FAIRMODE
Forum for air quality modelling in Europe

Technical Meeting

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WG2 Emissions

Estimating Traffic Emissions using air quality data – a modeling and monitoring approach

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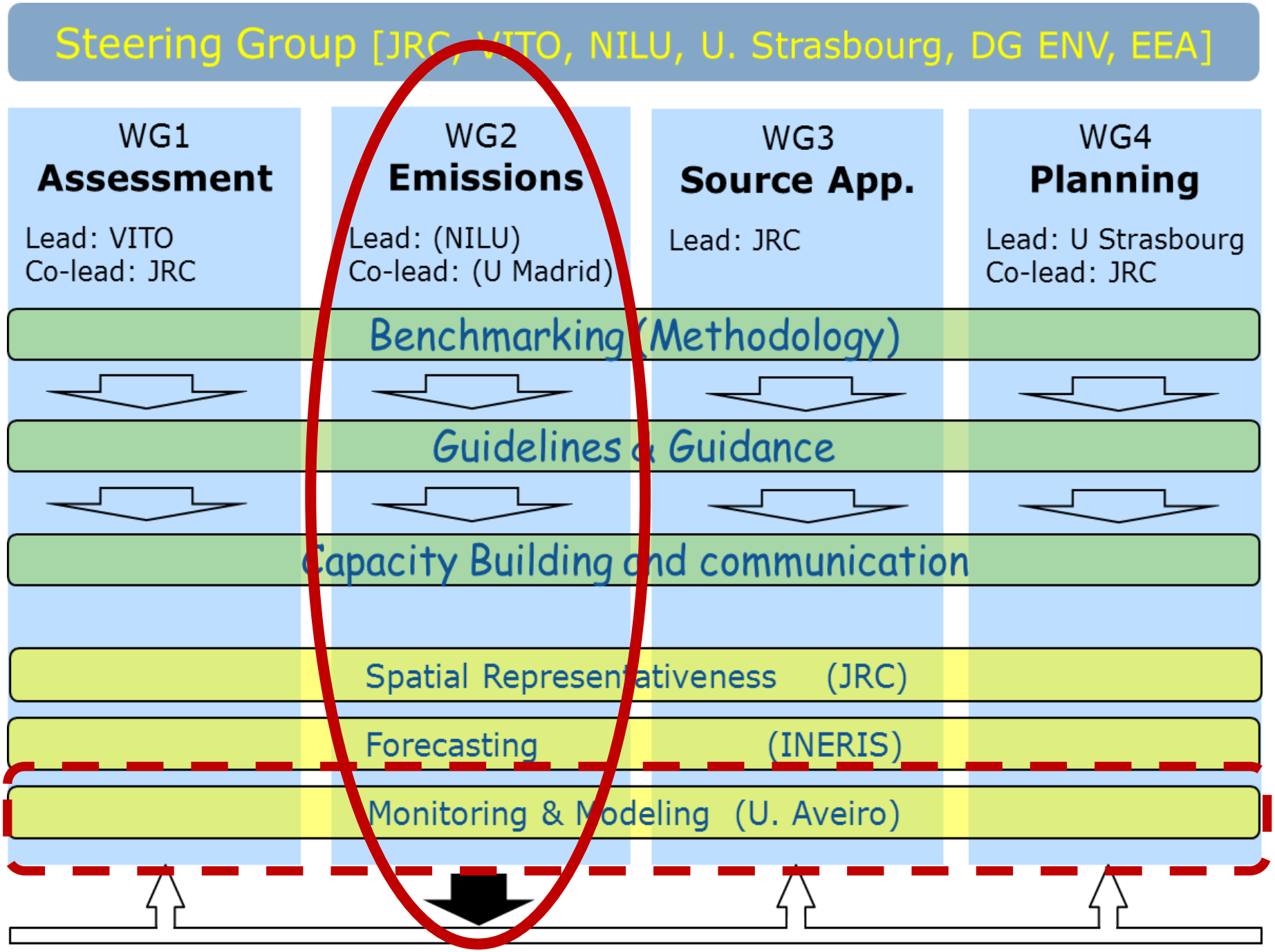

