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A TOOL TO SUPPORT EMISSION REDUCTION PLANNING AT REGIONAL SCALE

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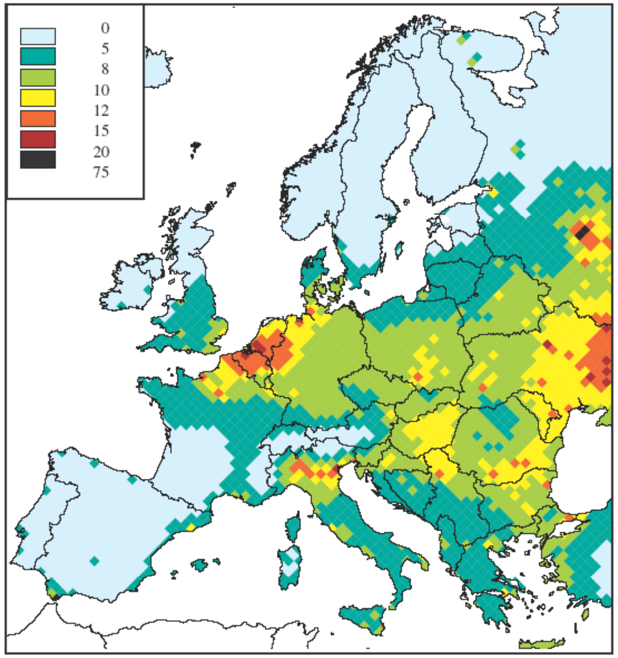
Integrated Assessment Modelling

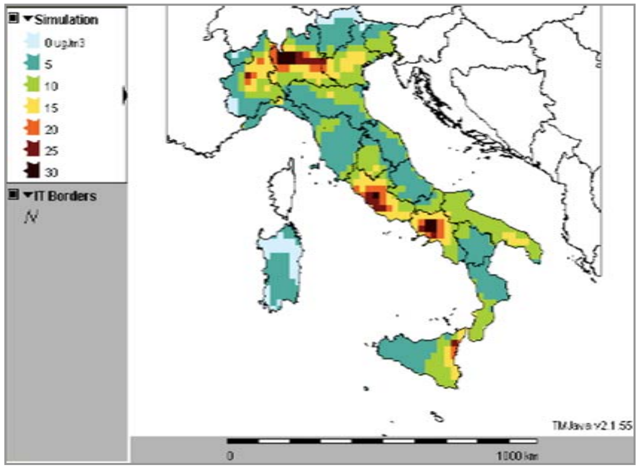
European scale

- Rains/Gains by IIASA



National scale

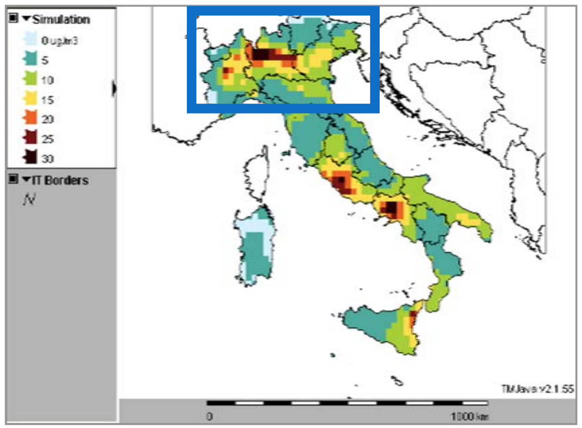
- Rains Italy by ENEA
- RAINS-Netherlands
- FRES-Finland
- UK-IAM



aim of RIAT (Regional Integrated Assessment Tool)

to identify efficient sub-national and local policies

- national and EU air quality standards
- financial, technological and social constraints
- focused on local to meso-scale:
  - specific features of the area
  - the meteorological and chemical conditions of the domain
  - the contribution of mesoscale and local precursor emissions



