

Integration of measurements and modelling in the Danish air quality monitoring programme

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11TH OCTOBER 2015

Content of presentation

- Introduction to the Danish air quality monitoring programme
- Integration of measurements and model calculations
- Examples:
 - Nitrogen deposition
 - Local scale ammonia deposition
 - Air quality at street level
 - Impact of change of traffic lanes
 - Information to the public, Air quality forecast and ozone warning
- Conclusions

Danish air quality monitoring programme

Aim - Fullfill international (EU, Conventions) and national obligations and needs:

- Actual status
- Trends
- Sources
- Information to and warning of the public

Only one monitoring programme on air quality in Denmark

Do it in a smart way – science based and mesurements integrated with models

Strategy – integrated monitoring

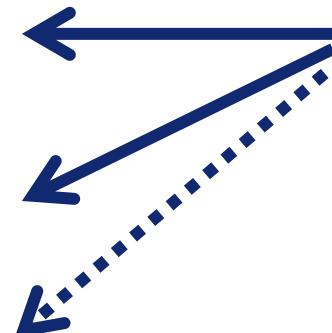
Objective:

Methods:

Actual state

Measurements

Long term trends



Source identification

Model calculations

Strategy – integrated monitoring

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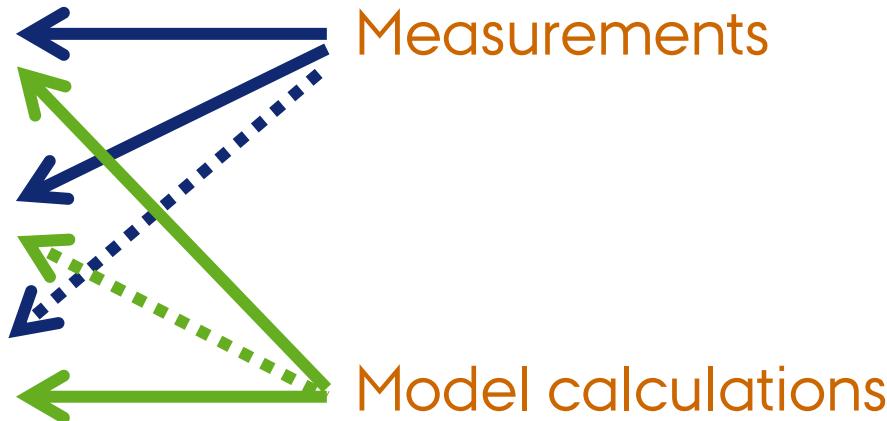
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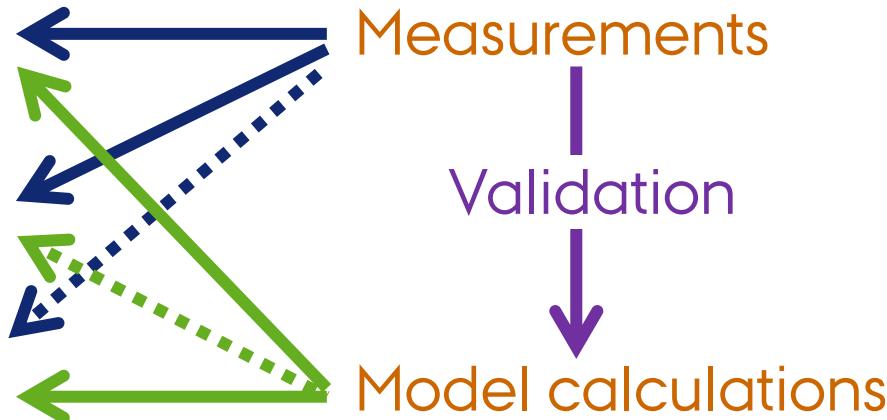
Source identification

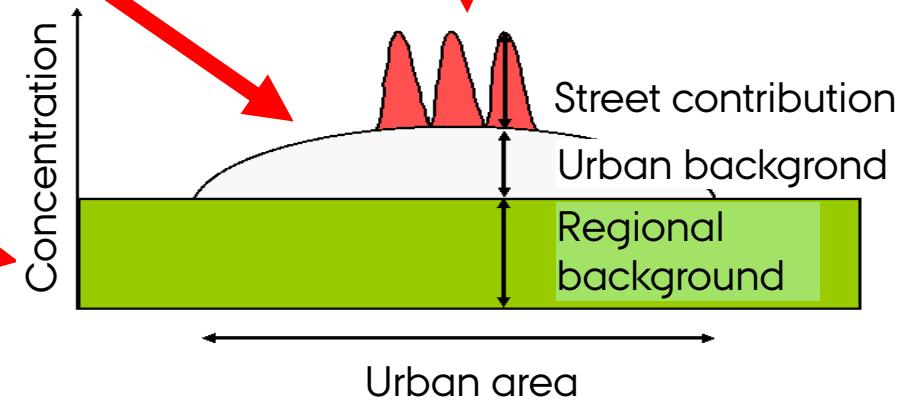
Methods:

