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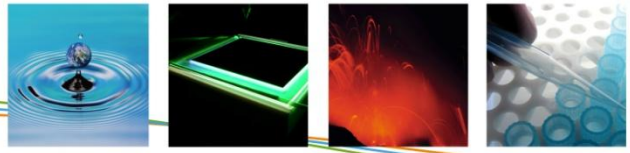


Integrated assessment modelling in Belgium: a multi-scale approach to support the regional and urban air quality management plans

Stijn Janssen, Wouter Lefebvre, Peter Viaene, Bino Maiheu, Bart Degraeuwe, Jean Vankerkom

OPERA conference – November 15, 2012 – Strasbourg, France

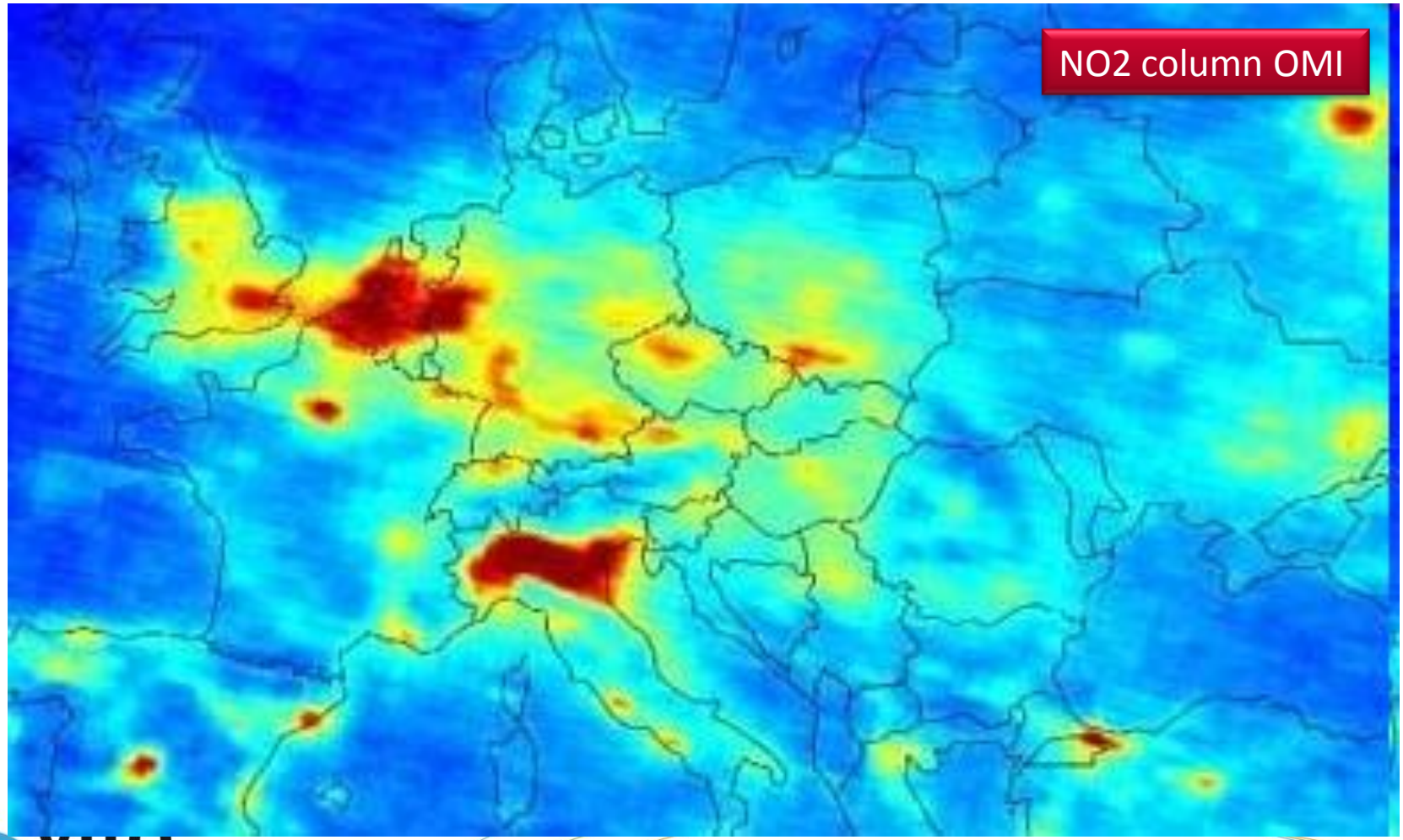
ATMOSYS
Air Quality Modelling System

Life

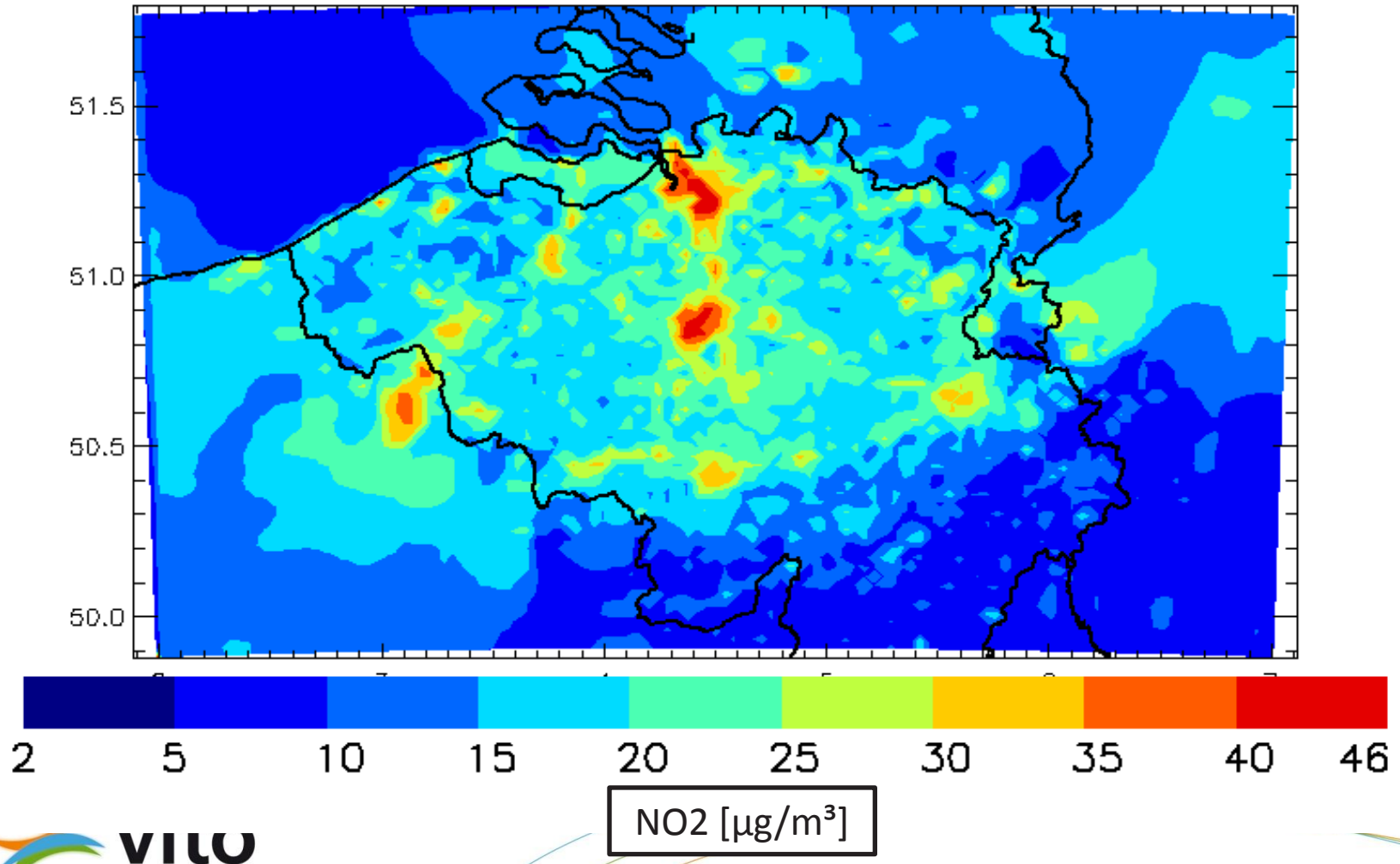
Content

- Different scales in air pollution requires a multi-scale approach
  - Methodology
  - Validation
- Regional air quality management plan for Flanders
  - Abatement measures
  - Impact on concentrations
  - Impact on exposure
- Urban air quality management plan for city of Antwerp
  - Abatement measures
  - Impact on concentrations
  - Impact on exposure
- Conclusions

