Air pollution in León during a set of forest fires in the NW of the Iberian Peninsula: a post-fires rain event

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In the Mediterranean area, forest fires have increased in number and surface over the last 50 years, becoming a health, environmental and social problem (Chen et al., 2017). An example is the set of fires that occurred in Galicia, Asturias, León and North of Portugal in October 2017. In total, more than 100,000 ha were burned between 14 and 16 October, the majority being arsons. The plumes from wildfires reached the most populated cities of the northwestern Iberian Peninsula and even central Europe (Fig.1), causing dark skies in the cities with a high ash content.

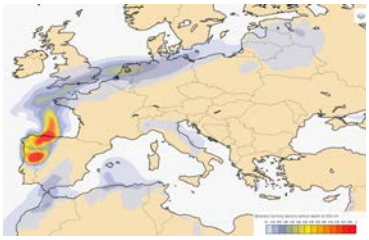

Figure 1. Biomass aerosol optical depth at 550 mm forecast on 17/10/2017 from the Copernicus Atmosphere Monitoring Service.

The aim of this study was to analyze the main air pollutants during the fires and the scavenging effect of a post-fires rain event.

The sampling site was located at the campus of the University of León (Spain), a city placed in the NW of the Iberian Peninsula. The data collection was carried out between 16 and 18 October 2017.

Several sampling instruments were used: i) particle size distributions were measured every minute using an optical spectrometer PCASP-X (that measures the concentration of aerosols with diameters between 0.1 and 26.8 µm in 31 channels); ii) nanoparticle size distributions were measured every six minutes using a high resolution nanoparticle sizer (SMPS Model 3938) between 7.6 and 310.6 nm in 104 channels; iii) an AE31 Aethalometer for measuring Black Carbon (BC) concentration; iv) a laser disdrometer Thies LPM which registered raindrops between 0.125 and 8 mm size in 22 channels; v) a Davis Weather Station to monitor some meteorological variables; vi) a High-Volume Air Collector, CAV-A/Mb model, that uses 150 mm diameter quartz filters; vii) an automatic wet-only collector Eigenbrodt model UNS130/E. Additional data provided by the regional air quality network related to PM_{10}, O_3, SO_2 and NO_X concentrations were also taken into account. Besides, in order to determine the origin of the air masses during the studied period, HYSPLIT4 (Hybrid Single Particle Lagrangian Integrated Trajectory) back-trajectories were calculated.

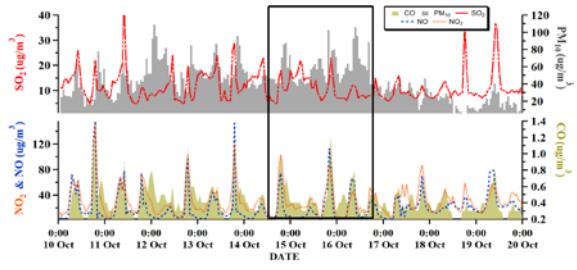

Figure 2. Evolution of PM_{10}, NO_x, CO and SO_2 concentration in León between 10 and 20 October (data source: Regional Air Quality Network).

High concentrations of air pollutants were registered in León during these days, reaching hourly PM_{10} values of 106 µg m^{-3} at 0900 UTC on 16 October (Fig. 2). This day, at 1509 UTC, a rainfall event occurred in León with a duration of 128 minutes and an accumulated rainfall of 0.84 mm. On 17 October at 0154 UTC, another rain event (4.84 mm and 582 minutes duration) started. It produced a patent scavenging, with a PM_{10} decrease of 42.5%. BC maximum concentration (7.94 µg m^{-3}) was recorded on 16 October, at 1806 UTC. At the same time, the nucleation, Aitken and accumulation maximum concentrations reached values of 3000, 7156 and 4555 # cm^{-3}, respectively. Furthermore, aerosol and rainwater chemical composition has been studied in detail.

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