PARTICULATE MATTER IN THE NORTHWEST OF THE IBERIAN PENINSULA: A ONE-YEAR STUDY

Fernanda Oduber[1], Carlos Blanco-Alegre[1], Ana Isabel Calvo[1], Amaya Castro[1], Roberto Fraile[1], Teresa Nunes[2], CÉLIA ALVES[2]

[1]*Department of Physics, IMARENAB, University of León, 24071 León, Spain.*
[2]*Centre for Environmental and Marine Studies, Department of Environment, University of Aveiro, 3810-193 Aveiro, Portugal.*

INTRODUCTION

Humans and the environment are exposed to a complex mixture of several atmospheric contaminants, including particulate matter (PM). The study of the PM composition and its temporal variation allows determining the potential emission sources and, therefore, establishing mitigation measures. Researches on the spatial and temporal variation of chemical characteristics of PM in the northwest of the Iberian Peninsula are scarce. Thus, this study aims to analyze the composition and the seasonal variation of PM_{10} in a suburban area at León (Spain) between March 2016 and March 2017.

STUDY AREA

León city, belonging to the Province of León, is located in the northwest of the Iberian Peninsula (42° 36' 50" N, 5° 33' 38" W, 846 m asl) (Fig. 1).

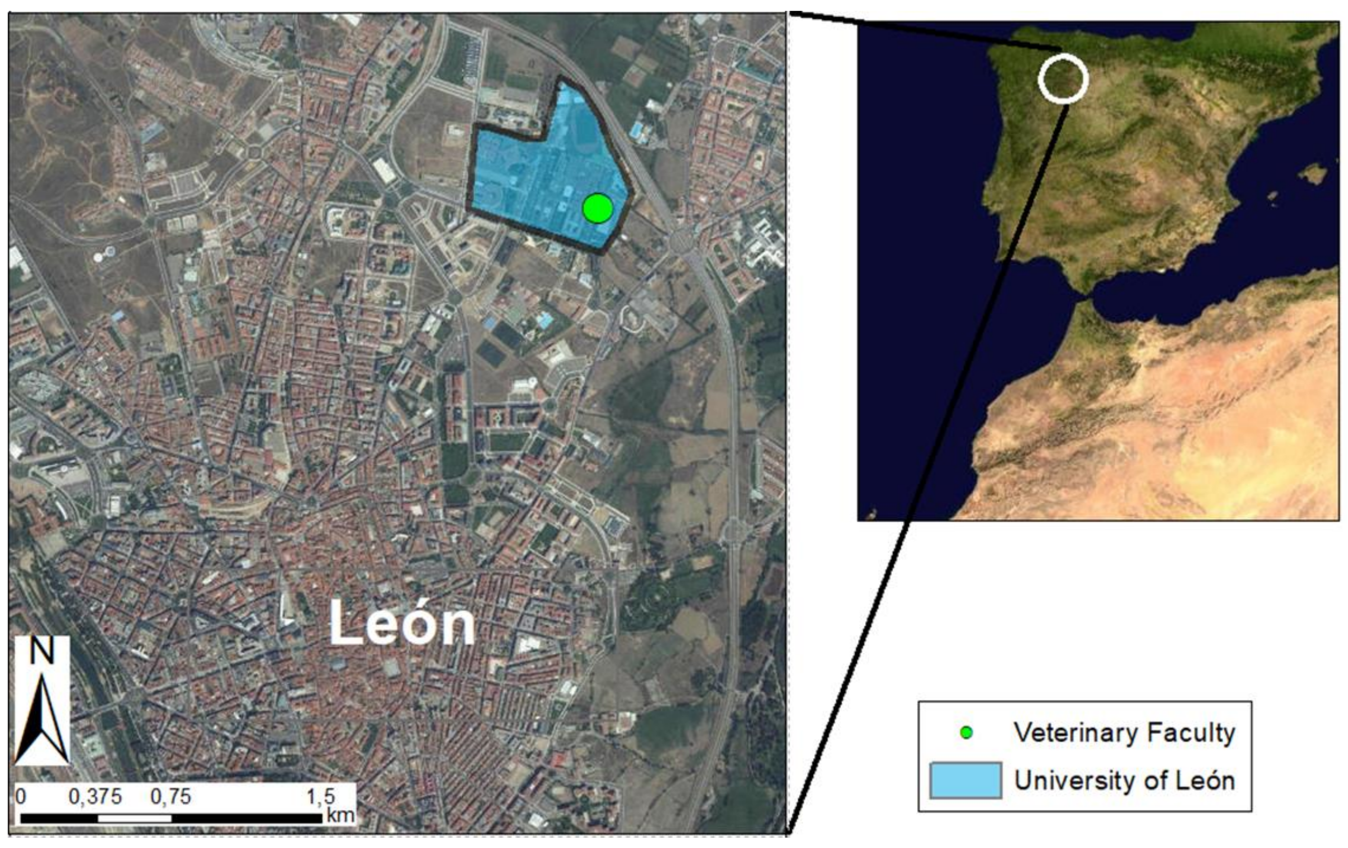

Fig. 1. Location of the sampling site

SAMPLING AND ANALYSIS

Sampling was carried out between 9 March 2016 and 14 March 2017 on the roof of the Faculty of Veterinary at the University of León (Fig. 1), with the instrumentattion shown in Fig. 2.a). The chemical analysis were carried out at the University of Aveiro using the instrumentation shown in Fig. 2.b).

