Progress of T2.3 Urban mapping

Martine Van Poppel – Jelle Hofman

VITO

With contribution of T2.3 partners

RI-URBANS (101036245)

European Commission

HORIZON 2020

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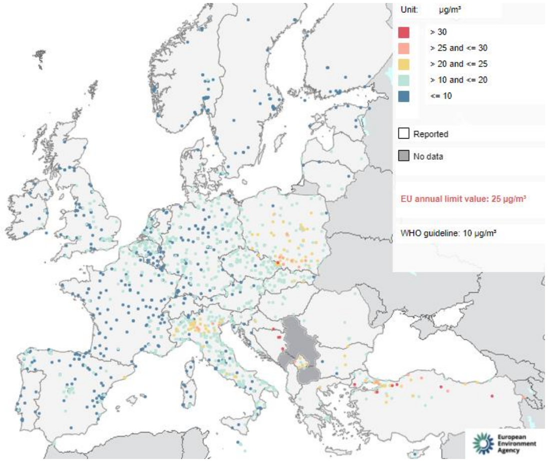
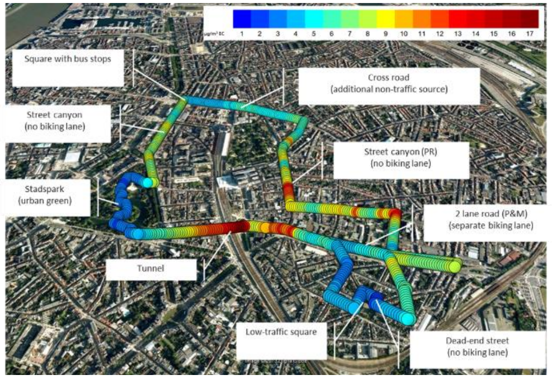
Urban Air Quality mapping

- Fixed AQM stations
  - Yearly or daily/hourly average
  - Accurate
  - Long time series, time trends
  - BUT limited in spatial resolution



- Air Quality is **not** uniform over a city, a region
  - Insufficient info about exposure and health effects
  - Source apportionment
  - Measures and impact of measures



- Citizens want to be involved
- High spatial and temporal resolution data is needed in health studies
- Scientific approach and data quality

Aim of T2.3

- WP2: evaluation of new AQ metrics for health studies and **exposure assessment approaches with urban spatial resolution** that can be used for better assessment of the burden of disease related to air pollution

- Task 2.3: Mobile monitoring of nanoparticles and citizen observatories to improve evaluation of health effects of long-term exposure

- Strong link to WP4.3: Urban fine-scale mapping
  - Pilot cities: BIRM, BUC, (PAR) and ROT

Objectives of T2.3

- T2.3 will result in a proposed methodology

- Aim of this task is
  - Summarize best practices and select methods based on literature and partners’ expertise, applicable in cities by AQMN and/or city authorities
  - Provide best practice document to pilots to test selected methods
  - Collect feedback from pilots to conclude on feasibility and added value

Deliverables of T2.3

- D2.5: Description of methodology for mobile monitoring and citizen involvement (VITO, R/PU, M12)
  - Finished, available at sharepoint
  - Will give input to pilots (WP 4.3)

Testing in PILOTS

- D2.6: Added value of mobile and citizens' observations for urban mapping and health (UU, R/PU, M36)
  - update of D2.5 with inputs from pilots (WP 4.3)

Timing

	YEAR 1												YEAR 2											
MM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
WP2		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
T2.1		X	X	X	X	X	X	X	X	X	X	D2.1	X	X	X	X	X	X	X	X	X	X	X	X
T2,2		X	X	X	X	X	X	X	X	X	X	D2.3	X	X	X	X	X	X	X	X	X	X	X	X
T2.3		X	X	X	X	X	X	X	X	X	X	D2.5	X	X	X	X	X	X	X	X	X	X	X	X
T2.4												X	X	X	X	X	X	X	X	X	X	X	X	X
Milestones												2.1	2.3	2.5										2.2

	YEAR 3												YEAR 4											
MM	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
WP2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
T2.1	X	X	X	X	X	X	X	X	X	X	X	D2.2												
T2,2	X	X	X	X	X	X	X	X	X	X	X	D2.4												
T2.3	X	X	X	X	X	X	X	X	X	X	X	D2.6												
T2.4	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	D2.7								
Milestones											2.4	2.6	2.7											

