

Roma, 29/10/2020

Dott. Claudio Gariazzo

INAIL

Il progetto BigData in Epidemiologia ambiEntale ed occuPazionale (BEEP)



Claudio Gariazzo, Giovanni Viegi, Massimo Stafoggia
per conto del Gruppo Collaborativo BEEP

Progetto Bigdata in Epidemiologia ambiEntale ed occuPazionale (BEEP)



- **Durata:** 2.5 anni, 29/6/2017 to 30/12/2019
- **Obiettivo principale:** stimare gli effetti sulla salute di inquinamento atmosferico, rumore e parametri meteorologici sulla popolazione generale, con un focus su:
 - a) **Rischi di ospedalizzazione e mortalità** in Italia e nelle principali aree metropolitane
 - b) **Rischi di incidente sul lavoro** in popolazioni di lavoratori in relazione a fattori di rischio ambientali
 - c) **Rischi di incidenti stradali** in relazione ed eventi climatici

Partners e professionalità:

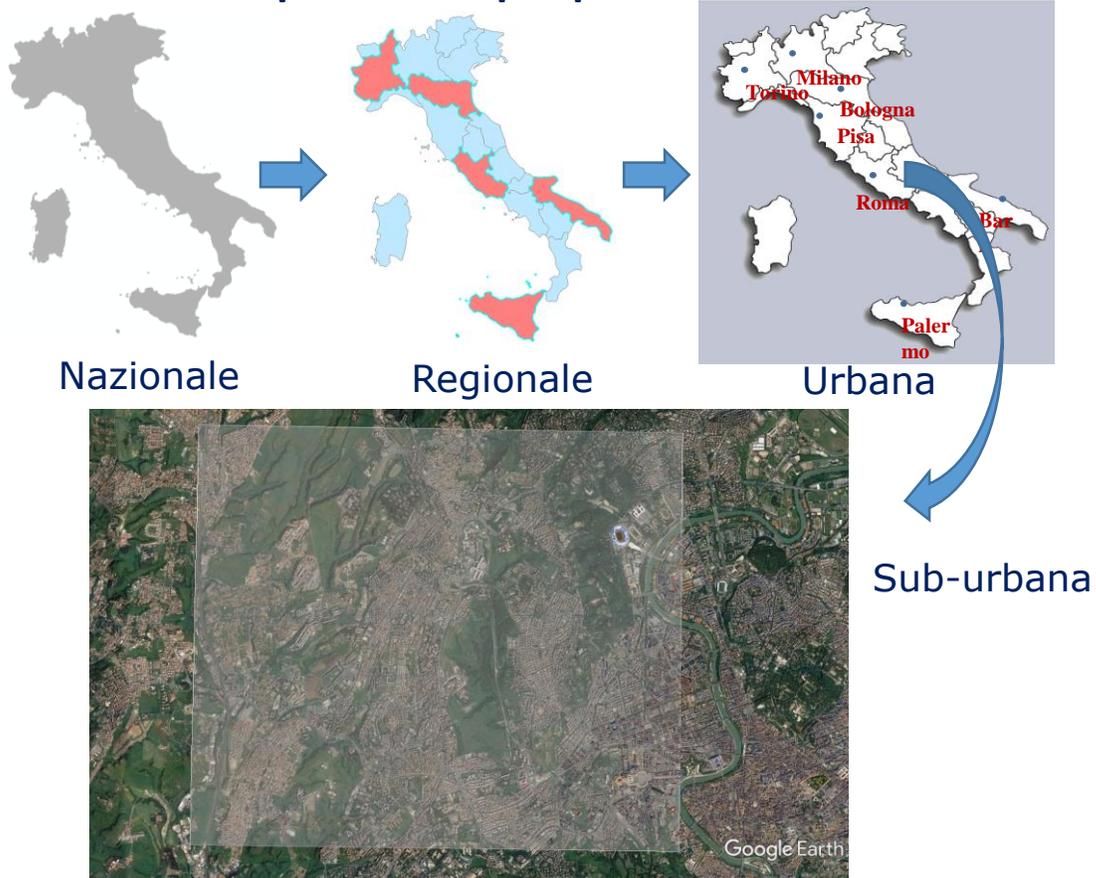


Coinvolti circa 30 ricercatori tra epidemiologi, modellisti ambientali e collaboratori vari

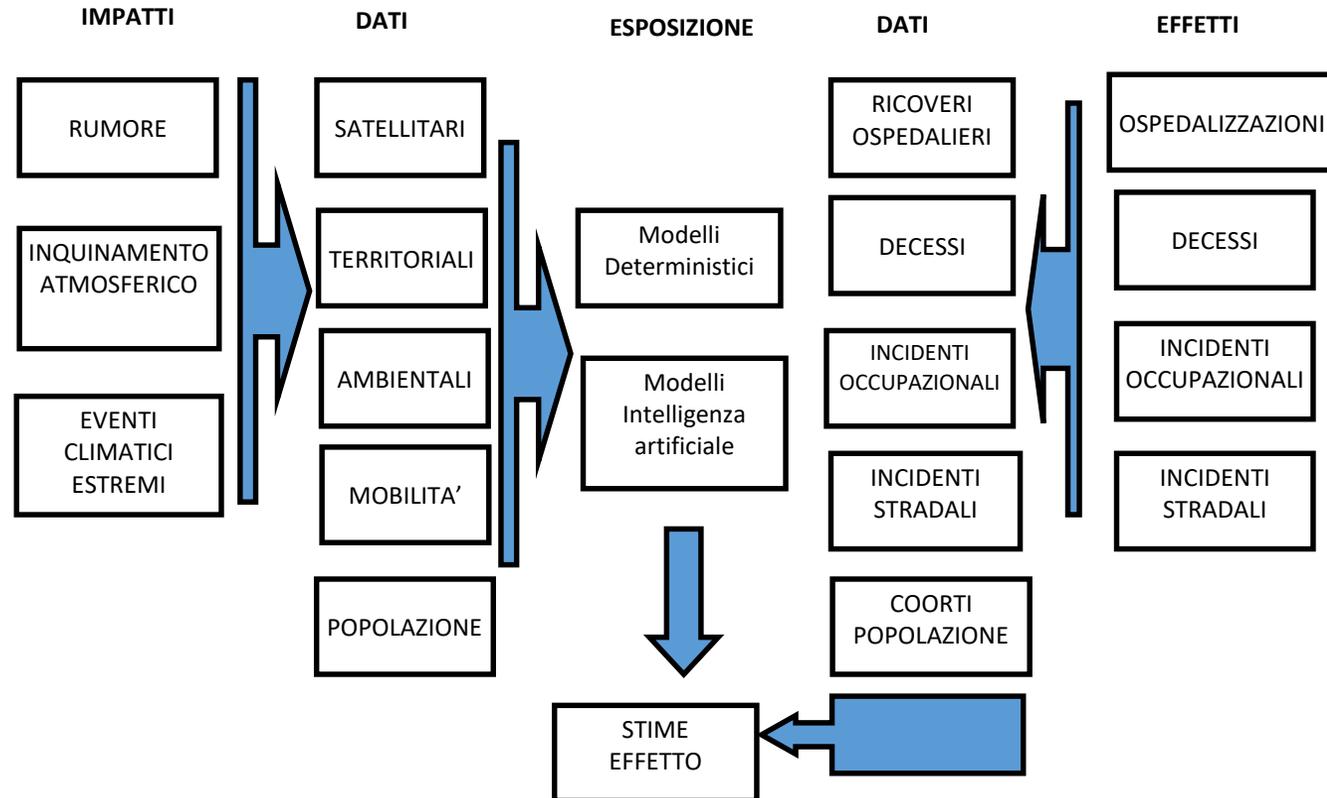
Progetto co-finanziato da : Bando BRiC 2016 finanziato dall'INAIL – ID 04

