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**Final Conference**

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# **Air4EU recommendations for integrated air quality assessment**

## **Overview and examples**

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6th Framework Programme- Policy oriented Research  
Priority 8.1 Topic 1.5 Task 2



*Introduction**Topic 2**Topic 3**Topic 4**Topic 5**Topic 6**Topic 7**Topic 8*

The Air4EU project addresses research on integrated air quality assessment at different temporal and spatial scales:

- local / hotspot
- urban
- regional

for regulated pollutants

*Introduction**Topic 2**Topic 3**Topic 4**Topic 5**Topic 6**Topic 7**Topic 8*

To develop scientifically sound and practical **recommendations** to:

- integrate measuring and modelling techniques into
  - consistent, cost-effective assessment methods
- for each spatial scale addressed

Topic 1

Scope

Topic 3

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## Assessment needs

### Main policy related need:

- Spatial assessment as a basis for mapping of concentrations and exceedances of limit values, on each scale

### Examples of cities' needs:

- How to design an adequate monitoring network
- How to assess PM properly
- QA/QC requirements for models
- How to assess the local contribution from the city itself
- How to explain discrepancies between measurements and models

Topic 1

## Assessment methods

Topic 2

- Monitoring, modelling, combining the two

Structure

## Cross-cutting issues

Topic 4

- Emissions, Uncertainty analysis of mon/mod

Topic 5

- Representativeness of mon/mod

Topic 6

- Scale interactions

Topic 7

- Data assimilation

Topic 8

## Level of the assessment (complexity/quality)

- Basic – minimum requirements
- Best practice – achievable methods/improved understanding
- Scientific level – further research required

Topic 1

Topic 2

**Structure**

Topic 4

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Topic 8

## Topic of recommendation

Overview

### Methods used

*Monitoring*

*Modelling*

*Combining monitoring and modelling*

*Emissions*

*Uncertainty analysis*

### *Level of assessment*

*Basic assessment requirements*

*Best practise recommendations*

*Scientific recommendations*

*Topic 1*

*Topic 2*

***Structure***

*Topic 4*

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## ***Spatial assessment topics***

- Assessment of PM and NO<sub>2</sub> at hot spots
- Assessment of PM, NO<sub>2</sub> and O<sub>3</sub> in urban areas
- Assessment of PM and O<sub>3</sub> in rural areas

Topic 1

Topic 2

Topic 3

**Monitoring**

Topic 5

Topic 6

Topic 7

Topic 8

## **Network design/monitoring program**

- reference to existing guidance and studies
- station pairs and triplets (rural-urban-hotspot)
- meteorological monitoring at stations/repr. for area
- traffic data for hotspot stations
- PM<sub>2.5</sub> and PM<sub>10</sub>
- PM speciation / Source apportionment

## **Methods**

- keep updated on PM monitoring methods

## **Data quality**

- establish proper data quality (QAQC) procedures

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Topic 4

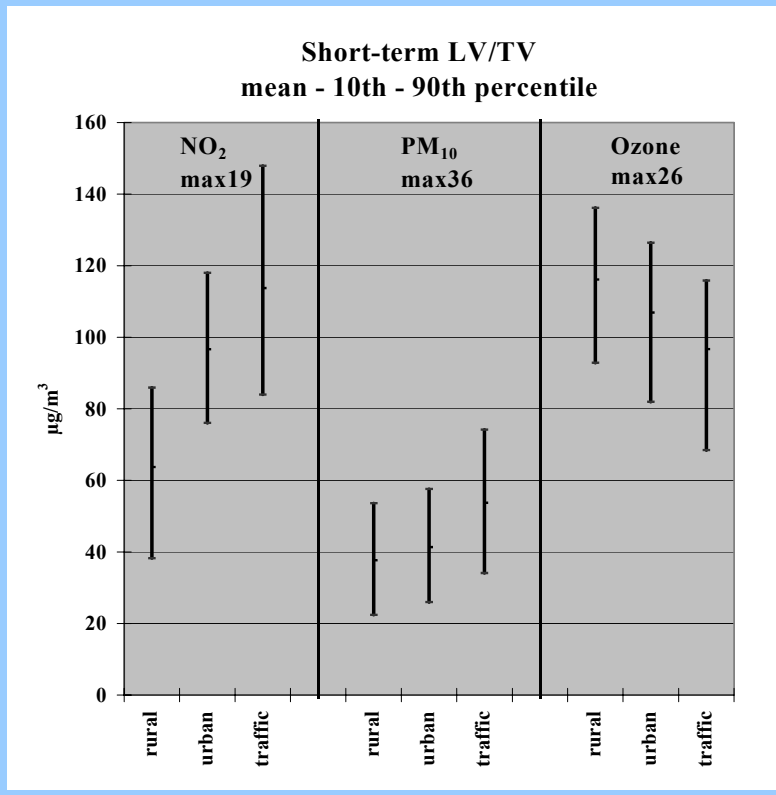
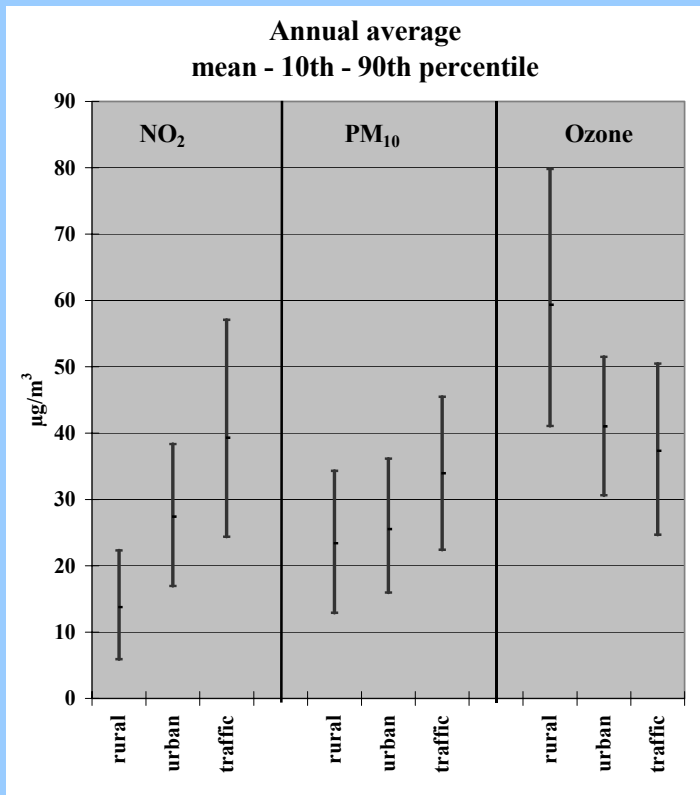
Topic 5

