



Agenzia nazionale per le nuove tecnologie,
l'energia e lo sviluppo economico sostenibile

Le prospettive della pianificazione della qualità dell'aria a livello italiano

Incontro finale del progetto Life REMY
Milano, 21 Marzo 2024

Antonio Piersanti, Ilaria D'Elia
Laboratorio Inquinamento Atmosferico, ENEA



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Outline

- The ENEA Laboratory of Atmospheric Pollution
- The Italian National Air Pollution Control Program (NAPCP)
- The GAINS-Italy model: a screening tool for national and regional scenarios

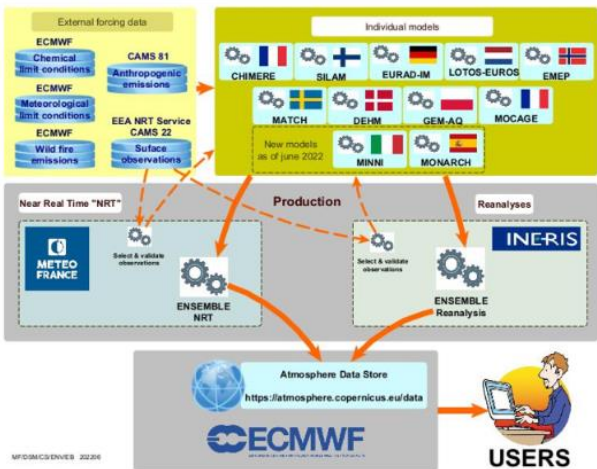
The ENEA Laboratory of Atmospheric Pollution

- Research on atmospheric processes, applied meteorology, numerical models of air pollution
- Air quality modeling simulations on historical years and future scenarios starting from emission scenarios developed with Integrated Assessment Models
- Short-term air quality forecasting systems
- Experimental activities for chemical and physical characterization of atmospheric aerosol
- Identification and analysis of environmental risks linked to air pollution for definition of mitigation strategies and specific long-term policies
- Evaluation of the effects of air pollution on health, vegetation and cultural heritage

The ENEA Laboratory of Atmospheric Pollution



CAMS2_40 Daily forecasts and analysis production



Chemical characterization of particles emitted from wood-fired pizza ovens in Italy

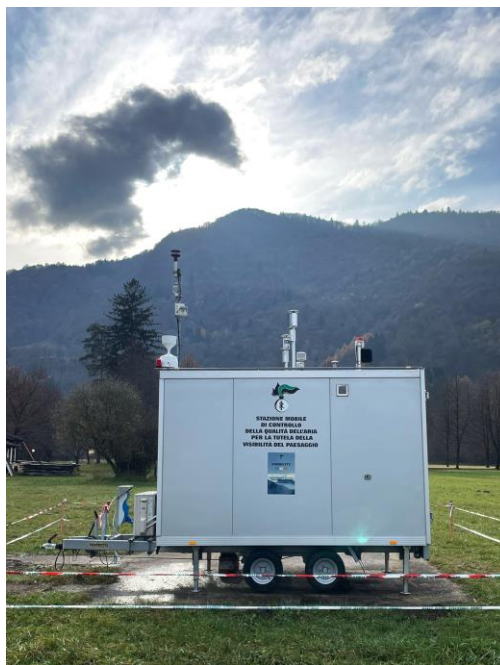
M. Stracquadanio¹, A. Bergom², S. Bertagna³, P. Fermo², F. Hugony¹, T. La Torretta¹, A. Malaguti¹, G. Migliavacca³, C.

Morreale³, A. Piersanti¹, I. D'Elia¹

¹ ENEA, Atmospheric Pollution Laboratory, Bologna IT 40129, Italy

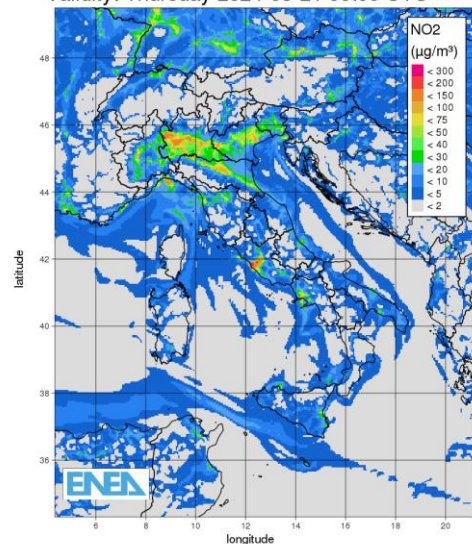
² Department of Chemistry University of Milano, Milano IT 20133, Italy

