



# PM2.5 Atlas 2023: new findings

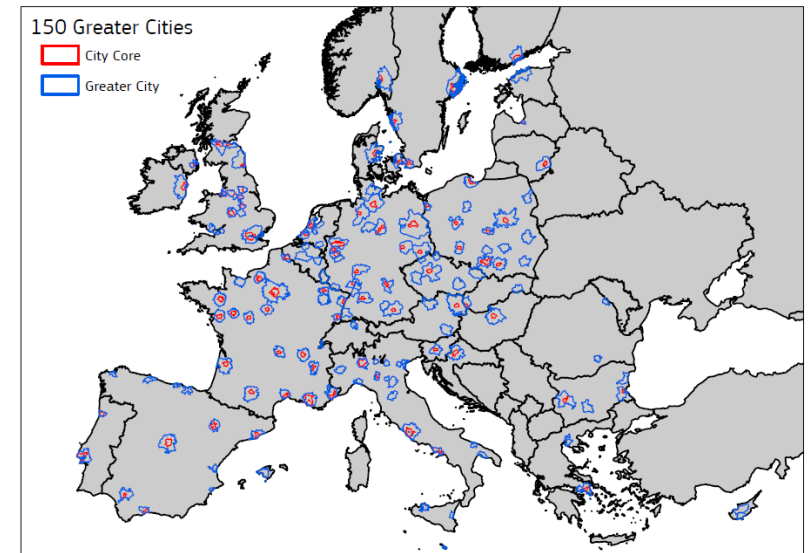
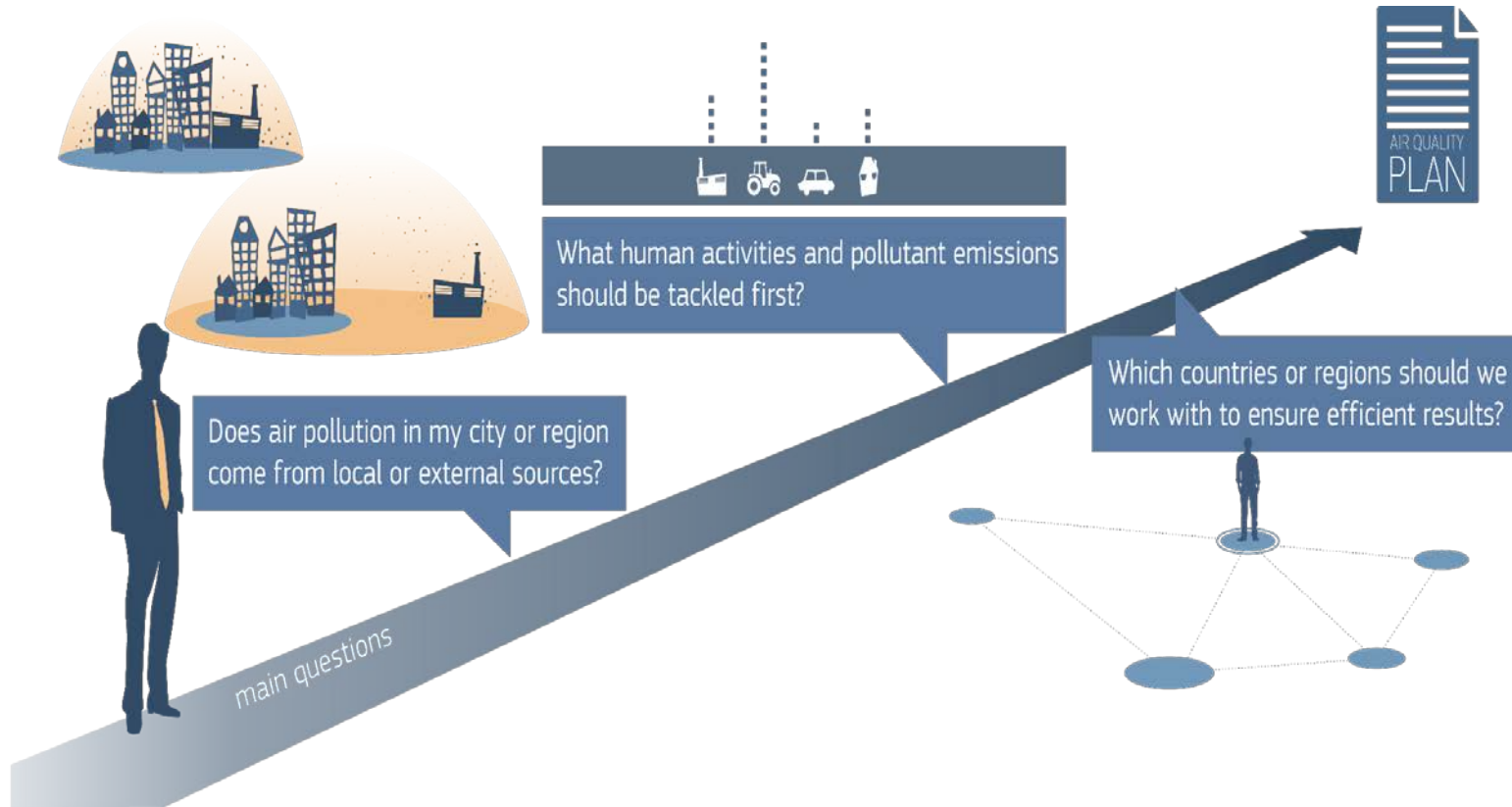
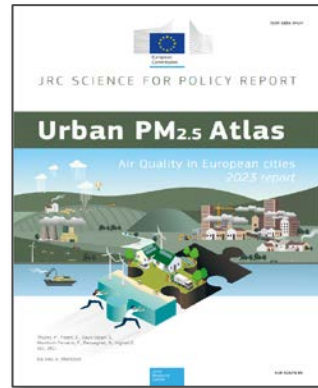
## FAIRMODE updates and possible collaboration with TFIAM

