Air quality in Castilla y León (Spain): one year study

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Introduction

Air quality is a concern of special relevance worldwide that needs further research at regional level. Several studies related to air pollution have been carried out in Spain; however those focused on Castilla y León (Spain) are scarce.

The objective of this study is to analyse the spatial and temporal variations of the air pollution in Castilla y León (Spain) in 2013. Data from 23 different air quality stations (Fig. 1), corresponding to the Castilla y León air quality network (www.jcyl.es), have been used. Hourly concentrations of NO, NO_2, CO_2, SO_2, O_3, PM_{10} were measured by the stations. A specific study for León city was carried out.

Study area

The study area is a region in north-west Spain covering an area of 94,223 square kilometres with an official population around 2.5 million. Castilla y León has a continental Mediterranean climate with annual rainfall averages from 450 to 500 mm, mostly at the lower altitudes.

León city is the capital of the province of León, located in the northwest of Spain. Including the metropolitan area, the population is estimated at 203,435 (2012). León features a warm-summer Mediterranean climate (Köppen climate classification: Csb).

Castilla y León

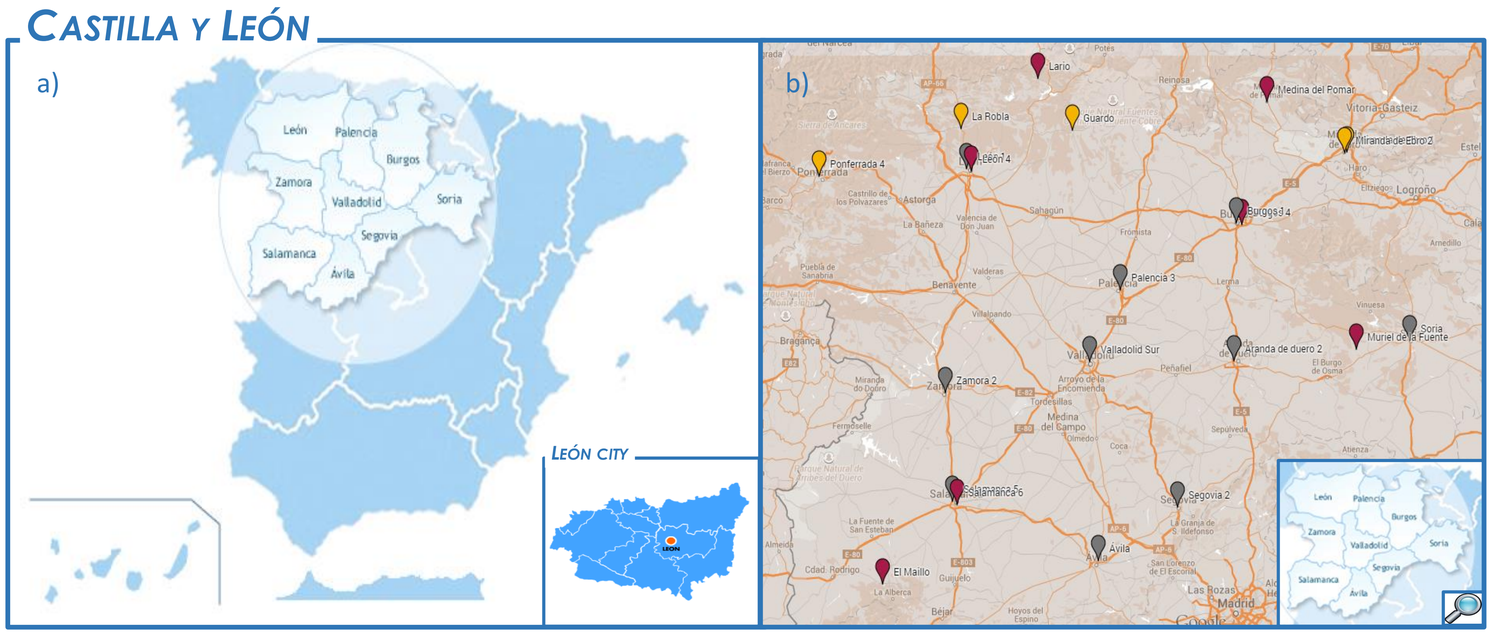

Figure 1. a) Castilla y León, León city and b) air quality network maps. Traffic stations are indicated in red, industrial stations in yellow and background stations in red on the air quality network map.