Decision problem

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

Internal Costs

Air Quality Index: PM10, PM2.5, Ozone

$$\theta \in \Theta$$

Set of feasible decisions

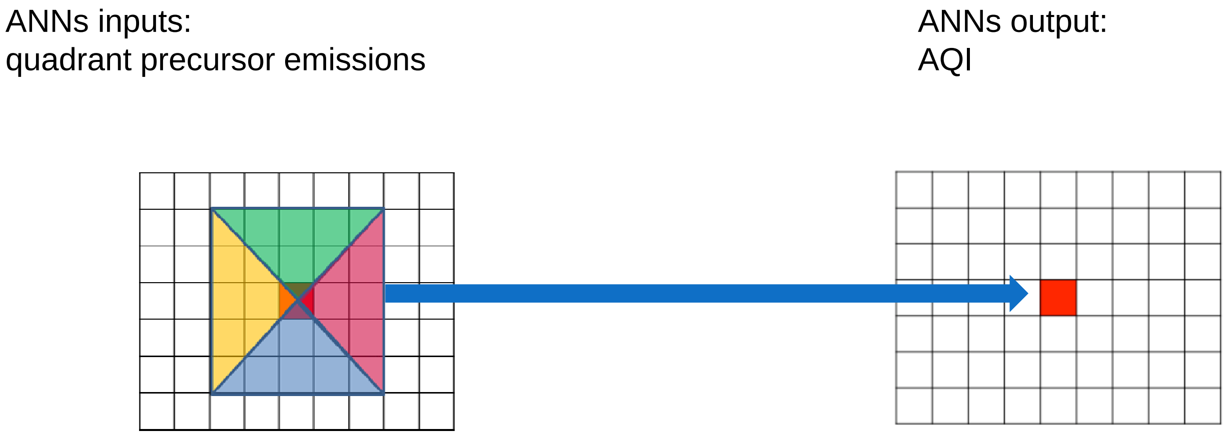
Set of decision variables (precursor emission reduction technologies)

$$E$$

precursor emissions

Source-receptor models: ANN

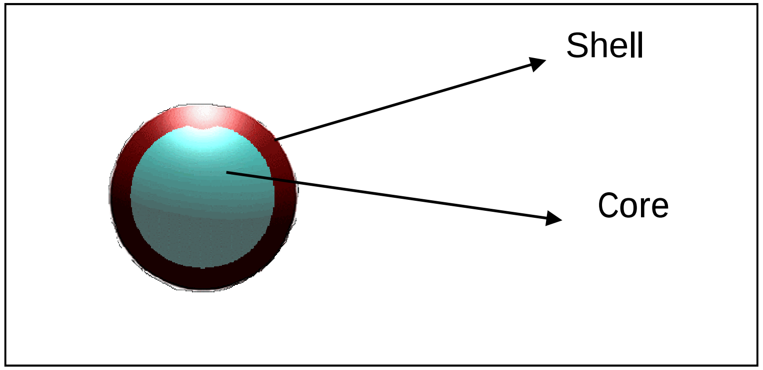
- Input data: NOx, VOC, PPM10, PPM2.5, NH3, SOx emissions
- Target data: PM10, PM2.5, AOT40, SOMO35



- Identification pattern: 21 TCAM simulations (POMI project)

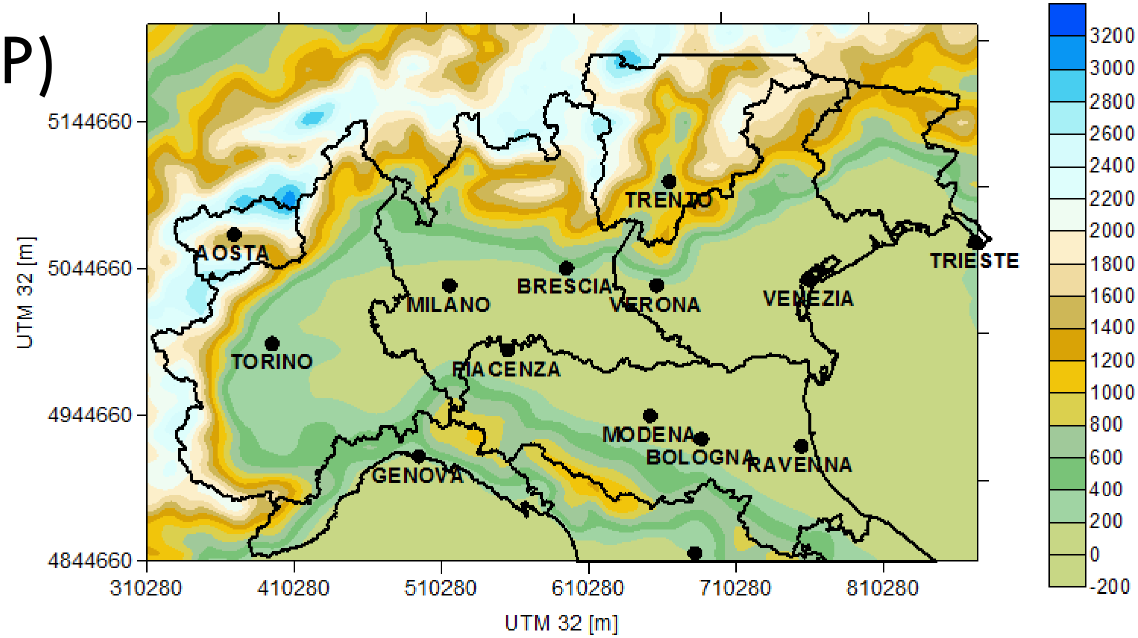
TCAM model

- gas phase chemical mechanisms: SAPRC90, SAPRC97, COCOH97, CBIV
- 21 aerosol chemical species
- 10 Size classes
  - Size varying during the simulation
  - Fixed-Moving approach
- processes involved:
  - Condensation/Evaporation
  - Nucleation
  - Aqueous Chemistry



