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

Update on air quality activities in ENEA

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on behalf of Atmospheric Pollution Laboratory (INAT)

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

https://met.sspt.enea.it/people
https://impatti.sostenibilita.enea.it/en
www.enea.it

Projects&Activities

- PULVIRUS
- Cooperation Agreement with MITE(Italian Ecological Transition Ministry) (CA-MITE)
- Cooperation Agreement with MITE: Study of Wood Burning Oven Emission
- ABC
- VISIBILTY
- Life Pre VEG-GAP
- TFMM inter-comparison exercises, CAMS and FAIRMODE activities

PULVIRUS: air pollution and COVID-19

Partners

ENEA, National Institute of Health (ISS) and the National System for Environmental Protection (SNPA) whose members are the National Institute for Environmental Research (ISPRA) and the Regional Agencies for Environmental Protection)

Purposes

To investigate at national level:

- ❑ the relationship between air pollution and the spread of the pandemic
- ❑ the physical-chemical-biological interactions between fine particulate matter and viruses
- ❑ the effects of the "lock down" on air pollution and greenhouse gases

for further support to environmental and health policies

Outcomes

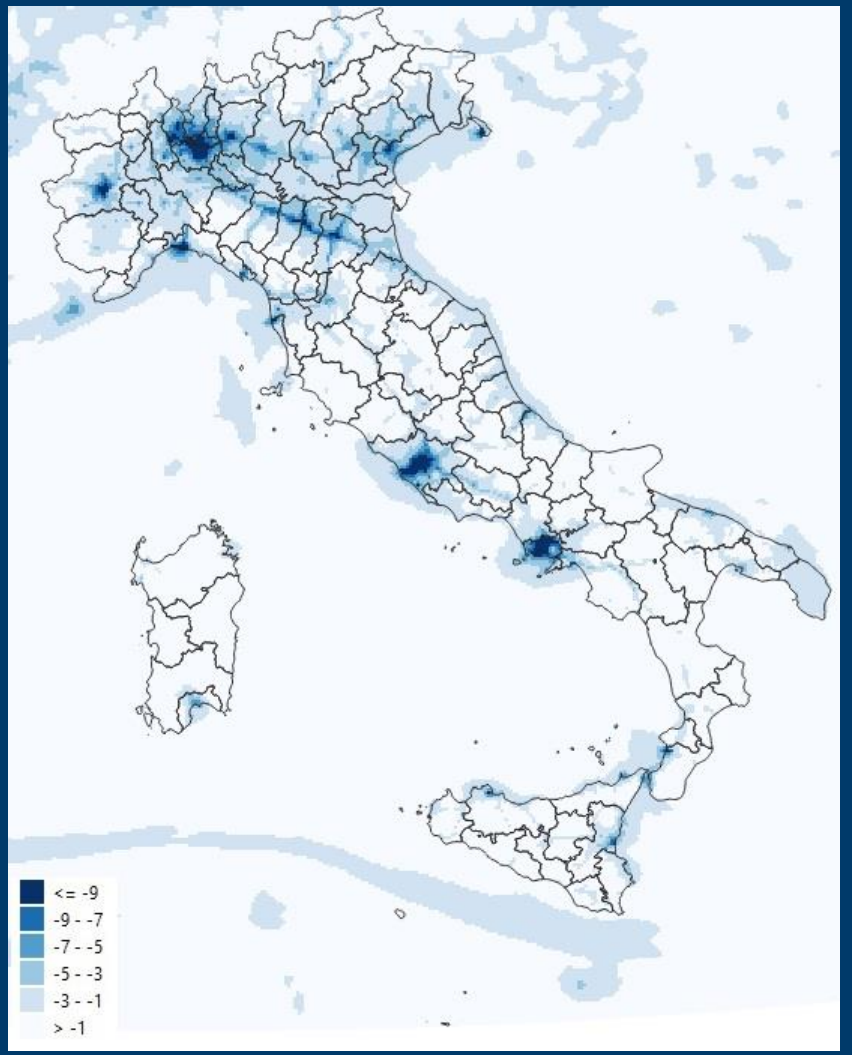
data, models and elaborations, reports and publications will be made available to the public and to the national scientific community through a website

https://impatti.sostenibilita.enea.it/en/projects/pulvirus

PULVIRUS approach: measurements and modelling

- **the impact of lockdown on atmospheric composition:** measurements and simulations with AMS-MINNI

- **study of the interaction between atmospheric particulate matter and virus:** "in silico" analysis, i.e. the reproduction of the interaction between virus and atmospheric particulate by means of computer simulation, and a biological model representative of the characteristics of SARS-CoV-2

