

## Internet based Nordic database for model evaluation

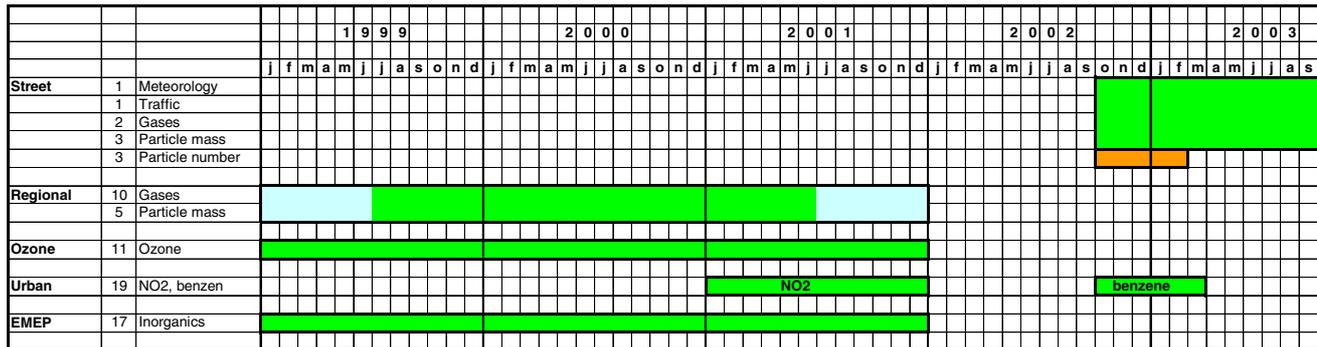
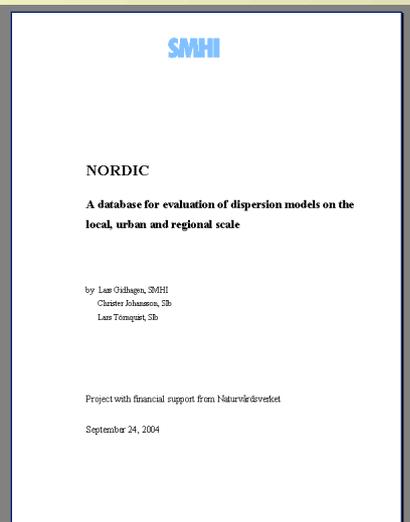
### OUTLINE

1. Purpose of the database *(Lars)*
2. Content of the database *(Lars)*
3. Examples of model comparisons performed *(Lars)*
3. How to access and work with the data (on the web) *(Lars)*
4. Challenges with the Hornsgatan PM10 data set *(Gunnar)*

### Purpose

-  Facilitate “approved” and complete data sets for model evaluation (units, time stamps etc. )
-  Easy access, analysis without download
-  Different users may repeat analysis (macros)
-  Stimulate model simulations based on identical input data, using identical data for evaluation
-  Facilitate the evaluation of coupled model systems (regional background, urban background, roadside data etc).

# Data sets loaded during phase 1 (November 2004)



Jagtvej  
HCOE  
HCAB



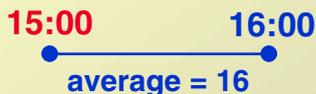
## Nordic database for model evaluation: Station group "STO\_street"

Case: Hornsgatan Period: Oct 01 2002 – Dec 31 2003

### 1. Street data: - Hornsgatan (hourly)

UCT+1 (winter)  
UCT+2 (summer)

Time stamp:



Variable	type	from station	Attribute	start	stopp
PM10	Street (North)	Hornsg_part V01	scN	021001 00	040101 00
	u.b.	Rosen!g_PM 000	u_b	021001 00	040101 00
	rural	Aspvreten duo	r_b	021001 00	040101 00
PM2.5	Street (North)	Hornsg_part V01	scN	021001 00	040101 00
	u.b.	Rosen!g_PM 000	u_b	021001 00	040101 00
	rural	Aspvreten duo	r_b	021001 00	040101 00
PM-antal	Street (North)	Hornsg_part 001	scN	021001 00	030301 00
	u.b.	Rosen!g_PM Tot	u_b	021001 00	030301 00
	rural	Aspvreten	r_b	021001 00	030301 00
NO2	Street (North)	Hornsg_A30 001	scN	021001 00	040101 00
	Street (South)	Hornsg_A30 002	scN	021001 00	040101 00
	u.b.	Torkel Kn.20 001	u_b	021001 00	040101 00
NOx	Street (North)	Hornsg_A30 001	scN	021001 00	040101 00
	Street (South)	Hornsg_A30 002	scS	021001 00	040101 00
	u.b.	Torkel Kn.20 001	u_b	021001 00	040101 00
CO	Street (North)	Hornsg_A30 001	scN	021001 00	040101 00
	Street (South)	Hornsg_A30 002	scS	021001 00	040101 00
	u.b.	Hornsg_A30 003	u_b	021001 00	040101 00
Bensen	Street (North)	Hornsg_part 001	scN	021001 00	040101 00
	O3	u.b.	Torkel Kn.20 001	u_b	021001 00
Wind speed		Maria_p_mast 036	036	021001 00	040101 00
Wind dir.		Maria_p_mast 036	036	021001 00	040101 00
Temp		Maria_p_mast 020	026	021001 00	040101 00
Globalstr.		Maria_p_mast 001	026	021001 00	040101 00
DiffT		Högd/met 020	020	021001 00	040101 00
RH		Maria_p_mast 001	026	021001 00	040101 00
Regn		Maria_p_mast 001	026	021001 00	040101 00
Trafikfl.		Hok 00a	N_n	021001 00	040101 00
Trafikfl.		Hok 00b	N_s	021001 00	040101 00
Trafikfl.		Hok 00c	S_n	021001 00	040101 00
Trafikfl.		Hok 00d	S_s	021001 00	040101 00

## 2. Regional (hourly data)

👉 UCT+1 (all year)

👉 Time stamp:

15:00 — 16:00  
average = 16

### Nordic database for model evaluation: Station group “Regional”

**Case:** Urban and rural background

**Period:** jan 1999 – dec 2001 (a few only jul 1999 – jun 2001)

**Variables:** PM10, PM2.5, NO<sub>2</sub>, NO<sub>x</sub>, SO<sub>2</sub>, O<sub>3</sub>

**Original time resolution:** Hourly data

Station	Location	Attribute	PM10	PM2.5	NO <sub>x</sub>	NO <sub>2</sub>	SO <sub>2</sub>	O <sub>3</sub>	CO
Femman	Göteborg	u_b	X	X	X	X	X		X
Biblioteket	Umeå	u_b	X	X					
HC Ørsted	Köpenhamn	u_b			X	X			X
Rosenl.g.	Stockholm	u_b	X	X					
Torkel Kn.20	Stockholm	u_b			X	X		X	
Södermalm DOAS	Stockholm	u_b				X	X	X	
Rosen Nkpg DOAS	Norrköping	u_b				X	X	X	
Växjö DOAS	Växjö	u_b				X	X	X	
SE11 Vavihill	Skåne	r_b	X	X					
SE12 Aspvreten	Nyköping	r_b	X	X					
Norra Malma	Norrtälje	r_b			X	X		X	
FI09	Utö	r_b				X			
FI17	Virolahti	r_b				X			
FI22	Oulanka	r_b				X			

#### Conversions and changes made to data

- **Femman:** PM2.5 shows a lot of negative values, often high numbers. The quality is poor, possibly there is a decrease in average levels which is spurious. For the Nordic database, all PM2.5 levels < 0.1 ug/m<sup>3</sup> have been eliminated.
- **HC Ørsted:** Gases are given in ppb and ppm (CO). The following conversions have been used: NO (1.29), NO<sub>2</sub> (1.98), O<sub>3</sub> (2.07), SO<sub>2</sub> (2.76), CO (1.21).
- **Finnish EMEP NO<sub>2</sub> stations:** NO<sub>2</sub> given as ug N/m<sup>3</sup>. Conversion used to convert to ug/m<sup>3</sup>: 3.29 (46/14)

## 3. Ozone (hourly data)

👉 UCT+1  
Swedish wintertime

👉 Time stamp:

15:00 — 16:00  
average = 16

### Nordic database for model evaluation: Station group “Ozone”

**Case:** Nordic (EMEP hourly)

**Period:** 1999 – 2001 (3 years)

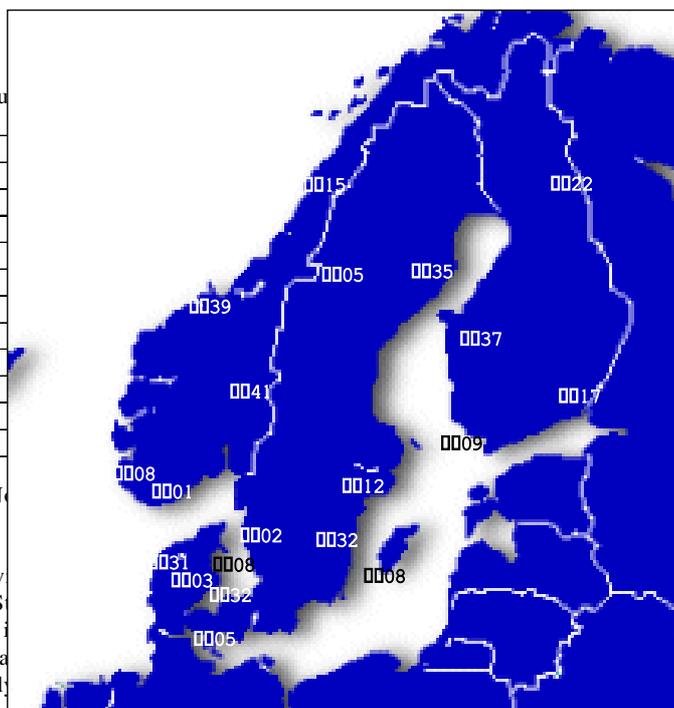
**Variable:** O<sub>3</sub>

**Original time resolution:** Hourly

Station	Name
SE02	Rörvik
SE32	Norra-Kvill
SE12	Aspvreten
SE35	Vindeln
DK31	Ulborg
DK32	Fredriksborg
NO1	Birkenes
NO15	Tustervatn
FI09	Utö
FI17	Virolahti II
FI22	Oulanka

Suggestions for *naming* in the Nordic database

- Variable name: O<sub>3</sub>
- Variable key: Standard Airv
- Station names: Use both “S
- Station key: Not important, i
- For each variable: Store mea
- Load both as daily and hourly



## 4. URBAN (daily data, weekly data)

### Nordic database for model evaluation: Station group “URBAN”

**Case:** Urban background NO<sub>2</sub>: Period: jan – dec 2001

Urban background and street canyon benzene data: Period: Oct 2002 – March 2003.

**Variables:** NO<sub>2</sub>, benzene

**Original time resolution:** Daily data (from IVL, mainly URBAN network)

Station	Attribute	NO <sub>2</sub>	Benzene
Helsingborg N	u_b	X	
Halmstad	u_b	X	
Borås	u_b	X	
Jönköping	u_b	X	
Lund	u_b	X	
Örebro	u_b	X	
Västerås	u_b	X	
Karlstad	u_b	X	X
Linköping	u_b	X	X
Södertälje	u_b	X	X
Uppsala	u_b	X	X
Falkenberg	u_b		X
Köping	u_b		X
Landskrona	u_b		X
Sandviken	u_b		X
Värnamo	u_b		X
Östersund	u_b		X
Göteborg Sprängkullsgatan	s_c		X
Örebro gaturum	s_c		X

#### Conversions and changes made to data

The data from IVL has been stored in the datase without any corrections.

## 5. EMEP (daily data)

### Nordic database for model evaluation

**Case:** Nordic (EMEP daily)

**Period:** 1999 – 2001 (3 years)

**Variable:** SO<sub>4</sub>, SO<sub>2</sub>, NO<sub>2</sub>, NH<sub>3</sub>+NH<sub>4</sub>(particulate), HNO<sub>3</sub>+NO<sub>3</sub>(particulate), HNO<sub>3</sub>(gas), NH<sub>3</sub>(gas), Na, Cl, summed inorganic