Measurements

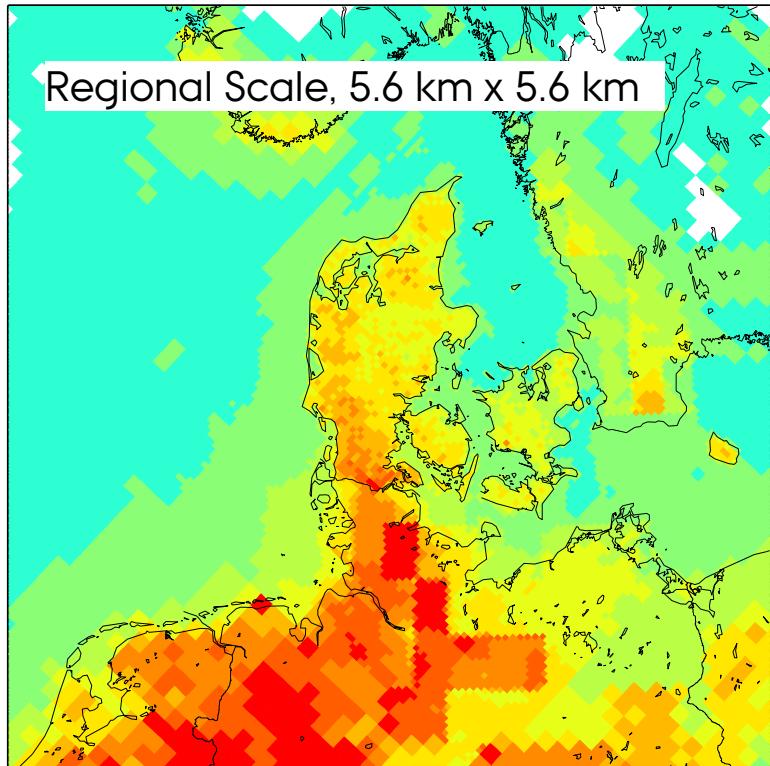
Validation

Model calculations

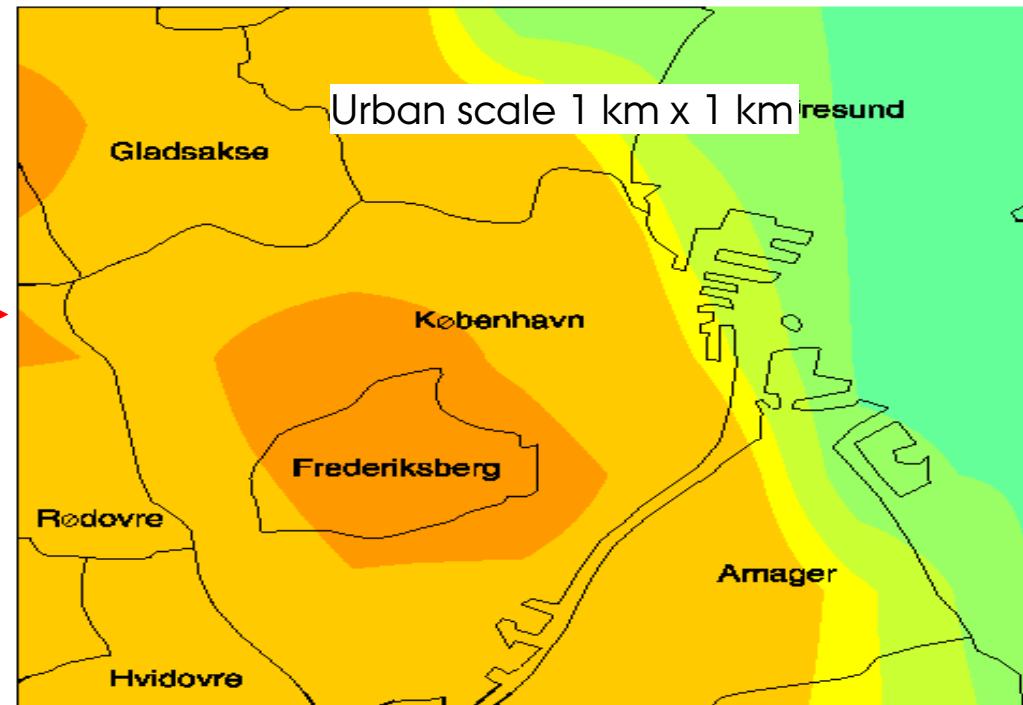
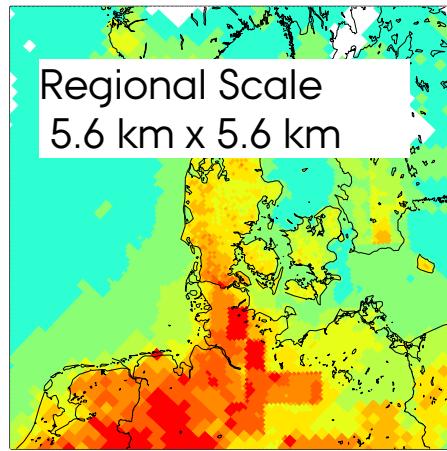




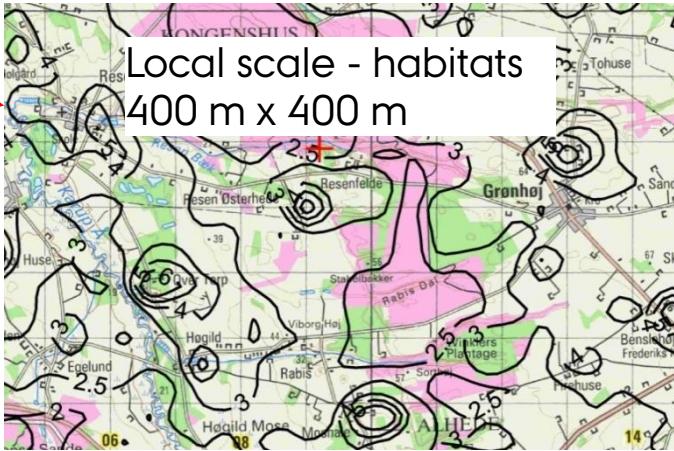
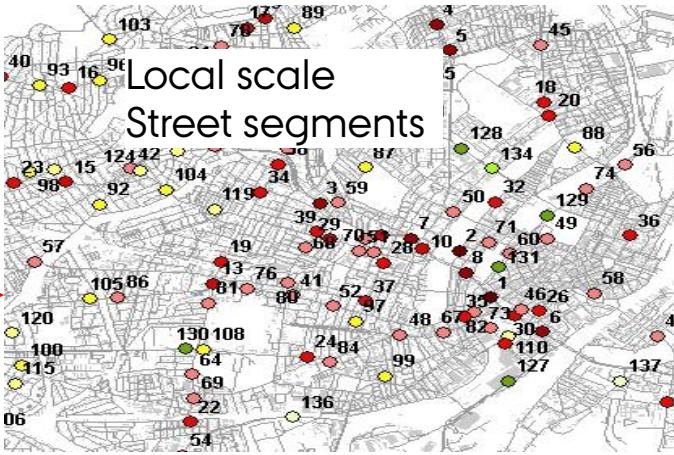
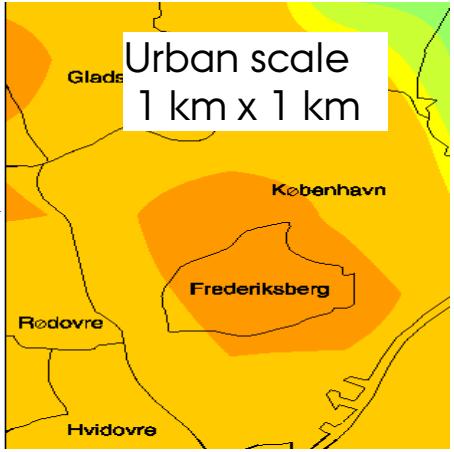
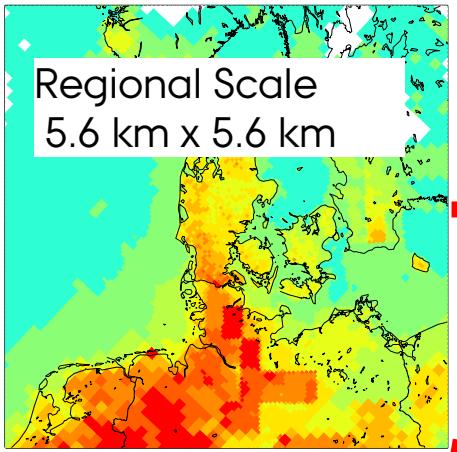
Model calculations



