The European Commission’s science and knowledge service
Joint Research Centre

Fairmode technical meeting: WG1 Spatial representativeness

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Zagreb 27-29/06/2016
Outline

- Scope and Objectives of the Intercomparison Exercise
- Timeline and Progression
- Datasets
- Participation
- Treatment of Results
- Extension with virtual stations for SR and Station Classification
- Discussion
Work Plan and Objective

The intercomparison exercise on spatial representativeness (SR) methods shall:

- Be executed by different groups, but on the same shared dataset.

- Cover as much as possible the whole range of procedures which are in use today - ranging from methods with moderate complexity, used for pragmatic purposes, to those which involve higher levels of data requirements and computational efforts.
### Recall of methodologies – Output data

<table>
<thead>
<tr>
<th>Output Data</th>
<th>Number of Methodologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maps</td>
<td>18</td>
</tr>
<tr>
<td>Simplified metrics</td>
<td>11</td>
</tr>
<tr>
<td>Scale</td>
<td>9</td>
</tr>
<tr>
<td>Similarity of locations</td>
<td>6</td>
</tr>
<tr>
<td>Spatial variance</td>
<td>1</td>
</tr>
<tr>
<td>Other statistical means</td>
<td>3</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
</tr>
<tr>
<td>No answer</td>
<td>3</td>
</tr>
</tbody>
</table>

#### Output Data

1. Maps
2. Simplified metrics
3. Scale
4. Similarity of locations
5. Spatial variance
6. Other statistical means
7. Others
8. No answer
Initial scope of the intercomparison exercise

1 traffic site
Borgerhout-Straatkant
SR: NO$_2$ and PM$_{10}$

2 urban background sites
Antwerpen-Linkeroever
Schoten
SR: NO$_2$ and PM$_{10}$

Additional virtual stations - industrial stations at the harbour

Classification of stations?
A) Progression & Past Dates

Jan. / Feb. 2015
- Distribution of questionnaires for the feasibility study

Feb. 2015
- FAIRMODE Plenary Meeting in Baveno (IT)
  - Presentation of the survey and of first outcomes

June 2015 & FAIRMODE Technical Meeting
- Final reporting on the results of the feasibility study
  - Identification of candidate methods and possible participants
  - Detailed discussion on means and operation (datasets, timeframe...)

since Nov. 2015
- Definition of datasets (selected for the city of Antwerp)

since Jan. 2016
- Preparation of AQM simulations to be performed by VITO
Feb. 2016
- Simulations based on the RIO-IFDM-OSPM model chain
  - Done by VITO (W. Lefebvre, H. Hooyberghs, S. Janssen, B. Maiheu)

April 2016
- Inspection of datasets by JRC

May 2016 (tentative)
- Official distribution of datasets
  - Datasets to be made available to participants for download from the FAIRMODE homepage

June 2016
- FAIRMODE Technical Meeting
  - Possibility to discuss and answer questions on technical details, means and operation (datasets, timeframe ...)

Sept. 2016 (tentative), with possibility to postpone to October on request
- Return of the SR results provided by participants
  - Uploading facility made available on ftp site
Presentation Dataset - VITO
Dataset 9 – Adding noise, virtual stations

- 341 virtual monitoring points with hourly data has been extracted from the RIO-IFDM-OSPM model chain outputs

- Simulate virtual monitoring stations with daily averages for PM$_{10}$, and virtual diffusive samplers with to 2-weeks averages for NO$_2$ and O$_3$

- Diffusive samplers should have higher uncertainties than reference values while the temporal variability of these virtual monitoring is equal or lower than the temporal variability of the existing monitoring stations in Antwerp
Dataset 9 – Adding noise, virtual stations


\[ \hat{y} = \beta_0 + \beta_1 \cdot x \]

\( \beta_0 = 0 \) and \( \beta_1 = 1 \), no correction for bias (!)

\[ s^2 = \alpha_0^2 + \alpha_1^2 \cdot x + \alpha_2^2 \cdot x^2 \]

\( \alpha_0, \alpha_1 \) and \( \alpha_2 \) values:

\( \text{NO}_2 \) and \( \text{O}_3 \) from studies of 2-week Radiello samplers

For \( \text{PM}_{10} \), the valuation the 2015 JRC-AQUILA Field Comparison Exercise for \( \text{PM}_{10} \) and \( \text{PM}_{2.5} \)


