



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

Attività ENEA all'interno del Copernicus Atmospheric Monitoring Service (National Collaboration Programme)

Massimo D'Isidoro

Laboratorio Inquinamento Atmosferico (SSPT-MET-INAT)



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Sommario

- **Il cammino verso i servizi Copernicus**
- **CAMS (Copernicus Atmospheric Monitoring Service)**
- **CAMS NCP (National Collaboration Programme)**

Verso i servizi Copernicus: da MINNI a FORAIR-IT

- Primi anni 2000: collaborazione ENEA-ARIANET Sviluppo di **MINNI** (modello integrato di valutazione della qualità dell'aria in Italia);
- 2017: Sviluppo sistema previsionale **FORAIR-IT** (partendo dal sistema ARIANET QualeAria)
- Esperienza maturata nei gruppi e Task Force internazionali di qualità dell'aria, esercizi di intercomparison Europei;

CAMS (Copernicus Atmospheric Monitoring Service)

<https://atmosphere.copernicus.eu/>

Gestito da ECMWF -> contratto a MeteoFrance



Il servizio si concentra su **cinque settori principali**:

- **Qualità dell'aria e composizione atmosferica**;
- Strato di ozono e radiazioni ultraviolette;
- Emissioni e flussi superficiali;
- Radiazione solare;
- Forzatura climatica.



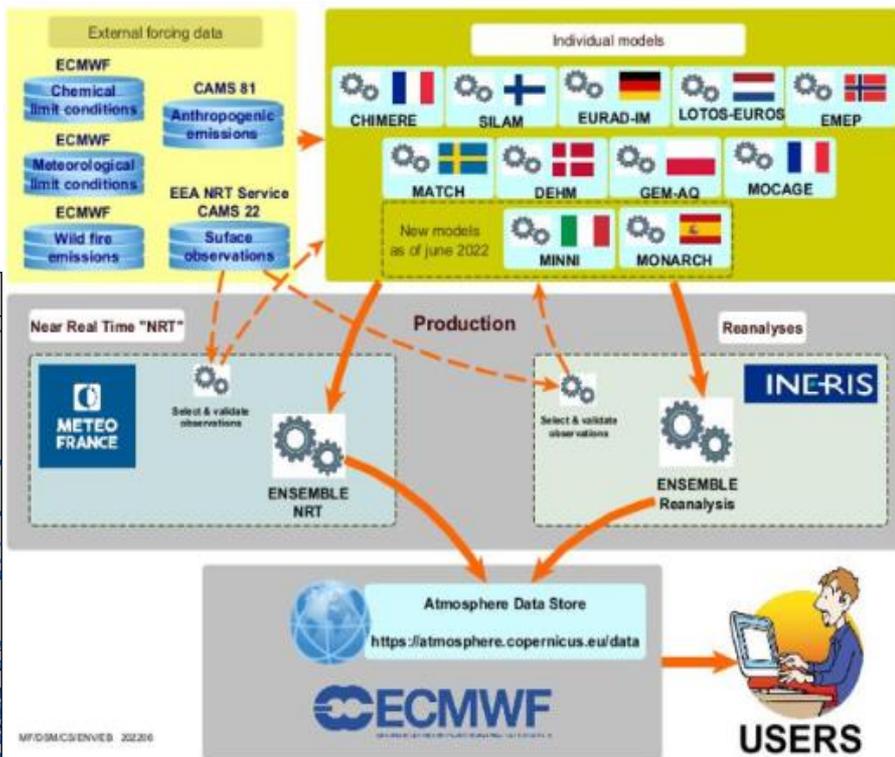
CAMS2_40 - Regional Air Quality production

<https://ads.atmosphere.copernicus.eu/>

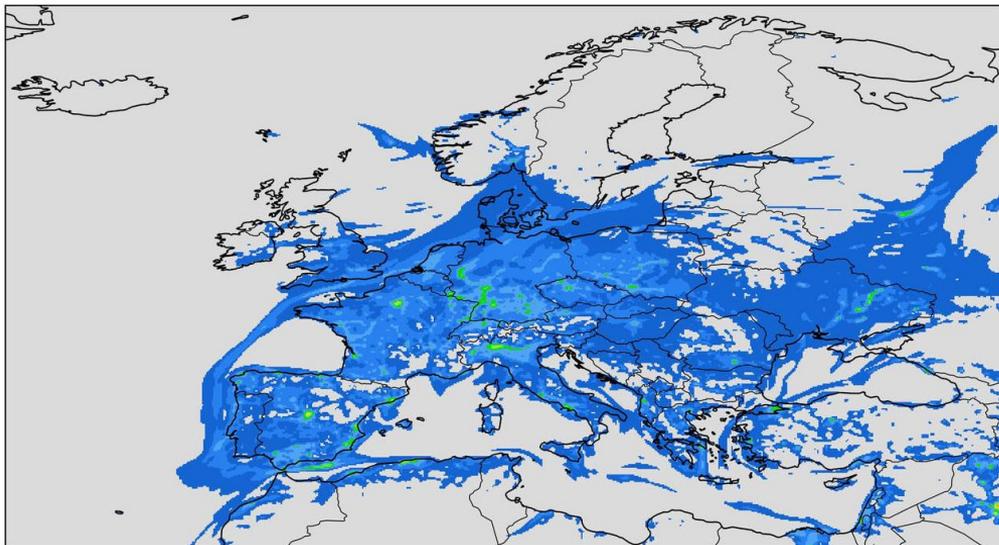
MINNI operativo dal 2022:

- Previsioni orarie quotidiane a 96h (4 giorni) $0.1^\circ \times 0.1^\circ$
- Analisi: D0-1;
- Rianalisi: D0-20; (Interim Reanalysis)
- Rianalisi: Y0-2 (Validated Reanalysis)

CAMS2_40 Daily forecasts and analysis production

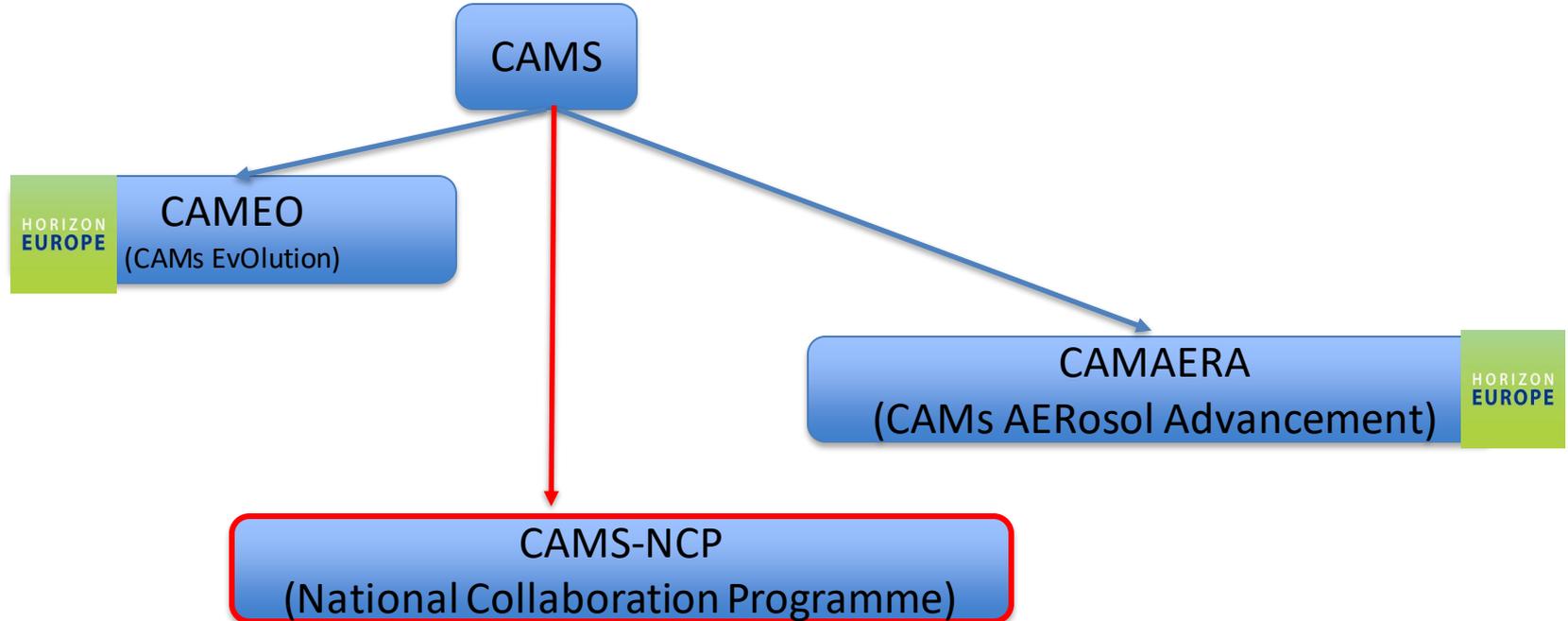


MINNI



CAMS (National Collaboration Programme)

<https://atmosphere.copernicus.eu/cams-national-collaboration-programme>





Atmosphere
Monitoring

NCP Qualità dell'aria (CAMS)

SCOPO: migliorare l'adozione dei prodotti CAMS a livello nazionale
(attività congiunte tra CAMS e ogni Stato Membro/contribuente)

2022: survey e manifestazione di interesse → sottoscrizione I contratto (durata: 18M)

CAMS fornisce:

- dati OT, prodotti europei e globali,
- competenza e supporto integrare prodotti sviluppati nell'ambito nazionale,
- divulgazione a livello internazionale.

