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People have the (statistical) power
Scientific and societal impact of large-scale citizen science

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Citizen science projects on air quality that involve a whole city , a whole country...



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V L A A N D E R E N

Het grootste burgeronderzoek
naar luchtkwaliteit ooit

Participants pick up a sensor package at local newspaper shop



Newspaper shop 't Park (Kapellen)

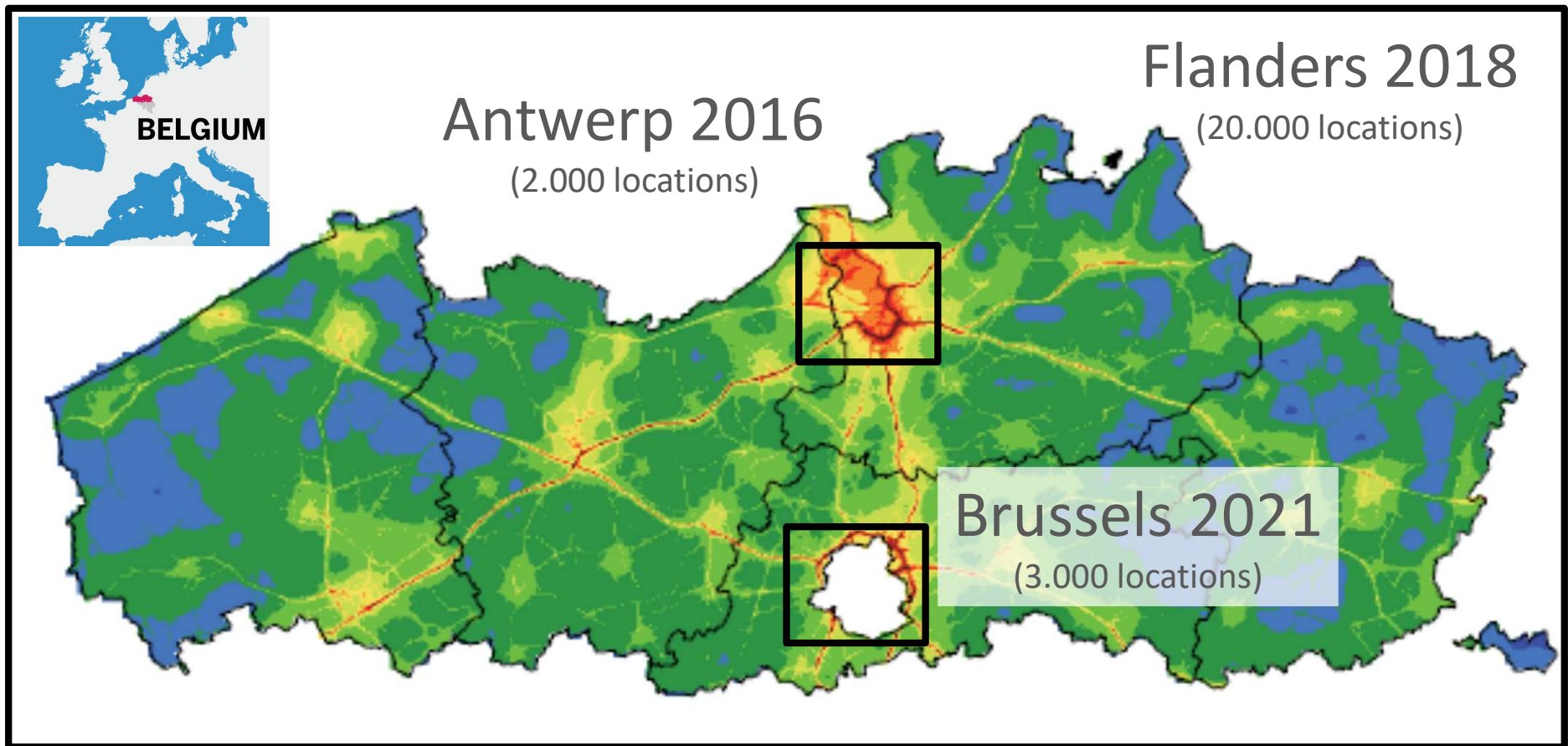
Simple, robust and accurate measurement method



Method needs to be generate reliable data for scientific publications:
Palmes diffusion tubes for nitrogen dioxide (NO_2)



Large scale citizen science projects on air quality (NO₂)



NO₂ map Flanders region (VMM – Environmental Protection Agency Flanders)

What should be the situation?

