e-shape

EuroGEO Showcases:
Applications Powered
by Europe

A Webinar on the 'Health Surveillance Air Quality-HSAQ' Pilot

S2-P3-EO-based pollution-health risks profiling in the urban environment

health

Addressing the UN SDGs – The pilot of Bari (CNR)

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Cristina Tarantino – Senior scientist

WHO WE ARE ?

CNR-IIA Earth Observation team

Our skills range from calibration, analysis, and publication of data, products, and models (algorithms) in the GEO and EuroGEOSS international frameworks to facing the upcoming Sustainable Development Goals (SDGs) challenges.

Biodiversity and Ecosystem Sustainability

15 LIFE ON LAND — Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss

Sustainable Urban Development

11 SUSTAINABLE CITIES AND COMMUNITIES — Make cities and human settlements inclusive, safe, resilient and sustainable

UN Sustainable Development Agenda

The United Nations UN Sustainable Development Goals (SDGs) 2030 Agenda, under the guidance of the World Health Organization (WHO), is a benchmark of specific targets to reduce air pollution exposure. These, are divided into indicators providing quantitative metrics to assess air quality and relative impacts on human health.

SDG indicators to inform on the health trends associated with exposure to air pollution:

❑ *Indicator 3.9.1: Mortality rate attributed to household and ambient air pollution;*

❑ *Indicator 7.1.2: Percentage of population with primary reliance on clean fuels and technology;*

❑ *Indicator 11.6.2: Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population-weighted).*
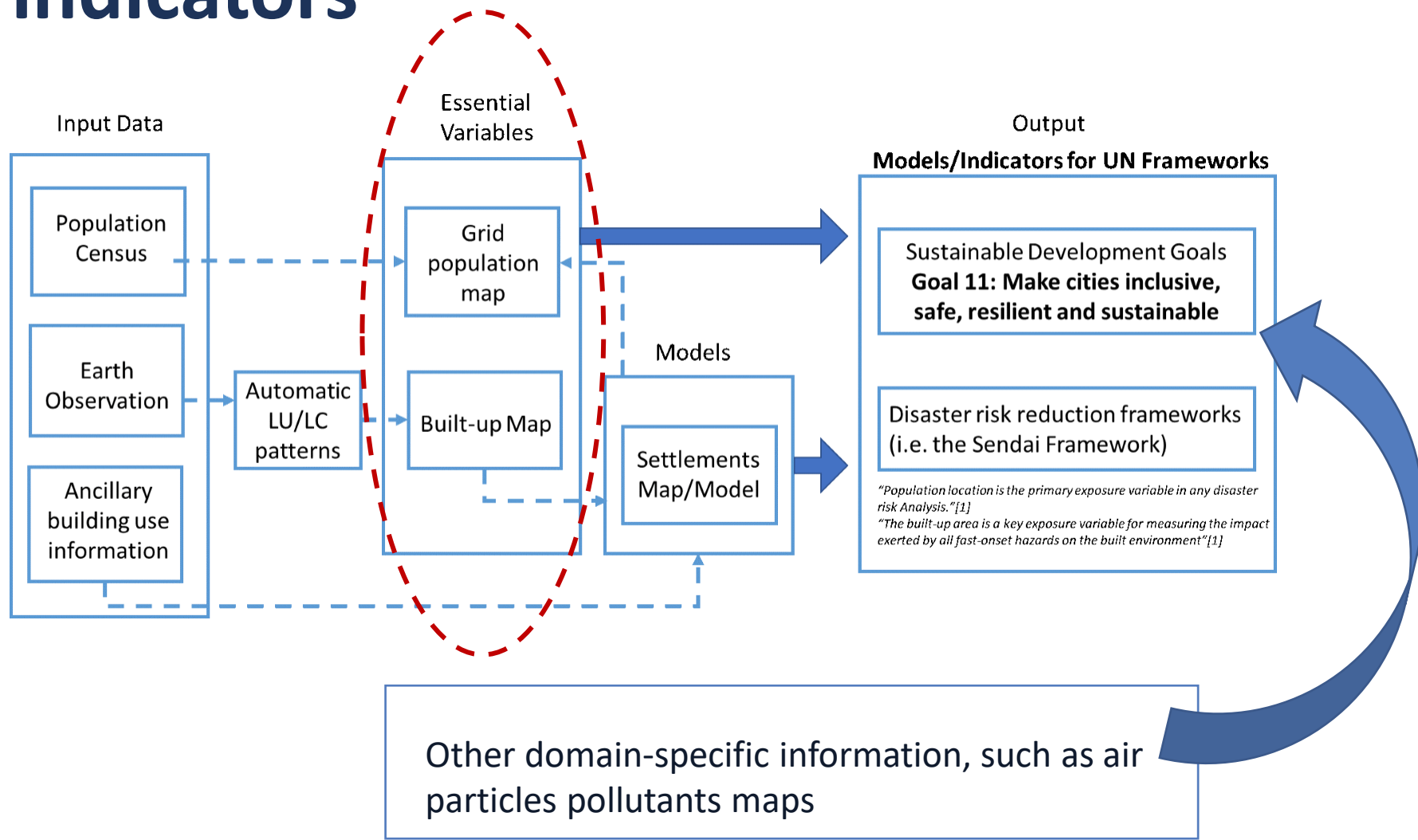
Target 11.6: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

