

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

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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 are scarce.

The objective of this study is to analyze the spatial and temporal variations of the air pollution in Castilla y León during the year 2013. Data from 27 different air quality stations, corresponding to the Castilla y León air quality network (www.jcyl.es), has been used. These stations are strategically positioned in the area. Hourly concentrations of NO, NO₂, CO₂, SO₂, O₃, PM₁₀ are measured by the stations.

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

For the different air quality stations, monthly and seasonal concentrations have been analysed. Statistical data analysis has been carried out to discriminate spatial (between air quality stations) and temporal (between months and seasons) differences. The significance level was determined by means of Mann-Whitney U test. Also European and World Health Organization (WHO) limit values of air pollution have been checked.

This study points out significant differences between the air quality stations. A singular case was found: the north-west stations have high values of SO₂ in winter, reaching daily concentrations up to 52 µg/m³, while the rest of the stations have values close to zero during all the year (Fig. 1). A particularized analysis has been made trying to explain this situation.

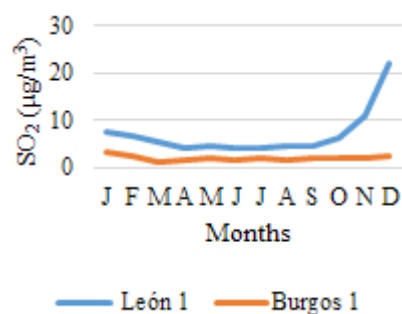


Figure 1. Monthly mean SO₂ concentration for León 1 (north-west station) and Burgos 1 air quality stations.

For years before 2013, the north-west air quality stations presented similar SO₂ concentrations to those observed in 2013. However, the concentrations of the rest of the pollutants studied presented a decreasing trend. Recently the newspapers reported that 10% of the population in the north-west of Castilla y León still use coal-burning appliances. This could explain the high SO₂ concentrations registered in this area of Castilla y León. Pearson correlation coefficient between temperatures, SO₂ and PM₁₀ concentrations corroborates our hypothesis (Table 1).

Table 1. Pearson correlation coefficient between temperatures (T), SO₂ and PM₁₀ values in León 1 (north-west air quality station).

Correlations	Pearson's R
PM ₁₀ -SO ₂	0.93
T-SO ₂	-0.75
T-PM ₁₀	-0.70

European limit values (Directive 2008/50/EC (EC, 2008)) for the pollutants studied have been checked and some exceedances detected for PM₁₀ and NO₂ in all air quality stations (Table 2).

Table 2. Number of exceedances following the Directive 2008/50/EC in 2013 for all air quality stations.

Pollutants	Period	Limit (µg/m ³)	Number of Exceedances
NO ₂	Hourly	200	12
PM ₁₀	Daily	50	14

Amann *et al.* (2008) indicate that ozone pollution affects the health of most of the populations of Europe, leading to a wide range of health problems. The O₃ values in Castilla y León never exceeded the legislative limits (120 µg/m³) during the studied period. However, health risk over 100 µg/m³ has been pointed out in the WHO air quality guideline (WHO, 2006). In our study, this limit was exceeded 47 times on average during 2013.

Amann, M., Derwent, D., Forsberg, B., *et al.* (2008) *Health risks of ozone from long-range transboundary air pollution*, World Health Organization.

EC (2008) *Directive 2008/50/EC of the European parliament and of the council of 21 May 2008 on ambient air quality and cleaner air for Europe*.

WHO (2006) *Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide*.