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PORTO RIAT+ APPLICATION

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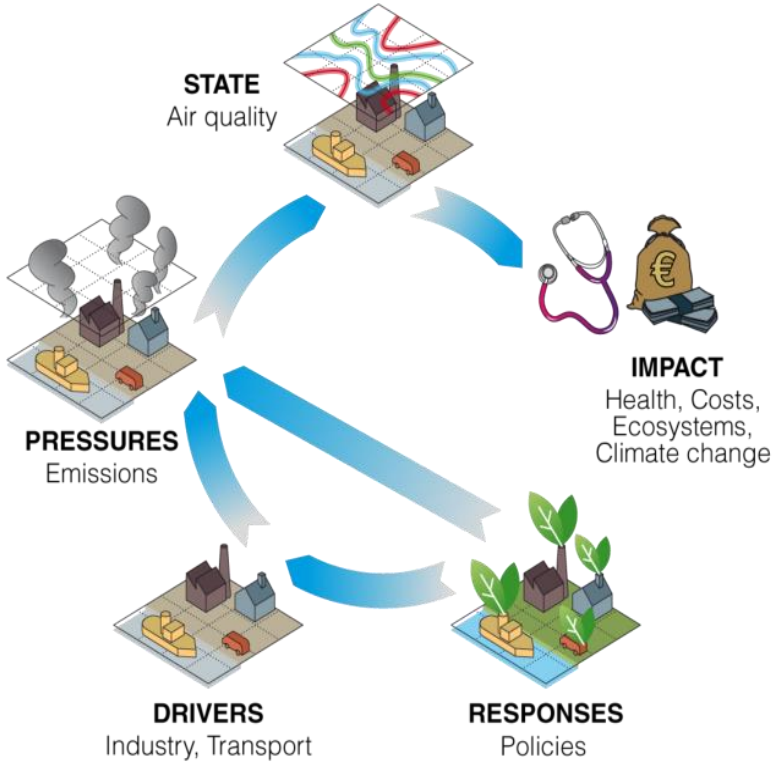
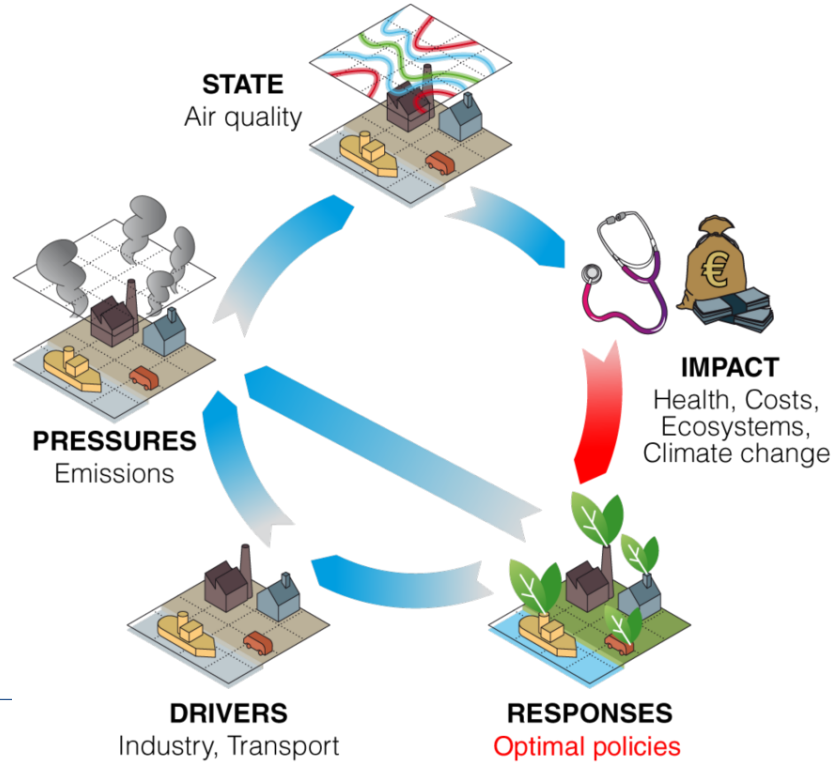
The challenge

The Porto region is one of the several EU urban areas that had to develop and implement AQPs to reduce particulate matter .

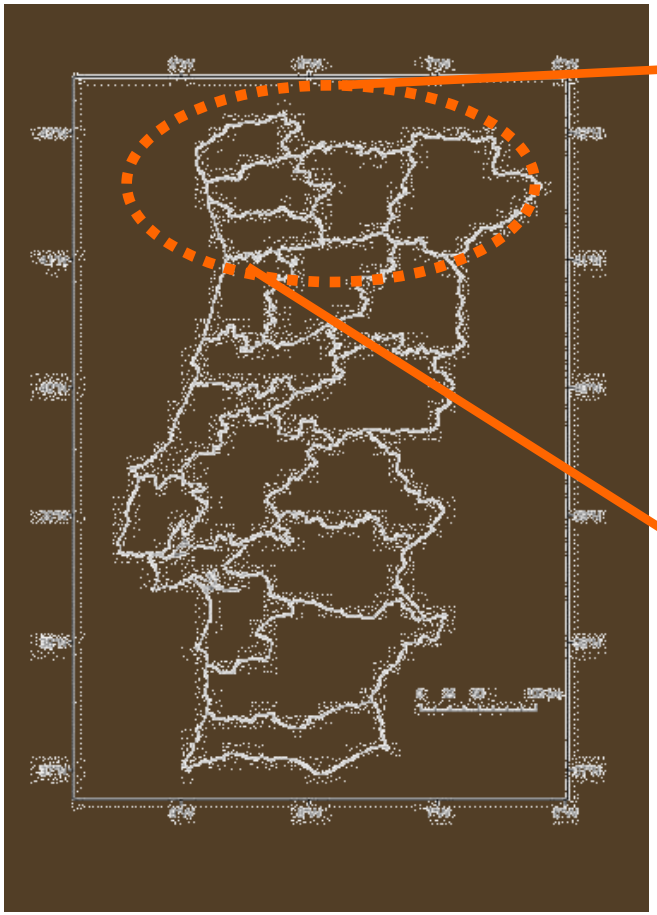
- The AQPs were designed based on a **scenario approach** and using an air quality model.

