



# Opera



**Operational Procedure for Emission Reduction Assessment**  
**LIFE09 ENV/IT/000092 (2010-2013)**

An integrated assessment methodology to plan local cost-effective air quality policies  
harmonized with national and European actions

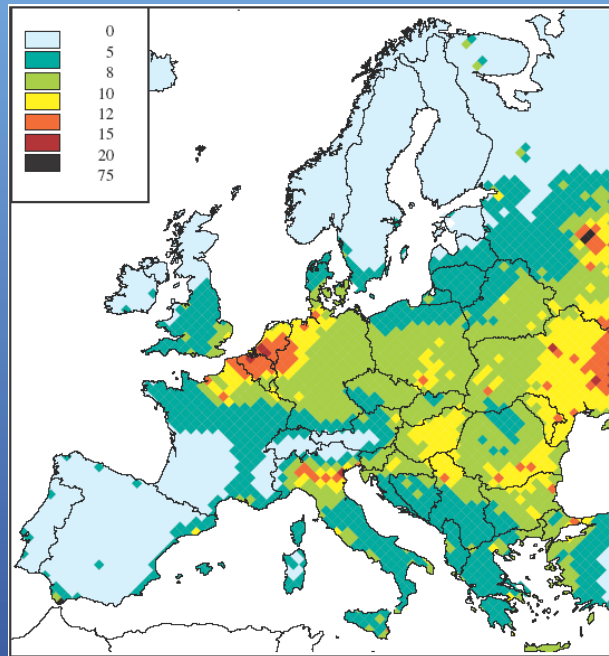
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# Background

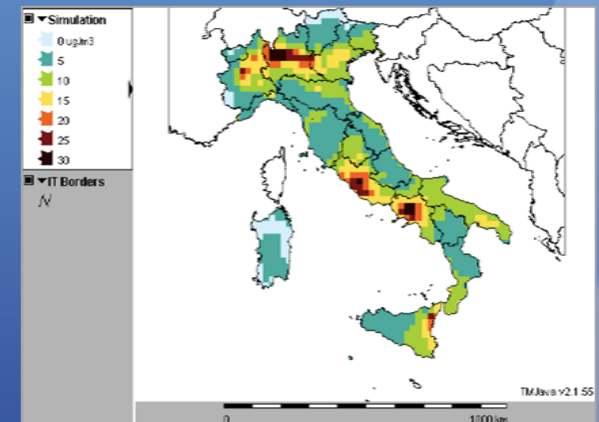
## European scale

- Rains/Gains by IIASA



## National scale

- GAINS Italy by ENEA
- GAINS-Netherlands
- FRES-Finland
- .....





# Objectives

In agreement with the EU Thematic Strategy for air quality (COM(2005) 446) and the DIRECTIVE 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe, the project objectives are:

- To set-up a methodology to assist sub-national authorities in:
  - preparing, implementing and monitoring air quality plans to reduce population exposure to PM<sub>10</sub>, NO<sub>x</sub> and O<sub>3</sub> pollution and ecosystems exposure to NO<sub>x</sub> and O<sub>3</sub>;
  - integrating regional air quality plans with national and European plans;
  - assessing the synergies between actions to reduce the burden of poor air quality and actions to limit climate change impacts.
- To develop an integrated assessment tool (**RIAT+**) to support the proposed methodology.
- To apply this integrated tool on the Emilia-Romagna (Italy) and Alsace (France) regions.
- To define guidelines for sub-national authorities to apply the methodology and tool.





# Expected results

- RIAT+, a software tool to support local authorities in designing and assessing efficient air quality plans.
- RIAT+ application to Emilia Romagna (IT) and Alsace (FR) and assessment of air quality plans in these two regions.
- A register collecting non-technical emission reduction measures.
- A full documentation, workshops and courses to support new users implementing the methodology to other European regions.
- A standardized set of quantitative indicators to monitor the action plans effectiveness.
- Guidelines for local administrations and environmental agencies to integrate local planning to national and European air quality policies.