E. Pisoni, P. Thunis  
JRC

# PM2.5 Atlas, new findings

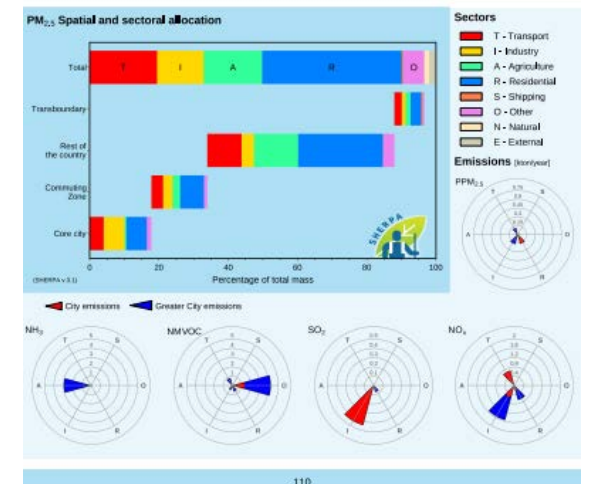
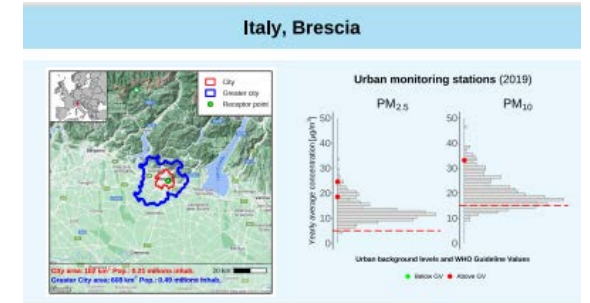
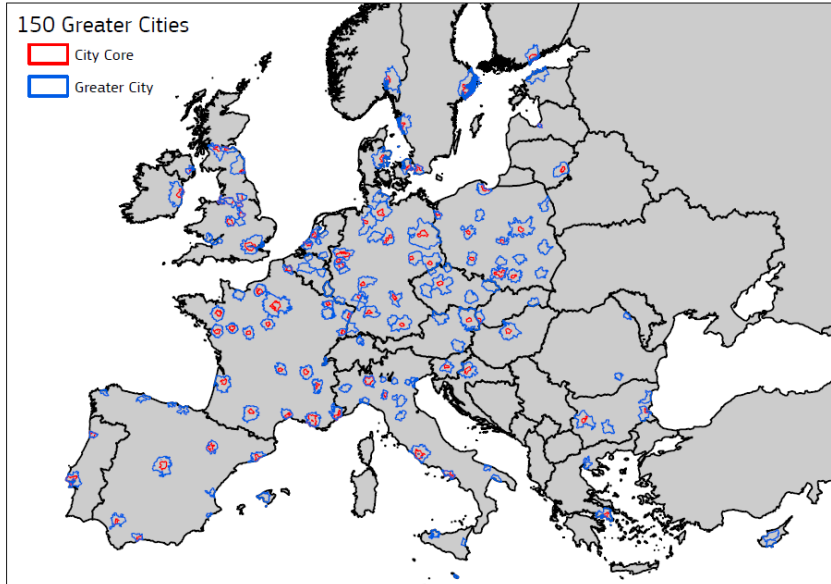
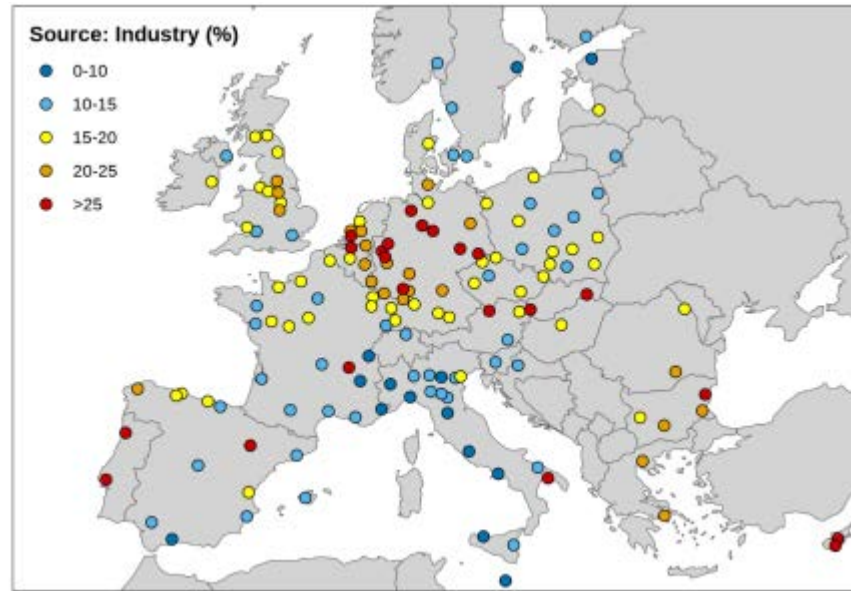
# The JRC PM2.5 urban atlas