**Original time resolution:** Daily data

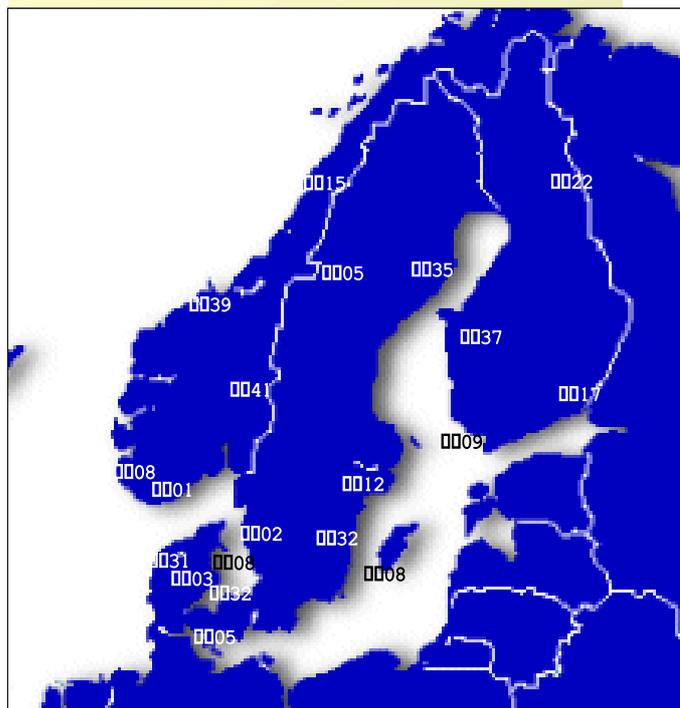
Station	Name	SO <sub>4</sub>	SO <sub>2</sub>	NO <sub>2</sub>	NH <sub>3</sub> +NH <sub>4</sub>	HNO <sub>3</sub> +NO <sub>3</sub>	HNO <sub>3</sub>	NH <sub>3</sub>	Na	Cl	inorg	SPM
SE02	Rörvik	X	X	X	X	X						X
SE05	Bredkälen	X	X	X	X	X						X
SE08	Hoburg	X	X	X								X
SE11	Vavihill	X	X	X	X	X						X
SE12	Aspvreten	X	X	X	X	X						
DK03	Tange	X	X		X	X						
DK05	Keldsnor	X	X		X	X						
DK08	Anholt	X	X	X	X	X		X				
NO01	Birkenes	X	X	X	X	X	X	X	X	X		
NO08	Skreådalen	X	X	X	X	X	X	X	X	X		
NO15	Tustervatn	X	X	X	X	X	X	X	X	X		
NO39	Kårvatn	X	X	X	X	X	X	X	X	X		
NO41	Osen	X	X	X	X	X	X	X	X	X		
FI09	Utö	X	X	X	X	X						
FI17	Virolahti II	X	X	X	X	X						
FI22	Oulanka	X	X	X	X	X						
FI37	Ahtäri II	X	X	X	X	X						

Suggestions for **naming** in the Nordic database:

- Variable names: According to table above (SO<sub>4</sub>, SO<sub>2</sub> etc...)
- Variable key: For some of them use SIb standard. Invent something for the remaining.
- Station names: Use both “Station” and “Name” in the table above, e.g. “SE02 Rörvik”
- Station key: Not important, invent!
- For each variable: Store measurement value with attribute “r\_b”, status flag with attribute “flg”
- Load both as daily and hourly values.

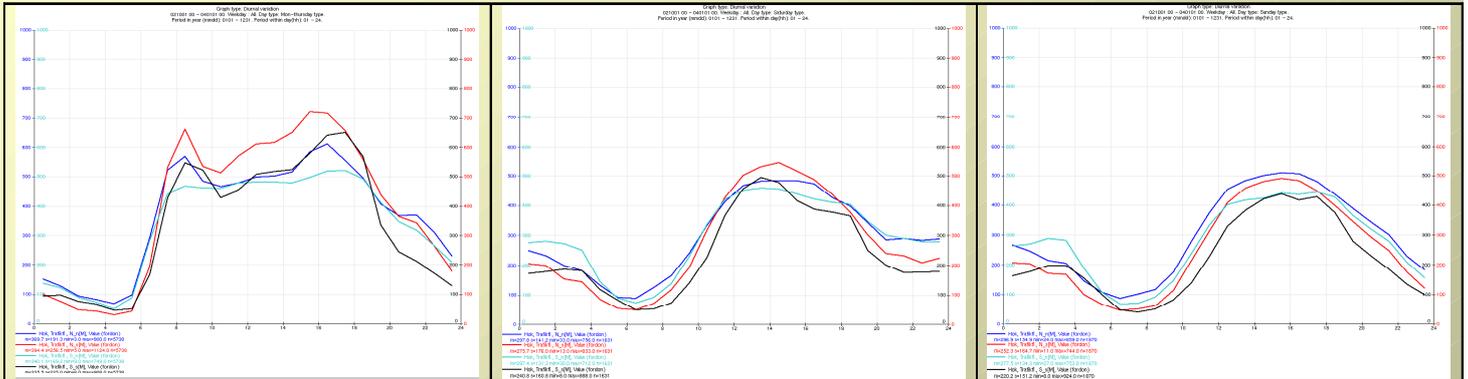
#### Conversions and changes made to data

