

CT7 – High-resolution emissions Challenges and Opportunities of increasing the use of ECM

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FAIRMODE

Forum for air quality modelling in Europe

CT7 activities

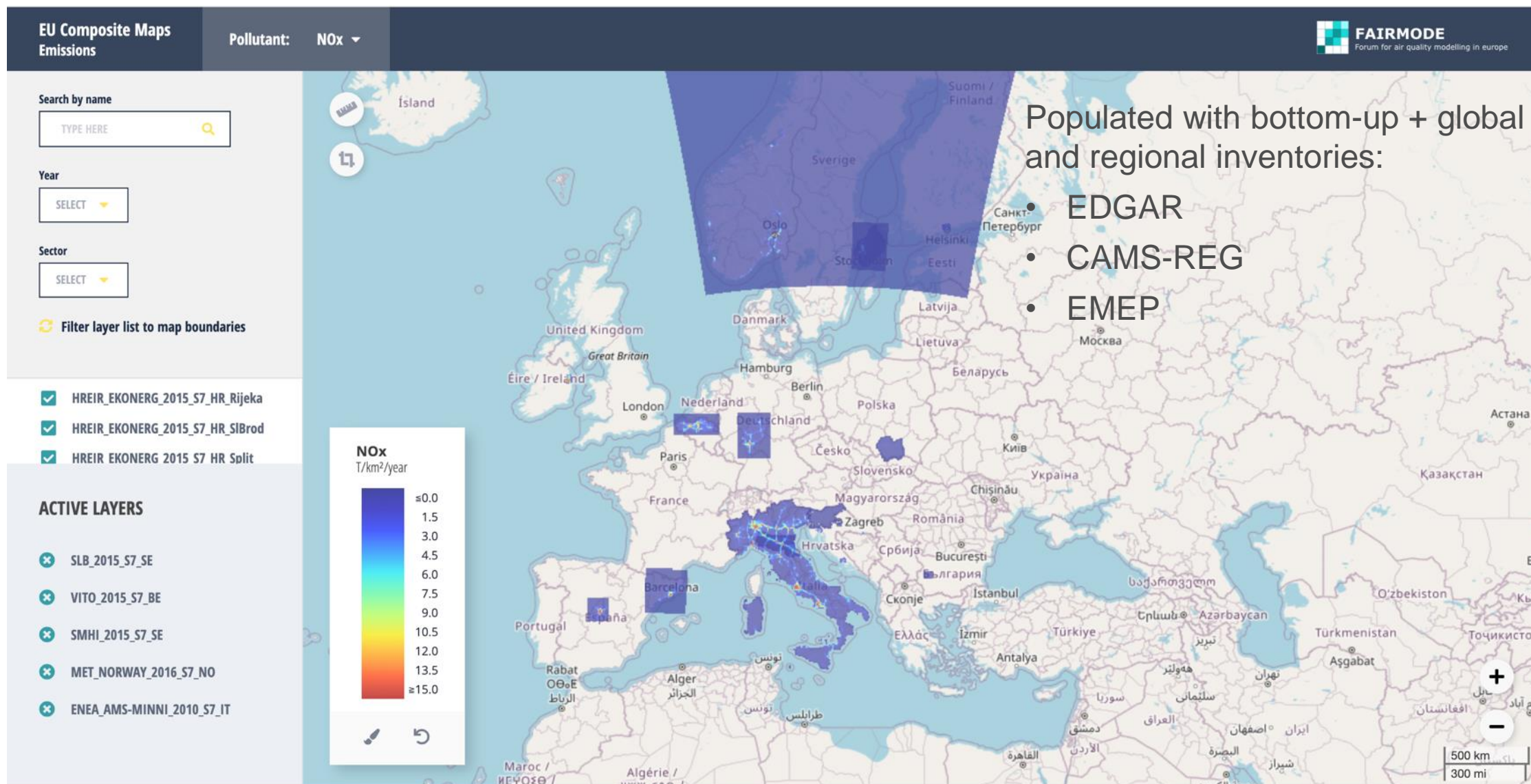
1. Identifying best practices and drafting final recommendations for the compilation of high resolution emission inventories
2. Perform benchmarking activities for the compilation of high resolution emissions.
3. Elaborating recommendations for a common system to document the use of ancillary data and define the relevant meta-data that support high resolution emission inventories.
4. Providing relevant feedback to improve European inventories used for regulatory purposes (EMEP) and Copernicus monitoring services (CAMS-REG)