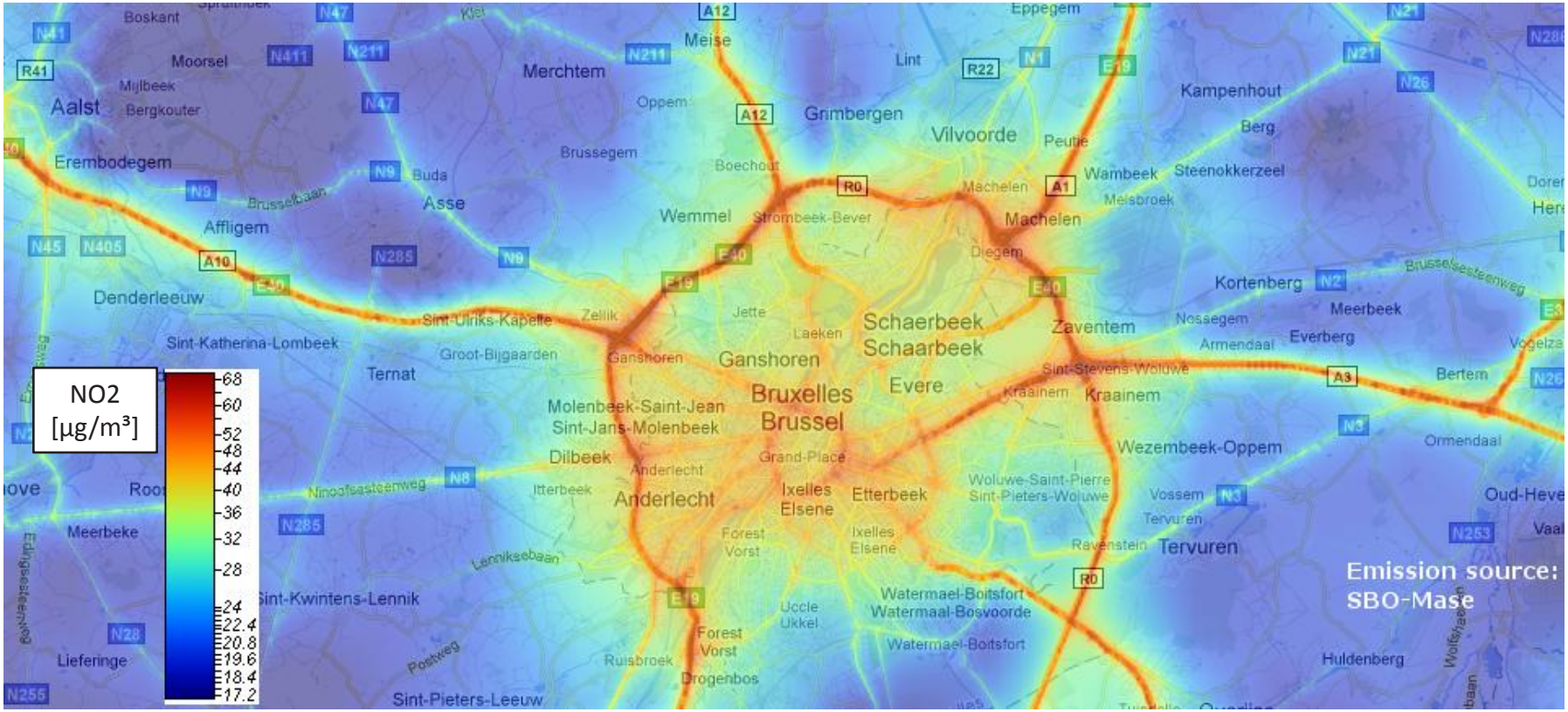
Different scales in air pollution:
Continental to Regional (NW Europe)



Different scales in air pollution:
Regional to urban (Belgium)

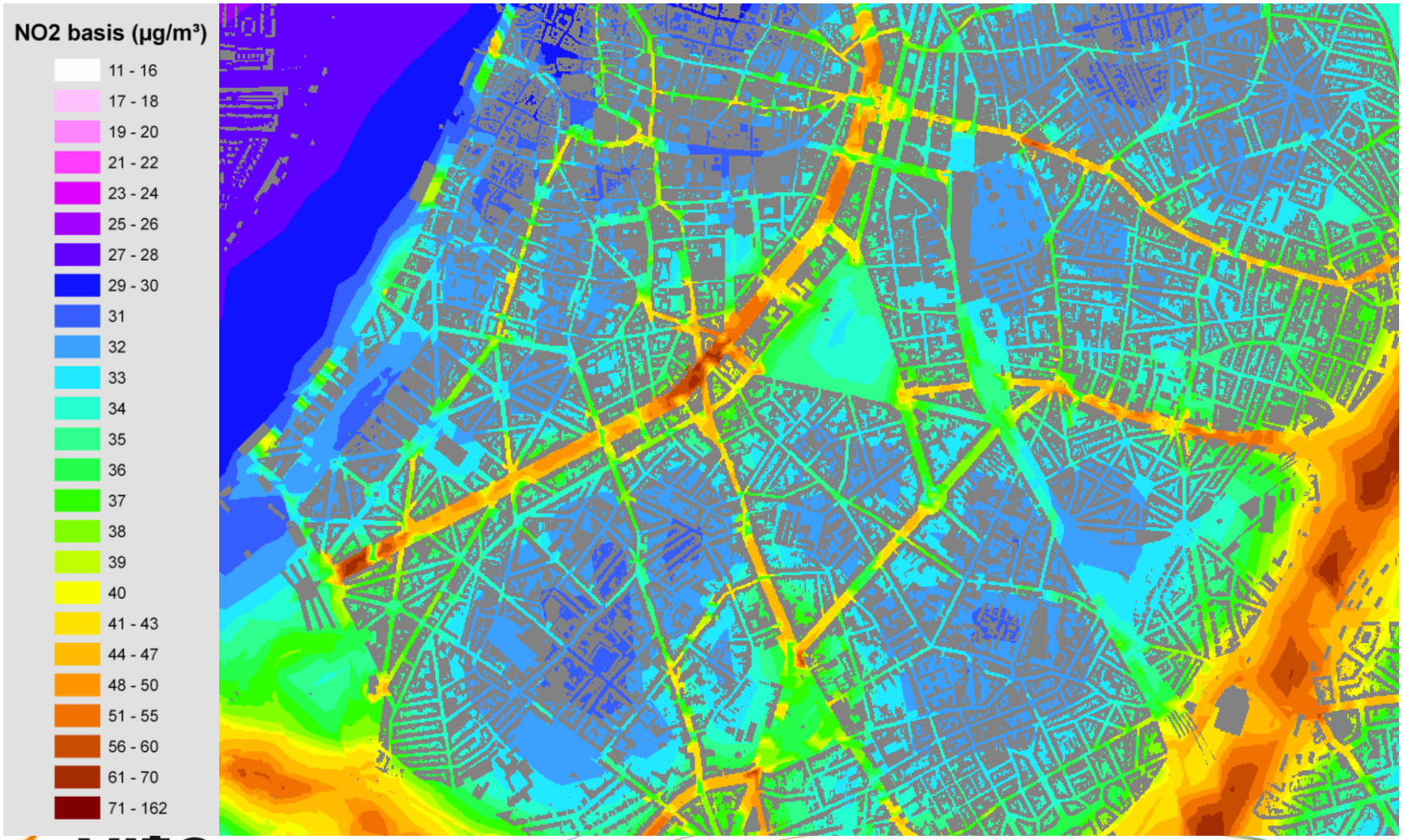


Different scales in air pollution:
Urban (Brussels)



Different scales in air pollution:

Urban to local (city center of Antwerp)



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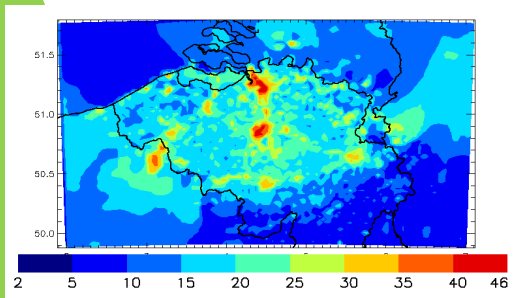
Different scales in air pollution

- Local scale depends on the urban scale, urban scale depends on the regional scale.
- For evaluation of planning scenario's at the local scale, all scales have to be taken into account
- How to couple AQ models in a correct and efficient way?

