

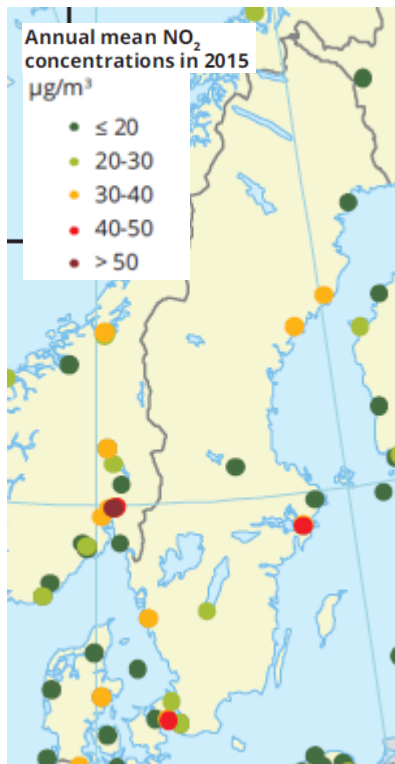
**FAIRMODE Technical Meeting, Tallinn, Estonia, 28 June 2018**

# **Source apportionment in Sweden using source oriented models**

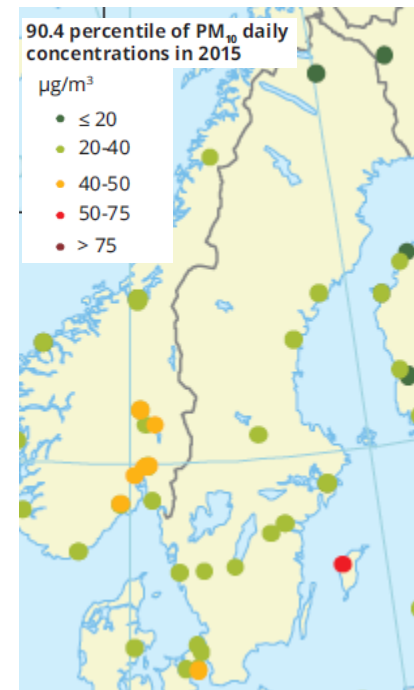
**Heléne Alpfjord Wylde**

**Swedish Meteorological and Hydrological Institute**

# Overview of air quality in Sweden



- Few exceedances of EU limit values
  - NO<sub>2</sub> annual mean
  - PM10 daily mean
  - Only in the most polluted traffic locations
  - Low regional and urban background
- More widespread exceedances of Swedish limit value for NO<sub>2</sub>
  - Max 7 days > 60 µg/m<sup>3</sup>
- All limit value exceedances require action plan, including information on
  - Source apportionment
  - Effects of measures
  - Projections / scenarios, etc



Source:  
<https://www.eea.europa.eu/publications/air-quality-in-europe-2017>

- Problems clearly traffic-related
  - Need for detailed source apportionment for regional & urban background as required by IPR (EU reporting provisions)?

## Decentralised system

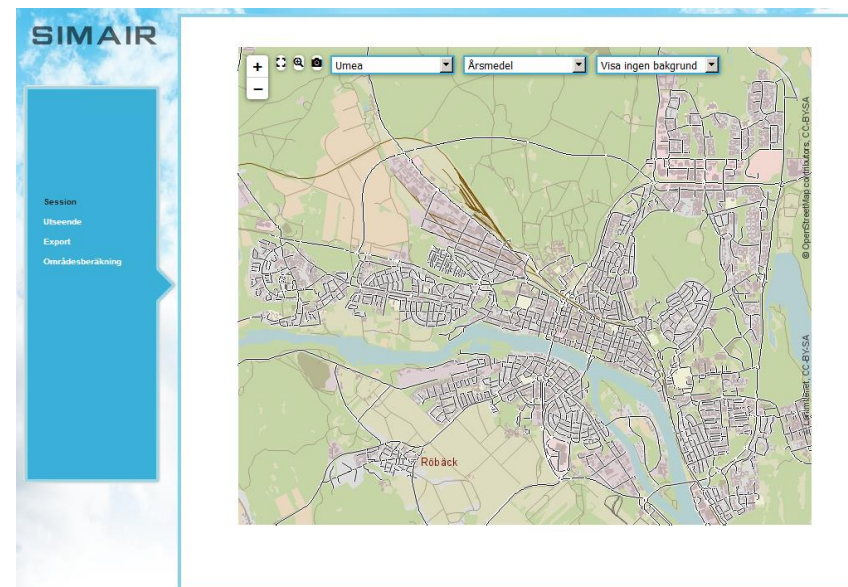
- Municipalities responsible for AQ assessment and management (action planning) where necessary
  - Regional co-operation in most counties
- Around 15 local and regional action plans produced
- Environmental health inspectors often responsible
  - Lack detailed technical knowledge
- Reported actions plans usually lacking information required by IPR
  - Source apportionment very limited