# Actions

- **Preparatory Tasks**

P<sub>1</sub>: Review of existing plans and methodologies, identification of RIAT+ requirement

P<sub>2</sub>: Data collection in Emilia Romagna

P<sub>3</sub>: Data collection in Alsace

- **Implementation Tasks**

I<sub>1</sub>: RIAT+ methods and design

I<sub>2</sub>: RIAT+ software implementation

I<sub>3</sub>: Application to Emilia Romagna (I) region

I<sub>4</sub>: Application to the Alsace (F) region

- **Communication Tasks**

- **Management Tasks**





# Partners

- ARPA-ER (IT): Emilia-Romagna exercise and coordinator
- UNIVERSITY OF BRESCIA (IT): RIAT+ models
- TERRARIA srl (IT): RIAT+ software implementation
- CNRS (FR): Alsace exercise
- UNIVERSITÉ DE STRASBOURG (FR): Alsace exercise





# Stakeholders

(in the steering committee)

- Regione Emilia Romagna (IT)
- ASPA (FR)

and in cooperation with JRC (EC)





# RIAT (2009-2010)



# RIAT

## Regional Integrated Assessment Tool

A DSS for air quality planning developed by



DII, Università di Brescia (I) and TerrAria srl (I)



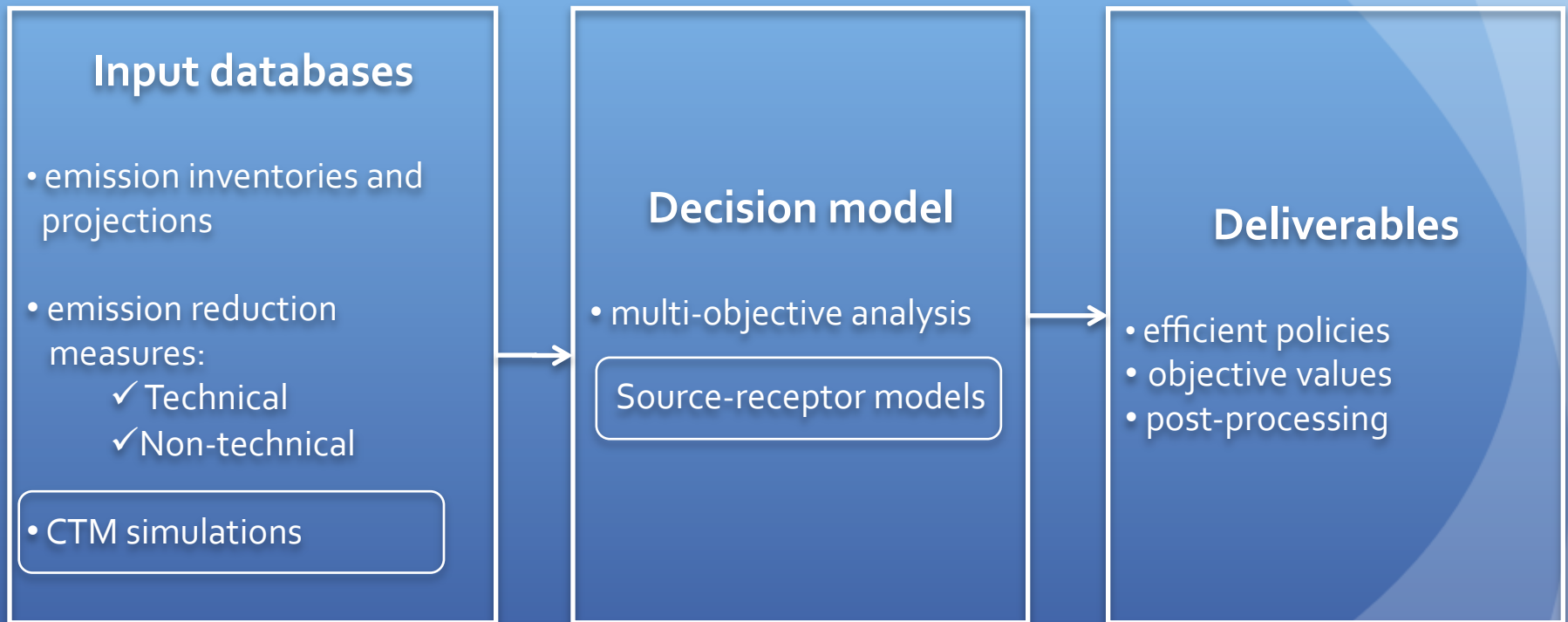
*with consultancy of DEI - Politecnico di Milano (I) -  
and Les White Associates Ltd (EN)*