to help local/regional policy makers design their air quality plans

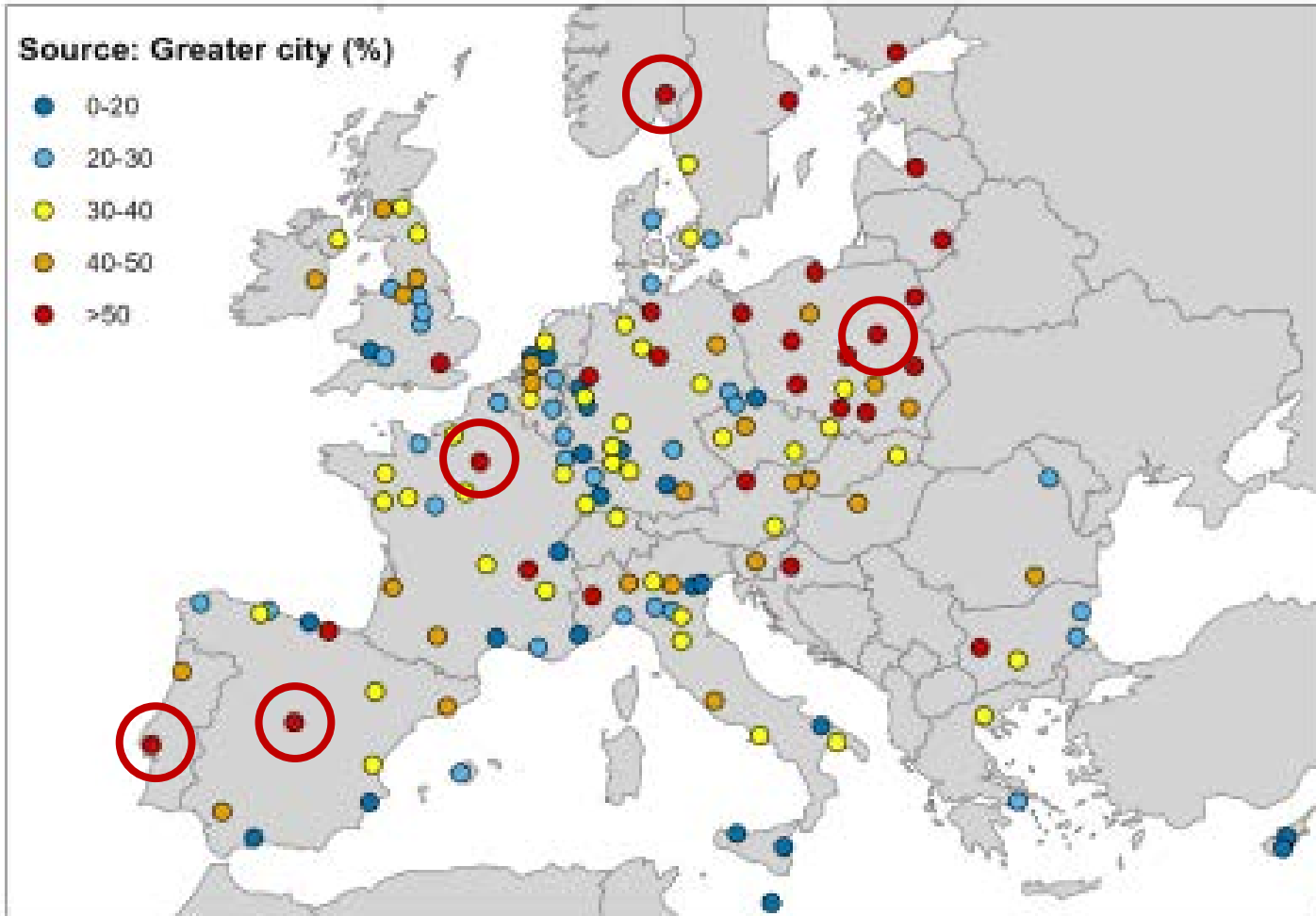


150 cities (atlas)  
+  
550 cities (online)

# Two main visualisations



# I - Local actions at the city scale are an effective means of improving air quality



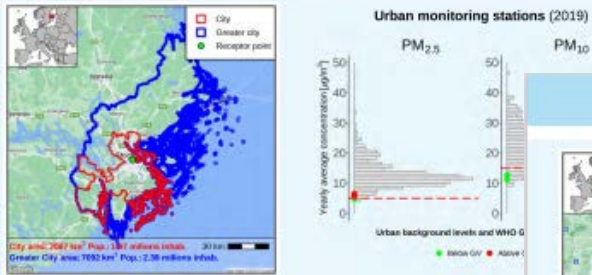
In average cities (greater area) contribute to 36% of their pollution

Oslo (75%), Warsaw (72%), Lisbon(68%), Paris (65%), Madrid (63%)