- SO<sub>4</sub>: 3.0
- SO<sub>2</sub>: 2.0
- NO<sub>2</sub>: 3.3
- NH<sub>3</sub>+NH<sub>4</sub>: 1.25
- HNO<sub>3</sub>: 4.5
- NH<sub>3</sub>: 1.2
- HNO<sub>3</sub>+NO<sub>3</sub>: 4.45



# Street canyon: Hornsgatan (1)

## Daily variation in traffic (veh/hour)



Weekdays

Saturday

Sunday

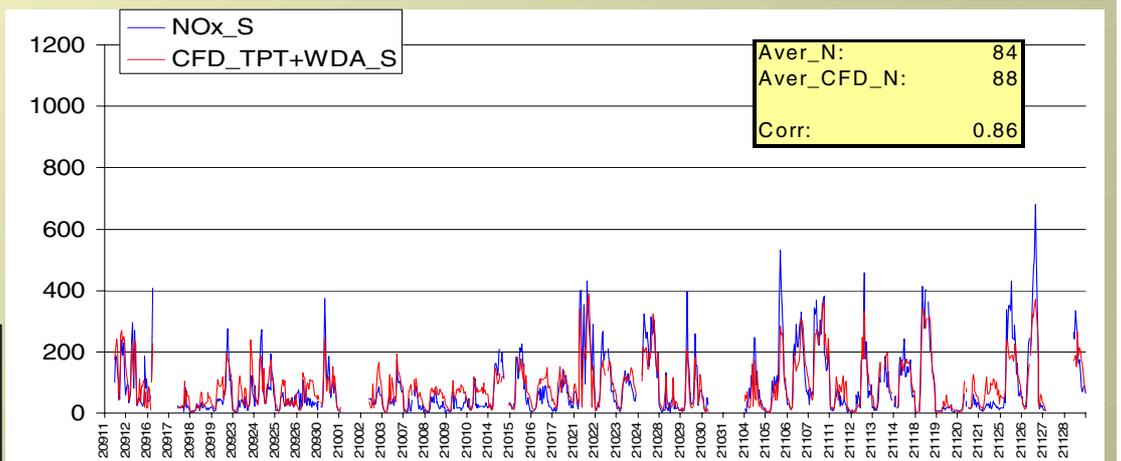
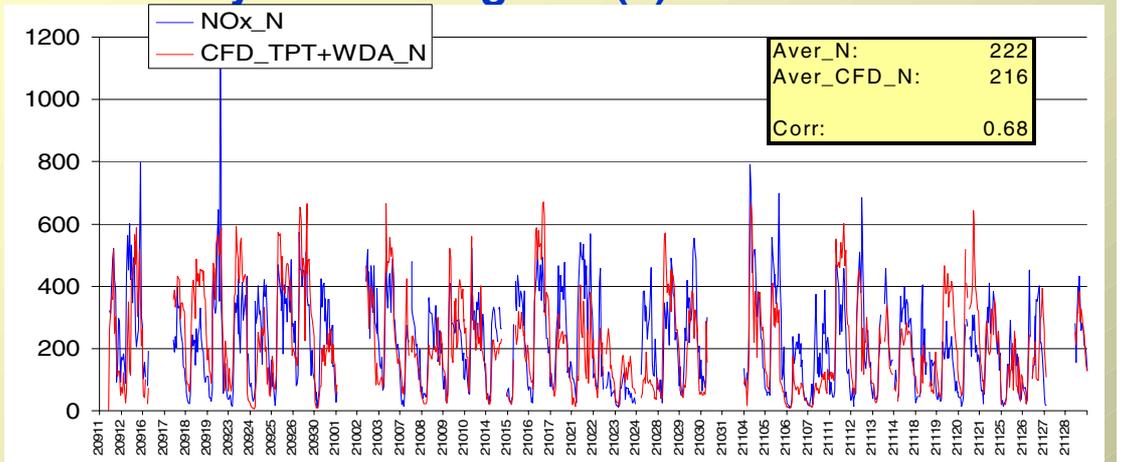
**Fig. 3.1.1** Daily variation of traffic volume at Hornsgatan