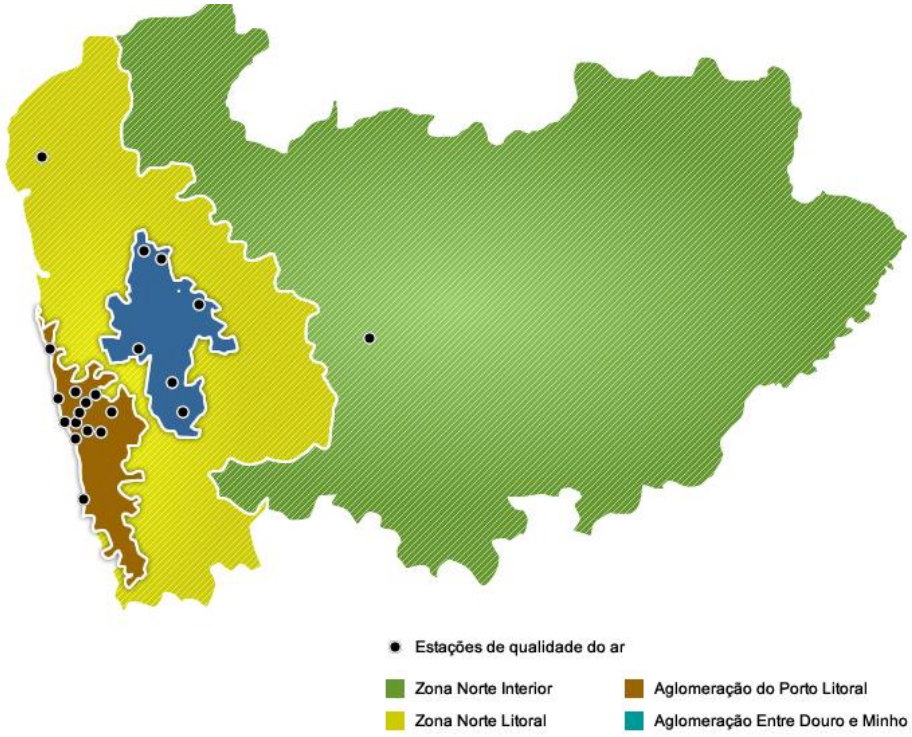


- To do an **optimization approach** based on the RIAT+ IA tool



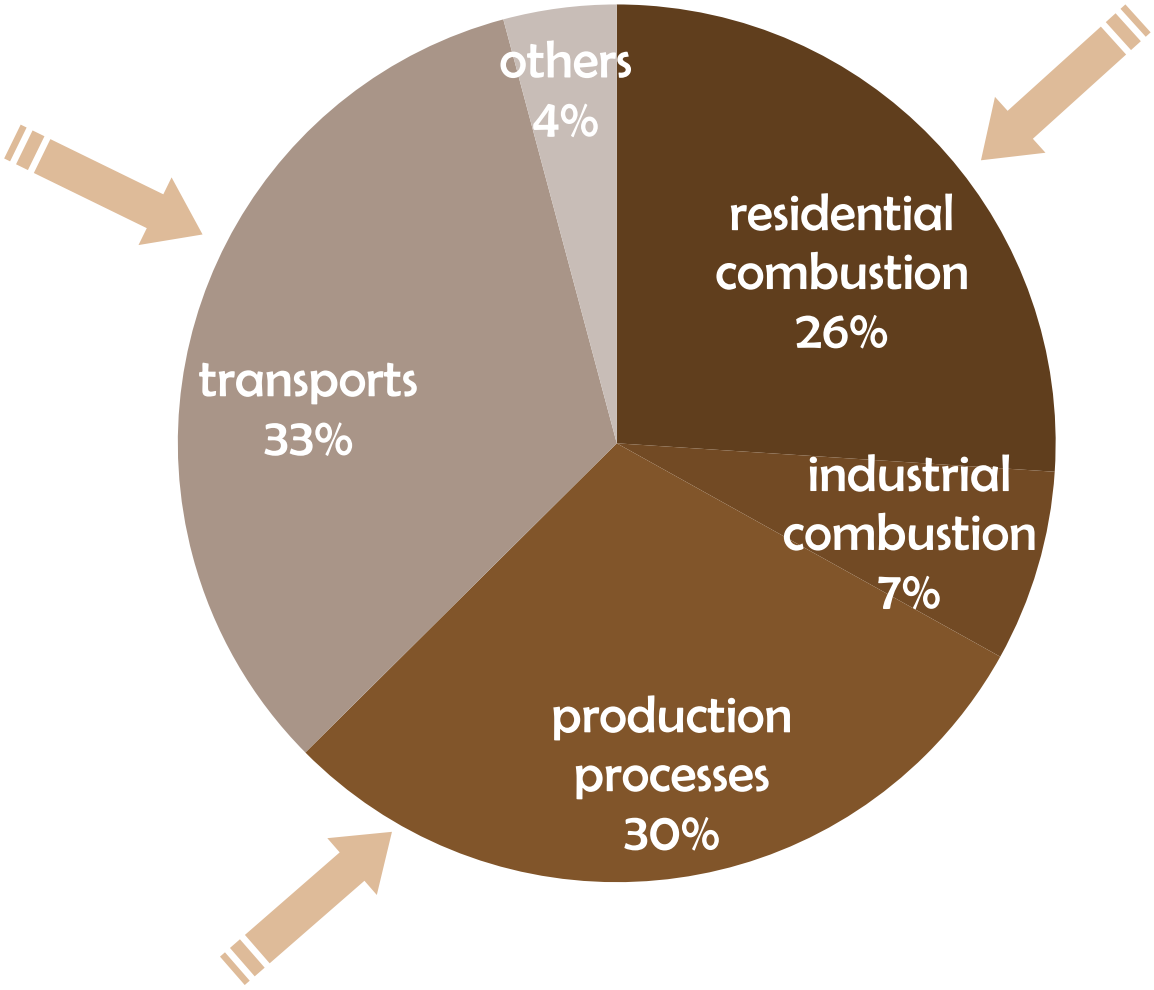
Northern Region





21 Air quality monitoring stations

PM10 emissions by sector in the Northern Region

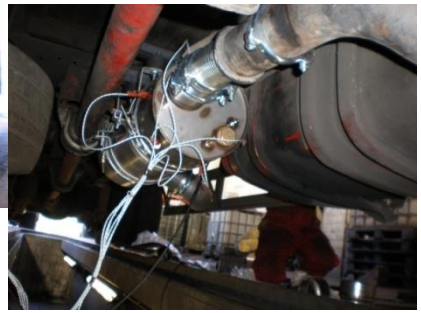


Measures	Traffic measures / Production processes / Residential combustion	Costs (€)
M1	Introduction of low-emission vehicles for transport of passengers and goods	13,668,042.45
M2	Improvement of public transport network	147,928,092.20
M3	Car sharing	
M4	Renewal of the fleet of taxis and vehicles for waste collection	525,186.00
M5	Decrease the percentage of heavy goods vehicles in circulation	
M6	Car parks peripheral construction	
M7	Strengthening the monitoring of illegal parking	4,800.00
M8	Low Emission Zones (LEZ)	
M14	Cut-off streets to traffic	14,316,996.19
M15	Introduction of public fueling stations for natural gas	
M16	Promote the implementation / improvement of industrial air cleaners	12,500,000.00
M17	Enhanced surveillance of stationary sources	67,500.00
M19	Emissions reduction from residential combustion	
M20	Reduction of particle emissions from agriculture and forests	1,772.00
M21	Street sweeping and washing	465,821.00
M22	Dust emissions reduction on construction sites	
M24	Environmental education and recomendation	144,050.00
	Total	**189,622,259.84**