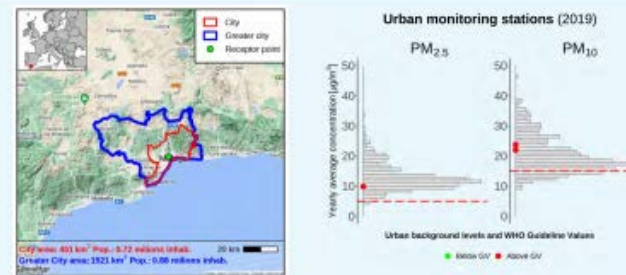


# II - Target sectors and scales to abate air pollution are city specific

Sweden, Stockholm



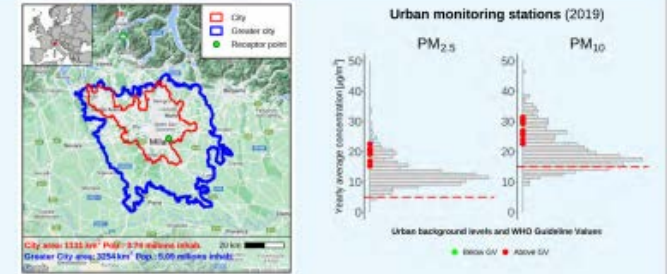
Spain, Málaga



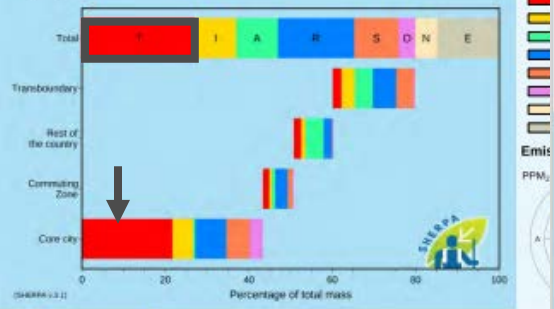
Slovakia, Bratislava



Italy, Milano

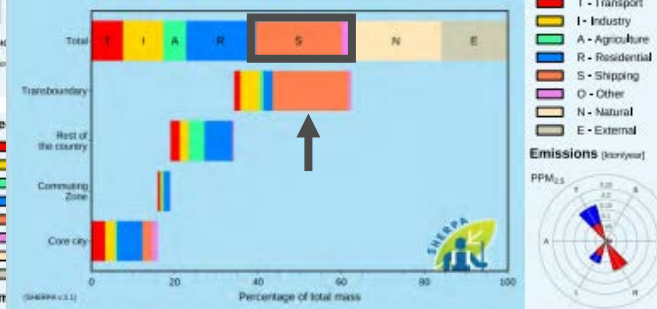


PM<sub>2.5</sub> Spatial and sectoral allocation



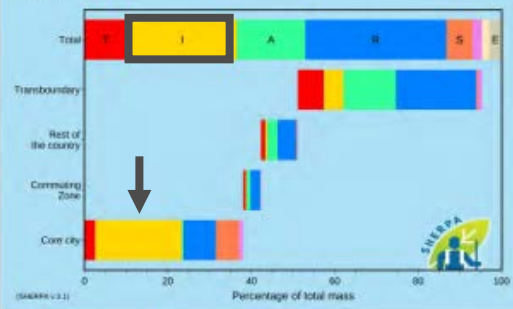
171

PM<sub>2.5</sub> Spatial and sectoral allocation



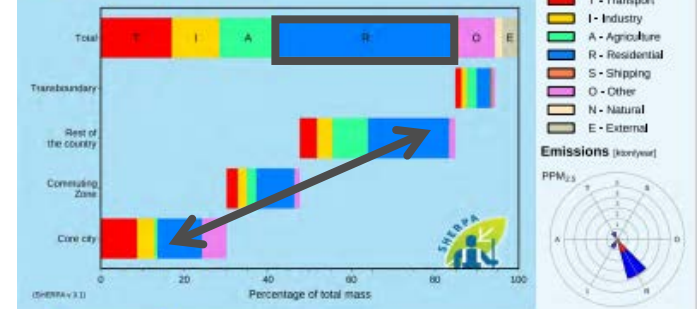
162

PM<sub>2.5</sub> Spatial and sectoral allocation



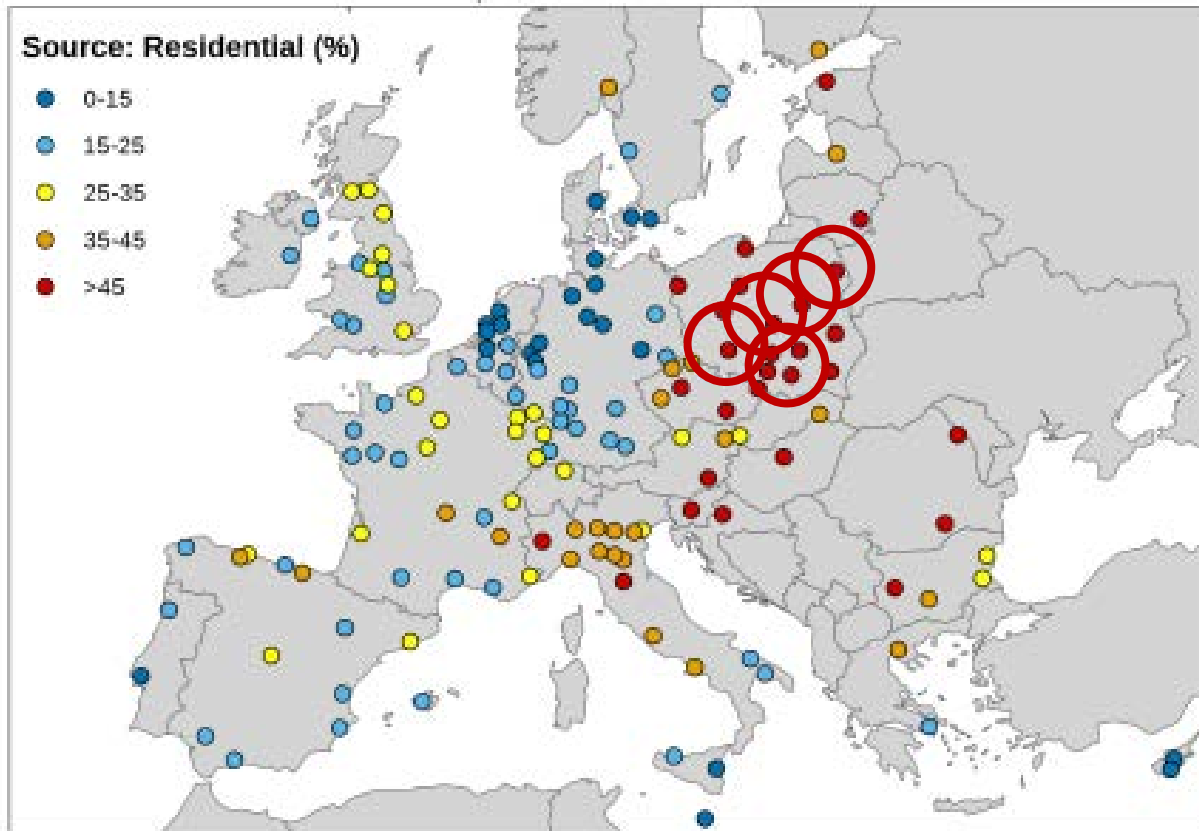
153

PM<sub>2.5</sub> Spatial and sectoral allocation



114

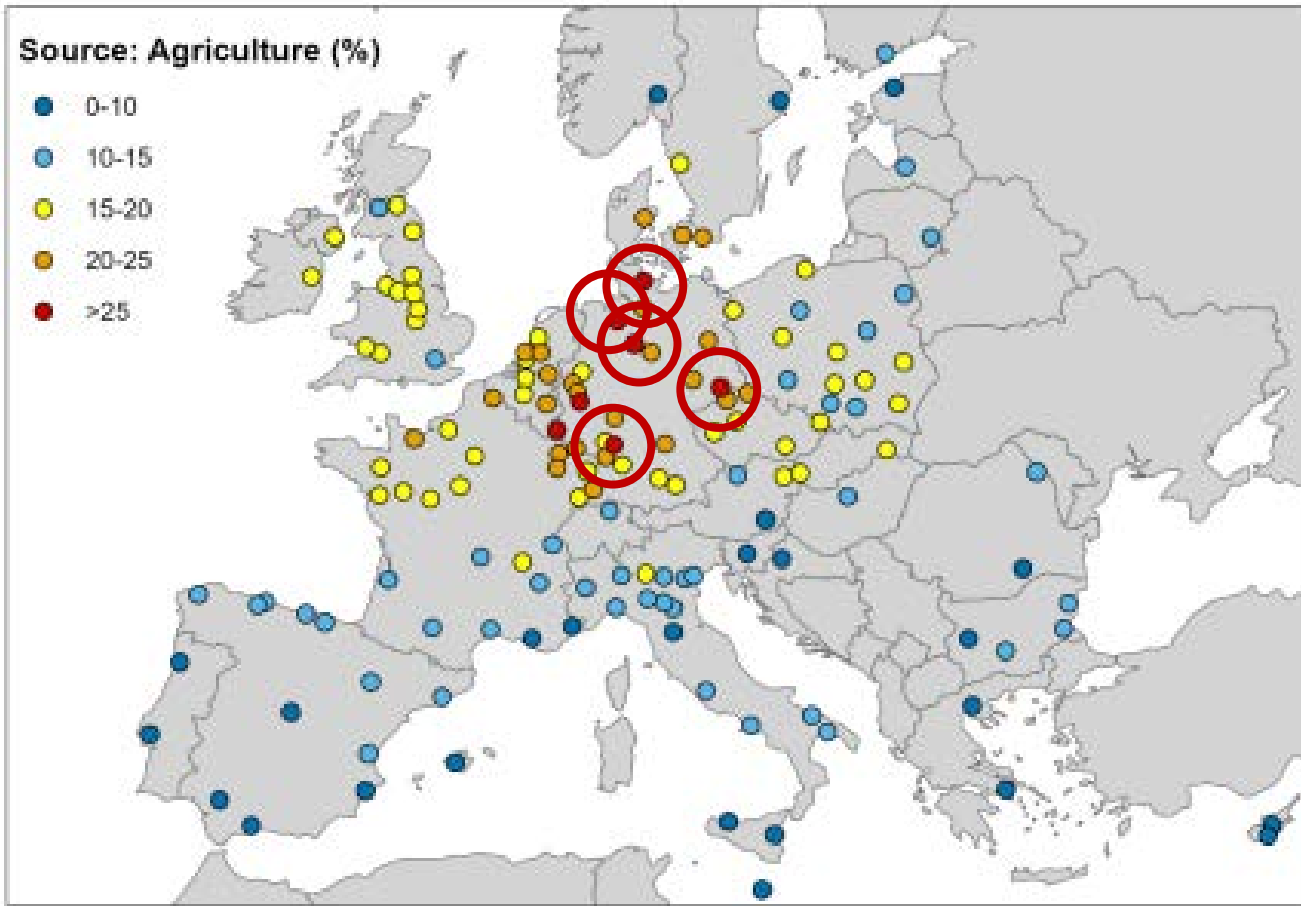
# III - Measures addressing residential heating at the local level would be very effective



In average 30% of the PM2.5 pollution in cities originate from residential emissions

Warszaw (64%), Krakow (63%), Wroclaw (60%), Lodz (59%), Bialystok (59%)

# IV - Measures addressing agriculture at country/EU scale would clearly benefit urban AQ



In average 15% of the PM<sub>2.5</sub> pollution in cities originate from agriculture emissions

Kiel (28%), Hannover (27%), Heidelberg (27%), Dresden (27%), Bremen (26%)





# Conclusions

The Atlas 2023 main messages:

Local actions are efficient in most cities

Abating agriculture emissions is an efficient way to improve urban air quality

City specificities must be considered when designing air quality plans

Measures addressing residential heating at the local level would be very effective

[https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/new-atlas-zooms-europes-city-specific-air-pollutants-sources-and-measures-take-2023-11-22\\_en](https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/new-atlas-zooms-europes-city-specific-air-pollutants-sources-and-measures-take-2023-11-22_en)

SHERPA online tool

<https://aqm.jrc.ec.europa.eu/Section/Sherpa/Background>

<https://jeodpp.jrc.ec.europa.eu/eu/dashboard/voila/render/SHERPA/Sherpa.ipynb>

# FAIRMODE updates and possible collaboration with TFIAM

# Composite mapping on emissions

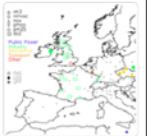
QA/QC of emission inventories is challenging because of the multiplicity of information to check: sectors \* pollutants \* space \* time

The FAIRMODE screening approach aims at detecting inconsistencies that should then be further discussed and explained, and potentially resolved