Regional scale: Eulerian model

AURORA (with passive data assimilation - residual Kriging)

Resolution: 3x3 km²



Urban scale: Gaussian plume

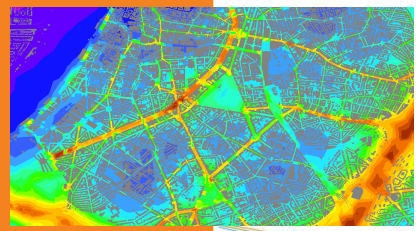
IFDM on an irregular grid

Resolution: 30x200m²

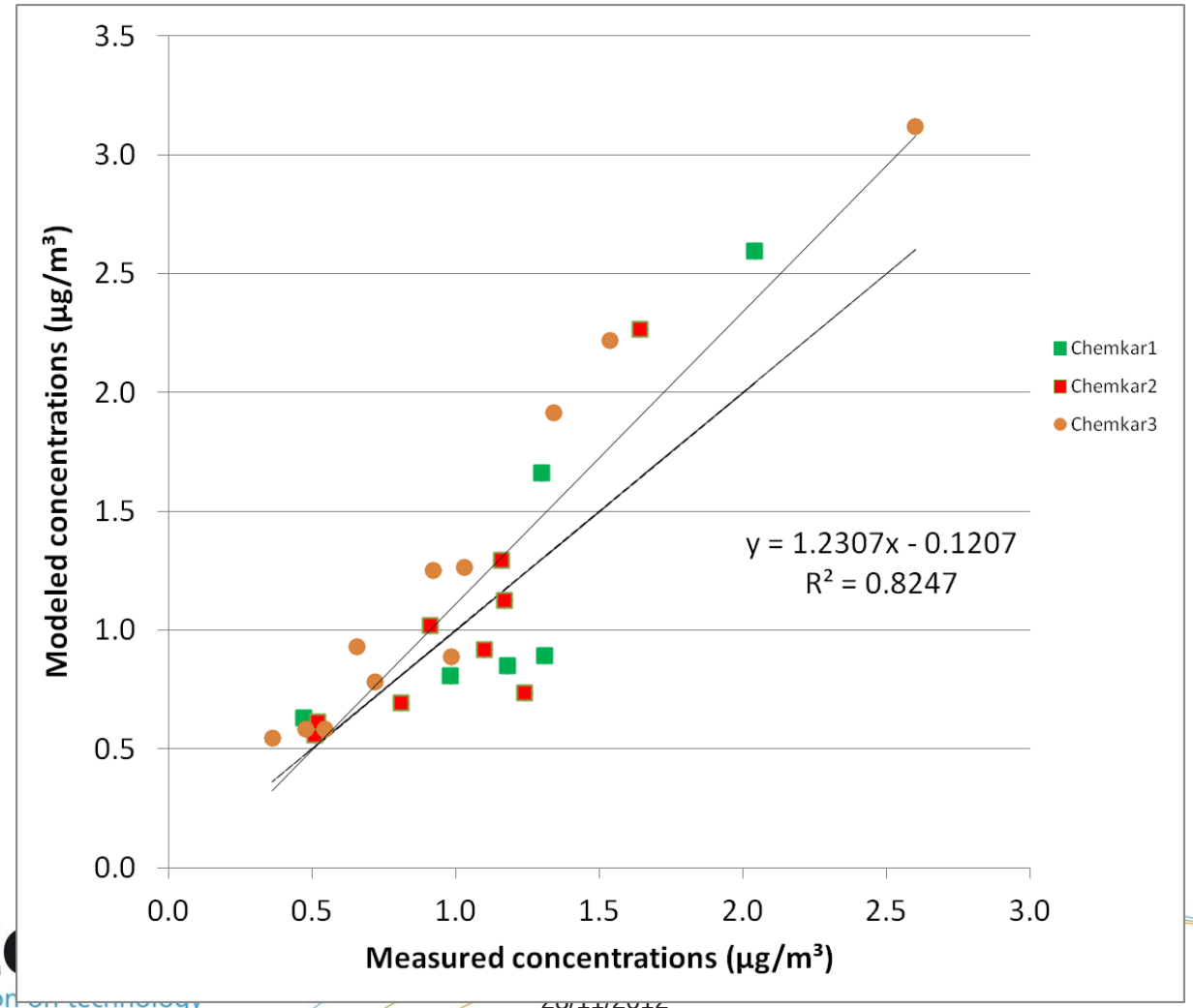
Local scale: Street box model

OSPM

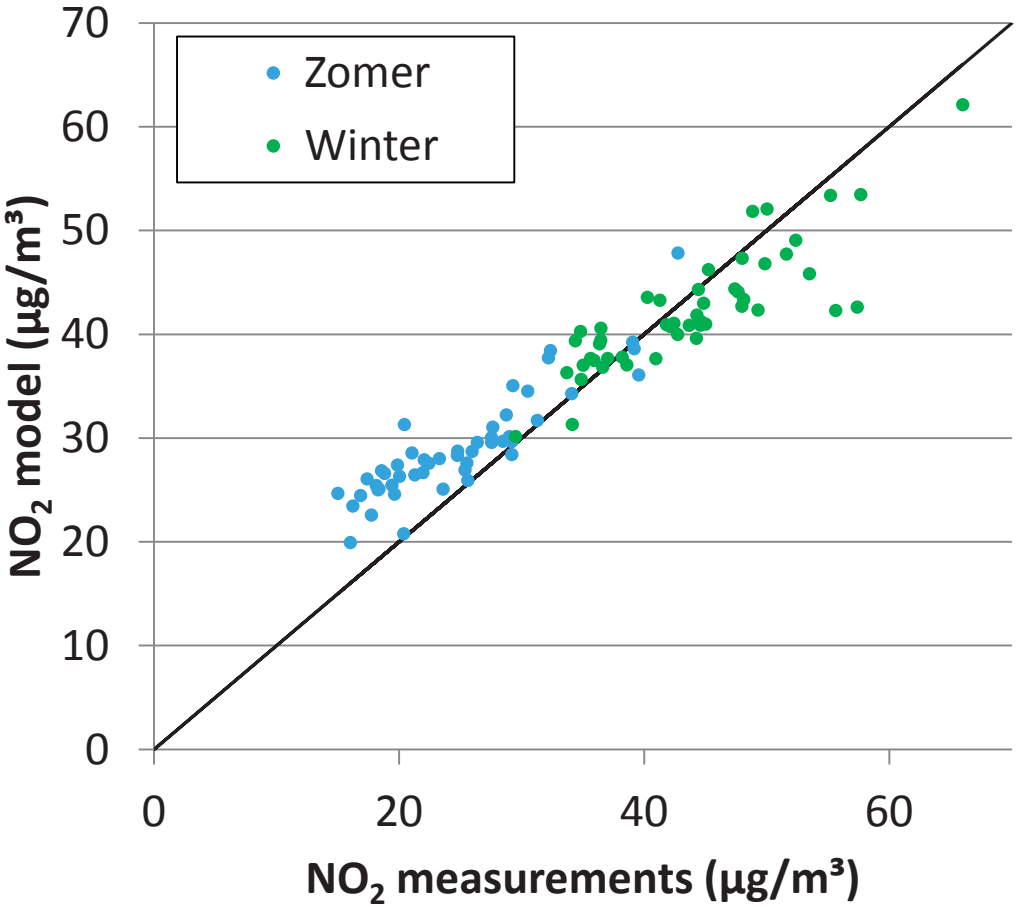
Resolution: 5x25m³

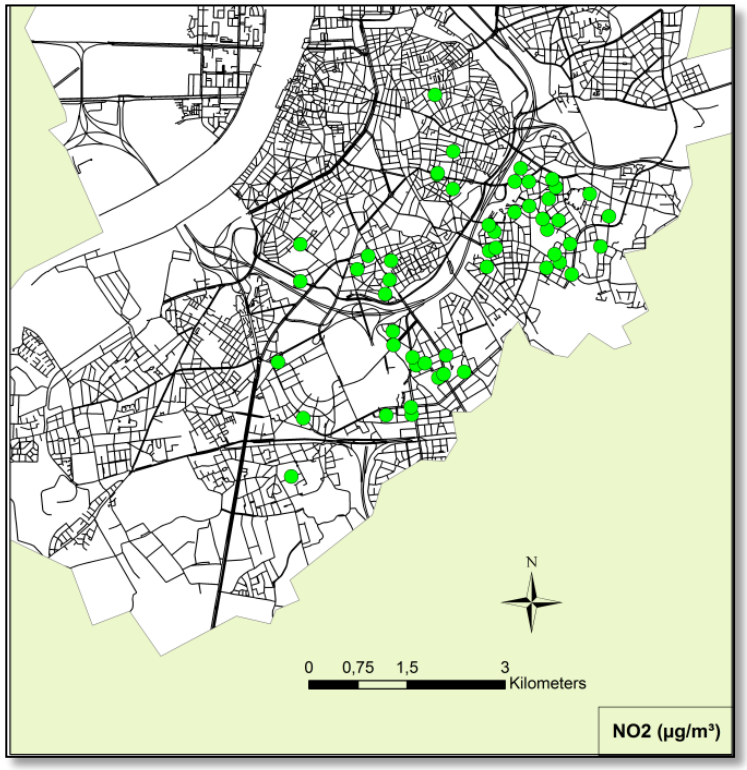


Validation @ regional scale (Elemental Carbon)



Validation @ local/urban scale (NO_2)





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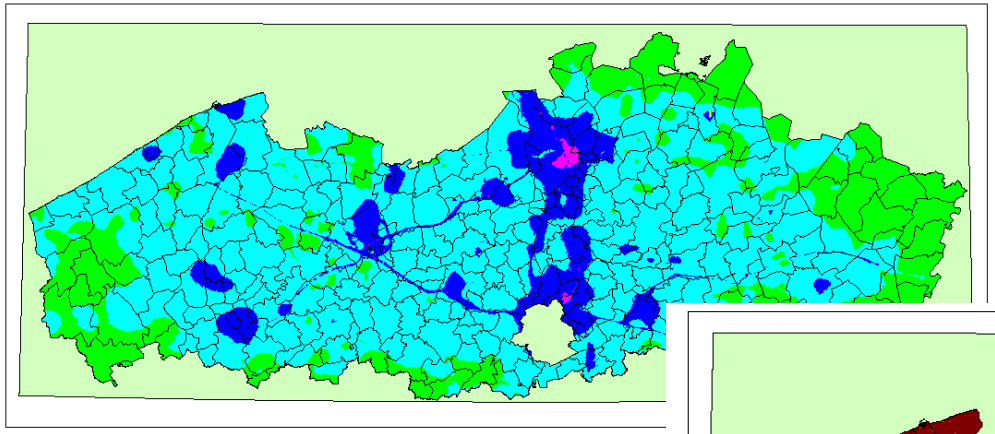
Regional air quality management plan for Flanders

- Setup for the regional environment administration (LNE)
