H17-163

Detailed Investigation of Traffic Pollution Dispersion Near Denmark's NO_2 HOT-SPOT

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Background:
Trends in DK, Why H.C. Andersens Boulevard, Former studies

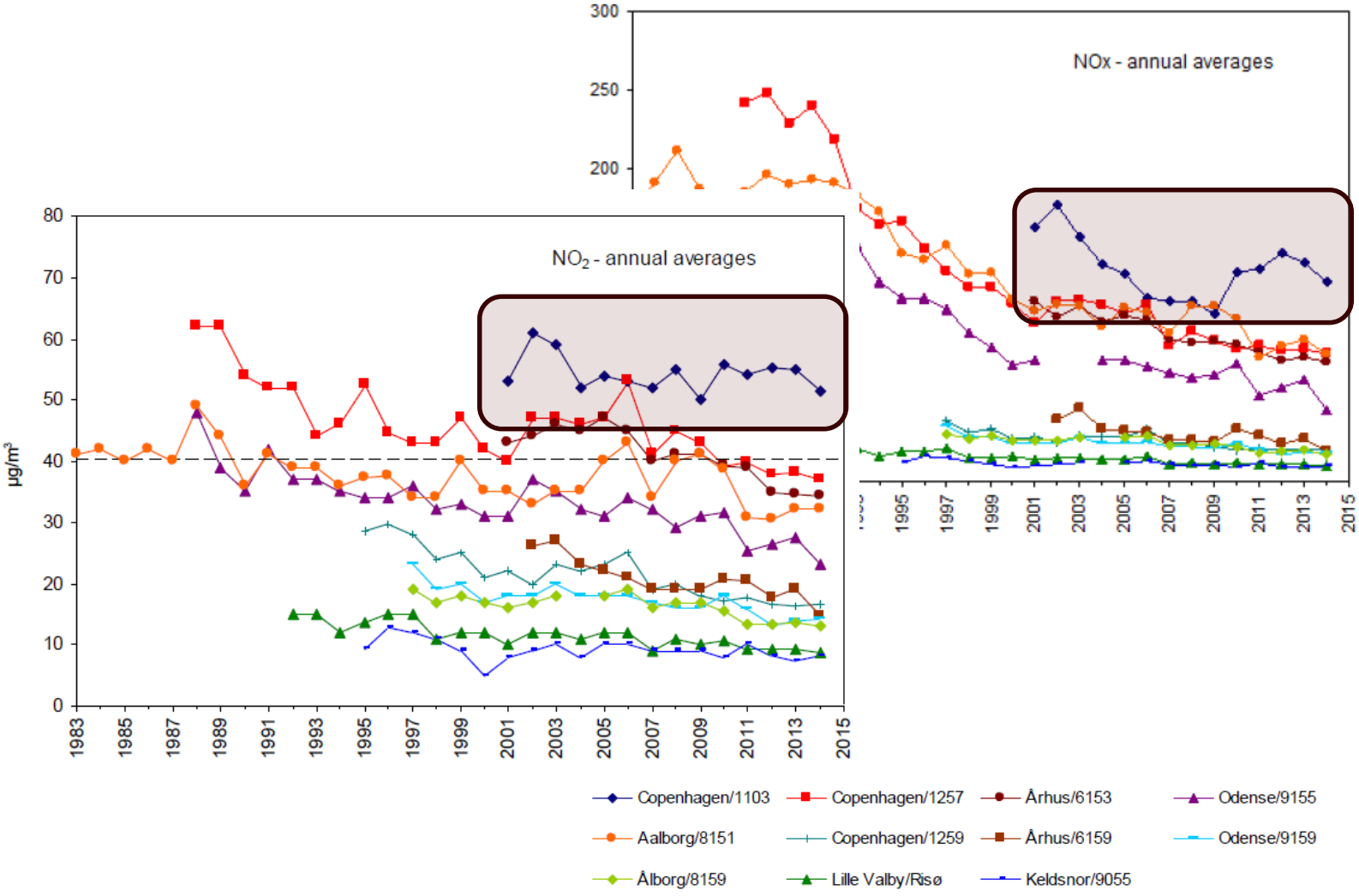
Methods:
Design / overview = HOW?

Results:
Traffic counts /emission modelling, OSPM modelling Passive sampling

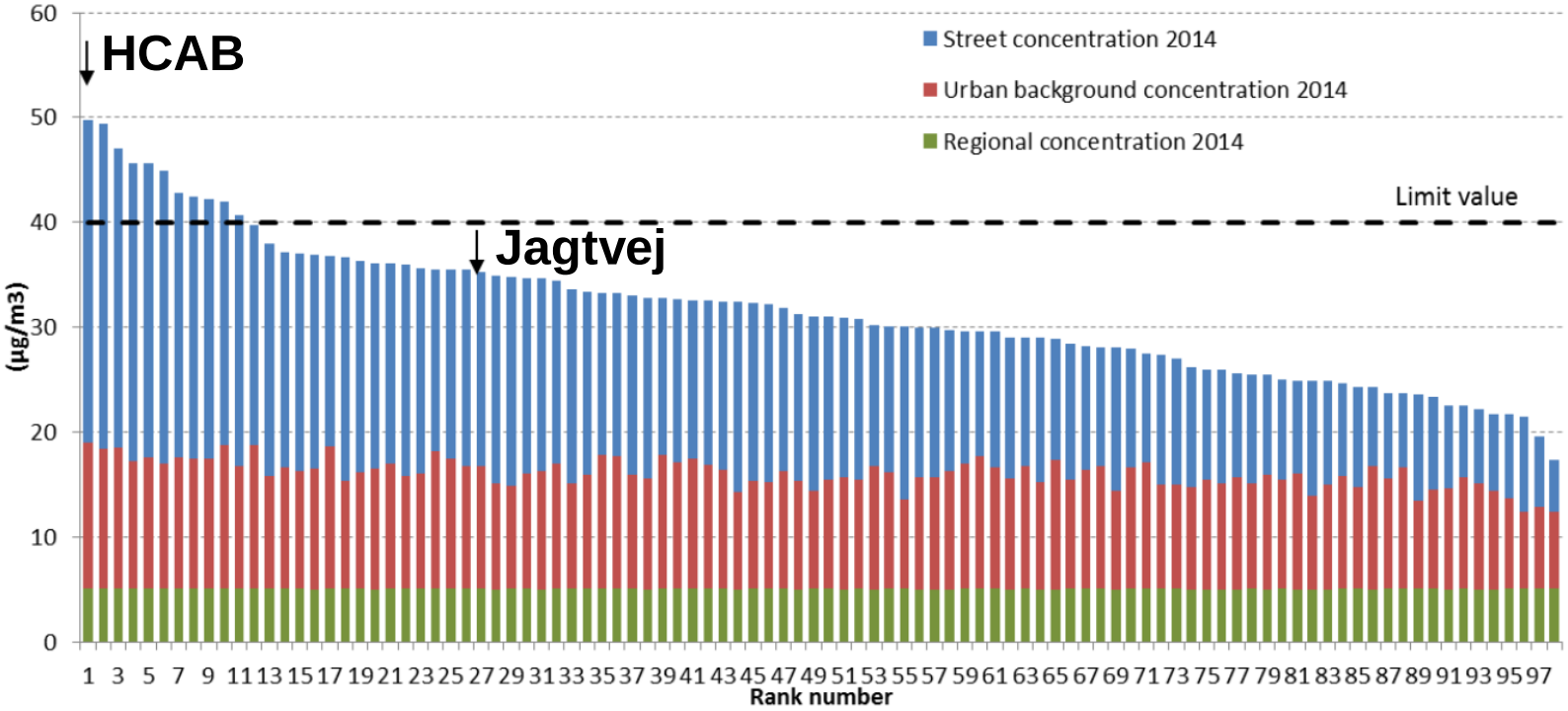
Conclusions:
Resume the main points and the **future** directions

NO_2 / NOx trends in Denmark

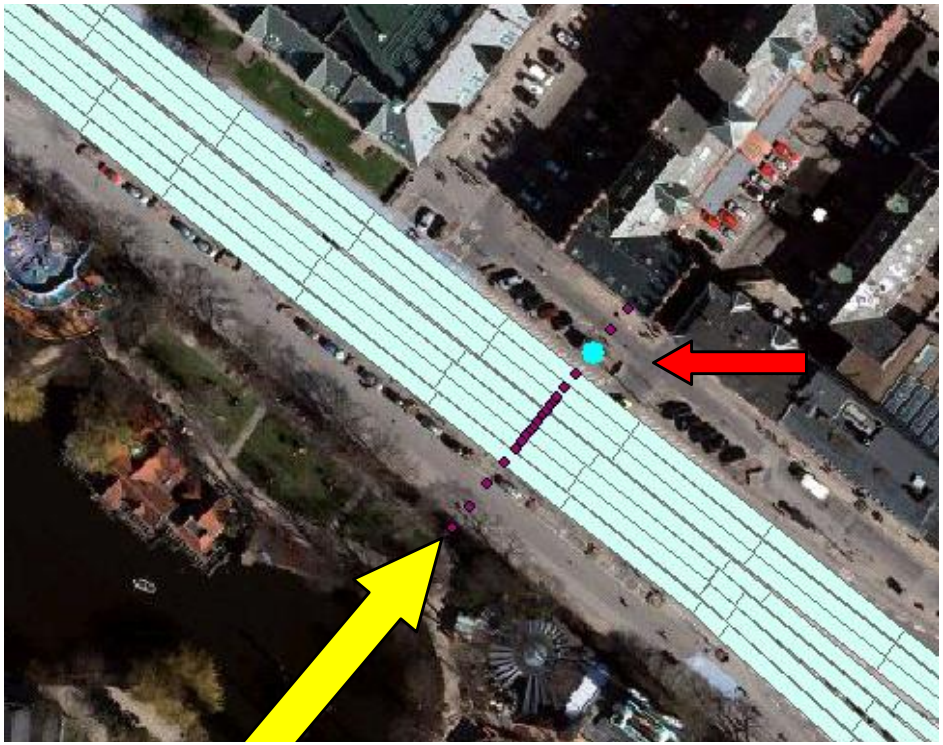
- Why H.C. Andersens Boulevard (= HCAB) ?