RIAT basecase

- Simulation domain: 570x372 km^2
- Spatial resolution: 6x6 km^2
- Emissions: CLE2010
- Meteo: 2005 (MM5)
- B.C.: 2005 (EMEP)

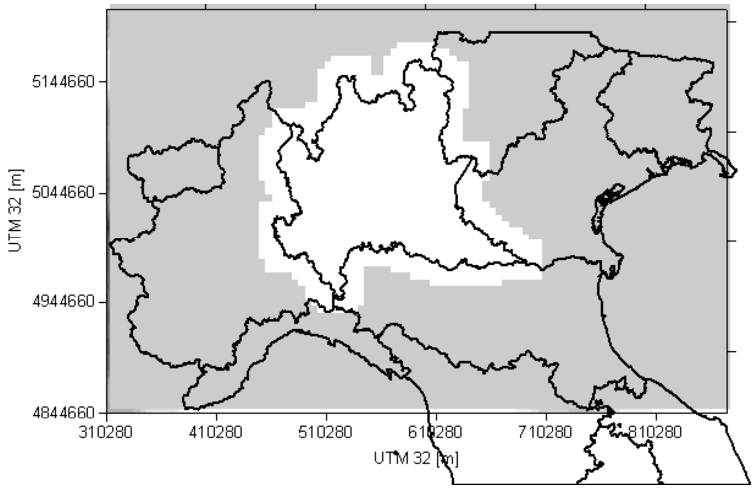


PM10 and PM2.5 ANNs: identification and validation patterns

- for each PM AQI, one ANN was identified

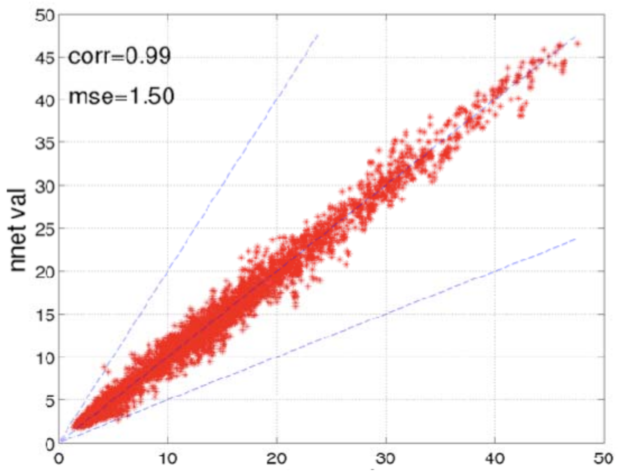
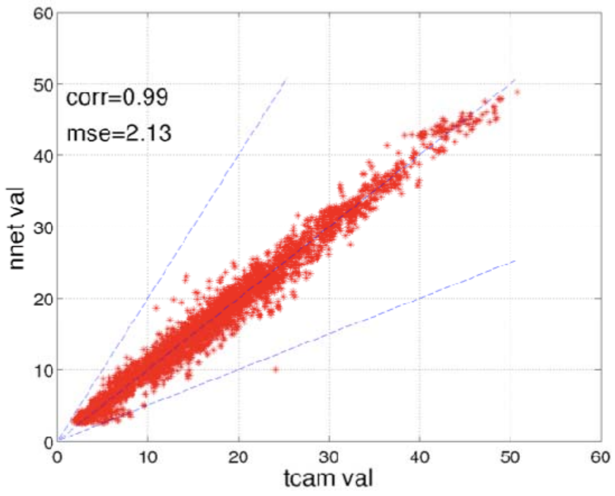
for the considered region (Lombardy)