Topic 6

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Topic 8

# Rural - urban - traffic hotspot relations



Topic 1

## **General model types and requirements**

Topic 2

- Box-Gaussian-Eulerian-....

Topic 3

- validation

Topic 4

- expert evaluation

**Modelling**

- emphasis on quality of input data

Topic 6

- uncertainty of fields/maps should be assessed

Topic 7

Topic 8

## **Meteorological data and models**

- data must be representative
- measure at air quality stations
- meteo network needs depend on topography etc.

Topic 1

## **Dispersion and transport**

Topic 2

- Box / Gaussian / Eulerian

Topic 3

- Sensitivity of Eulerian modelling to vertical resolution in your city should be assessed

Topic 4

## **Chemistry and aerosol processes**

Modelling

### **PM:**

Topic 6

- Basic: inert PM

Topic 7

- Urban regions: include inorganic PM chemistry

Topic 8

### **NO<sub>2</sub> and O<sub>3</sub> :**

- Photochemical equilibrium on UB scale
- Discrete parcel method (DPM) on local scale
- Generic reaction scheme (GRS) on local scale
- Complete ozone chemistry for Eulerian urban modelling

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Modelling

Topic 6

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Topic 8

## ***Rural background concentrations***

- assess through measurement and/or modelling (validated)

## ***Population exposure***

- high resolution assessment and population data near roads and hotspots, thus local scale models are required
- more dynamic population exposure assessment is a research topic

Topic 1

## Model evaluation using monitoring data

Topic 2

Topic 3

## Data assimilation (DA)

Topic 4

### Methods available to cities

Topic 5

- Linear regression between modelled and monitored data to remove model bias

Combination

Topic 7

- Optimal interpolation and kriging on monitored data or on the differences between monitored and modelled

Topic 8

- DA to PM<sub>2.5</sub> before PM<sub>10</sub>
- DA on NO<sub>x</sub> before NO<sub>2</sub>, on O<sub>x</sub> before O<sub>3</sub>
- You are better off putting efforts into validating/improving your model than doing data assimilation
- **Case studies: Regional (Europe I),**

**Urban: Prague, Oslo**

Topic 1

- Recommendations on bottom up and top down inventory methodologies

Topic 2

- line – point - area

Topic 3

- Use accepted data bases on emission factors (EF), and local data on technology levels and activity data

Topic 4

Topic 5

Topic 6

- Pay attention to details and accuracy
- Generate traffic data for many links of the main road network

Emissions

Topic 8

- Validation (cross-checking, source apportionment, external review)
- Documentation and archiving
- **Case studies: Rotterdam on direct NO<sub>2</sub> emissions**  
**Oslo: Source apportionment**  
**Non-exhaust PM study**

Topic 1

## Uncertainty of measurements

Topic 2

- Assess and report uncertainty of measurements

Topic 3

- Establish EUROAIRNET QA/QC procedures

Topic 4

## Uncertainty of models

Topic 5

- An assessment of model error/uncertainty is always required

Topic 6

- Communication with decision makers on uncertainties

Topic 7

- A number of uncertainty parameters are recommended, e.g.:

- for Directive's purposes: RPE

- **Case study: DA in open line source modelling in Oslo**

Uncertainty

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Uncertainty

## **Uncertainty when combining measurements and modelling**

- Use optimal interpolation and kriging to indicate the spatial distribution of the uncertainty
- Using DA, assess uncertainty using cross validation technique, the RMSE measure, and Bayesian methods
- Ensemble methods of DA provide insight into uncertainty of the assimilated field

## **Mapping of uncertainty**

- Provide a 'best estimate' of model uncertainty, when info is lacking
- RMSE is the recommended parameter to use
- Data assimilation techniques provide uncertainty assessment, this should be used for uncertainty in maps

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*Concluding*

Clearly there is much to be considered when carrying out air quality assessment for urban areas. The list of recommended basic requirements and best practices given in this document, which number more than 250 separate recommendations, describe a wide variety of aspects that need to be considered when carrying out such assessment. However, there are always real world limitations that will not allow all of the best practice recommendations to be carried out, nor indeed some of the basic requirements. Despite this, this document should serve as a guide to give both city users of air quality assessments and the institutes carrying them out an overview of the many methods, of varying quality or effectiveness, available. These recommendations are intended to steer decisions that need to be made in how assessment is carried out, from monitoring network design and modelling applications through to their eventual combination. This will not only achieve the best assessment of air quality but will also improve the understanding of the causes and effects that lead to the current and future air quality situation.

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