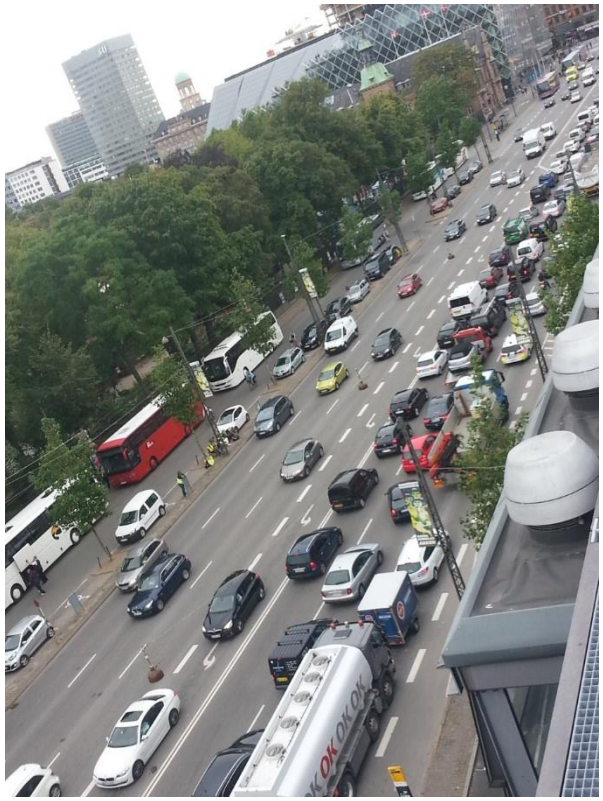


Model calculations on 98 streets in Copenhagen



- 52 000 veh / day
- Travel speed 16… 44 km/h

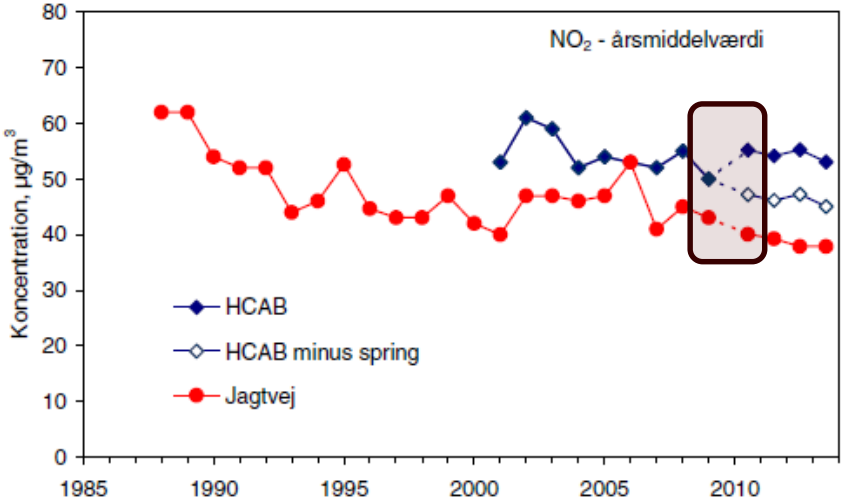




H.C. Andersens Boulevard

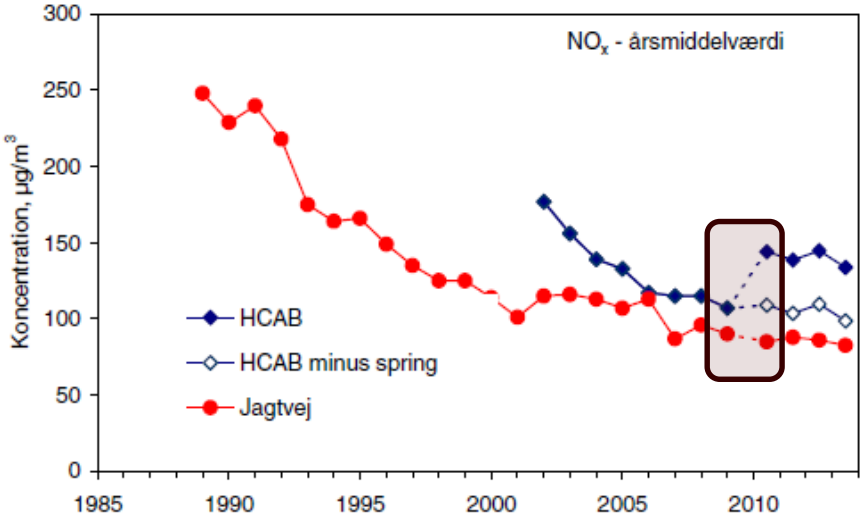
”Jump in 2010”

- Compare two street stations:



”jump” NOx +30..35 µg/m³
NO_2 + 8..10 µg/m³

Annual averages



”Jump in 2010”

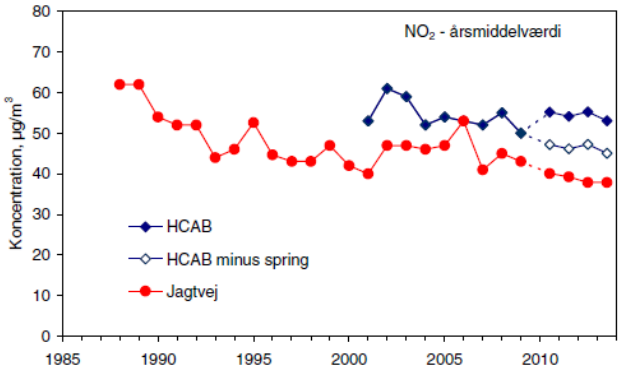
- Compare two street stations:

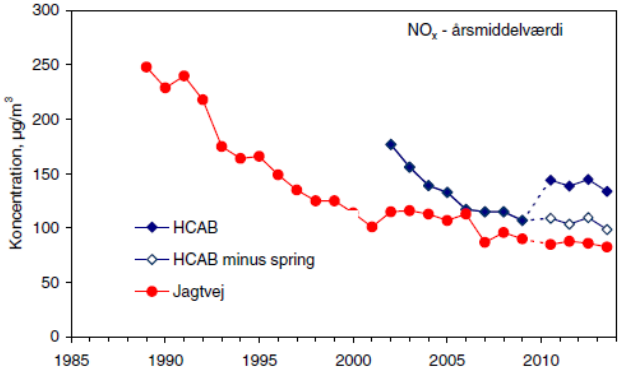
  Jagtvej vs. HCAB

  ”jump” NOx 30..35 µg/m^3

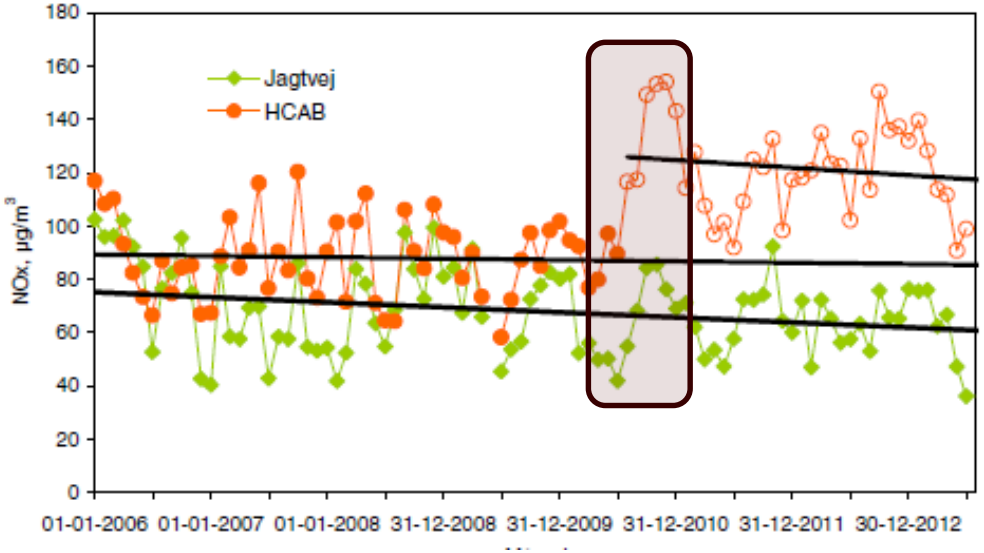
  NO_2 8..10 µg/m^3

Annual averages



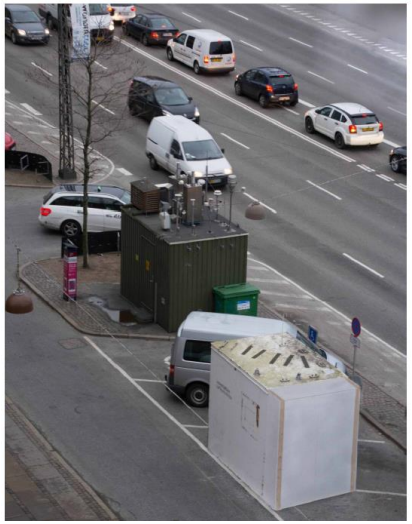


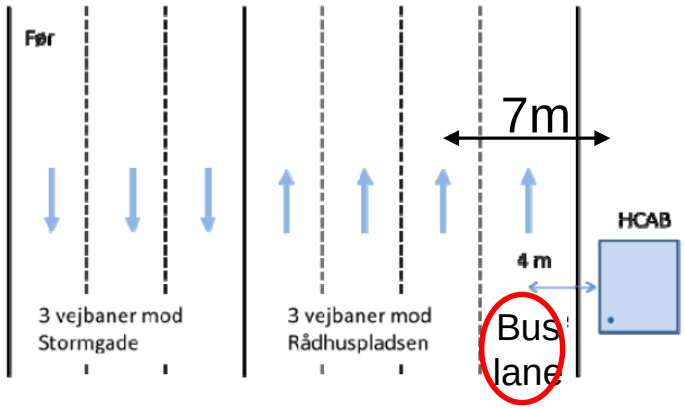
Monthly averages



Parallel station 2014

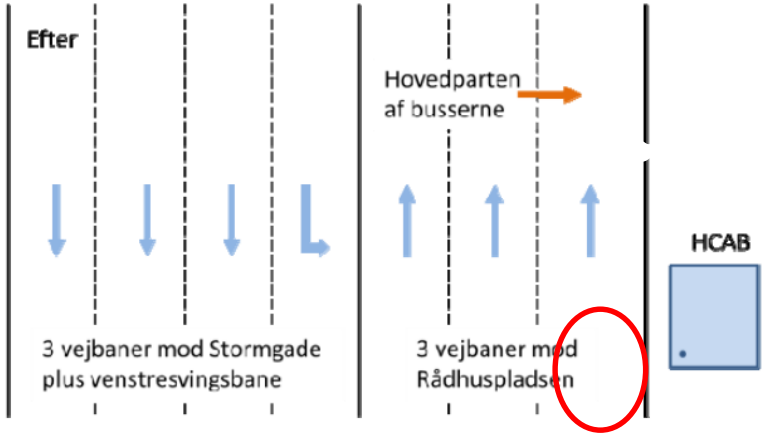
- Feb.-June 2014
- re-establish the 'old' distance to traffic lanes



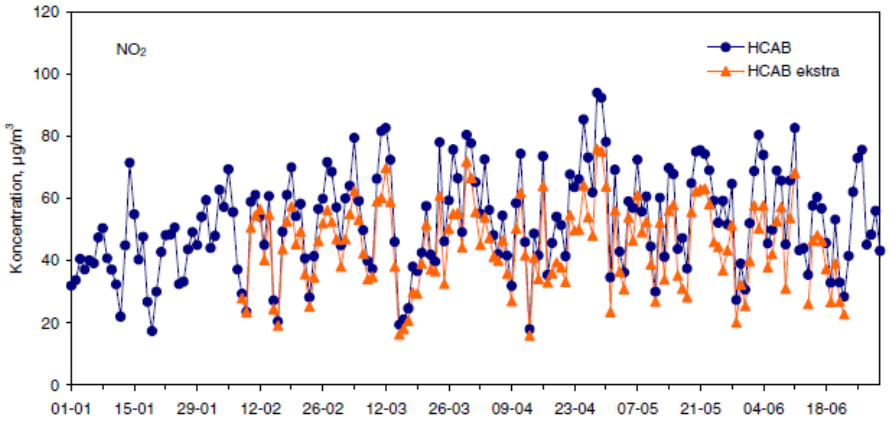


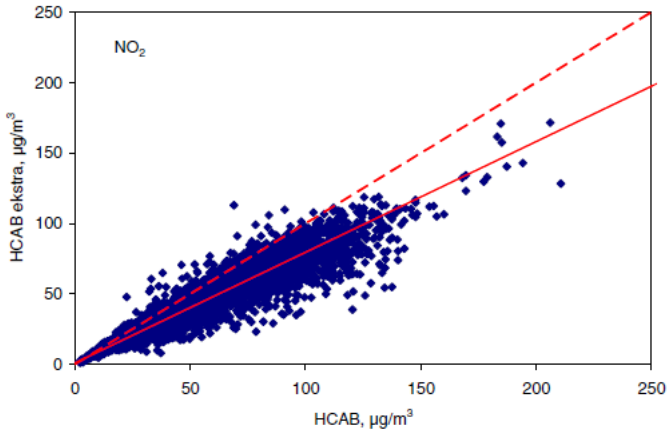
Before summer 2010

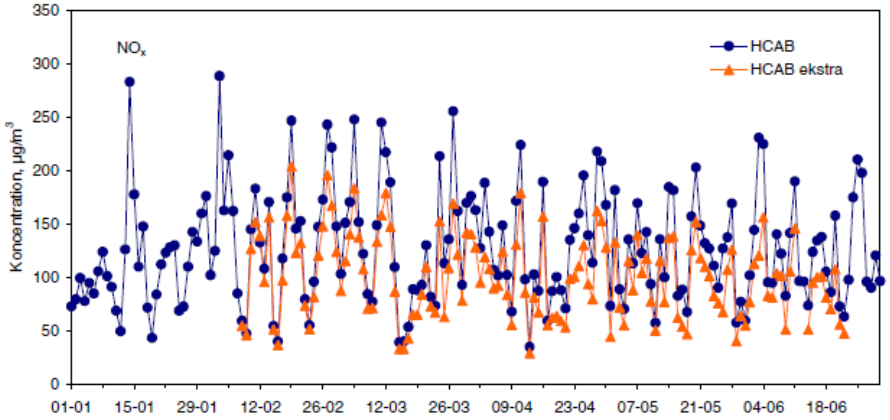
After summer 2010

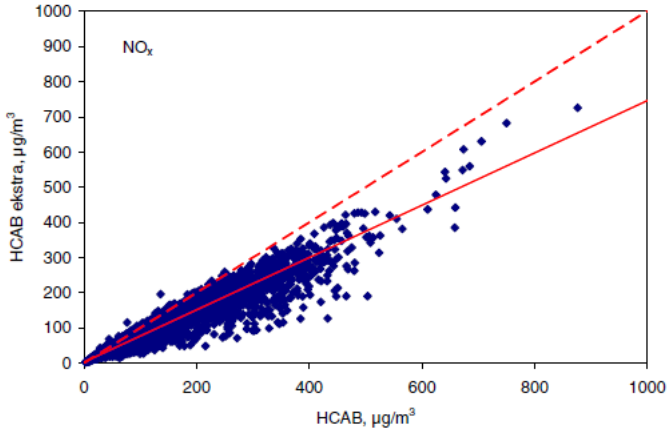


Parallel station 2014







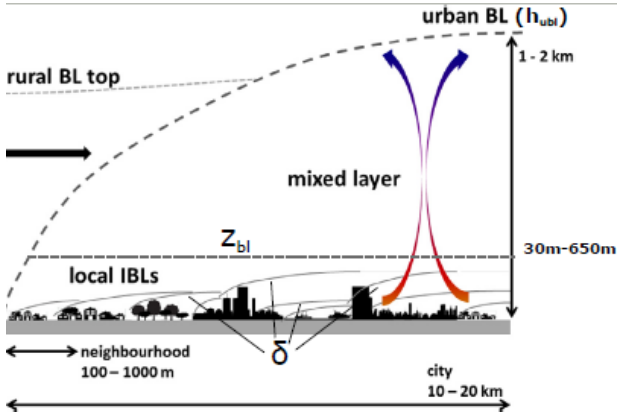


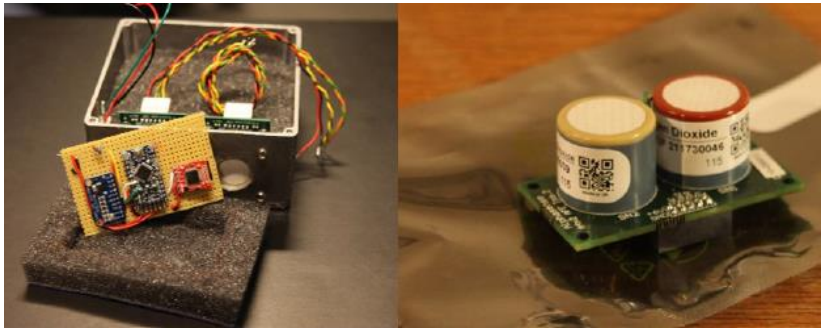
Mean concentrations
period: 8/2 – 23/6 2014