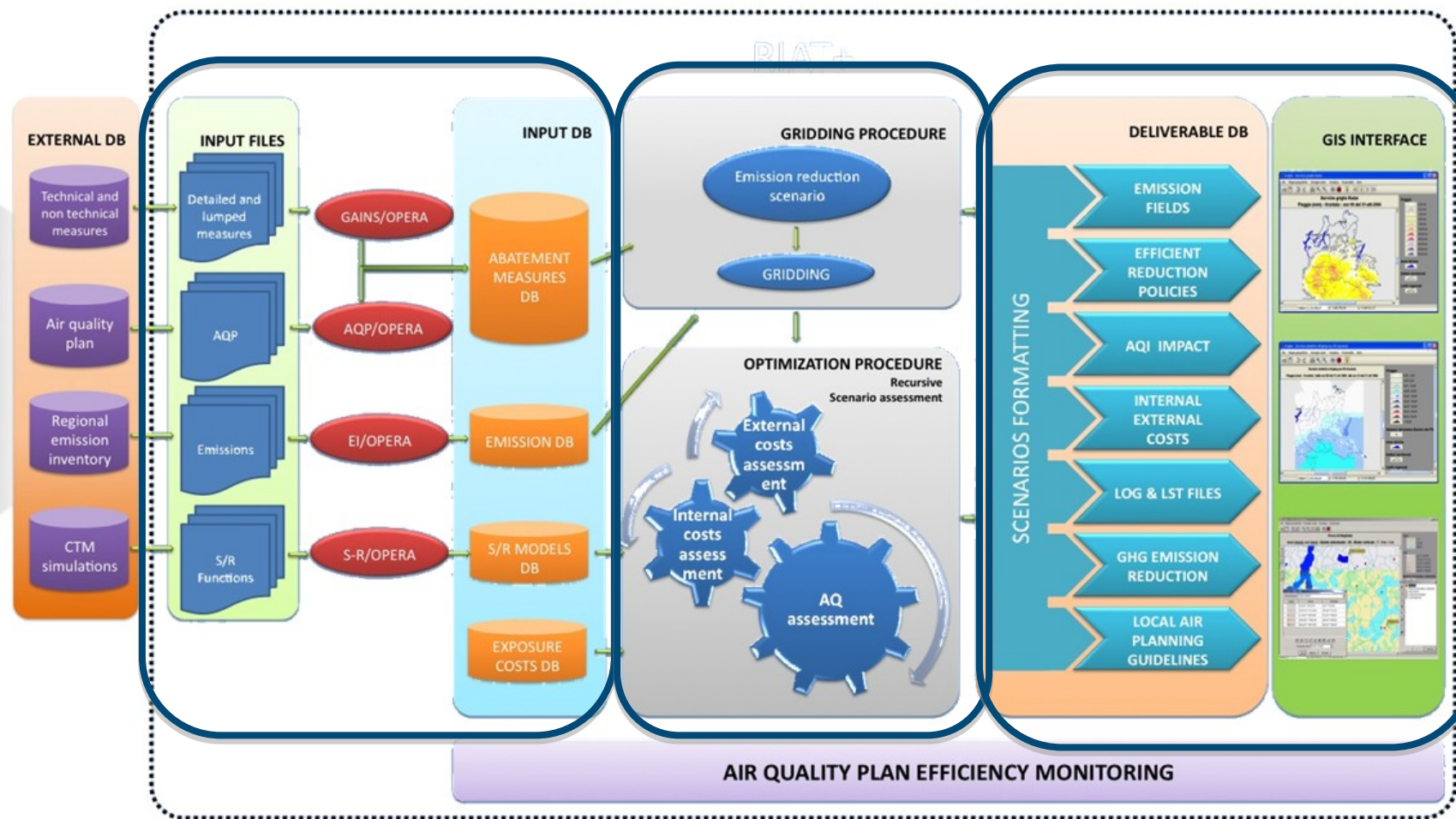




# RIAT architecture



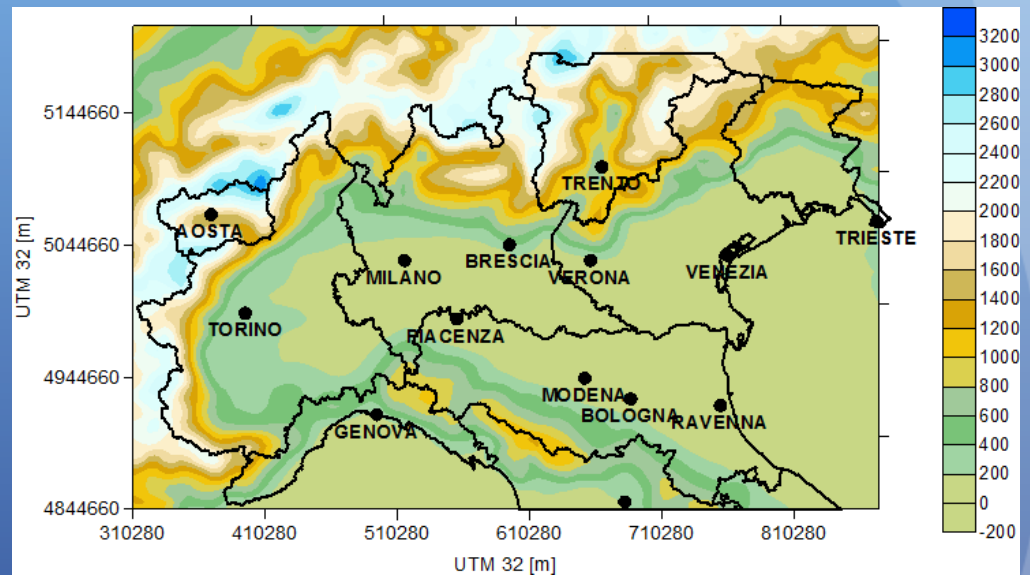
# RIAT system architecture



# RIAT basecase

- Simulation domain: 570x372 km<sup>2</sup>
- Spatial resolution: 6x6 km<sup>2</sup>
- Emissions: CLE2010
- Meteo: 2005 (MM5)
- B.C.: CLE2010

POMI project





# Decision problem

$$\min_{\theta} J(\theta) = \min_{\theta} [AQI(\theta) \quad C(\theta)]$$

Internal Costs

Air Quality Index: PM<sub>10</sub>, PM<sub>2.5</sub>, Ozone

$\theta \in \Theta$

Set of feasible decisions

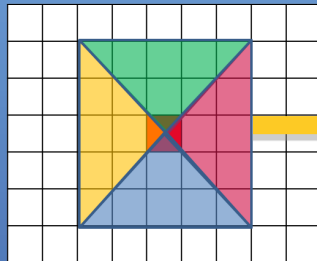
Set of decision variables (precursor emission reduction measures)



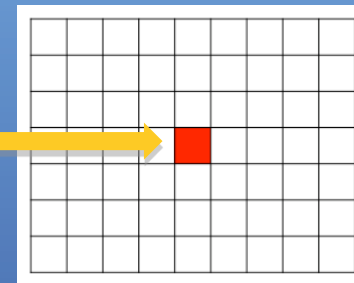
# Source-receptor models: ANN

- Input data: precursor emissions
- Target data: AQI

ANNs inputs:  
quadrant precursor emissions



ANNs output:  
AQI



- Identification pattern: 21 TCAM simulations (POMI project)





