

Air pollution and weather types at a background EMEP station in northern Spain: a fourteen-year study

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Air pollution is a problem that affects both the environment and the human health, caused by the emission of particles, substances or forms of energy into the atmosphere. This problem has been greatly magnified by the development of industrial and economic activities, especially during the last century (Calvo, 2009). However, as indicated by the European Environment Agency (EEA), the emissions of some pollutants are suffering a reduction in recent years, as a result of the emergence of new air pollution policies. Despite this, some urban areas still exhibit high atmospheric pollutant concentrations.

There is a great diversity of atmospheric pollutants, among which we can find tropospheric ozone (O_3), nitrogen oxides (NO_x), sulfur oxides (SO_x), carbon monoxide (CO), volatile organic compounds (VOCs) and aerosols or particulate matter (PM). In the present work we will focus especially on PM.

It is important to take into account not only the atmospheric pollution present close to the source, but also the one received in areas far from it, known as background regions. Background pollution is a consequence of the air masses transport (Poberžnik, 2016).

This study focuses on the evolution of the concentrations of atmospheric pollutants and precipitation in the background station of Niembro (Asturias) during the period 2001-2014. In addition, it is intended to establish the relationships between the concentration of atmospheric pollutants and the different weather types in the same period. This air quality station belongs to EMEP (European Monitoring and Evaluation Program). EMEP is a European program for the study of long-distance pollution, which arises from the Convention on Long-range Transboundary Air Pollution (LRTAP: Long-Range Transboundary Air Pollution). For the classification of the weather types, a methodology based on the classification of Lamb (1972) has been used. The application of this method to the Iberian Peninsula is done by characterizing different indices associated with the direction and vorticity of the geostrophic flow of daily circulation that affects the West of the Peninsula.

In the Iberian Peninsula there is a predominance of the anticyclonic weather type (A), followed by the northeast (NE) and the north (N) (Figure 1a). The largest percentage of PM_{10} is registered under the anticyclonic weather type, probably due to the stagnant episodes associated to it that promote pollutant accumulation. Other types of weather such as the western weather type (W) are associated with low concentrations of pollutants (Figure 1b). Regarding precipitation, it should be highlighted the low pH of rainwater registered in this station during some events, reaching a minimum of 2.0.

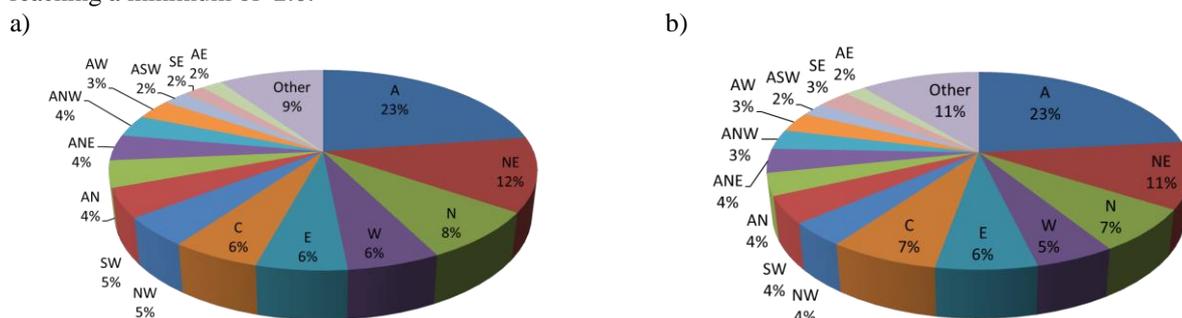


Figure 1. a) Percentage of each weather type in the period 2001-2014. b) Percentage of PM_{10} for each weather type in the period 2001-2014.

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- Calvo, A. I., Pont, V., Olmo, F. J., Castro, A., Alados-Arboledas, L., Vicente, A. M., Fernández-Raga, M., Fraile, R. (2012). Aerosol and Air Quality Research, 12, pp. 856-878.
- Poberžnik, M., Strumbej, E. (2016). Atmospheric Environment, 134, pp. 138-146.