- Identification area: Lombardy region + 2 contour cells

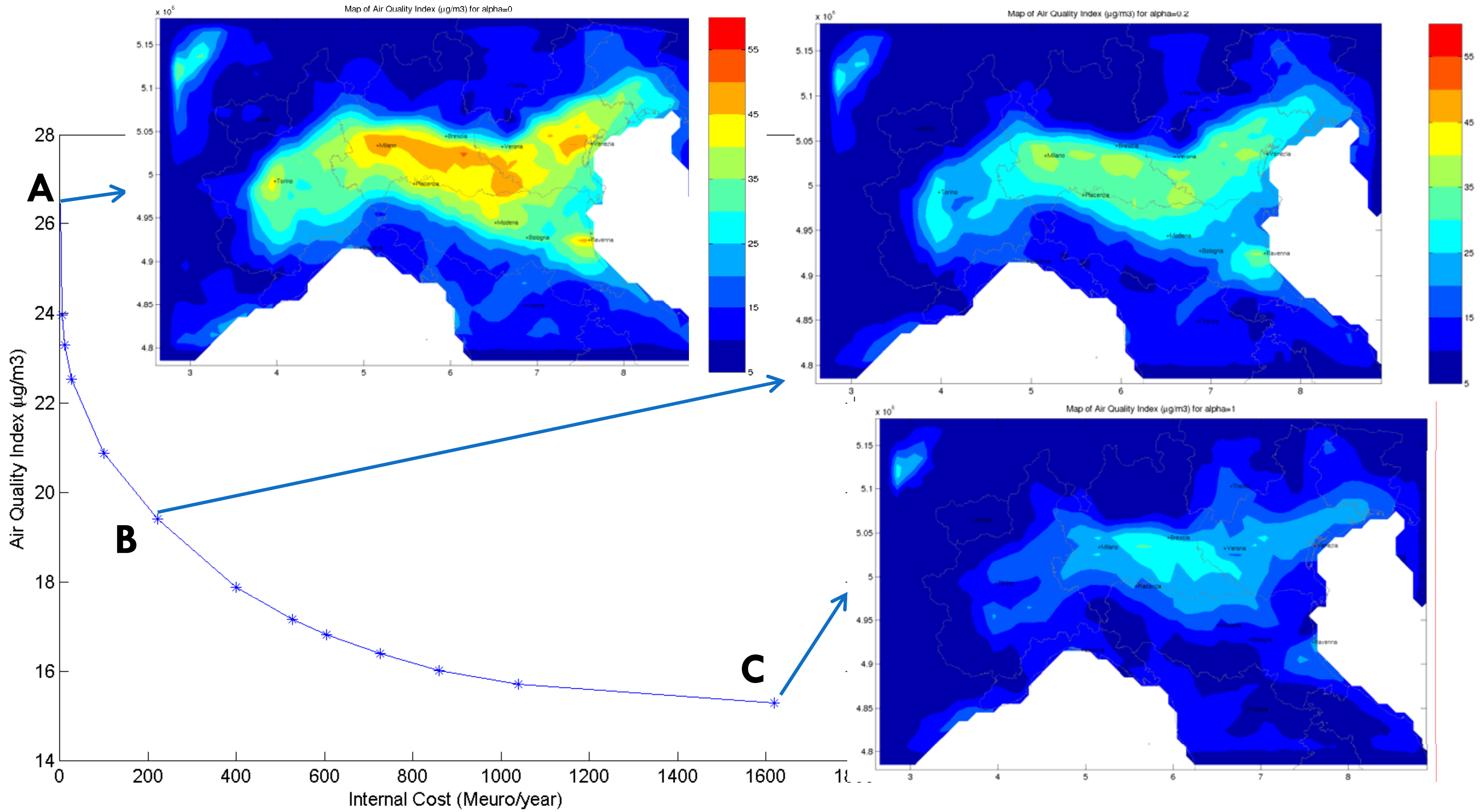


- Identification pattern: 932 cells x 21 scenarios
- Validation pattern: 234 cells x 21 scenarios

