



Italian National Agency for New Technologies,
Energy and Sustainable Economic Development

Update on air quality activities in ENEA

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<https://met.sspt.enea.it/people>

<https://impatti.sostenibilita.enea.it/en>

www.enea.it



Science research topics

- sources apportionment: tagged species in MINNI (ORSA)**
- wood burning emissions from oven**
- visibility in natural parks**
- sea-salt forecast**
- effects of air pollution on soiling and corrosion of materials**

New developed On-line Reactive Source Apportionment (ORSA) in MINNI: tagged species approach

- apportion simultaneously PM10 and gases, O₃ in particular
- track simultaneously the contributions of emission sources and the contributions of initial conditions (IC) and boundary conditions (BC)
- great flexibility in subdividing emission sources by sectors and geographic entities

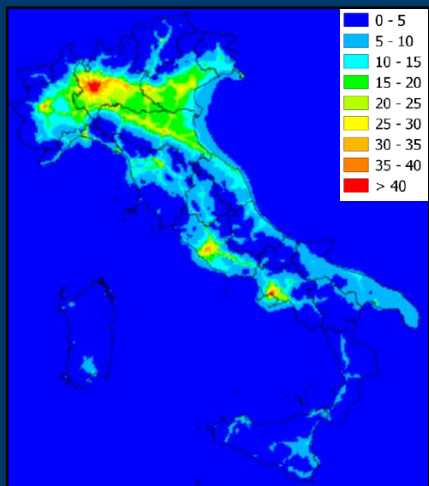
Developed in collaboration with ARIANET srl, manuscript submitted to Air Quality, Atmosphere & Health

Contribution of emission sectors on air concentration of pollutants

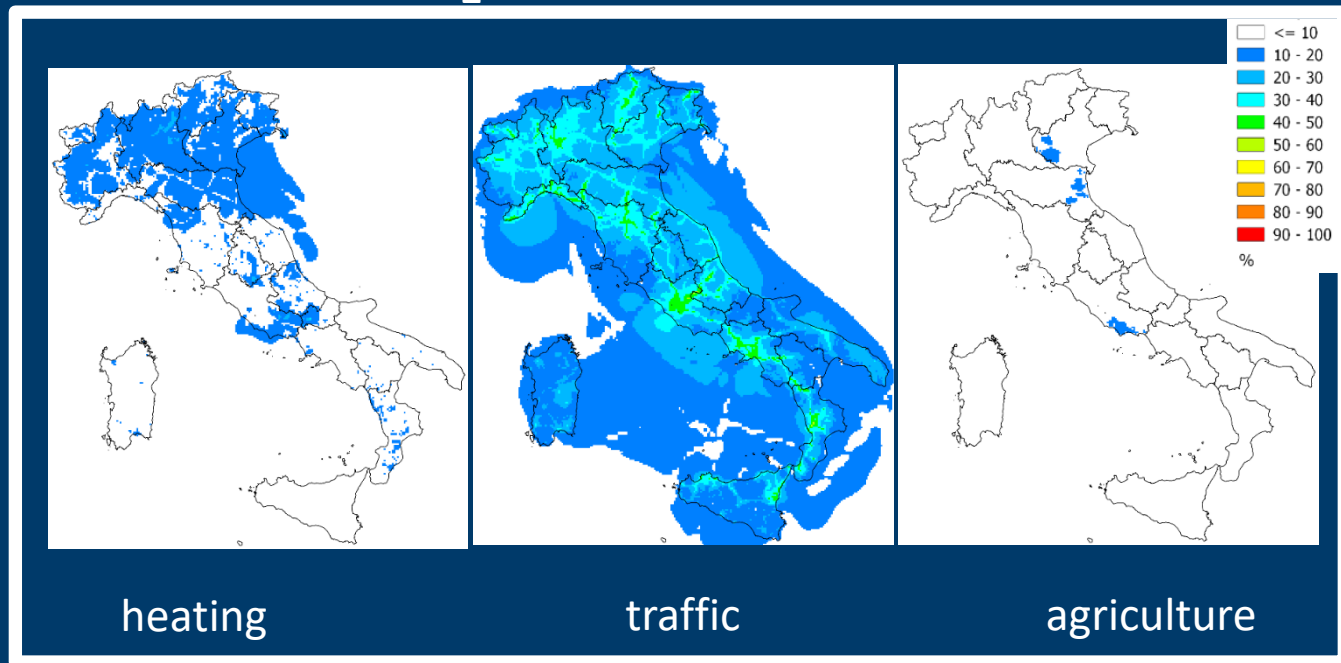
Annual limit value for human health protection: $40 \mu\text{g}/\text{m}^3$ (D.Lgs. 155/2010).