CONSORZIO (coordinamento ISPRA):



qualità e idoneità dei prodotti CAMS sul territorio nazionale → casi studio
accoppiamento prodotti CAMS e prodotti nazionali → output nazionale a disposizione di
ECMWF

promuovere uso prodotti CAMS a livello nazionale/regionale → attività di
comunicazione/training

da Antonella Tornato – ISPRA



Eventi

- 7^a Assemblea generale del CAMS, martedì 13 giugno 2023 a Valencia
<https://atmosphere.copernicus.eu/7th-cams-general-assembly-copernicus>
- 1° Atmosphere User Forum (24 Paesi: 39 partecipanti in presenza e 34 online)
<https://atmosphere.copernicus.eu/1st-atmosphere-user-forum>
- Numerosi UFN e tavoli connessi
- Workshop I CAMS-NCP Italy – 9 Ottobre 2023 (più di 60 utenti delle comunità locali): apprezzamento ufficiale da Dr Florence Rabier, Director-General ECMWF
- Tavolo della rete dei referenti della Qualità dell’Aria – 25 ottobre 2023
- Earth Technology Expo (ETE) Firenze – 15 novembre 2023
- COP28 Dubai – 4 dicembre 2023
- Workshop II CAMS-NCP Italy – 7 marzo 2024

Italia: Country-web site <https://atmosphere.copernicus.eu/italy>

Pagina ISPRA: <https://www.isprambiente.gov.it/it/progetti/cartella-progetti-in-corso/aria/progetto-cams-national-collaboration-programme-italia>

<https://atmosphere.copernicus.eu/italy>

Work Packages:

- Direct use of CAMS products at national level
- CAMS air quality products downscaled at national level ←
- Exploitation of the CAMS emission data set at national level
- Training and Communication

Contratto CAMS2-72IT (gen 2023 – apr 2024)

(coordinatore: ISPRA)

<https://atmosphere.copernicus.eu/italy>

- CAMS Regional air quality products downscaled at national level
 - FORAIR-IT, CHIMBO (ISAC-CNR), kAIROS (SNPA-ARPAE)

These activities explore different ways of improving the CAMS products uptake, to cover “the last mile” delivering high-quality and downscaled air quality information across Italy. For emissions, both GHG and pollutants, the contract will verify the potential refinement of emission factors to be used in the national emissions inventory for specific national activities. The first step is a preparatory phase, followed by testing of use cases, and a national output delivered for ECMWF. All the activities will be supported by communication and training activities.

