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Variability of atmospheric aerosol levels and composition at a regional background site in NE Iberian Peninsula

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Aerosols measurements performed at regional background sites, to avoid direct influence of local anthropogenic emissions, are clearly the best way to accurately document both aerosol long-term trends and synoptic features in air quality.

The monitoring site selected for this study is a regional background site situated in the Montseny Natural Park in NE Iberian Peninsula and it is part of the EUSAAR monitoring network (EUropean Supersites for Atmospheric Aerosol Research), which aims to integrate the measurements of atmospheric aerosol properties performed at European ground-based stations. Data on PM levels and speciation measured at this site are available from 2002 to 2007. PM_{10}, $PM_{2.5}$ and PM_1 levels were measured continuously by means of a GRIMM laser spectrometer dust monitor. 24 hour PM_{10} and $PM_{2.5}$ samples were collected on quartz micro-fibre filters with high volume samplers and analyzed for chemical speciation (Querol et al. 2001). The influence of the different atmospheric transport scenarios is investigated by means of air mass-back trajectory analysis using the Hysplit model (Draxler et al. 2003), the information supplied by NRL-NAAPs, SKIRON and DREAM-BSC dust maps and satellite images provided by the NASA SeaWIFS project.

This study summarizes the results of the interpretation of the variability of regional background PM levels and speciation. Special attention is paid on the search of interannual trends of PM_{10}, $PM_{2.5}$ and PM_1 levels, the identification and interpretation of

seasonal patterns, the study of the influence of atmospheric transport scenarios on the PM levels; and the detailed characterisation of specific PM episodes, such as African dust outbreaks and regional pollution episodes.

The mean annual PM_{10}, $PM_{2.5}$ and PM_1 levels recorded at Montseny reached 17, 13 and 11 $\mu g/m^3$respectively. However, inter-annual variations, probably caused by meteorological differences, are very important (14-21, 11-16 and 9-13 $\mu g/m^3$ respectively). A decreasing trend has been observed from 2002 to 2007, probably attributed to meteorological changes, a decrease in regional emissions or/and the variability of the frequency and intensity of the Saharan dust episodes.

A clear seasonal pattern has been observed in levels and speciation of PM. Minimum levels were recorded during the winter as a consequence of stronger winds, higher precipitation rates and the fact that the monitoring site is frequently located outside of the boundary layer. The maximum levels are recorded during the summer as a result of the higher frequency of recirculation of air masses, lower precipitations, higher resuspension, higher frequency of African dust outbreaks and a higher photochemical activity. A secondary maximum is observed during February and March as a result of regional pollution and African dust episodes.

PM_{10} consists mainly of mineral matter (26%), organic matter and elemental carbon (OM+EC, 20%), sulphate (16%), nitrate (10%) ammonium (6%) and sea spray (3%). $PM_{2.5}$ is composed of OM+EC (24%), sulphate (20%), mineral matter (10%), nitrate (10%), ammonium (9%) and sea spray (2%). The unaccounted mass varied from 19 to 25% in PM_{10} and $PM_{2.5}$ respectively. A seasonal pattern is observed for the mineral matter, sulphate and OM+EC with higher levels in the summer and February and March. Conversely, nitrate levels are lower in the summer due to the instability of the ammonium nitrate.

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