Deliverable 2.5

- Available!
- Can be downloaded:

https://riurbans.eu/work-package-2/#deliverables-wp2

- Thanks to all co-authors and reviewers
- …

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Deliverable D13 (D2.5)

Description of methodology for mobile monitoring and citizen involvement

RI-URBANS

Research Infrastructures Services Reinforcing Air Quality Monitoring Capacities in European Urban & Industrial AreaS (GA n. 101036245)

By

VITO, UU, CSIC, ISGlobal, UoB, ICL, UHEL & NOA

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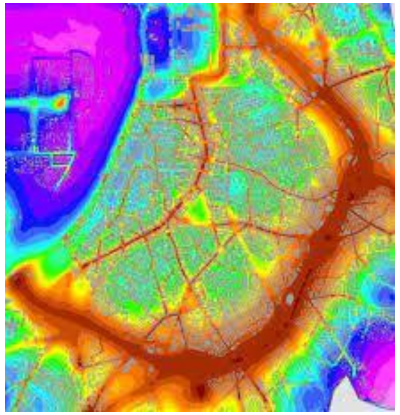
Background and scope

- D2.5 summarizes **complementary approaches** to traditional AQMS in order to assess **AQ exposure** for health and epidemiological studies, and to assess **policy actions** at urban scale
  - mobile sensing platforms and fixed sensor networks
  - to map pollutant concentrations at a high spatial density
  - resulting in high resolution exposure (HRE) maps

Different approaches



Mobile with citizens	Mobile without citizens
Fixed with citizens	Fixed without citizens