# TCAM simulations

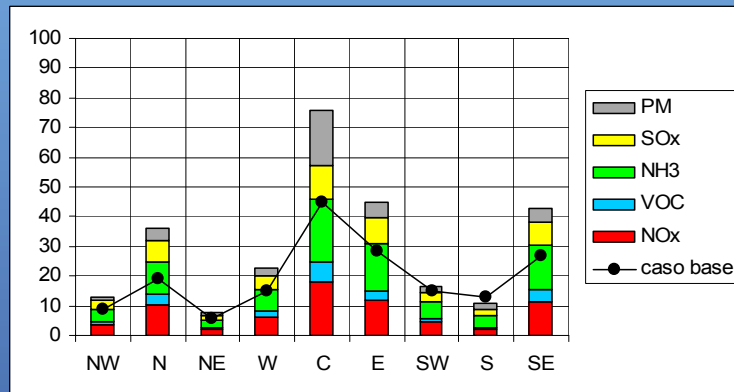
SCENARIOS	AREAL EMISSIONS					POINT EMISSIONS				
	NOX	VOC	NH3	PM	SO2	NOX	VOC	NH3	PM	SO2
1	L	L	L	L	L	B	B	B	B	B
2	H	H	H	H	H	B	B	B	B	B
3	H	L	L	L	L	B	B	B	B	B
4	L	H	L	L	L	B	B	B	B	B
5	L	L	H	L	L	B	B	B	B	B
6	L	L	L	H	L	B	B	B	B	B
7	L	L	L	L	H	B	B	B	B	B
8	L	H	L	H	L	B	B	B	B	B
9	H	H	L	H	H	B	B	B	B	B
10	H	L	H	L	L	B	B	B	B	B
11	B	B	B	B	B	L	L	L	L	L
12	B	B	B	B	B	H	H	H	H	H
13	B	B	B	B	B	H	L	L	H	H
14	B	B	B	B	B	L	L	L	L	H
15	B	B	B	B	B	H	L	L	L	H
16	L	L	L	L	L	L	L	L	L	L
17	H	H	H	H	H	H	H	H	H	H
18	H	L	L	H	H	H	L	L	H	H
19	L	L	L	L	H	L	L	L	L	H
20	H	L	L	L	H	H	L	L	L	H