Activities supported through the composite map platform



<https://fairmode.jrc.ec.europa.eu/ecmaps/>

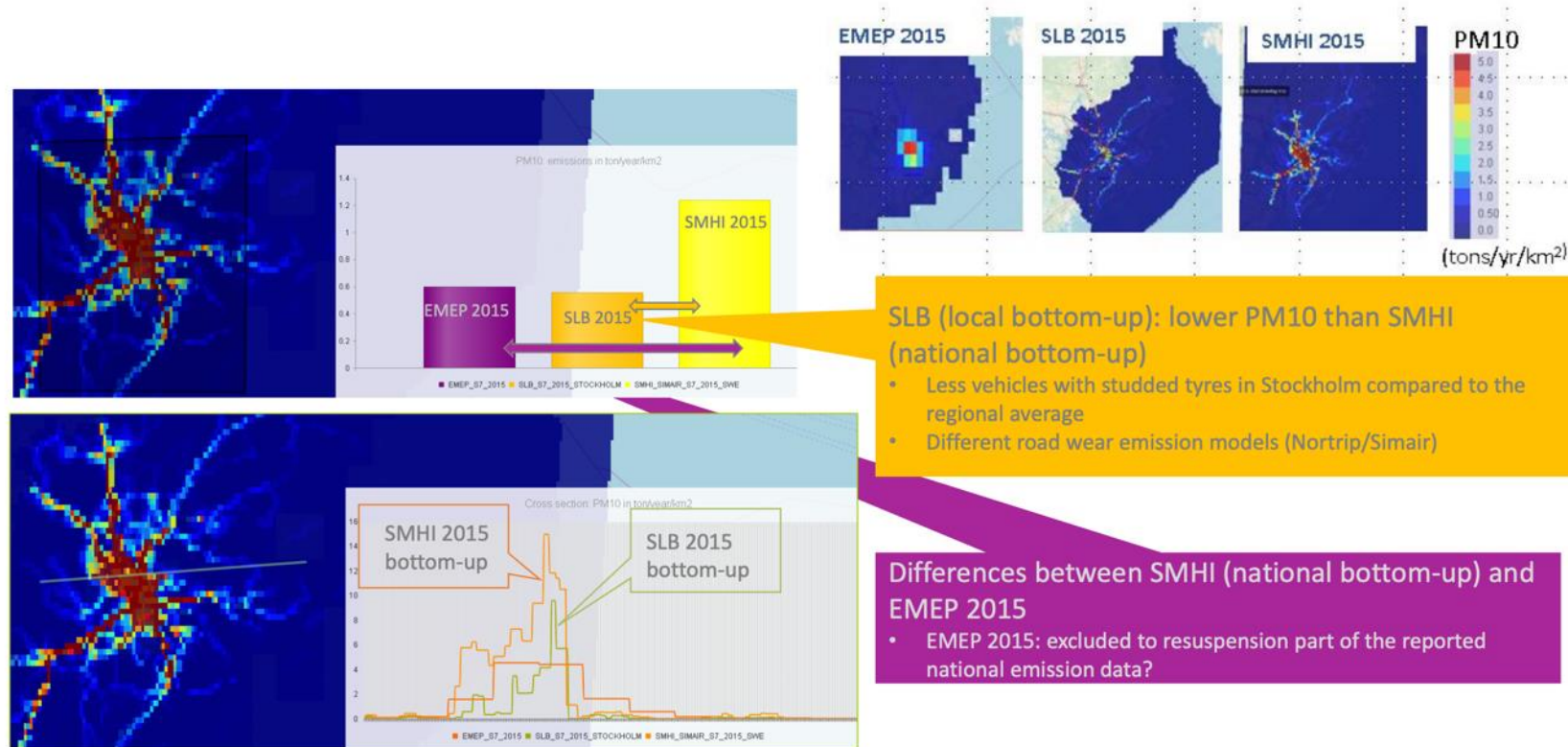
European Composite Map platform



European Composite Map platform

- Allows for qualitative and quantitative (spatial) comparison of emission maps
- Used in the framework of the FAIRMODE pilot study...
- **But since then, very little usage/update of emission datasets**

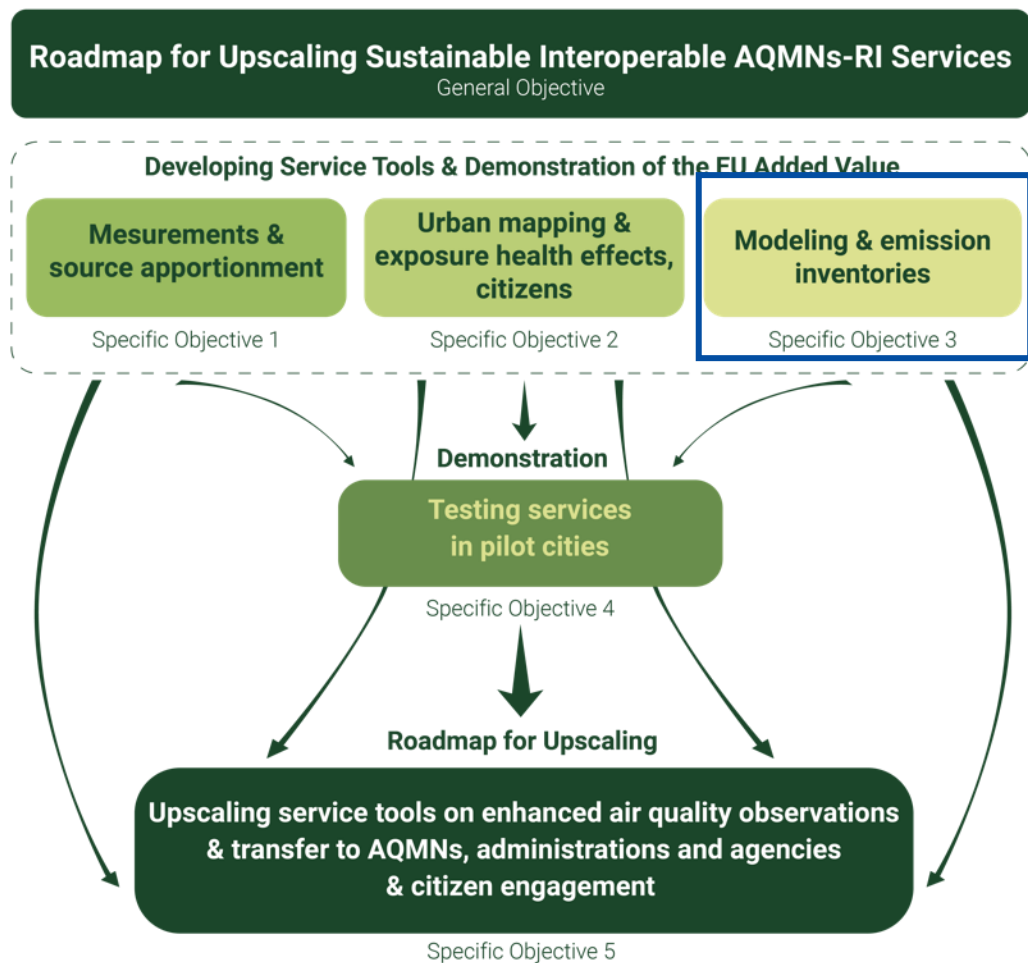
Composite mapping on emissions – PM10 s7 road traffic