Some measures …

Certified combustion appliances with PM emissions reduction

Diesel Particle filter

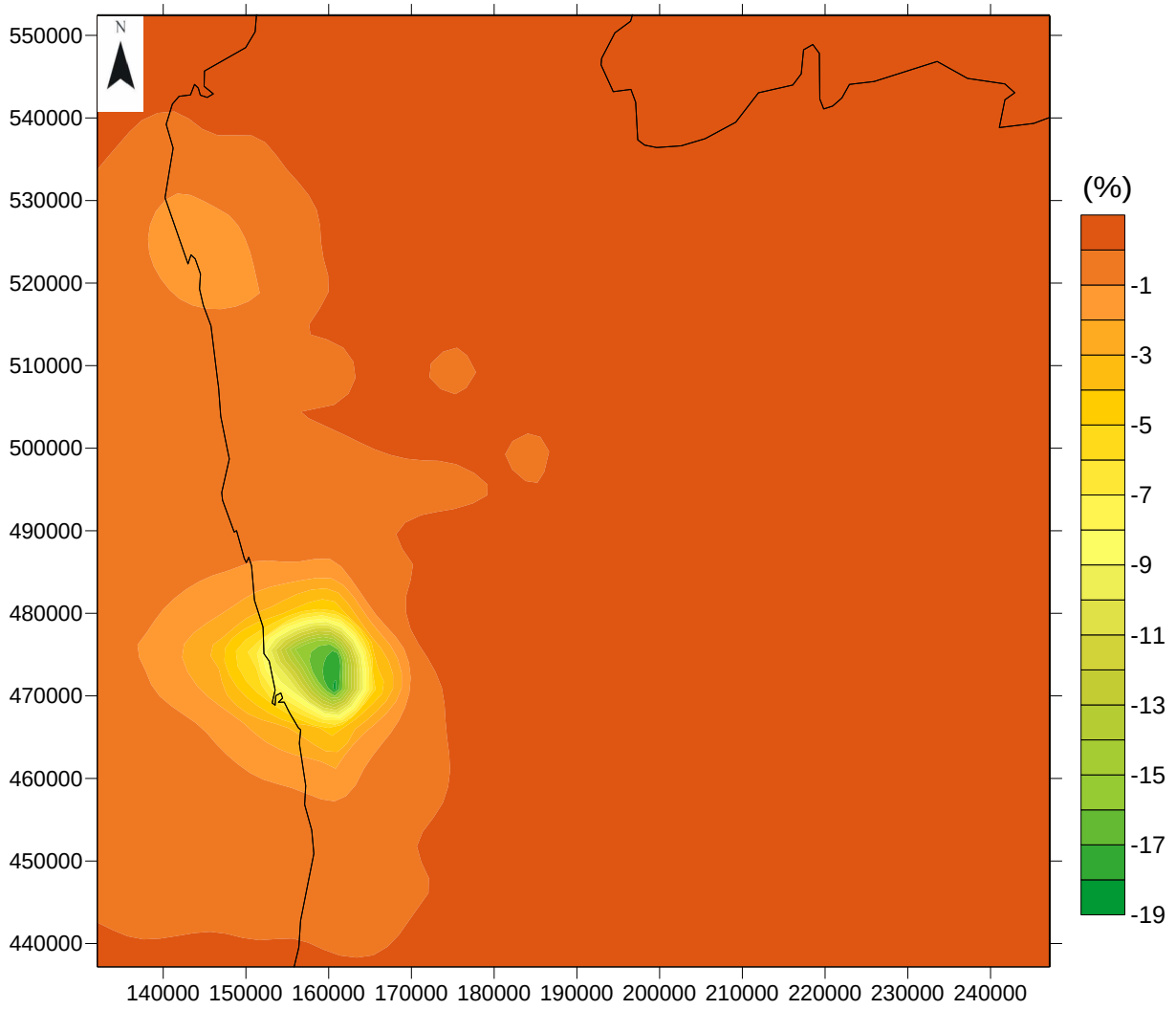


Improvement of industrial PM retention systems

Reinforcement of the inspection of industry sources

Public transportation with lower emission and improvement of public transport network

Spatial differences between base and reduction scenarios (2004) – annual mean



↓ 19 % [PM10] over Porto region

More information:

(Borrego *et al.*, 2012) Plans and programmes to improve air quality over Portugal: a numerical modelling approach

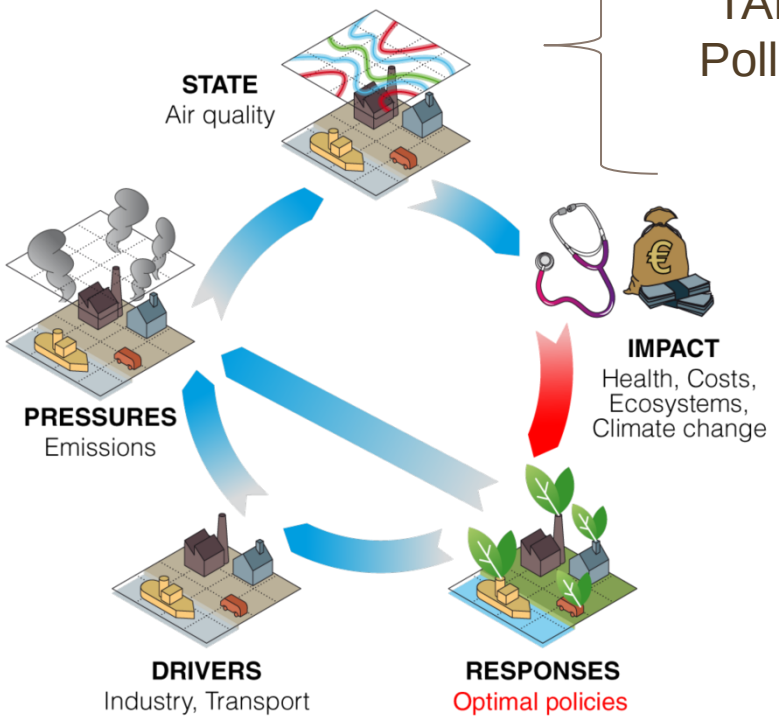
(Tente *et al*., 2011) Evaluating the efficiency of Diesel Particulate Filters in high-duty vehicles: Field operational testing in Portugal

(Borrego *et al*., 2010) Contribution of residential wood combustion to PM10 levels in Portugal

Application of the integrated assessment tool RIAT + to Porto urban area

TAPM (The Air Pollution Model)