# Street canyon: Hornsgatan (2)

## CFD simulation of NOx

$E_{f_{uphill}} = 2.0 \text{ g/veh,km}$

$E_{f_{downhill}} = 0.66 \text{ g/veh,km}$

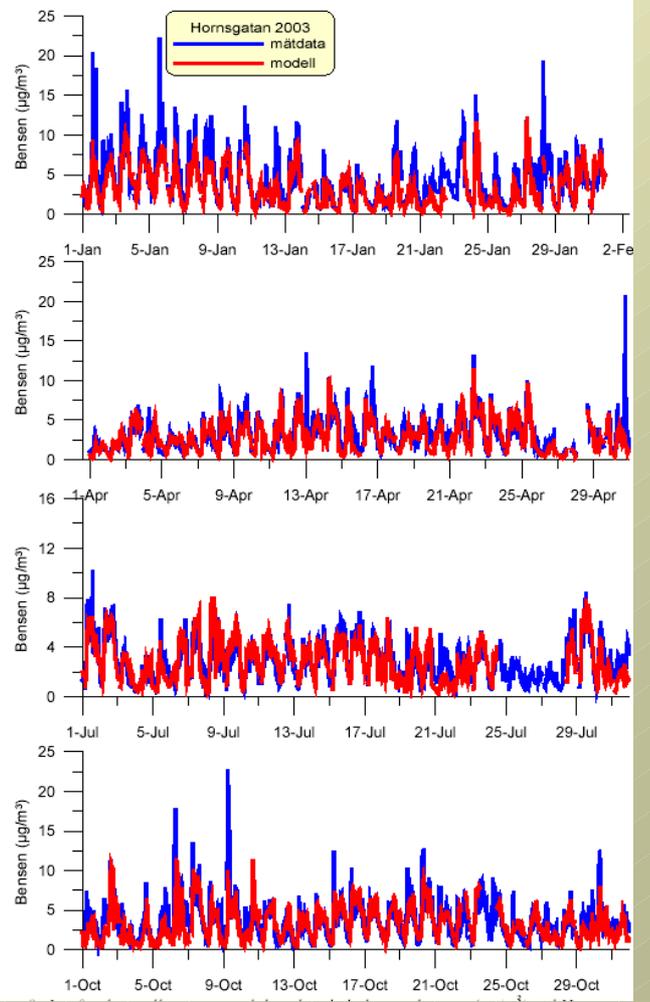


Gidhagen et al., 2004.  
 Simulations of NOx and ultrafine particles in a street canyon in Stockholm.  
 Atmospheric Environment, 38, 2029-2044.