Dataset 9 – Adding noise, virtual stations

Virtual Station 0
(no SC: outside of street canyon)
<table>
<thead>
<tr>
<th>Expert</th>
<th>Institution</th>
<th>Country</th>
<th>Dataset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jutta Geiger</td>
<td>LANUV, FB 42</td>
<td>Germany</td>
<td></td>
</tr>
<tr>
<td>Wolfgang Spangl</td>
<td>Umweltbundesamt Austria</td>
<td>Austria</td>
<td></td>
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<tr>
<td>Jan Duyzer</td>
<td>TNO</td>
<td>Netherland</td>
<td></td>
</tr>
<tr>
<td>David Roet</td>
<td>Flemish Environment Agency (VMM)</td>
<td>Belgium</td>
<td></td>
</tr>
<tr>
<td>Antonio Piersanti</td>
<td>ENEA</td>
<td>Italy</td>
<td>Received</td>
</tr>
<tr>
<td>Maria Teresa Pay</td>
<td>Barcelona Supercomputing Center</td>
<td>Spain</td>
<td></td>
</tr>
<tr>
<td>Ana Miranda</td>
<td>University of Aveiro</td>
<td>Portugal</td>
<td>Withdraw</td>
</tr>
<tr>
<td>Florian Pfäfflin</td>
<td>IVU Umwelt GmbH</td>
<td>Germany</td>
<td>Withdraw</td>
</tr>
<tr>
<td>Ronald Hoogerbrugge</td>
<td>National Institute for Public Health and the Environment</td>
<td>Netherland</td>
<td>Received</td>
</tr>
<tr>
<td>Fernando Martin</td>
<td>CIEMAT</td>
<td>Spain</td>
<td>Received</td>
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<tr>
<td>Daniel Brookes</td>
<td>Ricardo-AEA</td>
<td>UK</td>
<td>Missing SA</td>
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<td>Laure Malherbe</td>
<td>INERIS</td>
<td>France</td>
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<td>Stijn Janssen</td>
<td>VITO</td>
<td>Belgium</td>
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<tr>
<td>Roberto San Jose</td>
<td>Technical University of Madrid (UPM)</td>
<td>Spain</td>
<td>Received</td>
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<tr>
<td>Jan Horálek</td>
<td>Czech Hydrometeorological Institute</td>
<td>Czech Republic</td>
<td></td>
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<tr>
<td>Kevin Delaney</td>
<td>Irish EPA</td>
<td>Ireland</td>
<td>Mail Received</td>
</tr>
<tr>
<td>Lars Gidhagen</td>
<td>Swedish Meteorological and Hydrological Institute</td>
<td>Sweden</td>
<td>Withdraw</td>
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<tr>
<td>Hannele Hakola</td>
<td>Finnish Meteorological Institute</td>
<td>Finland</td>
<td></td>
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<tr>
<td>Tarja Koskentalo</td>
<td>Helsinki Region Environmental Services Authority</td>
<td>Finland</td>
<td></td>
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<tr>
<td>Erkki Pärjälä</td>
<td>City of Kuopio, Regional Environmental Protection Services</td>
<td>Finland</td>
<td>Mail received</td>
</tr>
<tr>
<td>Miika Meretoja</td>
<td>City of Turku / Environmental Division</td>
<td>Finland</td>
<td>Received</td>
</tr>
</tbody>
</table>
# Results expected from participants

<table>
<thead>
<tr>
<th>Nº</th>
<th>Output</th>
<th>Number of Methodologies</th>
<th>Output requested</th>
<th>In all cases, even from descriptive methods?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SR Maps</td>
<td>18</td>
<td>Shape files - concentration similarity threshold used to estimate the extent of SR. In addition please answer to other rows (2 to 6) if possible</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Simplified metrics</td>
<td>11</td>
<td>Metrics definition, metrics values. Please report the concentration similarity threshold if relevant</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Scale</td>
<td>9</td>
<td>Scale definition, scale description and values if any. Please report the concentration similarity threshold if relevant</td>
<td>SR in km²</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>A shape/raster file of the SR</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>The associated population in the area (shape file?)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Standard deviation of all concentration values in the area of representativeness</strong></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Similarity of locations</td>
<td>6</td>
<td>Gives the characteristics used to evidence similarity, their values and where possible report shape files. Please report the concentration similarity threshold if relevant</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Spatial variance</td>
<td>1</td>
<td>Variance values. If relevant give the concentration similarity threshold</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Other statistical means</td>
<td>3</td>
<td>Description of statistical method and values (e.g. pattern recognition, index of representativeness and other statistics). Please report the used concentration similarity threshold if relevant</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Others</td>
<td>5</td>
<td>Description of the method photos with qualitative description and station categorization</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>No answer</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Data treatment

- For the metrics (area in km², standard deviations of values in the area, spatial variance, population) we can carry out a r/R exercise (ISO 5725, ISO 13528) that can give repeatability, reproducibility, outliers ...

