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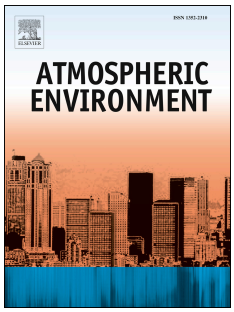

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$PM_{2.5}$ source allocation in European cities: a SHERPA modelling study

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Abstract

Many European cities suffer from poor air quality and still exceed the European standards prescribed by the Air Quality Directive, and the guidelines recommended by the World Health Organization (WHO). This is especially the case for $PM_{2.5}$, focus of this work. While international, national and local level actions to reduce air pollution have undoubtedly resulted in an overall improvement of the air quality over the years, there are still problems, which are localised in specific regions and many cities. A key issue is to determine at which scale to act in order to abate these remaining air pollution problems most effectively. Central to this, for cities, is a quantitative assessment of the different origins of air pollution (urban, regional, national and transboundary) to support the design of efficient, effective air quality plans, which are a legal obligation for countries and regions whenever exceedances occur. The "Screening for High Emission Reduction Potentials for Air quality" tool (SHERPA) is used in this work to quantify the origins of air pollution in cities and regions, both from a spatial (urban, country…) and sectoral (transport, residential, agriculture…) perspectives. For $PM_{2.5}$ we conclude that (1) for many cities, local actions at the city scale are an effective means of improving air quality in that city; (2) the target sectors and scales to abate air pollution are city specific, even for cities that are located in the same country. Consequently, it is important to take into account these city-specific circumstances when designing air quality plans and (3) for many cities, sectoral measures addressing agriculture at country or EU scale would have a clear benefit on urban air quality.

Keywords: urban air pollution, $PM_{2.5}$, source allocation, source apportionment, urban increment

1. Introduction

Many European cities suffer from poor air quality and regularly exceed both the European standards prescribed by the Air Quality Directive (EEA, 2017) and guidelines recommended by the World Health Organization (WHO). This is particularly the case for fine particulate matter (PM_{10}), for which both the daily (50 $\mu g/m^3$ not to be exceeded on more than 35 days a year) and the yearly average limit values (40 $\mu g/m^3$) are often exceeded in many cities and regions in Europe. For $PM_{2.5}$, the EU limit value (annual average of 25 $\mu g/m^3$) is generally met (EEA, 2017), but only few cities manage to keep concentrations below the levels recommended by the WHO (10 $\mu g/m^3$ on an annual basis). Adverse health effects and premature deaths are two of the major effects of poor air quality and current estimates suggest an average life loss of about 8 to 10 months in the most polluted European regions