# Street canyon: Hornsgatan (3)

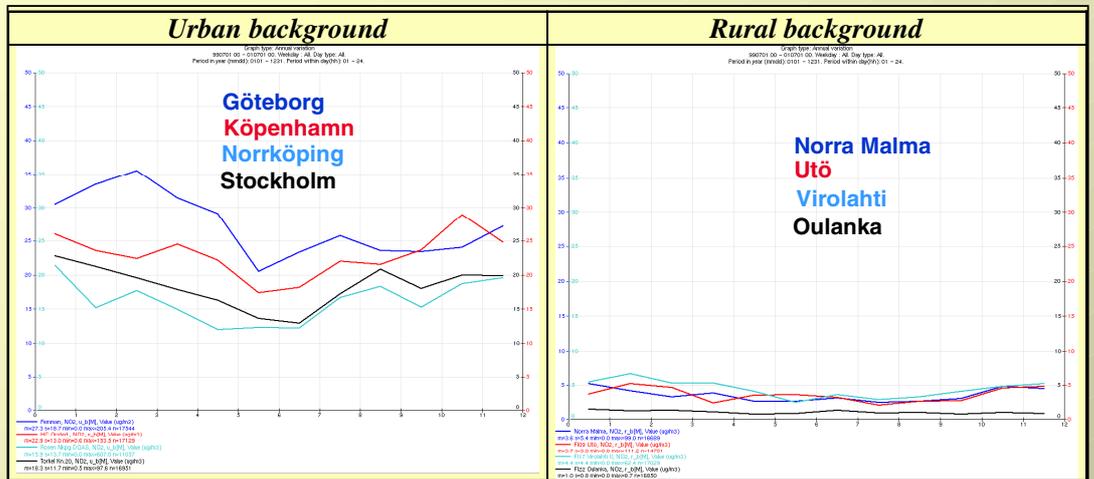
## OSPM simulations of benzene

$$E_{\text{mix}} = 35.3 \text{ mg/veh,km}$$



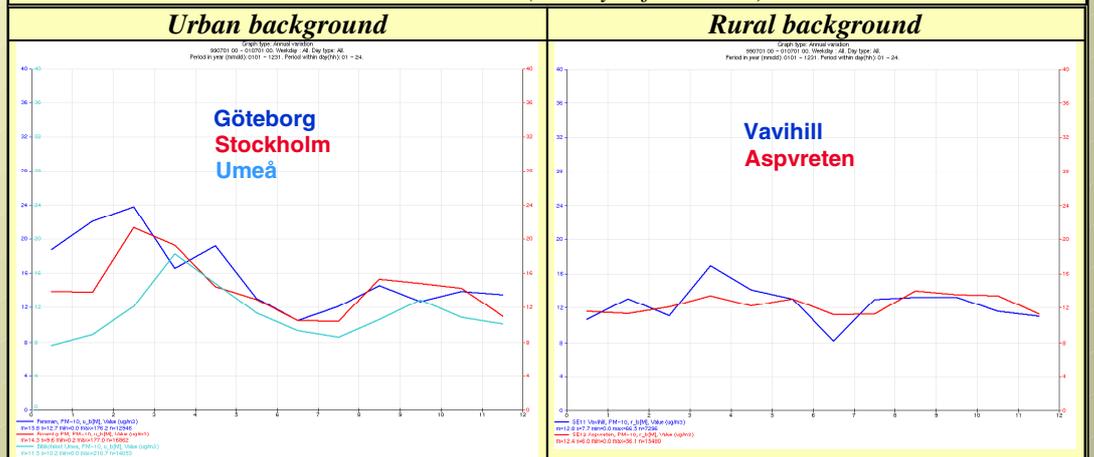
# Regional data

NO<sub>2</sub>



Annual variation (all days of the week)

PM10



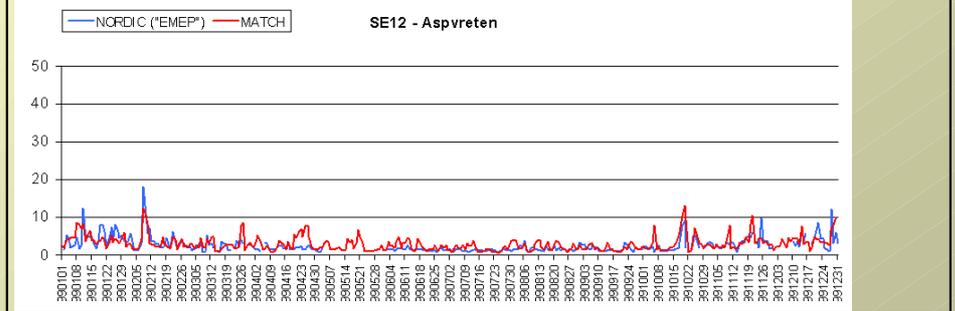
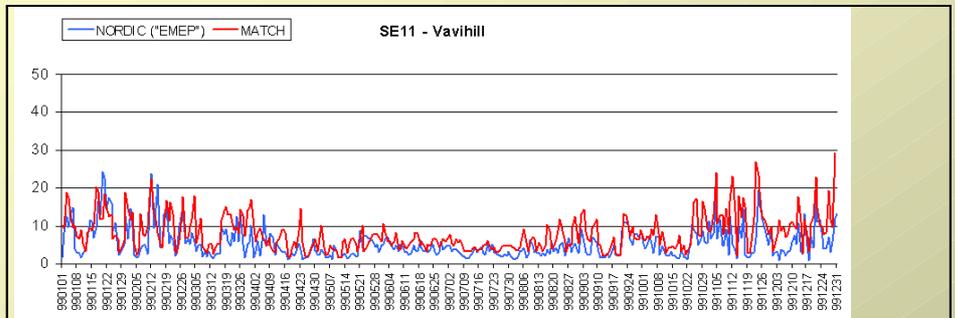
Annual variation (all days of the week)