Il progetto BEEP – Layout concettuale e scale spaziali

Scale spaziali sempre più definite:

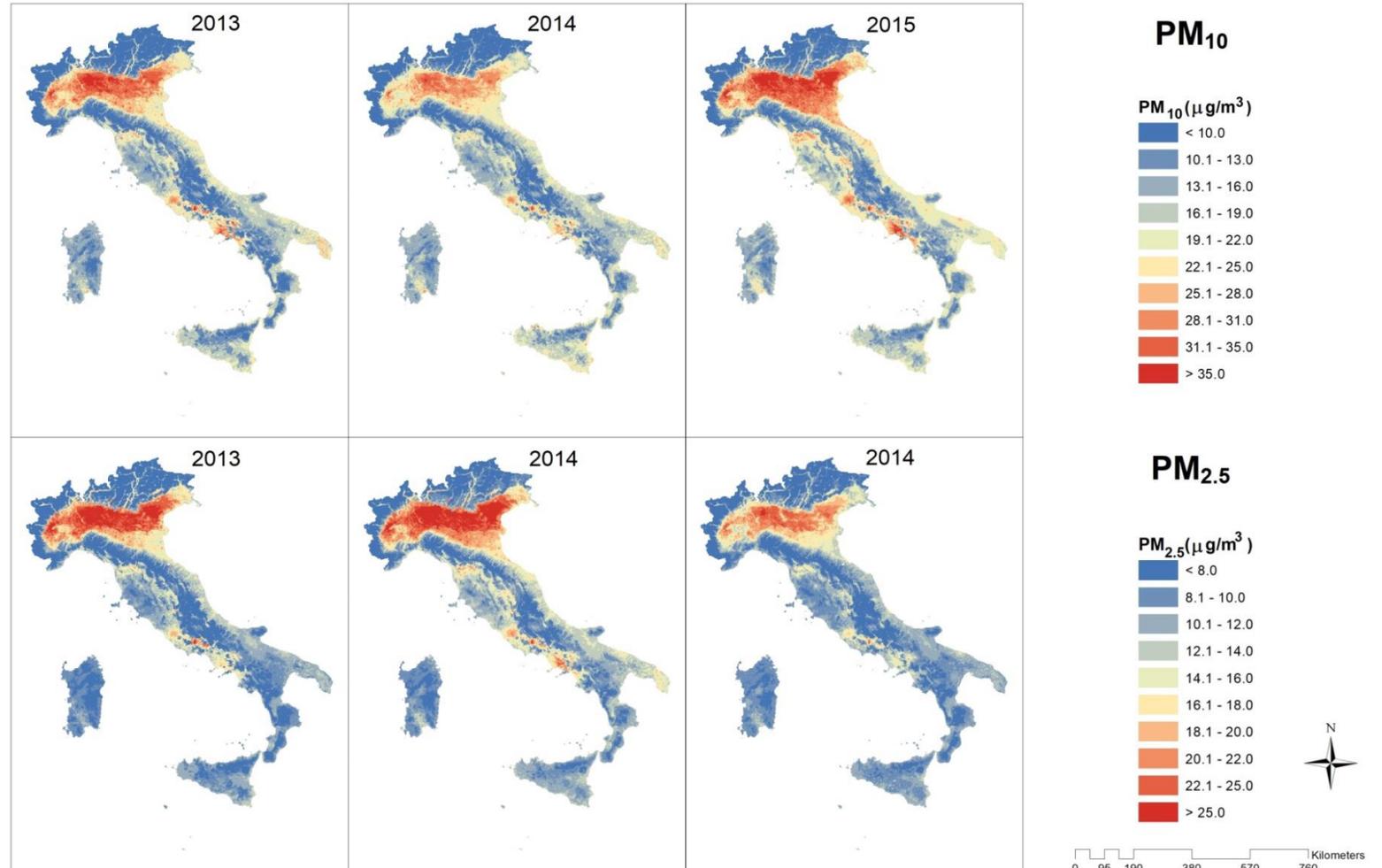


5. LAYOUT CONCETTUALE DEL PROGETTO

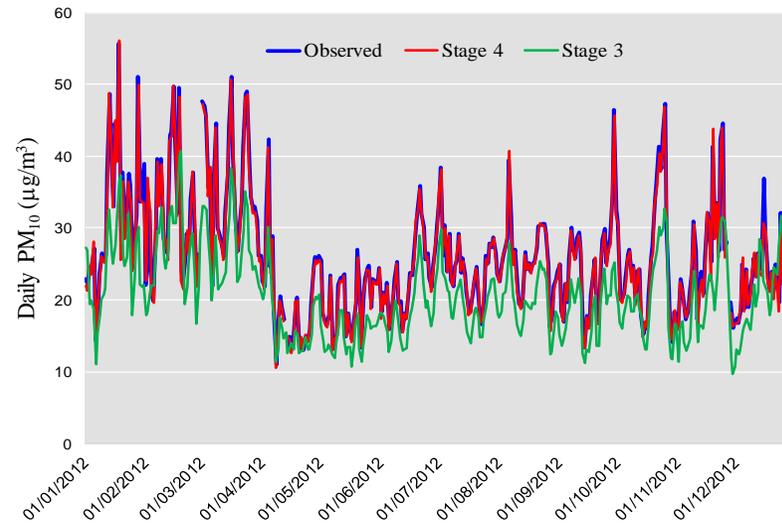


Le esposizioni ambientali disponibili in BEEP

Stime particolato atmosferico PM₁₀ e PM_{2.5} da dati satellitari e metodi di IA



