WILDFIRES IN THE SIERRA DE LA CULEBRA (ZAMORA): 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, Campus de Vegazana, 24071, León, Spain.
Keywords: aerosol, atmospheric pollution, retrotrajectories, Saharan dust outbreaks, wildfires
Presenting author email: cblaa@unileon.es

EAC 2023
European Aerosol Conference
Malaga (Spain) – September 3–8, 2023

INTRODUCTION

Air pollution generated by wildfires 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 began on June 15 and was controlled on June 24, and the second started on July 17 and was controlled on August 14. The total area affected by both fires was of almost 65,630 ha (of this area, 34,000 ha were of high ecological value as they belonged to the Sierra de la Culebra natural area, which is part of the Meseta Ibérica Transboundary Biosphere Reserve).

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.

MATERIAL AND METHODS

Dust Intrusion (13-16 June)
+
Forest fire (15 to 24 June)
29670 ha burnt

Forest fire
(17 July to 24 August)
35960 ha burnt

Barcelona Dust Regional Center
WMO SDS-WAS Dust Regional Center for North Africa, Middle East and Europe, conducting research and providing operational forecast
Launch of the new website
20 JANUARY 2022
15:00 - 16:00 CET

HYSPLIT

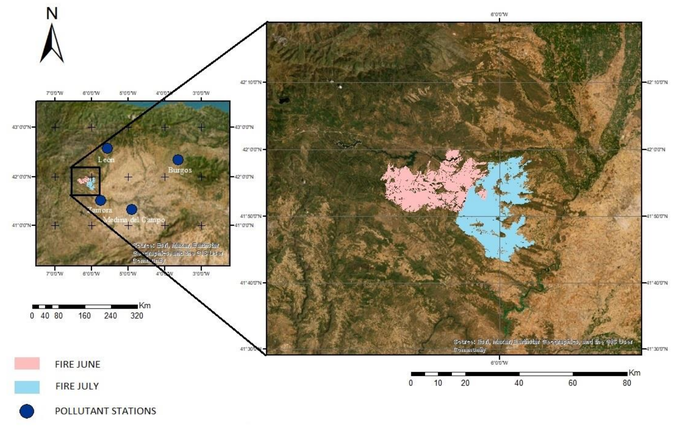

Figure 1. Map showing the four selected air quality stations and the area affected by the two fires studied.

RESULTS

JUNE

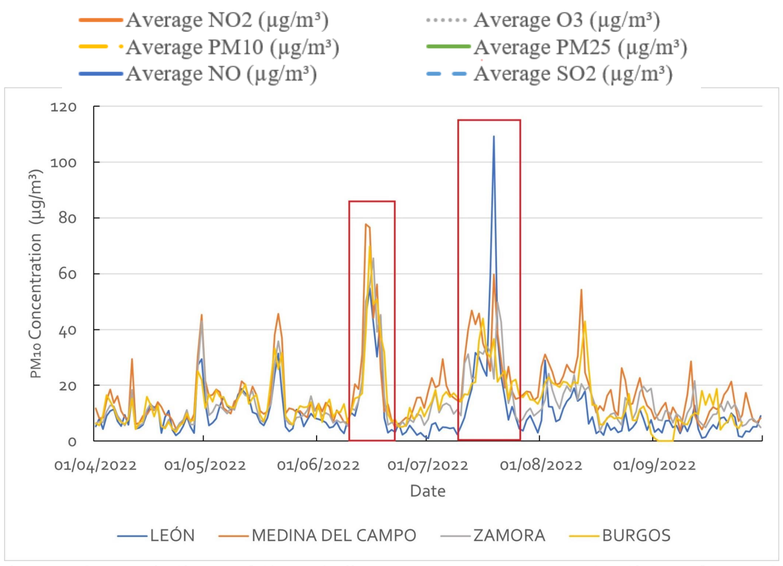

Figure 2. Evolution of the daily average concentration of PM10.

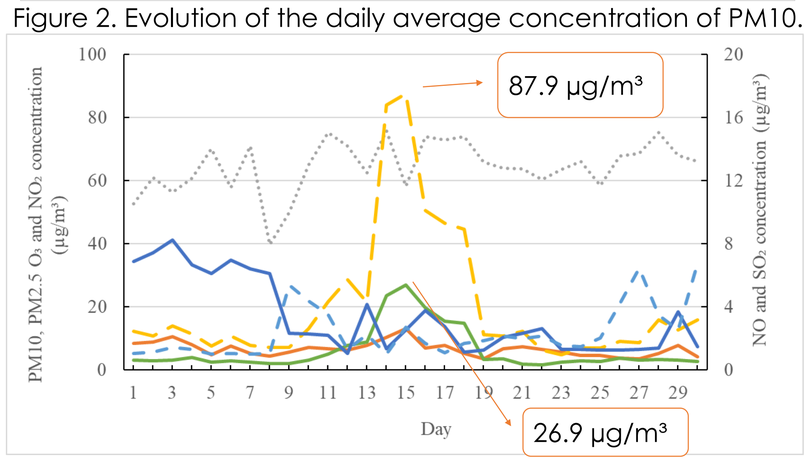

Figure 3. Evolution of the daily average PM10 concentration in Medina del Campo.

