Air quality in the city of León: the role of air masses

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The increase in urbanization in recent years throughout the world has led to important consequences, among which urban air pollution stands out. Air quality in urban areas is affected not only by the emission sources present in the city, but also by phenomena such as atmospheric dispersion and the transport of pollutants. To deal with this problem, it is necessary to establish regulations and effective mitigation measures. Then, it is crucial to know the transport routes of pollutants, the possible regions of origin and their relative contribution to the pollution levels in a city (Liu et al., 2013).

Different scientific studies have revealed the relationship between the spatial and temporal variations of pollutants with the transport of air masses. In previous studies about contaminant transport, the HYSPLIT (Hybrid single-particle Lagrangian integrated trajectory) model has been widely used as a powerful tool to determine the origin of pollutants at a given arrival point.

This paper presents an analysis of the influence of the origin of air masses on air quality in the city of León (Spain) during one year (2021). Although the main sources of pollution in this city are traffic and heating devices (Oduber et al., 2021), the arrival of atmospheric pollutants transported by air masses from different sources frequently increases pollution levels in León. CO, NO_2, NO, PM_{10} and SO_2 concentration have been analyzed in two stations of the Air Quality Network of Castilla y León (https://medioambiente.jcyl.es) with different characteristics: an urban traffic station and a background station. In this way, the influence of the air masses on the pollutant concentrations of two points with different characteristics located in the same city has been compared.

HYSPLIT model has been used to identify the relationship between atmospheric transport patterns and daily pollutant concentrations in León. Five-day back trajectories ending at four different heights (500, 1000 1500 y 3000 m agl) were computed with HYSPLIT model. Global Data Assimilation System (GDAS) meteorological data at 1° × 1° resolution were used for the trajectory calculations.

Depending on their origin, these back trajectories have been classified as Local, Saharan, Mediterranean, Continental, Arctic, Maritime Polar and Maritime Tropical (Fig. 1). Subsequently, the relative contribution of each air mass to the pollution levels in the city has been established.

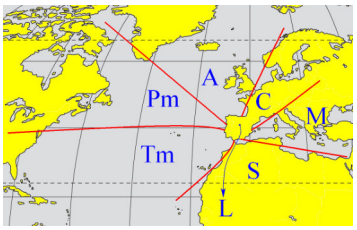

Figure 1. Zones of origin of air mases: local (L), Saharan (S), Mediterranean (M), Continental (C), Artic (A), Maritime Polar (Pm) and Maritime Tropical (Tm) (Calvo et al., 2012).

The results obtained show the regions of origin and the main transport routes of the pollutants arriving León. The determination of the contribution of the different air masses to the concentration of pollutants in the city will make it possible to establish mitigating measures when necessary.

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