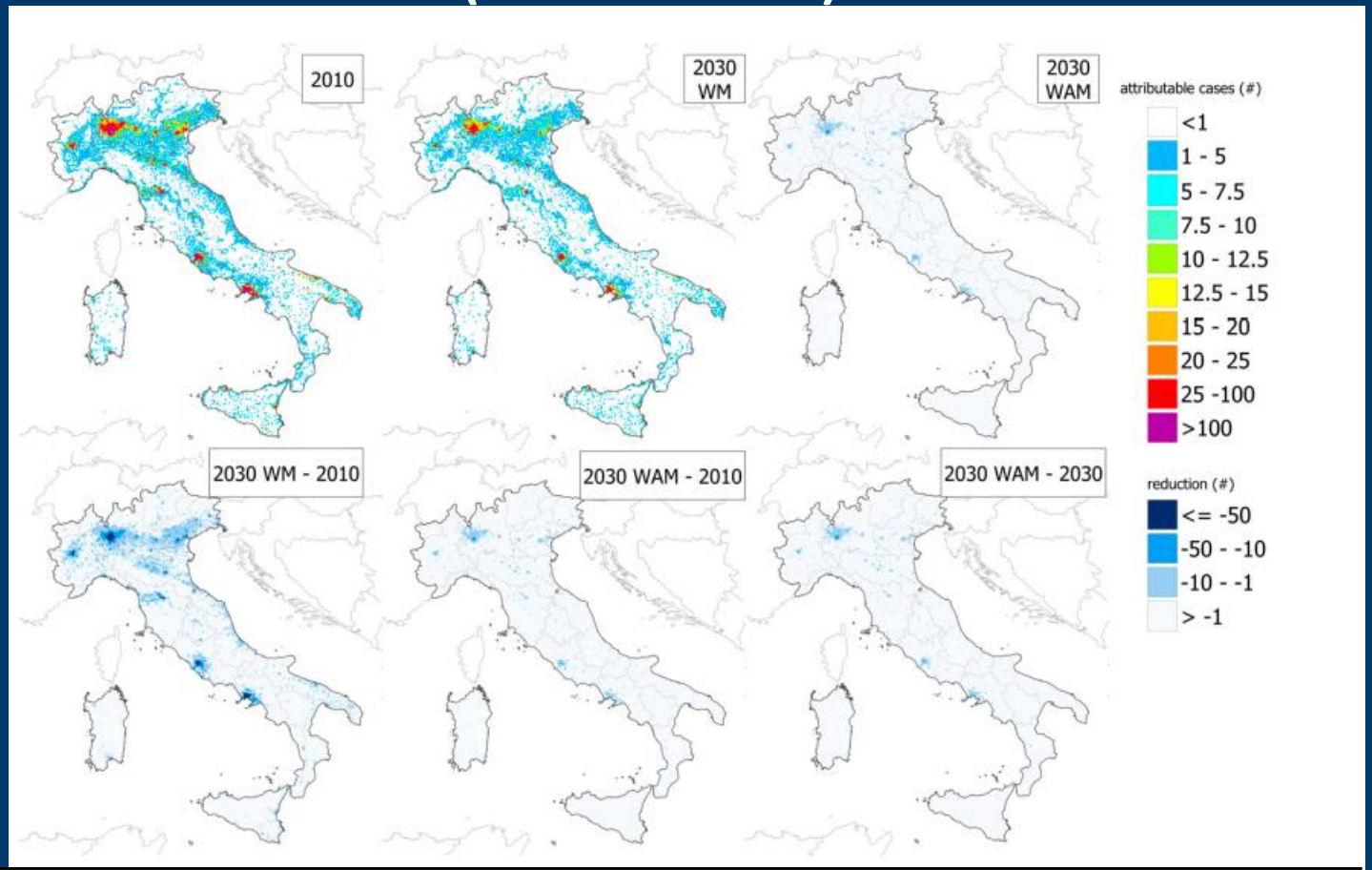


NO_2: modelled concentration reduction - April 2020

CA-MITE: Updated 2030 scenarios for National Air Pollution Control Plan (NEC Directive)