Main principle: If two emission estimates differ largely, then one of the inventory value or both need to be checked (and maybe corrected)

Methods for assessment of models 08 Jul 2022


A multi-pollutant and multi-sectorial approach to screening the consistency of emission inventories



Philippe Thunis<sup>1</sup>, Alain Clappier<sup>2</sup>, Enrico Pisoni<sup>1</sup>, Bertrand Bessagnet<sup>1</sup>, Jeroen Kuenen<sup>3</sup>, Marc Guevara<sup>4</sup>, and Susana Lopez-Aparicio<sup>5</sup>

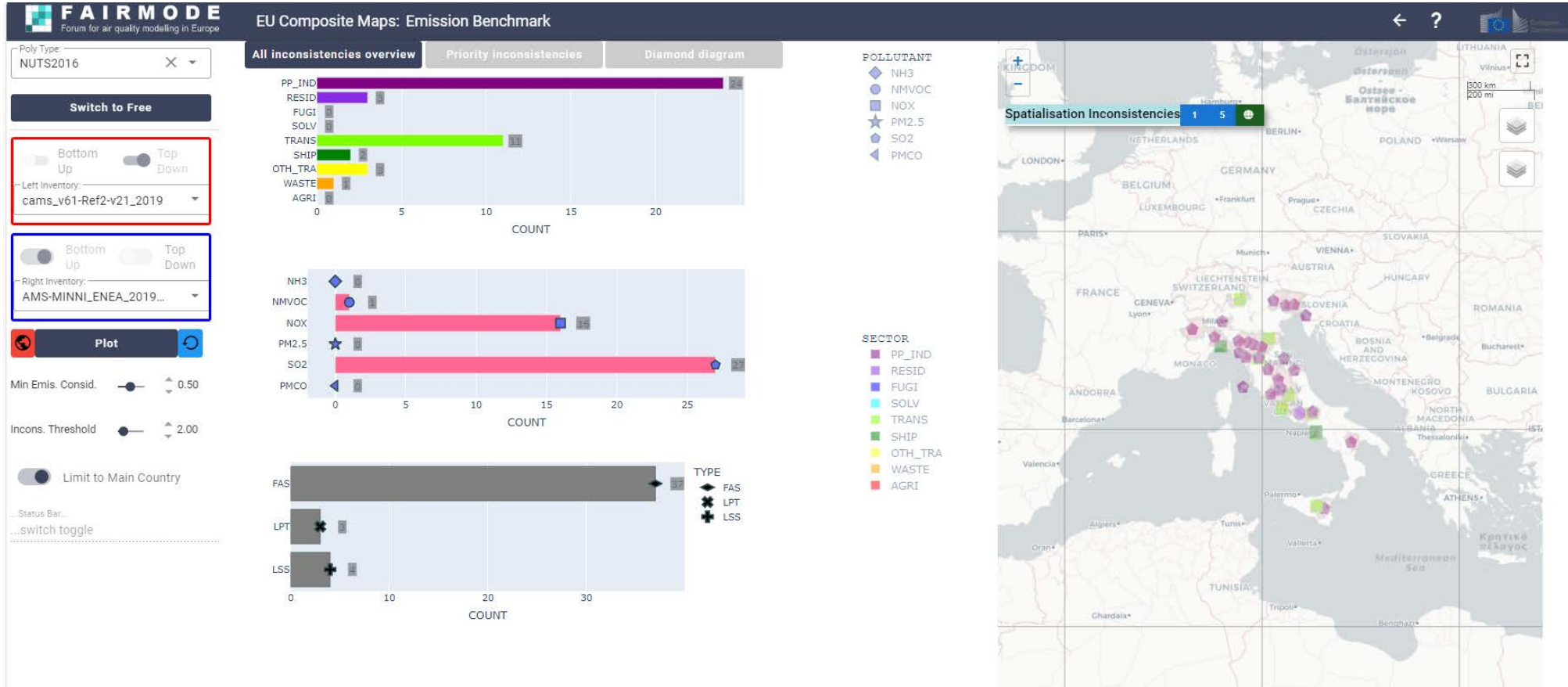
<sup>1</sup>European Commission, Joint Research Centre, Ispra, Italy  
<sup>2</sup>Université de Strasbourg, Laboratoire Image Ville Environnement, Strasbourg, France  
<sup>3</sup>TNO, Department of Air Quality and Environmental Modelling, Bilthoven, The Netherlands  
<sup>4</sup>Barcelona Supercomputing Center, Barcelona, Spain  
<sup>5</sup>NILU – Norwegian Institute for Air Quality, Oslo, Norway