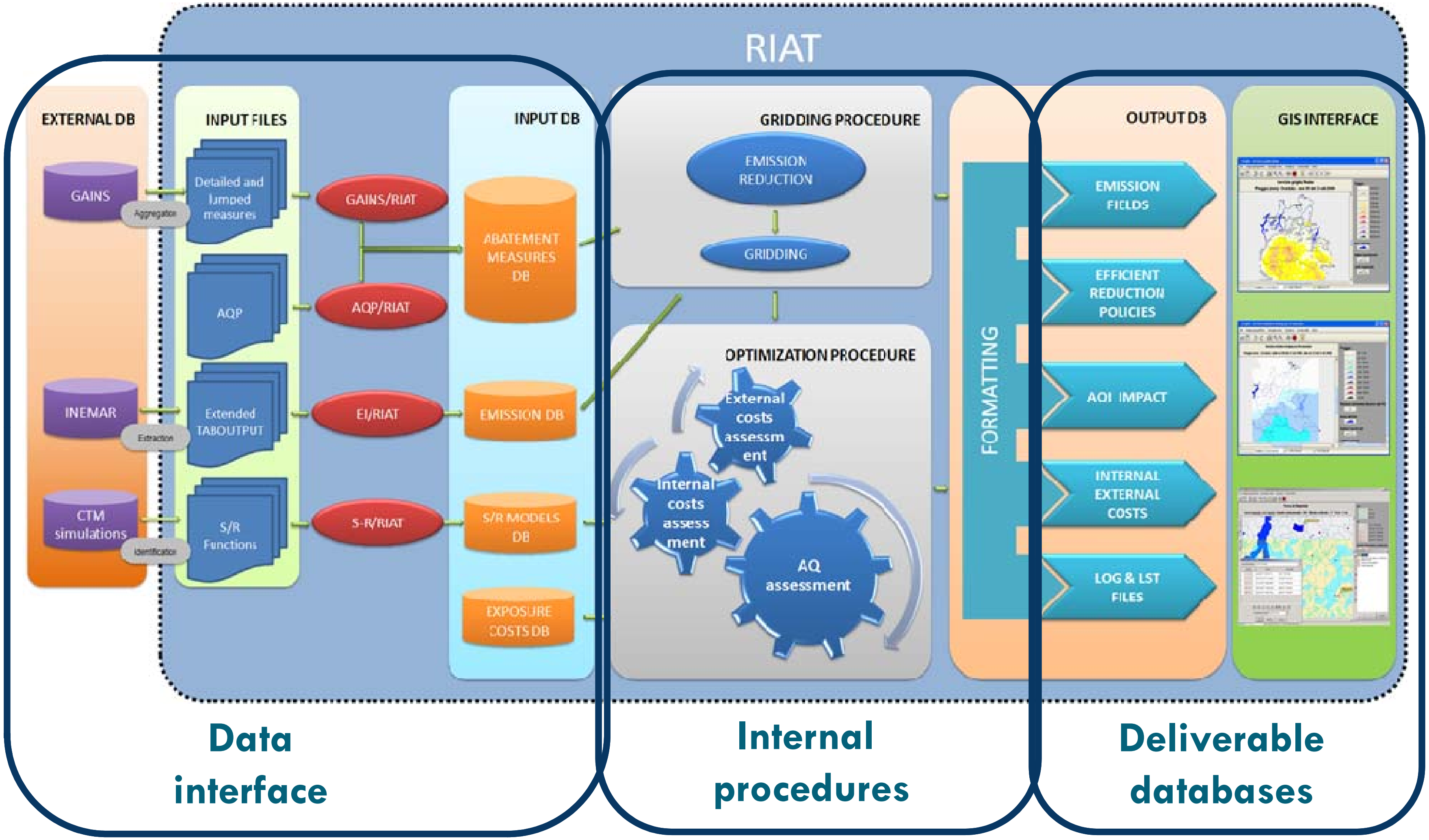
PM2.5 and PM10 ANNs validation

	scatter	indexes	
PM2.5 [μg/m³]		Mean TCAM [mg/m³]	14.15
		Mean ANN [mg/m³]	14.03
		corr	0.99
		Abs err [%]	0.06
		rmse	1.23
PM10 [μg/m³]		Mean TCAM [mg/m³]	15.9
		Mean ANN [mg/m³]	15.87
		corr	0.99
		Abs err [%]	0.07
		rmse	1.46