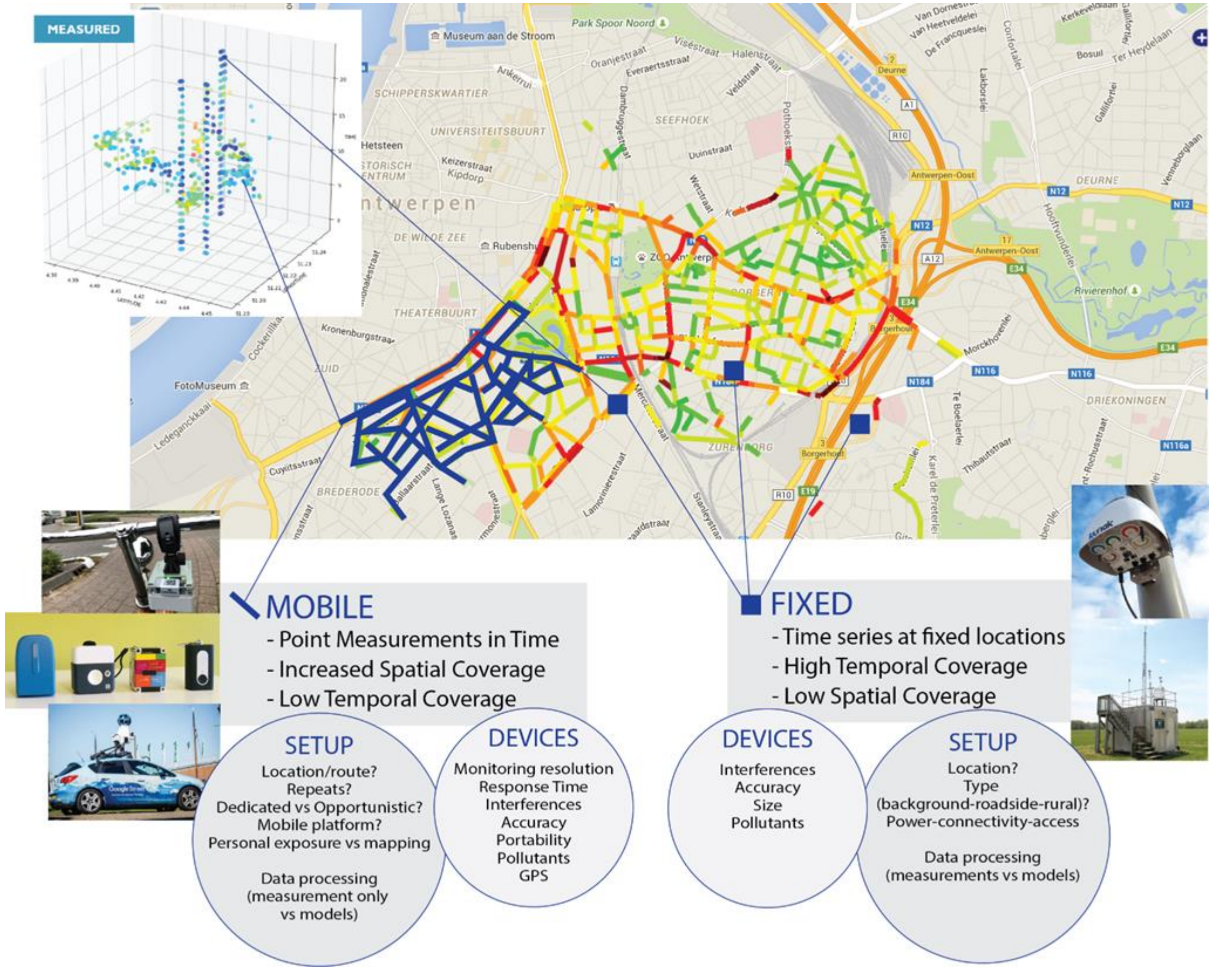
Citizen involvement and motivation

- The involvement of citizens in air quality monitoring is a growing practice, recommended by the European Environmental Agency (EEA, 2019) and can bring important benefits to both science and society
  - can help to obtain reliable, up-to-date, cost-efficient and high-resolution air quality data in a timely manner
  - can increase public awareness to air quality problems, motivate public learning about science, can result in behavior change

Citizen involvement (topics)

- Recommendations on how to involve citizens
- Ethics for citizen science experiments
- Recruitment process
- Representativity and diversity in citizen science
- Data collection
- Data validation
- Dissemination of results
- Impact assessment

Monitoring strategy

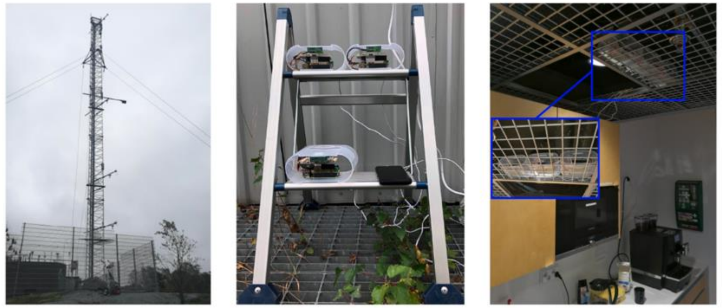


Targeted, opportunistic, with/without citizens

- **Targeted**: planned fixed route, with a specific purpose in mind
  - Measurement route is defined (in function of question)
  - At specific time(s) of day
  - Gives a representative picture of these moments in time
  - Easy to compare different locations
  - Additional effort to collect data
- **Opportunistic**: use existing mobile infrastructure or people’s daily routines
  - Measurement route is not defined
  - Measurements are performed using a ‘platform’
  - Collection of spatio-temporal data
  - Additional effort/attention to data processing
  - Risk of sampling bias
- **With or without citizens**

Monitoring devices: what is important?

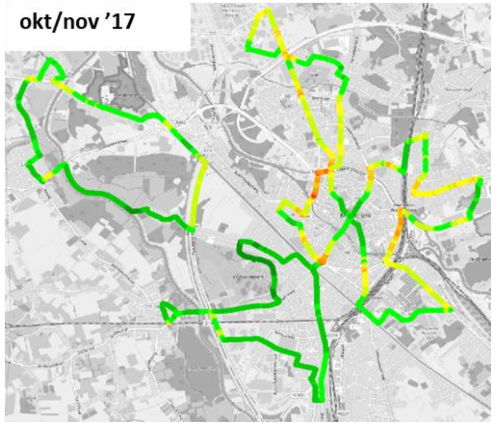
- Pollutants
- Data quality
- Mobile use

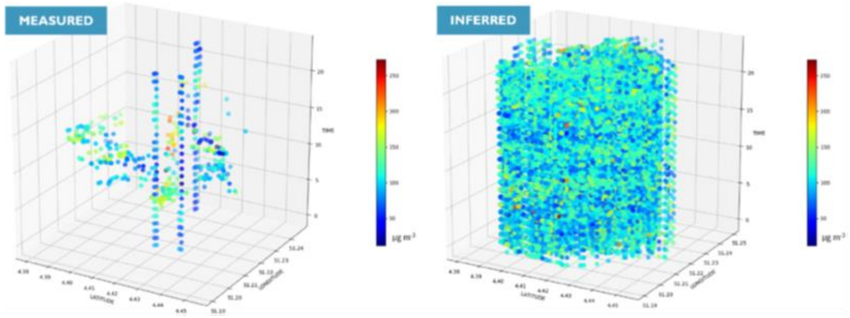


(a) (b) (c)