- Base line projections for 2007, 2010, 2015, 2020
- Scenario analysis for 2010, 2015, 2020 → Exploration of various policy options:
  - EU policy options
    - Related on IIASA scenarios
  - Regional policy options (focus on traffic related measures)
    - Road pricing
    - Diesel to gasoline switch
    - Speed limits at major ring roads
    - Retrofitting particle filters
    - Low emission zones

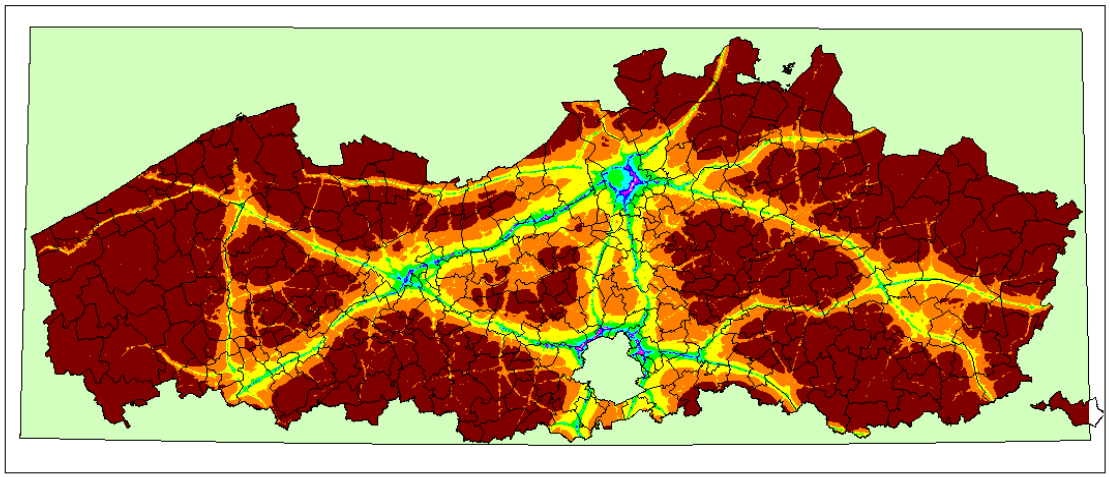
Impact on concentrations

» Effect of a collection of traffic measures on the NO_2 concentrations



2020 BEL - 2020 REF
Jaargem NO2 (µg/m³)

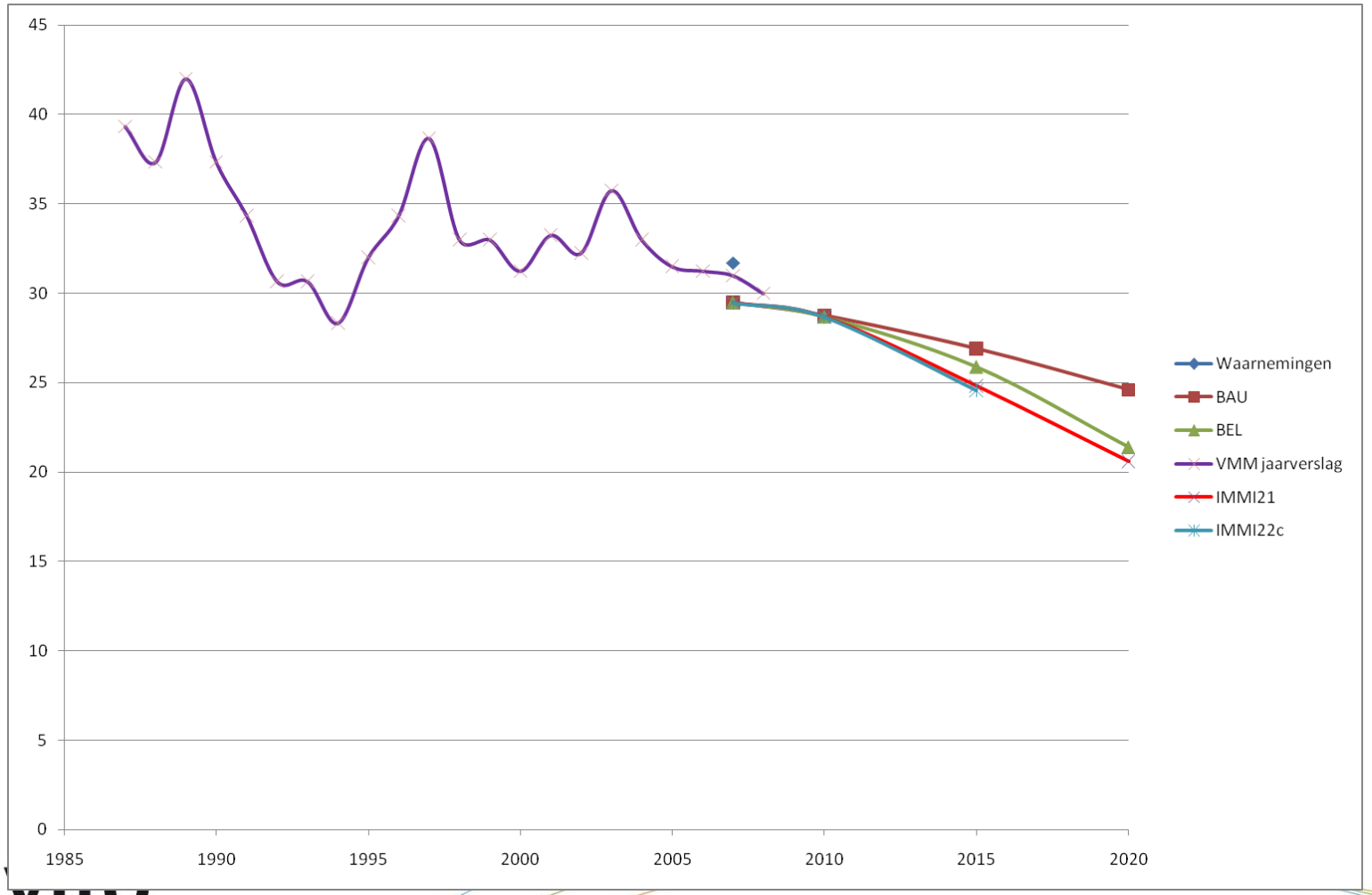
- <= -10
- -9,99 - -5
- -4,99 - -3
- -2,99 - -2
- -1,99 - -0,5
- -0,499 - 0,499
- 0,5 - 1,99
- >= 2