11 SUSTAINABLE CITIES AND COMMUNITIES

[World Health Organization. (2021). WHO global air quality guidelines: particulate matter (PM2.5 and PM10), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide. World Health Organization. https://apps.who.int/iris/handle/10665/345329. License: CC BY-NC-SA 3.0 IGO]
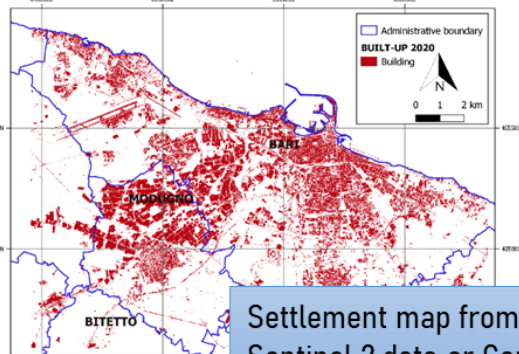
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Our approach for estimating SDG 11 indicators

Essential Variables

Input Data

Population Census

Earth Observation

Ancillary building use information

Automatic LU/LC patterns

Grid population map

Built-up Map

Models

Settlements Map/Model

Output
Models/Indicators for UN Frameworks

Sustainable Development Goals
Goal 11: Make cities inclusive, safe, resilient and sustainable

Disaster risk reduction frameworks (i.e. the Sendai Framework)

"Population location is the primary exposure variable in any disaster risk Analysis."[1]
"The built-up area is a key exposure variable for measuring the impact exerted by all fast-onset hazards on the built environment"[1]

Other domain-specific information, such as air particles pollutants maps

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Automatic workflows for Essential Variables

https://plugins.qgis.org/plugins/dasy/

11 SUSTAINABLE CITIES AND COMMUNITIES

SUSTAINABLE DEVELOPMENT GOALS

pyQGIS

Building heights [optional input]

Population density map (100 m x 100 m)

Settlement map from SVM on Sentinel 2 data or Copernicus ESM

Dasymetric method

VLAB
ESSI Lab
https://vlab.geodab.org/
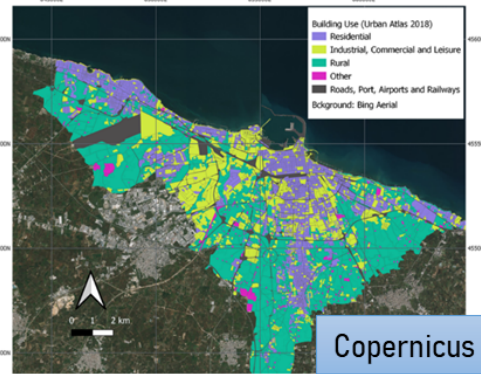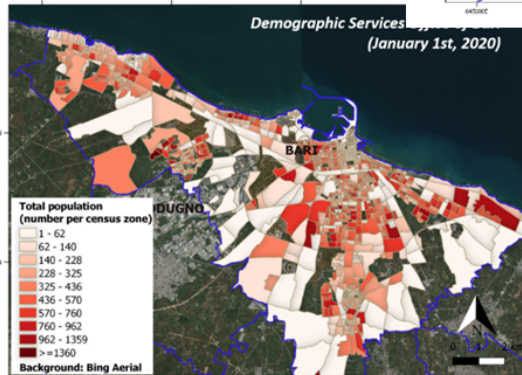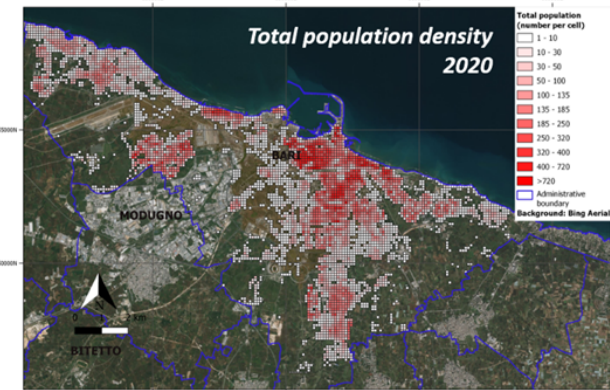
Copernicus Urban Atlas