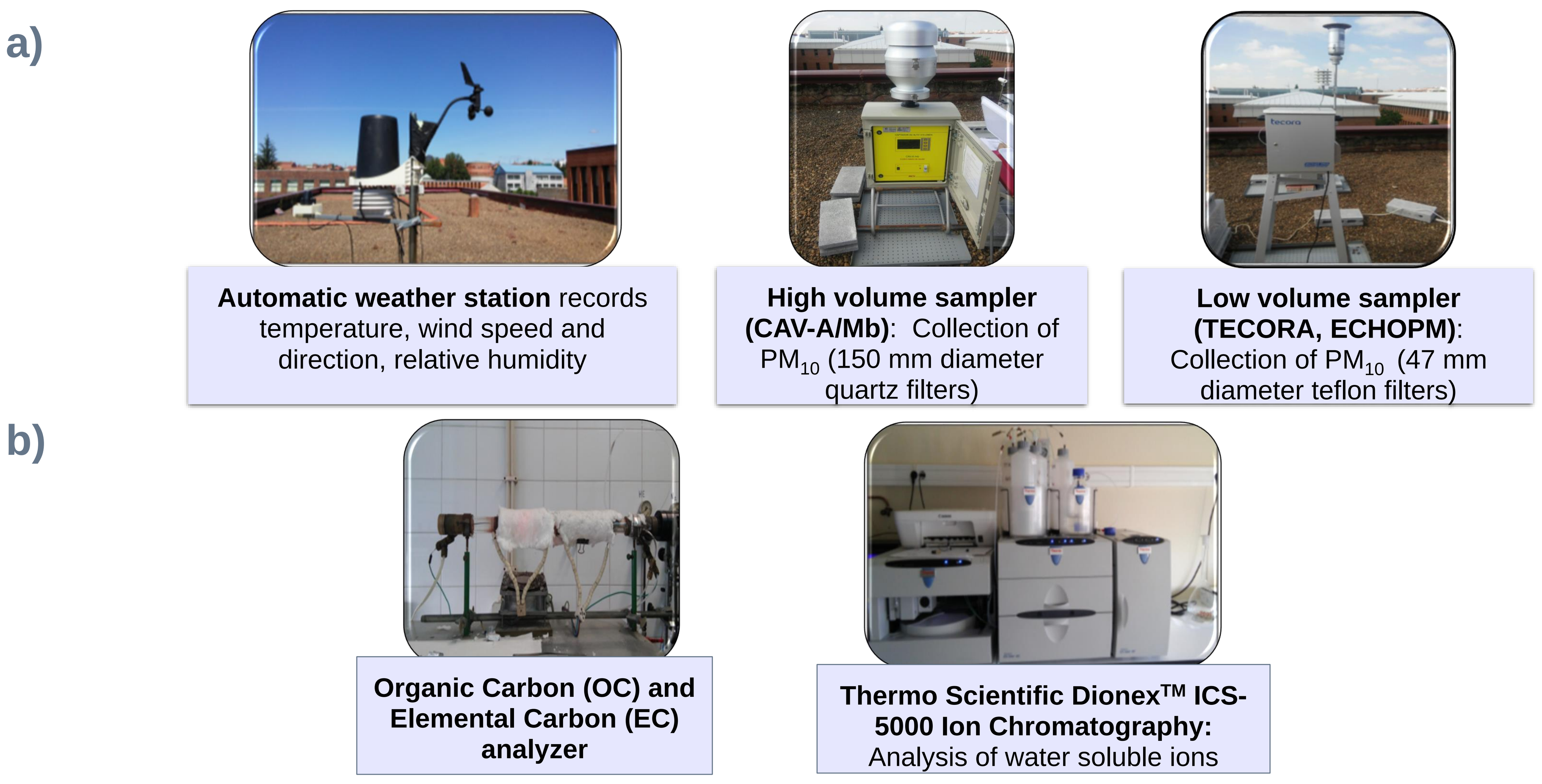

Fig. 2. Sampling and analysis instrumentation

RESULTS AND CONCLUSIONS

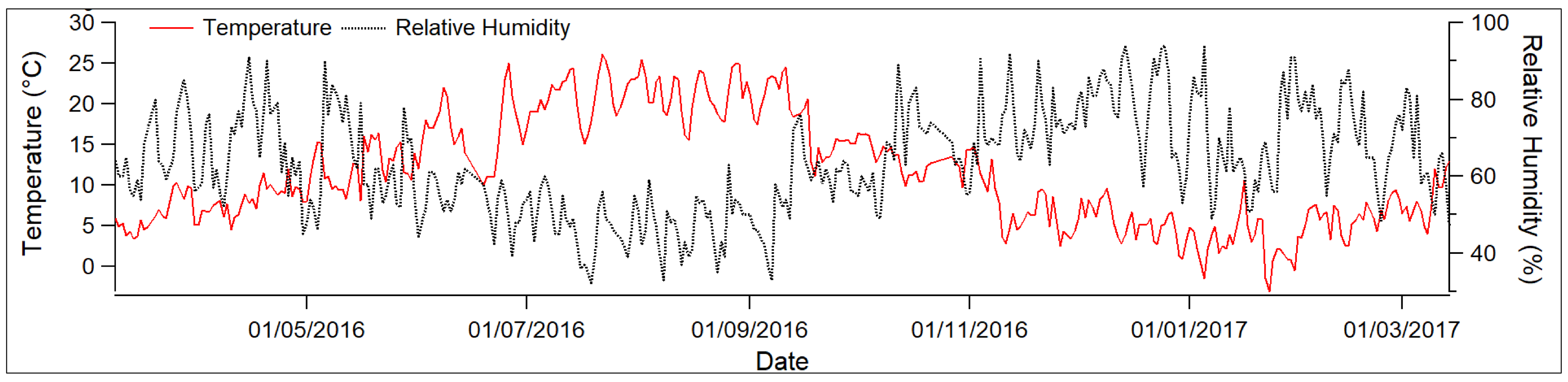

Fig. 3. Daily evolution of temperature and relative humidity during the sampling period

During the sampling period, the mean temperature and relative humidity were 12 ºC and 64%, respectively. Summer (July-September) was the season with less precipitation and higher mean temperature (21.3 mm and 20 ºC, respectively), whereas spring (April-June) was the rainiest season (223.2 mm) (Fig.3).

- The mean PM_{10} value during the study period was 16 ± 8 µg/m³
- The PM_{10} daily limit value (DLV of Directive 2008/50/CE, 50 µg/m³) was only exceeded on 23rd February 2017 (60 µg/m³) (Fig.4), coinciding with a Saharan dust intrusion episode.
- The lowest PM_{10} value (2.0 µg/m³) was observed in summer, after a precipitation event.