**B = CLE+10% (2010)**  
**L = (CLE+MFR)/2 (2015)**  
**H = MFR (2020)**

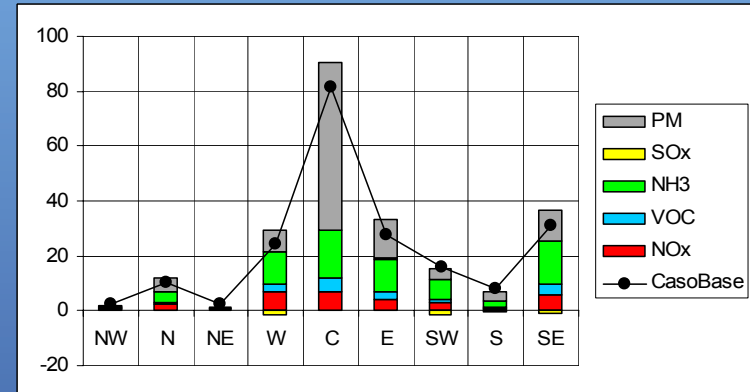


# Design of Experiments factor separation analysis

## Summer total impact



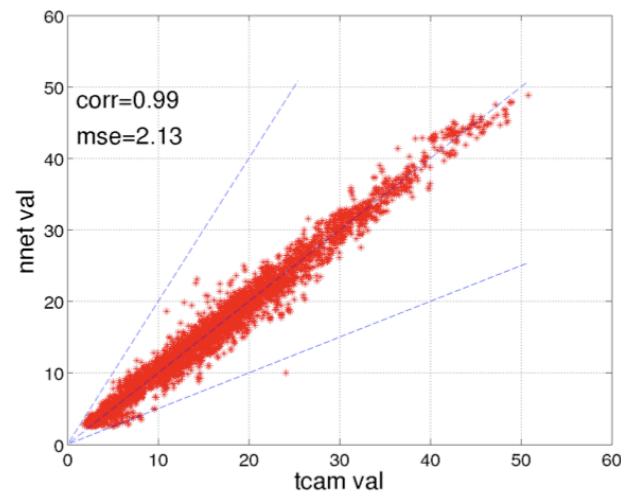
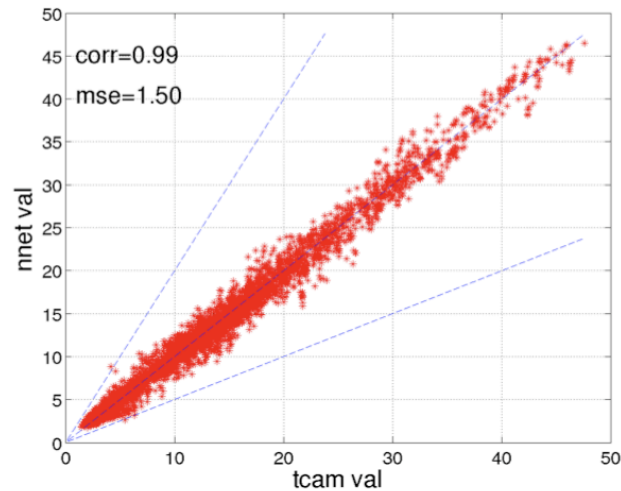
## Winter total impact





# PM<sub>2.5</sub> and PM<sub>10</sub> ANNs validation

scatter



indexes

Mean TCAM [mg/m <sup>3</sup> ]	14.15
Mean ANN [mg/m <sup>3</sup> ]	14.03
corr	0.99
Abs err [%]	0.06
rmse	1.23

Mean TCAM [mg/m <sup>3</sup> ]	15.9
Mean ANN [mg/m <sup>3</sup> ]	15.87
corr	0.99
Abs err [%]	0.07
rmse	1.46

PM<sub>2.5</sub> [μg/m<sup>3</sup>]

PM<sub>10</sub> [μg/m<sup>3</sup>]