Aquilino, M.; Adamo, M.; Blonda, P.; Barbanente, A.; Tarantino, C. Improvement of a Dasymetric Method for Implementing Sustainable Development Goal 11 Indicators at an Intra-Urban Scale. Remote Sens. 2021, 13, 2835, doi:10.3390/rs13142835.

Aquilino, M.; Tarantino, C.; Adamo, M.; Barbanente, A.; Blonda, P. Earth Observation for the Implementation of Sustainable Development Goal 11 Indicators at Local Scale: Monitoring of the Migrant Population Distribution. Remote Sens. 2020, 12, 950, doi:10.3390/rs12060950

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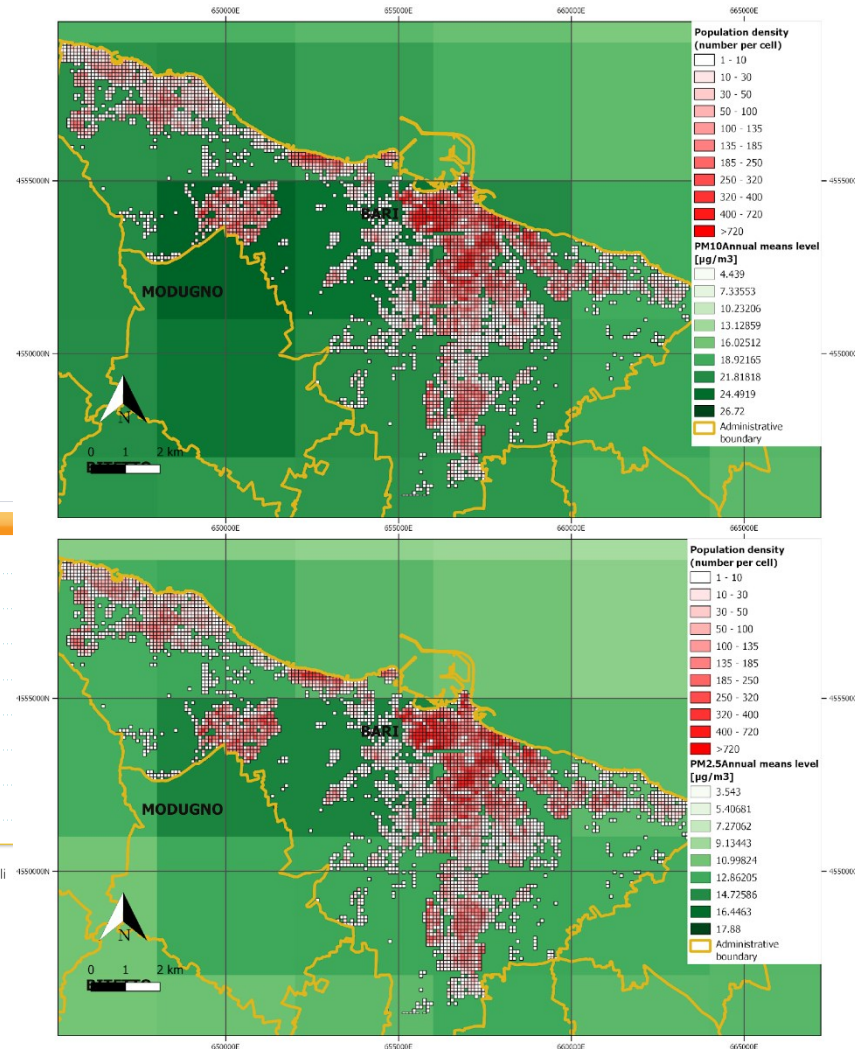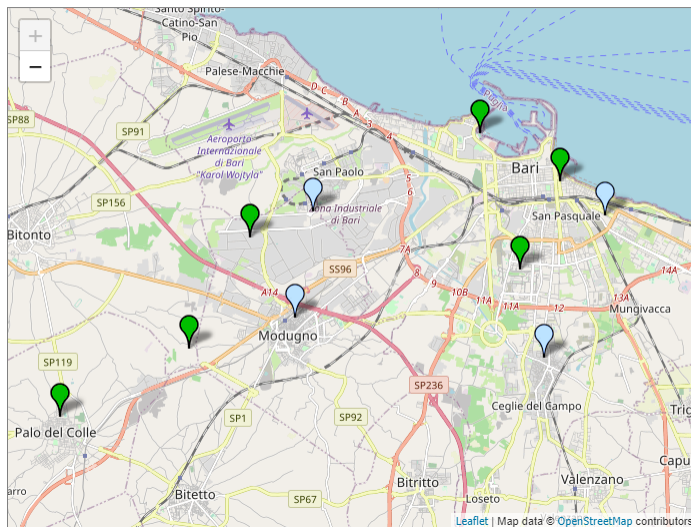# Particles pollutants maps by ARPA PUGLIA