Eneroth K. et al. (SLB, 2018)

RI-URBANS project

Research Infrastructures Services Reinforcing Air Quality Monitoring Capacities in European Urban & Industrial Areas (RI-URBANS)



- Demonstrate how **service tools** from atmospheric **research infrastructures** can be **adapted and enhanced in air quality monitoring networks** in an interoperable and sustainable way
- RI-URBANS focuses on human exposure to outdoor ambient nanoparticles (i.e., UFP) and atmospheric PM

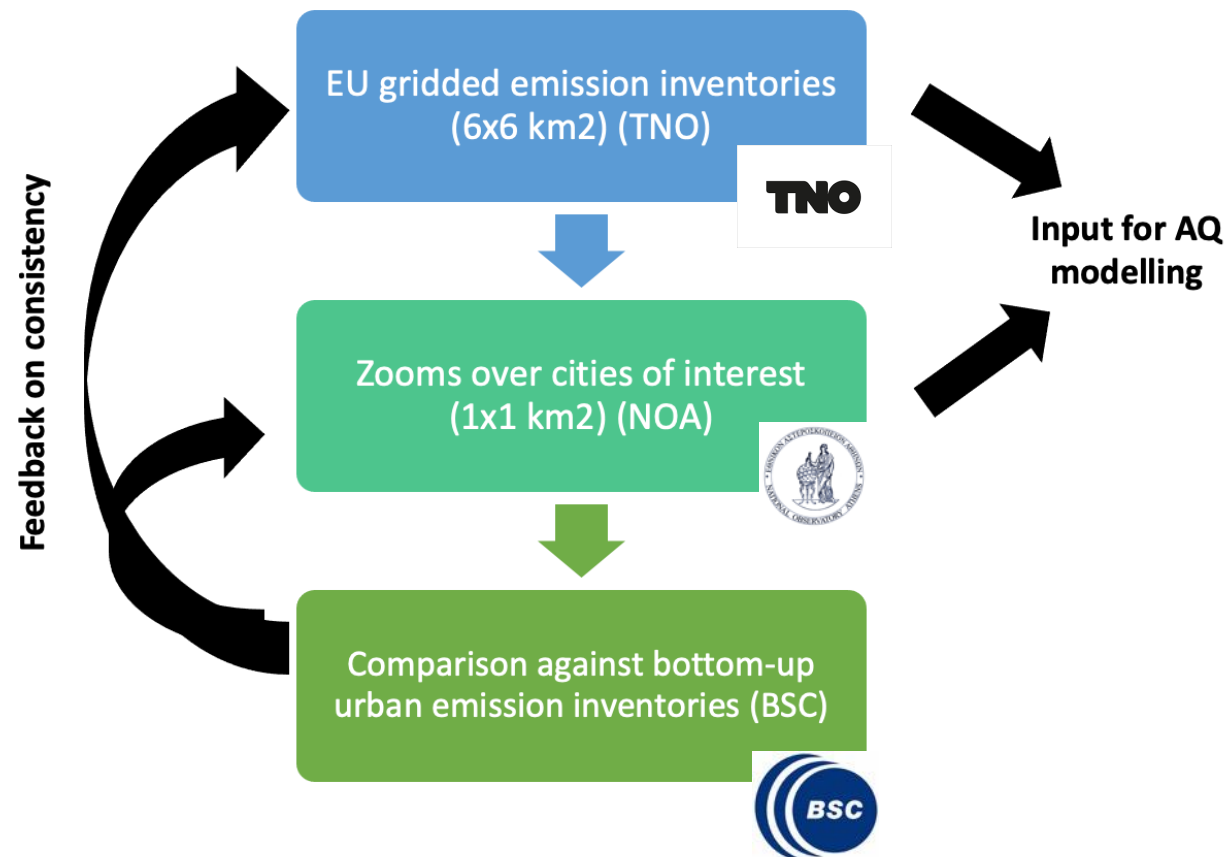
SO3: To improve air quality modelling tools and urban-scale emission inventories by assimilating measurements and performing intercomparison exercise

RI-URBANS project (HORIZON 2020)

Enhancing quality and completeness of emissions inventories

Objective: To better quantify emissions of gaseous and particulate pollutants at spatio-temporal scales relevant to urban areas:

- Construction of consistent regional inventories for Europe (6x6 km²) with zooms over cities of interest (1x1 km²)
- **Assess the consistency between regional inventories and local city inventories using fine scale emission estimates**



RI-URBANS project (HORIZON 2020)

