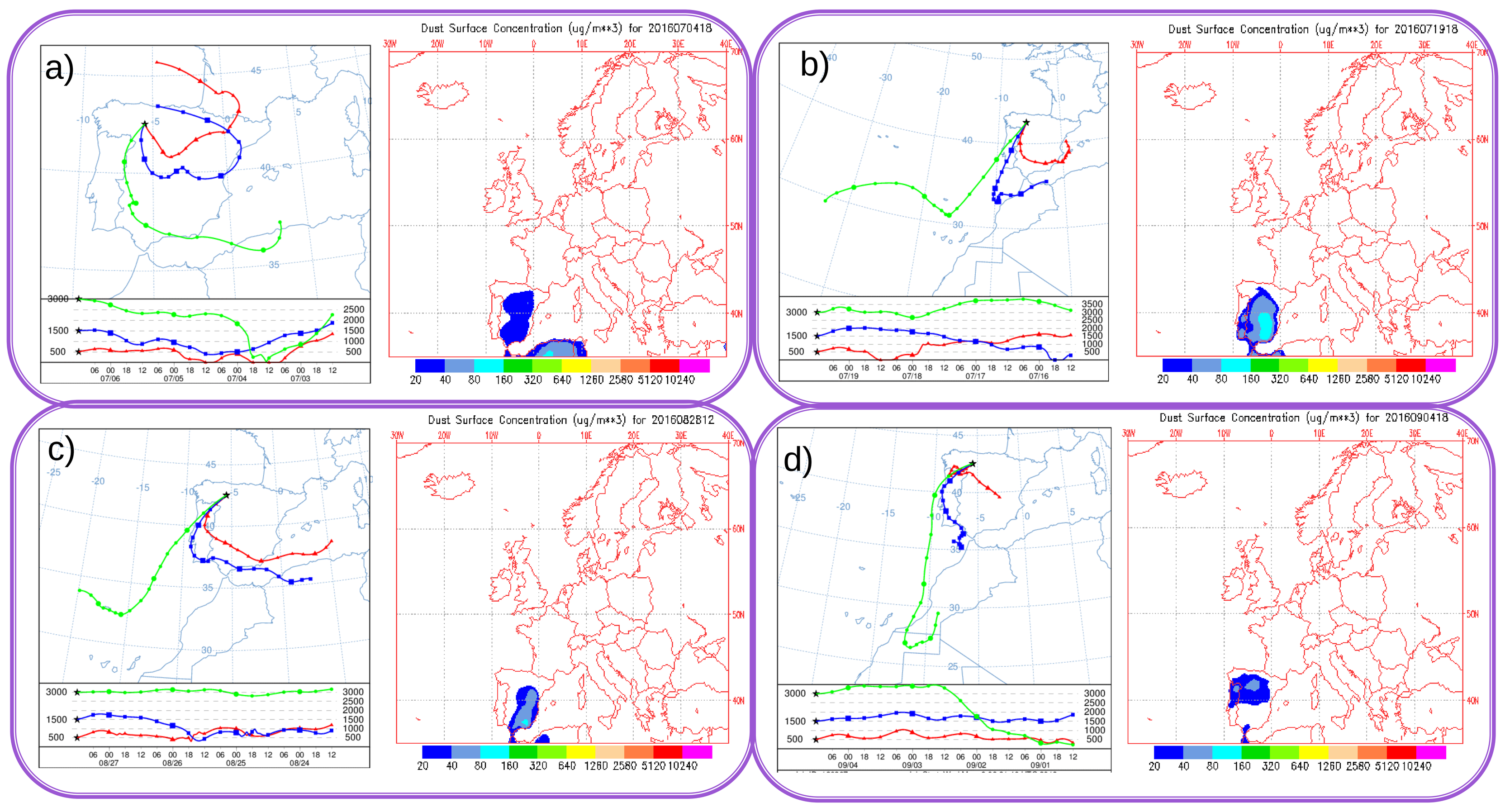


Fig. 3. Hysplit back trajectories at 500, 1500 and 3000 m and NAAPs images of dust concentration of a) 6 July, b) 19 July, c) 27 August and d) 4 September 2016**.**

- 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 peaks of 25.7 ºC and 34% on 19 July (not shown here).