NO_2 - media annuale

(%)

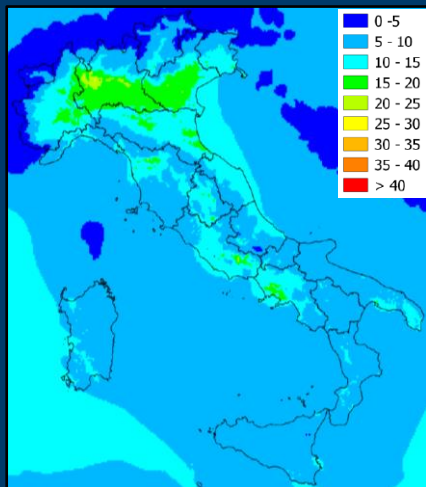


Concentration ($\mu\text{g}/\text{m}^3$)



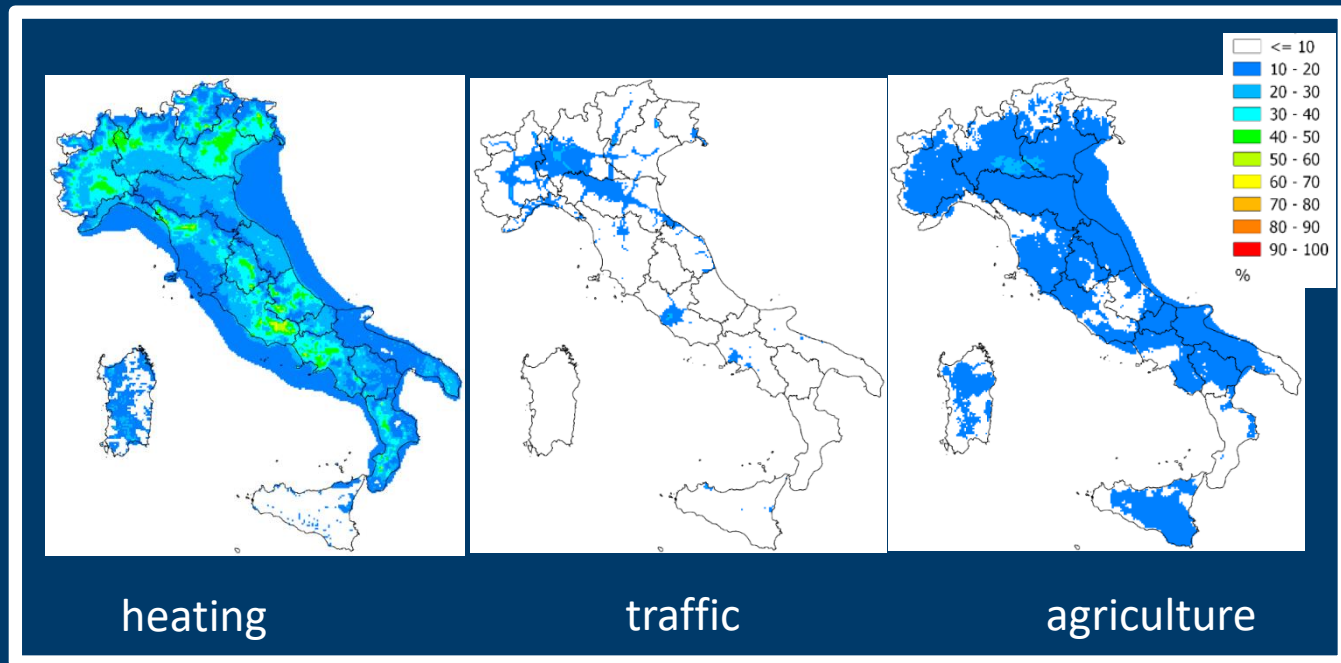
Contribution of emission sectors on air concentration of pollutants