$PM_{2.5}$ mortality

$PM_{2.5}$ variation in mortality



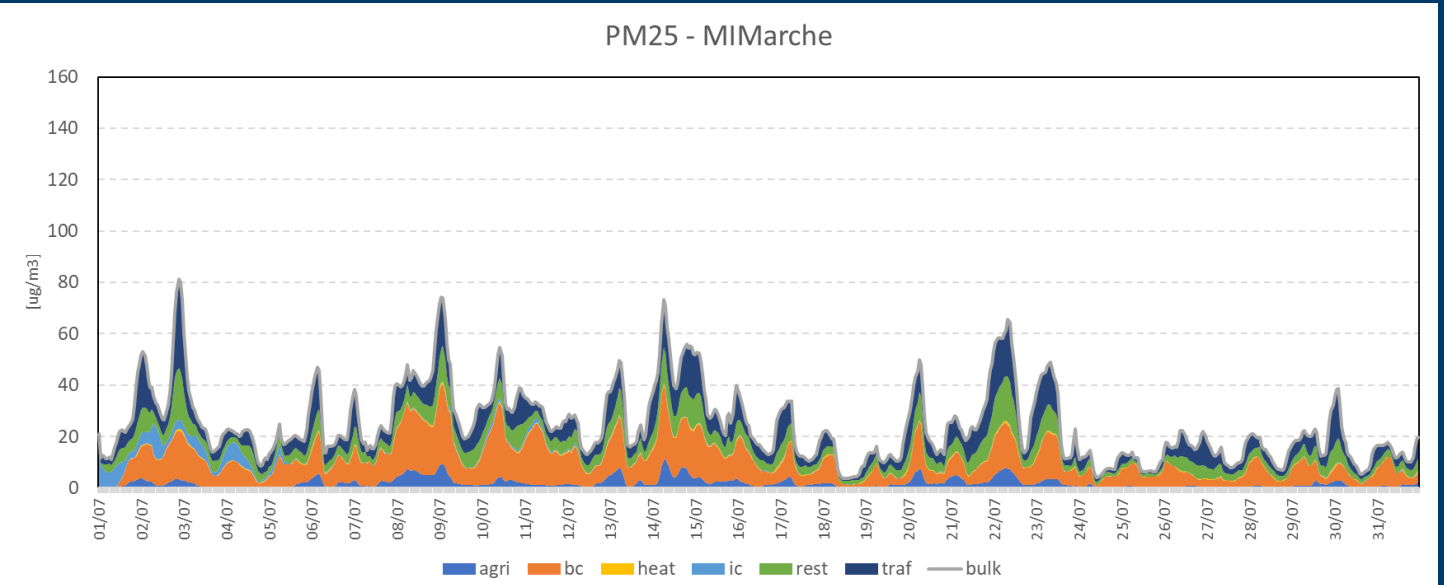
Health Outcome	2010 (min–max)	2030 WM (min–max)	2030 WM–2010 (%)	2030 WAM (min–max)	2030 WAM– 2010 (%)	WAM–WM (%)
Mortality all–natural causes	58,867 (35,379–83,670)	37,335 (22,608–52,656)	−37%	34,666 (21,013–48,840)	−41%	−7%

Piersanti et al., Atmosphere, 2021, 12, 196. doi: 10.3390/atmos12020196

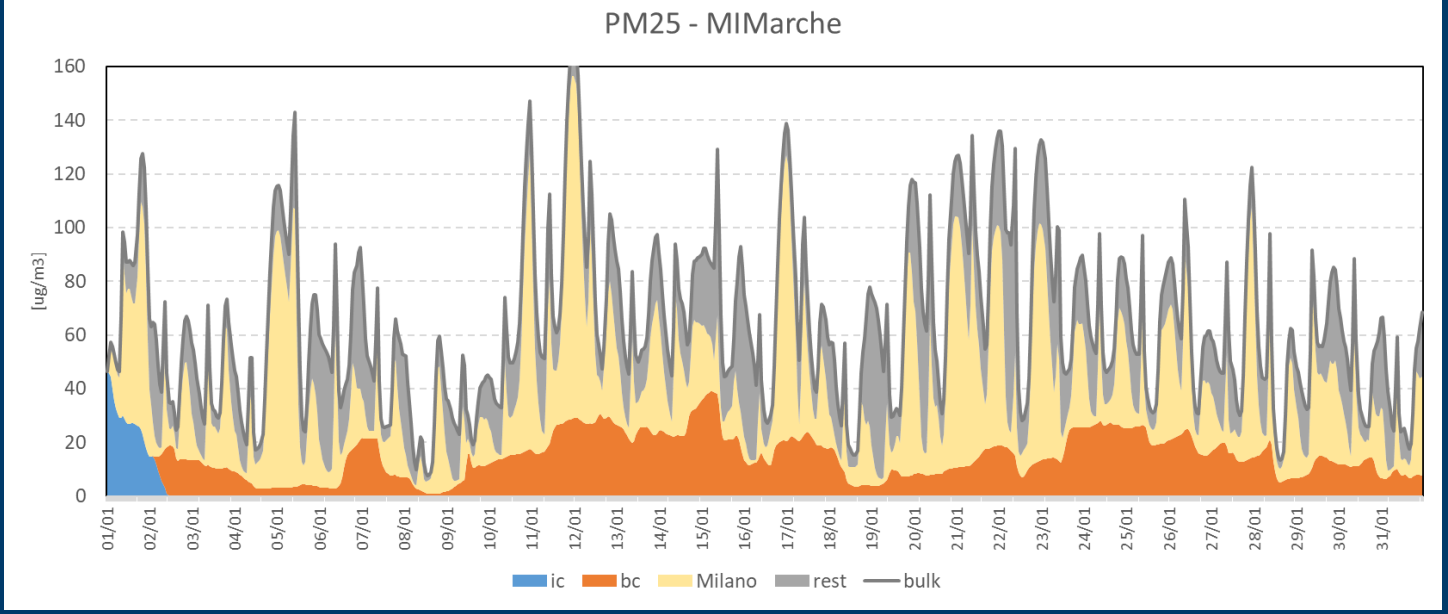
https://impatti.sostenibilita.enea.it/projects/accordo-direttiva-nec
https://iiasa.ac.at/web/home/research/researchPrograms/air/policy/8_Piersanti_TFIAM_2021.pdf