The answer is clear!

EU Air quality directive:

Nobody can live at a location that exceeds the legal limit (e.g. $\text{NO}_2 < 40 \mu\text{g m}^{-3}$)

What is the situation?

The answer is not clear!

How many people in a city, region, country are really living at locations that exceed the legal limit?

Scientific problem:

the monitoring strategy in the EU air quality directive is insufficient (based on 90's technology)

What should be the situation?

The answer is clear!

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What is the situation?

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How many people in a city, region, country are really living at locations that exceed the legal limit?

Thorough ground-truthing of air quality monitoring approaches

EPA reference data



Meteo data



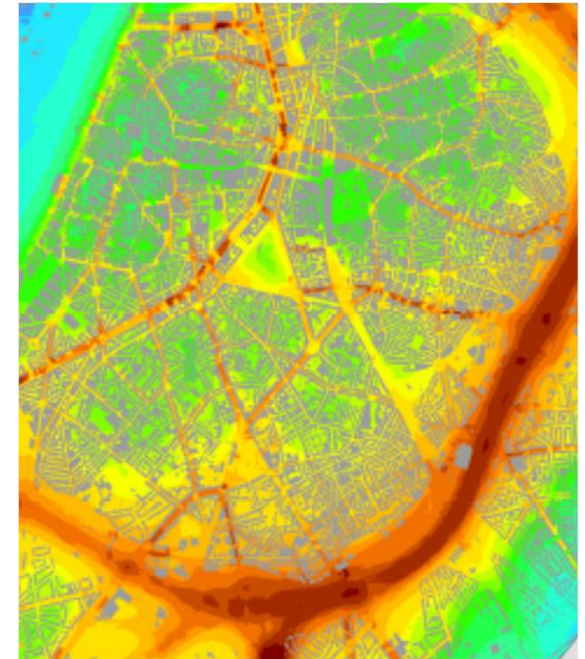
Traffic data



Computer model



Computer air quality map



How reliable are exposure estimates?

What information is supplied?

Information collection on air quality is the monopoly of the government and supplied at the level of the highly-educated, environmentally-aware (e.g. annual EPA reports)

What information is received?

Part of population has no access to information (How does it matter for the health of my kids?) and aspect of injustice (e.g. air quality and real estate prices).

Justice and air quality: access to information

Societal problem:

Environmental issues (air quality, climate) are considered a problem of the elite

What information is supplied?

Information collection on air quality is the monopoly of the government and supplied at the level of the highly-educated, environmentally-aware (e.g. annual EPA reports)

What information is received?

Part of population has no access to information (How does it matter for the health of my kids?) and aspect of injustice (e.g. air quality and real estate prices).

We need to move beyond the usual suspects!

Traditional audience



Our participants



Science (hard side)

We want to have
an impact on science

**Collect data to tackle a
really challenging
research question
(get a Nature paper!)**

Science (hard side)