		NO_2	NO_x
HCAB	µg/m³	55	129
HCAB-ekstra	µg/m³	45	100
Forskel	µg/m³	10	29
Relativ forskel	%	18	23

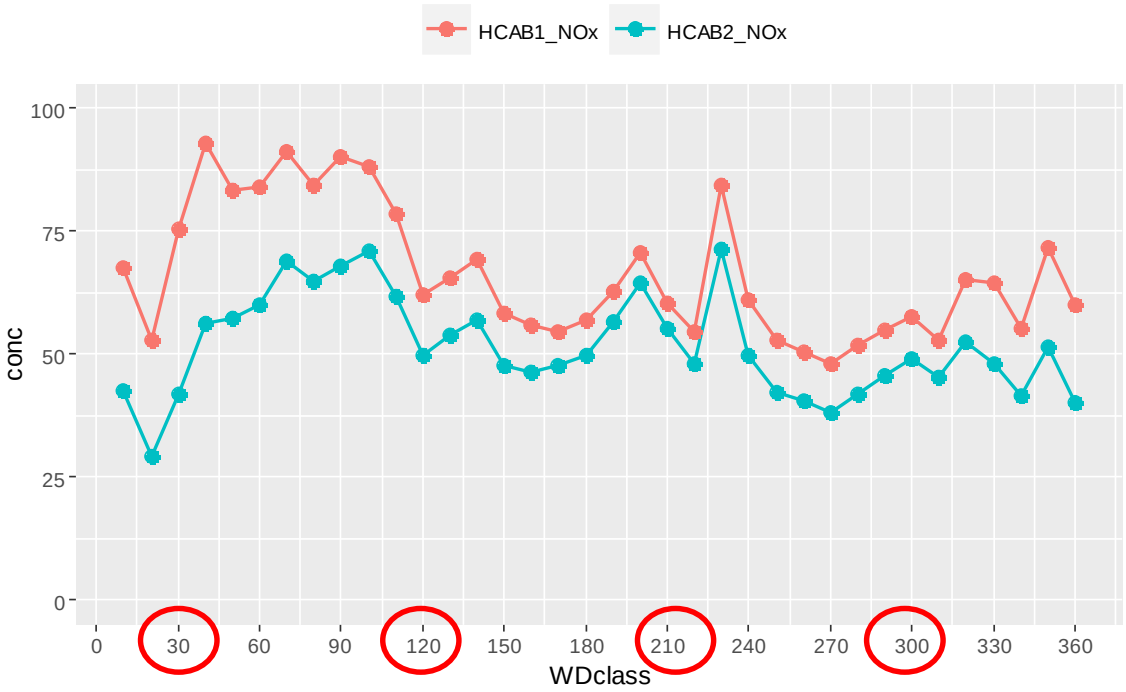
- Reanalysing 2014 parallel measurements
- Detailed traffic counts 2015 and emission modelling
- Modelling with OSPM
- Passive sampling using ”Radiello” samplers
- *Sonic measurements in street and roof top* (T.-B- Ottosen H17-140)

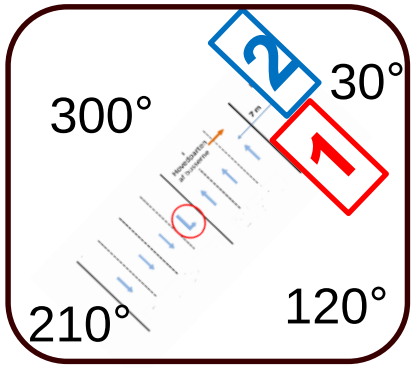
- *Low cost sampler testing*
  Alpha sense type
  Master thesis, Feb. 2016