Steering Group [JRC, VITO, NILU, U. Strasbourg, DG ENV, EEA]
WG1
Assessment
Lead: VITO
Co-lead: JRC
WG2
Emissions
Lead: (NILU)
Co-lead: (U Madrid)
WG3
Source App.
Lead: JRC
WG4
Planning
Lead: U Strasbourg
Co-lead: JRC
Benchmarking (Methodology)
Guidelines & Guidance
Capacity Building and communication
Spatial Representativeness (JRC)
Forecasting (INERIS)
Monitoring & Modeling (U. Aveiro)

For urban areas and focusing on traffic road emissions, …

… does it make sense to use air quality monitored data from traffic stations to improve emissions?

Previous studies

F. Palmgren, R. Berkowicz, A. Ziv, O. Hertel, 1999. **Actual car fleet emissions estimated from urban air quality measurements and street pollution models.** The Science of the Total Environment 235 1999. 101-109

A. Ziv, R. Berkowicz, E. Genikhovich, F. Palmgren, E. Yakovleva. 2002. **Analysis of the St. Petersburg traffic data using the OSPM Model**. Water, Air, and Soil Pollution: Focus 2: 297–310, 2002.

M. Ketzel, P. W(ahlin, R. Berkowicz, F. Palmgren, 2003. **Particle and trace gas emission factors under urban driving conditions in Copenhagen based on street and roof-level observations**. Atmospheric Environment 37 (2003) 2735–2749.

A. Cantelli, G. Leuzzi, P. Monti, P. Viotti, M. Villanova, S. Majetta, 2011. **An inverse modeling method to identify vehicular emissions in urban complex areas.** 14th Conference on Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes – 2-6 October 2011, Kos, Greece

Methodology

$$C = F(meteorology) \cdot Q + C_{background}$$

C is the concentration of a particular pollutant (considered as non-reactive) in the street,

Q is the emission of pollutants from the traffic in the street and is given by a street dispersion model

F(meteorology) is a function describing dispersion processes, and is given by a street pollution model.

C ***background*** is the contribution to pollution concentrations in the street from all other sources than the traffic in the street.

Palmgren et al., 1999;

How to apply

$$C = F(meteorology) \cdot Q + C_{background}$$

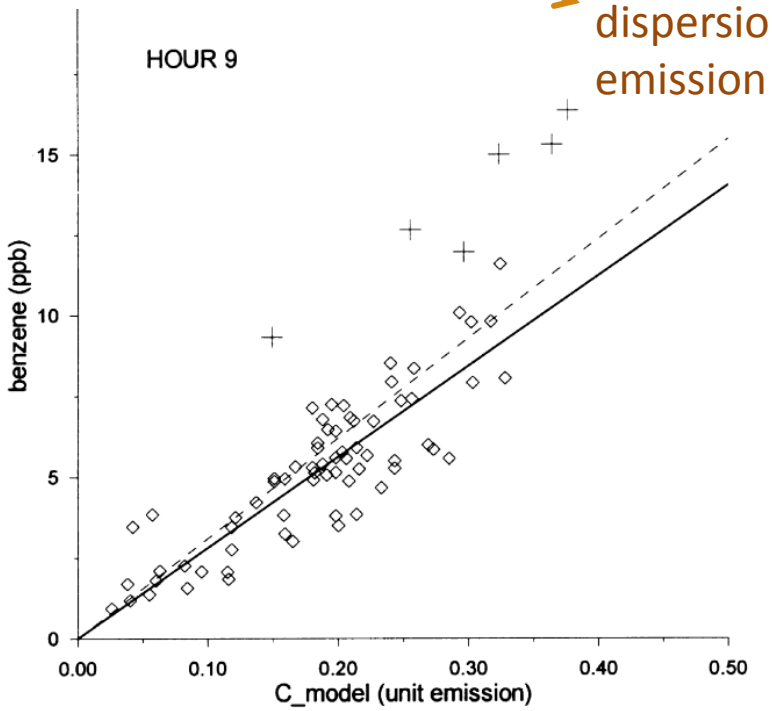
Hourly emissions

$$Q_h = \frac{C_h - C_{h\,background}}{F(meteorology)}$$

Observed hourly concentrations (street and urban background)