<https://doi.org/10.5194/egusphere-2023-1257>  
Preprint. Discussion started: 28 August 2023  
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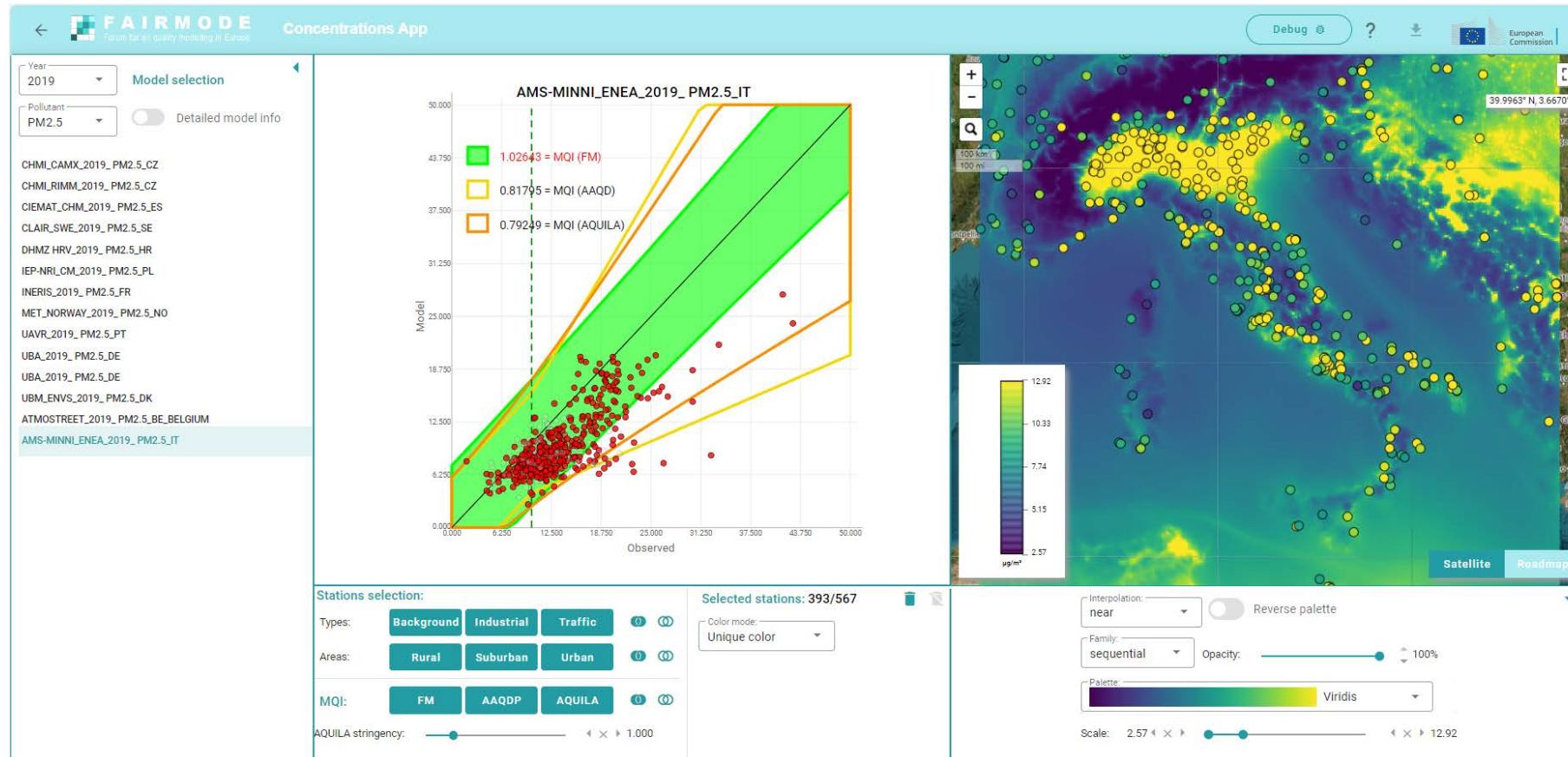
1 Emission ensemble approach to improve  
2 the development of multi-scale emission  
3 inventories  
4  
5 Philippe Thunis<sup>1</sup>, Jeroen Kuenen<sup>3</sup>, Enrico Pisoni<sup>1</sup>, Bertrand Bessagnet<sup>1</sup>, Manjola Banja<sup>1</sup>, Lech  
6 Gawuc<sup>3</sup>, Karol Szymankiewicz<sup>2</sup>, Diego Guizardi<sup>1</sup>, Monica Crippa<sup>1,4</sup>, Susana Lopez-Aparicio<sup>5</sup>,  
7 Marc Guevara<sup>4</sup>, Alexander De Meij<sup>1</sup>, Sabine Schindlbacher<sup>3</sup>, Alain Clappier<sup>2</sup>  
8

# Composite mapping on emissions



[https://jeodpp.jrc.ec.europa.eu/eu/vaas/voila/render/FAIRMODE/emissions-dashboard/main\\_pageEmisEval.ipynb](https://jeodpp.jrc.ec.europa.eu/eu/vaas/voila/render/FAIRMODE/emissions-dashboard/main_pageEmisEval.ipynb)

# Composite mapping on concentrations



<https://jeodpp.jrc.ec.europa.eu/eu/dashboard/voila/render/FAIRMODE/FAIRMODEConcentrations.ipynb>

# SHERPA: scenario analysis

SHERPA: Scenario Analysis

EEA stations: None NO2 PM10 PM25

Search: [input]

NUTS FUA CNC

- NUTS
  - AUSTRIA
  - BELGIUM
  - BULGARIA
  - SWITZERLAND
  - CYPRUS
  - CZECH REPUBLIC
  - GERMANY
  - DENMARK
  - ESTONIA
  - GREECE
  - SPAIN
  - FINLAND
  - FRANCE
  - CROATIA
  - HUNGARY
  - IRELAND
  - ICELAND
  - ITALY
  - LIECHTENSTEIN
  - LITHUANIA
  - LUXEMBOURG
  - LATVIA
  - REPUBLIC OF MONTENEGRO
  - FORMER YUGOSLAV REPUBLIC OF
  - MALTA
  - NETHERLANDS

Reduction table [%]

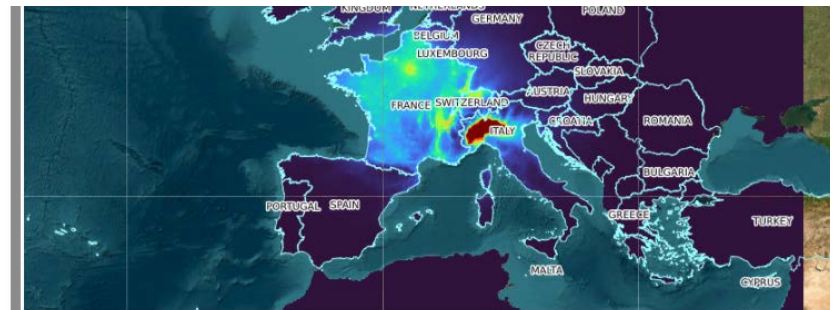
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ALL	30	30	30	30	30	30	30	30	30	30	30	30	30
NOx	30	30	30	30	30	30	30	30	30	30	30	30	30
NMVOc	30	30	30	30	30	30	30	30	30	30	30	30	30
NH3	30	30	30	30	30	30	30	30	30	30	30	30	30
PPM25	30	30	30	30	30	30	30	30	30	30	30	30	30
Sox	30	30	30	30	30	30	30	30	30	30	30	30	30