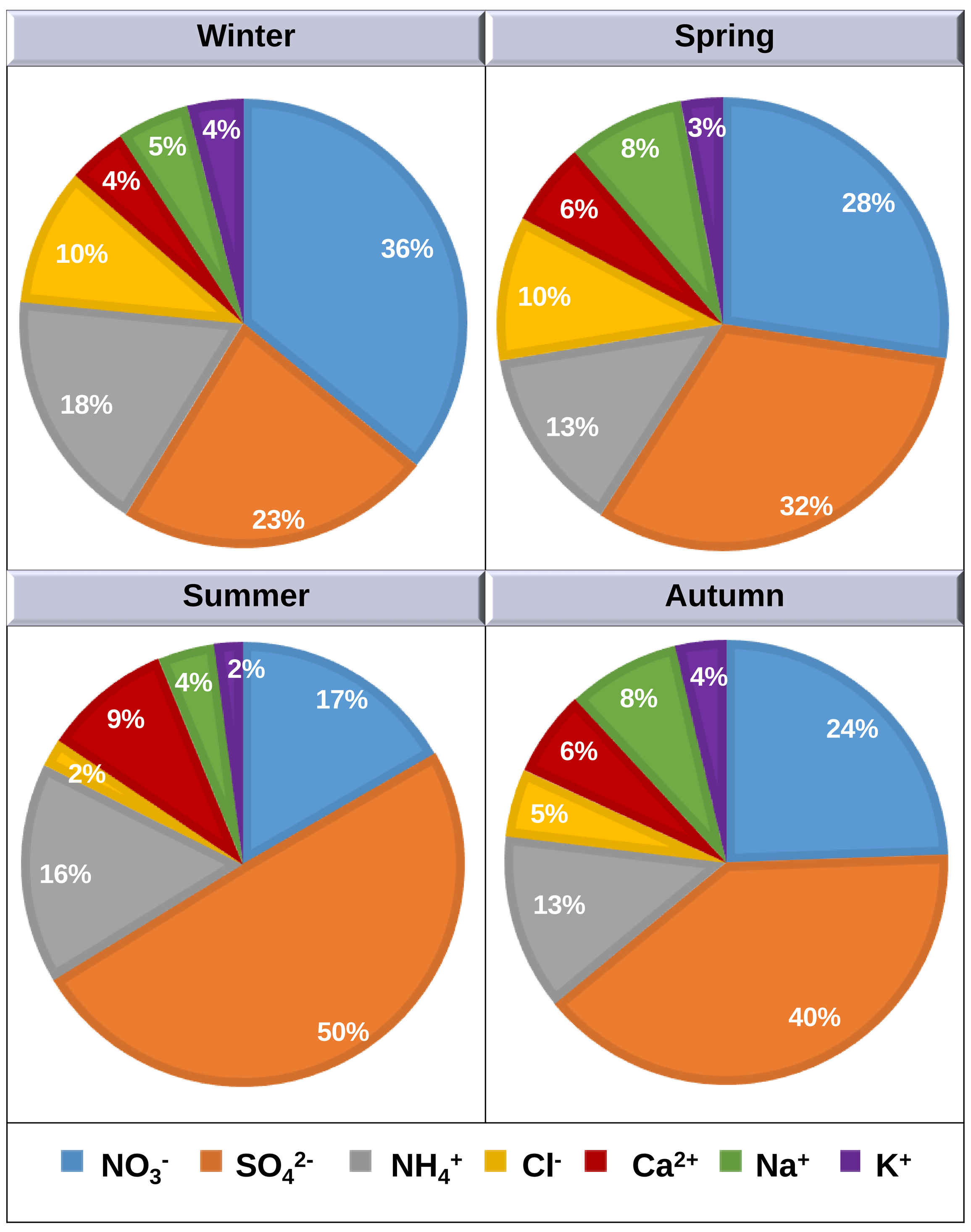

Fig. 5. Seasonal evolution of ion concentrations

The lowest PM_{10} and OC mean concentrations were observed in spring, with 11.8 ± 6.1 and 1.8 ± 1.0 µg/m³, respectively (Table 1 and Fig. 6). The decrease in the particulate matter levels during spring can be associated with the intense precipitation in this period.