Serie giornaliere a 1x1 km. Per PM₁₀ serie disponibili dal 2006



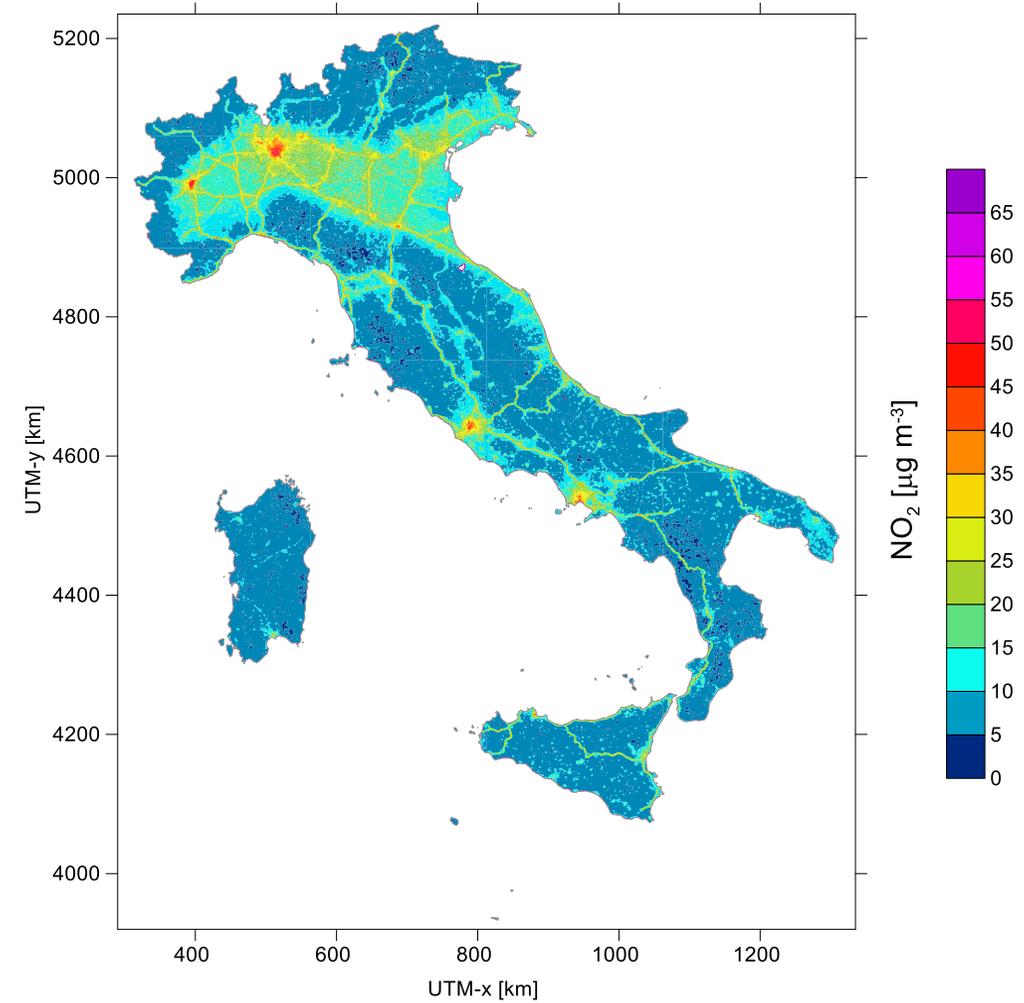
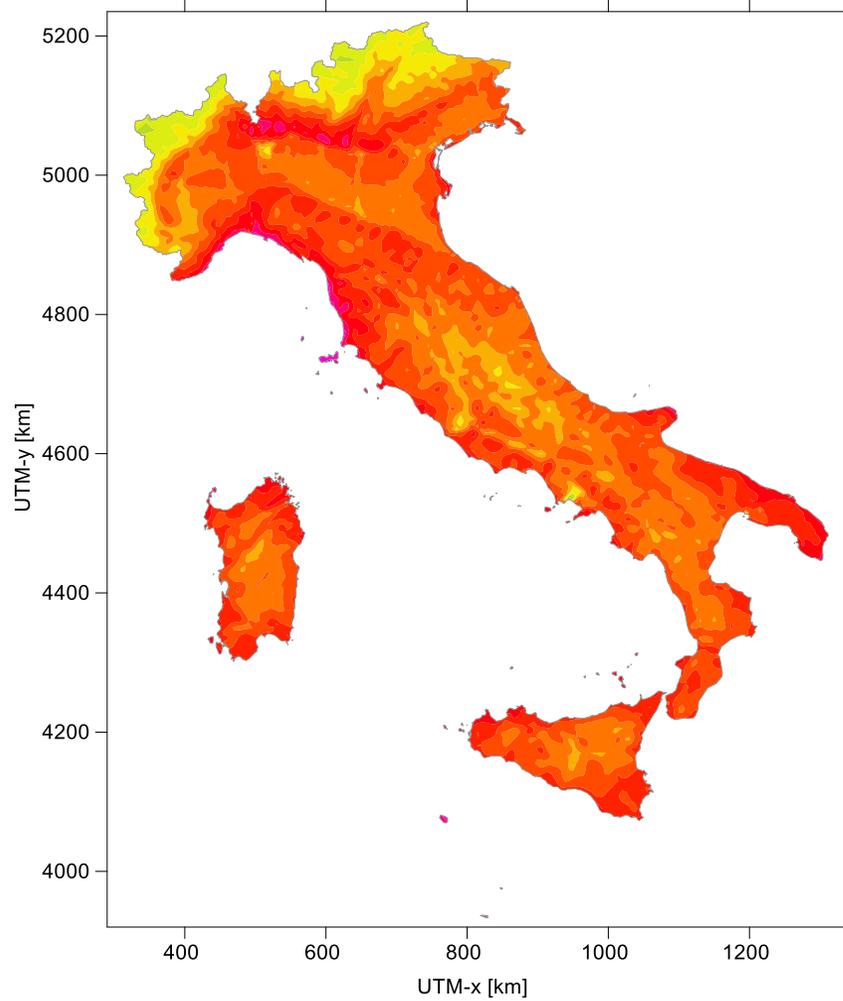
Validazione misure/modello



INAIL

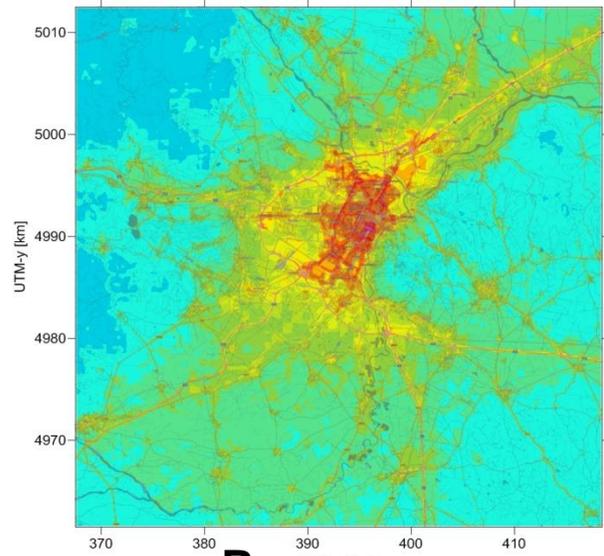
Mappe nazionali di altri inquinanti gassosi