CA-MITE: On-line source apportionment in MINNI

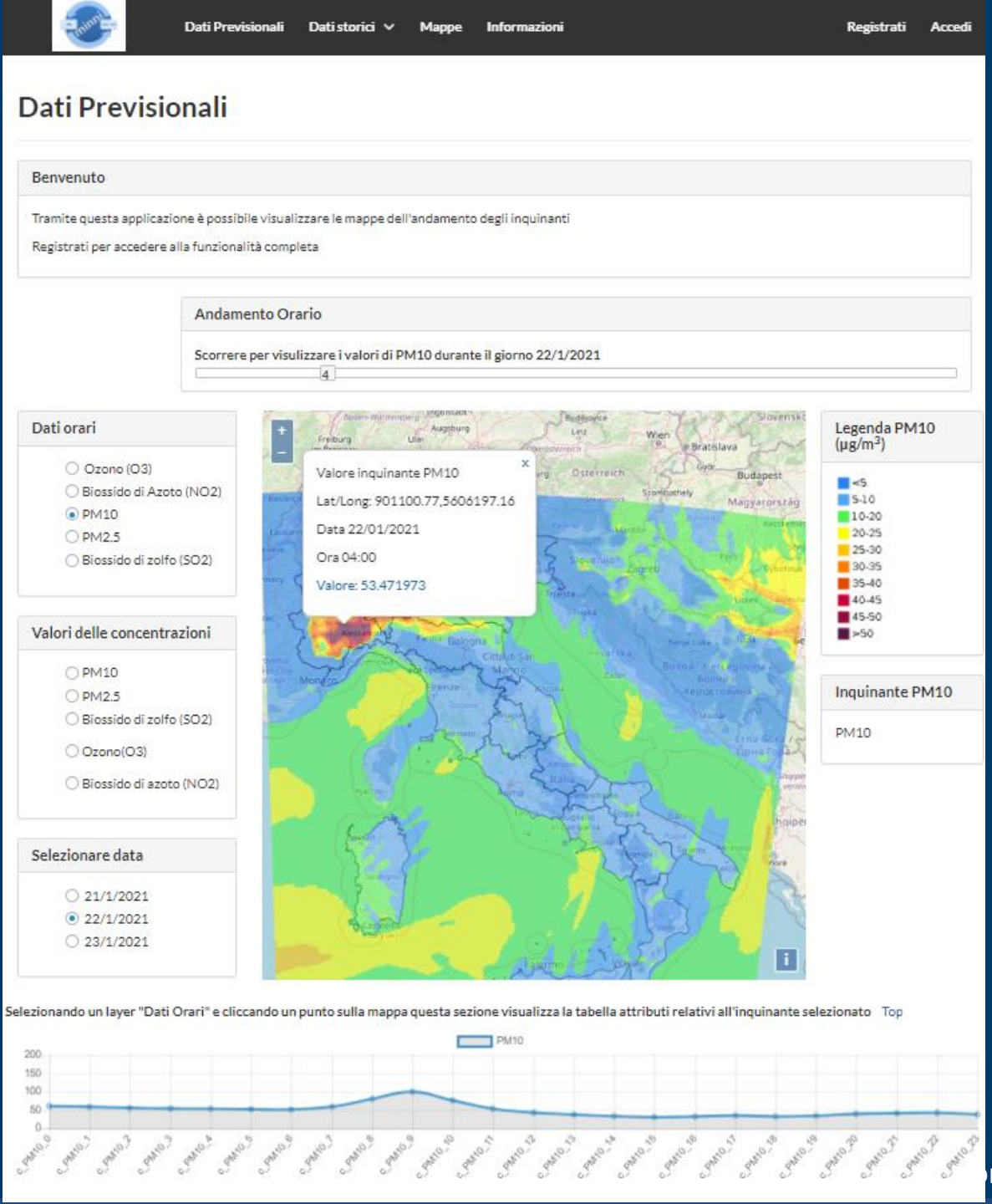
Sectorial SA



Geographic SA



SA using a tagged species approach as Kwok *et al.* (2013, 2015)



CA-MITE: Web gateway for MINNI historical simulations and FORAIR forecast

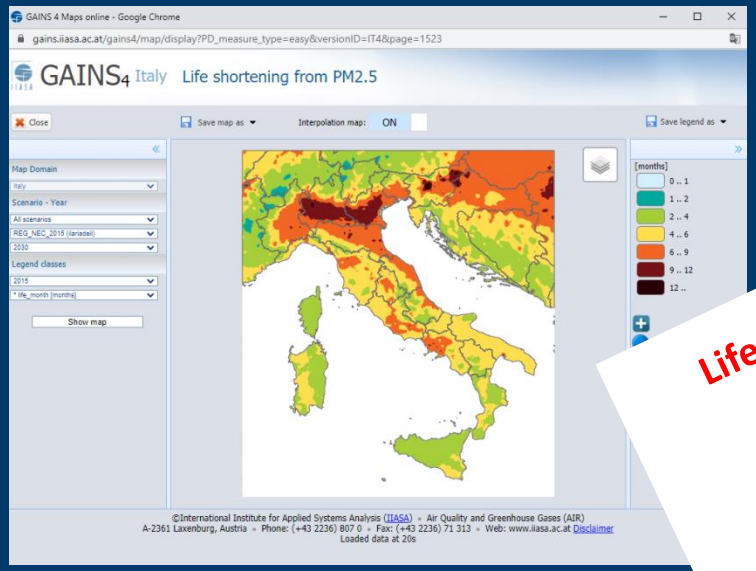
(online summer 2021)