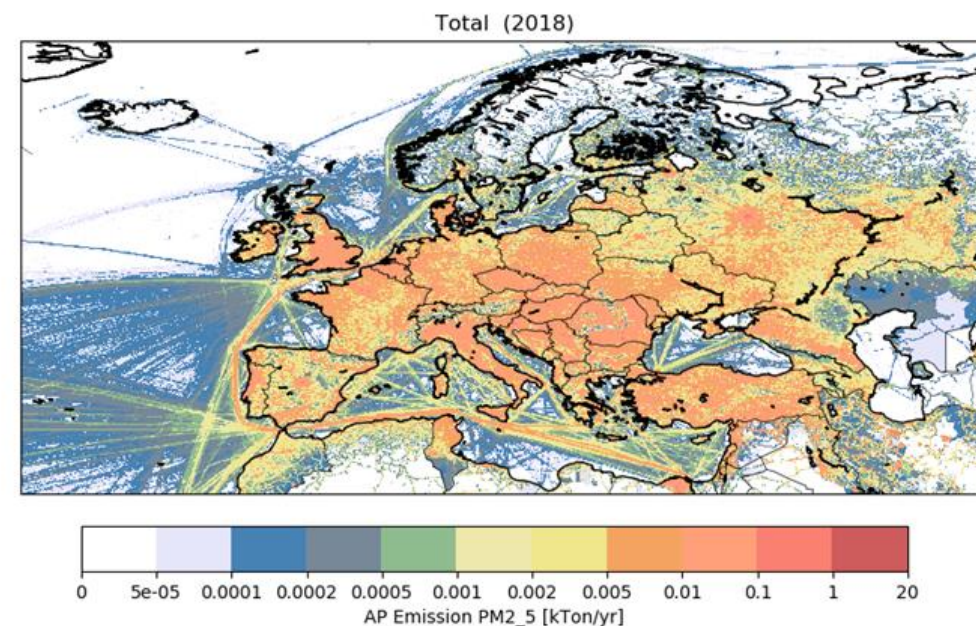
Pilot cities

Pilot city	year of reference	pollutants	spatial resolution
Barcelona	2019	NO _x , CO, NH ₃ , SO ₂ , NMVOC, PM ₁₀ , PM _{2.5} , UFP , BC	1kmx1km
Rotterdam & Amsterdam	2018	NO _x , CO, NH ₃ , SO ₂ , NMVOC, PM ₁₀ , PM _{2.5}	1kmx1km
Athens	2018	NO _x , CO, NH ₃ , SO ₂ , NMVOC, PM ₁₀ , PM _{2.5}	Under discussion
Birmingham	2018	NO _x , CO, NH ₃ , SO ₂ , NMVOC, PM ₁₀ , PM _{2.5} , PM ₁ , PM _{0.1}	1kmx1km
Helsinki	2019	PM _{2.5} , BC, BaP, NO _x , EC	Under discussion
Paris	2018	CO, SO ₂ , NO _x , PM ₁₀ , PM _{2.5} , NH ₃ , NMVOC	Regions (e.g. Paris city, metropolis, Ile-de-France)
Zurich	2015	NO _x , SO ₂ , CO, PM ₁₀ , VOC, Benzene, CO ₂ , NH ₃	Under discussion

RI-URBANS project (HORIZON 2020)

European inventory

- UNECE-Europe emission inventories for many pollutants
 - PM10, PM2.5, precursor gases: available from CAMS-REG (based largely on official reported emissions to EMEP/EU)
 - Resolution $0.05^\circ \times 0.1^\circ$ (~6x6km²)
 - Annual grids, latest: years 2000-2018
 - GNFR classification, including non-exhaust as separate sector
 - PM split in EC, OC, other components