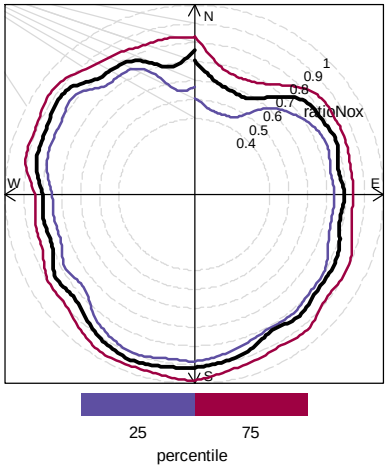


❑ Wind direction dependence - NOx

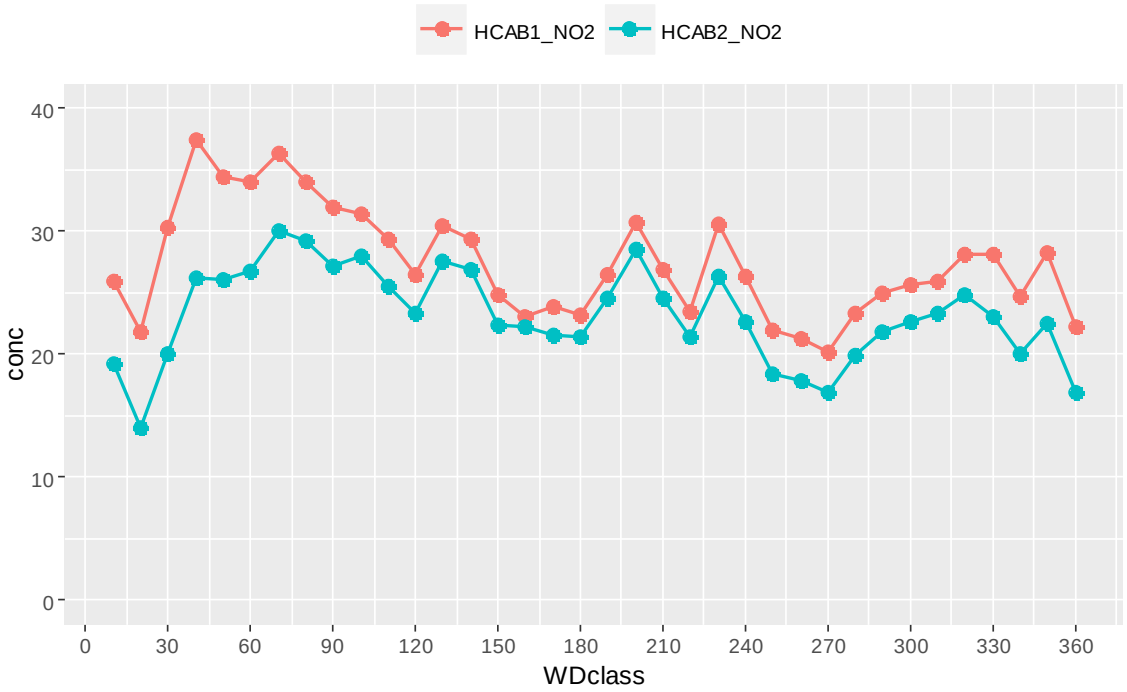


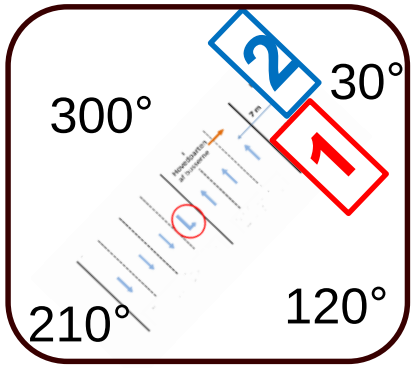


Ratio 2 / 1



❑ Wind direction dependence – NO_2





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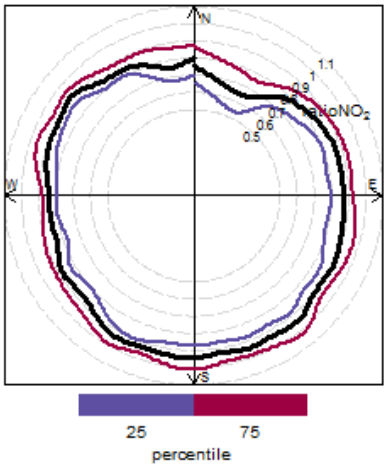
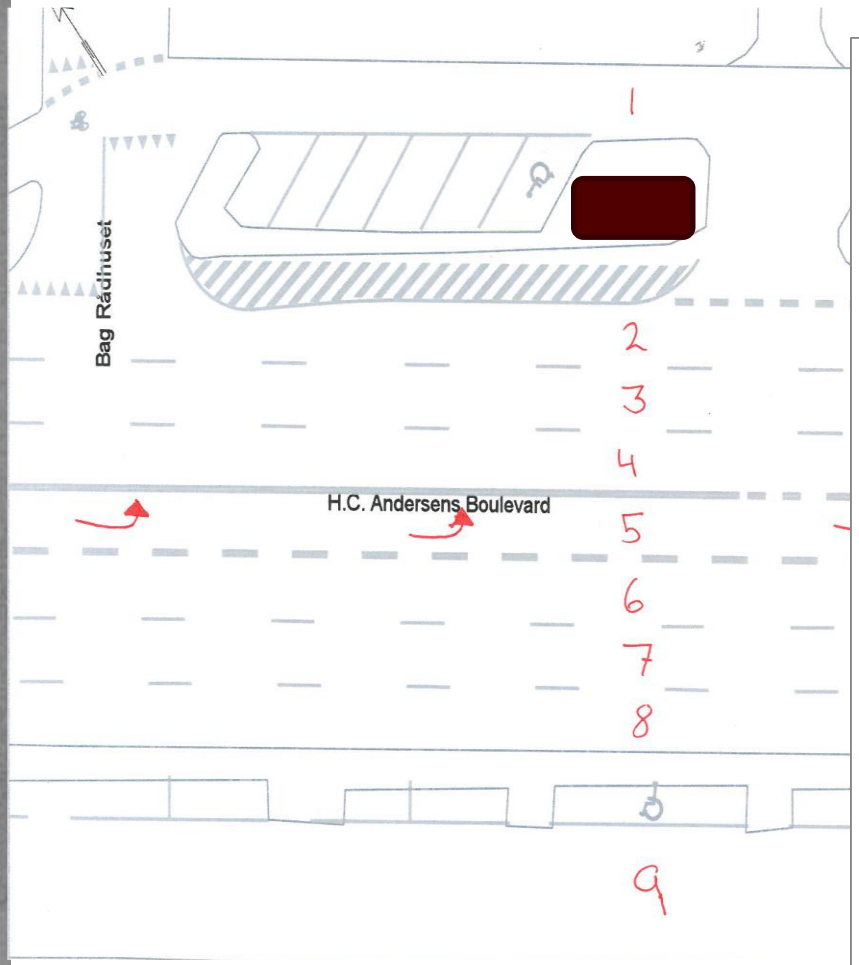
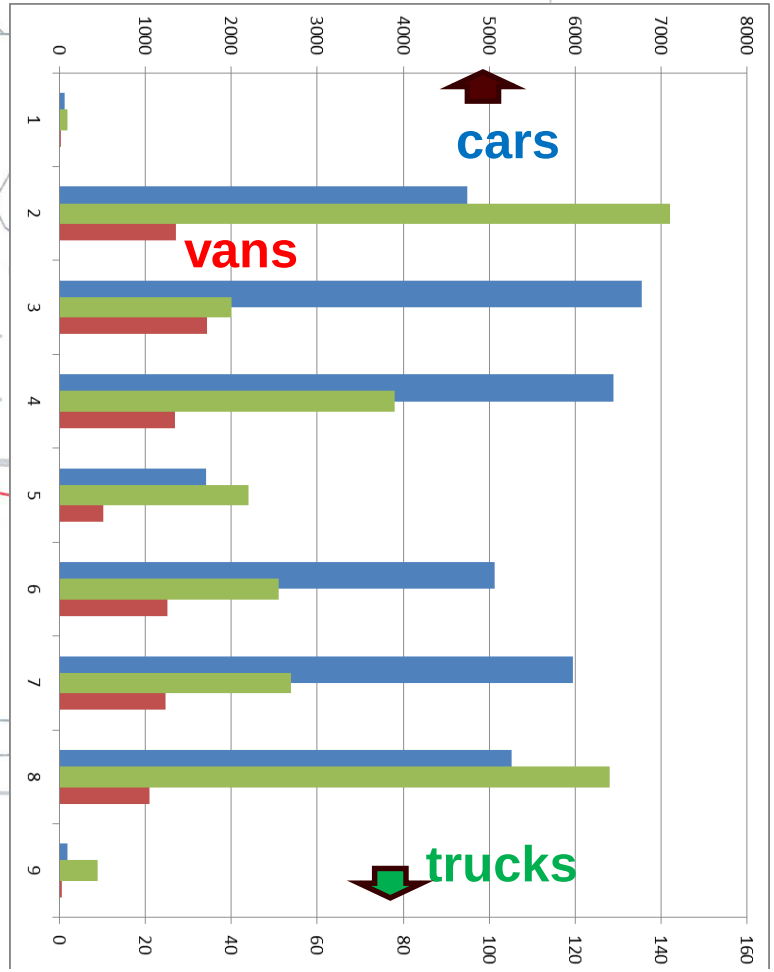


Detailed traffic counts in 2015

- Separate for each of the 7 lanes

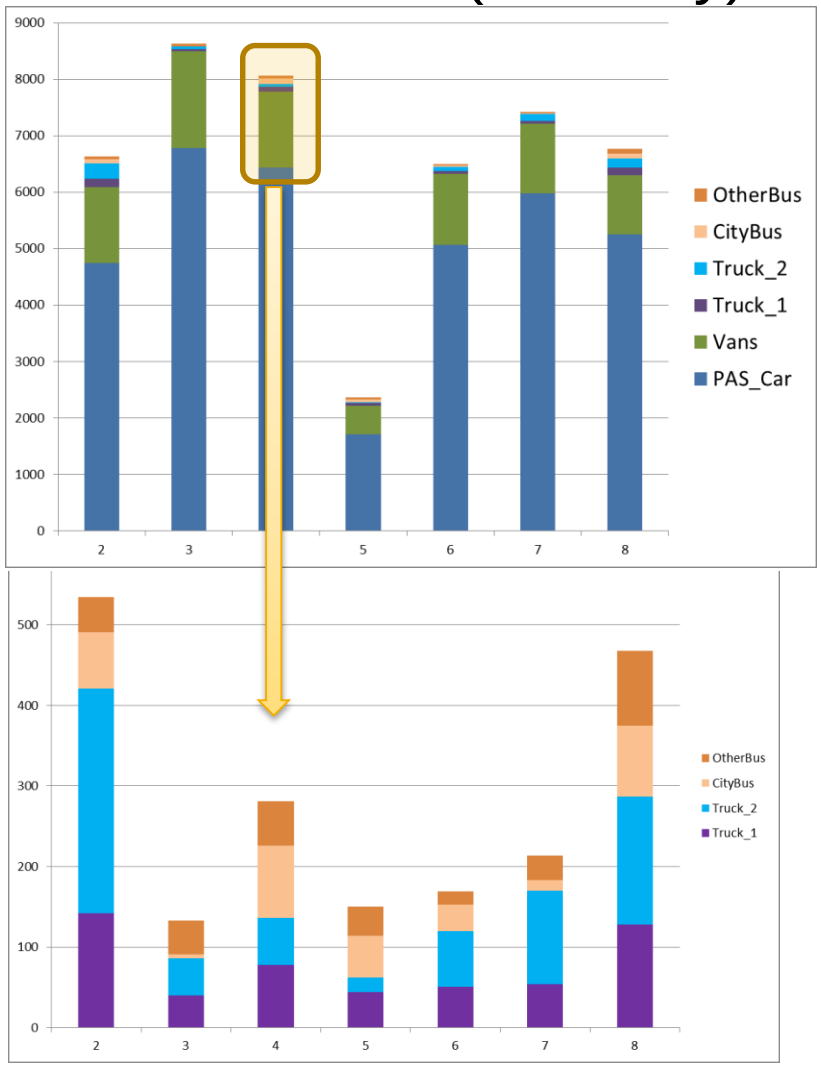
Detailed traffic counts in 2015



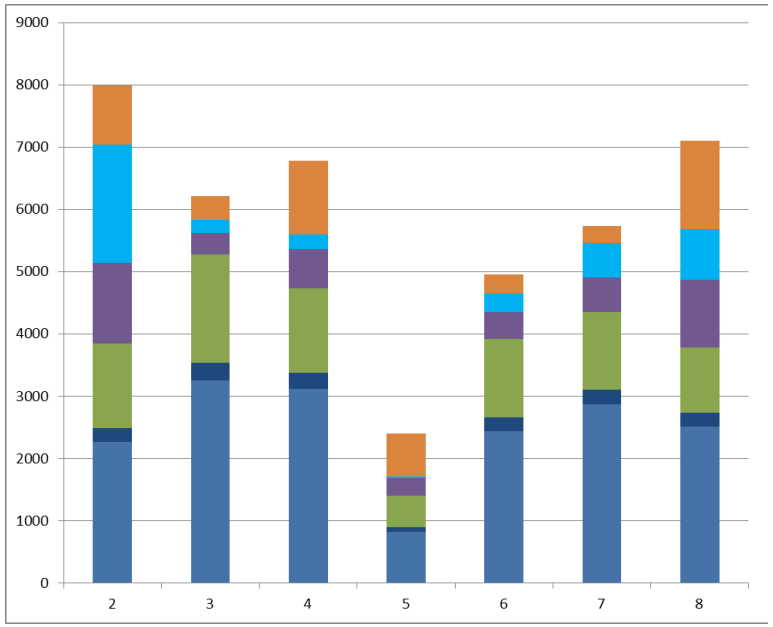


Detailed traffic counts in 2015

Traffic Counts (veh/ day)



Emissions (g/km /hour)