Annual limit value for human health protection: $40 \mu\text{g}/\text{m}^3$ (D.Lgs. 155/2010).



Concentration ($\mu\text{g}/\text{m}^3$)

PM10 - media annuale (%)



Wood burning emissions from pizza oven

Cooperation Agreement ENEA-MASE

Coordinator: Milena Stracquadanio

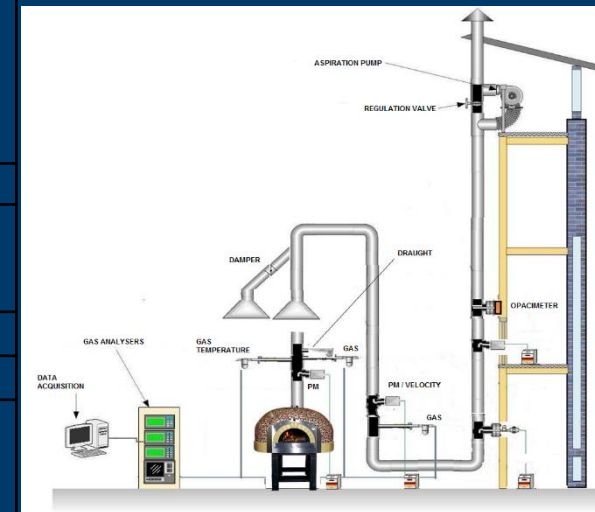
Outcomes:

- PM10, PM2.5, PAH wood burning oven emission factors
- Wood burning oven emission chemical characterization

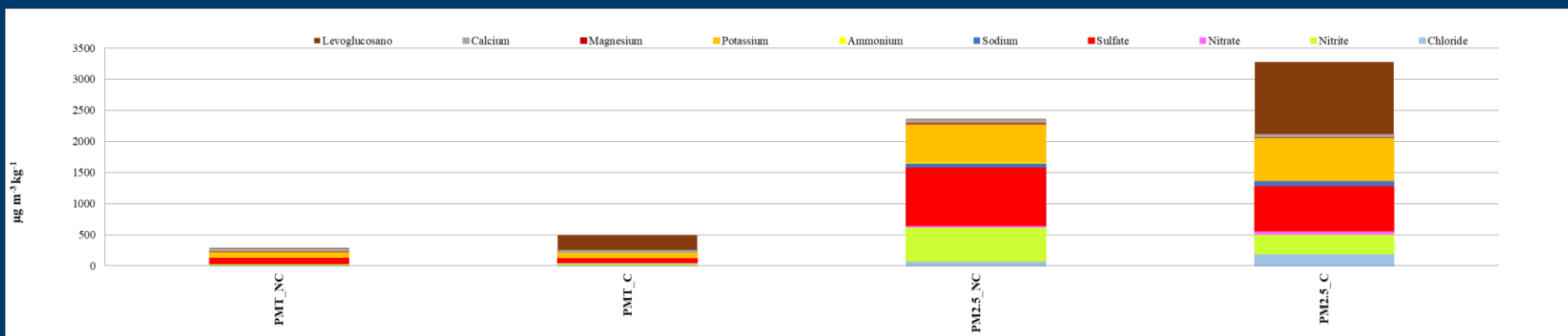
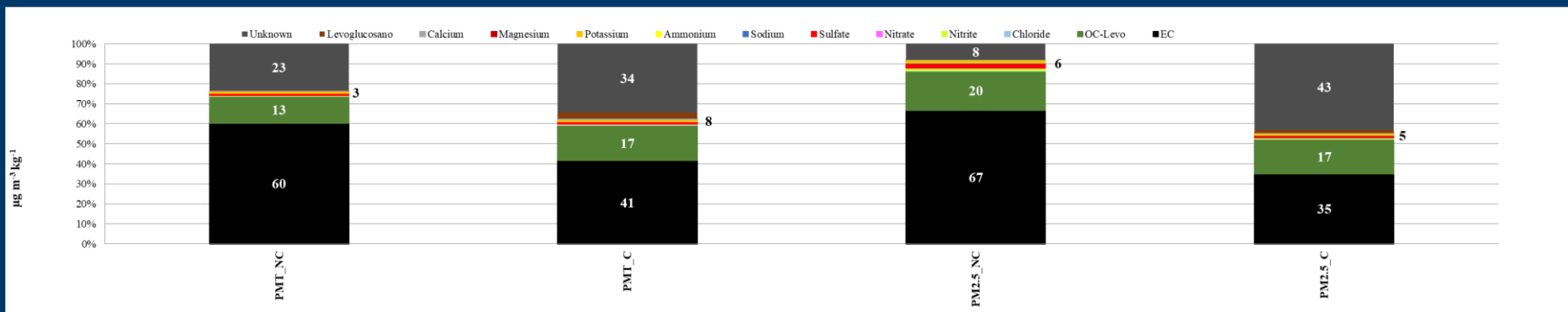
Sampling Plan:



Wood Burning Oven					
Fuel Type: Beechwood					
Sampling Method:	Cold Sampling (dilution tunnel), PM ₁₀	Cold Sampling (dilution tunnel), PM _{2.5}	Cold Sampling (dilution tunnel), Particle Associated PAH (PMT) +Gaseus Phase PAH (PUF)	Cold Sampling (dilution tunnel), PM _T	Hot Flue Gas Sampling, PM _T
	Mass Concentration PM ₁₀	Mass Concentration PM _{2.5}	PAH (BAP)	Mass Concentration PM _T	Mass Concentration PM _T
Parameters		TC (ECOC)		TC (ECOC)	
		WSII		WSII	
		Levoglucosan		Levoglucosan	
	Gas	CO-NO _x -COT			



Wood burning emissions from pizza oven -preliminary results-



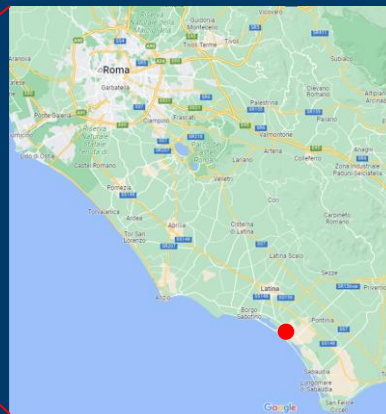
Visibility in Italian National parks

Cooperation Agreement ENEA-CUFAA

Coordinator: Ettore Petralia

Enjoying a clear panorama immersed in a natural landscape represents a precious recreational value, a de facto ecosystem service

Purpose: Apply American protocol I.M.PRO.V.E. (Interagency Monitoring of PROtected Visual Environment) based on the algorithm developed by Malm et al (1994) for the quantification of the coefficient B_{ext} (light extinction, equation (a)) as a function of different chemical-physical parameters associated with compounds in the particulate and gaseous phase of both anthropic and natural origin.



Sampling site near the Lago dei Monaci (Rome) and view of the Circeo Mount (brown arrows focus point of the photocamera)

Visibility in Italian National parks

-preliminary results-

PM chemical characterization

- spring-summer 2021 and winter 2021/2022, 24-hours samples every three days
- PM₁₀, PM_{2.5}, water soluble anions and cations, Elemental and Organic Carbon, metals and trace elements (Al, Si, Ca, Ti, Fe) and NO₂