JULY

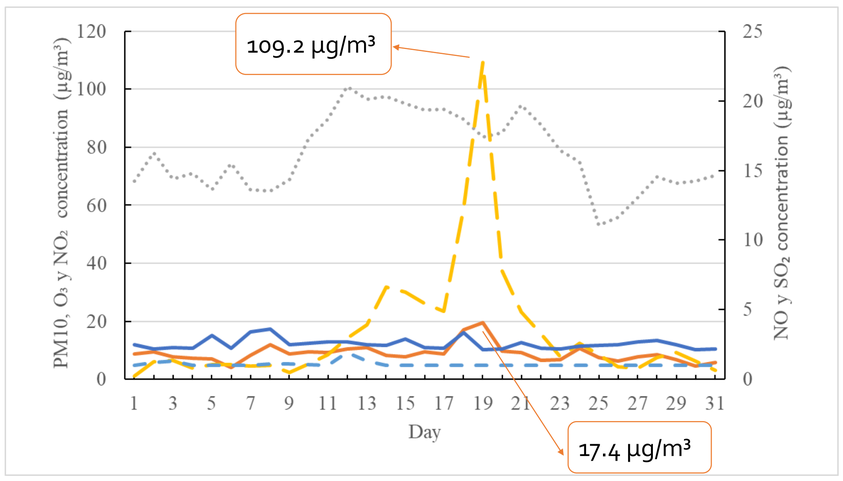

Figure 6. Evolution of the daily average PM10 concentration in León.

Table 1. Statistically significant differences before-during and during-after the event

City	Pollutant
León	O_3
Medina del campo	PM10
	PM2.5
Zamora	CO
	NO_2
	PM10

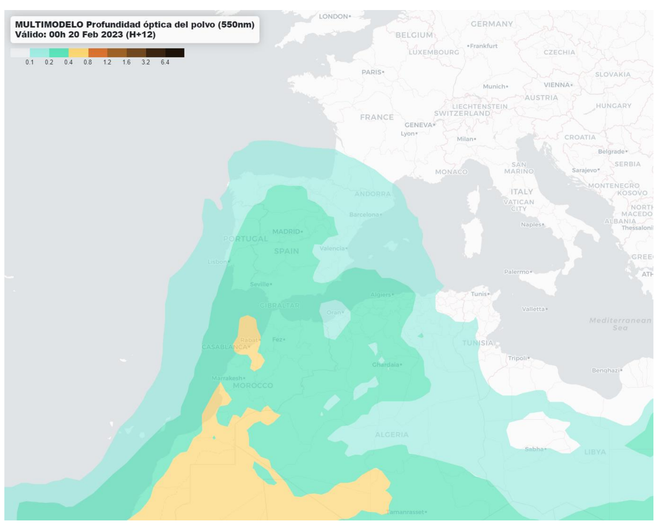

Figure 4. Dust optical depth map (550 nm) for 14 June 2022.

Table 2. Statistically significant differences before-during and during-after the event

City	Pollutant
León	NO_2
	PM10
Medina del campo	PM10
	PM2.5
Zamora	CO
	PM10
	SO_2