Web gateway for MINNI historical simulations and FORAIR forecast

nline

CA-MITE: Updates on GAINS-Italy

- Input data: The 20 Italian Regions
- ATM spatial resolution: 4 km
- Meteo: 2015, 2004, 2005 + average
- ATM equation : linear + second order terms some impact indicators (O_3, PM, NO_2…)
- Scenario years: 1990-2050 (5-year step)



Life shortening from PM2.5

Year 2030

Very preliminary results

(resolution 4km)

ENEA-IIASA collaboration

Cooperation Agreement with MITE: Study of Wood Burning Oven Emission

Partners

ENEA- MITE

Purpose

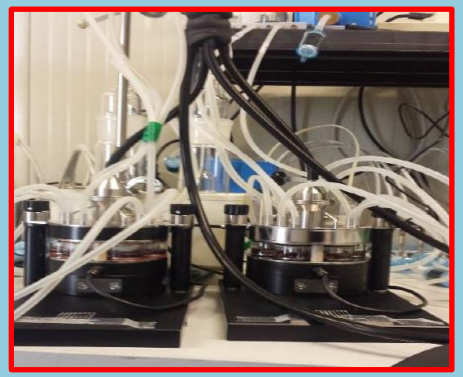
Investigation on the impact of wood burning oven (for cooking pizza) emissions on air quality

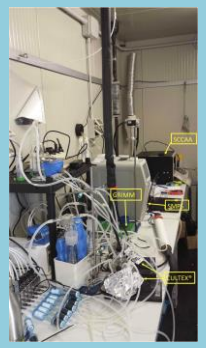
Outcomes

- PM_{10}, $PM_{2.5}$, PAH wood burning oven emission factors
- chemical characterization of wood burning oven aerosol emissions

ABC (Aerotrazione con BioCarburanti) – Airmotive with biofuels: sampling setup

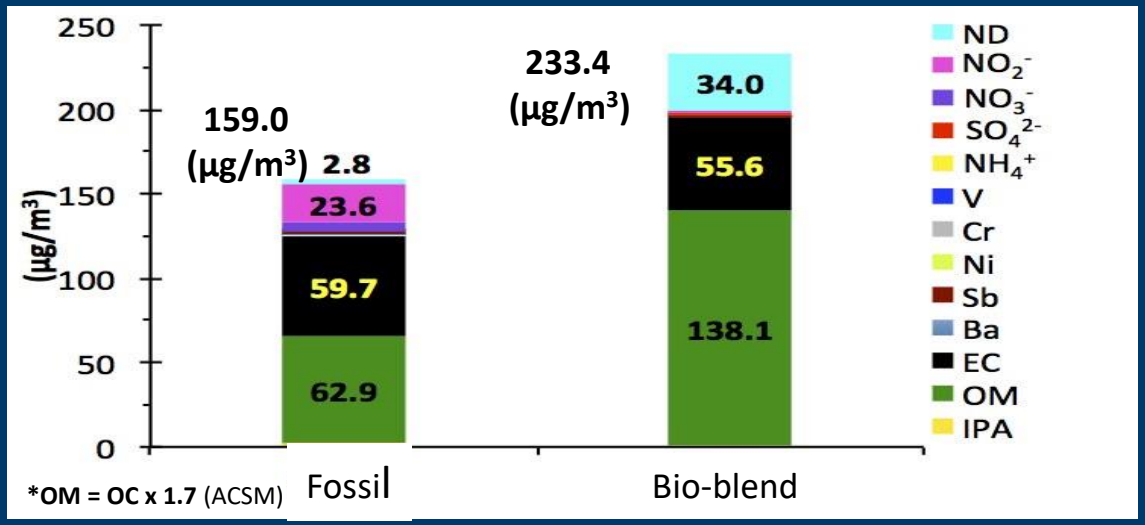
LINEA	1	2	3	4	5
PM/gas	PM_1	$PM_{2.5}$	$PM_{1.7}$	GAS	$PM_{2.5}$
lpm	3	38.3	4	-	9
Instruments	ACSM	3 pumps	SMPS GRIMM **2xCultex**	M/TNMHC CO_2, SO_2, NO, NO_2, NOx	OCEC Sunset





ABC results

Chemical composition of $PM_{2.5}$



	$PM_{2.5}$ (µg/m³)	err (µg/m³)
Fossil fuel	159.0	13.8
Bio-blend fuel *	233.4	26.9