# SIMAIR – Swedish national Air Quality model system

## Web-based Air Quality model tool

- Can be used by all municipalities and cities in Sweden.
- Simple user interface.
- Fast calculations.
- Applications for road traffic and small-scale residential wood combustion.

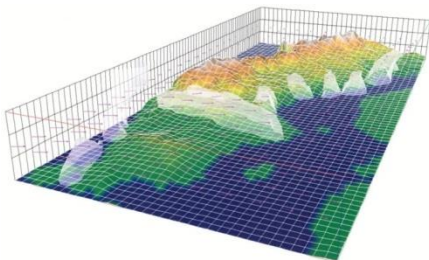


<http://www.smhi.se/tema/SIMAIR>

# SIMAIR - coupled model system

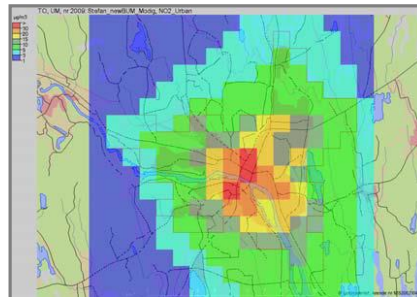
## Regional scale

- MATCH: Multi-scale Atmospheric Transport and Chemistry Model
- 22 km x 22 km (Europe)