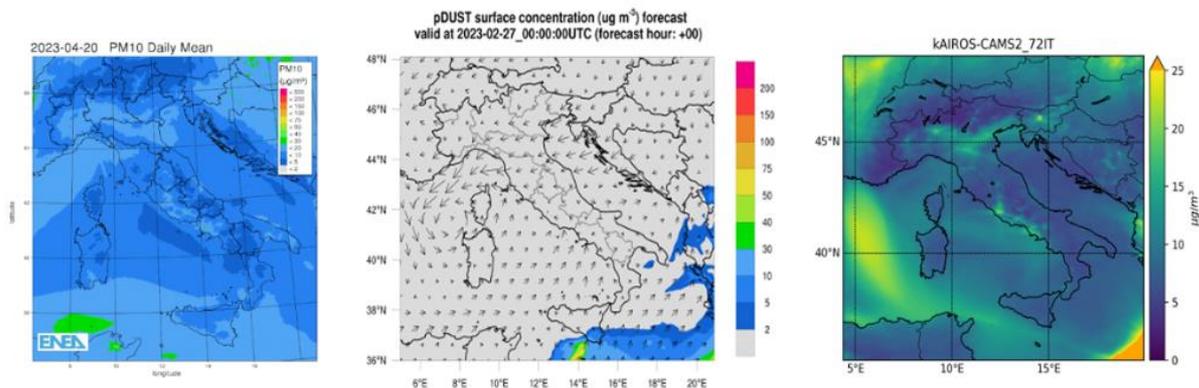
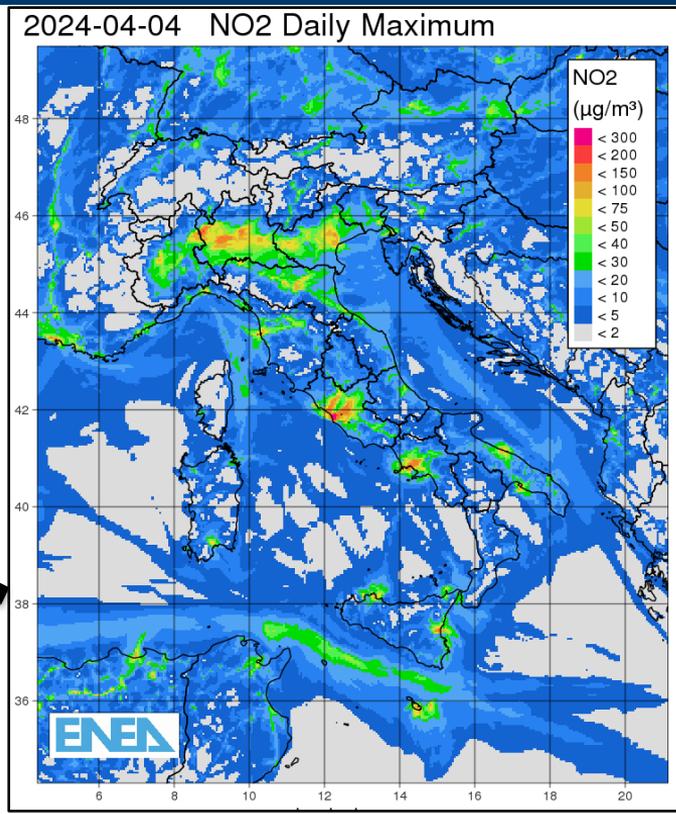
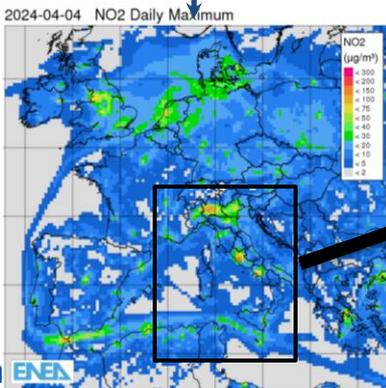
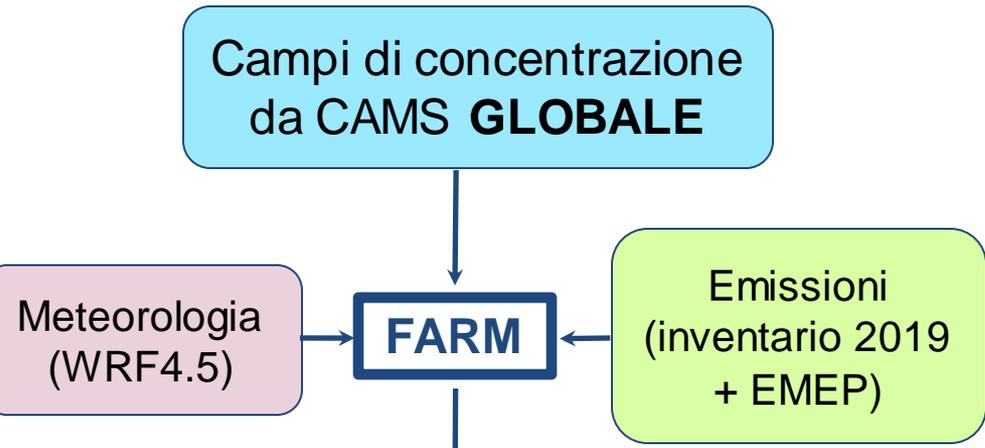


Figure 1: Model simulation using CAMS boundary condition. FORAIR-IT (left panel), CHIMBO (central panel), kAIROS (right panel)