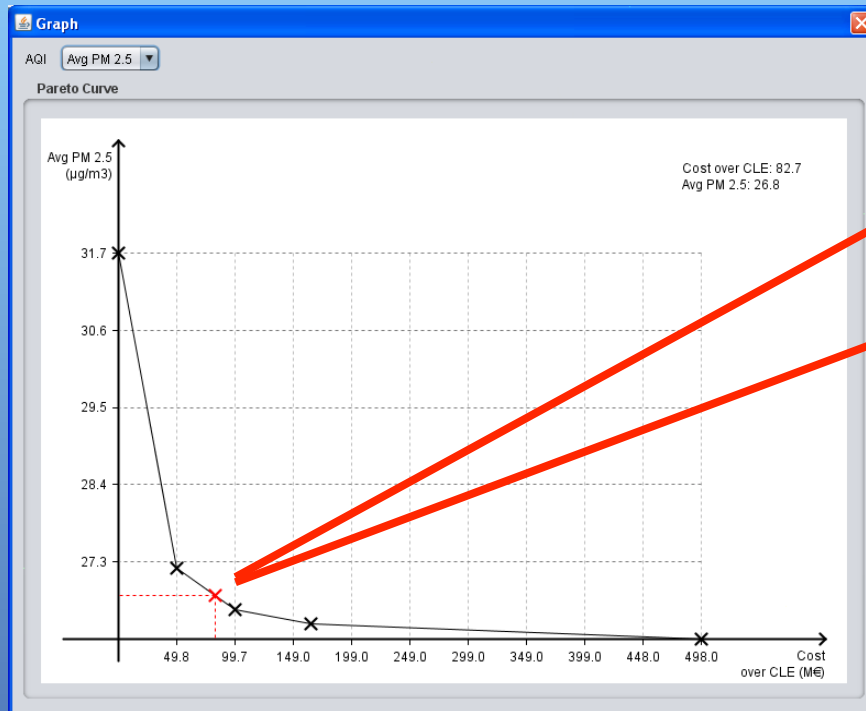


# RIAT output

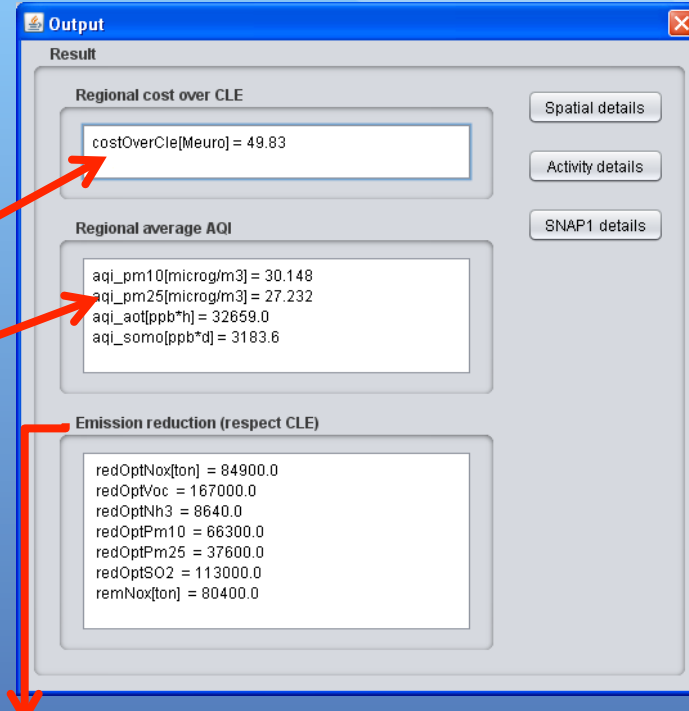
A project co-funded by the  
EU-LIFE programme



## Pareto Boundary



## Effective policy



Result Table

Result table

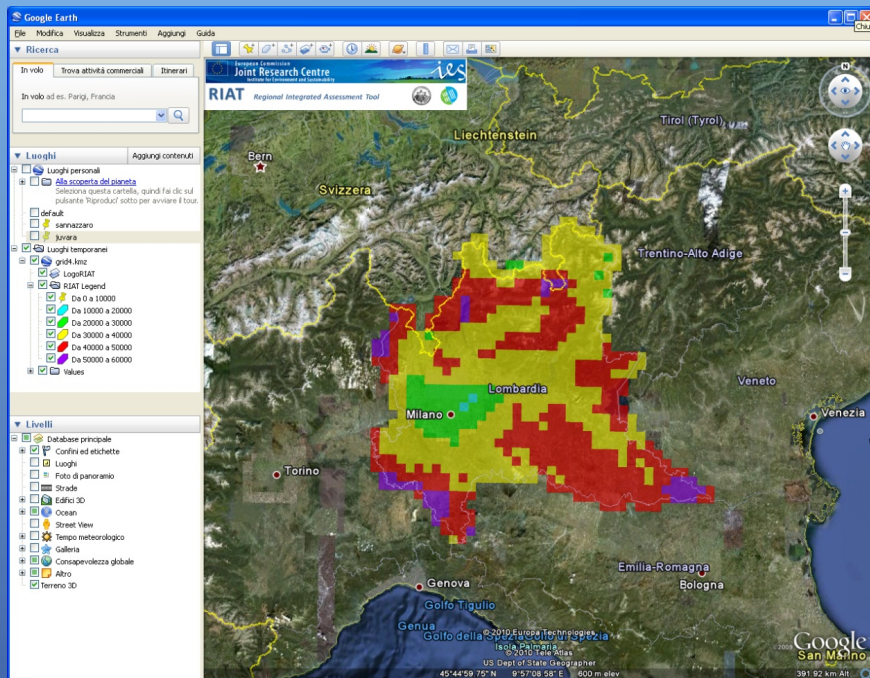
ms	sec	act	tec	lo...	Application rate (-1<+0<+1)	C
1	Agriculture: Livest...	No fuel use	Feed modification (all ...	1		0
1	Agriculture: Livest...	No fuel use	Hay-silage for cattle	1		0
1	Agriculture: Livest...	Other cattle - li...	Covered outdoor stora...	1		0
1	Agriculture: Livest...	Other cattle - li...	Combination of CS_L...	1		2
1	Agriculture: Livest...	Other cattle - li...	Covered outdoor stora...	1		0
1	Agriculture: Livest...	Other cattle - li...	Low ammonia applica...	1		0
1	Agriculture: Livest...	Other cattle - li...	Low ammonia applica...	1		1
1	Agriculture: Livest...	Other cattle - li...	Animal house adaption	1		0
1	Agriculture: Livest...	Other cattle - li...	Combination of SA_LNA	1		0
1	Agriculture: Livest...	Other cattle - s...	Low ammonia applica...	1		5
1	Agriculture: Livest...	Other cattle - s...	Low ammonia applica...	1		1
1	Agriculture: Livest...	Dairy cows - liq...	Covered outdoor stora...	1		2
1	Agriculture: Livest...	Dairy cows - liq...	Combination of CS_L...	1		5