- What is the measurement (sic) uncertainty if the AQMS values is attributed to all sites in the area of representativeness

- What is the reference area of representativeness, the intersection of all area (minimum area) or the cumulative area of representativeness. Compute a ratio of SR of each method / reference SR

- Still looking for a index of similarity of the shapes of SR on which to apply a cluster analysis

*(Hausdorff distance up to isometry ...)*
Should the IE be extended to SR and station classification?

- To be discussed.
  - We propose to open this possibility to those participants who would like to (with no obligation for the others)
  - We need a minimum number of participants
  - Feed back requested (not a lot of feed back since Feb 2016)

- Can this be seen feasible for the full set of ca 340 virtual stations (automatic processing?) or should a reduced set be defined?
  - We consider that a combined setting of tasks (a) full set of 340 points, plus (b) reduced set for those who cannot report on such a high number) could be most useful.
Ozone

10 virtual stations proposed for classification

![Map of ozone concentration with virtual stations](image)

- **Street canyon (n = 2)**
- **No street canyon (n = 8)**

**Annual average concentration [μg/m³]**
- 43: 28.6 μg/m³
- 63: 39.7 μg/m³
- 68: 30.4 μg/m³
- 88: 40.2 μg/m³
- 105: 39.7 μg/m³
- 115: 32.9 μg/m³
- 135: 27 μg/m³
- 137: 21.4 μg/m³
- 240: 28.6 μg/m³
- 258: 27 μg/m³

*File source: O3_Rad4.asc*
## Virtual stations

<table>
<thead>
<tr>
<th>Virtual station label</th>
<th>Site type</th>
<th>Annual PM$_{10}$ µg/m³</th>
<th>Annual NO$_2$ µg/m³</th>
<th>Annual O$_3$ µg/m³</th>
<th>Population in the cell</th>
<th>Corine, in the cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>43</td>
<td>No street canyon</td>
<td>37.4</td>
<td>37.4</td>
<td>28.6</td>
<td>0</td>
<td>27</td>
</tr>
<tr>
<td>63</td>
<td>No street canyon</td>
<td>22.4</td>
<td>22.4</td>
<td>39.7</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>68</td>
<td>No street canyon</td>
<td>37.1</td>
<td>37.1</td>
<td>30.4</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>88</td>
<td>No street canyon</td>
<td>22.6</td>
<td>22.6</td>
<td>40.2</td>
<td>4.6</td>
<td>12</td>
</tr>
<tr>
<td>105</td>
<td>No street canyon</td>
<td>23.1</td>
<td>23.1</td>
<td>39.7</td>
<td>23.6</td>
<td>2</td>
</tr>
<tr>
<td>115</td>
<td>No street canyon</td>
<td>29.9</td>
<td>29.9</td>
<td>32.9</td>
<td>8.7</td>
<td>20</td>
</tr>
<tr>
<td>135</td>
<td>No street canyon</td>
<td>40.9</td>
<td>40.9</td>
<td>27.0</td>
<td>0.4</td>
<td>20</td>
</tr>
<tr>
<td>137</td>
<td>No street canyon</td>
<td>64.8</td>
<td>64.8</td>
<td>21.4</td>
<td>0</td>
<td>2</td>
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<tr>
<td>240</td>
<td>Street Canyon</td>
<td>55.9</td>
<td>55.9</td>
<td>28.6</td>
<td>167.2</td>
<td>1</td>
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<tr>
<td>258</td>
<td>Street Canyon</td>
<td>60.5</td>
<td>60.5</td>
<td>27.0</td>
<td>191.3</td>
<td>2</td>
</tr>
</tbody>
</table>
Thank you for your attention!

Discussion, Questions and Suggestions?
Stay in touch

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