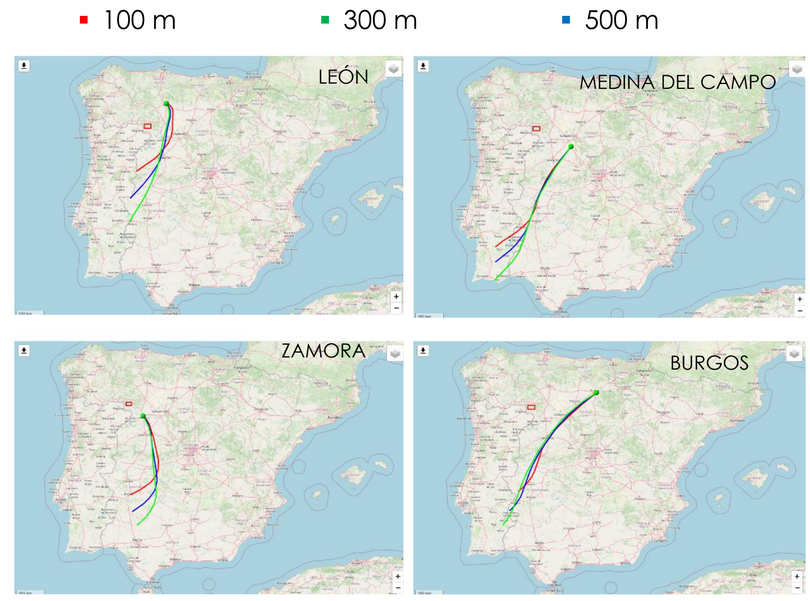

Figure 5. The air mass retrotrajectories of 24 hours duration at León, on the 15th at 4pm; Medina del Campo, on the 14th at 3pm Zamora, on the 15th at 5pm and Burgos, on the 14th at 9pm.

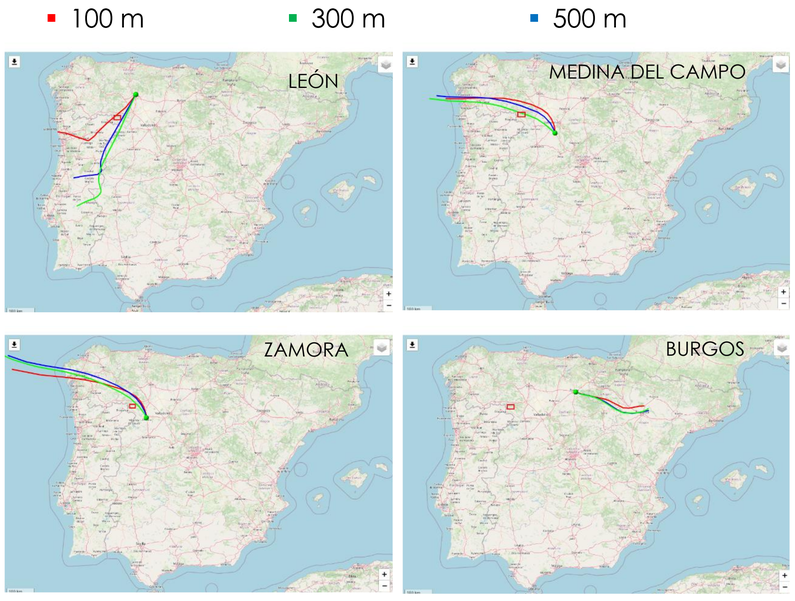

Figure 7. The air mass retrotrajectories of 24 hours duration at León, on the 18th at 15:00 h; Medina del Campo, on the 20th at 09:00 h; Zamora, on the 20th at 07:00 h and Burgos, on the 15th at 20:00 h.

CONCLUSIONS

- PM10 and PM2.5 reached the highest concentrations during the Saharan dust intrusion, with PM10 recording hourly values of up to 205 µg/m³ in Medina del Campo on 14 June.
- Statistical analysis of pollutant concentrations revealed statistically significant differences in the June event between before-during and during-after the fire for PM10 (Medina del Campo and Zamora); PM2.5 (Medina del Campo); NO_2 (Zamora) and O_3 (León). In the July event the observed pattern is similar with statistically significant differences for PM_{10} in the three cities; for PM2.5 in Medina del Campo; for CO in Zamora; for NO_2 in León and for SO_2 in Zamora.
- The concentration of PM10 exceeded on several occasions the daily limit value established by the regulations in León, Zamora and Medina del Campo. The highest value was recorded in León on 19 July, with an average daily concentration of 109.2 µg/m³, under the influence of the forest fire that occurred this month. Ozone recorded exceedances (daily maximum of the eight-hourly moving averages) in all four study cities, although, as expected, it showed no relationship with the events studied. For the rest of the pollutants, no exceedances were recorded.

REFERENCES

- 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. https://doi.org/10.1016/S1474-8177(08)00008-9
- Oduber, F., Calvo, A. I., Castro, A., Blanco-Alegre, C., Alves, C., Barata, J., Nunes, T., Lucarelli, F., Nava, S., Calzolai, G., Cerqueira, M., Martín-Villacorta, J., Esteves, V. and Fraile, R. (2020). *Sci. Total Environ.* **734**, 139202. https://doi.org/10.1016/j.scitotenv.2020.139202

Acknowledgements

This work was partially supported by the Junta de Castilla y Leon 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.