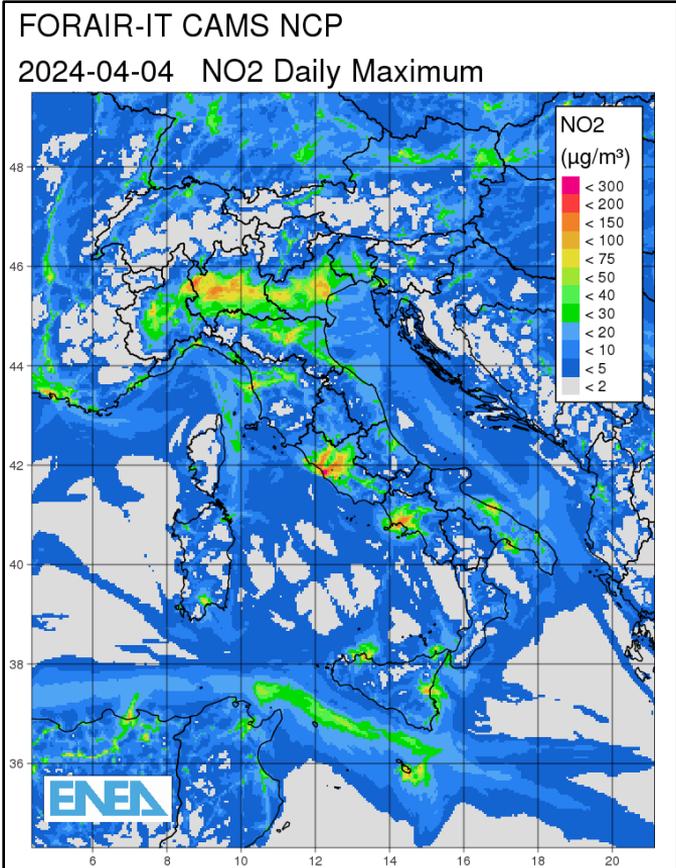
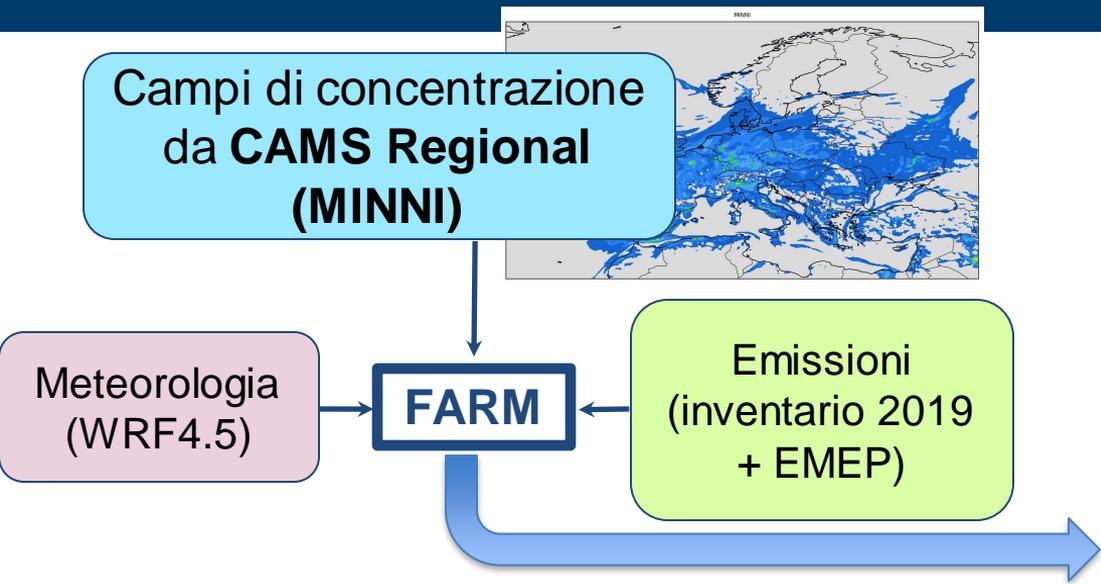
FORAIR-IT: La catena operativa attuale



<https://airqualitymodels.enea.it/>

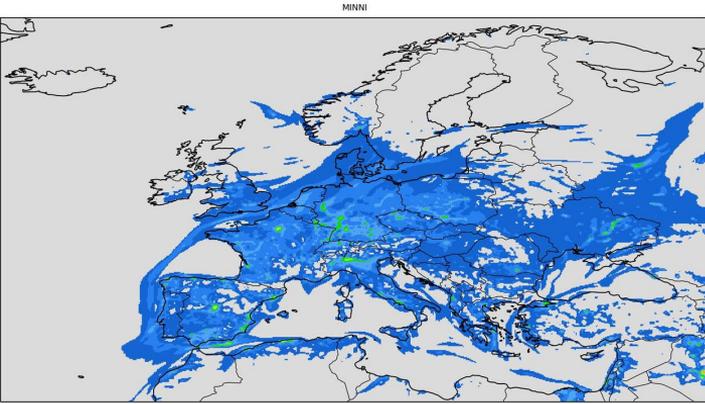


FORAIR-IT: La catena operativa in CAMS-NCP



FORAIR-IT: Problema speciazione (VOCs e PM totali)