Portuguese emission inventory (2009)



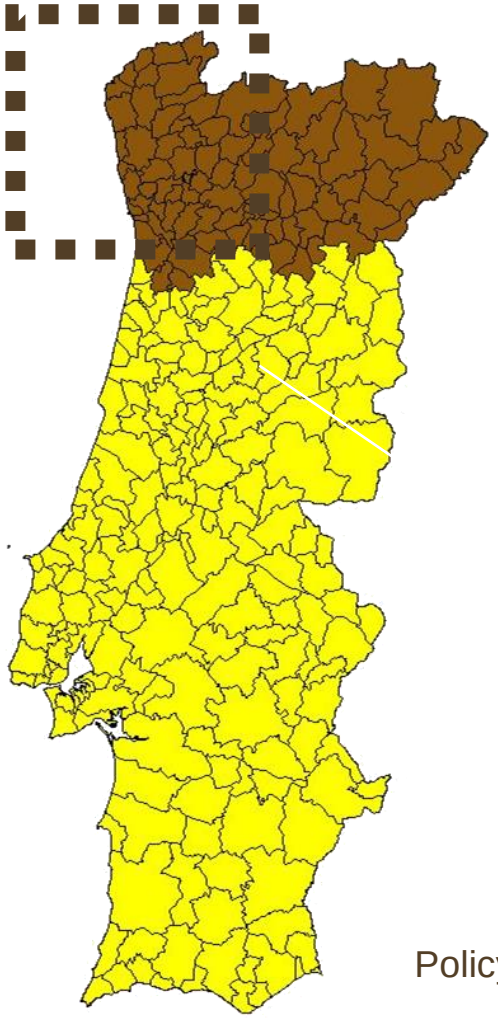
TAPM (The Air Pollution Model)

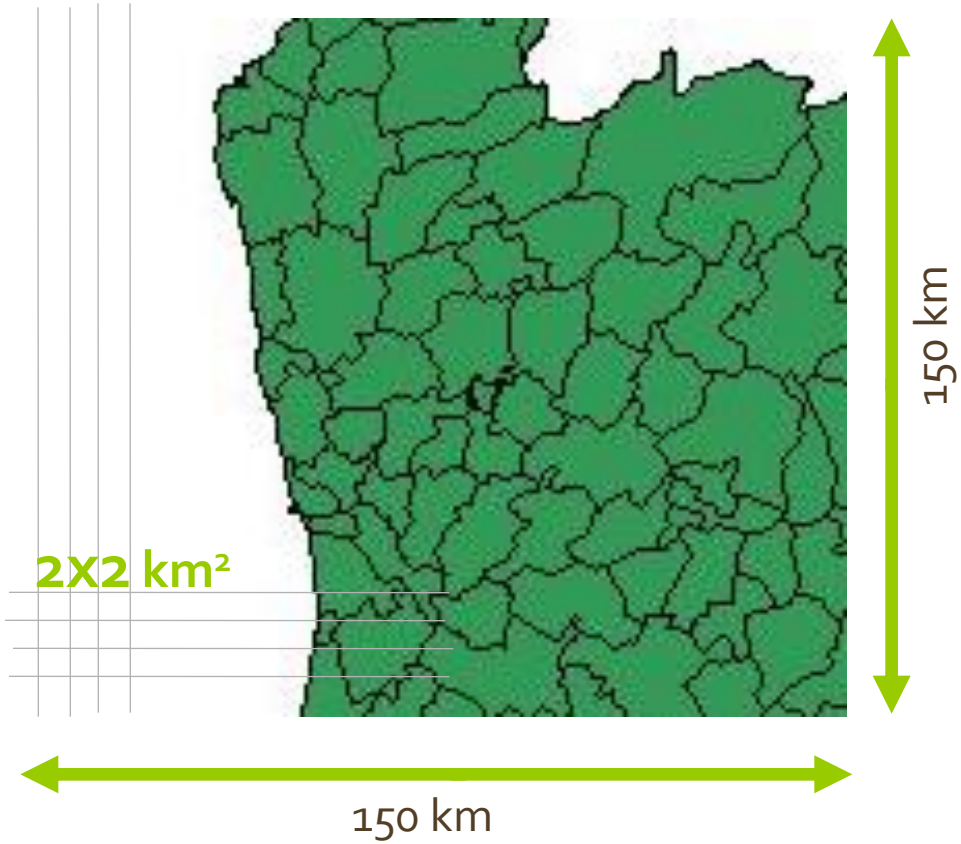
- A 3D prognostic meteorological and chemical transport integrated modelling system, with a Lagrangian particle model option for point source dispersion.