Comments on OSPM

Parameterised model

Based on physics

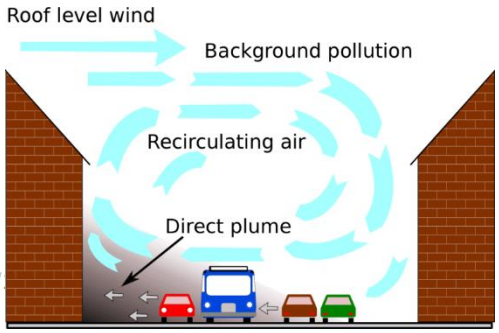
- Direct plume

$$\sigma_z(x) = \sigma_w \frac{x}{u_b} + h_o$$

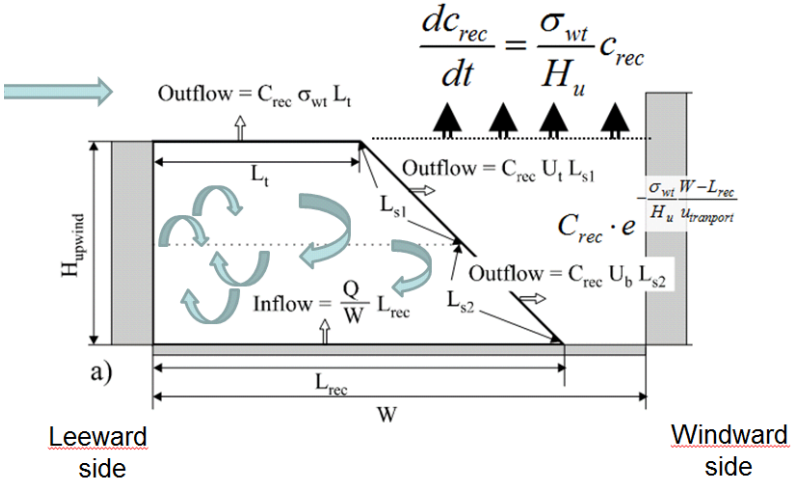
- Traffic produced turbulence

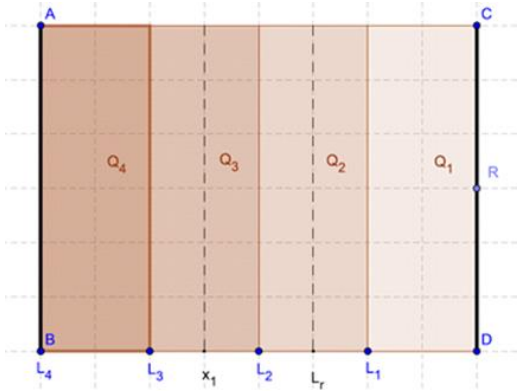
$$\sigma_w = \left((\alpha u_b)^2 + \sigma_{wo}^2\right)^{1/}$$

$$\sigma_{wo}^2 = b^2 V^2 D$$

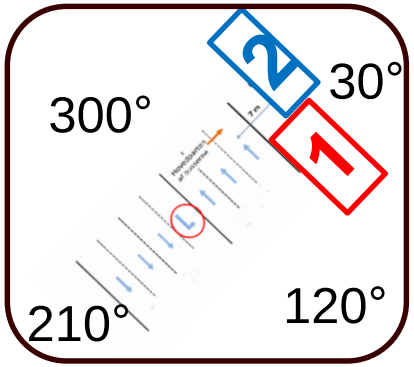


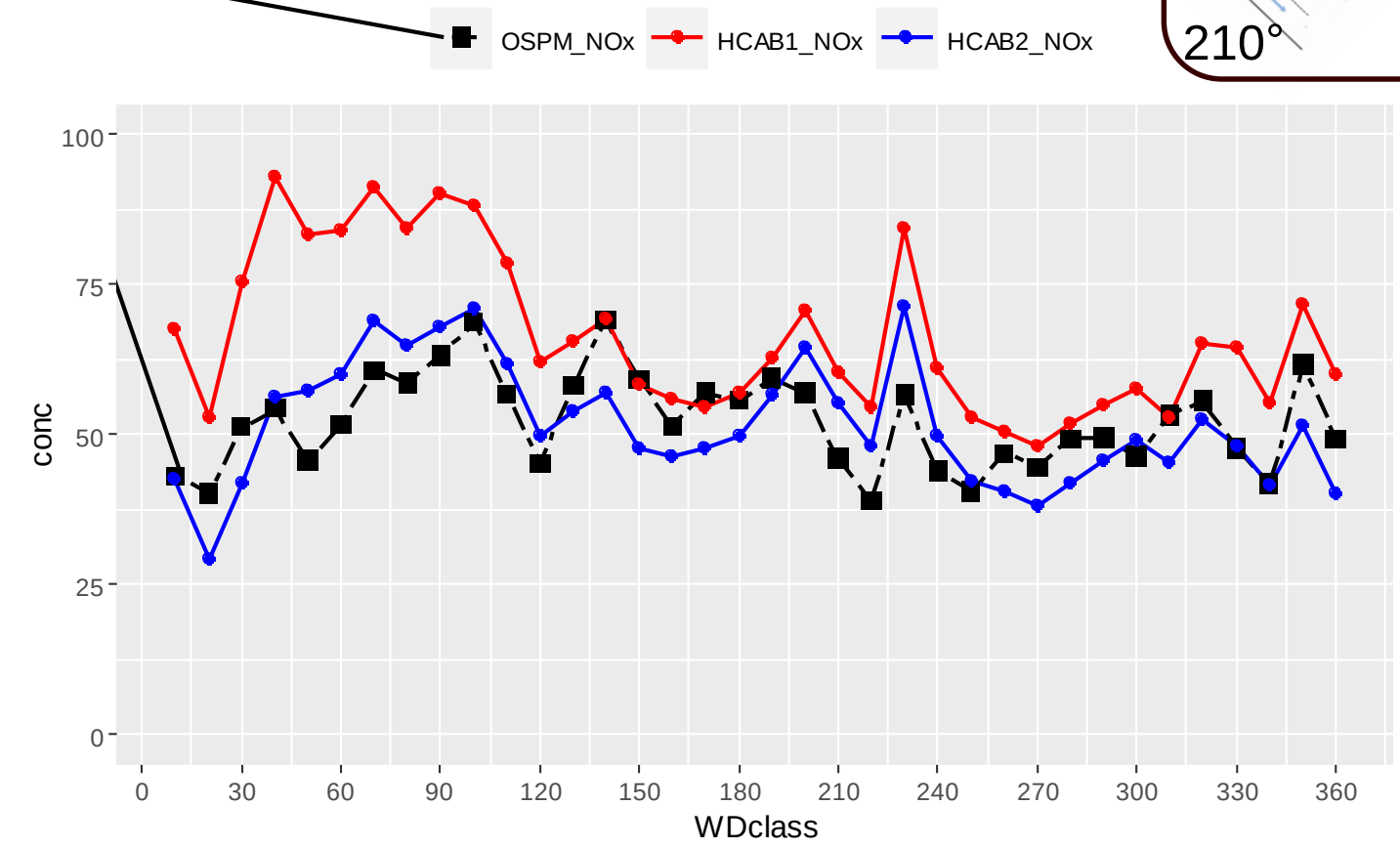
- Recirculation





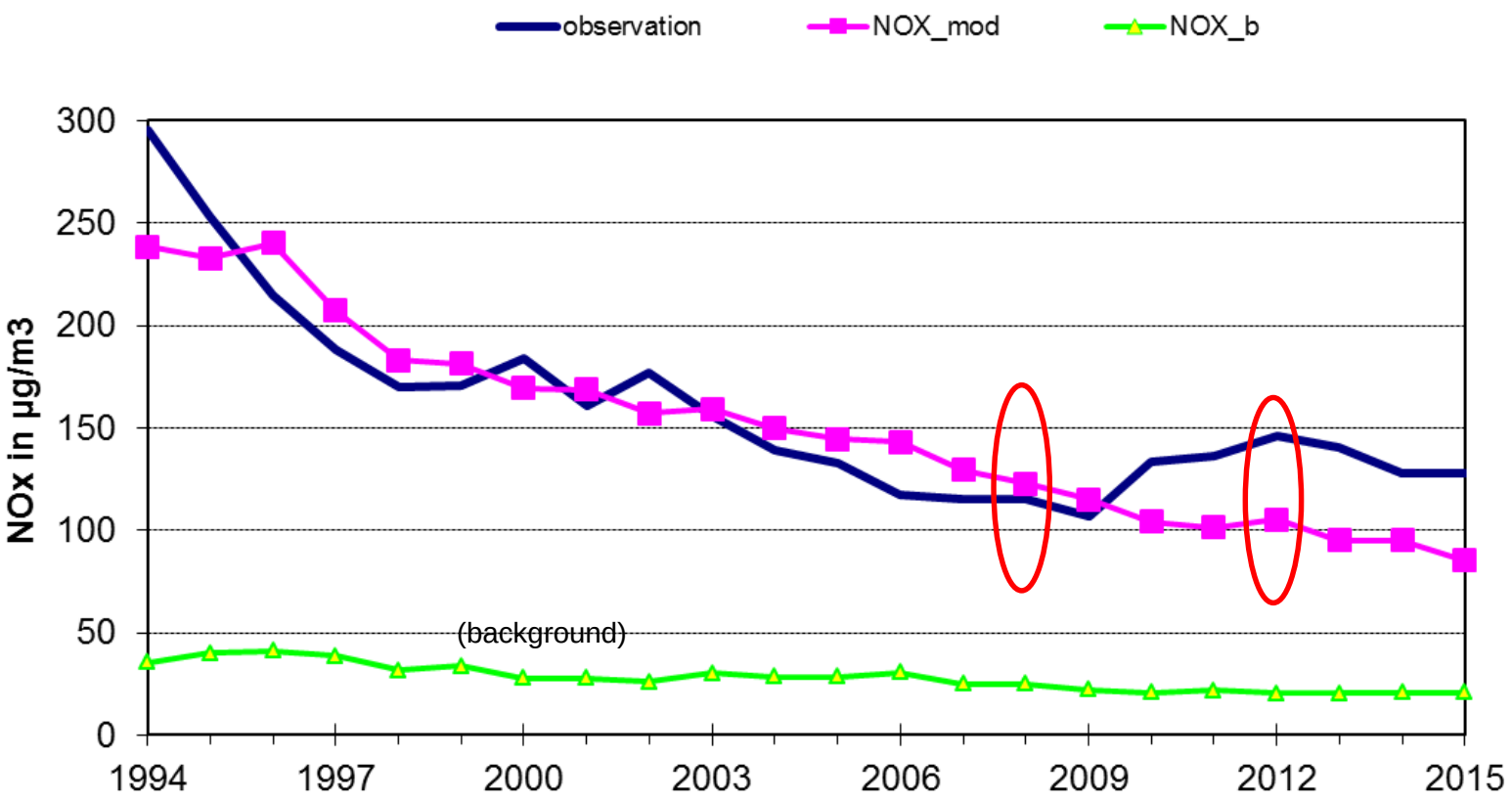
- Standard OSPM fits well with ”extra” station 2