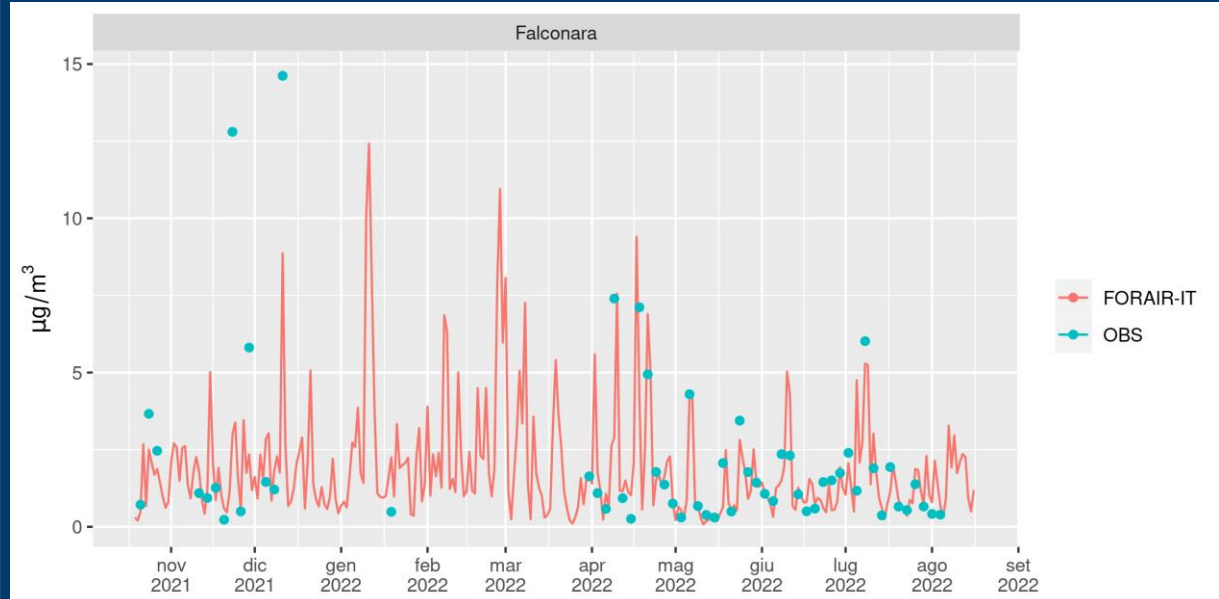
Visibility index B_{ext} vs. visual images



Sea-salt forecast with FORAIR-IT

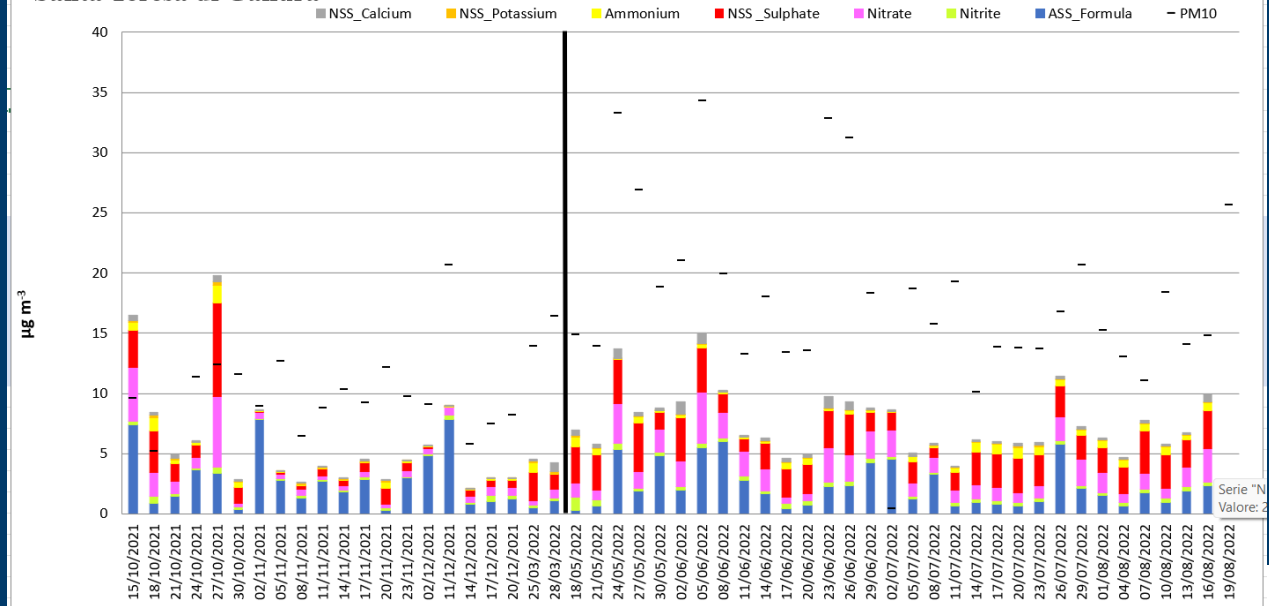
Contratto Terna: Impact of marine aerosol on Italian electric system
 Terna spa
 Coordinator: Milena Stracquadanio

