

# AIR QUALITY IN LEÓN AND ALMERÍA (SPAIN): IMPACT OF SAHARAN DUST INTRUSIONS IN THE NORTH-SOUTH CONTEXT

## Introduction

Saharan dust intrusions are a recurrent phenomenon that impact air quality in Spain, especially in southern regions and sometimes even in more northerly areas. Saharan dust is transported by air currents from North Africa to southern Europe, and can cover large areas of the country, causing significant repercussions on air quality and public health. When Saharan dust reaches Spain, it can increase the levels of suspended particles in the atmosphere, which has an impact on visibility and air quality. These particles can contain organic compounds, heavy metals and other pollutants that can be harmful to human health, especially for people with respiratory and cardiovascular diseases. Saharan dust intrusions can also affect the climate and the environment (Oduber et al., 2019). In this context, the present study aims to analyze the air quality in León (NW of Spain) and Almería (SE of Spain), focusing specifically on the impact of Saharan dust intrusions.

## Methodology

- Period studied: 11 years. From 2013 to 2023.
- Air quality data were obtained from the air quality networks of Castilla y León and Andalucía (for León and Almería, respectively – Fig. 1). An urban (León 1 and Plaza del Castillo) and a background stations (León 4 and Mediterráneo) were selected from each city.
- Information on the number, dates, and durations of Saharan dust intrusions in the NW and SE sectors was obtained from the Ministry for Ecological Transition and Demographic Challenge (MITECO).
- Models used: Hysplit and NAAPS. Back-trajectory calculations have been performed air mass origin at specific altitudes (500, 1500 and 3000 m). In addition, the NAAPS system has provided detailed data on the distribution of aerosols in the atmosphere.

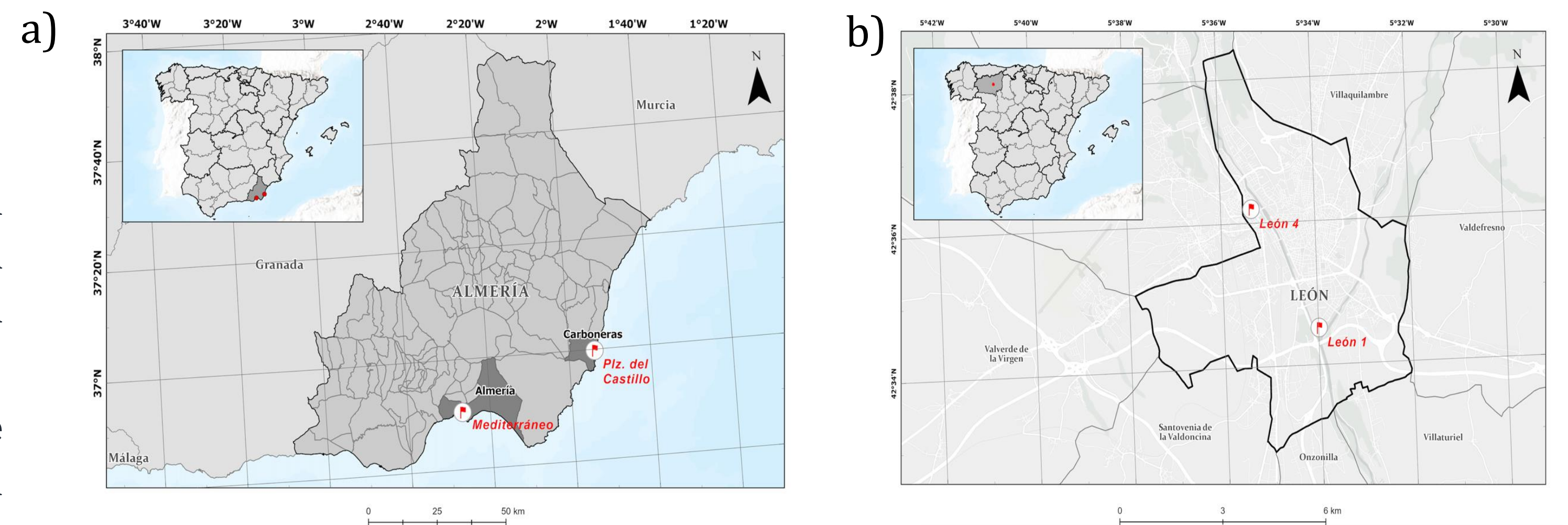


Figure 1. Study areas: a) Province of Almería in the SE of the Iberian Peninsula. b) City of León in the NW of the Iberian Peninsula. The red dots indicate the air quality stations from which the data were obtained.