Model calculations

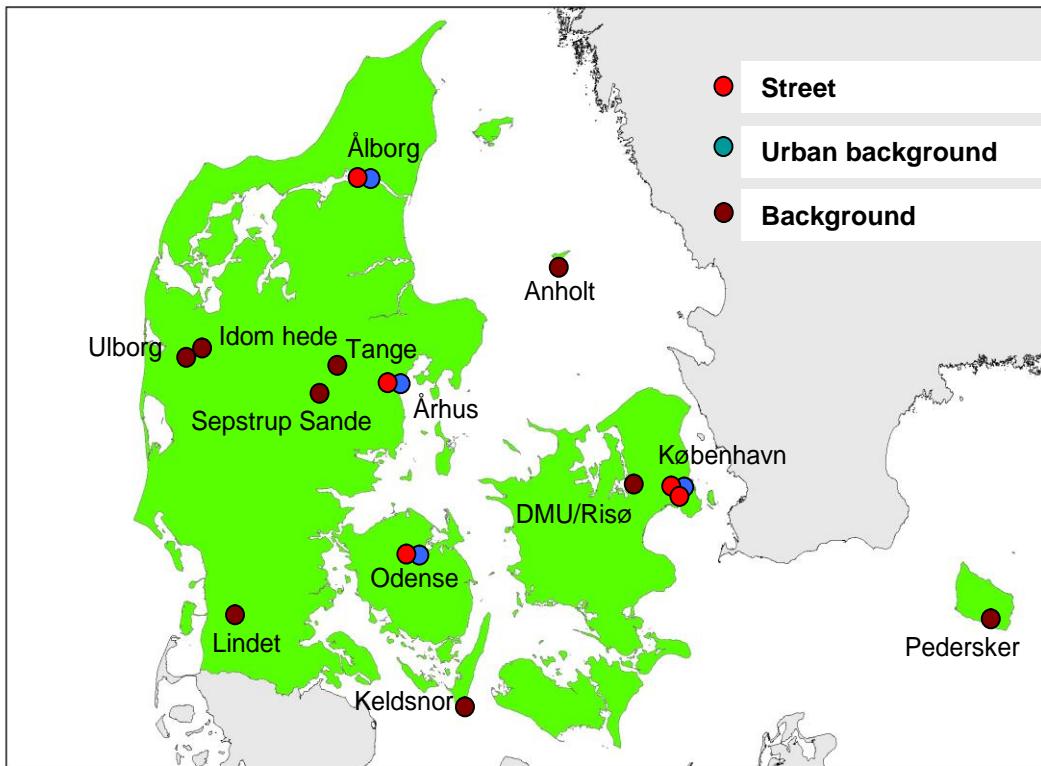


Model calculations

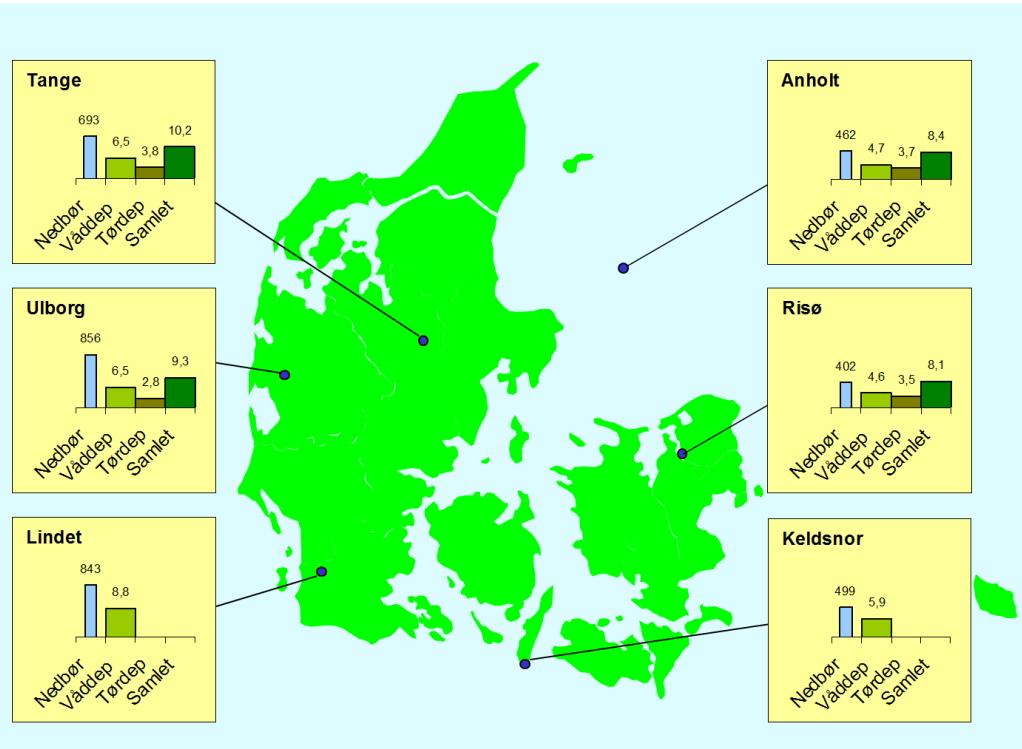


Meteorological data