No Sea Salt Water Soluble Inorganic Ions and estimated from measurements SSA in a North Sardinia coast site.



Comparison between predicted and estimated from measurements SSA in an Adriatic coast site.

Santa Teresa di Gallura



Effects of air pollution on soiling and corrosion of materials

WGE-Materials

International Cooperative Programme on Effects of Air Pollution on Materials, including Historic and Cultural Monuments

Co-Chairs: Mr. Johan Tidblad (KIMAB, Sweden) and Ms. Teresa La Torretta (ENEA, Italy)

“The objectives of ICP Materials are to perform a quantitative evaluation of the effect of sulphur and nitrogen compounds and other major pollutants, including the effects of low concentrations of these pollutants on the atmospheric corrosion of important materials, and to assess the trends of corrosion and pollution.” (<https://unece.org>)

Trends exposure

In order to produce dose-response functions and elucidate trends, ICP Materials maintain and develop a network of atmospheric corrosion field exposure test sites of about 30 exposure sites across around 18 countries.

Corrosion attack and soiling of standard materials are evaluated after exposure on racks at the test site and environmental data are collected at or close to the test sites as described in the [ICP Materials Technical Manual](#).

Italian Sites



ENEA_Casaccia



Roma_ISS

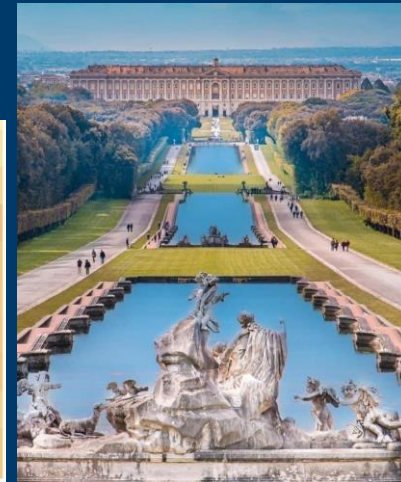
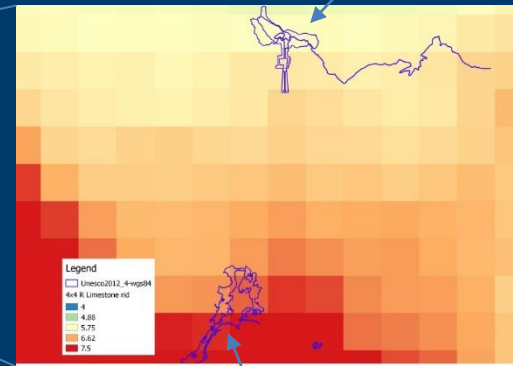
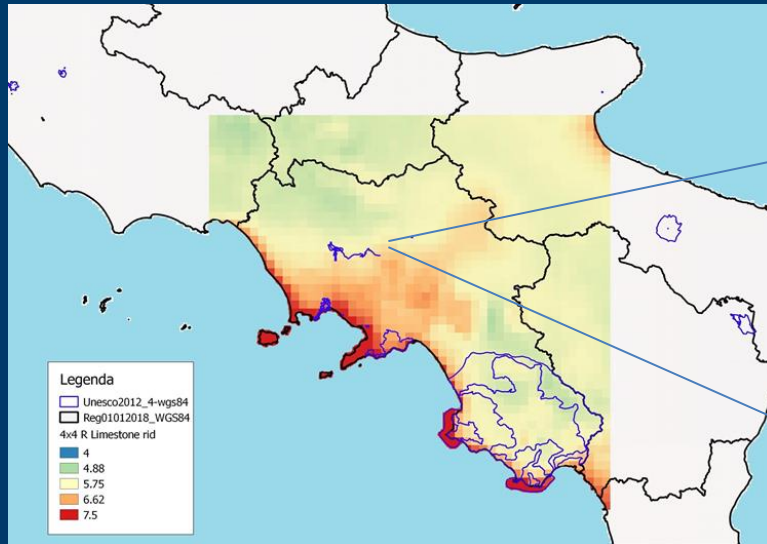