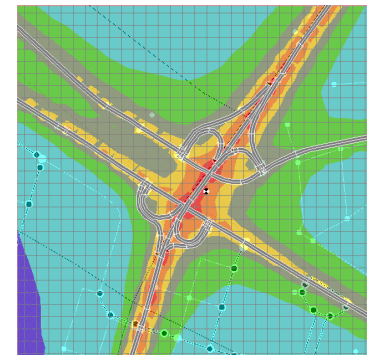
## Urban scale

- BUM – back-trajectory model + Gaussian model
- 1 km x 1 km



## Local scale

- OSPM (street canyon)
- Open road
- Dispersion
- 25 m x 25 m

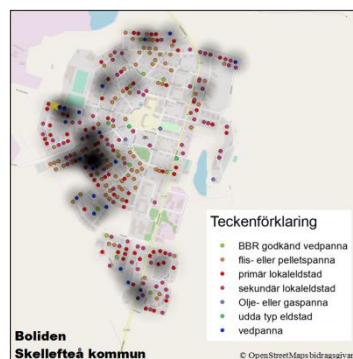
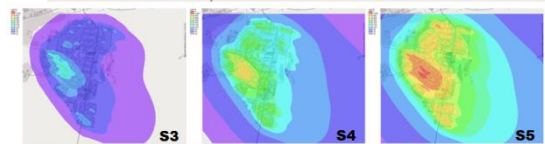
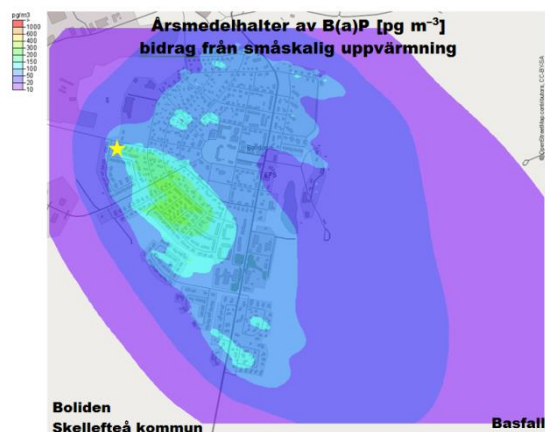
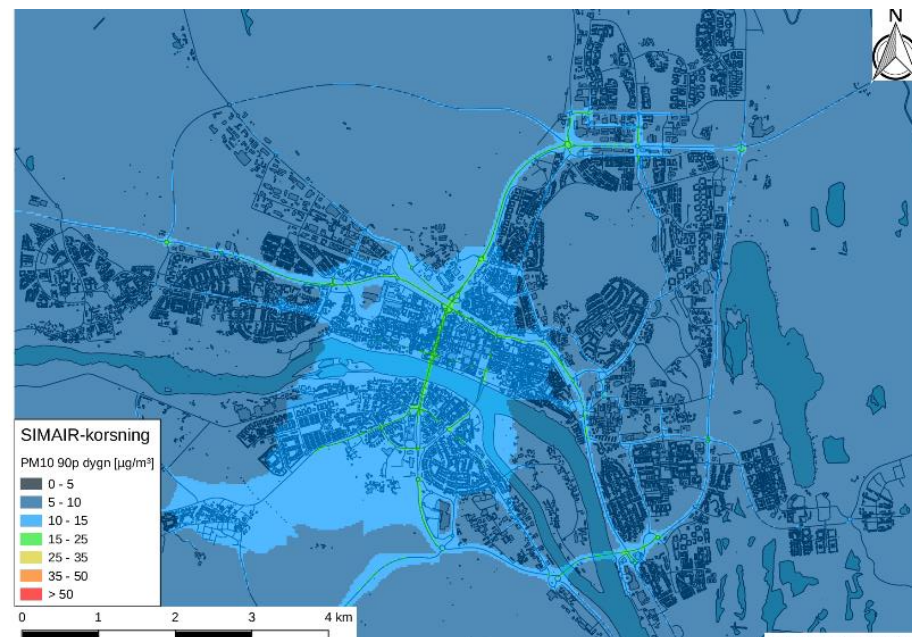


# **New development in SIMAIR - urban source apportionment**

- Emission sectors used:
  - Traffic
    - Heavy
    - Light
    - Road wear
  - Work machines
  - Agriculture
  - Industry
  - Small-scale residential heating
  - Heating
  - Shipping
  - Other
  
- Sector contributions calculated (point and area emissions) and all together (scale to match total concentrations) for each city
- Background concentrations from regional modelling (MATCH)
- Results - urban concentration contributions on 1 x 1 km resolution

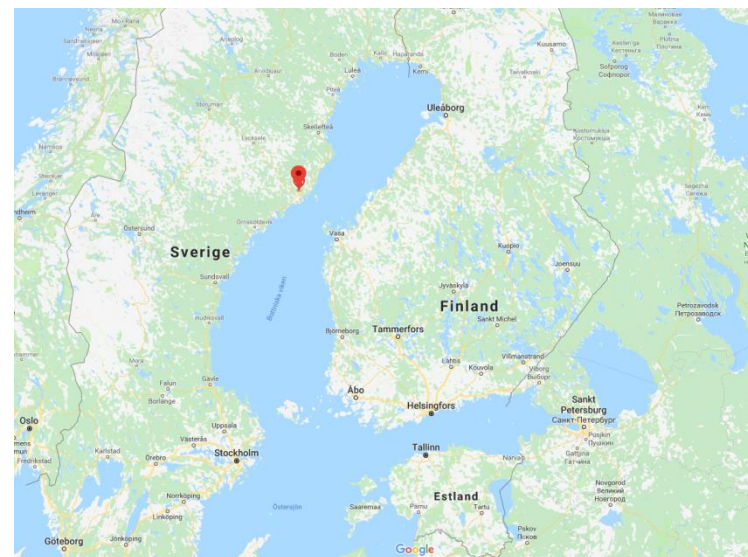
# Local source apportionment

- Traffic
  - Exhaust emissions
  - Road wear (resuspension)
- Local residential wood combustion
- Large point sources
- Area sources