*ca. 15% bio

	IPA	
	µg/m³	%
Fossil fule	2.81	1.8
Bio –blend fuels	1.59	0.7

Emissions factors

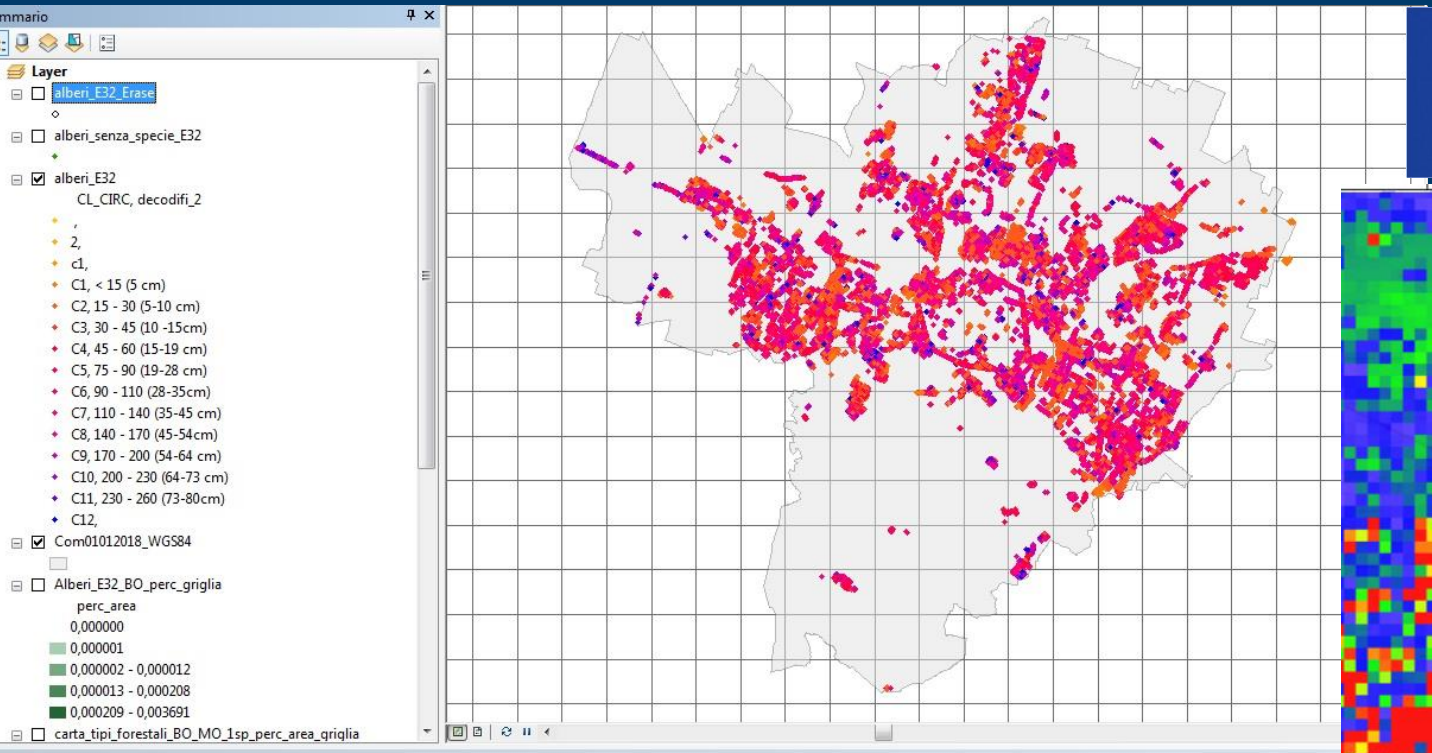
Emissions factors for kg of fuel		Bio-blend fuel	Fossil Fuel	Ratio B/F
PM2.5 (mg)		612.0 (70.4)	455.6 (39.5)	1.3
Organic carbon	ɔ OC (mgC)	219.7 (54.1)	109.9 (21.4)	2.0
Elemental carbon	EC (mgC)	145.6 (31.8)	169.4 (31.5)	0.9

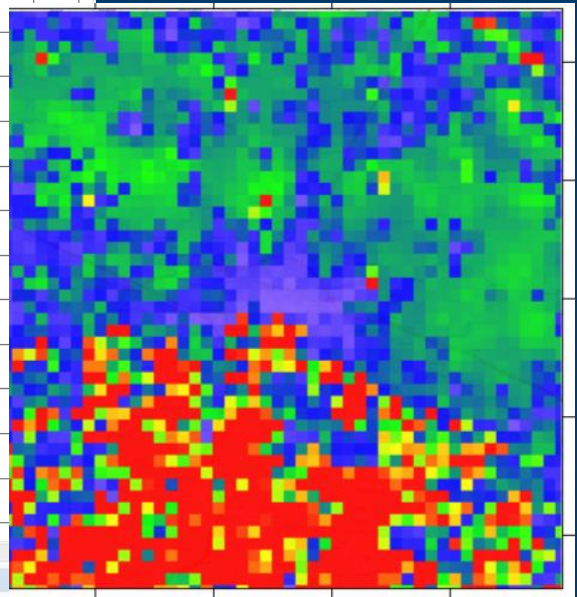
Application of US EPA visibility approach and National Park Service (NPS) methodology in Italy

ENEA - Arma dei Carabinieri: sampling campaign near Circeo National Park

Visibility in natural/wilderness areas is essential for the “recreational” interest of these areas.