## Results

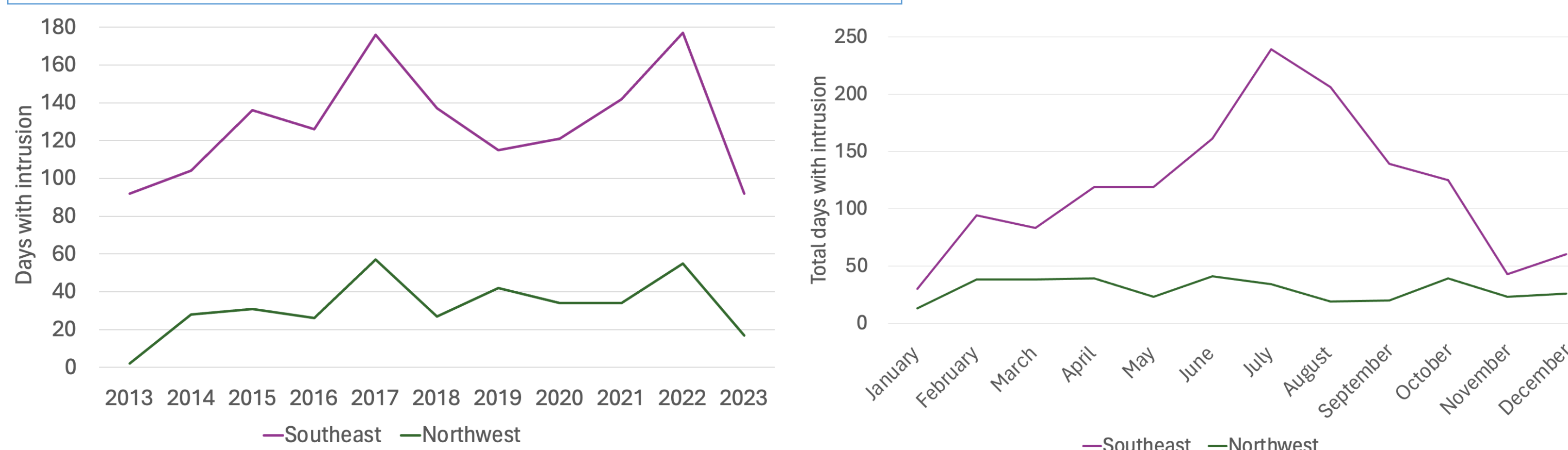


Figure 2. Evolution of the number of intrusions per year in the SE and NW sectors.

Figure 3. Monthly average number of days with intrusion during the study period.

The year with the highest number of Saharan intrusion events was 2022 in both the SE and NW sectors (Figure 2). However, these intrusions have been more frequent in the SE, with a maximum of 180 days in 2022. The month with the most intrusion was July, with a maximum of 240 approximately for the southeast and 30 for the NW in October (Figure 4).