Emission inventories

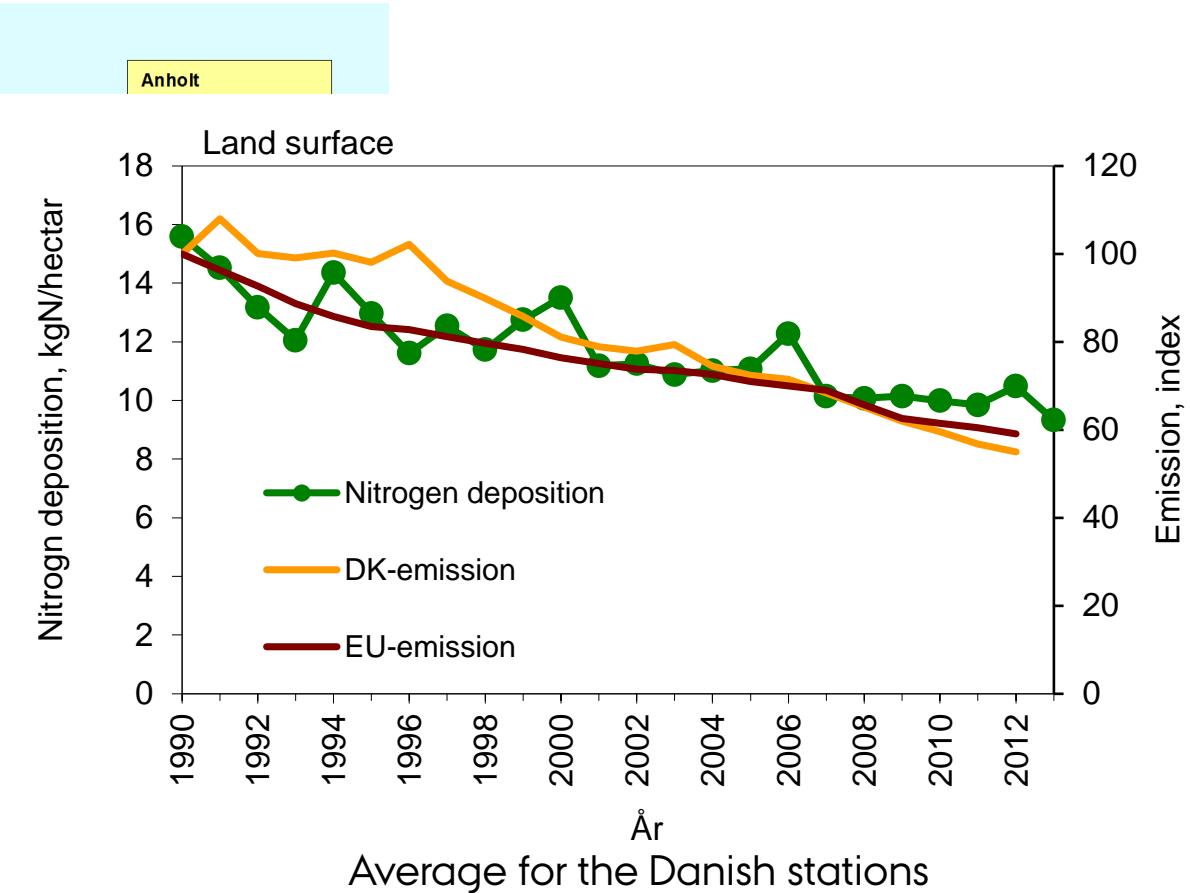
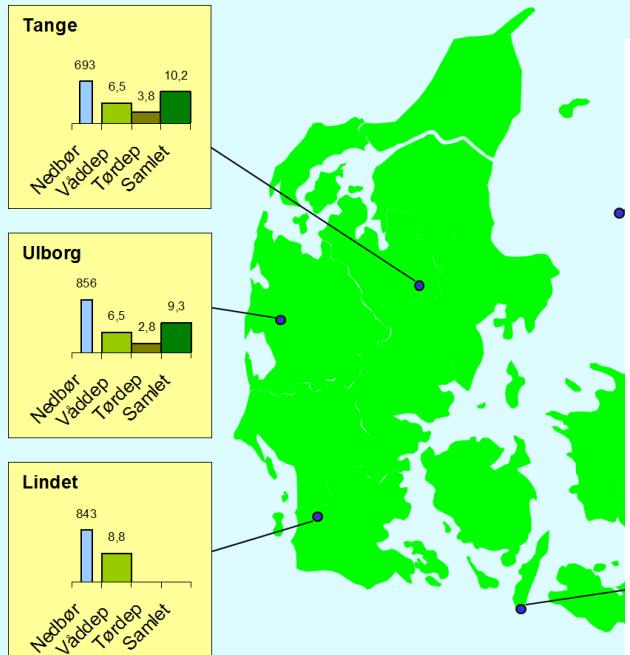
Measurements of actual status and trends