Flexible Air quality Regional Model (FARM)

Multi-grid Eulerian model for dispersion, transformation, and deposition of airborne pollutants in gas and aerosol phases

INPUT DATA:

- 5 monitoring stations in Bari urban areas;
- Meteorologic model and so on…..
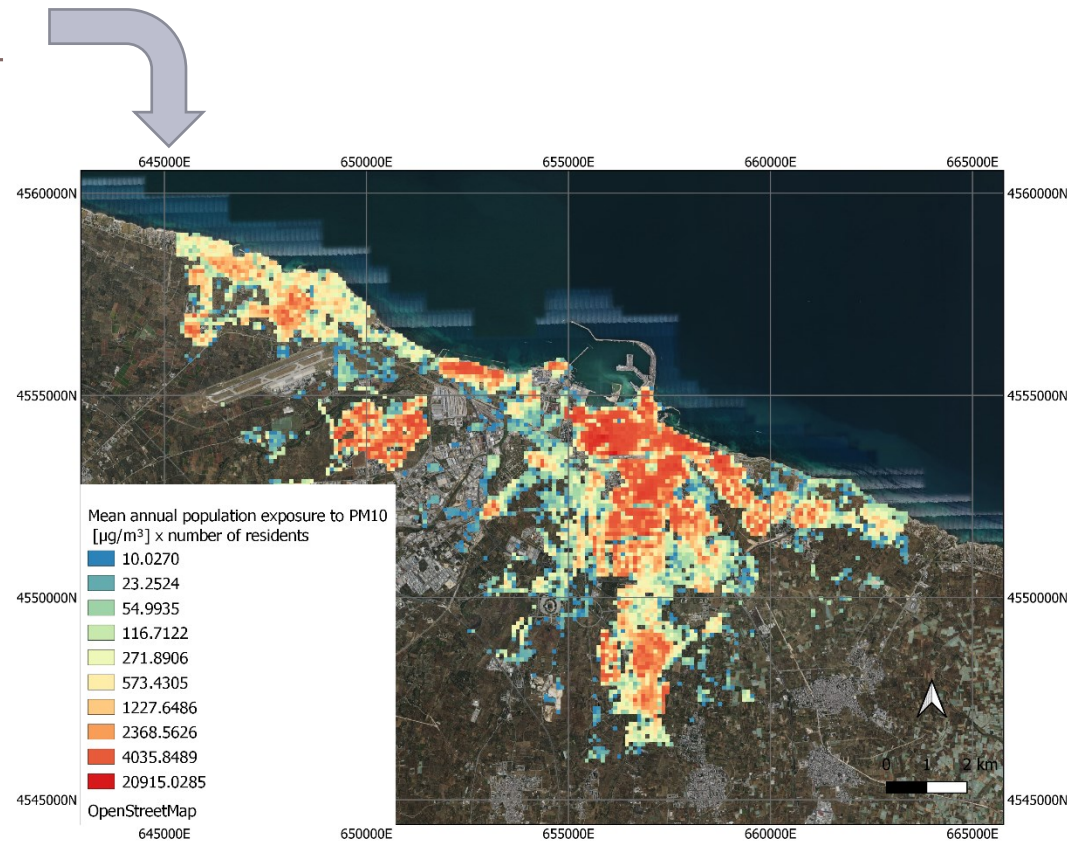
Rilevazioni del 06/03/2022

Mean annual Population Weighted Exposure Levels

$$C_{city} = \frac{\sum_{i=1}^{n} C_{4\,km \times 4\,km} * \sum_{j=1}^{m} P_{GRID\_j}}{P_{city}}$$

where,

- C_{city} is the city estimate;
- $C_{4\,km \times 4\,km}$ is the particulate matter concentration in a 4 km × 4 km cell;
- P_{GRID_j} is population density value per cell 100 m × 100 m;
- m is the number of cells of fine-grid population map included in a cell of atmospheric pollution map (4 km × 4 km);
- n is the number of cells of atmospheric pollution map covering Bari territory;
- P_{city} is the total population of Bari.