CAMS-REG emission inventory
Kuenen et al. (2022), ESSD

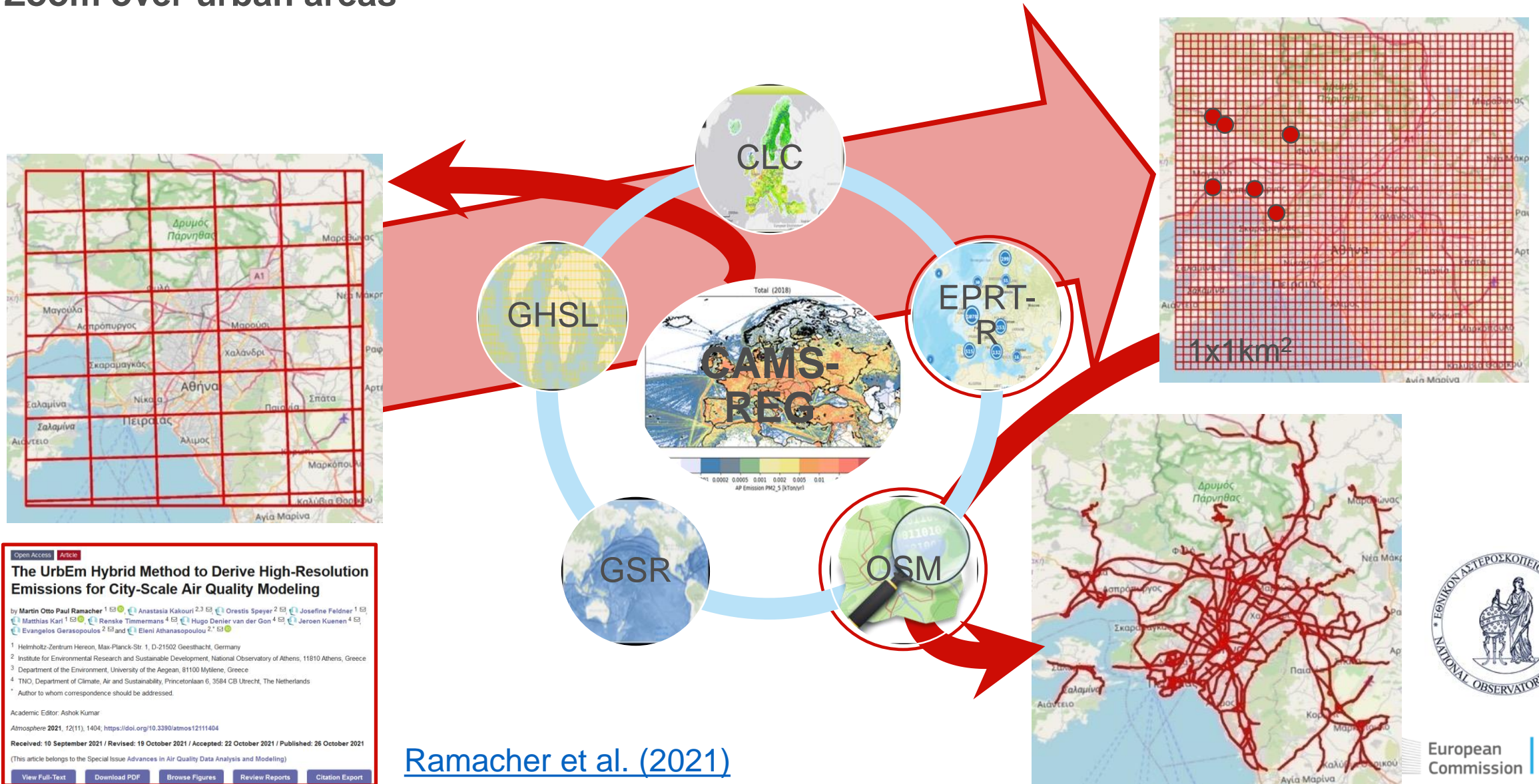
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RI-URBANS



RI-URBANS project (HORIZON 2020)

Zoom over urban areas



Open Access Article

The UrbEm Hybrid Method to Derive High-Resolution Emissions for City-Scale Air Quality Modeling

by Martin Otto Paul Ramacher¹, Anastasia Kakouri^{2,3}, Orestis Speyer², Josefine Feldner¹, Matthias Karl¹, Renske Timmermans⁴, Hugo Denier van der Gon⁴, Jeroen Kuenen⁴, Evangelos Gerasopoulos² and Eleni Athanasopoulou²