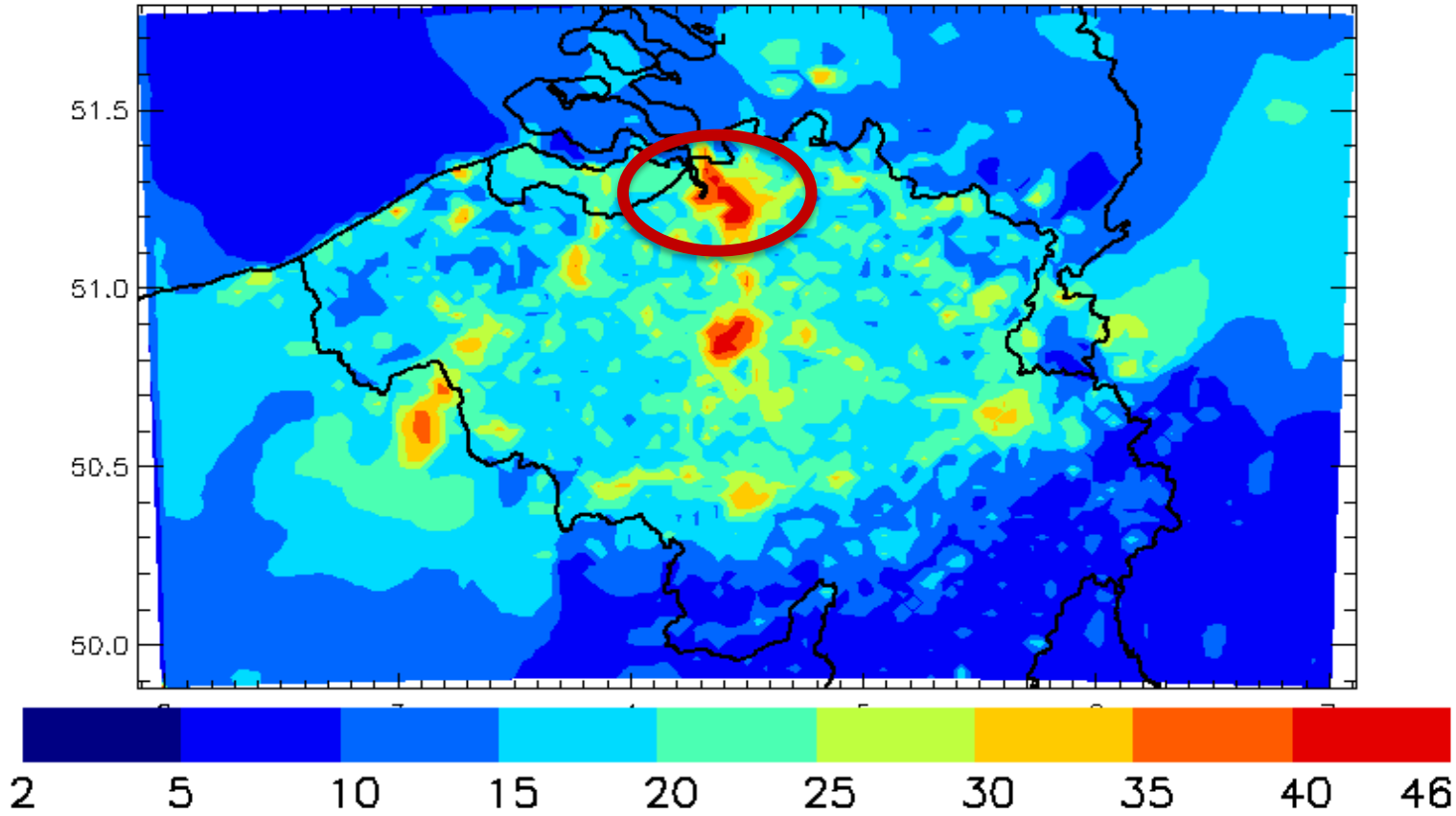
2015IMMI21 - 2015BEL
Jaargem NO2 (µg/m³)

- <= -7
- -6,99 - -5
- -4,99 - -4
- -3,99 - -3
- -2,99 - -2
- -1,99 - -1
- -0,99 - -0,5
- > -0,5

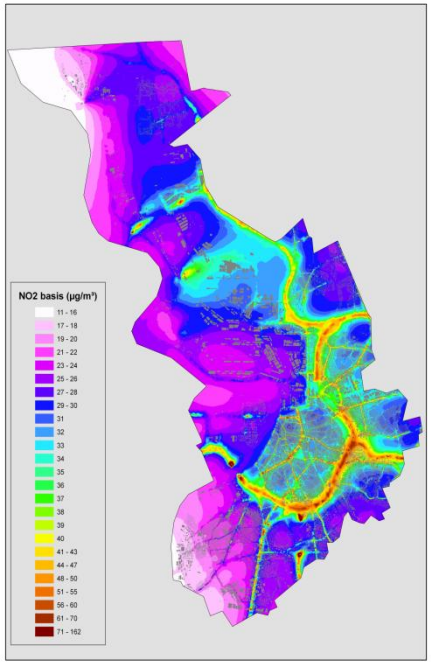
Historical trend and future projections for regional averaged NO_2 concentrations under different policy options

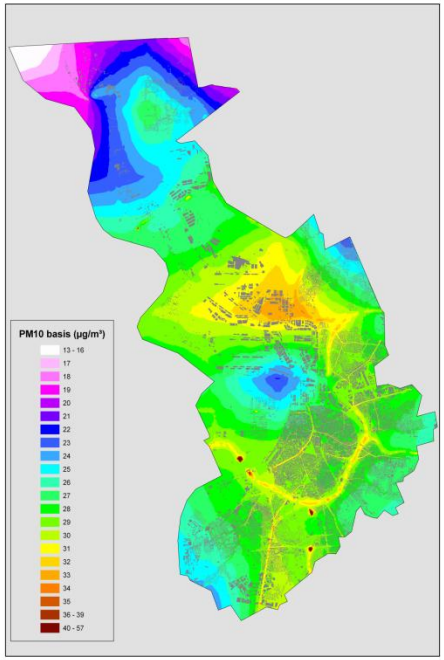


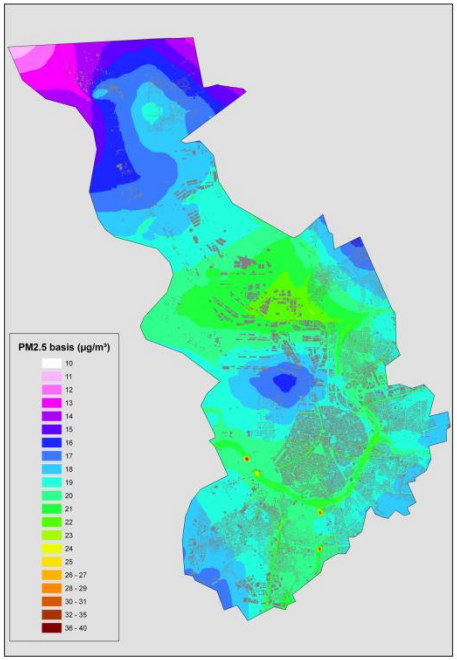
Urban air quality management plans: case study Antwerp