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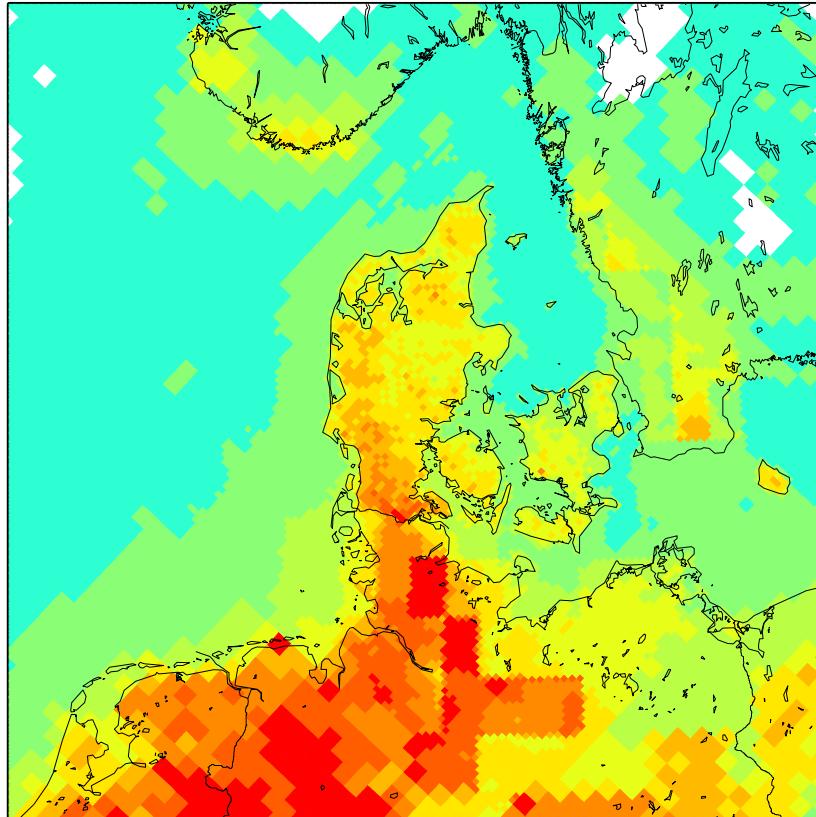
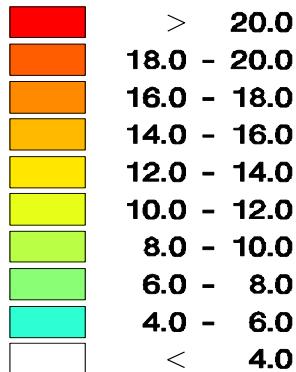
Measurements of actual status and trends