Export Excel

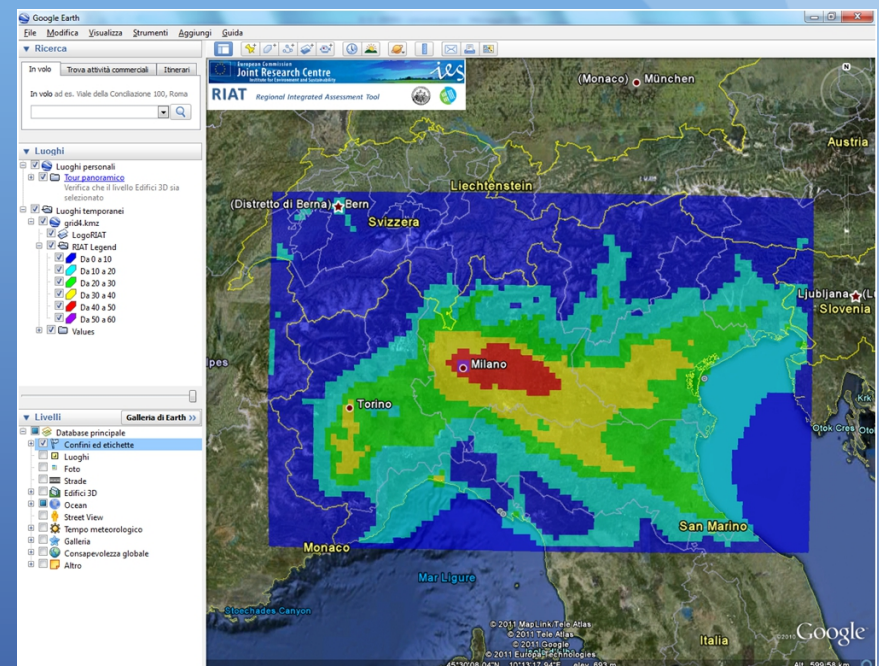


# RIAT output

## Emission maps



## AQI maps





# Innovative aspects in RIAT+

- Standard DSS for sub-national air quality planning in EU
- Harmonization with EU/national decision problem
- Population exposure assessment
- Including non-technical measures
- GHGs budget for effective policies
- Lumped approach for decision problem in case of scarce data availability





# OPERA website: [www.operatool.eu](http://www.operatool.eu)



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## Operational Procedure for Emission Reduction Assessment

An integrated assessment methodology to plan local  
cost-effective air quality policies harmonized with  
national and European actions.

*The goal of the project is to develop a methodology, a software (RIAT+) and the relative guidelines to support local authorities for the planning of regional policies integrated with national and European actions in order to comply with National and EU air quality standards, considering potential synergies with actions to reduce GHG emissions. This project will be performed in the context of existing agreements between national and regional administrations to reach a common goal in a consistent and efficient way.*

[Click here to download the project summary \(pdf\).](#)





# Thank you

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