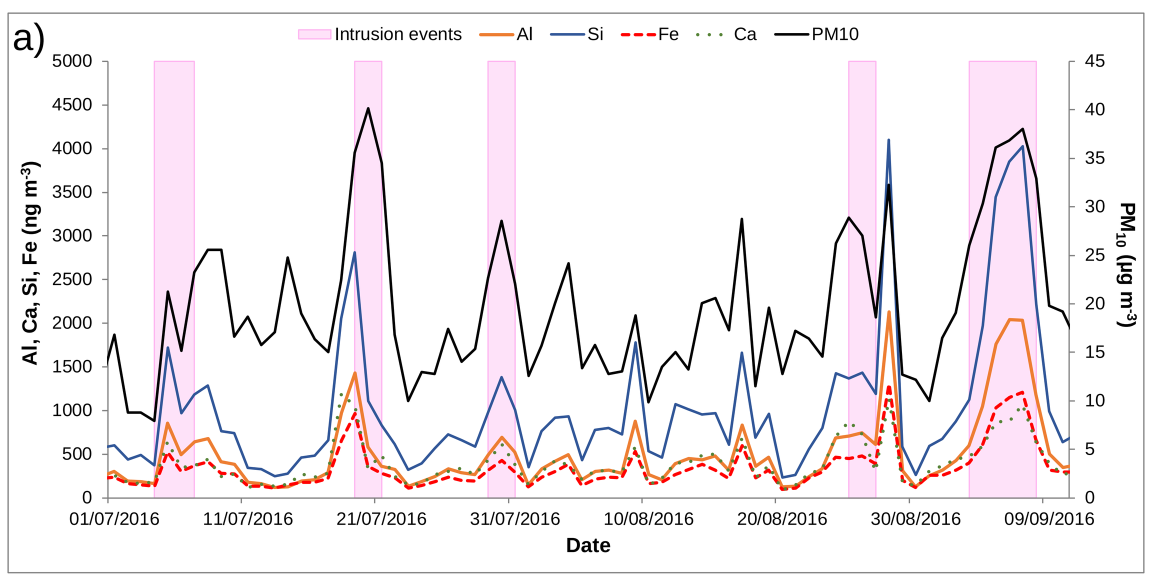


Fig. 4. a) Daily evolution of Al, Ca, Si, Fe and PM_{10} concentrations between July 1 and September 10, 2016 and b) quartz filter sampled on July 19.

There was an important increase of particles with aerodynamic diameters > 100 nm during the events, reaching a maximum of 12407 particles cm^{-3} on July 21, 2016 between 0000-0100 UTC.

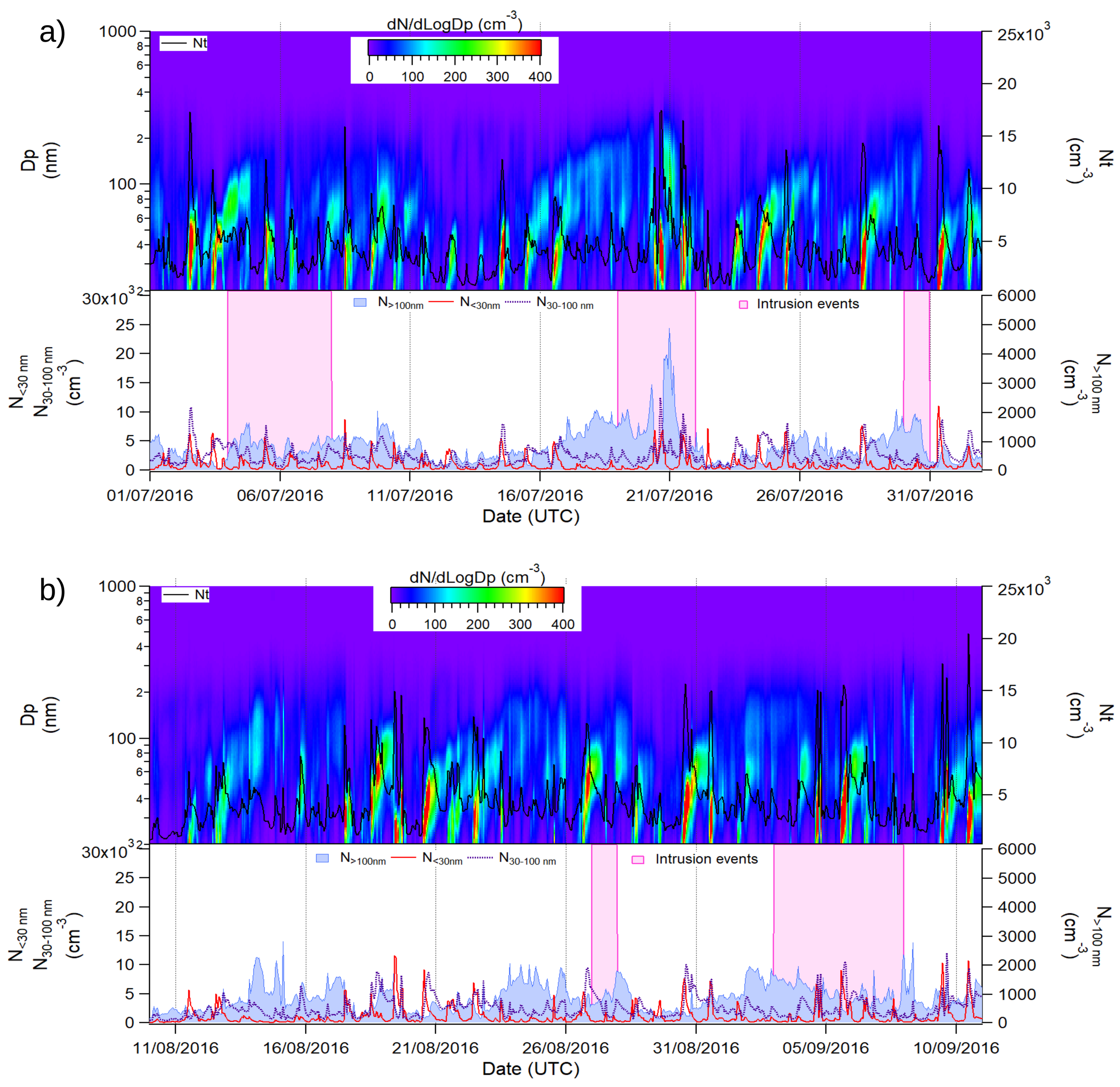


Fig. 5. Evolution of the aerosol size distributions, total particle number concentration (N_t) and particle concentration for each of the three modes: nucleation ($N_{<30nm}$), Aitken ($N_{30\text{-}100nm}$) and accumulation ($N_{>100nm}$) for the months of a) July and b) August and September.

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.

PM_{10} levels showed an increment with a maximum on 19 July (40 μg/m^3), followed by 6 September (38 μg/m^3), not exceeding the DLV.

- On 27 August, the sulfate concentration registered a very significant increase, reaching the highest value of the entire summer (7.9 μg/m^3), probably due to the African dust intrusion reported on this day (not shown here).

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