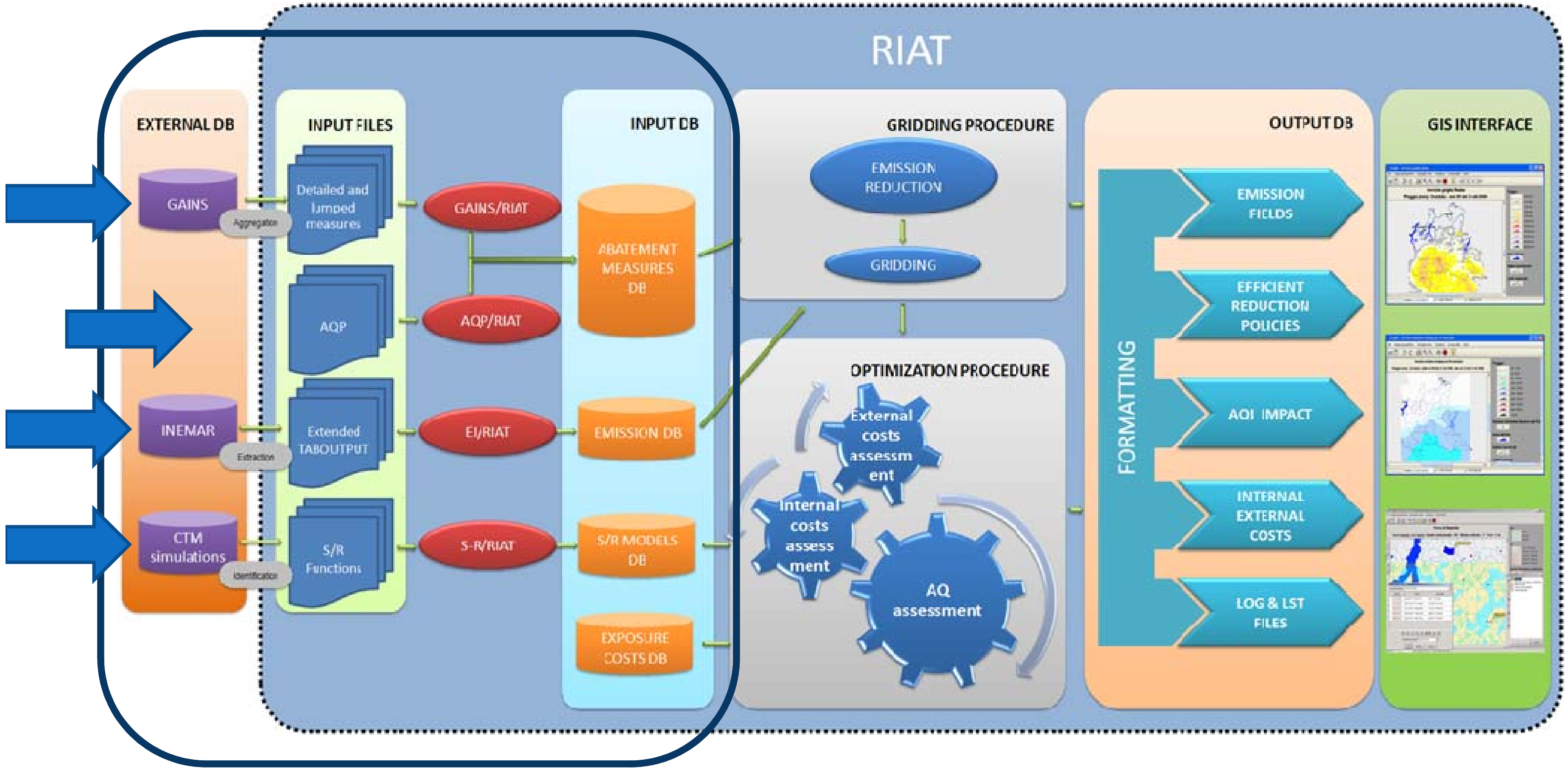
Pareto boundary (PM10)