Chemical characterization of aerosol for testing IMPROVE Equation used for estimating aerosol light extinction





Isoprene emissions

FID	Shape	NUM_PT	COD_UG	SPECIE	CL_H	CL_CIRC	PREGIO	decodifica	decodifi_2	decodifi_4	Classe	tronco	coefficiente	chioma
39	Punto	4128	48	Qur	4	C12	S	16 - 23		Quercus robur	C12	<Null>	15	15
46	Punto	13286	1861	Aei	3	C12	N	12 - 16		Aesculus hippocastanum	C12	<Null>	15	15
145	Punto	62165	3081	Tg1	4	C12	N	16 - 23		Tilia intermedia	C12	<Null>	15	15
286	Punto	97822	3411	Poex	4	C12	N	16 - 23			C12	<Null>	15	15
309	Punto	90340	3589	Pon	4	C12	N	16 - 23		Populus nigra	C12	<Null>	15	15
388	Punto	15915	1505	Poa	5	C12	N	>23		Populus alba	C12	<Null>	15	15

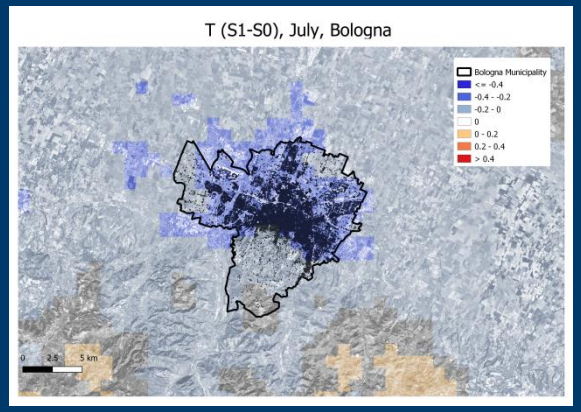
(0 fuori di 76845 Selezionati)

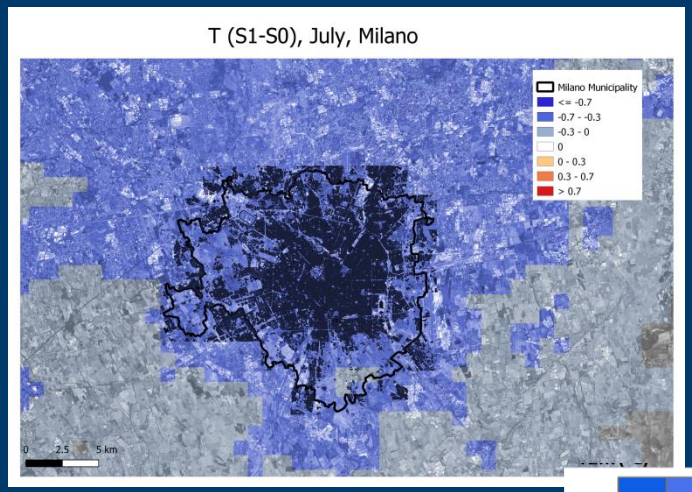
Parameters
Heat capacity of roof/walls [J m^{-3} K^{-1}]
Heat capacity of ground [J m^{-3} K^{-1}]
Thermal conductivity of building wall/roof [J m^{-1} $s^{-1}$$K^{-1}$]
Thermal conductivity of ground [J m^{-1} $s^{-1}$$K^{-1}$]
Albedo of walls/roof/ground [-]

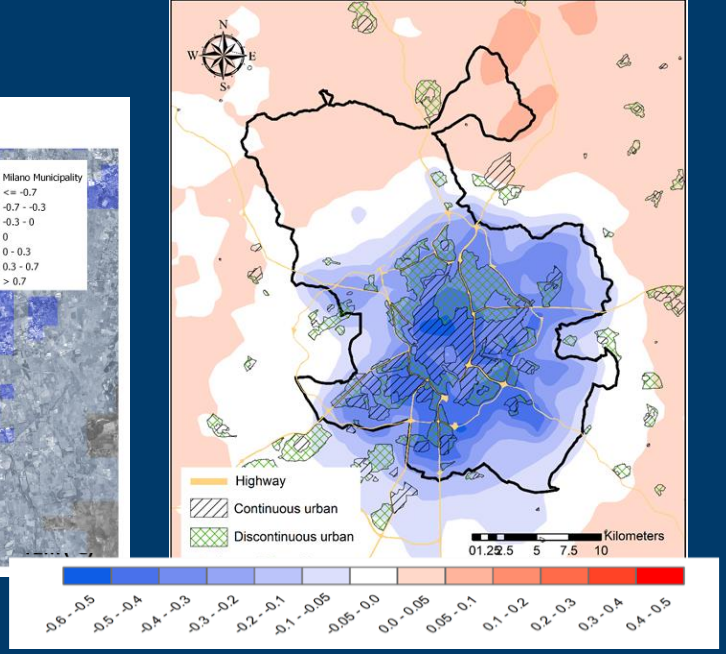
Parameters	Unit
Building height	m
Building width	m
Width of the road	m
Urban fraction	Fraction
Roof albedo	Fraction
Wall albedo	Fraction
Pavement albedo	Fraction
Roof roughness length	m
Wall roughness length	m
Pavement roughness length	m