**We want to have
an impact on science**

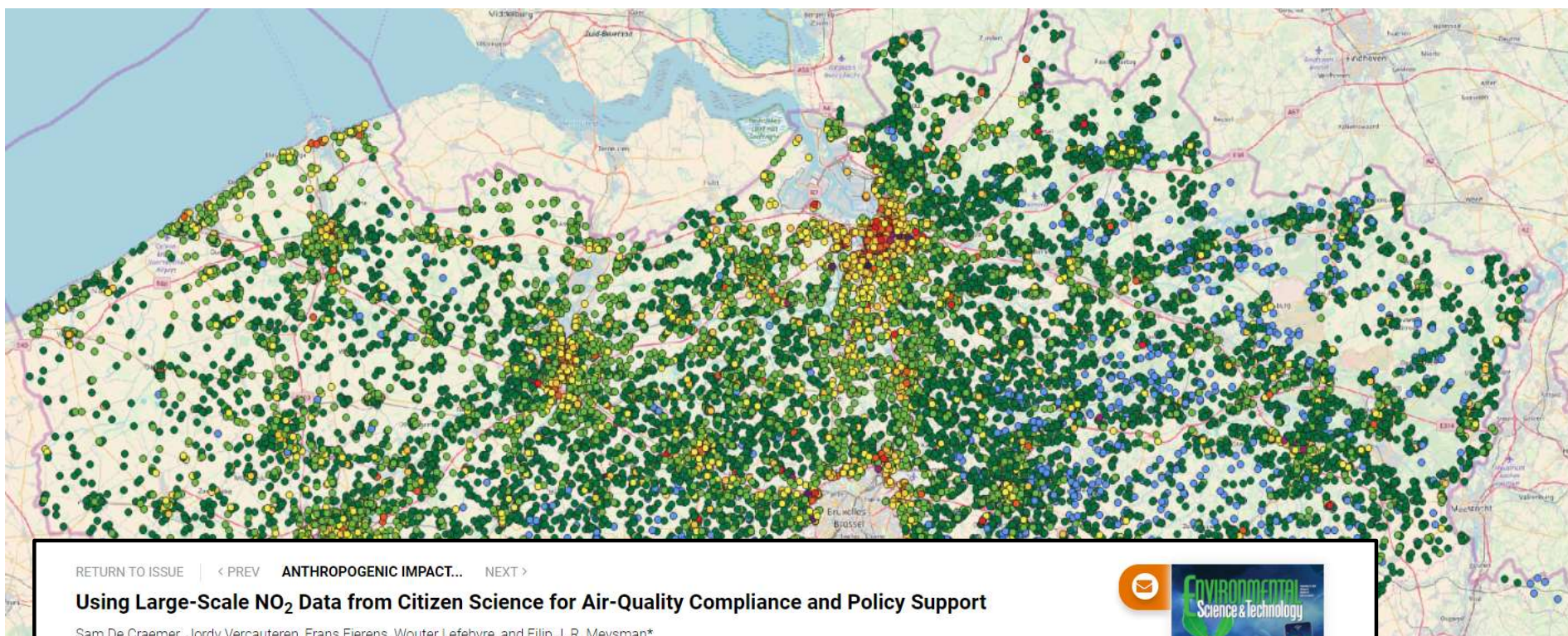
**Collect data to tackle a
really challenging
research question
(get a Nature paper!)**

Citizen (soft side)

**We want to have
an impact on society**

**Increase environmental
awareness at large
(change the outcome of
the next elections!)**

Scientific impact : unique spatially distributed datasets



RETURN TO ISSUE | < PREV ANTHROPOGENIC IMPACT... NEXT >

Using Large-Scale NO₂ Data from Citizen Science for Air-Quality Compliance and Policy Support

Sam De Craemer, Jordy Vercauteren, Frans Fierens, Wouter Lefebvre, and Filip J. R. Meysman*