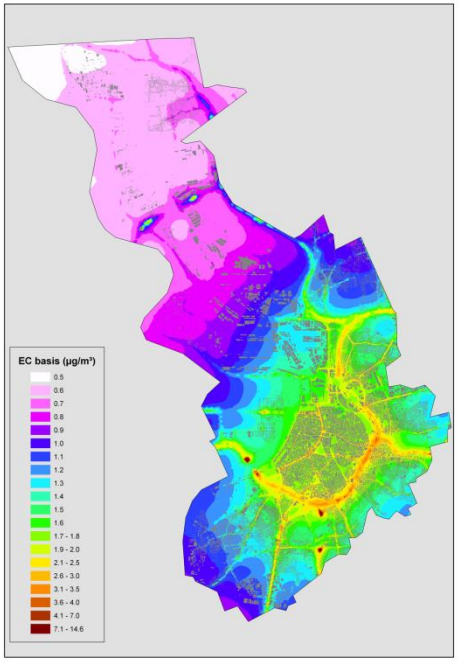


Air quality maps for Antwerp: reference case









NO_2 PM_{10} $PM_{2.5}$ EC

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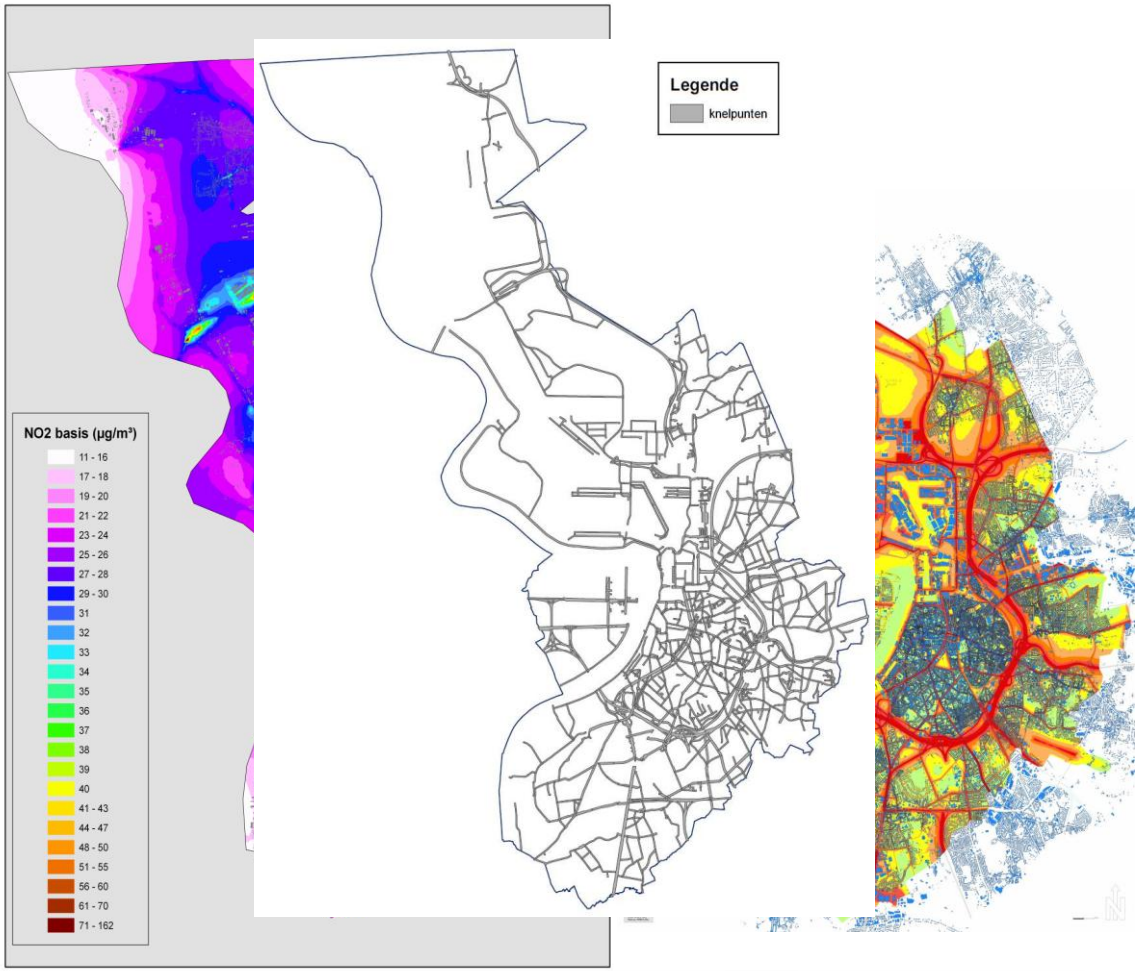
Methodology

Selection of hotspots in the area of interest

Selection of feasible policy measures

Combining measures into scenarios



Air q | Hotspots (GIS) | Noise

Methodology

Selection of hotspots in the area of interest

Selection of feasible policy measures

Combining measures into scenarios

Measure:

→ Feasable in 2015?

→ Impact on air quality
→ Impact on noise

→ Optimal scenario?

→ Cost/benefit analysis

Wegverkeer	*Verkeersafwikkeling*	Wi
	Vracht- en busverkeer	VI bu
		Co 've bu
	Interne milieuzorg	rich op
Evenementen	*Interne milieuzorg*	sta bo pu die me

Maatregel GL 09: Energiezuinige woningen

Omschrijving	Promoten van energiezuinige woningen: stookinstallatie/zonneboiler/isolatie/... (zie website Stad Antwerpen)				
Effect op lucht	Het installeren van energiezuinige woningen zal zeker een positief effect hebben op de luchtkwaliteit. De grootte orde is echter onduidelijk en onzeker, waardoor we het effect tegen 2015 beperkt inschatten.				
Effect op geluid	Enkel aangepast glas kan gevelisolatie verbeteren maar speciaal thermisch glas is niet veel akoestisch beter. We verwijzen voor geluid specifiek naar maatregel SG.01.				
Waardering lucht	0 tot +	**Waardering geluid**	0		
Besluit	Op Vlaams niveau wordt hier al veel actie ondernomen. De Stad Antwerpen zou bepaalde maatregelen kunnen steunen om dit proces te bevorderen. Wegens beperkte cijfers kunnen we die niet meenomen in de berekening, maar wordt deze maatregel wel als aanbeveling meegenomen.				
Optimaal scenario	Weerhouden als aanbeveling	**Rekenmodel Lucht**	Nee	**Rekenmodel Geluid**	Nee

Kosten/baten afweging

Overheid / Stad Antwerpen	+	
	-	- Kost sensibiliseringscampagne (enkel voor nieuwe maatregelen) - Kost verbonden aan premies (indien van toepassing) (enkel voor nieuwe maatregelen)
Transport gebruikers	+	
	-	
Bedrijven	+	
	-	
Andere	+	- Netto kostenbesparing (hele levensduur) bij efficiëntere ketel/kachel, betere beglazing en dakisolatie - Premies (indien van toepassing) - betere luchtkwaliteit
	-	- Netto meerkost (hele levensduur) bij zonneboiler, muurisolatie, vloerisolatie, lager E-peil
Opmerking(en)		Hier enkel meerkost opnemen ten gevolge van nieuwe maatregelen door de stad Antwerpen

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Methodology

Selection of hotspots in the area of interest

Selection of feasible policy measures

Combining measures into scenarios

Package 1: Measures at city level

- Extension local mobility plan
- Changing traffic circulation
- Speed limit: 30 km/h in the inner-city
- Defining traffic areas: car free, low traffic…
- Reducing number of heavy duty vehicles in the city
- Expanding and improving public transport: trams + P&R
- Greening the car fleet of the municipality
- Reducing tyre noise
- Ecofriendly and silent busses
- Acoustic barriers/screens
- Reducing road noise
- Lower speed limits

Package 2: Low Emission Zone and/or Congestion charge
(cfr London, Stockholm)

Package 3: Measures in the industrial sector

- Strict supervision on sources of particulate matter
- Demanding implementation of best available technologies