³ Innovhub Stazioni Sperimentali per l'Industria, Milano IT 20097, Italy



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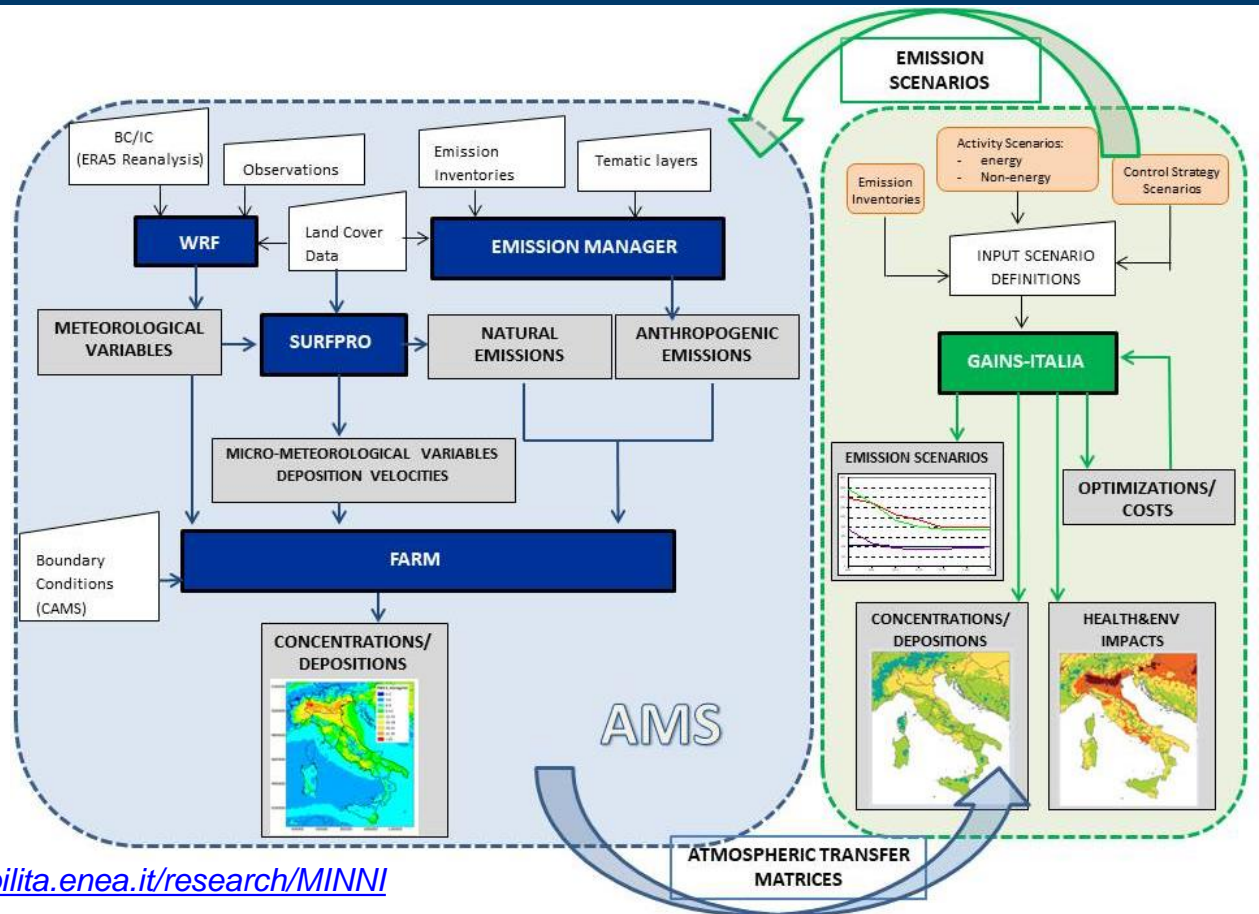


Lessons learnt for air pollution mitigation policies from the COVID-19 pandemic: The Italian perspective

Massimo D'Isidoro¹, Ilaria D'Elia^{2,1}, Lina Vitali^{2,1}, Gino Briganti², Andrea Cappelletti², Antonio Piersanti², Sandro Finardi³, Giuseppe Calori³, Nicola Pepe³, Alessandro Di Giosa⁴, Andrea Bolignano⁵, Gabriele Zanini²