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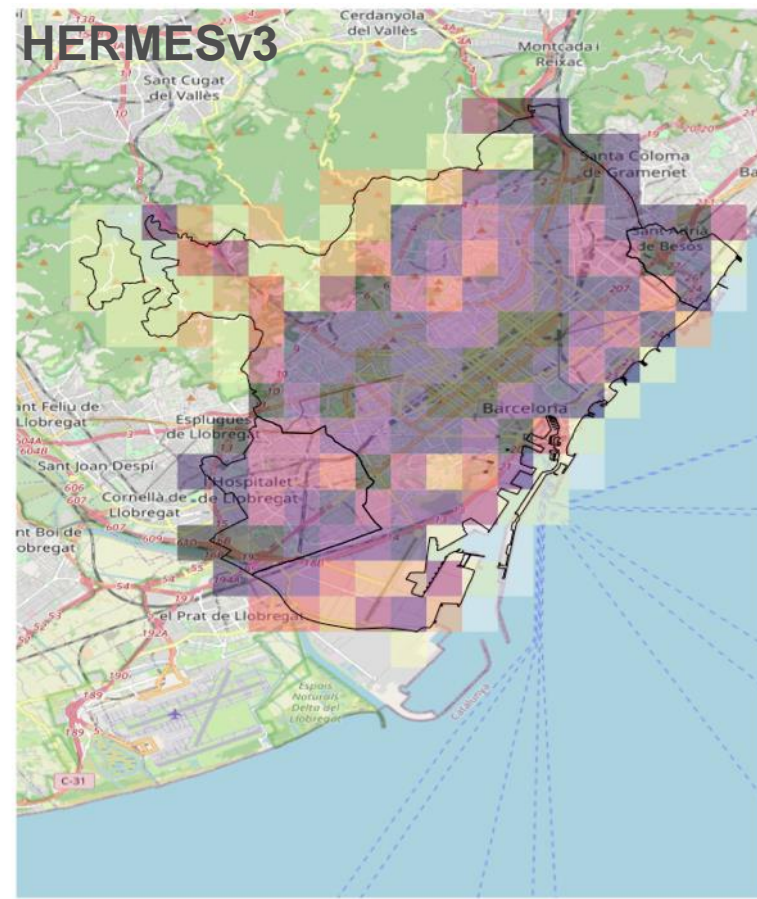
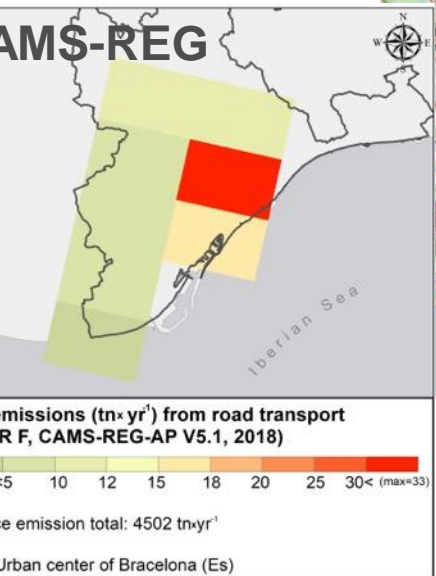
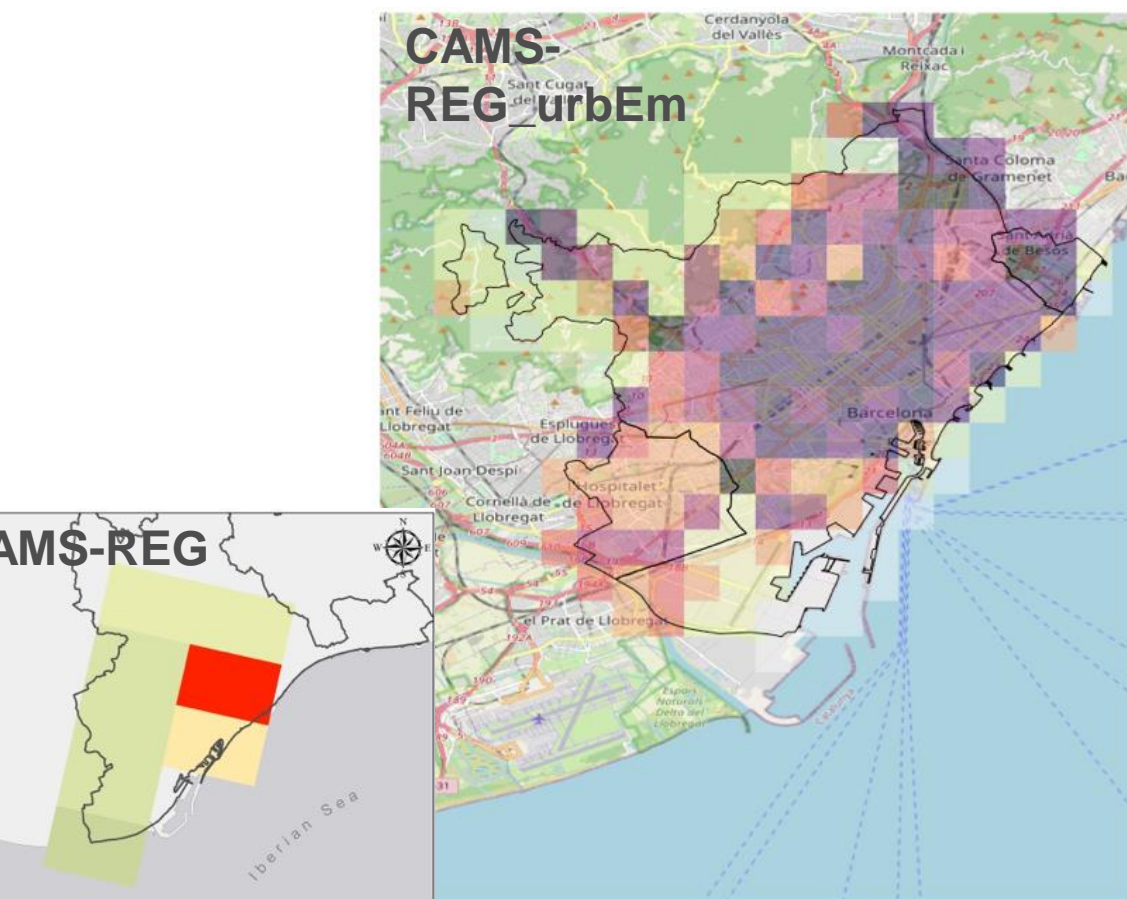
[Ramacher et al. \(2021\)](#)