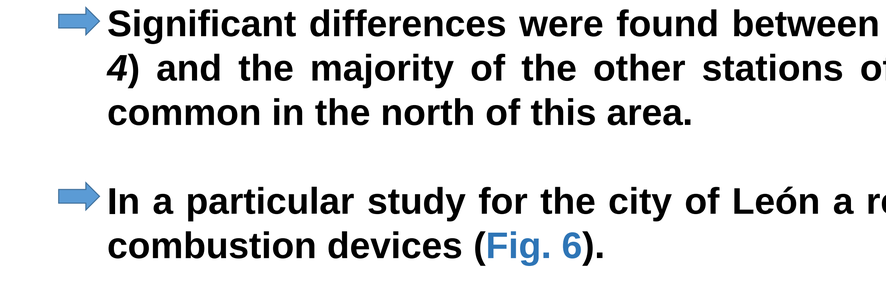

Figure 2. a) Ávila, b) Palencia and c) Soria air quality stations.

Material and Methods

- **For the different air quality stations, daily, monthly and annual concentrations have been analysed.**
- **The non parametric Mann-Whitney U test has been used to identify the significance level.**
- **The Pearson correlation coefficient has been used to study the relationships between pollutants levels.**
- **European limit values of air pollution have been checked.**

Results and Conclusions

- **Traffic, coal combustion, resuspension and African dust intrusions have been identified as major sources of air pollution in Castilla y León.**
- **The different activity of the sources of air pollution and the height of the planetary boundary layer play a key role in the distribution of concentrations throughout the year. The highest values of NO_2 and SO_2 are recorded during the winter months (Fig. 3) while O_3 peaks in the months with highest insolation (Fig. 4). Saharan dust intrusions recorded during the summer months and resuspension increased the average of PM_{10} concentrations for all stations studied (Fig. 5).**
- **Significant differences were found between stations located in northern (*León 1*, *Ponferrada 4*, *La Robla*, *Guardo* and *Burgos 4*) and the majority of the other stations of Castilla y León. These differences can be attributed to coal combustion, more common in the north of this area.**
- **In a particular study for the city of León a relationship was found between the concentration levels of SO_2 and domestic coal combustion devices (Fig. 6).**
- **The pollutant concentrations in Castilla y León in 2013 are lower than the limits proposed in the European Directive 2008/50/EC. The information threshold for ozone (180 µg/m³) was only exceeded once in *Ponferrada 4* station.**

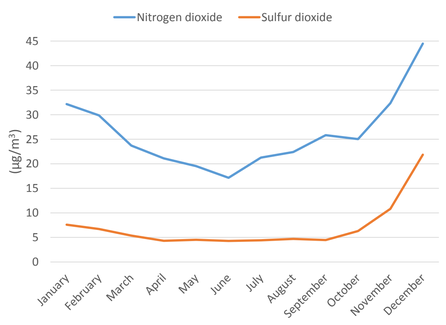

Figure 3. NO_2 and SO_2 monthly values in *León 1* station.

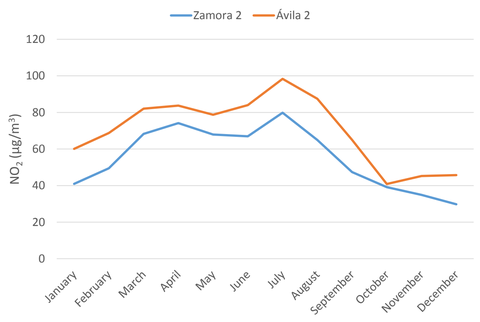

Figure 4. O_3 monthly values in *Zamora 2* and *Ávila 2* stations.

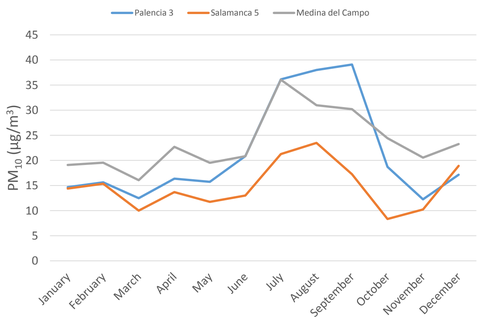

Figure 5. PM_{10} monthly values in *Palencia 2, Salamanca 5* and Medina del Campo stations.

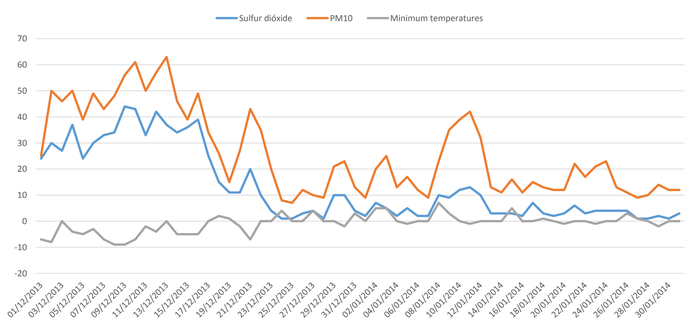

Figure 6. SO_2, PM_{10} and minimum temperatures values for December (2013) and January (2014) in *León 1* station.