## Example Umeå

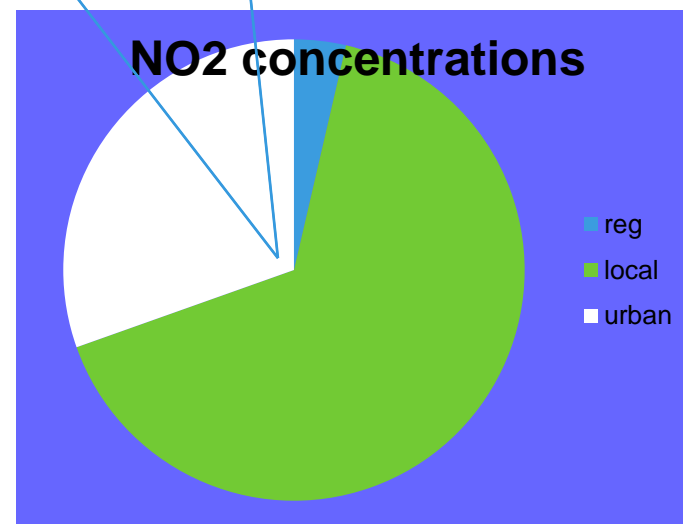
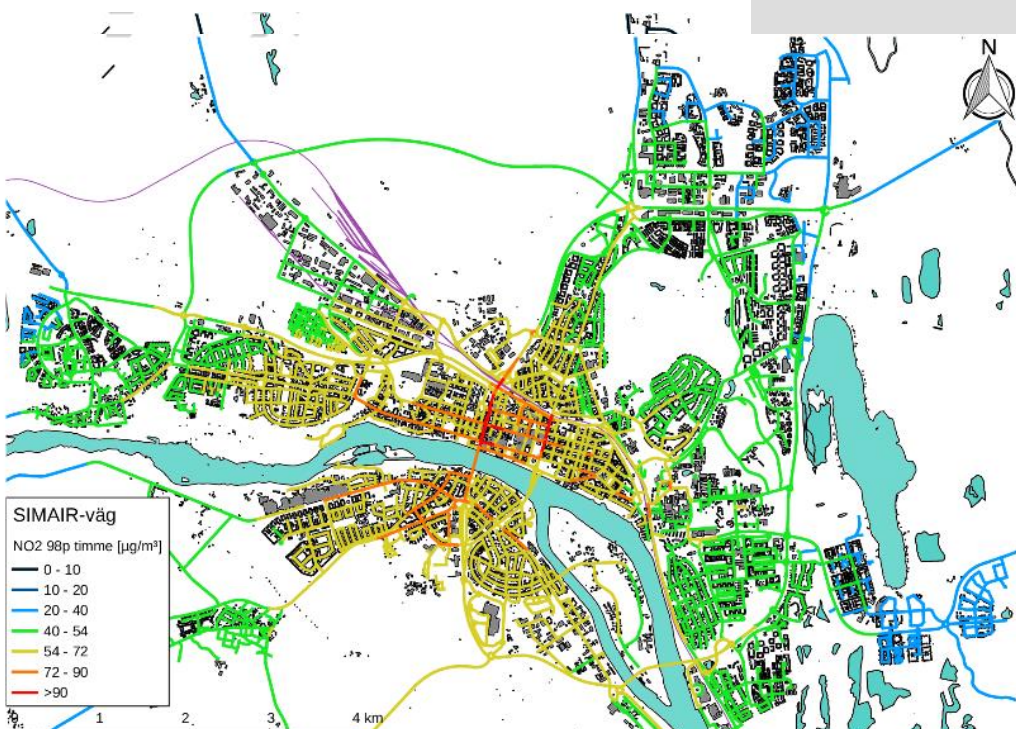
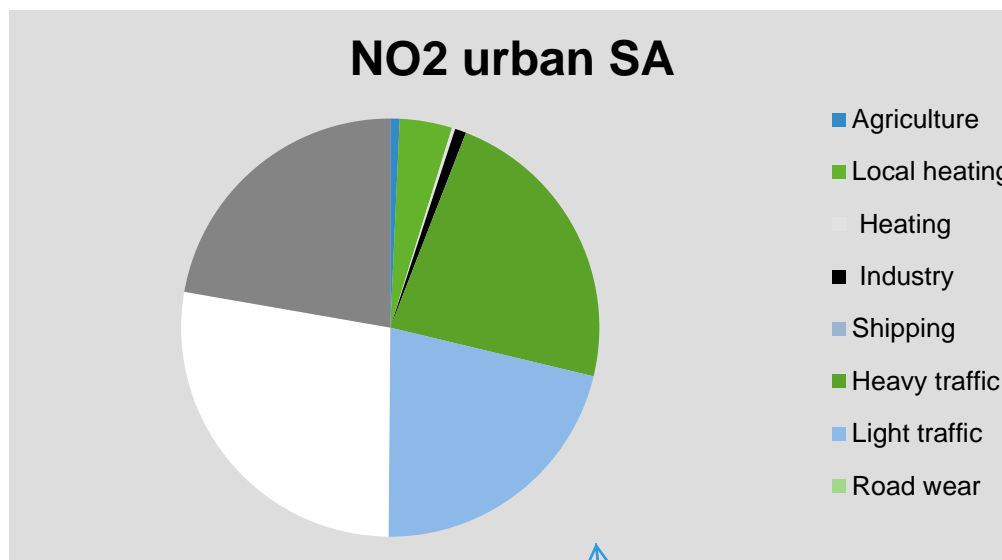
- 120 000 inhabitants
- Problems with inversions, dense central traffic
- AQ plan due to NO<sub>2</sub> exceedances