Modell comparisons

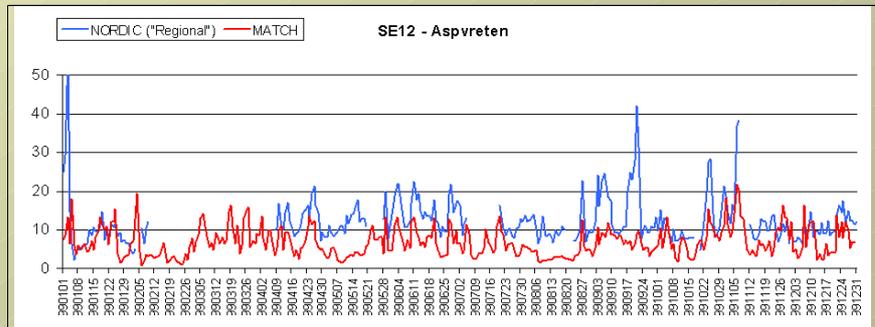
Regional data

MATCH model (EURODELTA and TNO model intercomparison exercise)

NO<sub>2</sub>



PM10



Modell comparisons

Ozone data

MATCH EUROPE model (40x40 km grid)

Rörvik

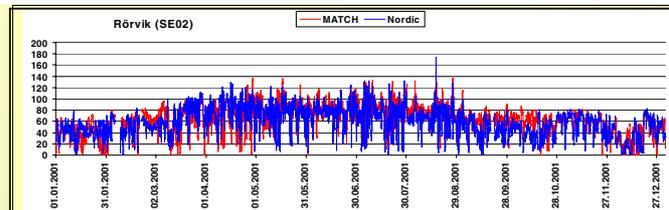


Fig. 3.3.2 Simulated MATCH (red) and measured (blue) ozone at Rörvik. Unit:  $\mu\text{g m}^{-3}$ . Average levels for MATCH was 65 (measured 59)  $\mu\text{g m}^{-3}$ , with a correlation coefficient of 0.72.

Aspveten

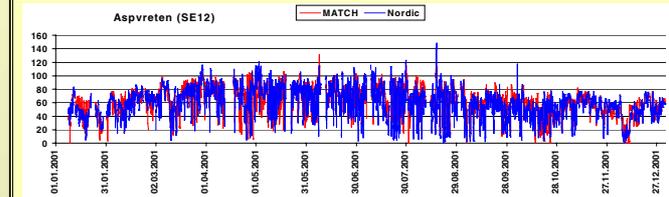


Fig. 3.3.3 Simulated MATCH (red) and measured (blue) ozone at Aspveten. Unit:  $\mu\text{g m}^{-3}$ . Average levels for MATCH was 63 (measured 59)  $\mu\text{g m}^{-3}$ , with a correlation coefficient of 0.75.

Norra Kvill

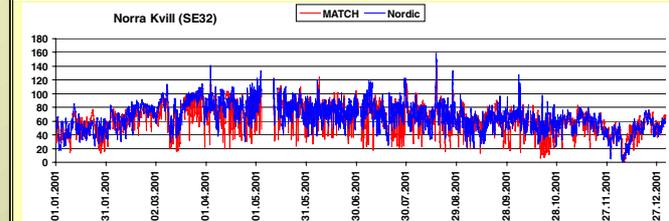


Fig. 3.3.4 Simulated MATCH (red) and measured (blue) ozone at Norra Kvill. Unit:  $\mu\text{g m}^{-3}$ . Average levels for MATCH was 63 (measured 66)  $\mu\text{g m}^{-3}$ , with a correlation coefficient of 0.70.

Vindeln

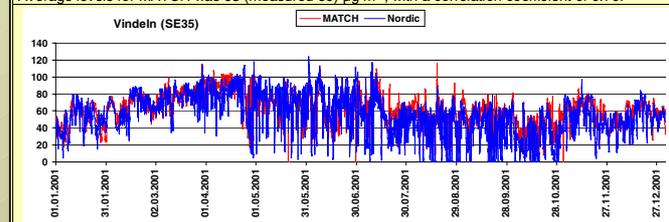


Fig. 3.3.5 Simulated MATCH (blue) and measured (blue) ozone at Vindeln. Unit:  $\mu\text{g m}^{-3}$ .

**NORDIC:** <http://www.luftkvalitet.se/>



**NORDIC:** user and password needed