Model calculation of nitrogen deposition covering Danish land and marine waters

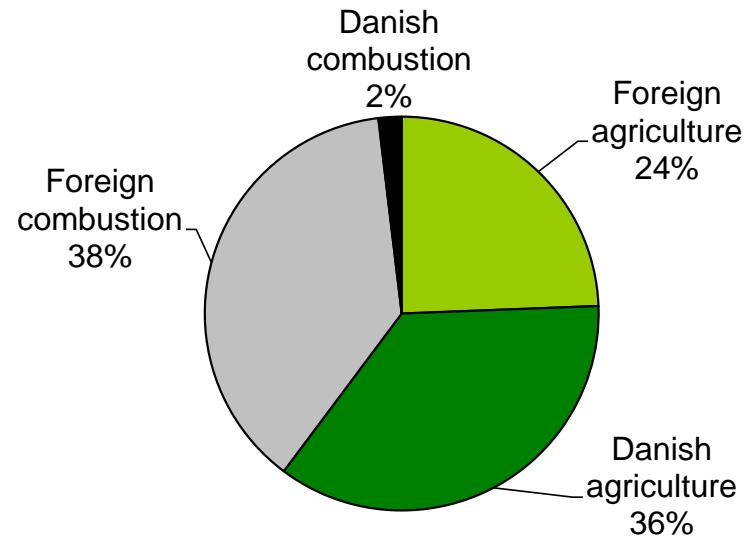
2013

Unit: kg N/hectar

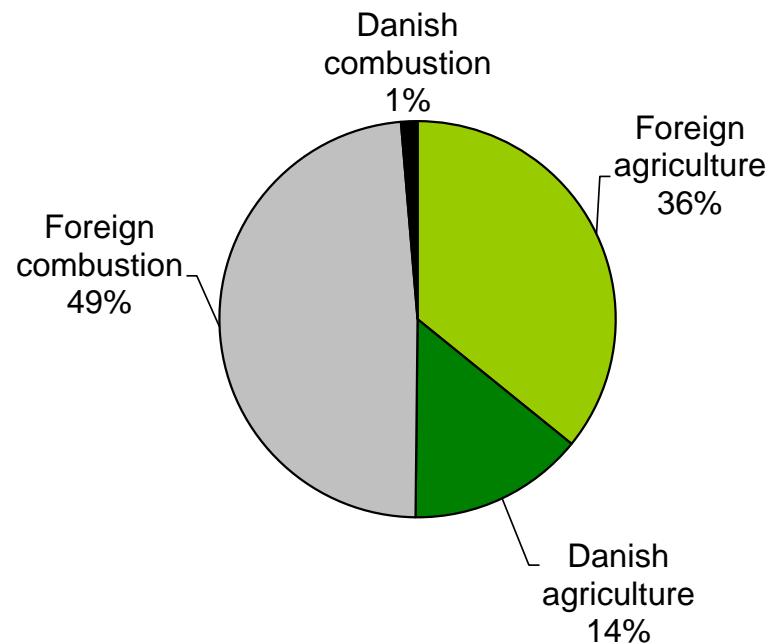


Model calculation of sources

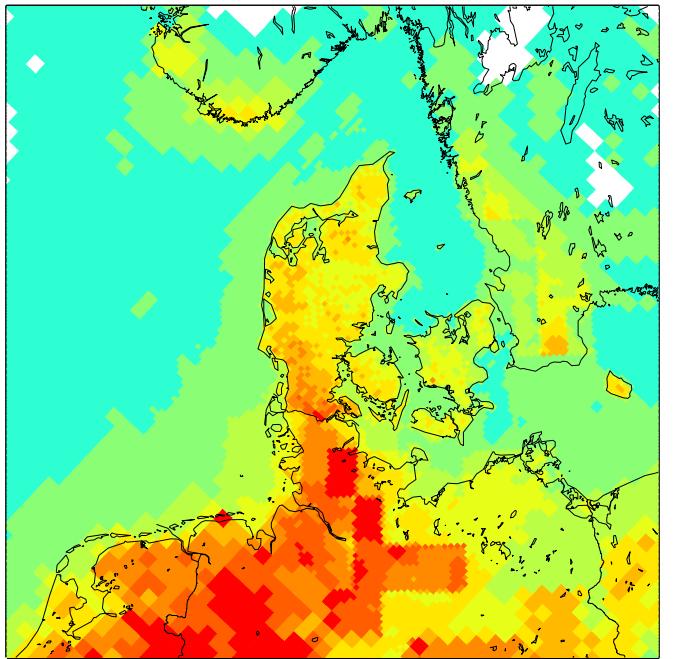
Land surface



Marine waters

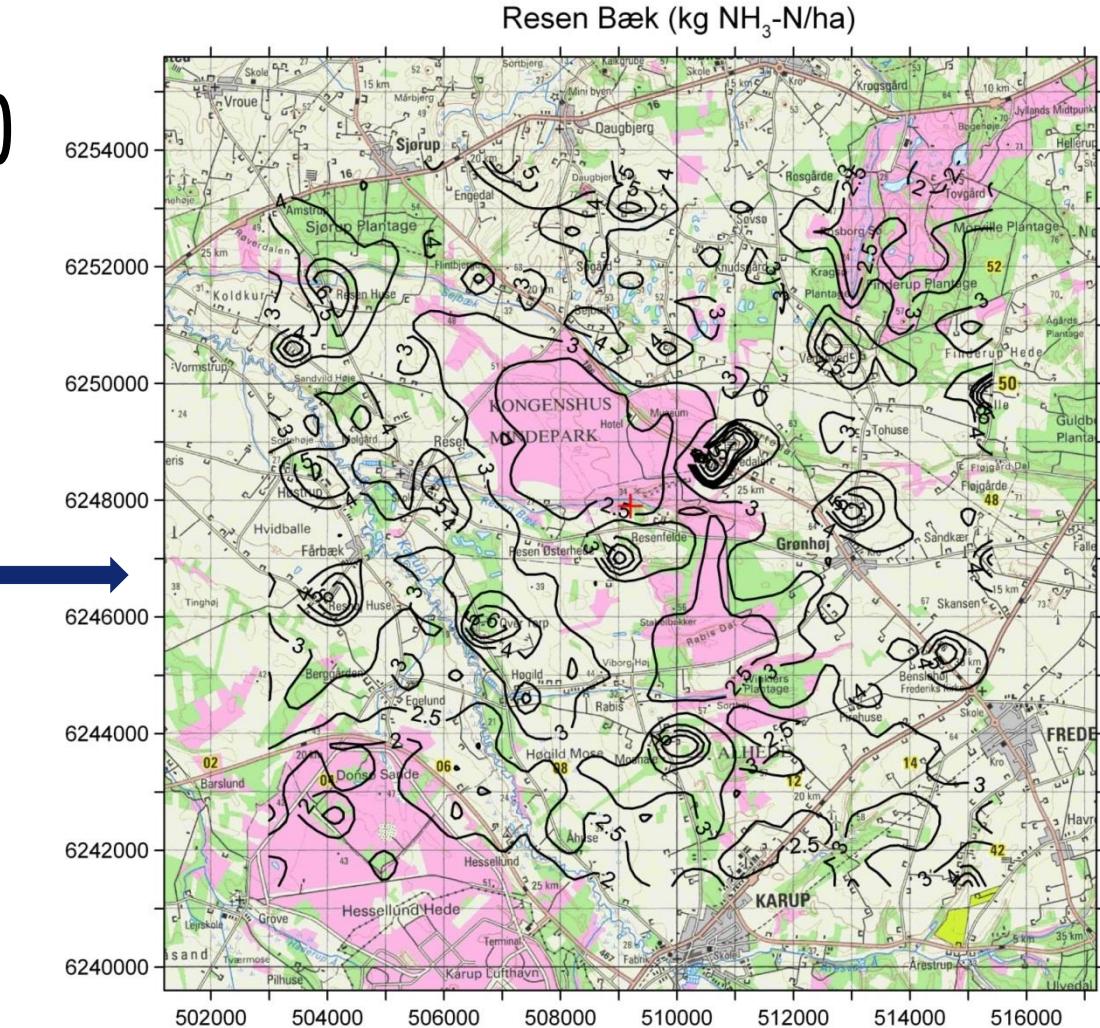


Local scale ammonia deposition (OML-DEP)