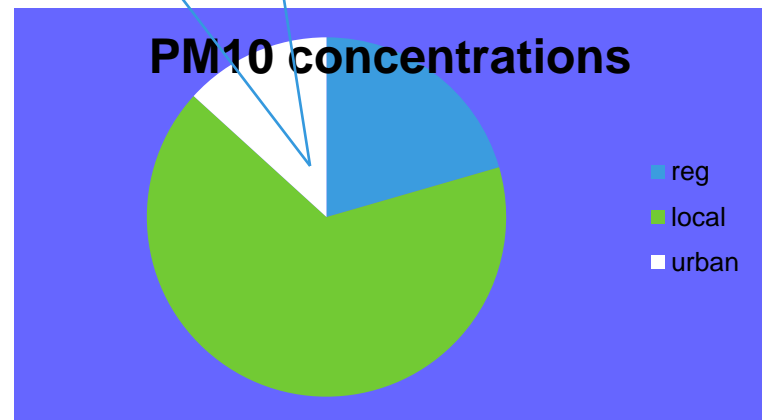
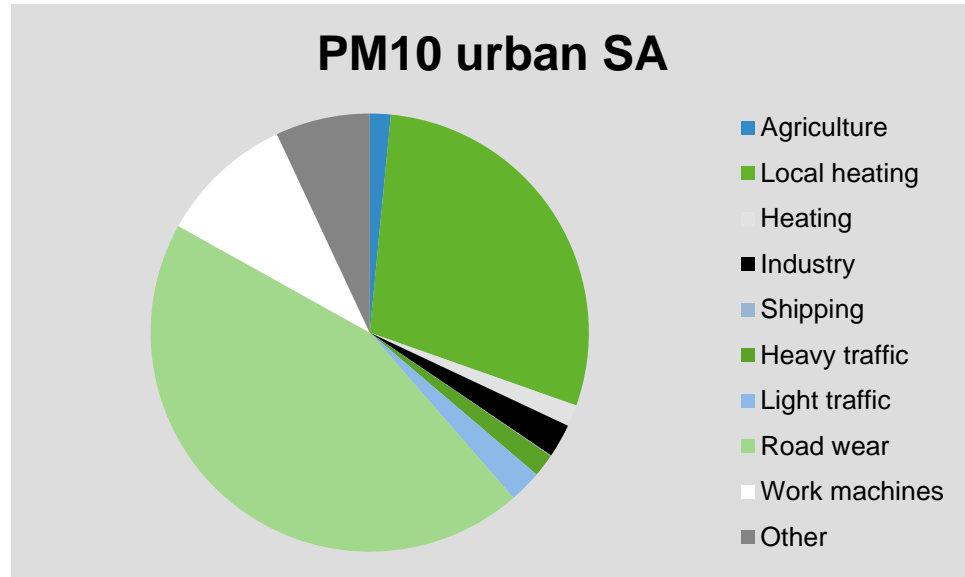
## Example Umeå