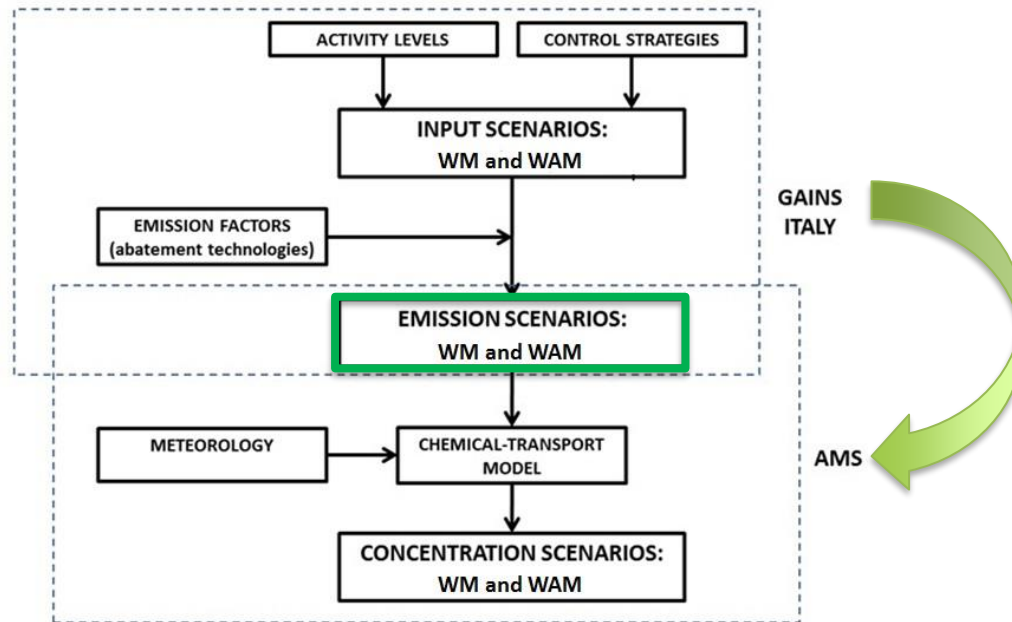
MINNI: the Italian National Integrated Assessment Model

The national Integrated Assessment Model MINNI has been developed and updated by ENEA since 2000 and it supports the Environmental Ministry during the negotiation and the following implementation in national laws of European Directive on Air Quality (D.Lgs. 155/2010) and National Emission Ceilings (NEC, D.Lgs. 81/2018)



NAPCP scenarios: methodology

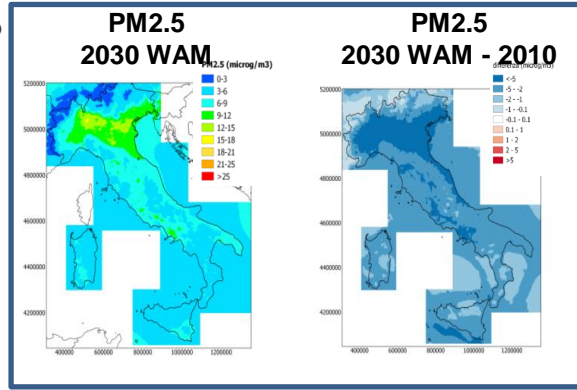
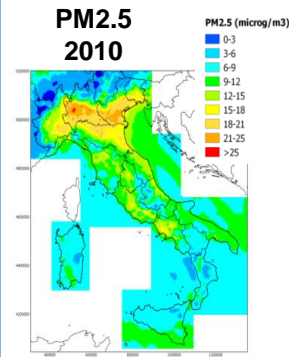
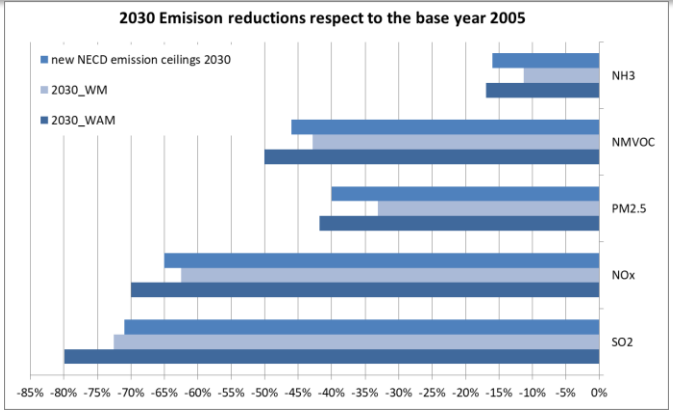
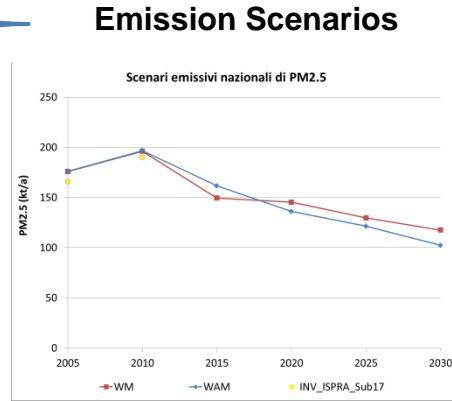
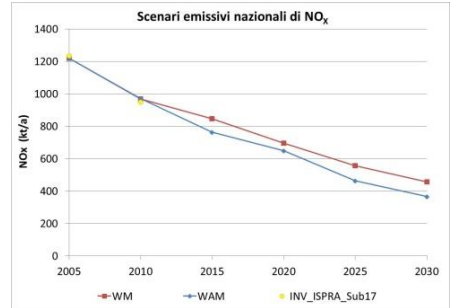
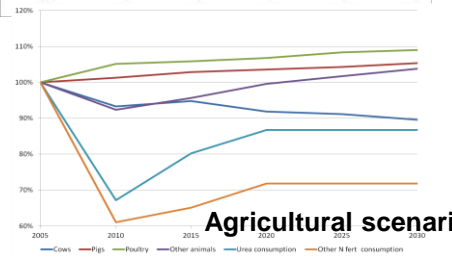
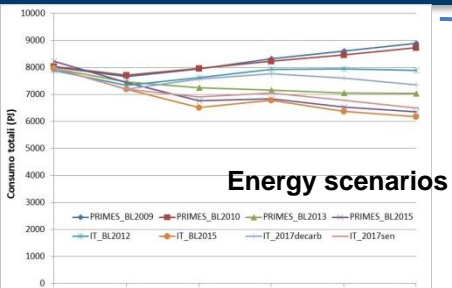
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WM = With Measures; WAM = With Additional Measures