Table. 1. Seasonal evolution of PM_{10} concentrations

Season	PM_{10} (µg/m³)
Winter	21 ± 9
Spring	12 ± 6
Summer	15 ± 8
Autumn	15 ± 6

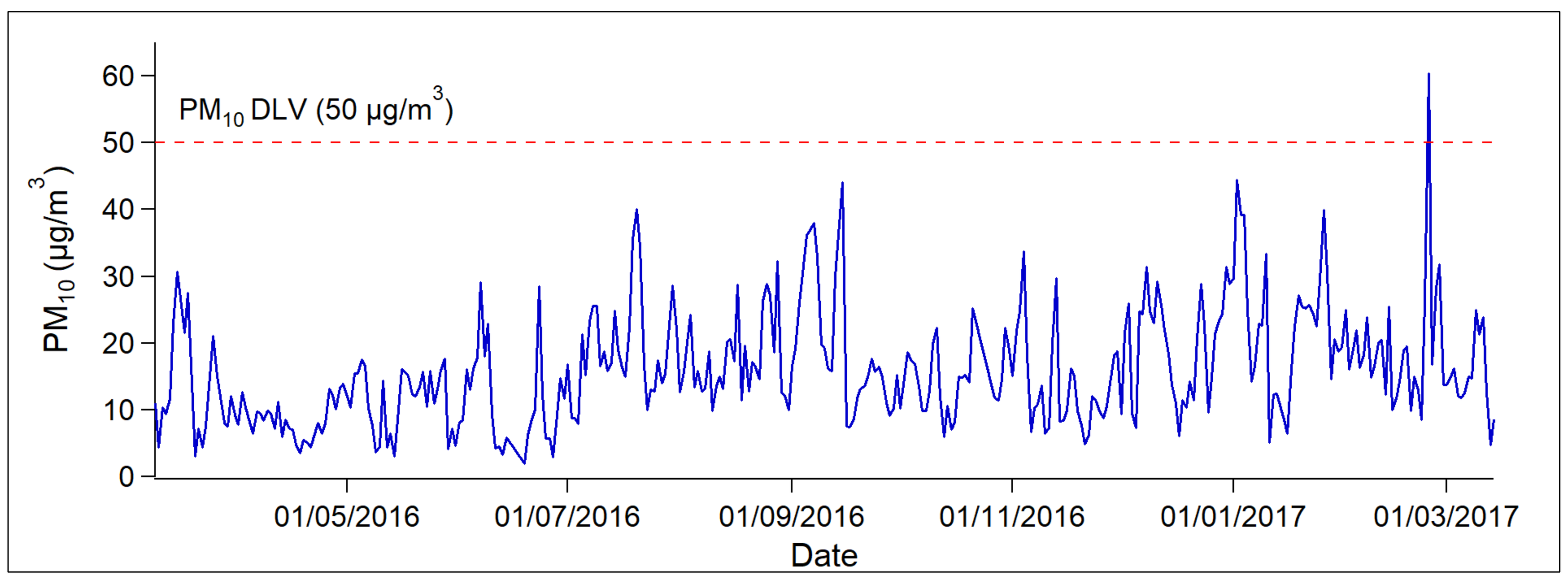

Fig. 4. Daily evolution of PM_{10} concentration (blue) and daily limit value in red (DLV, 50 µg/m³)

Summer was characterized by low EC and NO_3^- concentrations (0.6 ± 0.3 and 0.5 ± 0.3 µg/m³, respectively) and high Ca^{2+} and SO_4^{2-} mean values (0.3 ± 0.2 and 1.6 ± 1.1 µg/m³, respectively) (Fig. 5 and 6). The presence of high levels of ions, such as Ca^{2+} and SO_4^{2-}, can be attributed to different episodes of African dust intrusions that reached the Peninsula [1, 2].