- SIMAIR calculations
- Traffic and work machines are major urban sources
- Percentile exceedances



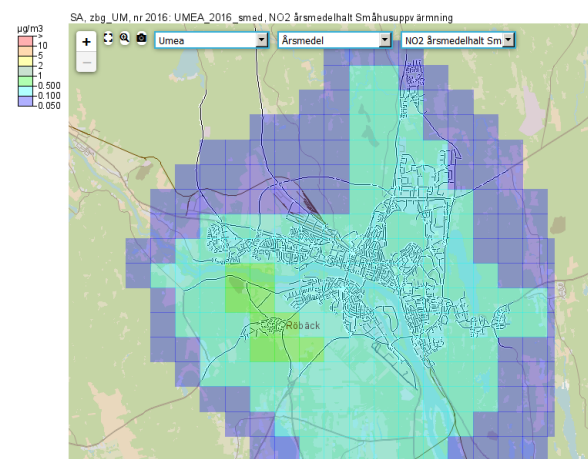
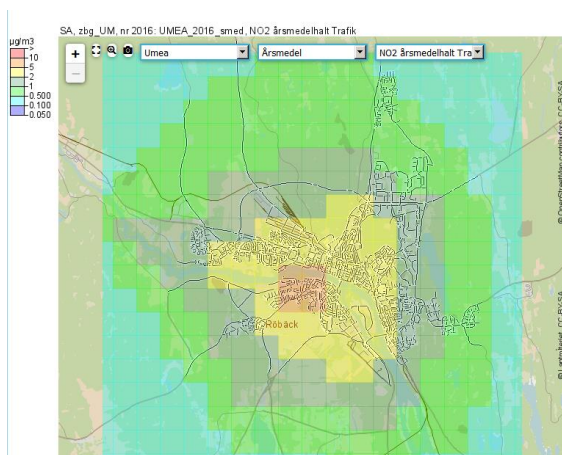
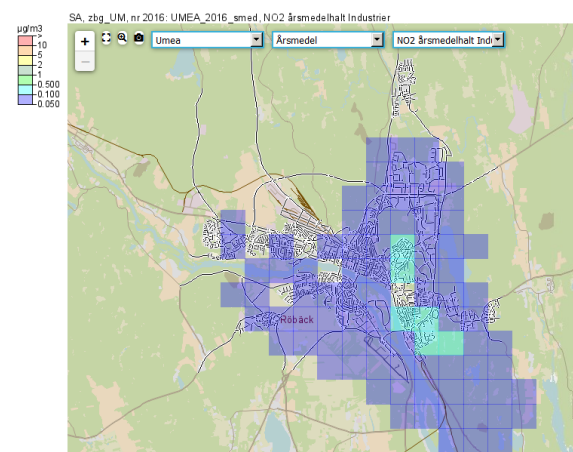
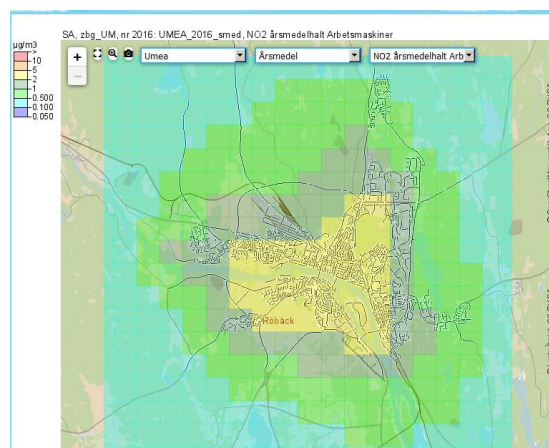
## Example Umeå