- CSIRO Marine and Atmospheric Research

- Pollutants: SO_2, NOX, NO_2, PM10, PM2.5, O_3

RIAT+ Application: Simulation domain





Policy Application Domain (PAD) → **Great Porto (11 Municipalities)**

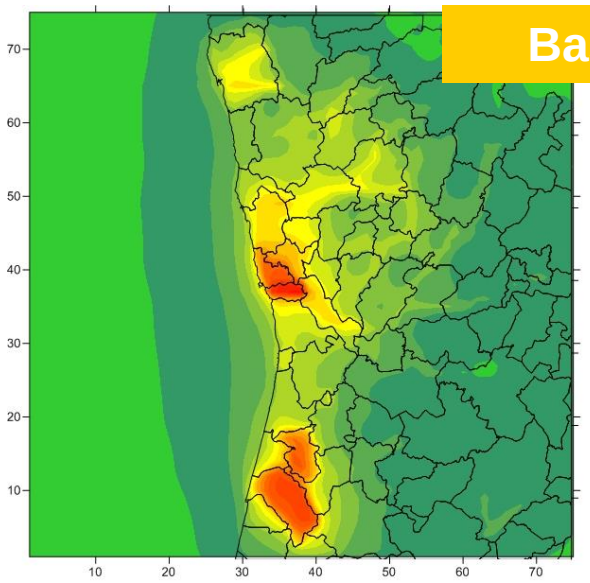
Creation of simulation scenarios

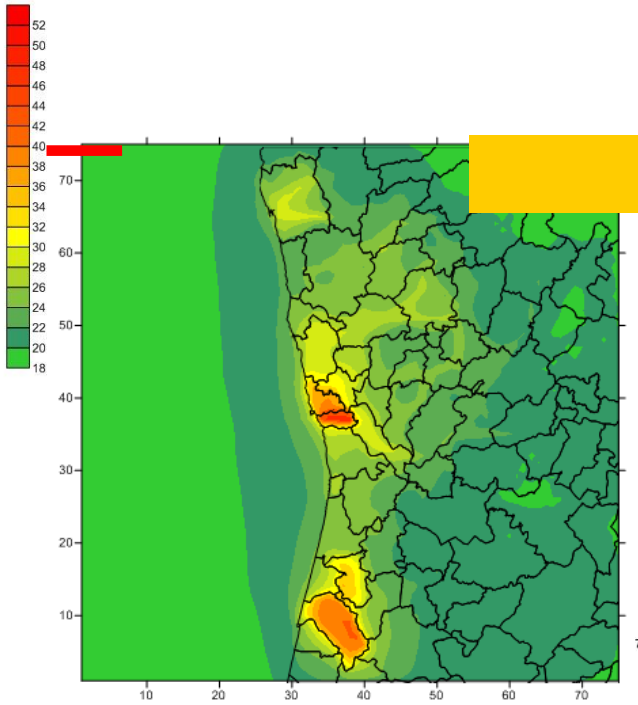
Scenarios	NOXa	VOXa	NH3a	PMa	SO2a	NOXp	VOCp	NH3p	PMp	SO2p
0	B	B	B	B	B	B	B	B	B	B
1										B
2										B
3										B
4										B
5										B
6										B
7										B
8	H	H				B	B	B	B	B
9	H		H	H	H	B	B	B	B	B
10	H		H			B	B	B	B	B
11	H		H		H	B	B	B	B	B
12	B	B	B	B	B	L	L	L	L	L
13	B	B	B	B	B	H	H	H	H	H
14	B	B	B	B	B	H			H	H
15	B	B	B	B	B					H
16	B	B	B	B	B	H				H
17	H	H	H	H	H	H	H	H	H	H
18	H		H	H	H	H			H	H
19					H					H
20	H		H		H	H				H
21	H	H				H	H			

The letters B, L and H used in the table have the following meaning:
- B: Current Legislation (CLE) emissions + 15% ;
- L: average of Current Legislation (CLE) and Maximum Feasible Reduction (MFR)
- H: Maximum Feasible Reduction (MFR) at 2020.

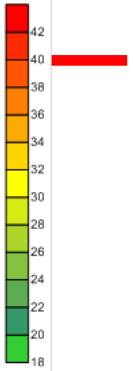
Some Results – annual mean PM10 ($\mu g.m^{-3}$)

Basecase – scenario 0

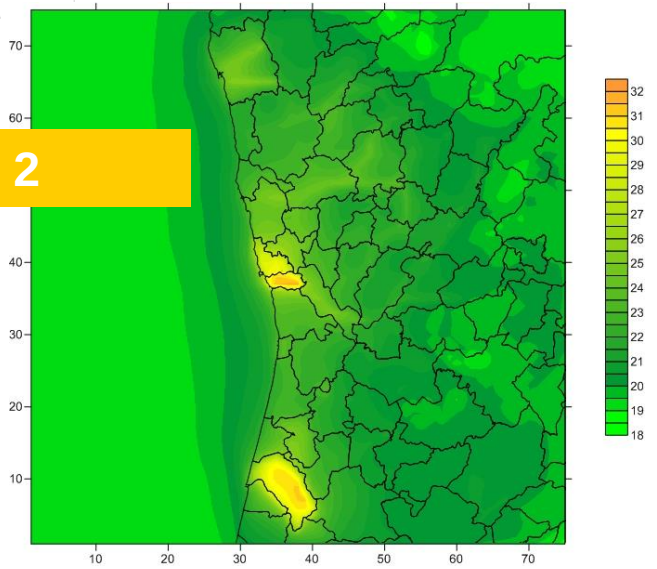




scenario 1



MFR – scenario 2

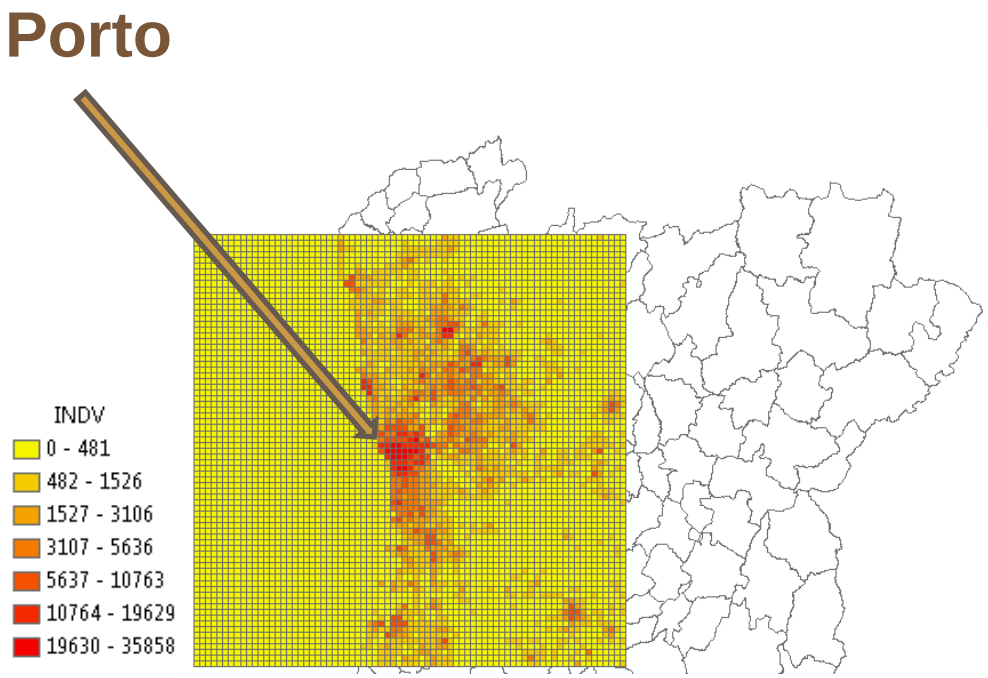


RIAT+ IMPLEMENTATION

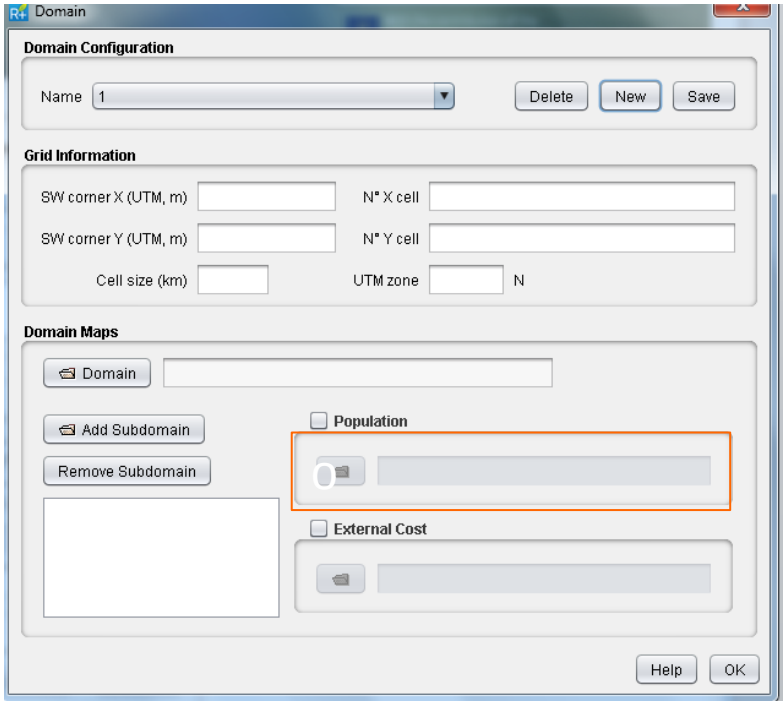
To implement RIAT+ 4 main setting are needed:

- Domain
- Measures DB
- Emission Inventory
- S/R functions

RIAT+: domain



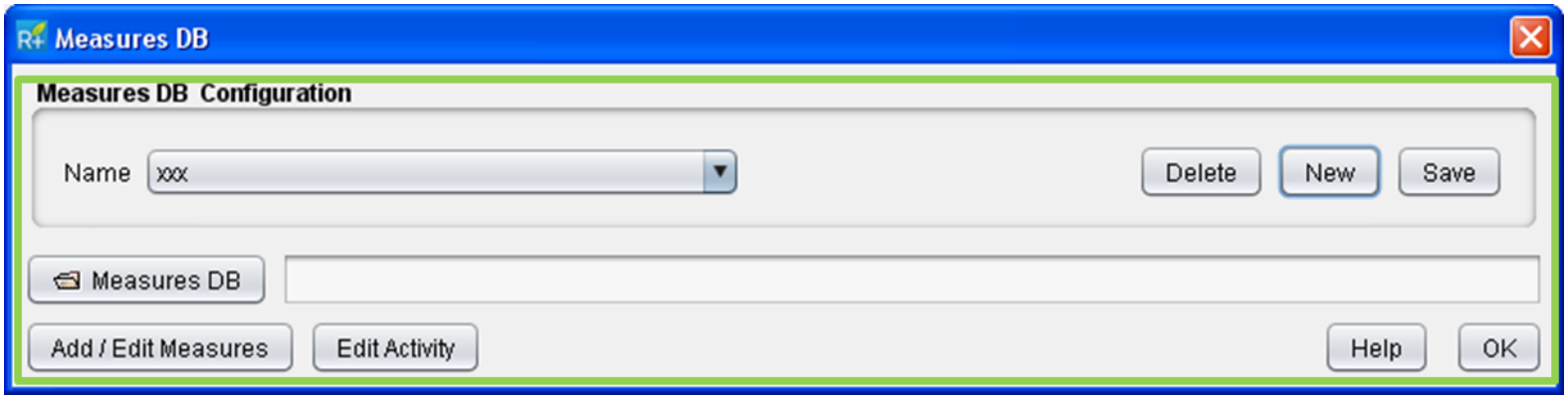
Population on the gridded domain



Status: OK

RIAT+: Technology DB

Status: OK



- **It has been downloaded from IIASA web site (http://gains.iiasa.ac.at/gains/EUN/index.login?logout=1)**
- **The reference scenario is «TSAP» of March 2013, Portugal**
- **The technology database is made up of 420 «triplet» (sector-activity-technology) and of 130 (sector-activity).**
- **In a second phase non-technical measures will be included**

RIAT+: Inventory

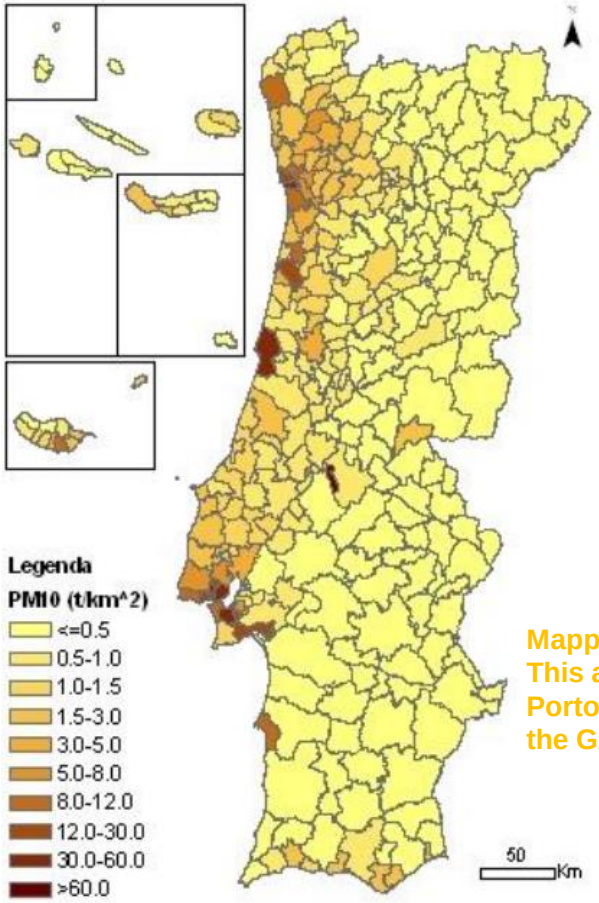
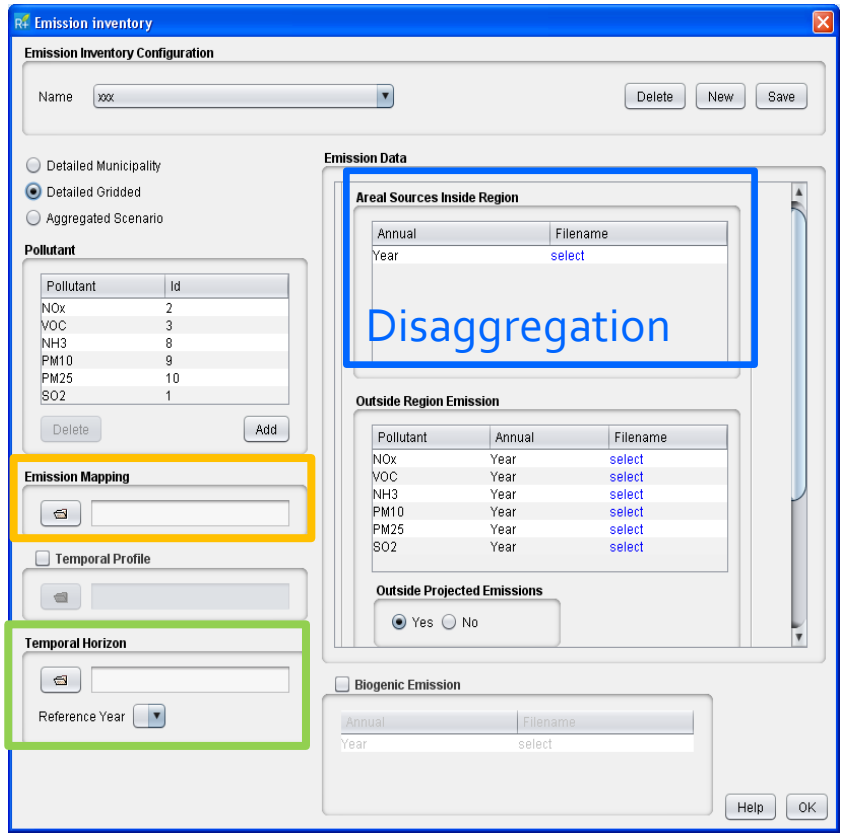