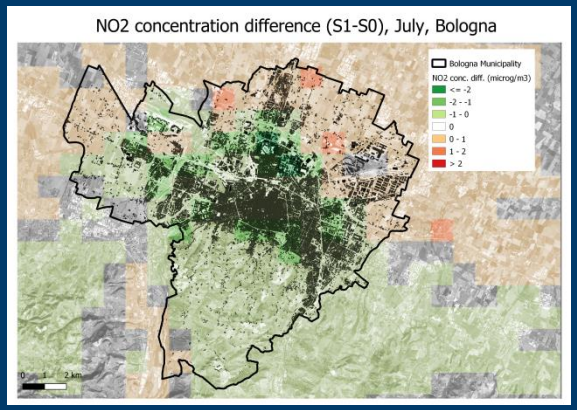
Life

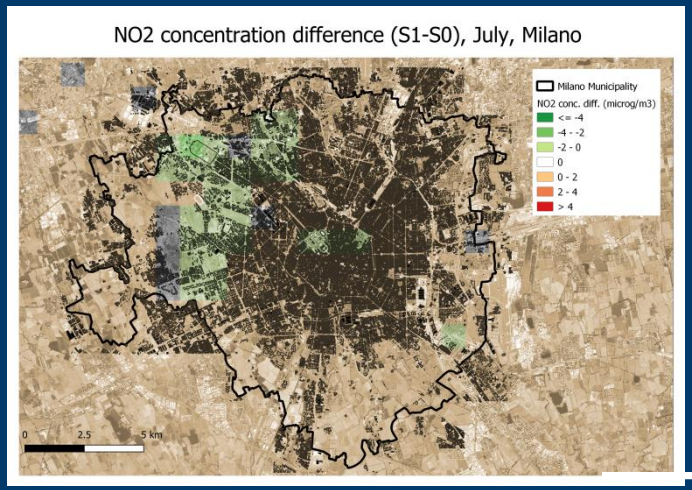
Veg Gap
Vegetation for Urban Green Air Quality Plans

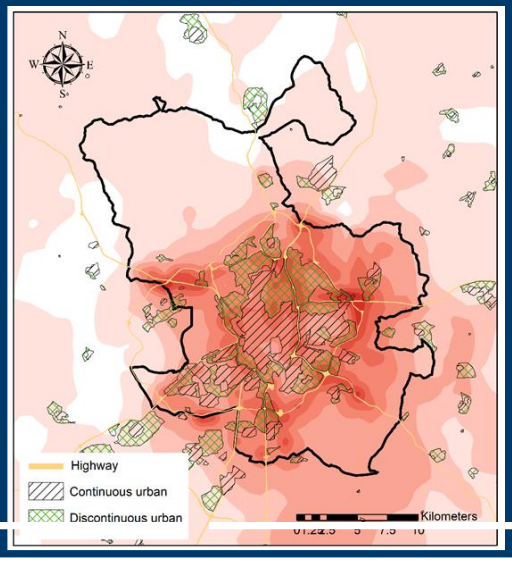










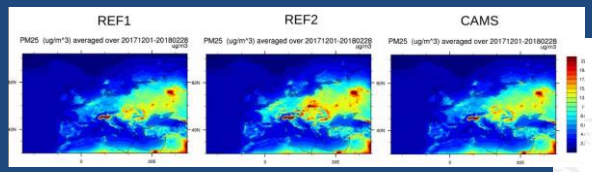


ENEA

TFMM inter-comparison exercises and FAIRMODE activities

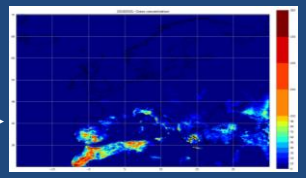
TFMM

EURODELTA –CARB →

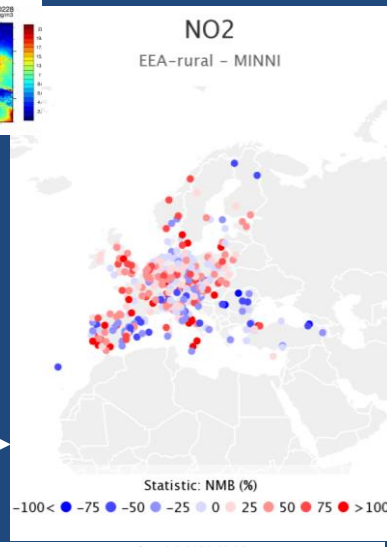


EURODELTA –CARB-BaP → In preparation

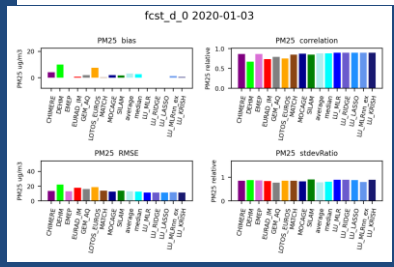
CAMS50 participating as candidate model →



CAMS61 participating to sensitivity test for year 2018 →



CAMS63 participating to the development of least square fitting of CAMS Regional air Quality ensemble →



FAIRMODE

CT1- Source apportionment to support AQ management
CT2 - Development of an overall QA/QC protocol for AQ assessment
CT3 - Quality control indicators for AQ forecast
CT4 - Micro-local scale air quality modelling
CT5 - Best practices for local and regional AQ management
CT8 - Exposure and exceedance indicators
CT9 - Effectiveness and robustness of air quality projections

THANK YOU!

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