Piersanti et al., 2021, doi: 10.3390/atmos12020196

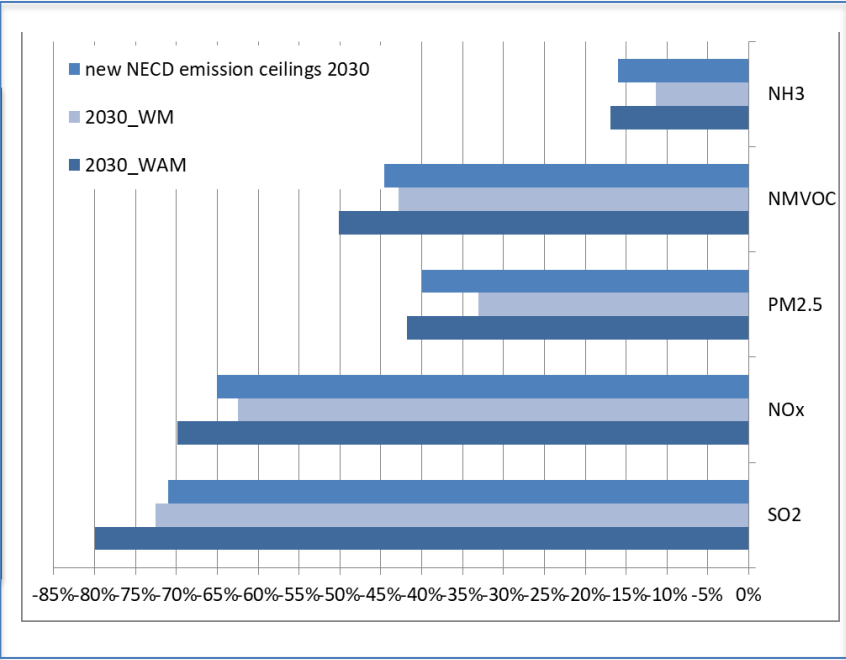
An overview of NAPCP



NAPCP scenarios: the NEC targets

2030 emission reduction targets with respect to the base year 2005

	NECD targets
SO ₂	-71%
NO _x	-65%
PM2.5	-40%
NMVOC	-46%
NH ₃	-16%



2030 Ceilings: non-compliance for WM (With Measure) scenario (all pollutants but SO₂) → Additional measures needed (WAM)

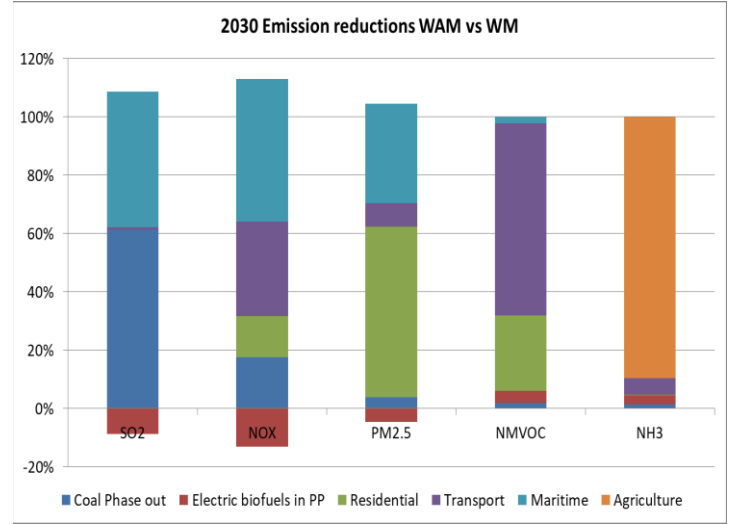
NAPCP scenarios: measures in the WAM scenarios

Table 1. Measures adopted in the 2030 “With Additional Measures” (WAM) scenario.

