

Devasting wildfires in Sierra de la Culebra (Zamora, Spain): impact on the air quality of Castilla y León

J.M. Paniagua, C. Blanco-Alegre, A.I. Calvo and R. Fraile

Department of Physics, Universidad de León, León, 24071, Spain

Keywords: aerosol, gases, Saharan dust outbreaks, transport, wildfires

Associated conference topics: 2.9, 4.1

Presenting author email: cblaa@unileon.es

Air pollution generated by forest fires is a growing problem in recent years in the Mediterranean area. The high temperatures recorded are one of the main factors that enhance the appearance and severity of these phenomena (Barbosa et al., 2008). Other events that affect air pollution in the Iberian Peninsula are the Saharan dust outbreaks. They transport large amounts of particles, sometimes leaving clouds of dust that reduce visibility and can cause problems in different fields (human health, aviation, ecosystems, heritage, etc.) (Oduber et al., 2020).

In the summer of 2022, two large fires took place in the Sierra de la Culebra (Zamora, NW Spain). They were caused by an electrical storm. The first one (FF1) began on June 15 and was controlled on June 24, and the second (FF2) started on July 17 and was controlled on August 14. More than 55,000 hectares were consumed by both fires (Junta de Castilla y León, 2023).

The aim of this study is to analyze the impact of the wildfires occurred in Sierra de la Culebra on the air quality in Castilla y León. In order to analyze the pollution levels before, during and after the fires, the study period covers from April to October 2022.

The pollutant concentrations have been obtained from the Castilla y León Air Quality Network (<http://servicios.jcyl.es/esco/index.action>). Specifically, work has been carried out with hourly data from the air quality stations of León, Zamora and Valladolid. The air pollutants analyzed include particulate matter (PM₁₀ and PM_{2.5}), CO, NO, NO₂, SO₂ and O₃.

The evolution of the concentration of the different pollutants was studied. Thus, for example, two important peaks of PM₁₀ were identified in the region (Fig. 1): i) the first one (maximum hourly concentration of 123 µg/m³ in León, 205 µg/m³ in Valladolid and 126 µg/m³ in Zamora) registered in June, seems to be produced by a Saharan dust outbreak, which may later be overlapped by the emissions from one of the wildfires registered in Sierra de la Culebra (FF1) and ii) the second one (maximum hourly concentration of 234 µg/m³ in León, 126 µg/m³ in Valladolid and 120 µg/m³ in Zamora) in July, probably caused by the second fire (FF2). SO₂ reached values of 40 µg/m³ on July 22 in Valladolid and of 7 µg/m³ on July 20 in Zamora.

The application of the Kruskal–Wallis non-parametric test allowed us to determine the existence of statistically significant differences between the

concentrations of pollutants registered in the different periods (before, during and after the fires).

Furthermore, several models have been used to complete this study: i) HYSPLIT (Hybrid Single Particle Lagrangian Integrated Trajectory; from NOAA) to calculate the air mass trajectories; ii) NAAPS (Navy Aerosol Analysis and Prediction System; from U.S. Navy): to study the influence of the Saharan dust intrusions and forest fires in the Iberian Peninsula and iii) Multi-model (from the WMO Barcelona Dust Regional Center) to analyze the impact of dust particles in the atmosphere.

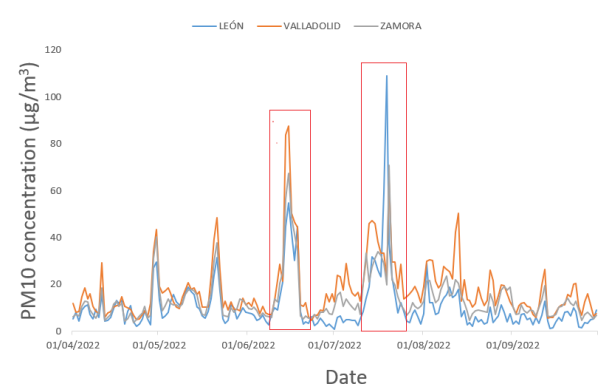


Figure 1. Daily PM₁₀ concentration registered in the air quality station of León, Valladolid and Zamora from April to September 2022.

This work was partially supported by the Junta de Castilla y León co-financed with European FEDER funds (Grant LE025P20). It was also in part supported by the AEROHEALTH project (Ministry of Science and Innovation, co-financed with European FEDER funds. Grant PID2019-106164RBI00). Furthermore, it is part of the project TED2021-132292B-I00, funded by MCIN/AEI/10.13039/501100011033 and by the European Union “NextGenerationEU”/PRTR.

Barbosa, P., Camia, A., Kucera, J., Libertà, G., Palumbo, I., San-Miguel-Ayanz, J. and Schmuck, G. (2008). *Developments in Environmental Science*, **8**, 197–208.

Junta de Castilla y León, 2023. Consejería de Medio Ambiente. Access date: 02/03/2023.

Oduber, F., Calvo, A. I., Castro, A., Blanco-Alegre, C., Alves, C., Barata, J., Nunes, T., Lucarelli, F., Nava, S., Calzolari, G., Cerqueira, M., Martín-Villacorta, J., Esteves, V. and Fraile, R. (2020). *Sci. Total Environ.* **734**, 139202.