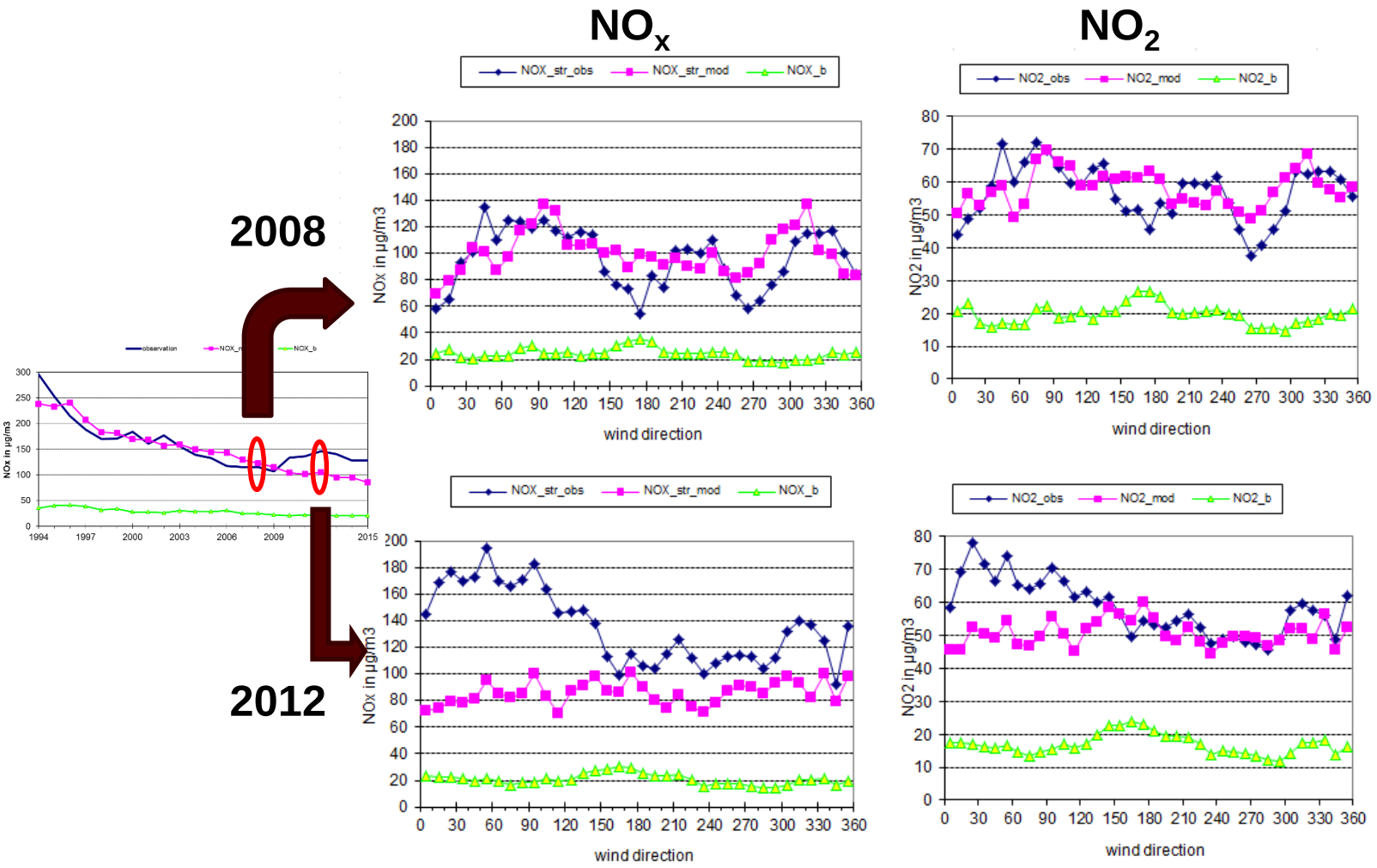


Modelling long term trends

- NOx annual mean at HCAB station
- ”Standard” OSPM



- Wind direction dependence

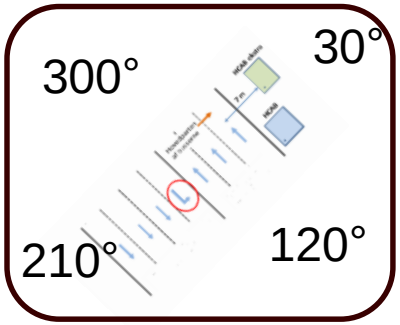


background

Methods

Results

In Progress



- Sensitivity study
- Constant emission/ wind speed
- Variable wind direction

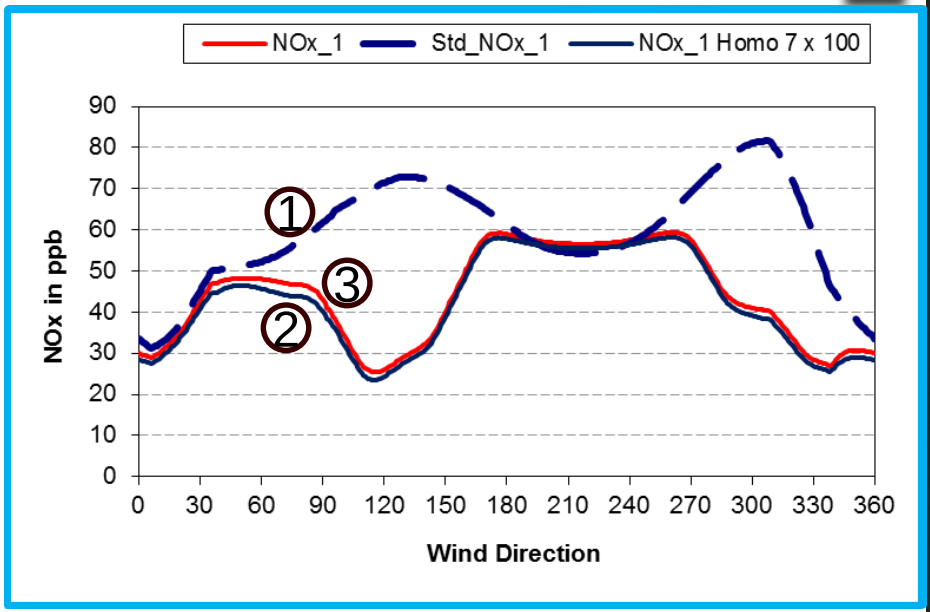
1. Standard, emissions homogeneous over all street (50m)

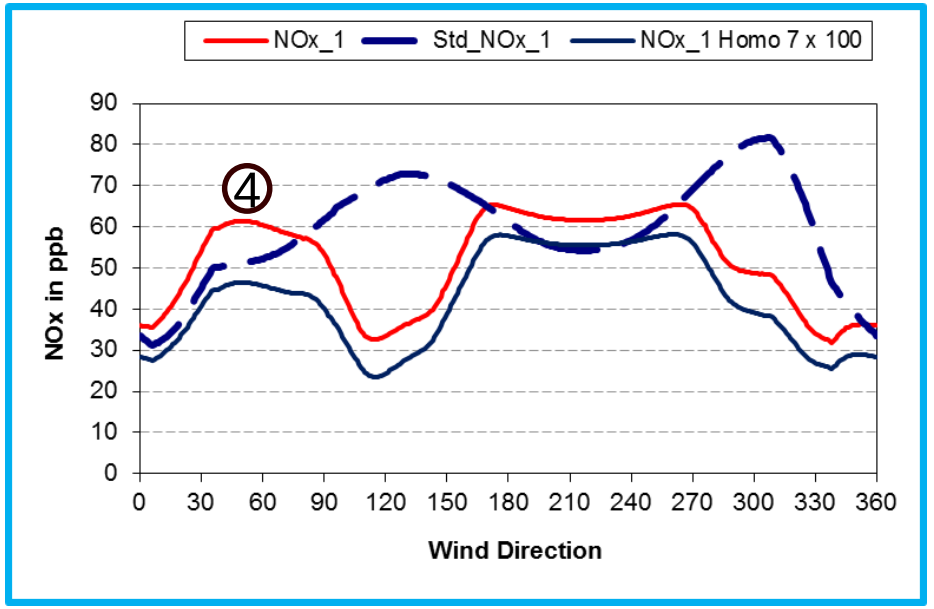
2. Limit to (7*3m=21m) emissions homogeneous