Serie giornaliere disponibili dal 2013-al 2015

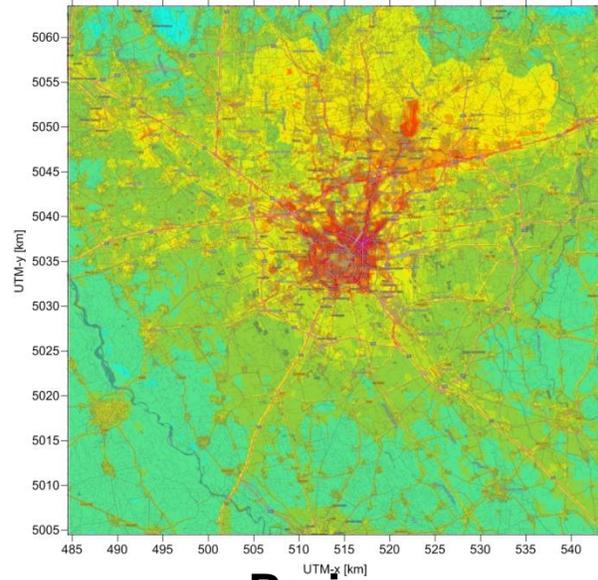


Le esposizioni nelle aree metropolitane

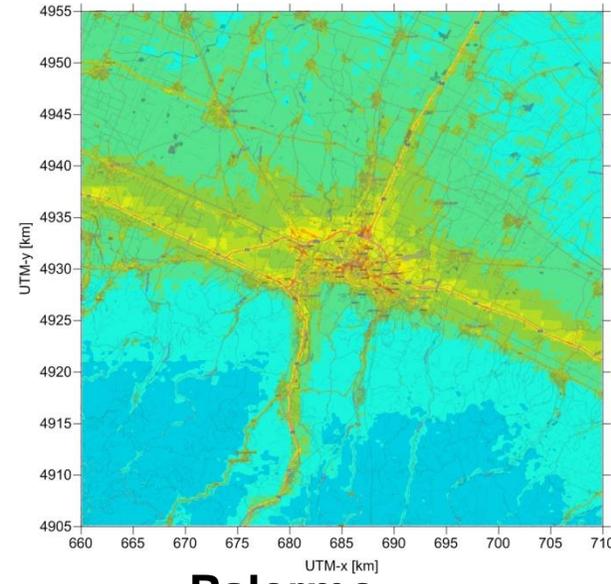
Torino



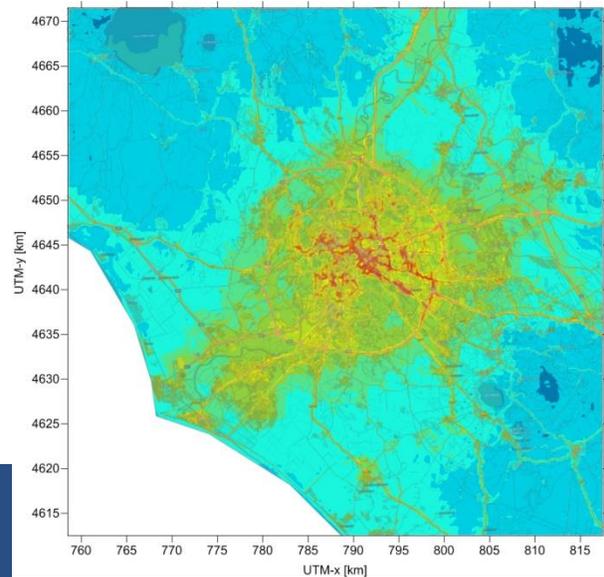
Milano



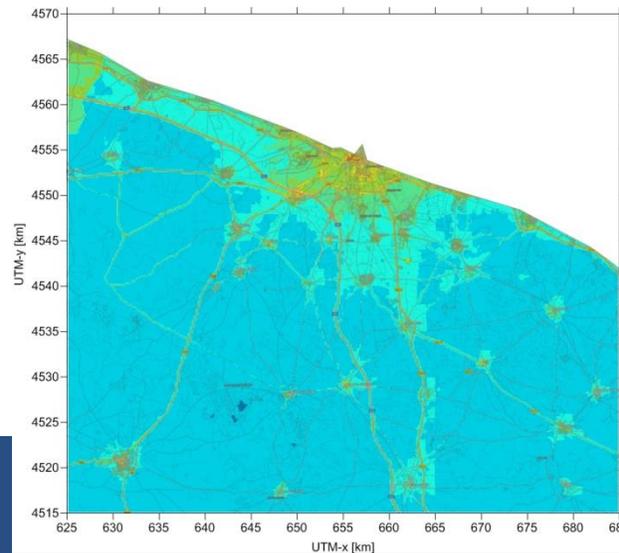
Bologna



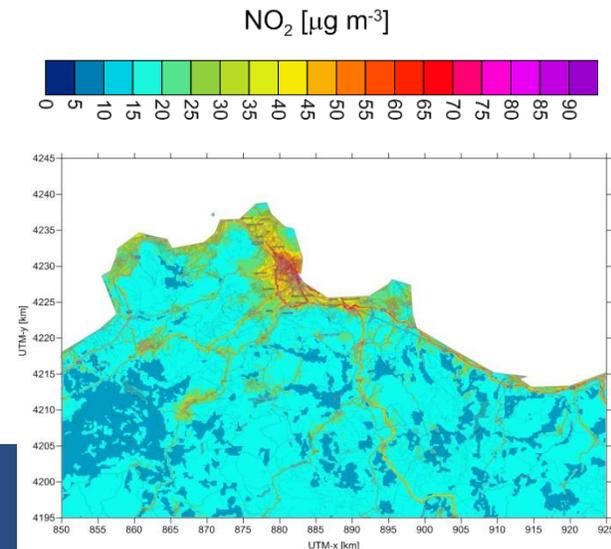
Roma



Bari



Palermo

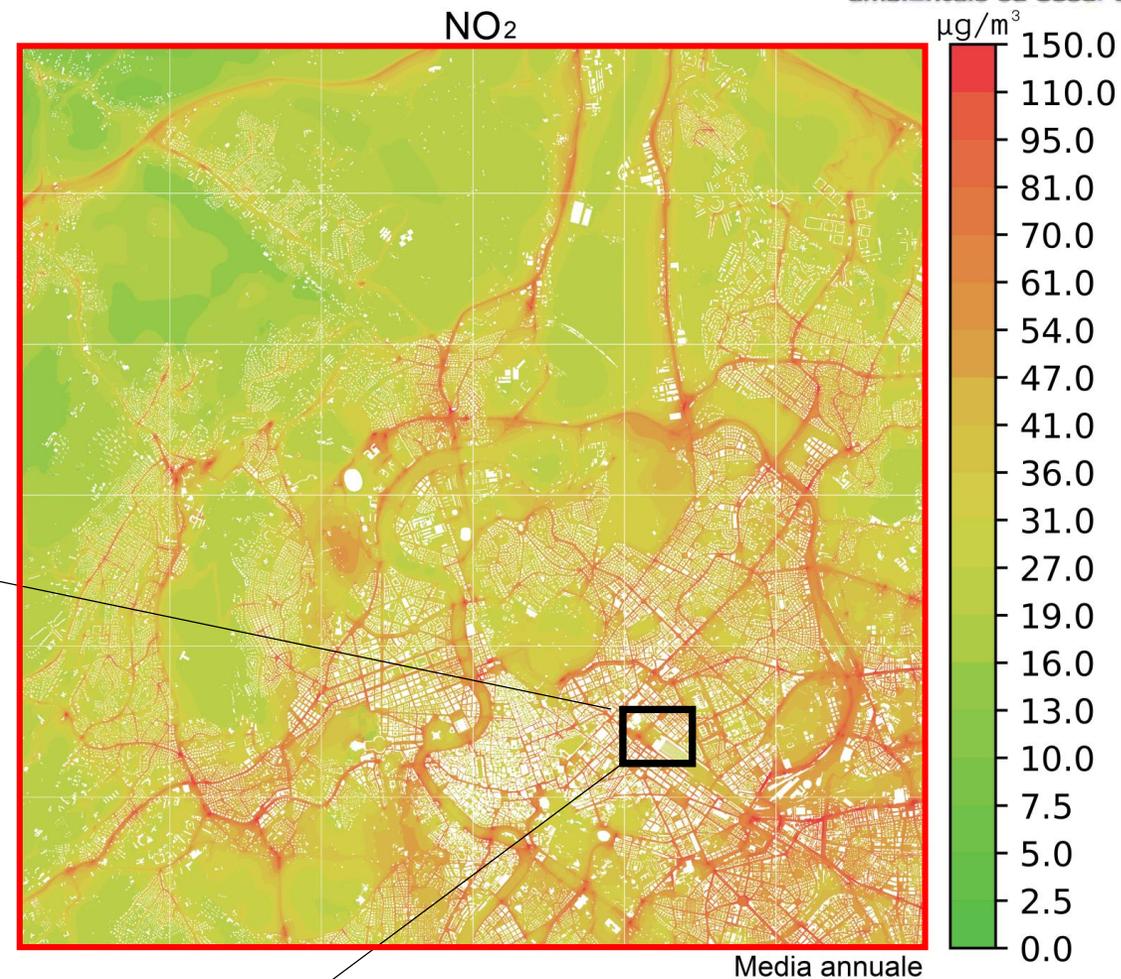