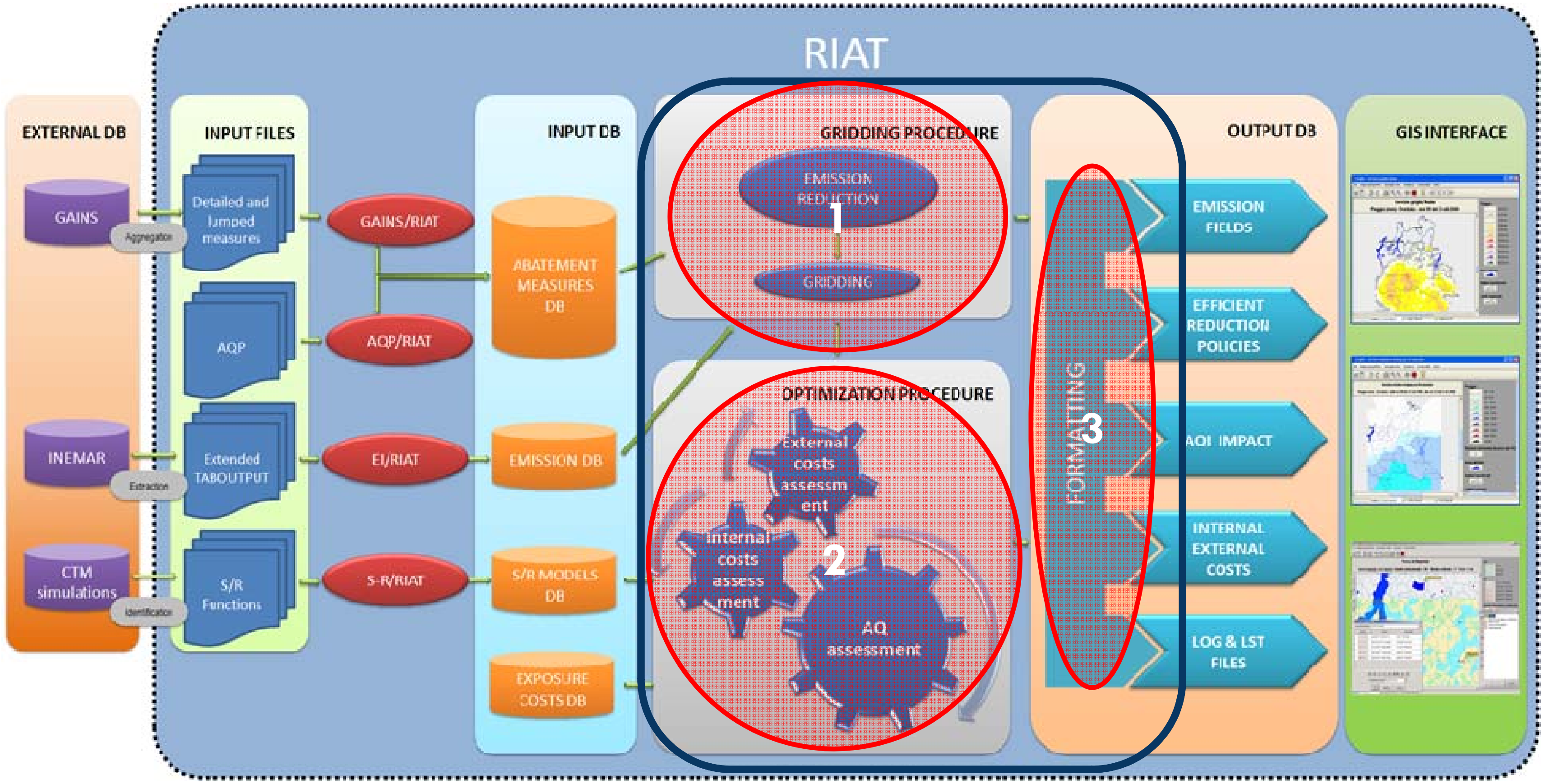
System architecture



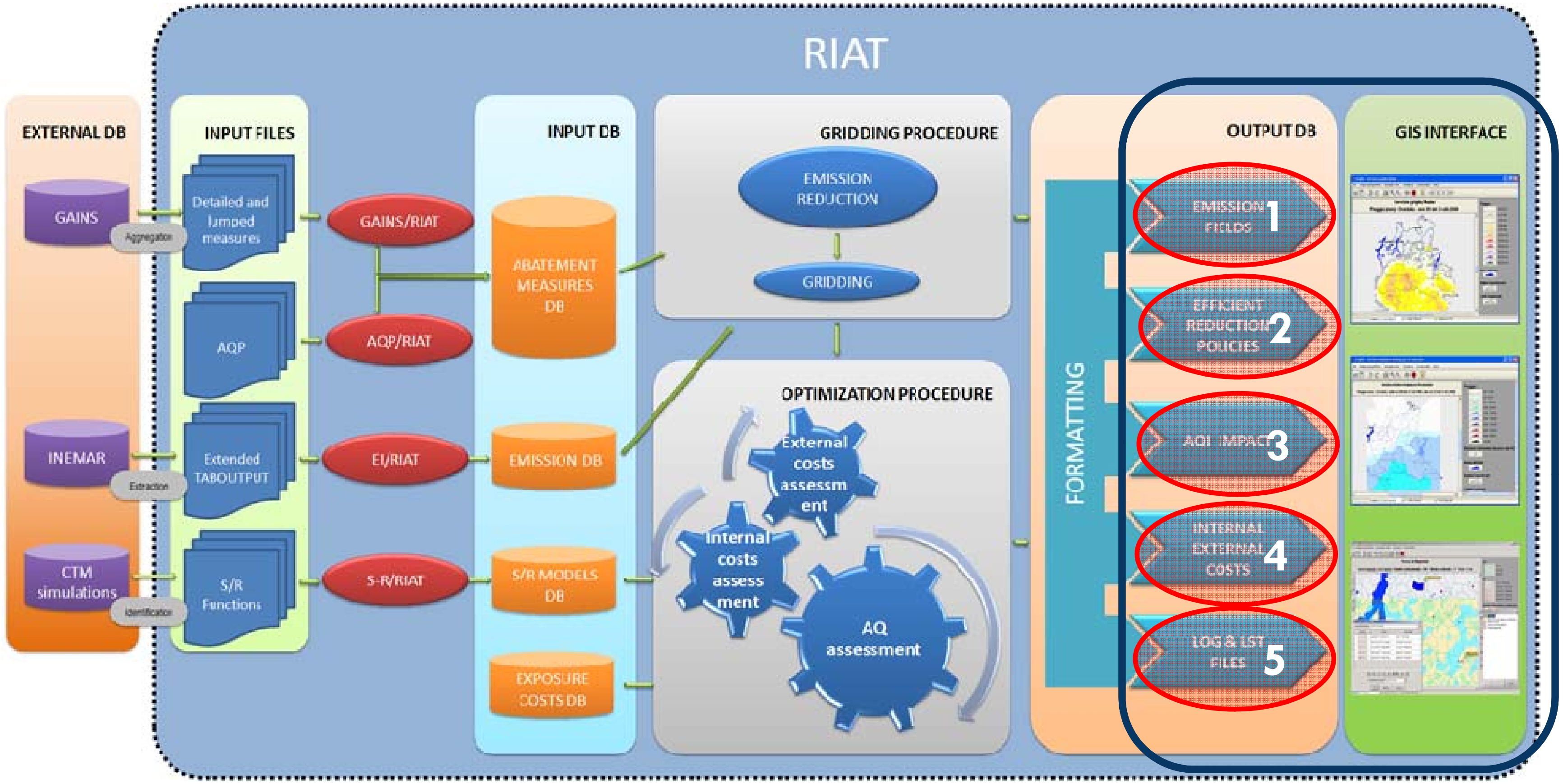
The data interface procedures



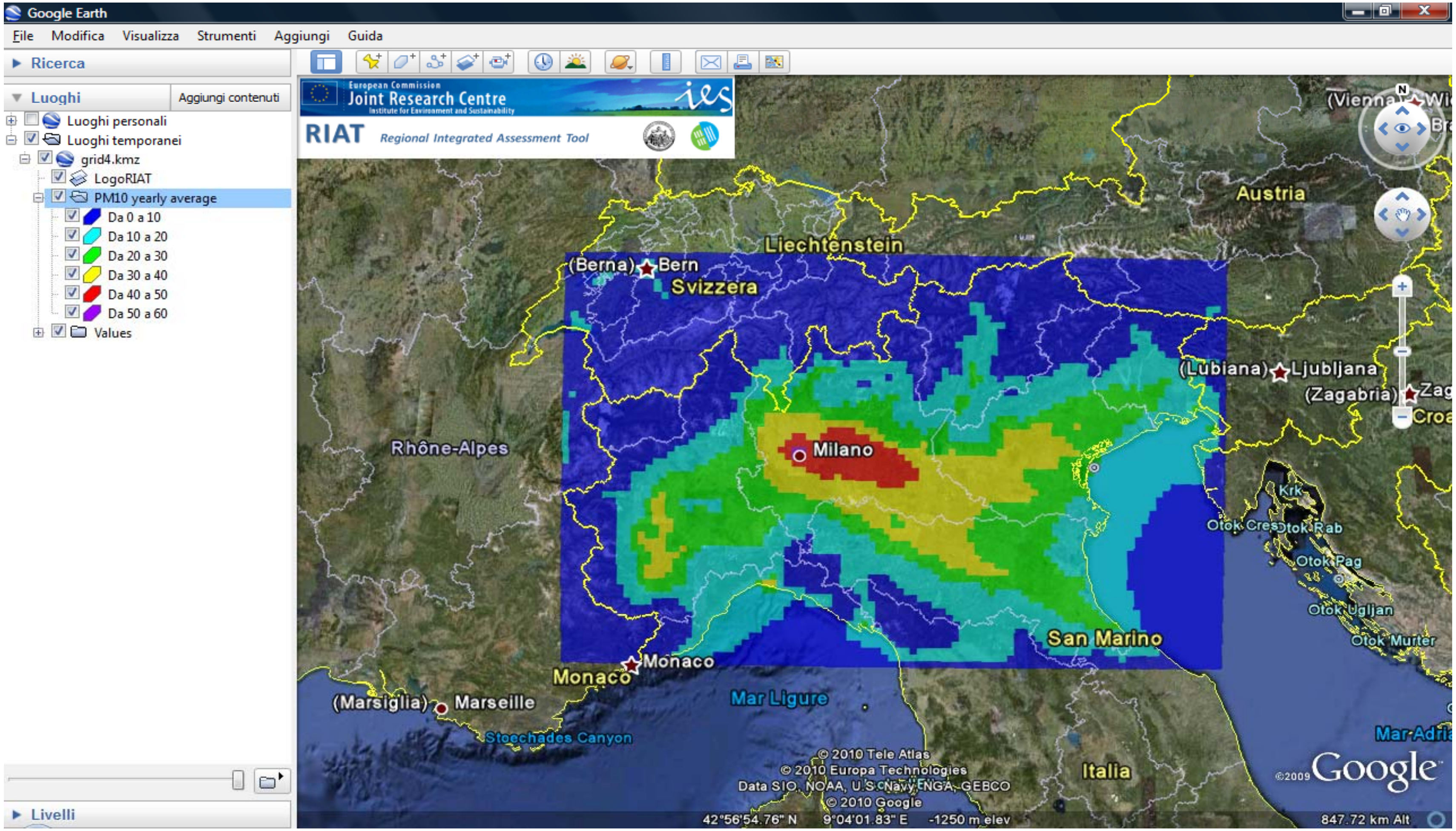
The internal procedures



The output databases



GIS visualization



Conclusions

- A DSS has been formalized to control secondary pollution exposure in Northern Italy
- Decision problem: multiobjective
- AQI are simulated by ANNs
- RIAT DSS implementation
- Optimal local/regional policy analysis

Acknowledgments

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Thanks to all of you!