Simulated hourly concentrations by a 1-year simulation of a street level dispersion model, but with a unit emission

the slope of the **best-fit-line** to the relationship at each hour, ex:

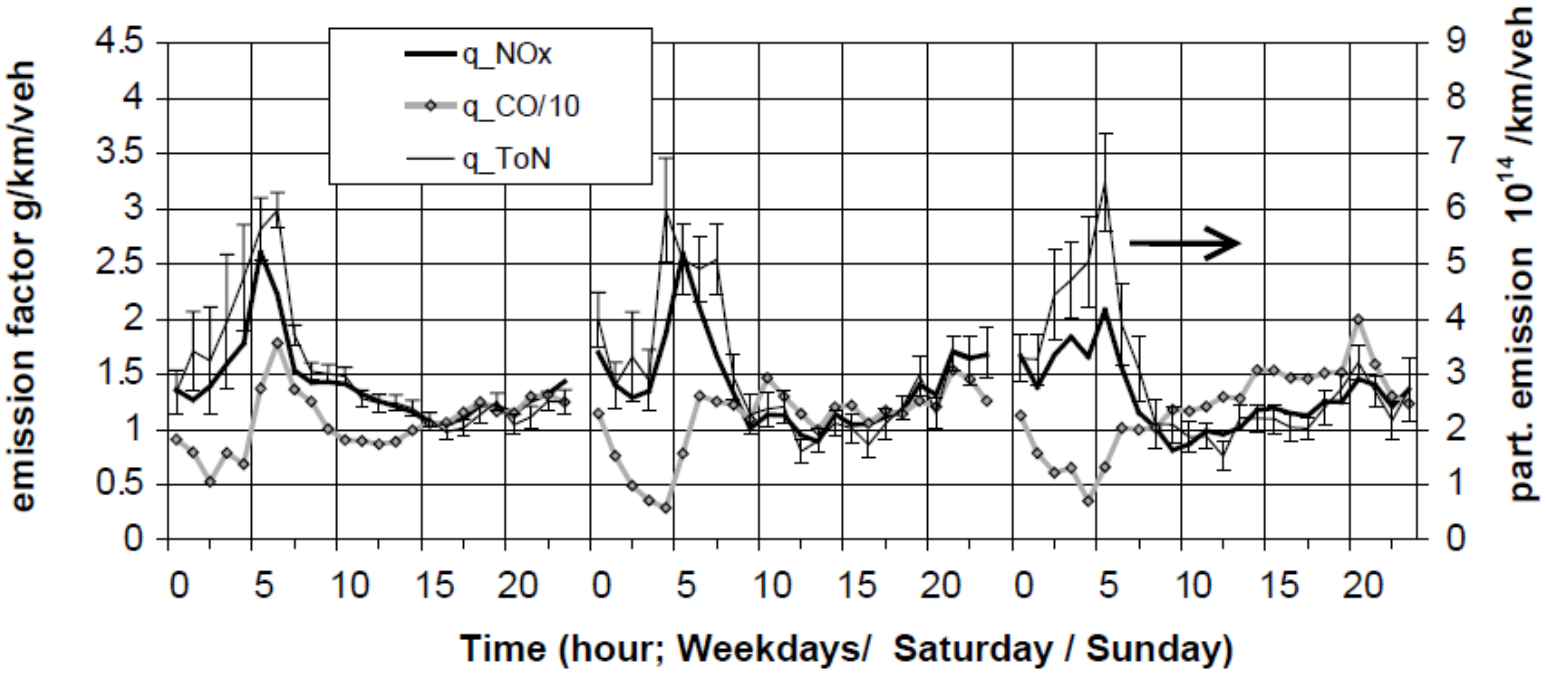


Examples

inverse modelling applied to:

- estimate average fleet emission factors typical of urban conditions in Denmark

Emission factors for NOx, CO and ToN (total particle nr)



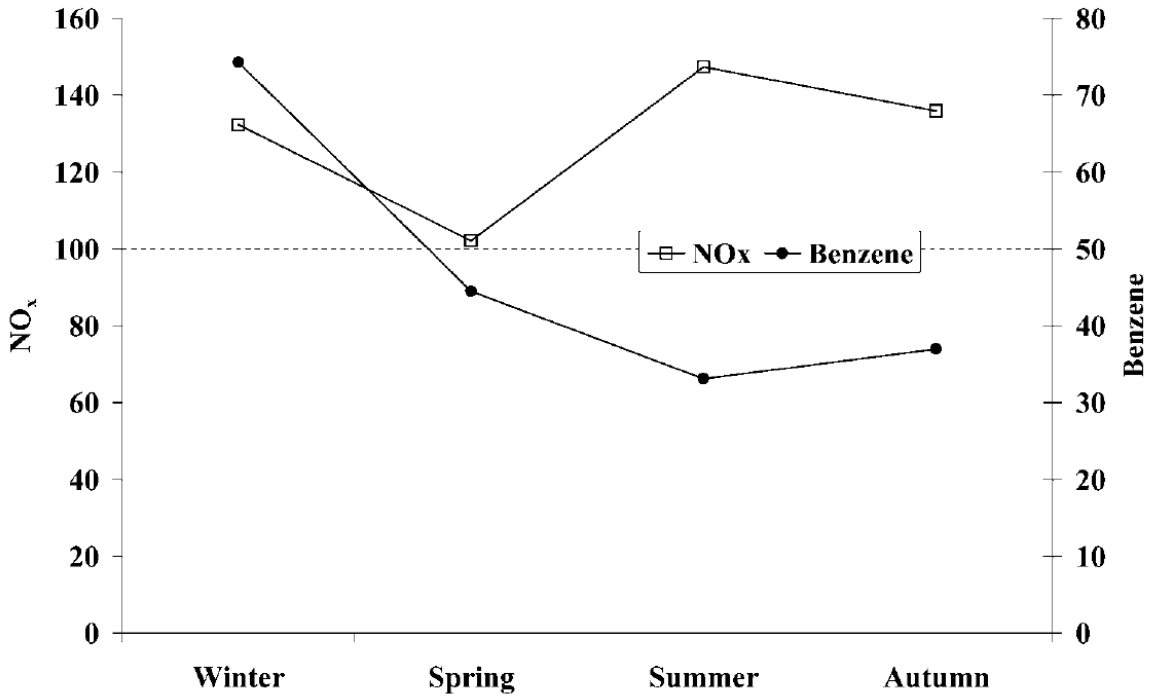
Ketzel et al., 2003

Examples

inverse modelling applied to:

- estimate total emissions and emission factors at street level in St Petersbourg

Seasonal variation of **averaged calculated emissions (µg m^{-1} s^{-1})** for **benzene** and **NOx.**



Ziv et al., 2002;

Strengths and Limitations

- Air quality monitoring data at street and urban background levels are needed
- Accuracy depends on number of observations
- A (long term) simulation of a street dispersion model is required, but with a unit emission
- Adequate to estimate traffic emissions for areas where detailed emission data is not available
- Possibility to estimate emissions by vehicle category if detailed traffic counts are available
- Only applicable to non-reactive pollutants

Challenge

- Can we test this approach for a few case studies?