Air quality at different sites in the city of Buenos Aires

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WHAT CAN HELP TO ABATE URBAN AIR POLLUTION?

AIR POLLUTION SYSTEM

Sources -> Atmosphere -> Receptors

Emission inventories

How is the air quality like?

Atmospheric dispersion models

Air quality monitoring

Emission control?
This study presents an analysis of hourly concentrations of CO, NO and NO\textsubscript{2} registered at four sites in the city of Buenos Aires during June-August 2009.

(S1) a commercial area,
(S2) a green area,
(S3) a residential area near the geographic center of the city
(S4) close to the SE edge of the city in an open area with few buildings and highways nearby.

This Figure will be discussed in relation to local features and pollution sources.
Air quality at different sites in the city of Buenos Aires

RESULTS AND DISCUSSION

(S1) - Commercial area

Air pollution roses

Asymmetric irregular street canyon near a traffic intersection

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Mean value W→N→E</th>
<th>Mean value E→S→W</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO (ppm)</td>
<td>0.696</td>
<td>1.188</td>
</tr>
<tr>
<td>NO (ppb)</td>
<td>67.8</td>
<td>119.5</td>
</tr>
<tr>
<td>NO₂ (ppb)</td>
<td>37.3</td>
<td>42.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Mean value N→E→S</th>
<th>Mean value S→W→N</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO (ppm)</td>
<td>0.792</td>
<td>0.985</td>
</tr>
<tr>
<td>NO (ppb)</td>
<td>81.2</td>
<td>97.3</td>
</tr>
<tr>
<td>NO₂ (ppb)</td>
<td>38.9</td>
<td>40.2</td>
</tr>
</tbody>
</table>

The application of the t-Student test reveals that the difference between the averages for both sides is statistically significant at the 99% confidence level.
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RESULTS AND DISCUSSION

(S2) - Green area

Air pollution roses

Direct influence of traffic emissions coming from two nearby avenues located west and very low concentrations for other wind directions.

The similar values of mean concentrations of NO and NO$_2$ for sector N$\rightarrow$E$\rightarrow$S indicate that in these directions there are not sources of NOx near the monitoring site. Pollutants transported by these wind directions come from sources located at intermediate or long distances from the monitoring site.

The difference between mean concentrations at the two sides is statistically significant (at the 99% confidence level).
RESULTS AND DISCUSSION

(S3) - Residential area near the geographic center of the city
Air pollution roses

Roses have an almost circular pattern with a little influence of local emissions from WSW.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Mean value: NNW→ENE→SSE</th>
<th>Mean value: SSE→WSW→NNW</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO (ppm)</td>
<td>0.879</td>
<td>0.946</td>
</tr>
<tr>
<td>NO (ppb)</td>
<td>48.0</td>
<td>68.1</td>
</tr>
<tr>
<td>NO$_2$ (ppb)</td>
<td>36.9</td>
<td>35.9</td>
</tr>
</tbody>
</table>

Concentrations at S3 result mainly from the urban emissions all over the city, with an extra little contribution from traffic flow at the nearby avenue.

The difference between mean concentrations of NO at the two sides is statistically significant (at the 99% confidence level).
Air quality at different sites in the city of Buenos Aires

RESULTS AND DISCUSSION

(S4) - Close to the SE edge of the city.

Air pollution roses

Open area with few buildings and highways nearby.

Pollutant roses show the contribution of traffic emissions coming directly from the avenue where the monitoring station is located.

(there is no evidence of recirculation airflow)

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Mean value ENE→SSE→WSW</th>
<th>Mean value WSW→NNW→ENE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO (ppm)</td>
<td>0.303</td>
<td>0.584</td>
</tr>
<tr>
<td>NO (ppb)</td>
<td>49.8</td>
<td>91.8</td>
</tr>
<tr>
<td>NO₂ (ppb)</td>
<td>28.5</td>
<td>34.9</td>
</tr>
</tbody>
</table>

The difference between mean concentrations at the two sides is statistically significant (at the 99% confidence level).
RESULTS AND DISCUSSION

Comparison between mean CO, NO and NO₂ concentrations at the four sites

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>S1</th>
<th>S2</th>
<th>S3</th>
<th>S4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO (ppm)</td>
<td>0.91</td>
<td>0.58</td>
<td>0.92</td>
<td>0.45</td>
</tr>
<tr>
<td>NO (ppb)</td>
<td>91.0</td>
<td>26.7</td>
<td>60.6</td>
<td>72.2</td>
</tr>
<tr>
<td>NO₂ (ppb)</td>
<td>39.7</td>
<td>17.0</td>
<td>36.3</td>
<td>31.9</td>
</tr>
</tbody>
</table>

Besides the difference between mean CO for S1 and S3 (which are not statistically different), the differences between mean concentrations at two sites are statistically significant at the 99% confidence level. The best correlation of pollutant hourly concentrations at different sites is given by CO between S3 and S4 (r=0.7697).
The analysis of pollutant roses for hourly CO, NO and NO$_2$ concentrations registered during June-August 2009, at four sites in the city of Buenos Aires reveals that:

a) at S1, pollutant roses are typical for an urban street canyon near a traffic intersection configuration;
b) at S2, pollutant roses show an important direct contribution of traffic emissions coming from SW→W→NW and very low concentrations for other wind directions,
c) at S3, pollutant roses do not show a marked contribution from a preferential direction, except for a small contribution from WSW (emissions from a nearby avenue),
d) at S4, pollutant roses show the contribution of sources located NW and the direct contribution of traffic emissions in the avenue where the monitoring station is located.
e) For each pollutant, mean concentrations at any pair of monitoring sites are significantly different (at the 99% confidence level), except mean CO at S1 and S3 which are similar.
LEAPFROGGING

WHAT DID WE GET FROM THE PREVIOUS ANALYSIS?

1. Information on the air quality condition.

2. Air quality information at one site is significantly different from the registered at any other site.

3. Air Pollution Roses + t-test

Identification of the sector where the main sources responsible for the air pollution level at that site are located

EXAMPLE
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(S2) - Green area
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Air pollution event in Buenos Aires city originated by a biomass burning far from the city

THANK YOU FOR YOUR ATTENTION