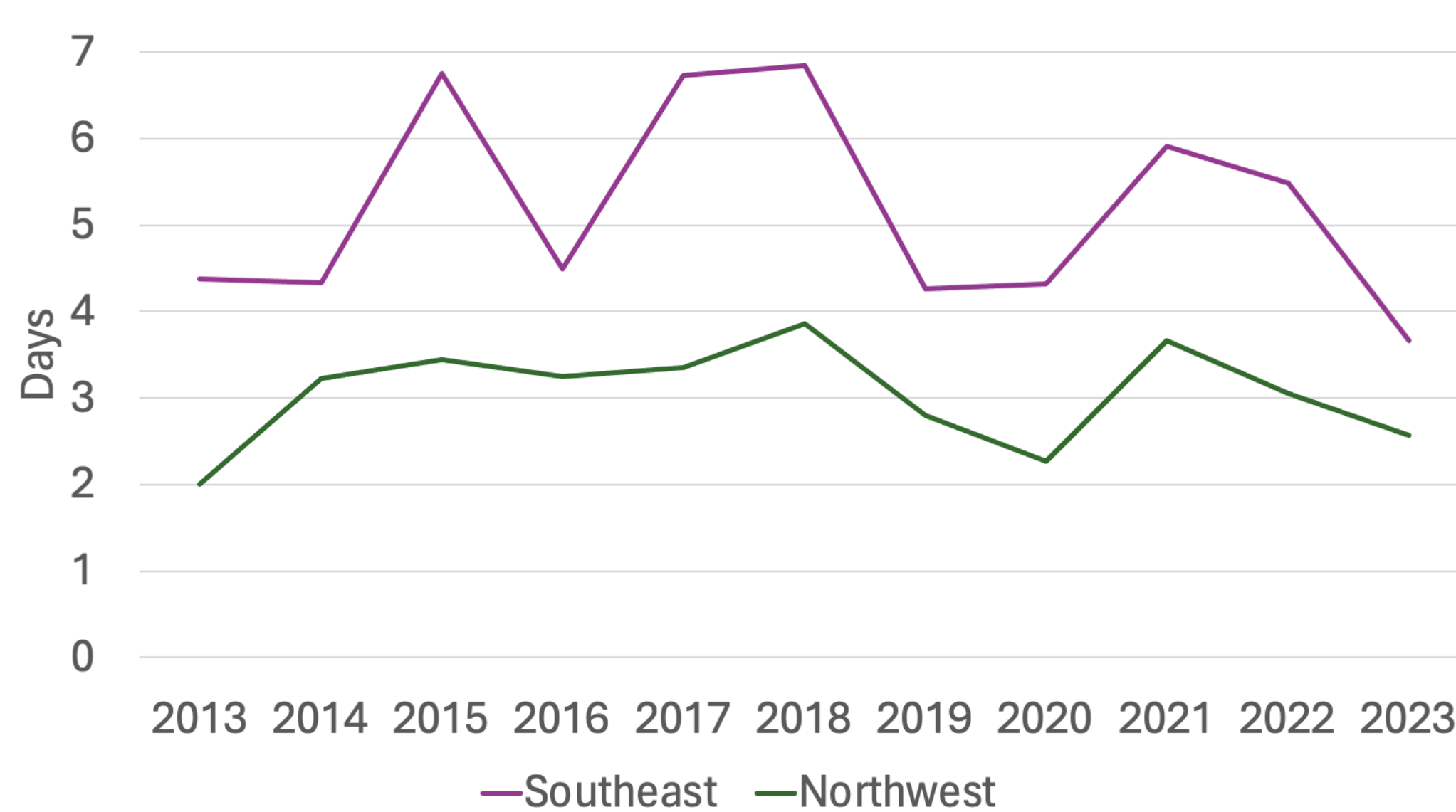


Figure 4. Mean duration of intrusions during the 11 years of study.

Statistically significant differences (Kruskal-Wallis test) were found in the PM10 concentrations recorded at the four air quality stations during Saharan dust intrusions compared to those recorded in the absence of intrusions.

## Conclusions

Almería and León show a difference in terms of Saharan dust intrusions, highlighting differences in the frequency and magnitude of these events, which translates into significant impacts on air quality and public health in both regions. These results underline the importance of specifically investigating the effects of Saharan dust intrusions in different regions, as evidenced by the study conducted in Almería and León, in order to develop effective environmental protection and public health strategies.

## References

Oduber et al. (2019) "Unusual winter Saharan dust intrusions at Northwest Spain: Air quality, radiative and health impacts". Science of the Total Environment, 669, 13–228.