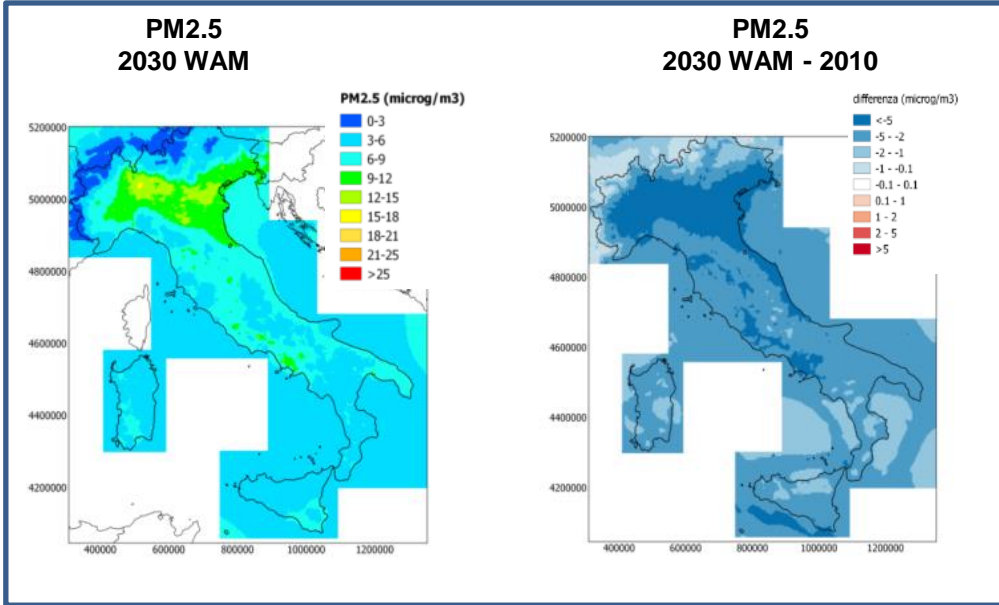
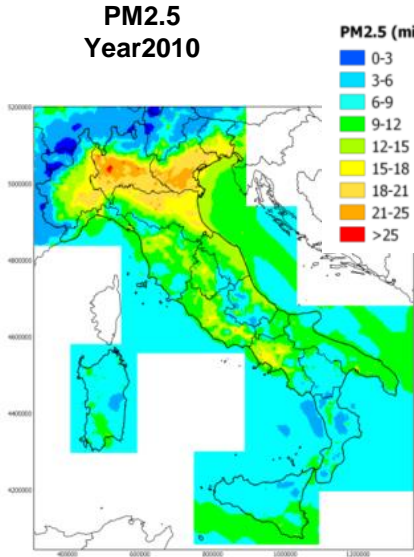
Sector	Name	Description
Power plants	Coal phase-out	Gradual phasing-out of coal power plants to be completed by 2025
Residential/Services sector	Replacement of biomass systems	Renewal of old biomass heating systems with efficient and low-emission technologies
Residential/Services sector	Energy efficiency in buildings	Tighten minimum standards for building (for example, Nearly Zero Energy Buildings)
Transport	Public transport promotion	Promote public transportation to reduce private transport and renew bus fleet
Transport	Electric vehicles	Increase the spread of electric vehicles for private urban mobility
Transport & Maritime	Renew fleet for freight vehicles	Promote the use of methane/liquefied natural gas (LNG)-powered heavy duty trucks. Promote the use of LNG in maritime transport
Agriculture	Incorporate fertilizers	Incorporate urea-based fertilizers
Agriculture	Ban on new waste lagoons	Ban on constructing new waste lagoons
Agriculture	Slurry	Measures to reduce spread slurry and its incorporation
Agriculture	Spreading of solid manure	Incorporation of manure distributed on the surface



WAM Compliance with NEC target... but what happens to air quality?

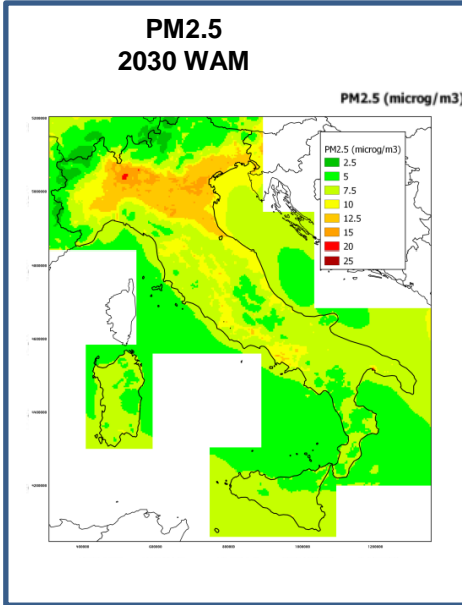
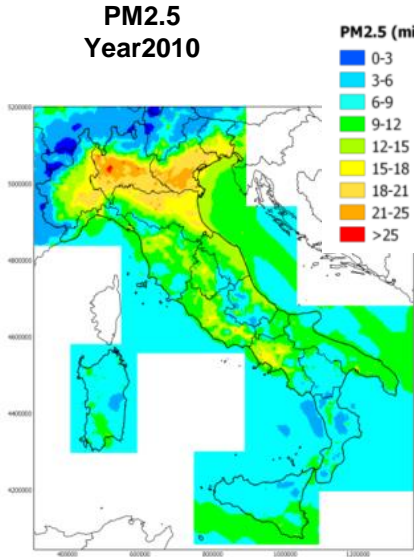