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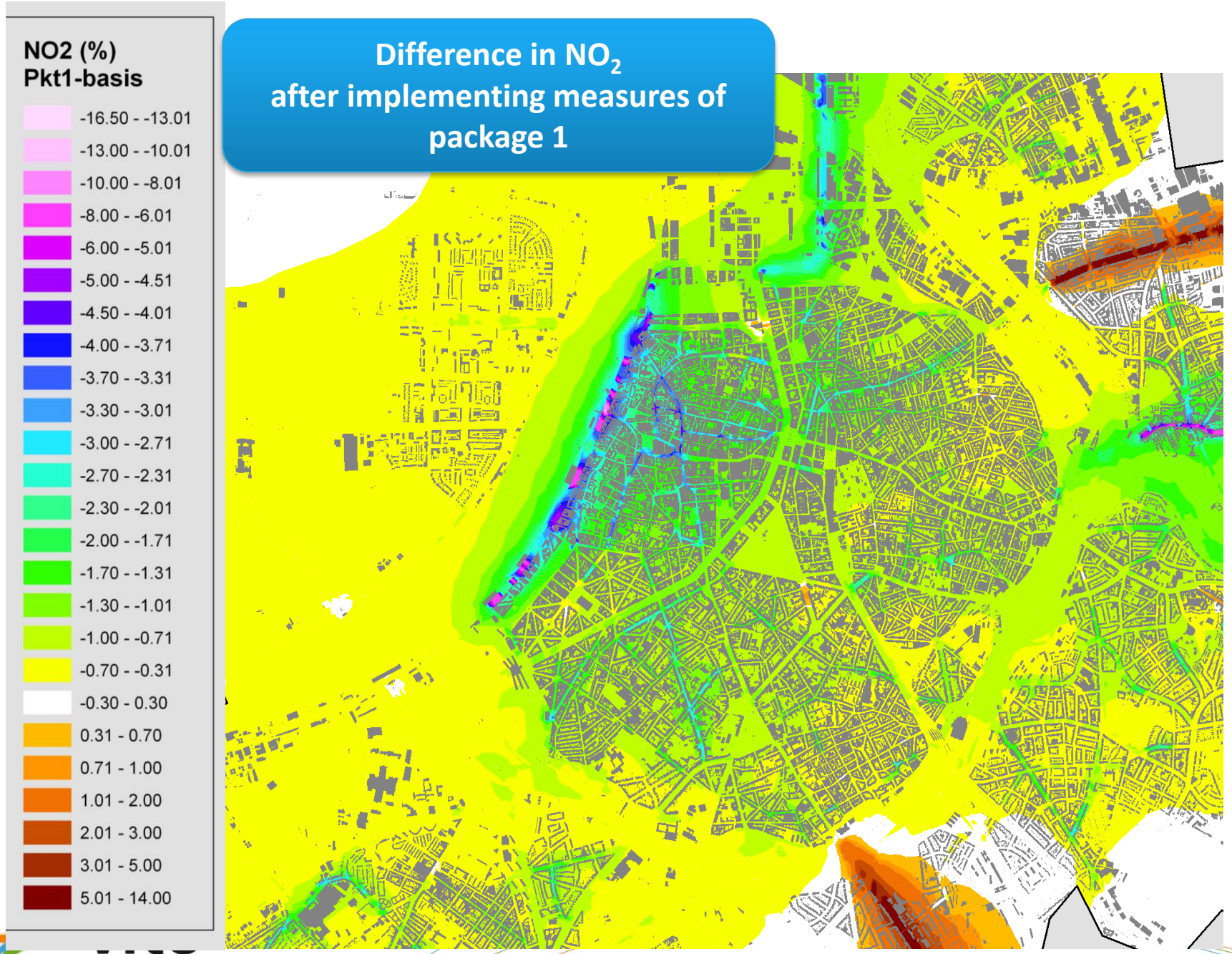
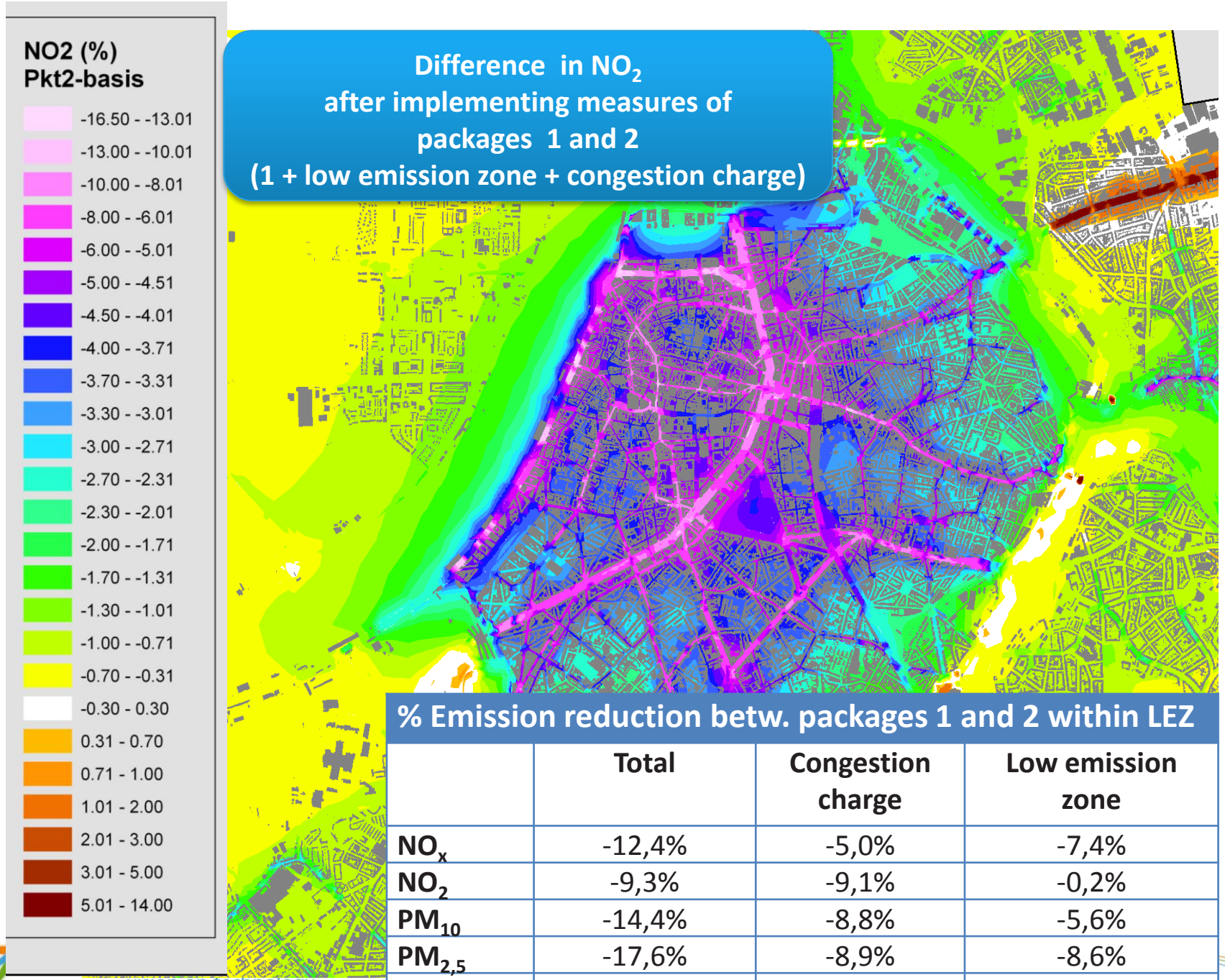
Difference in NO_2 after implementing measures of package 1