Surface, 50m, 100m, 250m, 500m, 750m, 1000m, 2000m, 3000m, 5000m

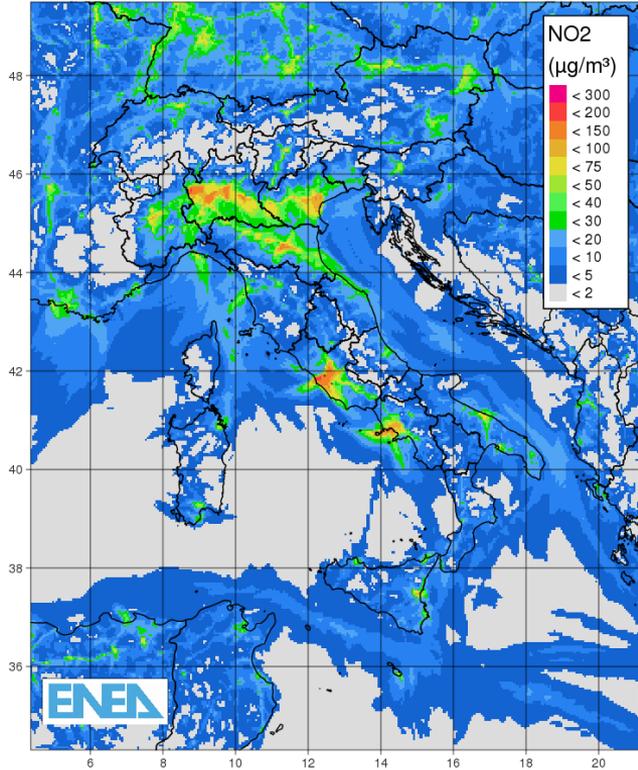


Alder pollen	Ozone
Ammonia	PM10, sea salt (dry) only
Birch pollen	PM10, wildfires only
Carbon monoxide	PM2.5, total organic matter only
Dust	Particulate matter < 10 µm (PM10)
Formaldehyde	Particulate matter < 2.5 µm (PM2.5)
Glyoxal	Peroxyacyl nitrates
Grass pollen	Ragweed pollen
Mugwort pollen	Residential elementary carbon
Nitrogen dioxide	Secondary inorganic aerosol
Nitrogen monoxide	Sulphur dioxide
Non-methane VOCs	Total elementary carbon
Olive pollen	
Ozone	

FORAIR-IT: le due versioni a confronto (NO₂)

