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IMPACT OF THE SIERRA DE LA CULEBRA WILDFIRE ON THE AIR QUALITY OF THE CITY OF LEÓN: AEROSOL CHARACTERIZATION AND INFLUENCE OF METEOROLOGICAL CONDITIONS

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Wildfires and air pollution pose significant challenges in the Mediterranean region, with implications for both human health and the climate, with complex interconnections between them. An instance is the wildfire that occurred in Sierra de la Culebra, Zamora, Spain, from July 15th to 20th, 2022, affecting approximately 30,000 hectares. During the fire, air masses carried the smoke plume directly towards the city of León, located 100 km away from the fire zone (Fig. 1). The objective of this study is to delineate the principal findings concerning the total number concentration of aerosol particles, their carbonaceous content, and their light-scattering properties in León during this period, taking into account meteorological variables.

The sampling campaign was carried out at the campus of the University of León (Spain) during July 2022. Several sampling instruments were used: i) a Total Carbon Analyzer (TCA08) coupled with an aethalometer AE33 to detect Organic Carbon (OC) and Black Carbon (BC) (and, therefore Total Carbon-TC) in PM10; iii) a Scanning Mobility Particle Sizer spectrometer (TSI-SMPS Model 3938) to measure the particle number concentration between 8 and 310 nm in 110 channels; iv) an Ecotech Aurora 3000 nephelometer to measure the forward and backward scattering at three wavelengths (450, 525 and 635 nm) and; v) a weather station to monitor some meteorological variables.

Fig. 1. Backward trajectories of air masses for a 24-hour duration at 100 (red), 300 (blue) and 500 m (green) over León on the 18/07/2022 at 2300 UTC. The point of wildfire is marked with a flame. Source: HYSPLIT model.

All pollutant concentrations increased significantly due to the arrival of the plume the day 18th until 20th (Fig. 2). Below are the maximum hourly concentrations reached during the fire: i) OC concentration of 61.9 μg m^{-3} on 19/7/2022 at 1900 UTC - it should be noted that the equipment saturated due to high concentration on July 18th); ii) BC concentration of 20.2 μg m^{-3} on 18/7/2022 at 2300 UTC; iii) total particle concentration of 21,400 particle cm^{-3} with a geometric mean of 20.3 nm on 18/7/2022 at 2300 UTC; iv) a maximum scattering Ångström extinction coefficient ($SAE_{525\ nm/635\ nm}$) of 2.61 on 19/7/2022 at 1700 UTC. It's important to highlight that the temperature presented a decrease in both its maximum and minimum values to 11 and 12 ºC, respectively, due to the plume's arrival, the absorption of heat of aerosols in the atmosphere and the inability to reach the Earth's surface radiation (Jiang *et al.*, 2020). However, the relative humidity doubled during the days when the city was covered by smoke.

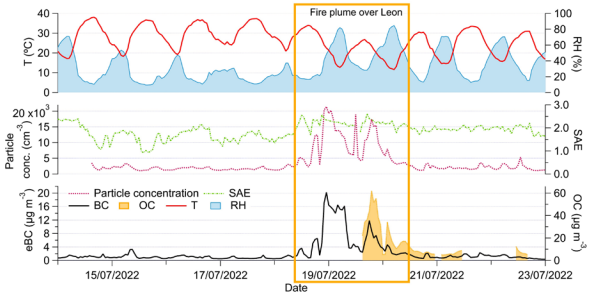

Fig. 2. Evolution of particle concentration, BC, OC, $SAE_{525\ nm/635\ nm}$ and meteorological conditions between 14 and 23 July 2022 at León.

Given the increase in wildfire frequency in Mediterranean area, the study of "extreme" situations becomes crucial for public health, facilitating the launch of population alerts. The next step in our study will be analyze the influence of such wildfire on radiative forcing.

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