Milano
Air Monitoring station
ARPAL Pascal



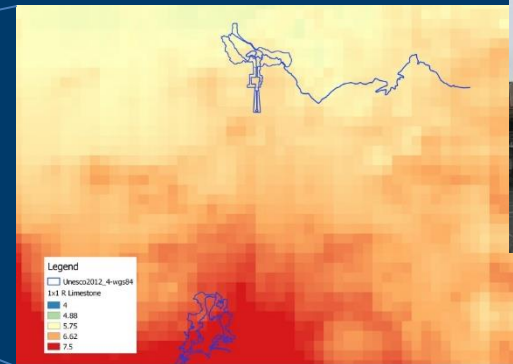
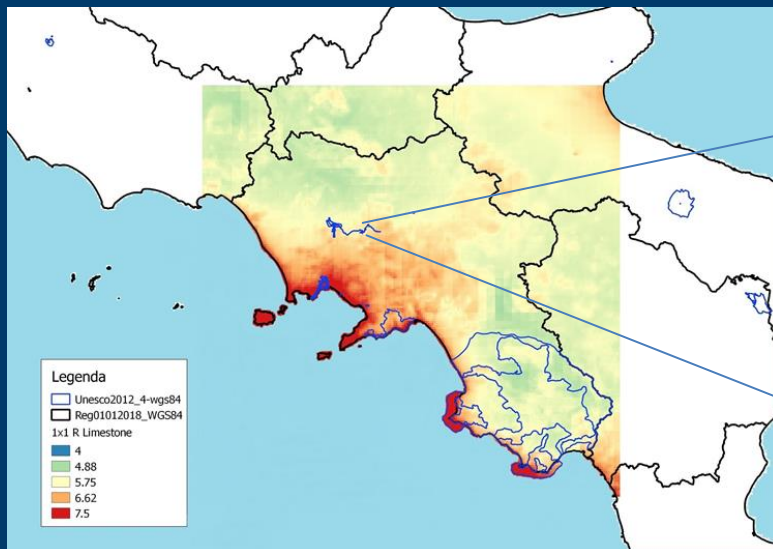
Application of air quality models with increased resolution at selected UNESCO sites to assess the damage on materials due to air

Royal Palace Caserta



MINNI 4 x 4 km limestone recession zoom

Historic Centre of Naples



MINNI 1 x 1 km limestone recession zoom

(https://unece.org/sites/default/files/2022-08/ECE_EB.AIR_GE.1_2022_13-2212585E.pdf)

24th TFMM Meeting –Warsaw, 10-12 May 2023



Suggestions for 2024-2025 Workplan

- improve sea salt parametrizations in models, in particular for Mediterranean Sea; intercomparison modelling exercise
- improve the actual formulation of Bext or propose a new one adequate for European area and useful for CTMs; investigate at European level the model capability to predict visibility with the new function;
- CTMs application in urban areas (relevant for human health, ecosystems and ICP materials) - intercomparison exercise

THANK YOU