Figura 19. Emissões de PM_{10} em 2009

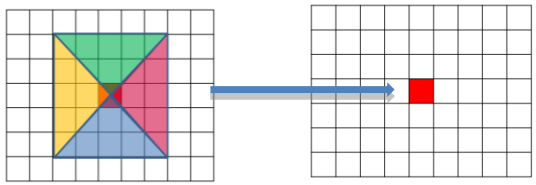
In progress …From macrosector to activity detail

Mapping
This action is necessary to link Porto emission inventory to the GAINS world

Temporal Horizon: 2010-2020-2025-2030
Reference year: 2010



RIAT+: S/R

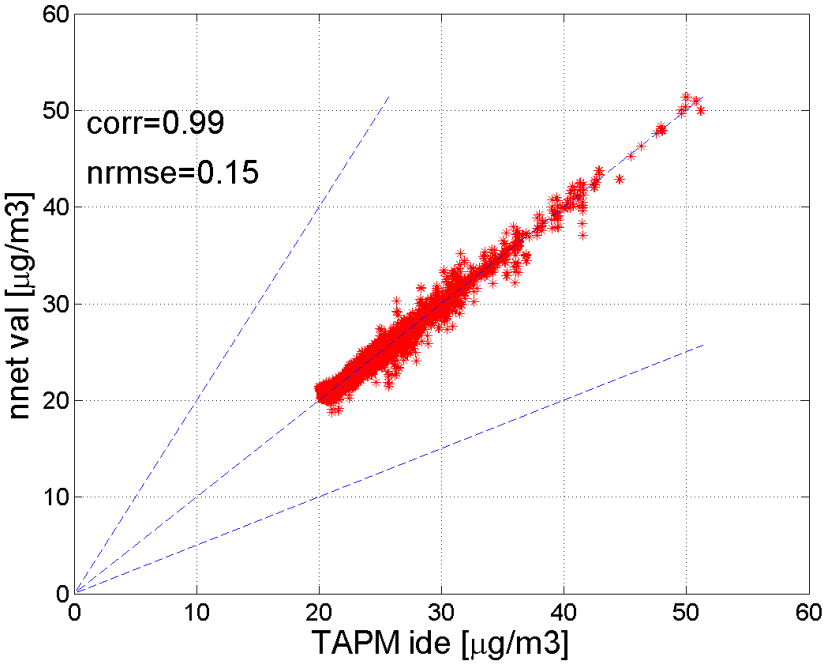


Status: OK

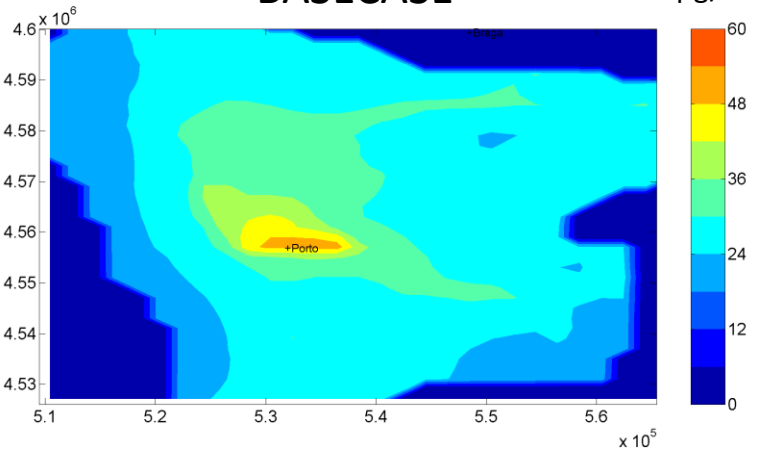
20 Simulation scenarios

	RADIUS (NUMBER OF CELLS)	FUNCTIONS
PM10	**4**	**Logsig - purelin**
PM25	4	Logsig - purelin
NO2	**14**	**Tansig - purelin**
AOT40	14	Logsig - tansig
SOMO35	14	Logsig - tansig
MAX8H	14	Logsig - purelin