European Commission

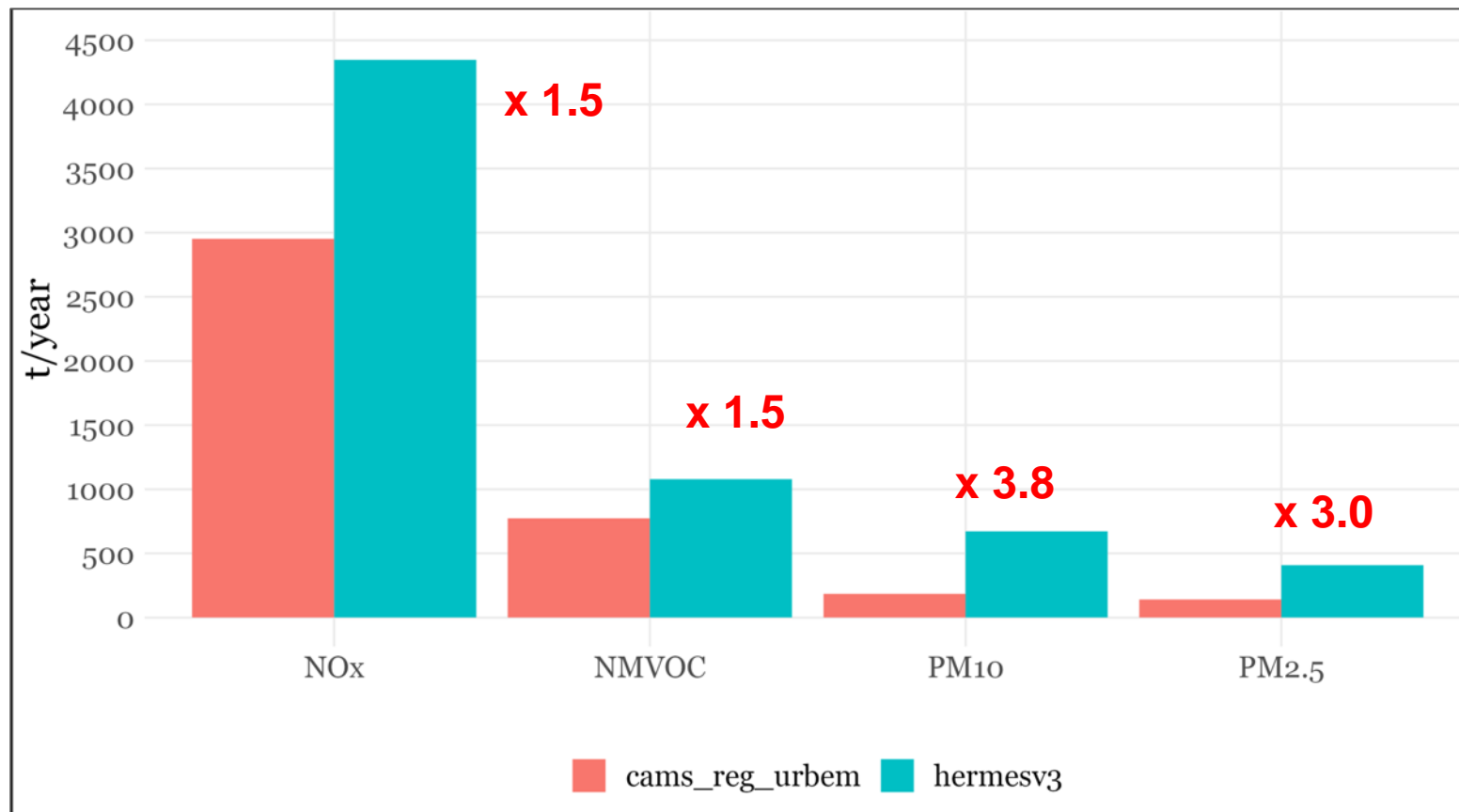
RI-URBANS project (HORIZON 2020)

Intercomparison – Barcelona (road transport emissions)



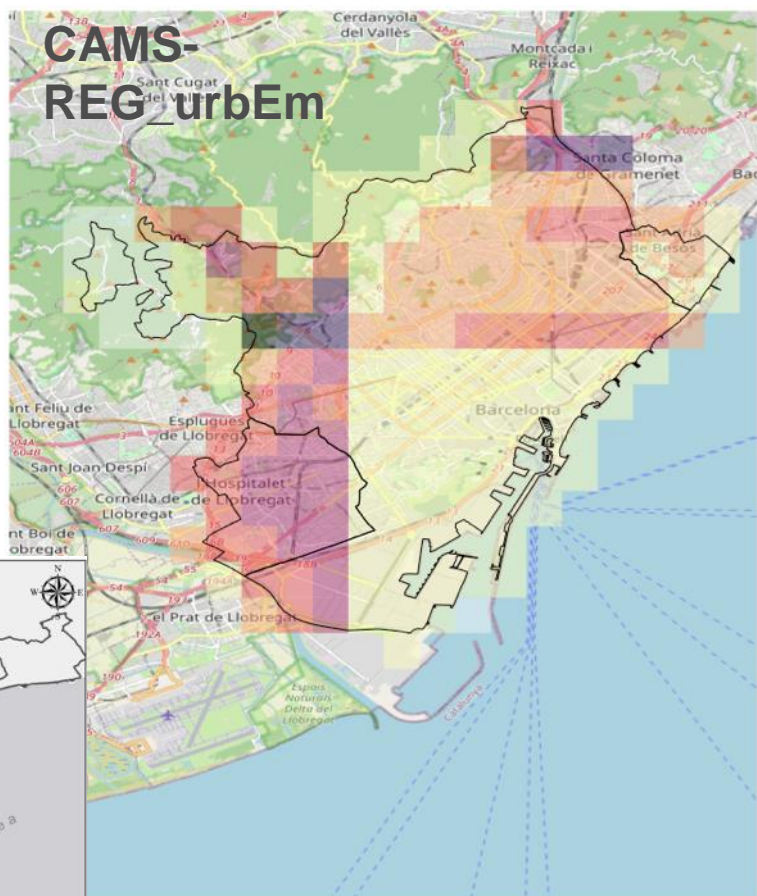
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Intercomparison – Barcelona (road transport emissions)

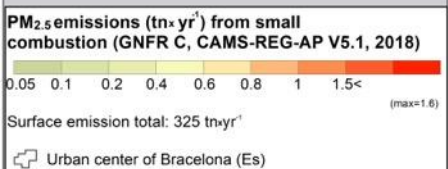
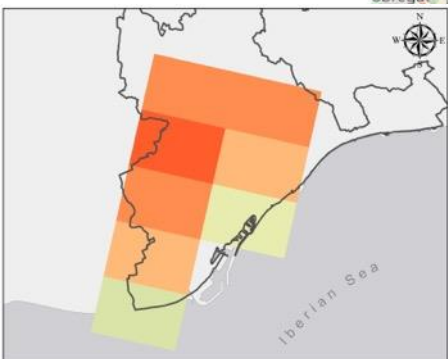