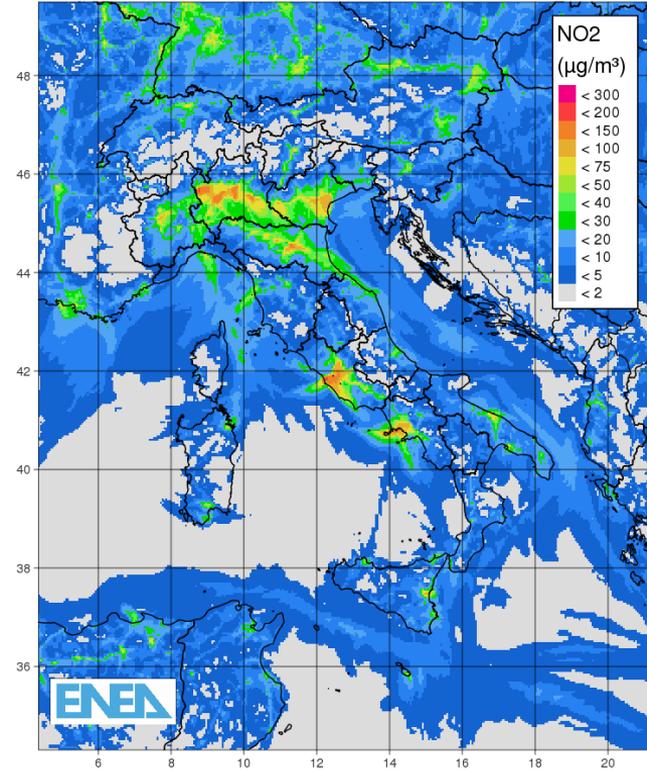
FORAIR-IT

2024-04-11 NO₂ Daily Maximum



FORAIR-IT CAMS NCP

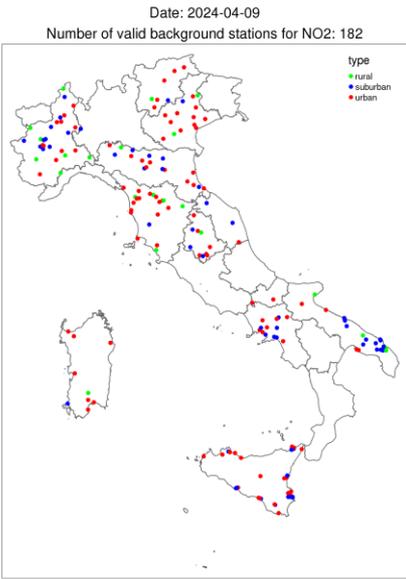
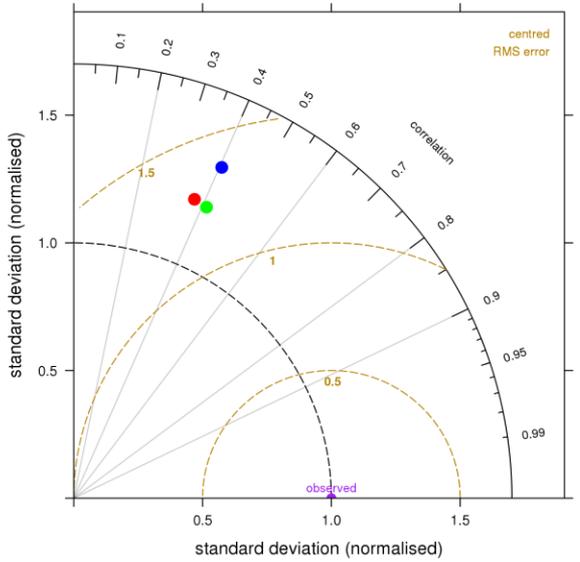
2024-04-11 NO₂ Daily Maximum



FORAIR-IT: le due versioni a confronto (NO₂)

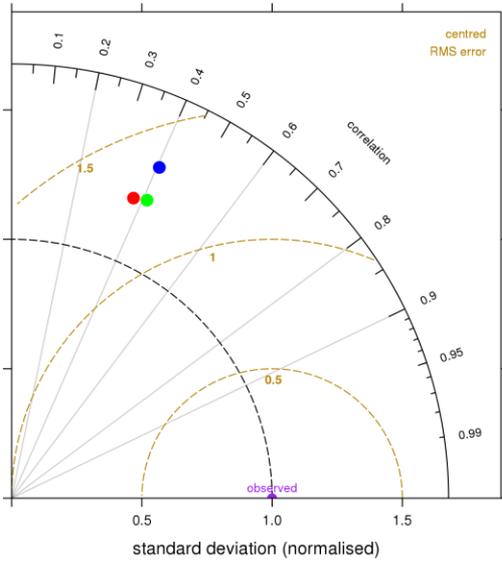
FORAIR-IT

Date: 2024-04-09 Hourly data
 Number of valid background stations for NO₂: 182

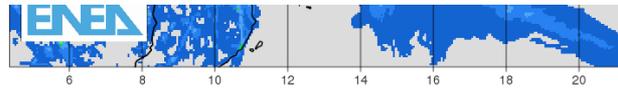
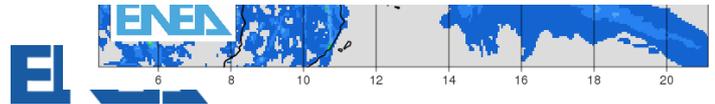