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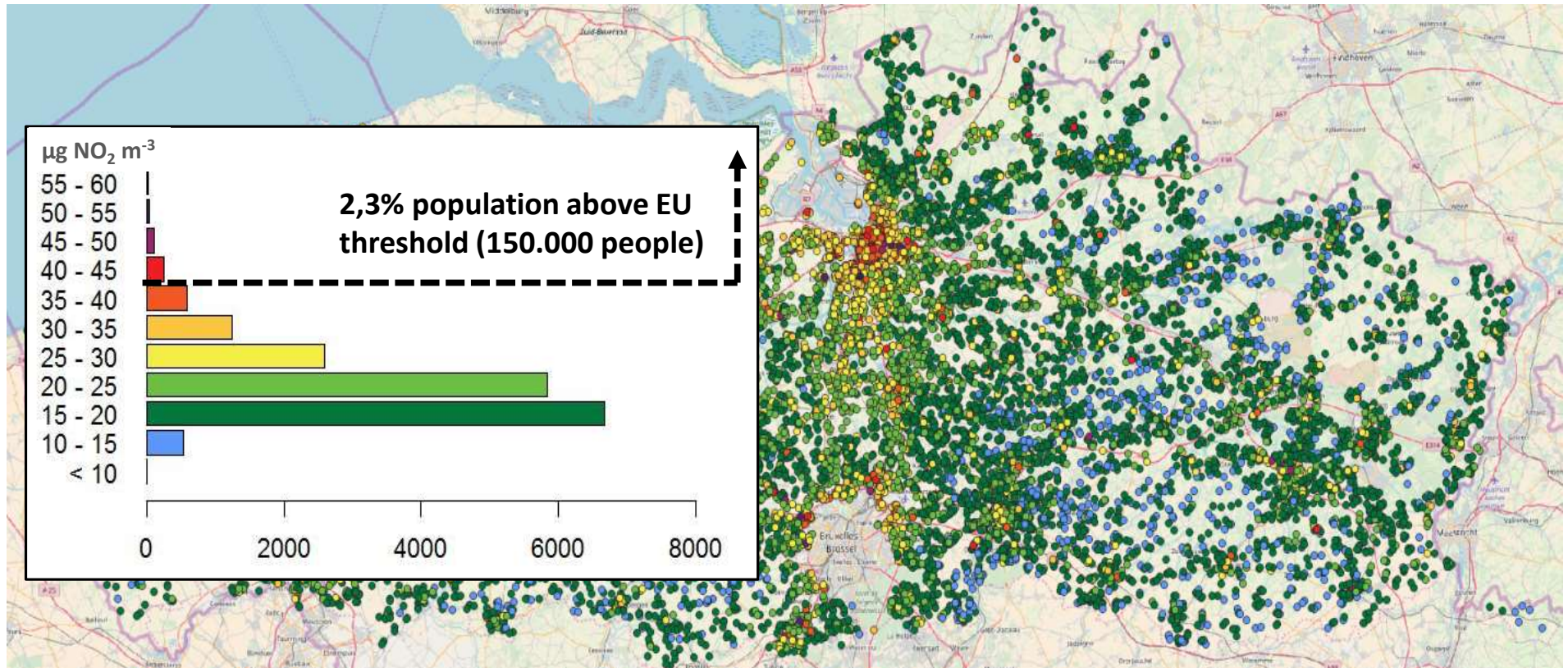
PDF (3 MB)

TU Delft full text

Supporting Info (1) »

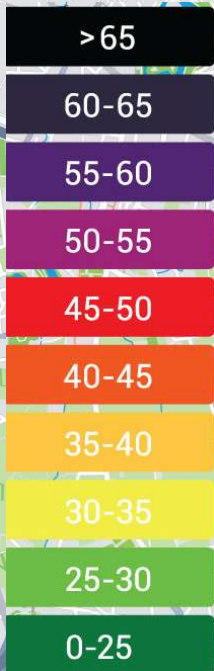
SUBJECTS: Environmental chemistry, Environmental modeling, Wind, Quality management, >

First time: reliable direct estimate of population exposure



Ground-truthing of air quality models

NO₂ (microgram per m³)



Exceedence EU AQ limit
(40 µg m⁻³)

31 ± 8 %



State-of-the-art model
(street canyon)

52 ± 8 %



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dataset

Citizen (soft side)

We want to have
an impact on society

Professional marketing and communication campaign



- TV, radio adds
- Print adds
- Out of home (buses...)
- Social media



Wide approach: the whole country needs to participate

Flanders = 6,4 million inhabitants

Direct participant



20.000 families, schools...
(5% of the population)

Narrow contact



Individually spread the word
(15% of the population)

Generally informed



Collectively spread the word
(50% of the population)



Het grootste burgeronderzoek
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- Individual level: behavioural changes, people self-inform
- Street level: new grassroots initiatives
- Local level: theme in local elections 2018, debates in city council
- National level: debates in parliament, impact on EPA monitoring, more ambitious air quality plan 2030
- EU level: lawsuit Greenpeace (additional data for compliance)

Summary

- **There is (statistical) power in the people.** Large-scale citizen science can be a powerful tool to collect high quality scientific data at large scale about air quality.
- **EU air quality legislation need reconsideration.** Monitoring strategies in need to account for spatially distributed measurements, model ground truthing.
- Large-scale citizen science is a powerful tool to **raise awareness** about environmental problems to **broad sections of society**. All people care about air quality.
- **Providing information is not enough.** Communication strategies about air quality need to make sure that the information also comes across.



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Questions?

General project website: <https://www.curieuzeneuzen.be/>

2016 Antwerp Air Quality project: <https://2016.curieuzeneuzen.be/en/>

2018 Flanders Air Quality project: <https://2018.curieuzeneuzen.be/en/>

2021 Flanders Climate project: <https://curieuzeneuzen.be/en/home-en/>