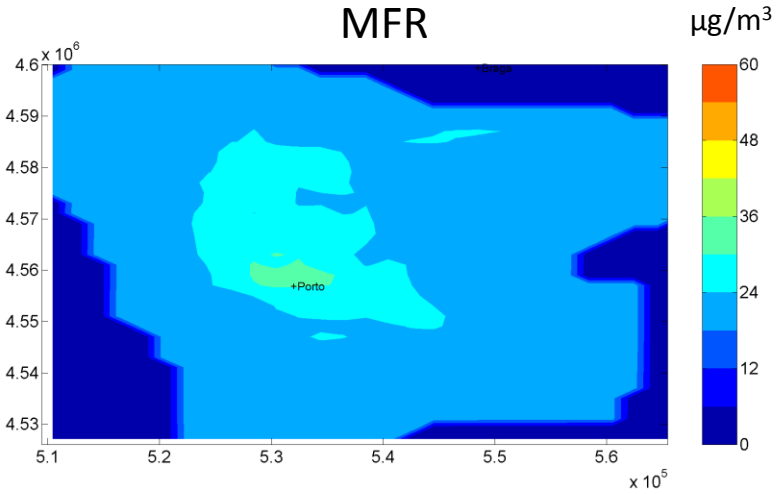
PM10 – net



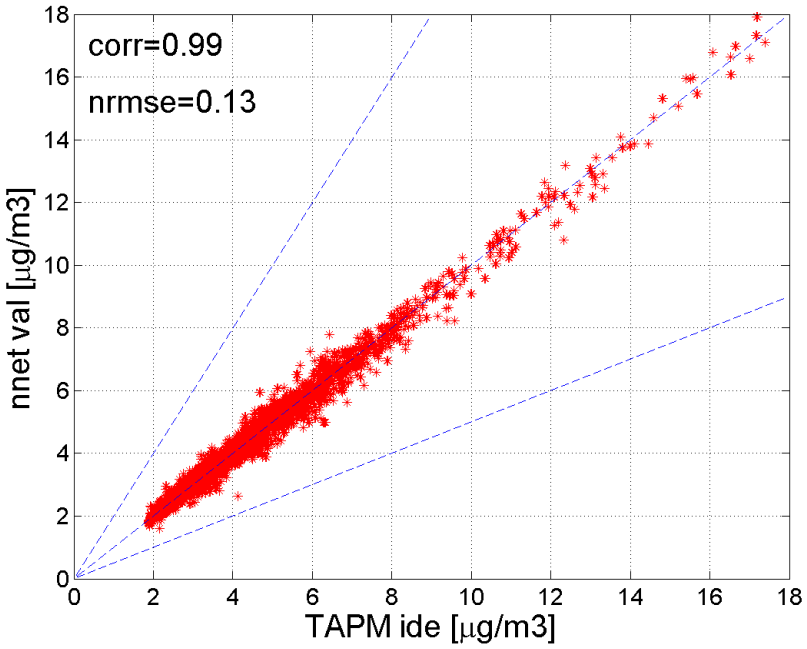
BASECASE



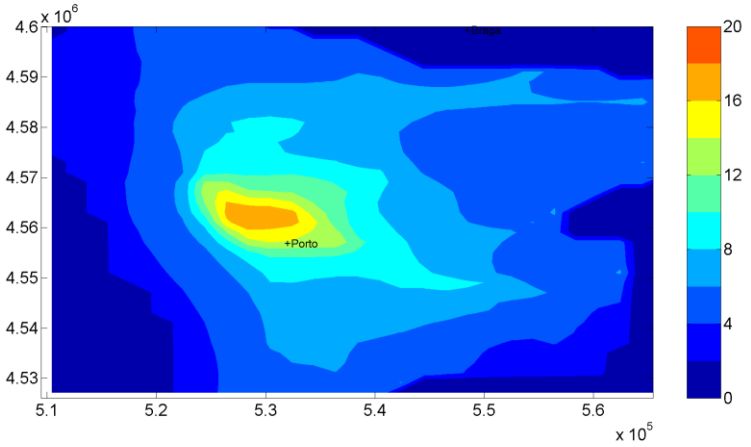
MFR



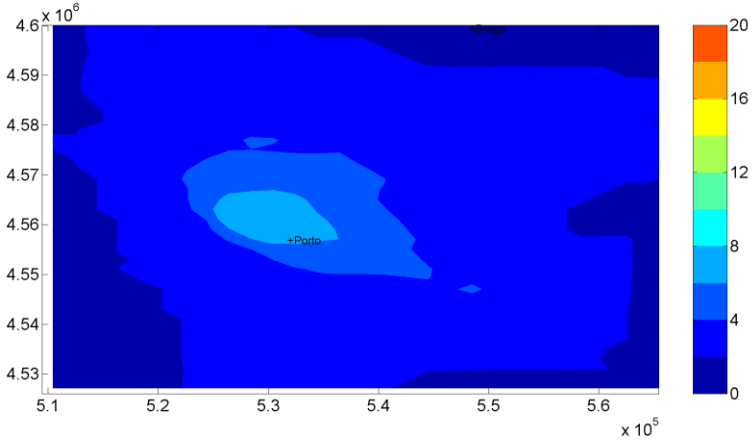
NO_2 – net



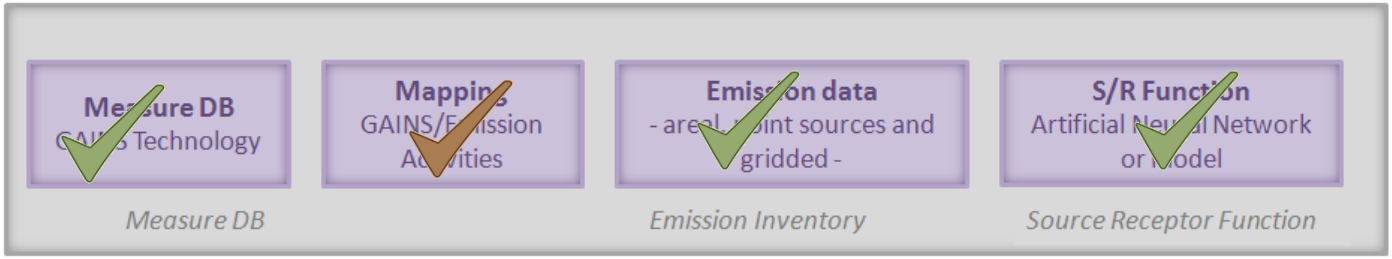
BASECASE µg/m³

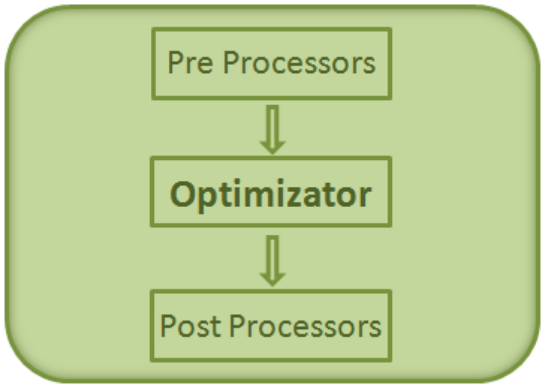


MFR µg/m³



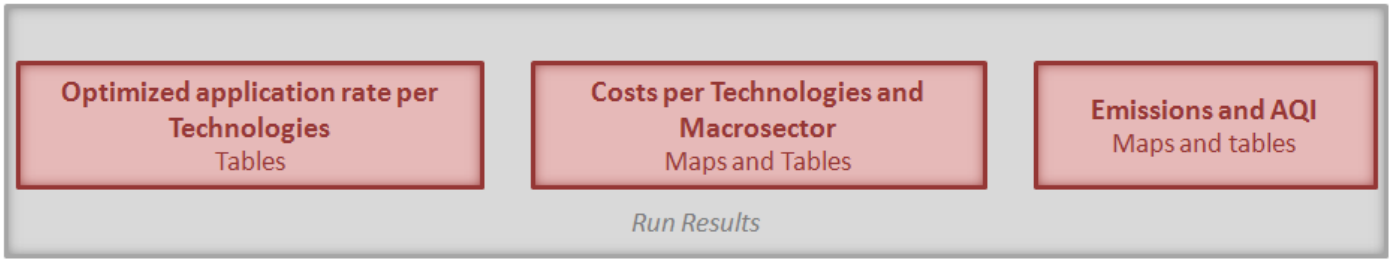
INPUT





RIAT + CORE SYSTEM

OUTPUT



Difficulties

Disaggregation and mapping

Sometimes it is necessary to make approximations and most of the activity mapping work is “manual”, comparing case by case.

Technology DB

In GAINS database the MFR Application Rate values are smaller than CLE application rate or is set to zero.

Future work

- Run RIAT+ configurations and analyze the results






Obrigado!

Thank you!

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