NAPCP scenarios: AQ concentrations

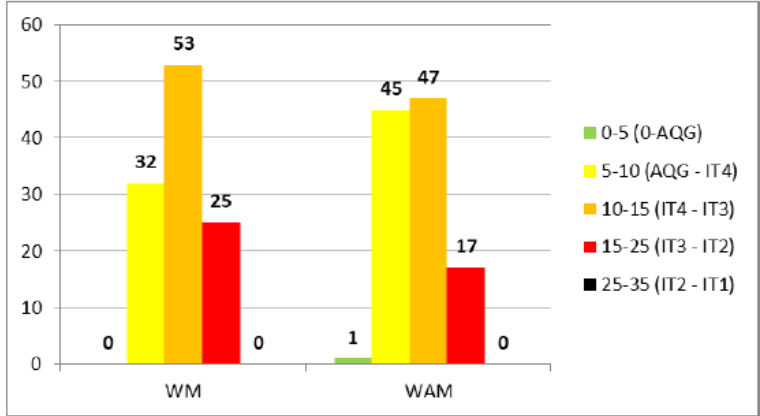


EU limit values attained but far from the WHO limits

NAPCP scenarios: AQ concentrations



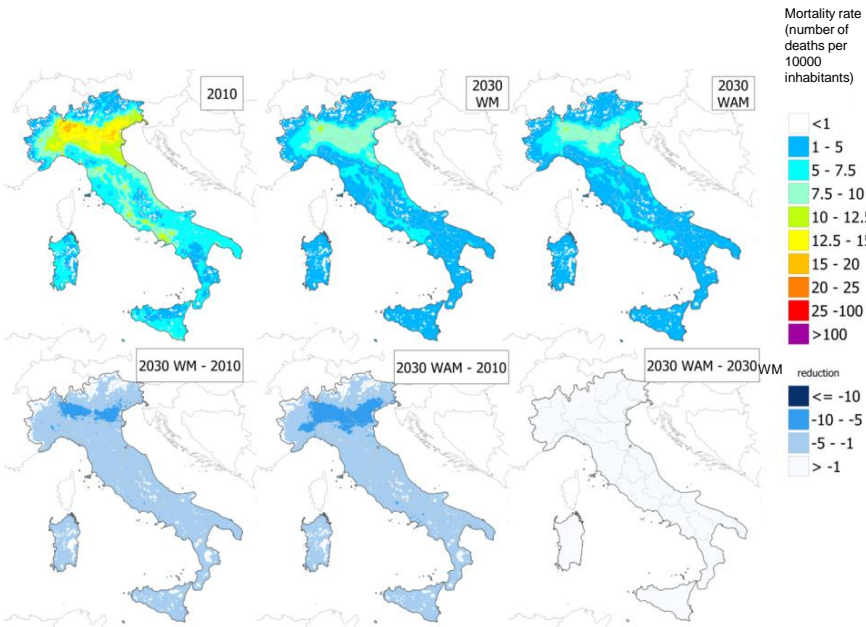
EU limit values attained but far from the WHO limits



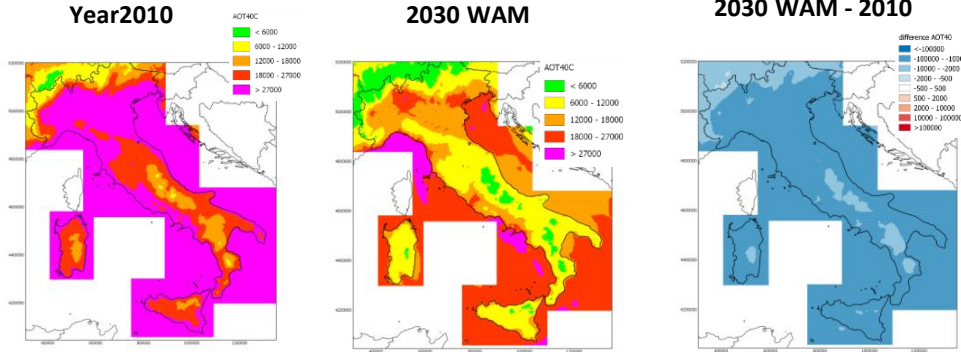
Number of PM2.5 monitoring stations for the WHO Interim targets (total: 110)