RI-URBANS project (HORIZON 2020)

Intercomparison – Barcelona (residential/commercial combustion emissions)



CAMS-REG



PM_{2.5} [t/ye

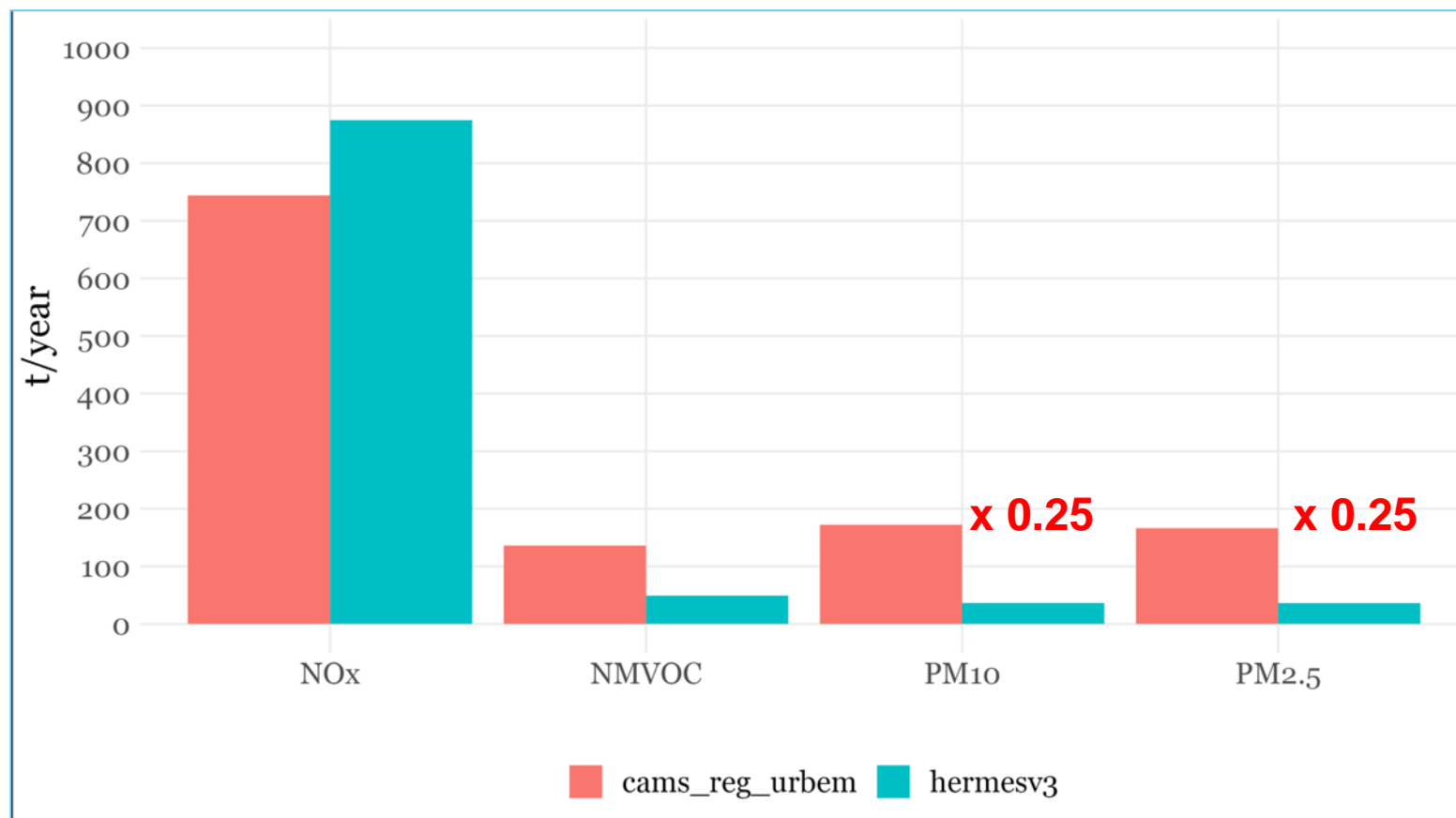
- 0-0.5
- 0.5-1
- 1-2
- 2-3
- 3-5
- 5-10
- 10-15

PM_{2.5} [t/year

- 0-0.5
- 0.5-1
- 1-2
- 2-3
- 3-5
- 5-10
- 10-15

RI-URBANS project (HORIZON 2020)

Intercomparison – Barcelona (residential/commercial combustion emissions)



Opportunities and challenges

The comparison exercise performed under RI-URBANS could be a great opportunity for using the ECM, but several challenges appear....

Challenge	Explanation	How to overcome them
Lack of official agreement on the use of the data	Emission inventories are usually perceived as sensitive information and sometimes groups are reluctant to share the data	FAIRMODE to design a memorandum of understanding indicating terms and conditions of the usage of the data (e.g., can only be visualized, not downloaded)
Added value not clearly perceived by users	Bottom-up inventories are usually based on very local and detailed information, and it is assumed little room for improvement exist compared to regional inventories	Emphasize the tools allow performing a QA/QC of emissions used for modelling applications under the AAQDs + better understanding of the air quality modelling results + improvements of regional inventories
Difficulty to upload datasets in the system	Each group has to process the data to specific format, then upload it to a database managed by VITO and then transferred to ECM platform	Propose a more centralised system to upload the information (a single group/center processes and uploads all the information)