Mean annual population exposure to PM10
[µg/m³] × number of residents

■	10.0270
■	23.2524
■	54.9935
■	116.7122
■	271.8906
■	573.4305
■	1227.6486
■	2368.5626
■	4035.8489
■	20915.0285

OpenStreetMap

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Long-term Exposure to PM10 e PM2.5 analysis

Mean Annual Levels

	Stat [µg/m³]	PWELs [µg/m³]	Regulation limits in force in Italy [µg/m³]
PM 2.5	MAX: 15.1, **MEAN: 12.4**, MEDIAN: 12.7, MIN: 10.2,	**13.5**	25
PM 10	MAX: 25.1, **MEAN: 20.4**, MEDIAN: 20.8, MIN: 15.5,	**22.1**	40

An Interim target refers to an air pollutant concentration associated with a specific decrease in health risk. An interim target classification serves as a suggestion of actions for an incremental air pollution reduction strategy toward the **Air quality guideline level.**

AQG level is a particular form of guideline recommendation consisting of a concentration of a pollutant linked to an averaging time. It is assumed that adverse health effects do not occur or are minimal below this concentration level.
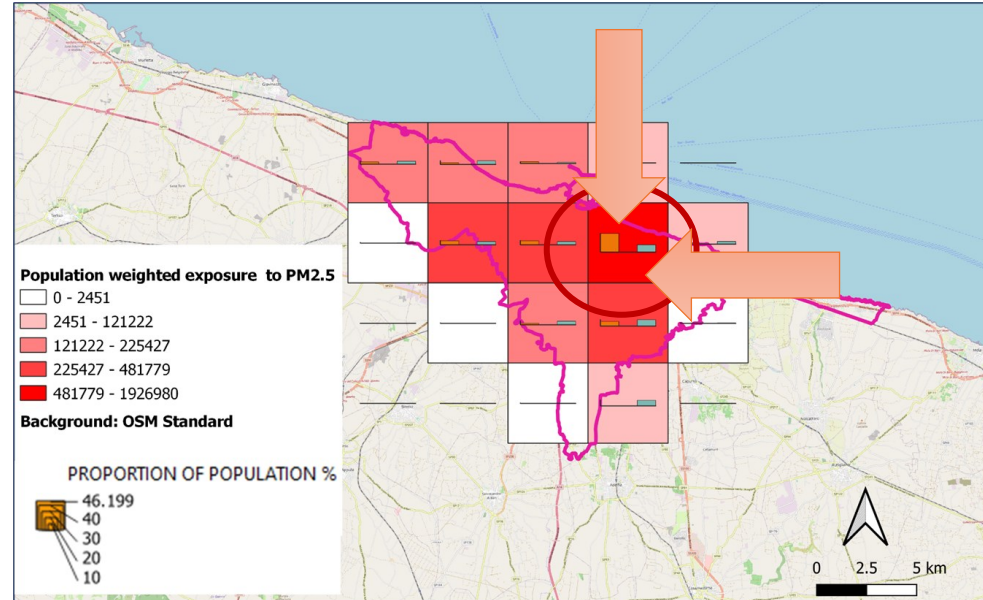
Exposure level	PM 2.5 ranges [µg/m³]	PM 10 ranges [µg/m³]	WHO Interim Target
1	PWEL < 5	PWEL < 15	Annual mean AQG level
2	5 < PWEL < 10	15 < PWEL < 20	Interim target 4
3	10 < PWEL < 15	20 < PWEL < 30	Interim target 3
4	15 < PWEL < 25	30 < PWEL < 50	Interim target 2
5	25 < PWEL < 35	50 < PWEL < 70	Interim target 1

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Conclusion

In Bari, the highest annual population exposure levels to PM2.5 and PM10 are in the central area of the city (where PM2.5 and PM10 concentrations approximate PWELs evaluated at city scale)

Population weighted exposure to PM2.5
- 0 - 2451
- 2451 - 121222
- 121222 - 225427
- 225427 - 481779
- 481779 - 1926980

Background: OSM Standard

PROPORTION OF POPULATION %
- 46.199
- 40
- 30
- 20
- 10

0 2.5 5 km

Future studies

❑ Further studies need to be conducted to improve the spatial intra-urban variability of PM concentrations

❑ Maps of seasonal exposure levels will soon be ready to be uploaded to the teaser platform.

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Thanks for your attention!