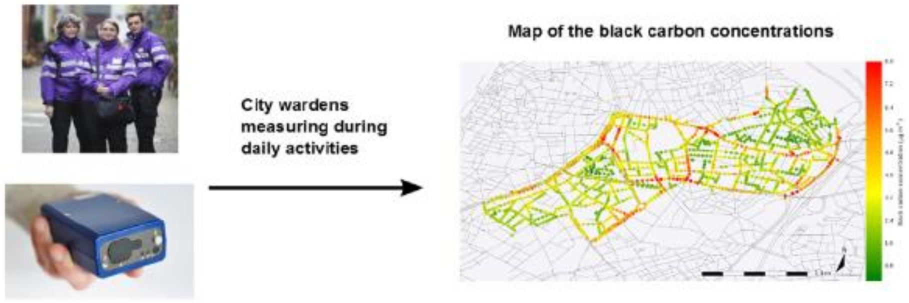
Data processing

- Direct mapping vs. spatio-temporal interpolation models
  - Spatial coverage
  - Temporal coverage
- Models for intra-urban exposure assessment
  - proximity based
  - spatial interpolation
  - Land Use Regression (LUR)
  - Machine Learning
  - Hybrid models
  - ...





Mobile measurements



airQmap (www.airqmap.com)

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Fixed measurements

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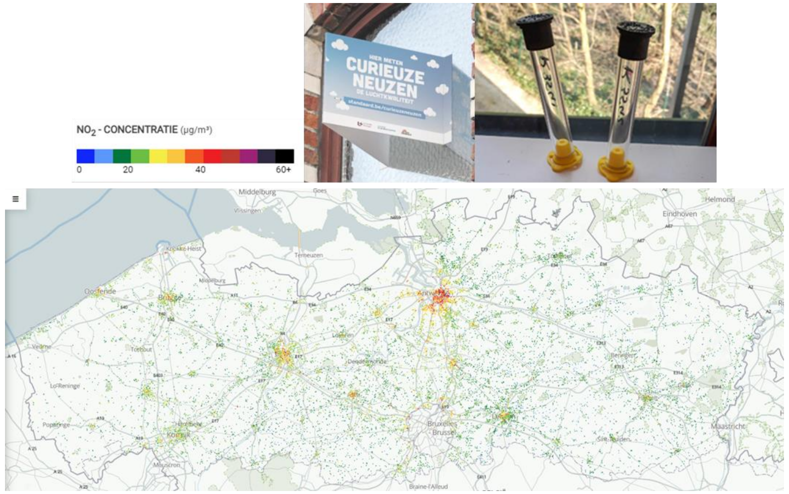
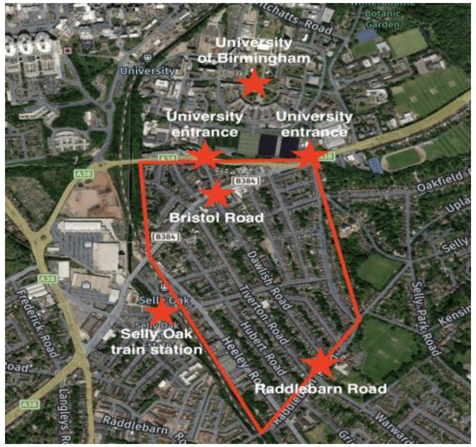
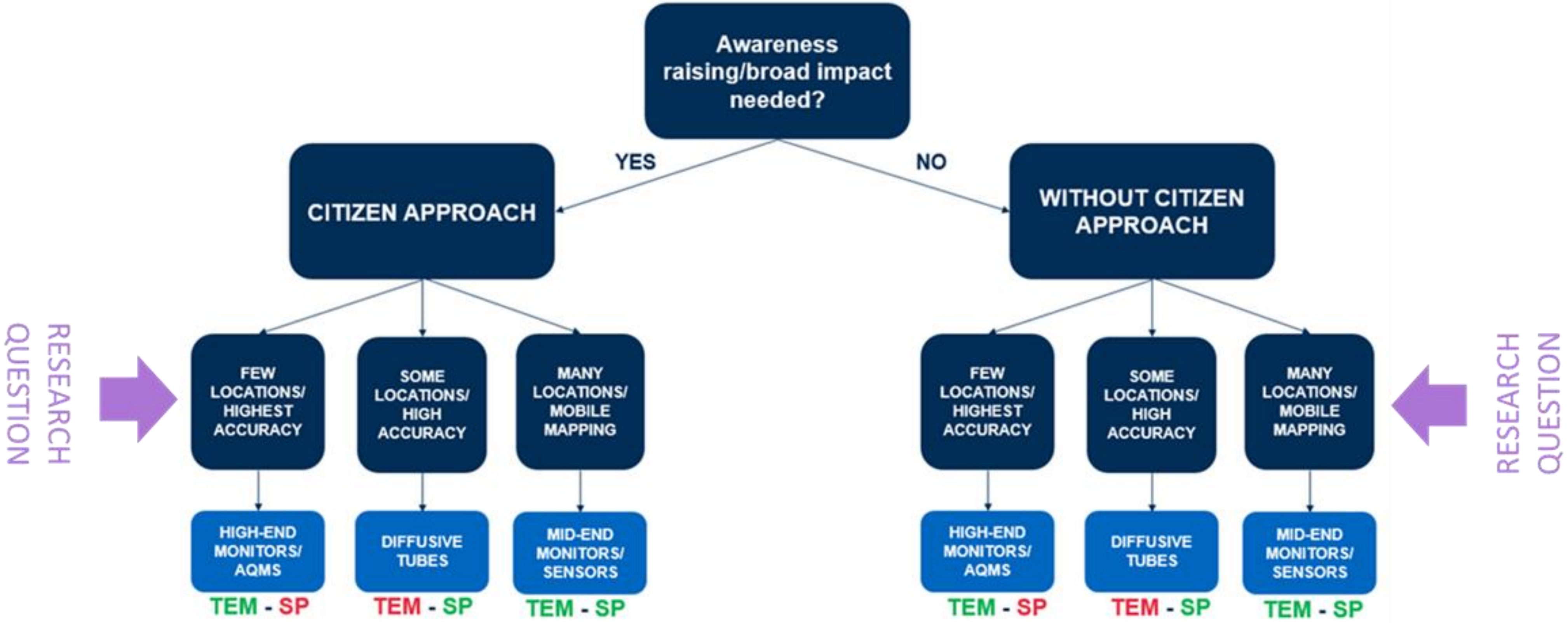