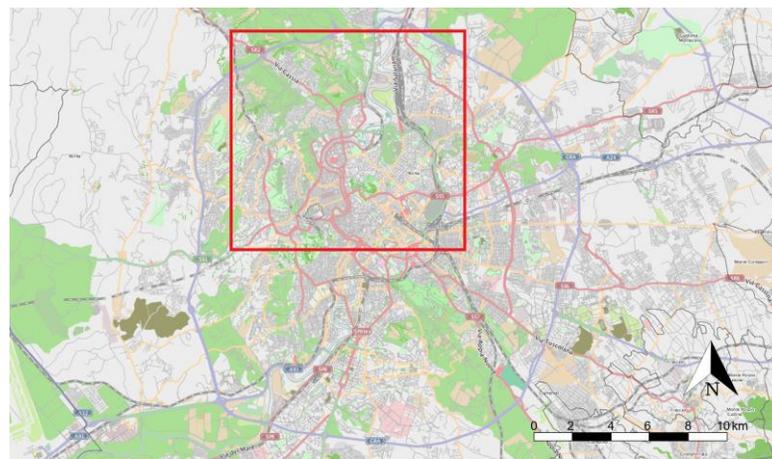


NO₂ [$\mu\text{g m}^{-3}$]



- Ottenute con metodi di IA
- Serie giornaliere 2013-2015
- 200m risoluzione
- Disponibili anche per:
 - PM₁₀
 - PM_{2.5}
 - Ozono

L'esposizione alla micro-scala metropolitana caso studio di Roma

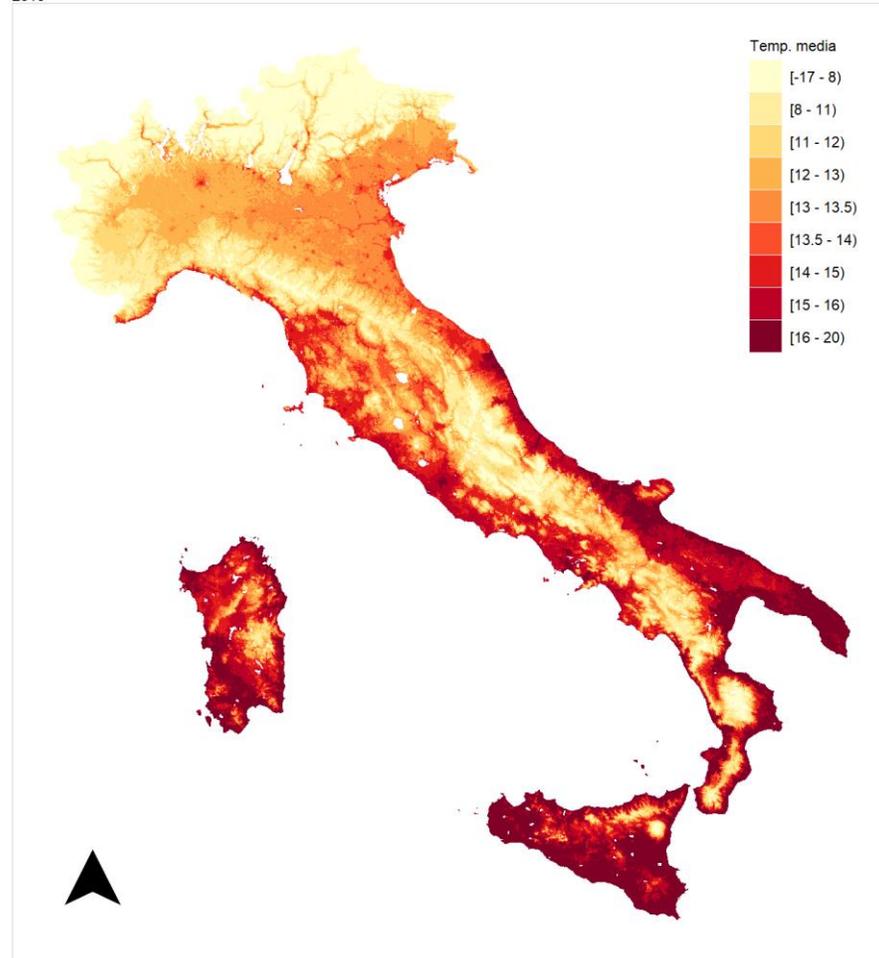


- Realizzato con computer paralleli e modelli avanzati
- Serie orarie di PM10 e NO₂ a 4m di risoluzione
- Anno 2015

