Spatial and temporal variability in PM$_{10}$ data from Italian urban networks

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The attention to airborne particulate matter pollution has constantly grown during the past years. This is due to its well-known health effects and to the high levels of mass concentration measured year-round, especially in urban sites.

PM$_{10}$ concentrations are monitored in all the main Italian urban areas through air quality networks, formed by a different number of stations, which are different in type. In fact, referring to the European Exchange of Information (EoI) classification, monitoring stations can be defined by type of area (urban, suburban and rural) and type of dominant emission sources (traffic, industrial and background).

Consequently, frequently it is hard to compare data sets coming from dissimilar urban networks and obtained with different sampling devices. Above all, it is often demanding to define the spatial and temporal representativeness of data on whose basis anti-pollution measures, like traffic limitations, are taken.

In Italy, following the implementation of the European Directive 1999/30/EC, dated in 2002, the 24-hour and the annual limit values are defined in, respectively, $50\ \mu g/m^3$ (not to be exceeded more than 35 times a year) and $40\ \mu g/m^3$.

With the aim to investigate this topic, four years sets of data (from 2002 to 2005), produced by urban air quality networks of the main Italian cities were examined. These cities have been chosen on the basis of geographic and data-coverage criteria.

Therefore, temporal trends and weekend/weekday differences in PM$_{10}$ mass concentrations (see figures 1 and 2 illustrating temporal and weekly trends in PM$_{10}$ levels in Rome) were analysed using statistical techniques so to delineate homogeneity of results among stations belonging to the same type (see table 1).

Table 1. Correlation between vectors of values from different stations (2002-2005).

<table>
<thead>
<tr>
<th></th>
<th>Rome</th>
<th>Class.</th>
<th>A</th>
<th>F</th>
<th>G</th>
<th>Ad</th>
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<tbody>
<tr>
<td>A</td>
<td>T</td>
<td>U</td>
<td>1.00</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>F</td>
<td>T</td>
<td>U</td>
<td>0.92</td>
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<td>T</td>
<td>U</td>
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<td>0.85</td>
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<tr>
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<td>B</td>
<td>U</td>
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<td>0.86</td>
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</tr>
</tbody>
</table>

T: traffic; B: background; U: urban.
A: L. Arenula station; F: P. Fermi station; G: P. M.Grecia station; Ad: V. Ada station.

Although average PM$_{10}$ concentrations, from 2002 to 2005, have not clearly decreased or increased on a national scale, the four-year results showed a well-defined seasonal and spatial pattern.

Moreover, through the comparison between PM$_{10}$ and some primary pollutants levels (such as carbon monoxide, CO, and nitrogen monoxide, NO) was highlighted if and when PM$_{10}$ concentrations from traffic type stations were evidently connected to traffic sources.