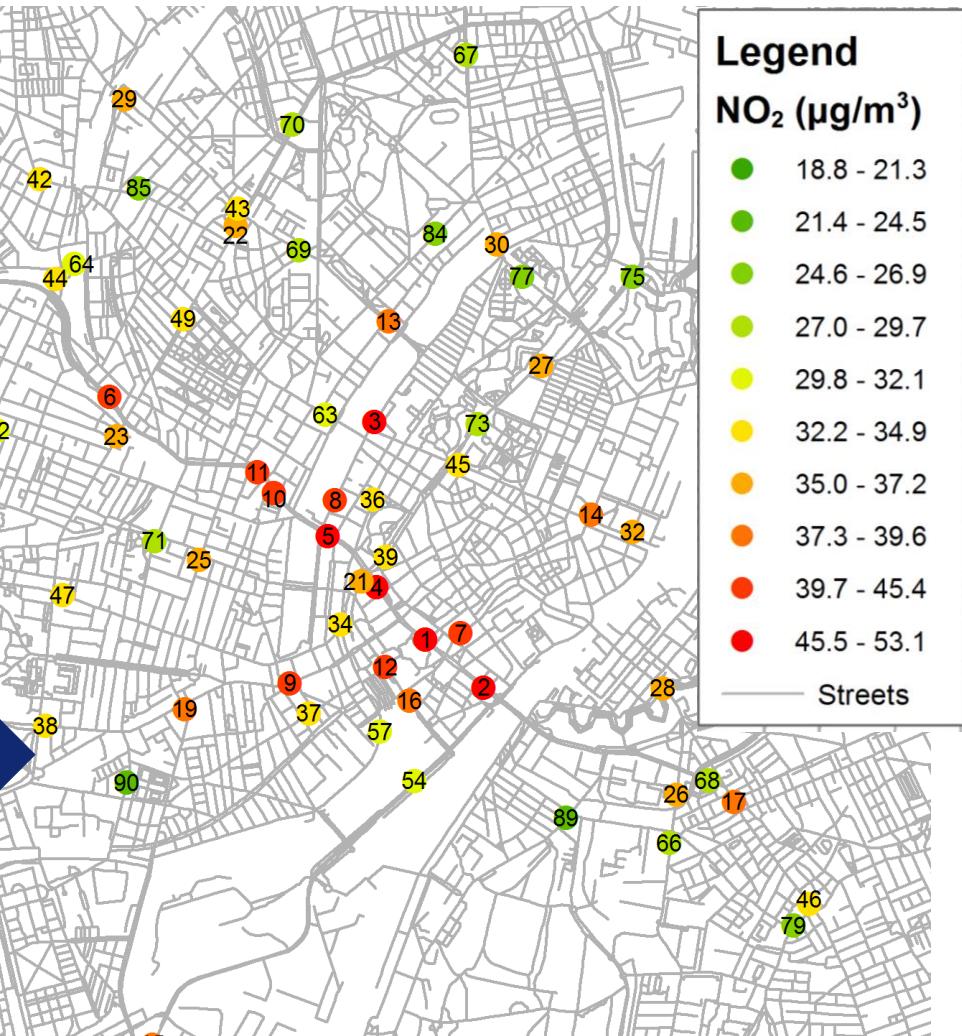
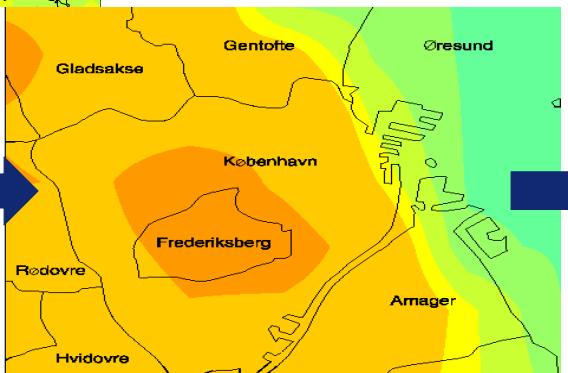
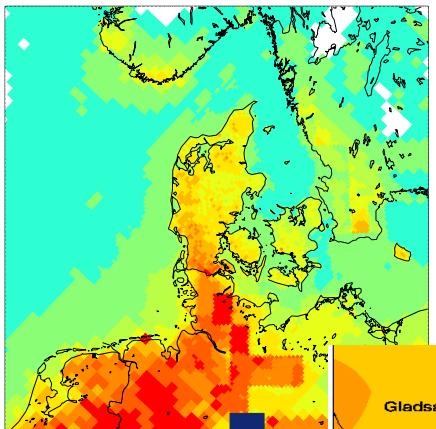


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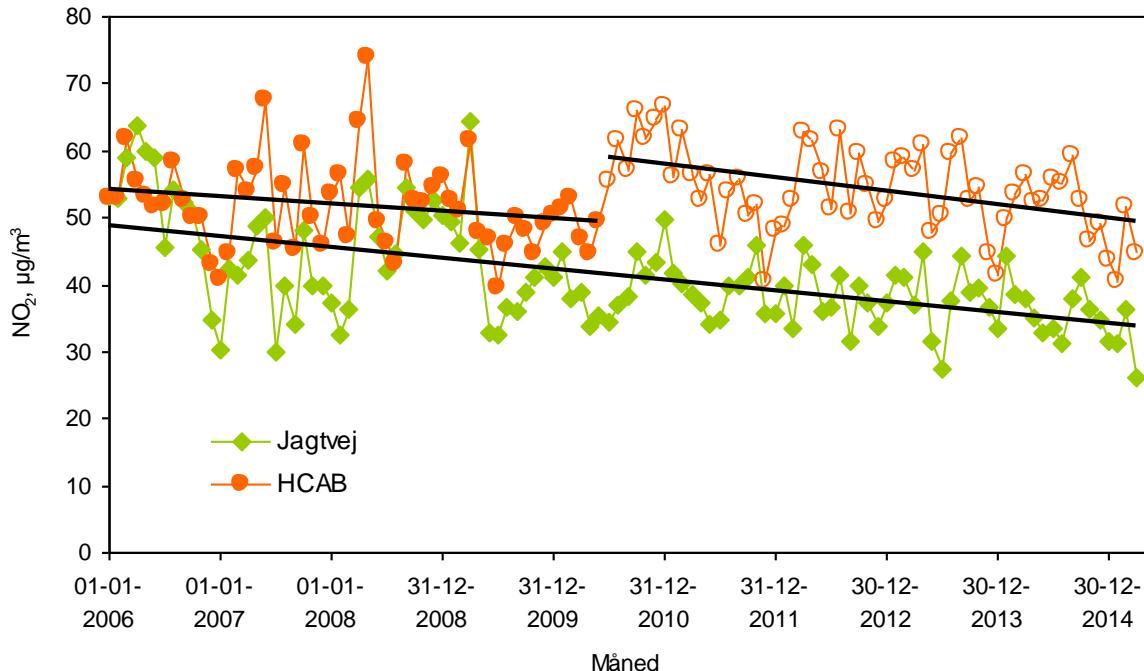
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Air quality at street level in 2013 (OSPM)



Impact of change in traffic lane - NO₂ at H. C. Andersen Boulevard



Jump in NO₂ of 8 µg/m³ in summer 2010

Several possible reasons:
Higher traffic intensity
Change in traffic composition
Change in speed
Change in traffic lanes

Carried out detailed analysis of measurement results and used models in order to understand the reason behind the jump.