3. As 2. + non-homog. emiss.

4. Moving emissions 3m closer to receptor

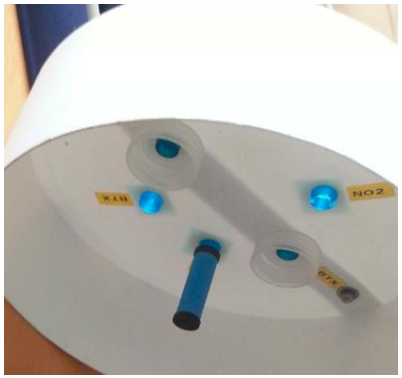
New OSPM



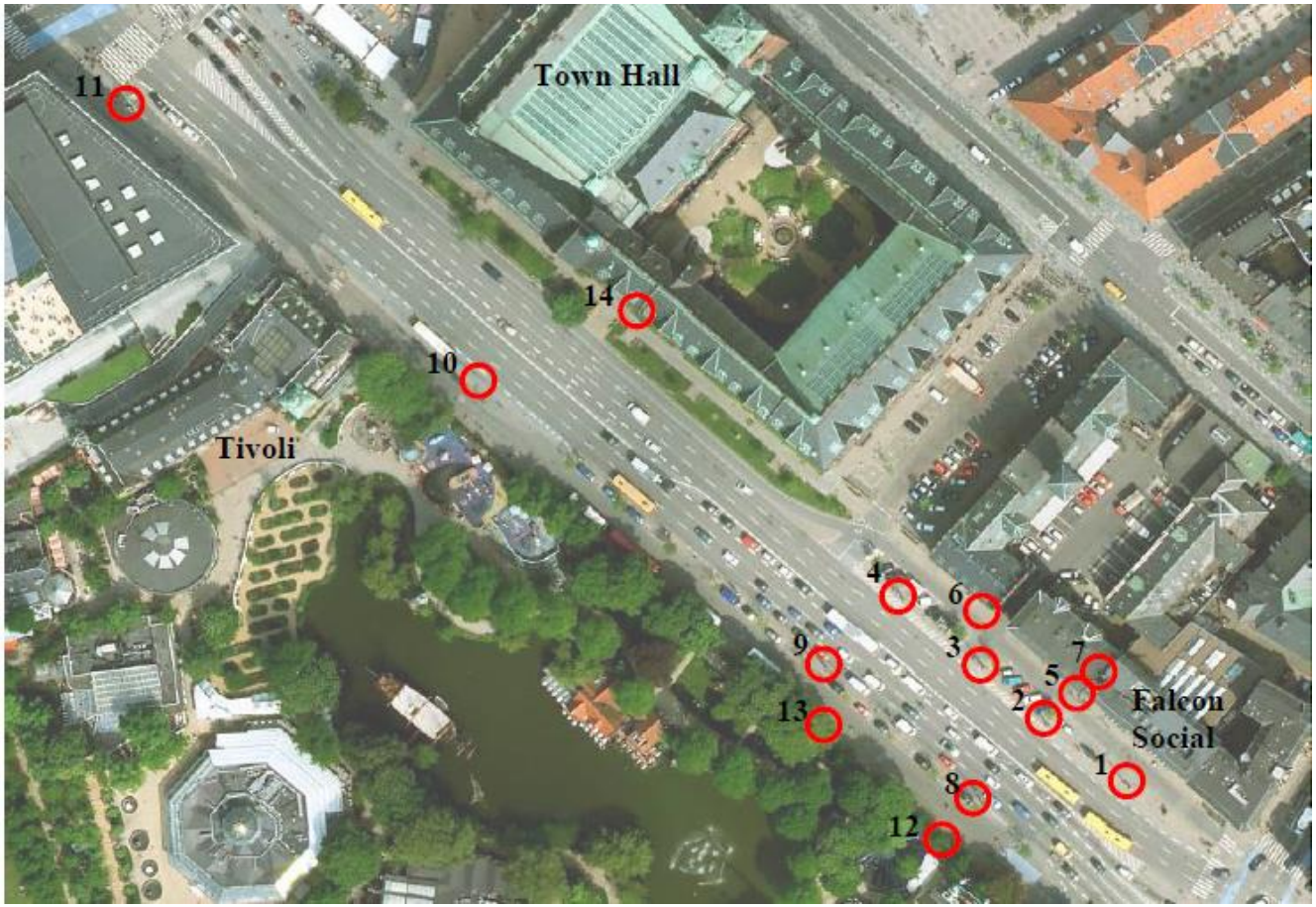


Passive sampling 2015

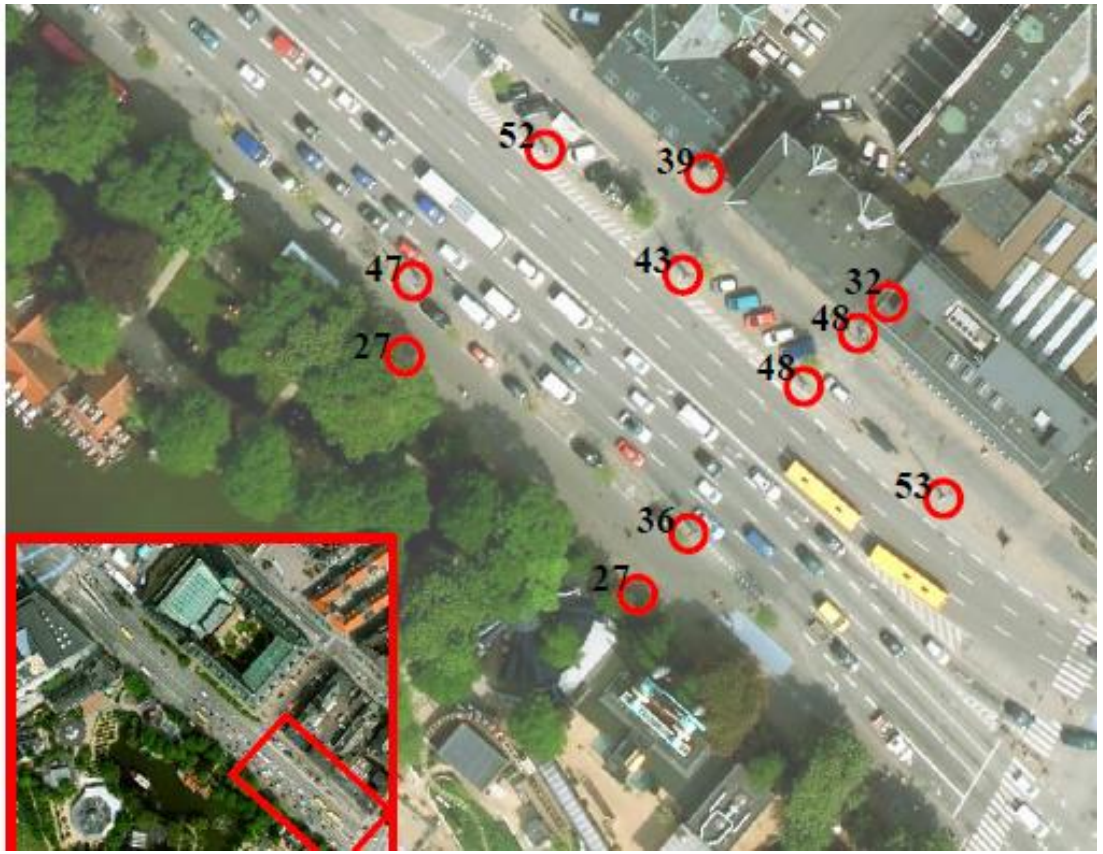
- 14 locations
  - 3 x 1 week exposure
  - Nov. / Dec. 2015
- Radiello tubes
- Very wet period
  wet tubes
- Large scatter between
  the 2..3 co-located tubes
- Large bias compared
  to permanent station



- 14 locations



- Mean from all 3 campagins
- Large scatter/ uncertainty inerpret with care
- NO_2 conc. in µg/m3



Conclusions

- Analysing old data gains new insights
  - High spatial gradient of NO_2 concentrations
  - Wind direction dependence is very important indicator
- First time traffic counts lane for lane
  => emission per lane
- ”starting to understand” what is going on at HCAB
  - OSPM (non-homo) is in qualitative agreement with observation

Future:

- Passive campaign to be repeated maybe IVL or other type samplers
- More OSPM modelling, moving receptor not emissions
- CFD (MISKAM/OpenFOAM) modelling ?

Thank you

شكرا

Ευχαριστώ

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