- Small-scale heating and road wear are dominant urban (and local!) sources



# Example Umeå

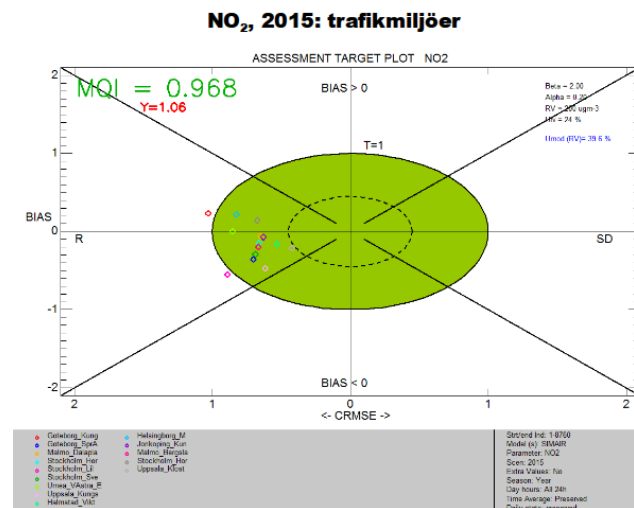
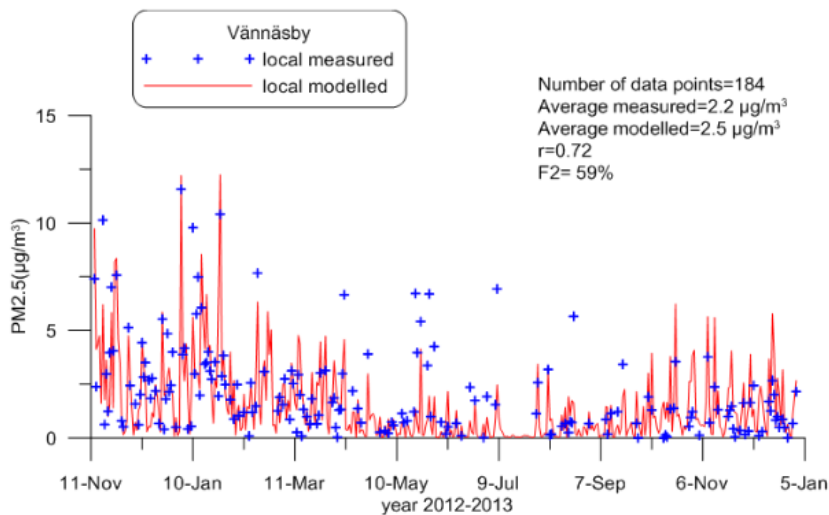
- NO2 urban sector contributions from work machines, traffic, industry and small-scale residential heating



## Example Umeå

### Validation studies

- Local residential wood combustion
- Total concentrations



## **Source apportionment in Sweden**

For air quality plans:

- Focuses mostly on urban/local scale
  - Traffic and residential wood combustion greatest causes of exceedances
- Fine scale emission inventory most important for modelling quality
- Temporal variation of different emission sources (percentiles)

On national scale:

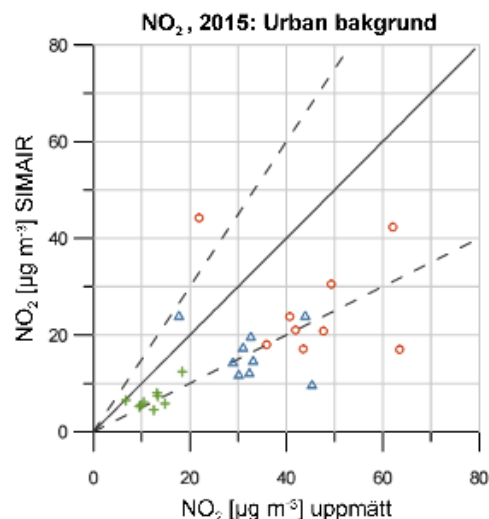
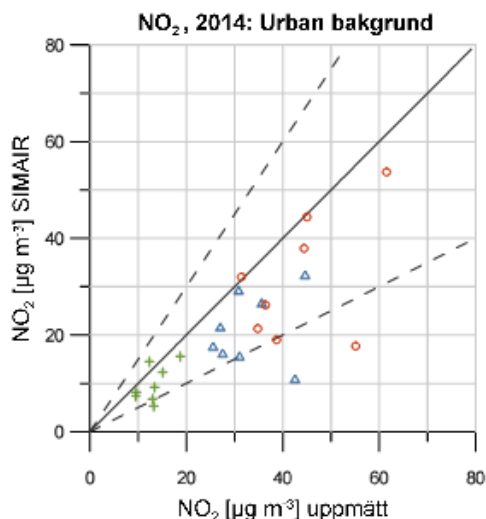
- Regional SA modelling more important
- National emission inventories of good quality
- Margin cost analysis for shipping, aviation....
- Impact on health and environment

**Thank you!**

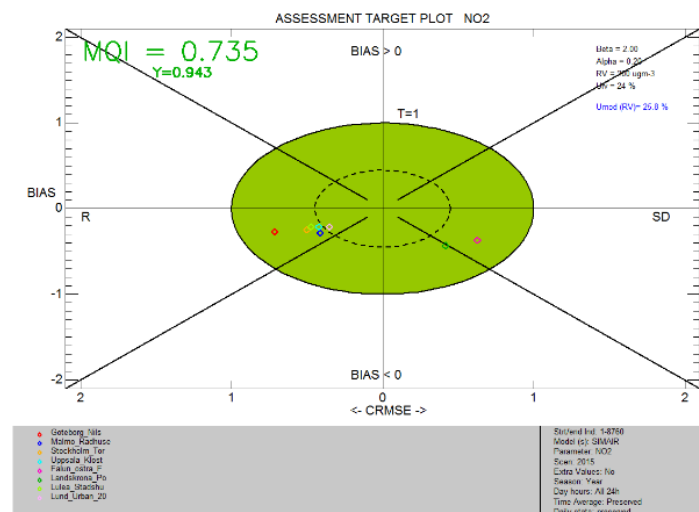


# Delta tool question

- + Årsmedelvärde
- △ 98-percentils dygnsmedelvärde
- 98-percentils timmedelvärde



NO<sub>2</sub>, 2015: urban bakgrund



		SUMMARY STATISTICS		Nb of stations/groups: 8 valid / 8 selected	
INDICATOR					
OBS	Mean	[Bar chart showing distribution of mean values]			
	Exceed 98 ppm-3	[Bar chart showing exceedance values]			
TIME	Bias Norm	[Bar chart showing bias distribution]			
	Corr Norm	[Bar chart showing correlation distribution]			
	StdDev Norm	[Bar chart showing standard deviation distribution]			
	Hperc Norm	[Bar chart showing percentile distribution]			
SPACE	Corr Norm	[Bar chart showing correlation distribution]			
	StdDev Norm	[Bar chart showing standard deviation distribution]			
	StdDev Norm	[Bar chart showing standard deviation distribution]			