NAPCP scenarios: Health & Environmental Impacts

PM2.5 Mortality rate - WM and WAM

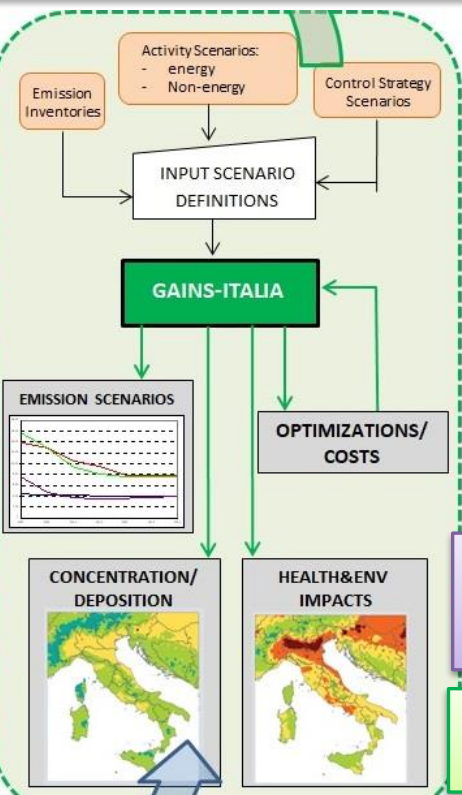


Ozone AOT40 vegetation - WAM



May to July
 Target value: 18 000 µg/m³
 Directive 2008/50/EC

GAINS-Italy: a screening tool for national and regional scenarios



UPDATES:

- Input data/ Emission Scenario: REGIONS
- ATM resolution: 4 km
- Meteo years: 2015, 2004, 2005 + avg
- ATM equations: linear + second order terms for different indicators (O_3 , PM, NO_2 ...)
- 1990-2050 (5-year step)

ATMOSPHERIC TRANSFER MATRICES

Sign in

Username

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Remember last work session

Accept disclaimer

Login

Create an account

Three user interface modes enable interactive analyses at different levels of complexity:

- GAINS Basics mode
It allows rapid exploration of the key features of (pre-defined) alternative policy intervention scenarios.
- GAINS Advanced mode
This mode provides all technical details of activity projections and policy response scenarios with a more complex user interface.
- GAINS Expert mode
This mode enables upload of own activity projections, specifying new policy packages, and comprehensive cost-effectiveness and cost-benefit optimization analyses. As this version is still under development and requires substantial training, access is only granted to I2ASA collaborators.

D'Elia et al., doi:10.1016/j.atmosenv.2009.09.003

<https://impatti.sostenibilita.enea.it/research/GAINS-Italy>

<https://gains-italy.enea.it/gains4/IT4/index.login>

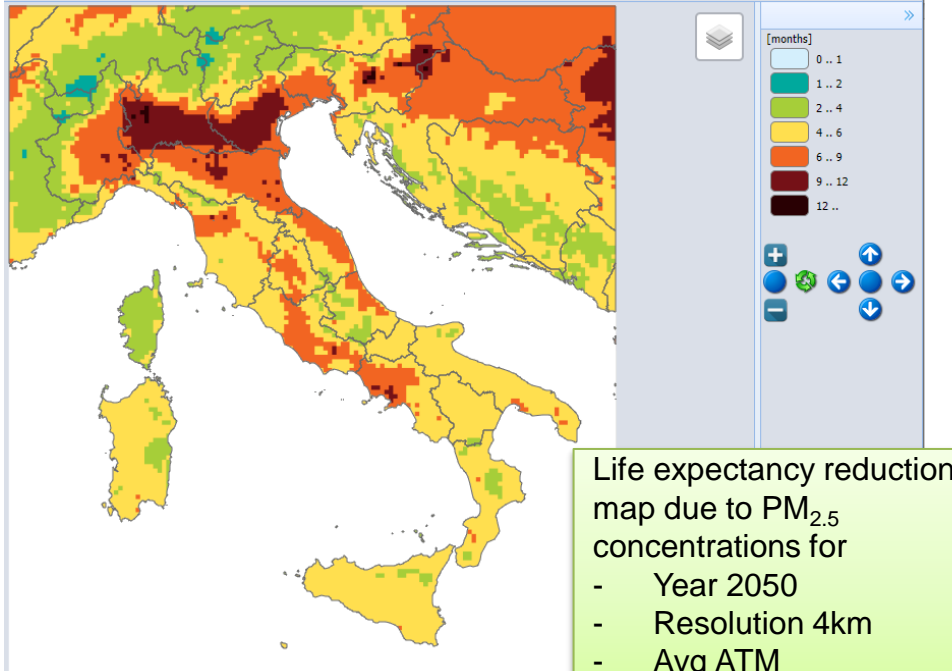
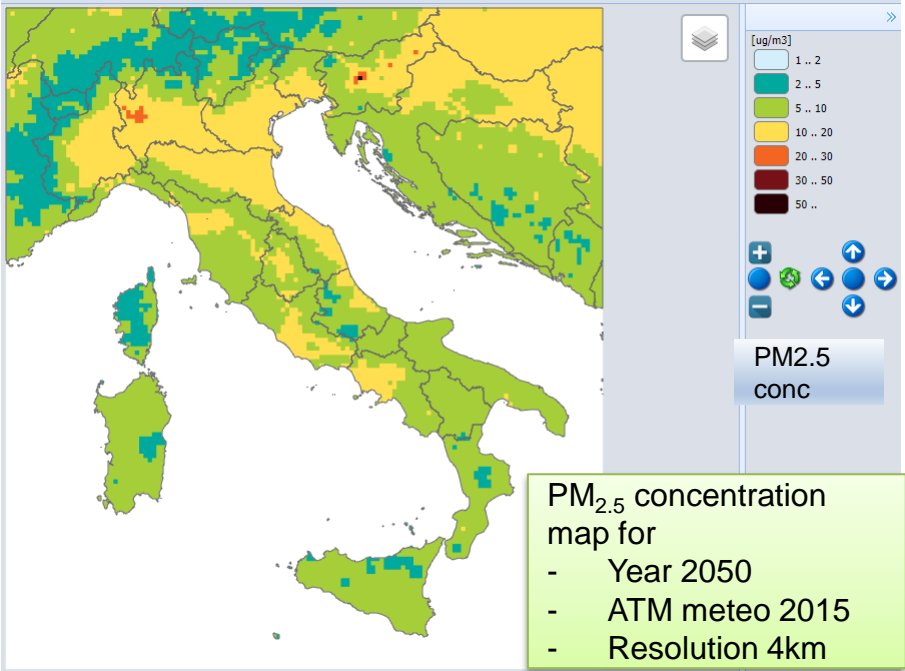
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GAINS-Italy: impact scenarios