## Acknowledgements

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## → CASE OF STUDY: 15th March 2022 Extreme Saharan intrusion event

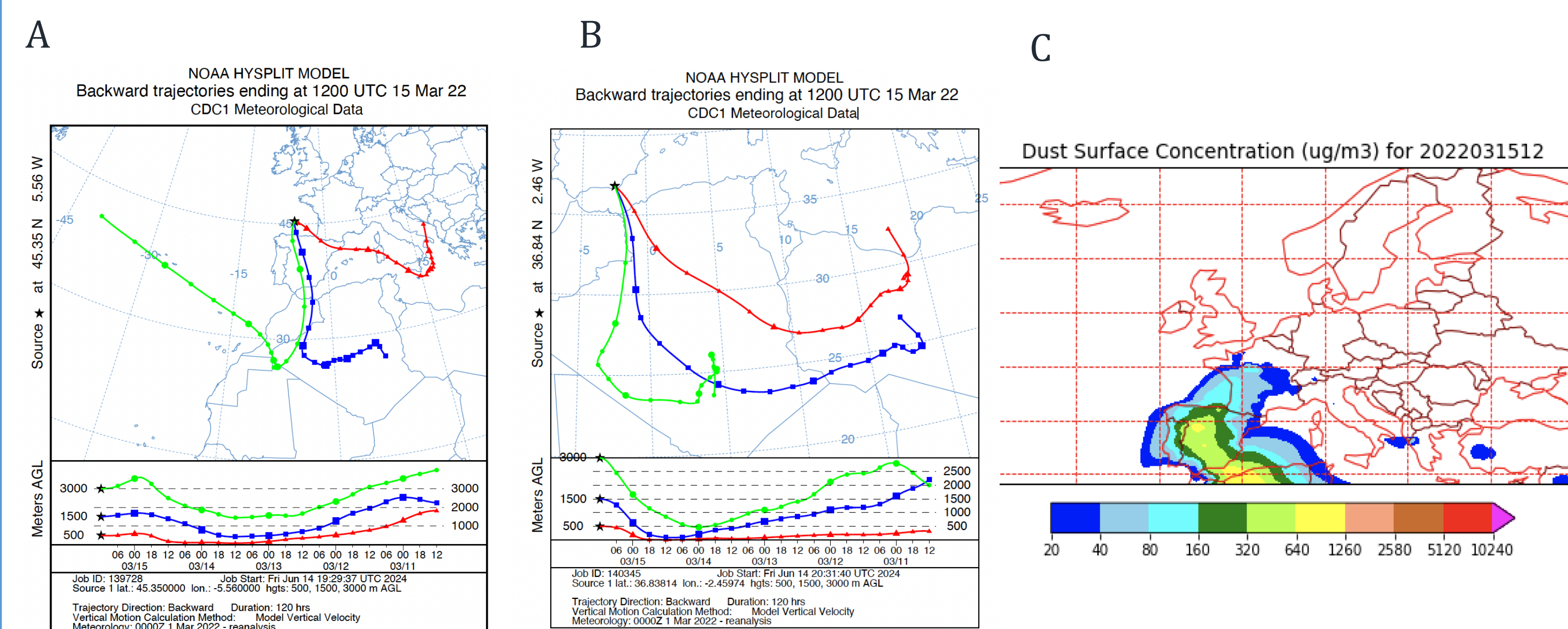


Figure 6. Five-day (120 h) backtrajectories at 500, 1500 and 3000 m ending at A) León and B) Almería. C) Surface dust concentration from NAAPS for 15th March 2022.