Air Quality Index: PM25

Local calculation

Compute map

Load computation



Computation Scenario Analysis

Name asd

Air quality index PM25

Location NORD-OVEST, SWITZERLAND, FRANCE

Geogr. Entity NUTS

Precursors NOx, NMVOC, NH3, PPM25, SOx

Show: Concentration

Data: Delta

Precursor: NOx

Macrosector: ALL

Aggregate to geogr. levels: No 0 1 2 3

Display reductions parameters

Display Costs charts

Close computation

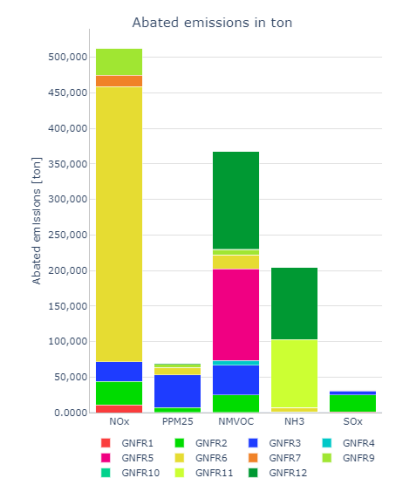
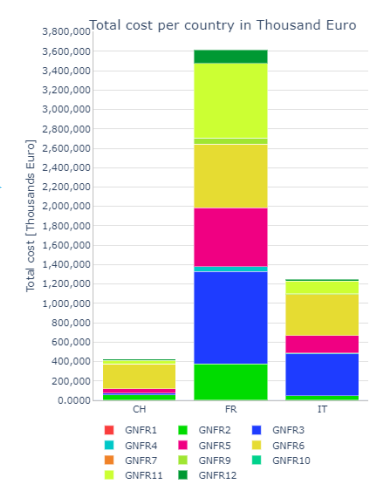
## Costs charts

Download image

Display values

Country: ALL

Download image



<https://jeodpp.jrc.ec.europa.eu/eu/dashboard/voila/render/SHERPA/Sherpa.ipynb>

# SHERPA Source allocation: default view

SHERPA: Source Allocation - Sectoral

EEA stations: **None** NO2 PM10 PM25

Display City Fiches

Search:

NUTS FUA CNC

- NUTS
- AUSTRIA
- BELGIUM
- BULGARIA
- SWITZERLAND
- CYPRUS
- CZECH REPUBLIC
- GERMANY
- DENMARK
- ESTONIA
- GREECE
- SPAIN
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- LITHUANIA
- LUXEMBOURG
- LATVIA
- REPUBLIC OF MONTENEGRO
- FORMER YUGOSLAV REPUBLIC OF
- MALTA
- NETHERLANDS
- NORWAY

Search city by name:

**Legend**

- city area and FUA area > 300 km<sup>2</sup>
- FUA area > 300 km<sup>2</sup>
- FUA area <= 300 km<sup>2</sup>

Reduction table

	ALL	GNFR1	GNFR2	GNFR3	GNFR4	GNFR5	GNFR6	GNFR7	GNFR8	GNFR9	GNFR10	GNFR11	GNFR12
ALL	<input type="checkbox"/>												
NOx	<input type="checkbox"/>												
NM VOC	<input type="checkbox"/>												
NH3	<input type="checkbox"/>												
PPM10	<input type="checkbox"/>												
PPM25	<input type="checkbox"/>												
SOx	<input type="checkbox"/>												

Milano.pdf

Italy, Milano

Urban monitoring stations (2019)

PM<sub>2.5</sub> PM<sub>10</sub>

Yearly average concentration (µg/m<sup>3</sup>)

Urban background levels and WHO Guideline Values

City area: 1331 km<sup>2</sup> PUV: 3.74 million inhab. Greater City area: 3034 km<sup>2</sup> PUV: 5.49 million inhab.

PM<sub>2.5</sub> Spatial and sectoral allocation

Sectors

- T - Transport
- I - Industry
- A - Agriculture
- R - Residential
- S - Shipping
- O - Other
- N - Natural
- E - External

Emissions (kt/year)

Percentage of total mass

Core city

Transboundary

Rest of the country

Commuting Zone

Greater City emissions

City emissions

PPM<sub>2.5</sub>

NH<sub>3</sub> NMVOC SO<sub>2</sub> NO<sub>x</sub>

# 'Planning' activities

Modelling in planning mode ... priorities:

- Using 'base-case biases' for planning (absolute value? % values?)
- Integrating local with larger scale air quality plans

Other actions:

- Checklist for reporting air quality measures – to improve reporting
- The AQ database of measures: we are looking for an alternative version of it



# Conclusions

**PM2.5 Atlas** confirms the main messages of the previous 2017 and 2021 versions:

- Local action is relevant but city specific
- Sector and pollutants to target are city-specific
- Residential heating and agriculture are confirmed as important contributors to urban pollution

## **Possible tasks for collaboration:**

- For benchmarking: emissions and concentrations dashboards are open to new deliveries!
- For planning: the cloud-version of SHERPA is now available
- For planning: Fairmode will now focus its work on the use of bias correction

# Thank you



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