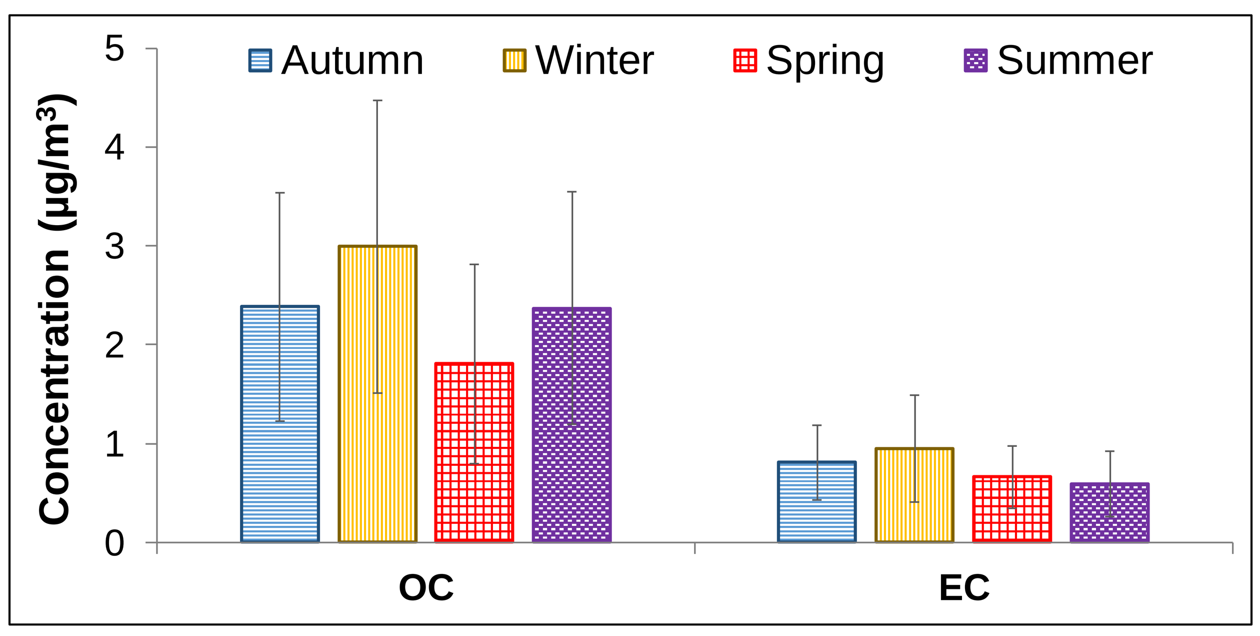

Fig. 6. Seasonal evolution of OC and EC concentrations

Winter (January-March) was characterized by high PM_{10}, OC, EC and NO_3^- mean concentrations (20.6 ± 9.3, 3.0 ± 1.5, 1.0 ± 0.5, and 1.7 ± 1.8 µg/m³, respectively). These results may be due to the contribution of fossil fuel-based heating systems and the low height of the boundary layer which prevents the dilution and dispersion of pollutants.

REFERENCES

[1] S. Rodríguez, X. Querol, A. Alastuey, and F. Plana, Sources and processes affecting levels and composition of atmospheric aerosol in the western Mediterranean, J. Geophys. Res. Atmos., 107, 24, 1–14, 2002.
[2] J. C. Cerro, V. Cerdà, and J. Pey, Trends of air pollution in the Western Mediterranean Basin from a 13-year database: A research considering regional, suburban and urban environments in Mallorca (Balearic Islands), Atmos. Environ., 103, 138–146, 2015.

ACKNOWLEDGEMENTS
This work was partially supported by the Spanish Ministry of Economy and Competitiveness (Grant TEC2014-57821-R), the University of León (Programa Propio 2015/00054/001) and AERORAIN project (Ministry of Economy and Competitiveness, Grant CGL2014-52556-R, co-financed with FEDER funds). F. Oduber acknowledges the grant BES-2015-074473 from the Spanish Ministry of Economy and Competitiveness. C. Blanco-Alegre acknowledges the grant FPU16-05764 from the Spanish Ministry of Education, Culture and Sport.