Stime temperatura basate su dati satellitari

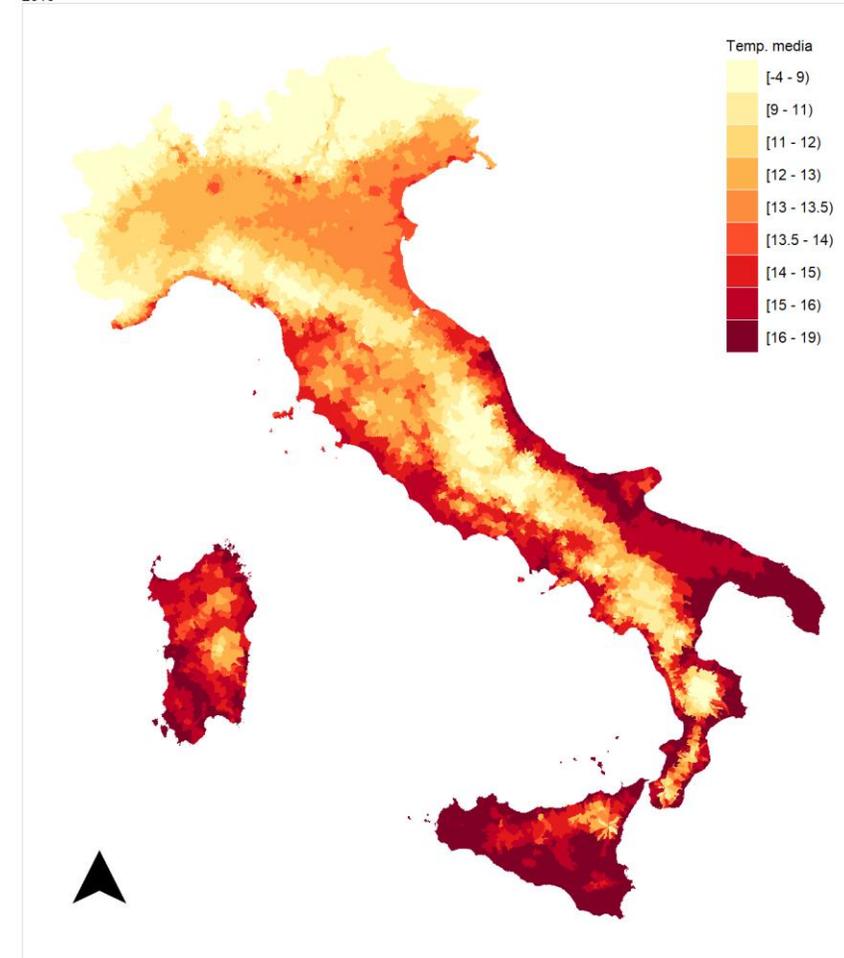
Temperatura media per cella (°C)

2010



Temperatura media per comune (°C)

2010



Serie giornaliere a 1x1 km disponibili dal 2006 al 2013.

Gli esiti sanitari ed occupazionali disponibili

Gli esiti disponibili

Mortalità 2006-2015



Cause	Totali	
	N	%
Naturali	2,159,015	100.0
Cardiovascolari	869,039	40.3
Cardiache	589,618	27.3
Ischemiche	240,511	11.1
Cerebrovascolari	254,148	11.8
Respiratorie	153,603	7.1
Mentali	56,403	2.6
Nervose	80,802	3.7
Metaboliche	102,638	4.8
Diabete	43,815	2.0

Ricoveri 2001-2015



Diagnosi	Codici ICD9	Totale	
		N	%
Naturali	001-799	50,169,403	100.0
Cardiovascolari	390-459	11,789,049	23.5
Cardiache	390-429	8,024,915	16.0
Ischemiche	410-414	2,835,604	5.7
Cerebrovascolari	430-438	2,932,314	5.8
Respiratorie	460-519	6,082,496	12.1
Mentali	290-319	1,676,581	3.3
Nervose	320-389	1,784,134	3.6
Metaboliche	240-279	1,238,542	2.5
Diabete	250	430,705	0.9

Incidenti occupazionali 2006-2010



	Total
Total	2,277,751 (1247)
Year	
2006	502,667 (275)
2007	492,315 (270)
2008	467,041 (256)
2009	411,856 (226)
2010	403,872 (221)
Age	
15-34	790,673 (433)
35-60	1,429,116 (783)
60+	57,962 (32)

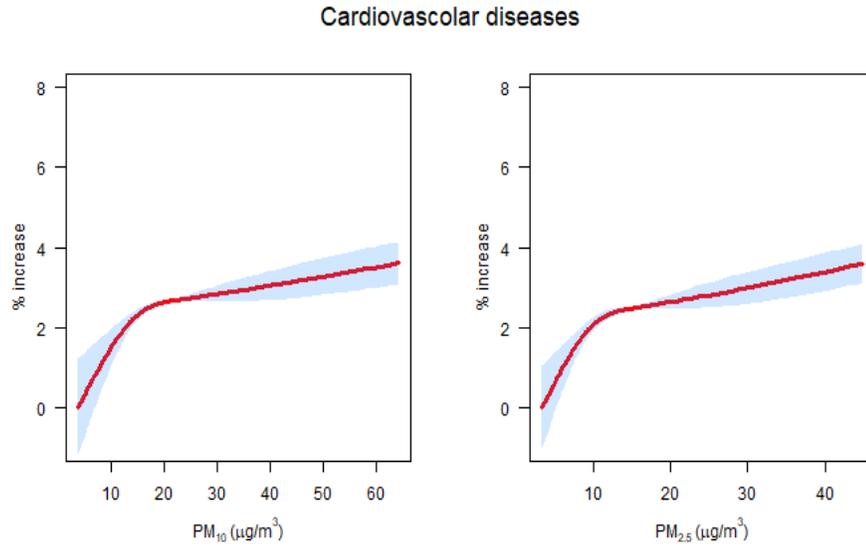
Le stime di rischio

Sfruttando gli esiti su ospedalizzazione, mortalità, incidenti occupazionali e le serie temporali di esposizione a inquinanti atmosferici (PM, NO₂, O₃) e temperature, **il progetto BEEP ha eseguito studi ed ottenuto risultati in merito a:**