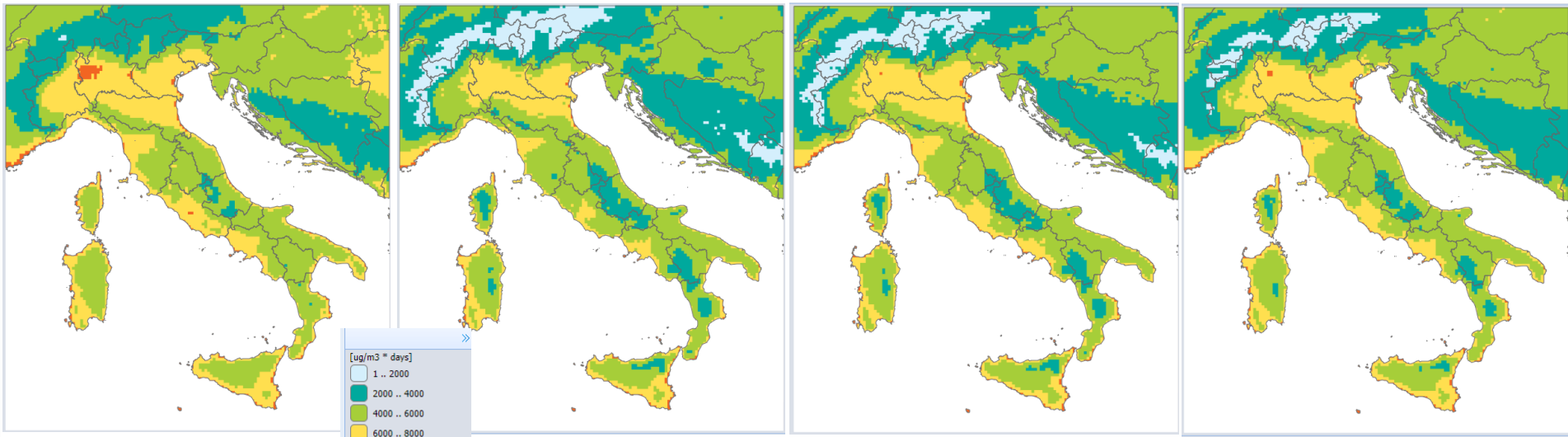
Greenhouse Gas - Air Pollution Interactions and Synergies

$$c = c_{ref} + \alpha \cdot \Delta PM_{10} + \beta \cdot \Delta NO_x + 0.5 \gamma \cdot (\Delta NO_x)^2 + \delta \cdot \Delta NH_3 + 0.5 \varepsilon \cdot (\Delta NH_3)^2 + \zeta \cdot \Delta SO_2 + \eta \cdot \Delta NMVOC$$



GAINS-Italy: the atmospheric transfer matrices

SOMO35 – anno 2050



Year 2015

Year 2004

Year 2005

Average

Antonio Piersanti
Ilaria D'Elia

antonio.piersanti@enea.it



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