Combined approach

Selecting the right approach



Conclusions D2.5

- Different approaches can be used to assess exposure to pollutant concentrations (UFP,...)
- Combined approaches can be used (stationary, mobile)
    - Stationary data of different origin (AQMS, sensors,...)
    - Stationary data can be used in different ways (background corr., representativity check, calibration, additional data points...)
- Different data processing
    - Only data
    - Models

Conclusions D2.5

- Mobile versus fixed:
    - Mobile monitoring can collect more datapoints but give a snap-shot (no time trends)
    - Repeated measurements, and associated sensitivity analysis, are needed to obtain representative results.
- Targeted mobile monitoring versus opportunistic approach:
    - Targeted: easier to compare different locations (collected at the same time); more constrained in space and time coverage
    - Opportunistic approaches mostly require less effort in data collection but need proper processing to obtain representative results
- Involving citizens
    - can significantly contribute to awareness raising and obtained impact
    - require more time and effort for communication, logistics and dissemination.
- Sensors versus mid:high-end instruments
    - Sensors can be deployed at a lower cost but can suffer from lower data quality
    - Sensor calibration and compensation can significantly improve data quality.
- Selected data-processing can have a large impact on results

Link with pilots

- ROT
  - Google Car (reference instruments, UFP, BC, PM, NOx,…), without citizens
  - Mobile with citizens: Black carbon (airQmap approach)

  ⇒Compare both approaches , evaluate methodology and data processing

  - Short campaign (airQmap) with citizens during on-going project (Ruisdael case)

  ⇒Compare BC with NO_2 , evaluate methodology

- BIRM
  - Combined fixed/mobile approach (with citizens)
- BUC

Questions

Contact:

Martine.vanpoppel@vito.be

Jelle.hofman@vito.be