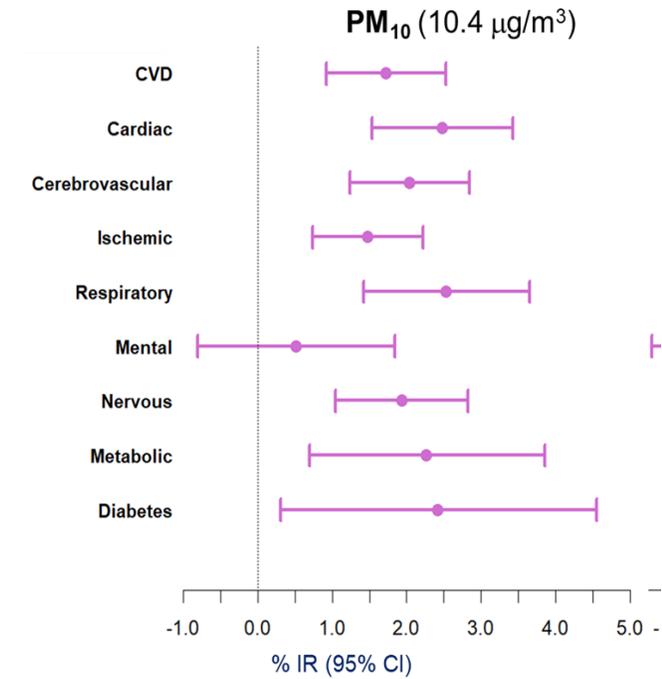
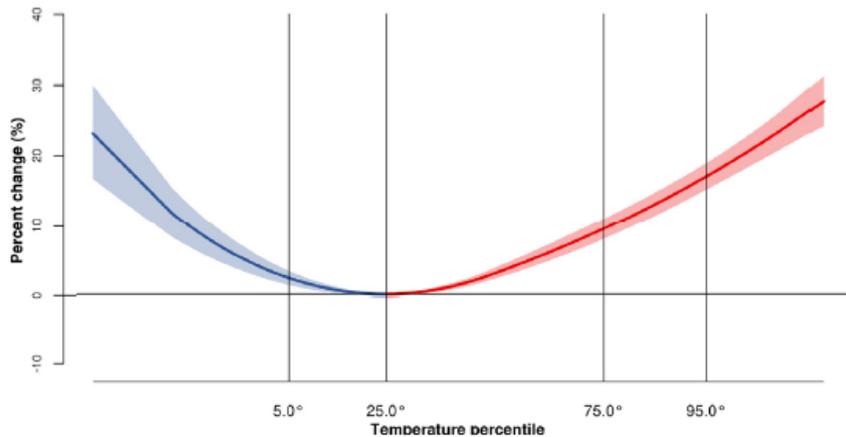
- **Rischi di ricovero giornalieri per patologie cardio-respiratorie**
 - Scala Nazionale
- **Rischi di mortalità naturale e cardio-respiratoria**
 - Scala regionale (5 regioni)
 - Scala metropolitana (5 città)
 - Scala sub-urbana (2 città)
- **Rischi di incidente occupazionale per temperature estreme**
 - Scala nazionale
 - Scala metropolitana (6 città)
- **Rischi di incidente stradale per temperature estreme e piogge**
 - Scala metropolitana (1 città)

Le stime di rischio – Alcuni risultati

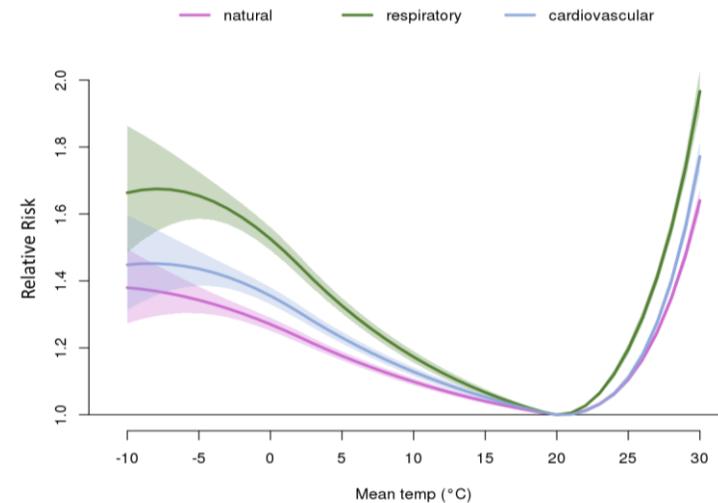
Curva C-R per rischio di ospedalizzazione e per PM



Curva C-R per rischio di incidenti occupazionali causati da temperature estreme



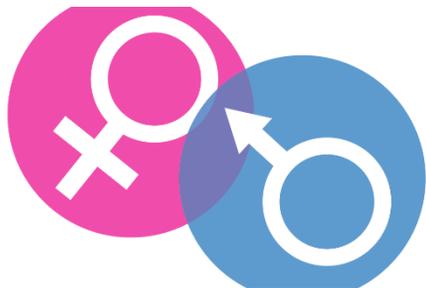
Incrementi di rischio di mortalità per PM10



Incrementi di rischio di mortalità per temperature

MODIFICAZIONE DI EFFETTO

SESSO



GRADO DI
URBANIZZAZIONE



basso



medio



alto

ETÀ



0-64



65-74



75+

I lavori pubblicati su riviste peer-review



Estimation of daily PM₁₀ and PM_{2.5} concentrations in Italy, 2013–2015, using a spatiotemporal land-use random-forest model

Massimo Stafoggia^{a,b,*}, Tom Bellander^b, Simone Bucci^b, Marina Davoli^b, Kees de Hoogh^{c,d}, Francesca de' Donato^e, Claudio Gariazzo^c, Alexei Lyapustin^f, Paola Michelozzi^g, Matteo Renzi^h, Matteo Scortichini^g, Alexandra Shtein^g, Giovanni Viegi^h, Itai Kloog^g, Joel Schwartz^g

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^e INAIL, Department of Occupational & Environmental Medicine, Monteporzio Catone, Italy
^f National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC), Greenbelt, MD, USA
^g Department of Geography and Environmental Development, Ben-Gurion University of the Negev, Beer Sheva, Israel
^h Institute of Biomedicine and Molecular Immunology "Alberto Monroy", National Research Council, Palermo, Italy
ⁱ Department of Environmental Health, Harvard T. H. Chan School of Public Health, Cambridge, MA, USA

ARTICLE INFO

ABSTRACT



A multi-city air pollution population exposure study: Combined use of chemical-transport and random-Forest models with dynamic population data

Claudio Gariazzo^{a,*}, Giuseppe Carlino^b, Camillo Silibello^c, Matteo Renzi^d, Sandro Finardi^c, Nicola Pepe^c, Paola Radice^c, Francesco Forastiere^{e,f}, Paola Michelozzi^d, Giovanni Viegi^e, Massimo Stafoggia^d, On behalf of the BEEP Collaborative Group[†]

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^b Simulatia, Turin, Italy
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^e CNR Institute of Biomedicine and Molecular Immunology "Alberto Monroy", National Research Council Palermo, Italy
^f Environmental Research Group, King's College, London, UK



Nationwide epidemiological study for estimating the effect of extreme outdoor temperature on occupational injuries in Italy