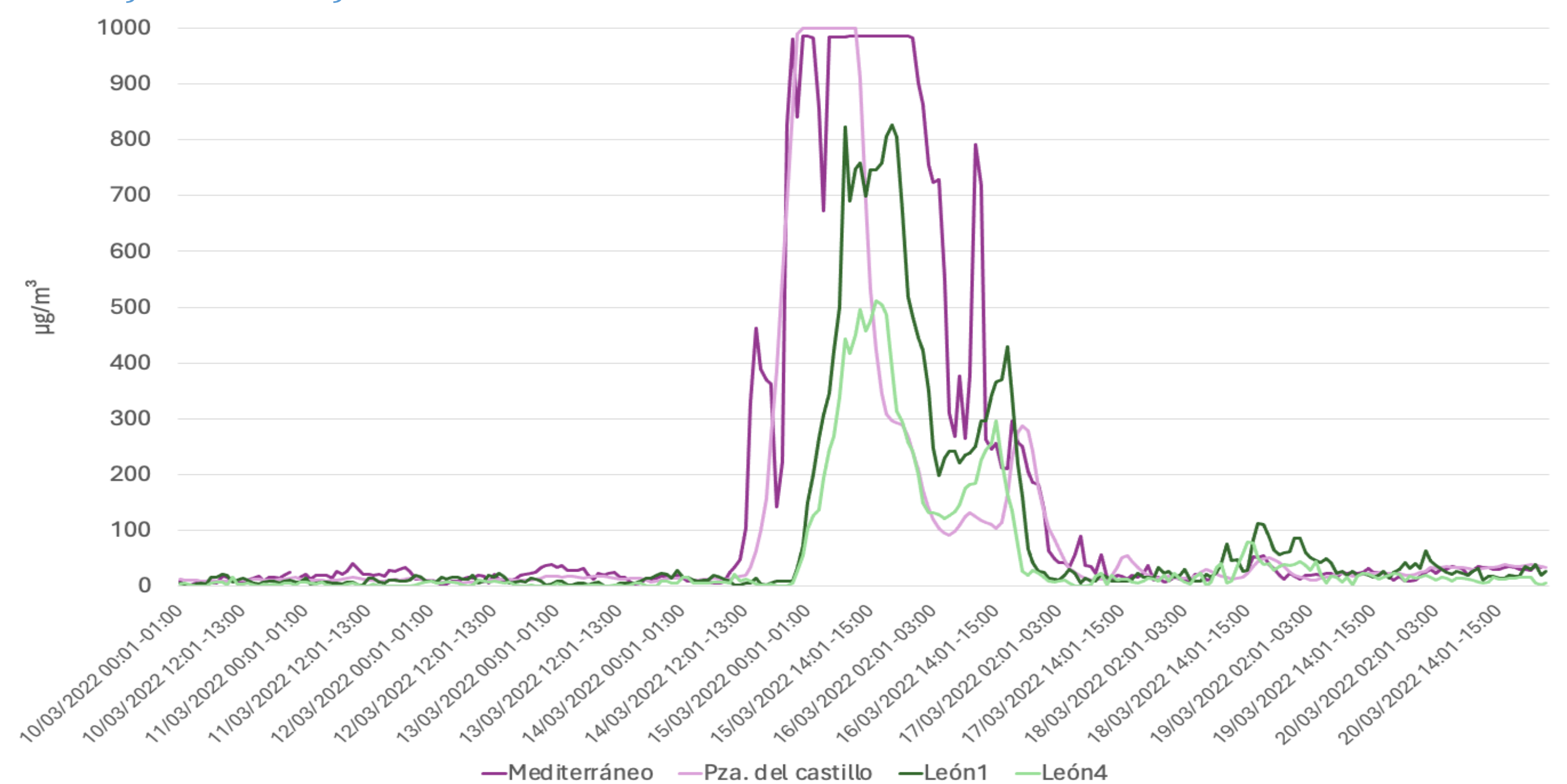


Figure 5. Evolution of PM10 concentration 5 days before and 5 days after Saharan intrusion event of 15th March 2022.

An increase in PM10 concentration was observed at all stations (Figure 5), with a maximum peak on March 15 between 1:00 am and 9:00 am. Pza. del Castillo recorded the highest hourly concentration, reaching 1000  $\mu\text{g}/\text{m}^3$  (limit measurable by equipment), followed by Mediterráneo (985  $\mu\text{g}/\text{m}^3$ ), León1 (823  $\mu\text{g}/\text{m}^3$ ) and León4 (512  $\mu\text{g}/\text{m}^3$ ).