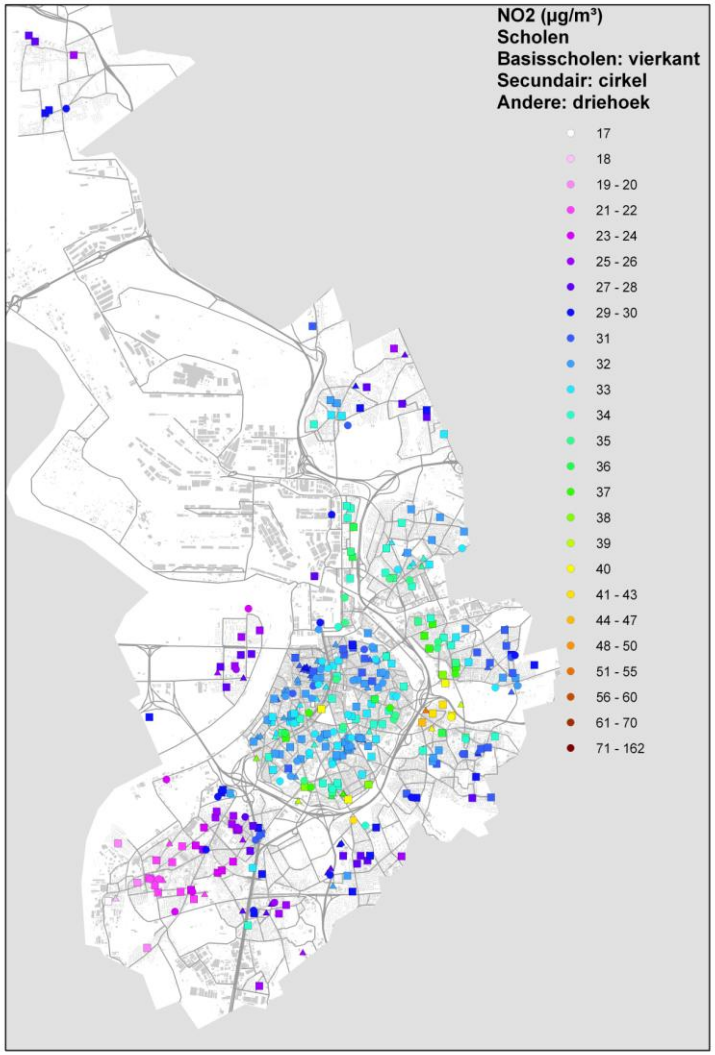


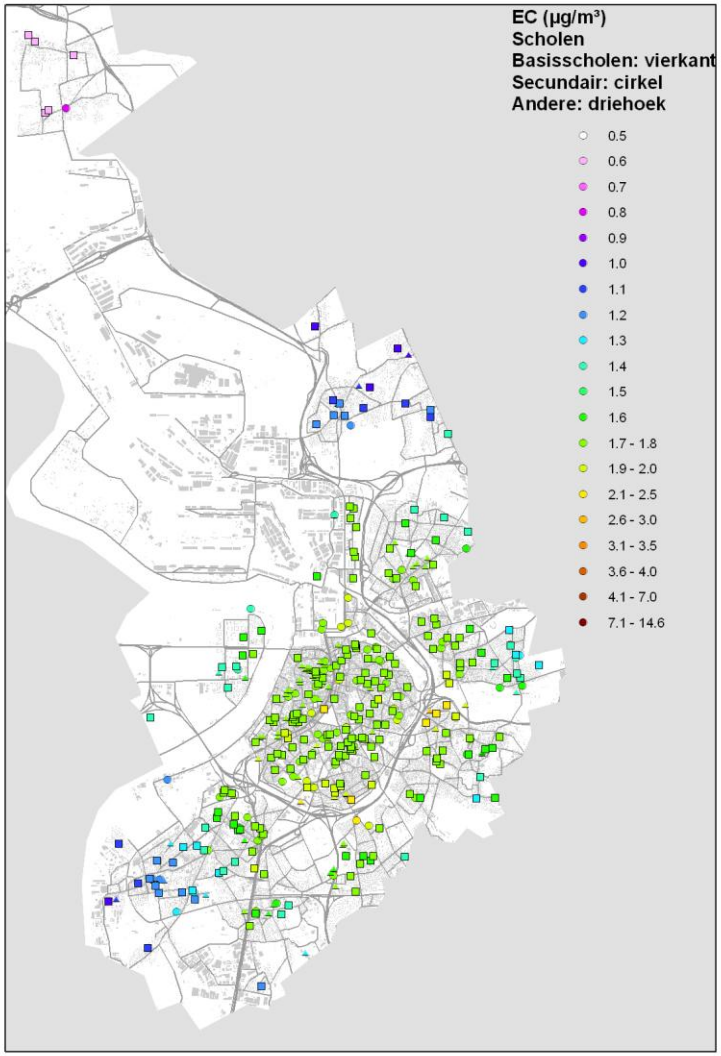
Difference in NO_2 after implementing measures of packages 1 and 2 (1 + low emission zone + congestion charge)

% Emission reduction betw. packages 1 and 2 within LEZ

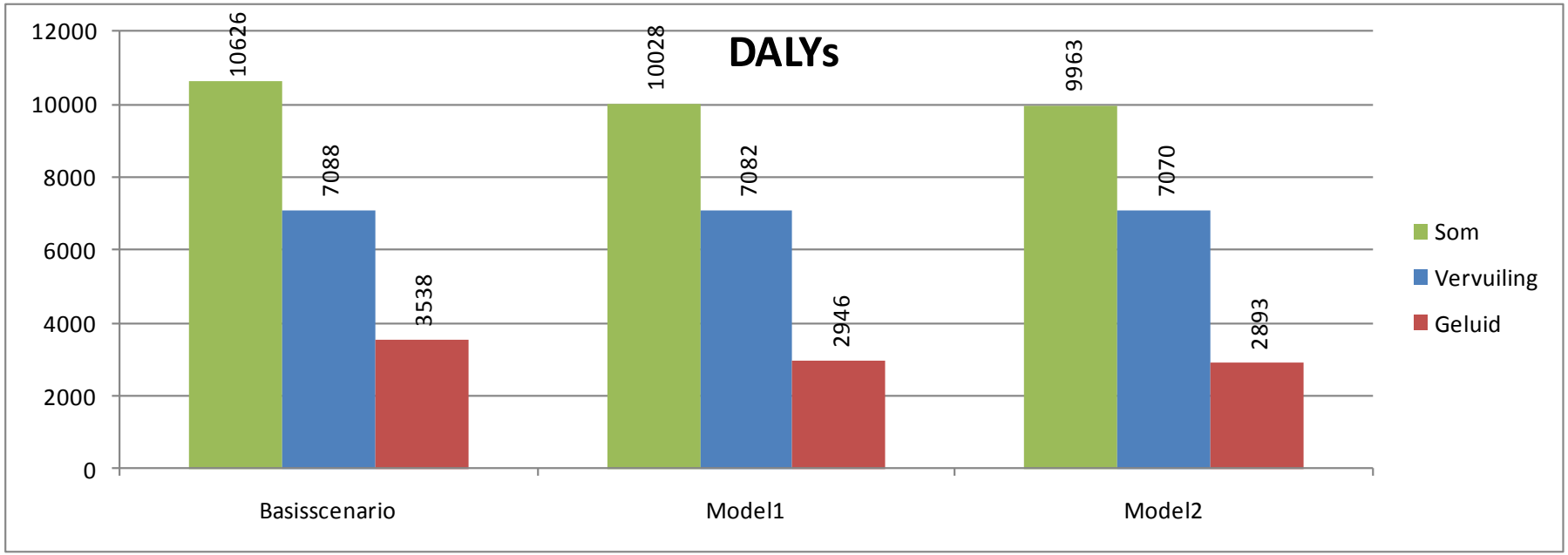
	Total	Congestion charge	Low emission zone
NO_x	-12,4%	-5,0%	-7,4%
NO_2	-9,3%	-9,1%	-0,2%
PM_{10}	-14,4%	-8,8%	-5,6%
$PM_{2,5}$	-17,6%	-8,9%	-8,6%
EC	-17,6%	-8,9%	-8,6%

Exposure of sensitive groups (schools, hospitals...)





Health impact assessment: DALY's



Conclusions

- Due to intrinsic multi-scale character of air pollution, a multi-scale analysis is required to assess impact of local measures in combination with regional, national and EU policy.
- Impact assessment on concentrations and exposure is feasible.

  However, what about:
  - Static versus dynamic exposure assessment?
  - Classical DALY approach is NOT very sensitive to local traffic measures
    - Look at “new pollutant” (EC/BC)?
- Policy measures can be indentified and used scenario packages.

  However, what about:
  - Quantification of the cost?
  - Quantification of implementation effectiveness?
- But, air modelling tools are essential to support AQ management

Thank you!

» Acknowledgement:

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