Alessandro Marinaccio^{a,*}, Matteo Scortichini^b, Claudio Gariazzo^a, Antonio Leva^a, Michela Bonafede^a, Francesca K. de' Donato^b, Massimo Stafoggia^b, Giovanni Viegi^f, Paola Michelozzi^g, BEEP Collaborative Group (Ancona Carla, Angelini Paola, Argentini Stefania, Baldacci Sandra, Bisceglia Lucia, Bonomo Sergio, Bonvicini Laura, Broccoli Serena, Brusasca Giuseppe, Bucci Simone, Calori Giuseppe, Carlino Giuseppe, Cemigliaro Achille, Chietti Antonio, Fasola Salvatore, Finardi Sandro, Forastiere Francesco, Galassi Claudia, Giorgi Rossi Paolo, La Grutta Stefania, Licitra Gaetano, Malo Sara, Migliore Enrica, Moro Antonino, Nanni Alessandro, Ottone Marta, Pepe Nicola, Radice Paola, Ranzi Andrea, Renzi Matteo, Scodotto Salvatore, Silibello Camillo, Sozzi Roberto, Tinarelli Gianni, Ubaldi Francesco)

^a Occupational and Environmental Medicine, Epidemiology and Hygiene Department, Italian Workers' Compensation Authority (INAIL), Roma, Italy
^b Department of Epidemiology, Lazio Regional Health Service, ASL Roma 1, Rome, Italy
^c Italian National Research Council (CNR), Institute of Biomedical Research and Innovation (IRIB) (previously Institute of Biomedicine and Molecular Epidemiology "Alberto Monroy"), Palermo, Italy

ARTICLE INFO

ABSTRACT

Handling Editor: Zorana Janovic Andersen
 Keywords:
 Climate change
 Extreme outdoor air temperature
 Occupational injuries
 Heat impacts
 Cold impacts
 Case-crossover study

Background: Despite the relevance for occupational safety policies, the health effects of temperature on occupational injuries have been scarcely investigated. A nationwide epidemiological study was carried out to estimate the risk of injuries for workers exposed to extreme temperature and identify economic sectors and jobs most at risk.
Materials and methods: The daily time series of work-related injuries in the industrial and services sector from the Italian national workers' compensation authority (INAIL) were collected for each of the 8090 Italian municipalities in the period 2006–2010. Daily air temperatures with a 1 × 1 km resolution derived from satellite land surface temperature data using mixed regression models were included. Distributed by non-linear models



Article

Effects of Particulate Matter on the Incidence of Respiratory Diseases in the Pisan Longitudinal Study

Salvatore Fasola^{1,*}, Sara Maio², Sandra Baldacci², Stefania La Grutta¹, Giuliana Ferrante³, Francesco Forastiere¹, Massimo Stafoggia⁴, Claudio Gariazzo⁵, Giovanni Viegi^{1,2} and on behalf of the BEEP Collaborative Group[†]

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 - 3 Department of Health Promotion Sciences, Maternal and Infant Care, Internal Medicine and Medical Specialities, University of Palermo, 90127 Palermo, Italy; giuliana.ferrante@unipa.it
 - 4 Department of Epidemiology, Lazio Region Health Service—ASL Roma 1, 00147 Rome, Italy; m.stafoggia@deplazio.it
 - 5 Occupational and Environmental Medicine, Epidemiology and Hygiene Department, Italian Workers' Compensation Authority (INAIL), Monte Porzio Catone, 00144 Rome, Italy; c.gariazzo@inail.it
- * Correspondence: salvatore.fasola@irib.cnr.it
[†] Membership of the BEEP Collaborative Group is provided in the Acknowledgments.



Article
 pubs.acs.org/est

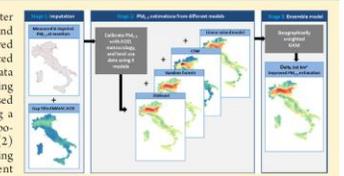
Estimating Daily PM_{2.5} and PM₁₀ over Italy Using an Ensemble Model

Alexandra Shtein^{a,*}, Itai Kloog^g, Joel Schwartz^g, Camillo Silibello^g, Paola Michelozzi^h, Claudio Gariazzo^g, Giovanni Viegi^h, Francesco Forastiere^h, Arnon Karnieli^g, Allan C. Just^g, and Massimo Stafoggia^g

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ⁱ Department of Epidemiology, Lazio Regional Health Service/ASL Roma 1, Rome 00147, Italy
^j Department of Occupational & Environmental Medicine, Occupational and Environmental Medicine, Epidemiology and Hygiene Department, Italian Workers' Compensation Authority (INAIL), Monte Porzio Catone (RM) 00078, Italy
^k Institute for Biomedical Research and Innovation, National Research Council, Palermo 90146, Italy
^l Jacob Blaustein Institutes for Desert Research, Ben-Gurion University of the Negev, Sede Boker Campus 84990, Israel
^m Department of Environmental Medicine and Public Health, Icahn School of Medicine at Mount Sinai, New York, New York 10029, United States
ⁿ Environmental Research Group, King's College, London SE1 9NH, U.K.
^o Institute of Environmental Medicine, Karolinska Institutet: Institute of Environmental Medicine, Stockholm 171 77, Sweden

Supporting Information

ABSTRACT: Spatiotemporally resolved particulate matter (PM) estimates are essential for reconstructing long and short-term exposures in epidemiological research. Improved estimates of PM_{2.5} and PM₁₀ concentrations were produced over Italy for 2013–2015 using satellite remote-sensing data and an ensemble modeling approach. The following modeling stages were used: (1) missing values of the satellite-based aerosol optical depth (AOD) product were imputed using a spatiotemporal land-use random-forest (RF) model incorporating AOD data from atmospheric ensemble models; (2) PM estimations were produced using four modeling approaches: linear mixed effects, RF, extreme gradient



Accettati per la pubblicazione:

- Stafoggia et al., 2020. Short-term effects of particulate matter on cardiovascular morbidity in Italy. A national analysis. *European Journal of Preventive Cardiology*
- Gariazzo et al., 2020. Impact of different exposure models and spatial resolution on the long-term effects of air pollution. *Environmental Research*

- Il progetto **BEEP** rappresenta **uno dei più approfonditi ed accurati studi di epidemiologia ambientale ed occupazionale** svolti in Italia
- L'utilizzo di **BigData** ha permesso di **produrre serie storiche di stima di esposizione** ambientale su scala Nazionale, Metropolitana e sub-urbana **altrimenti non disponibili**
- L'accoppiamento di stime di esposizione ambientale con esiti sanitari ed occupazionali ha permesso la **elaborazione di stime di rischio e analisi di curve dose-risposta non solo nel contesto urbano ma anche nei comuni rurali e sub urbani italiani.**
- I **dati e stime di effetto** elaborati nel progetto BEEP saranno di **grande supporto per ulteriori approfondimenti epidemiologici e per supportare politiche di prevenzione e mitigazione** degli effetti sulla salute e sulla sicurezza del lavoro.

Grazie per l'attenzione



BEEP
Bigdata in Epidemiologia
ambiEntale ed occuPazionale

Progetto finanziato dal Bando
BRic 2016-18 - **INAIL**



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DIPARTIMENTO MEDICINA
EPIDEMIOLOGIA IGIENE
DEL LAVORO AMBIENTALE
(INAIL-DIMEILA)



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Servizio Sanitario Regionale
Regione Lazio



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SERVIZIO SANITARIO REGIONALE
EMILIA-ROMAGNA



Regione Siciliana