Change in traffic lanes during summer 2010

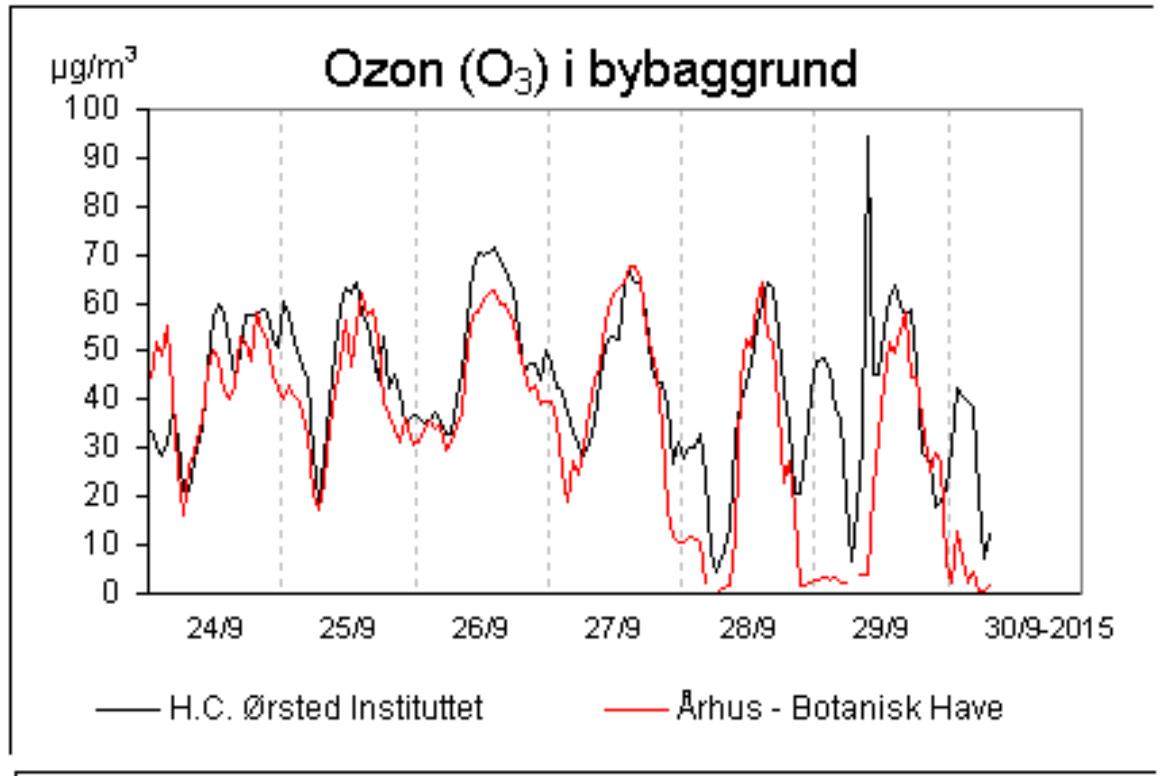


Campaign with extra measurement station

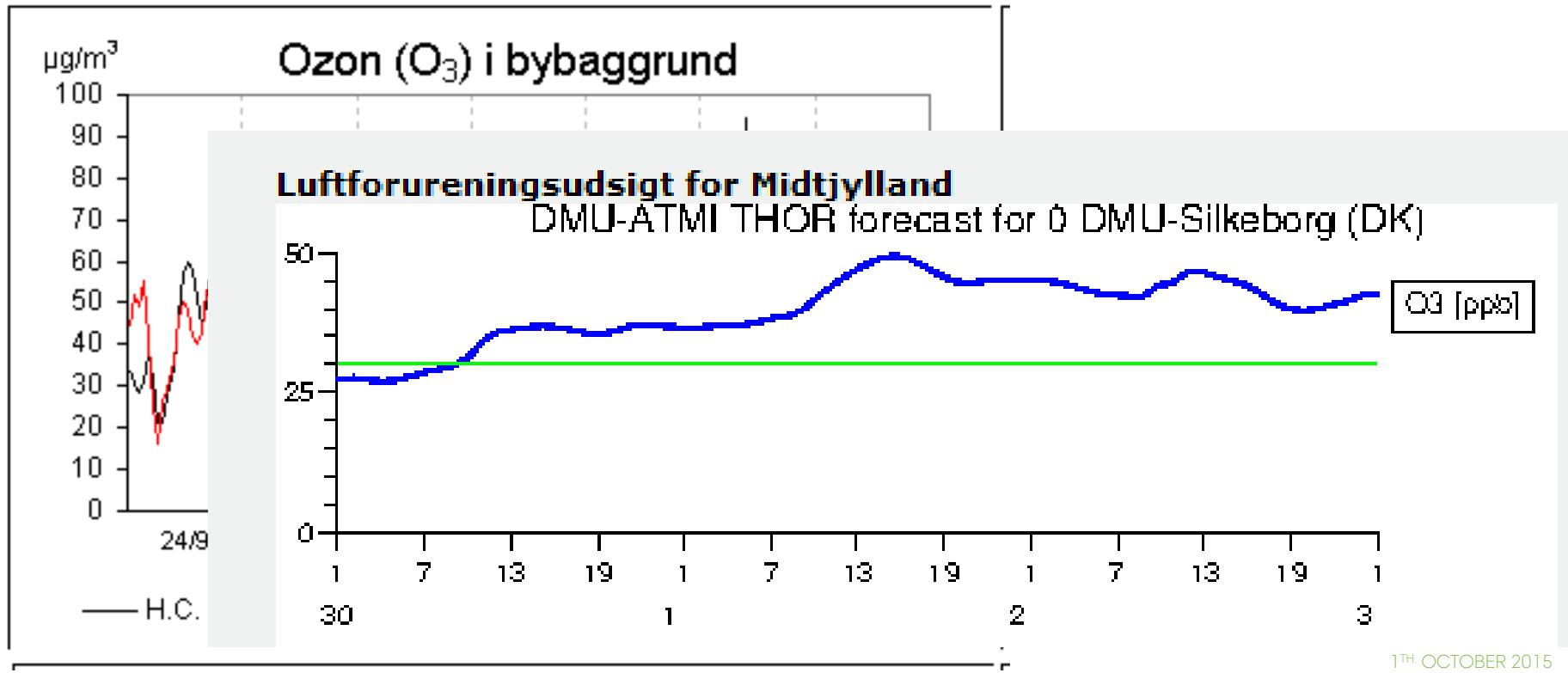
- ▶ Change of traffic lanes the main reason for the jump in NO₂
- ▶ Models were not detailed enough
- ▶ Initiated new development of the Danish Operational Street Pollution Model



Information, Air quality forecasts and ozone warning



Information, Air quality forecasts and ozone warning



Conclusions

- ▶ Combination of measurements and model calculations creates a synergy that results in improved monitoring of air quality
- ▶ Better value for the money
- ▶ Improvement of measurement techniques – cheap smart devices or drones?
- ▶ Improvement of models and model products
 - › Local scale model calculations to all streets and all habitats in Denmark
 - › APP with forecast and ozone warning



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