FORAIR-IT CAMS NCP

Date: 2024-04-09 Hourly data
 Number of valid background stations for NO₂: 182

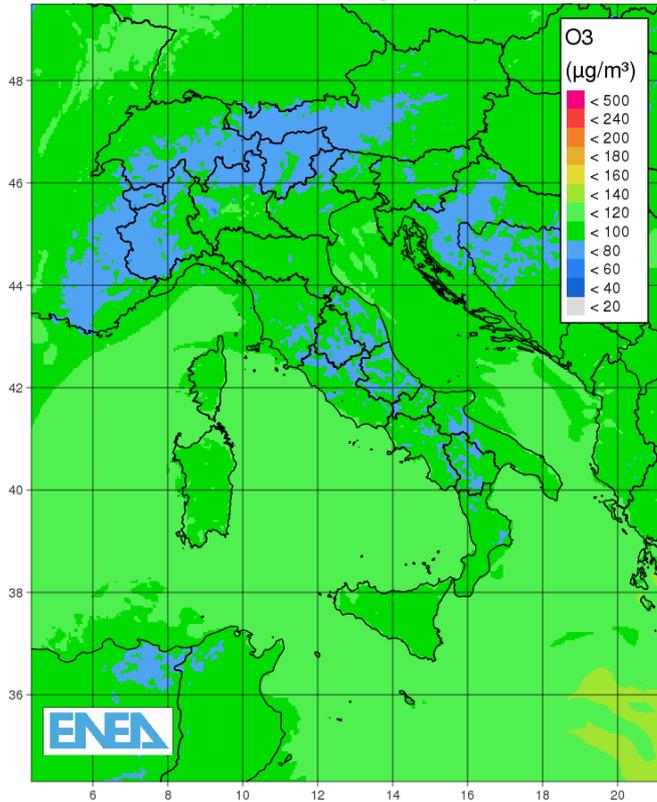


type
 ● rural
 ● suburban
 ● urban

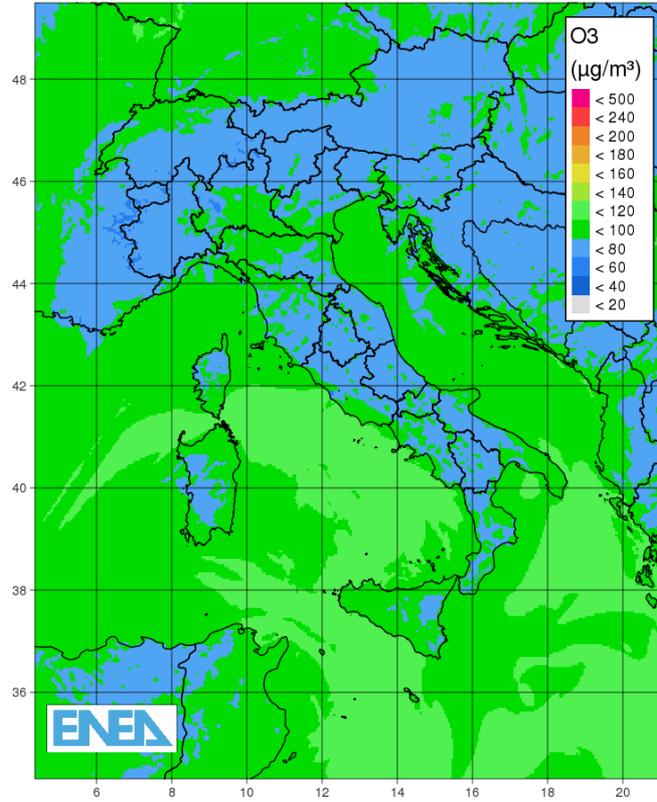


FORAIR-IT: le due versioni a confronto (O₃)

FORAIR-IT
2024-04-11 O₃ 8h-average Daily Maximum



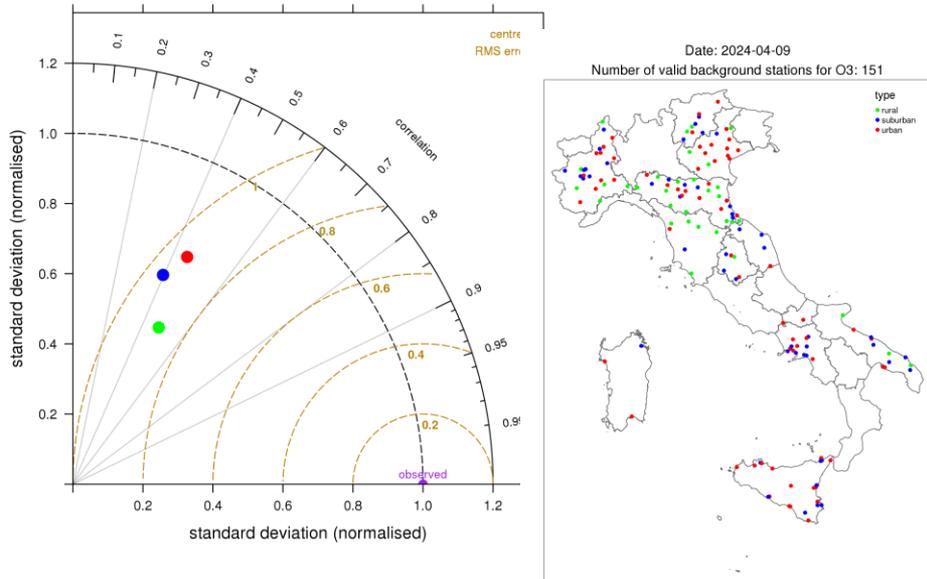
FORAIR-IT CAMS NCP
2024-04-11 O₃ 8h-average Daily Maximum



FORAIR-IT: le due versioni a confronto (O₃)

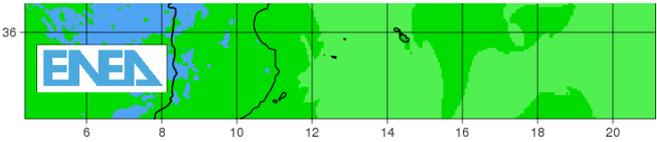
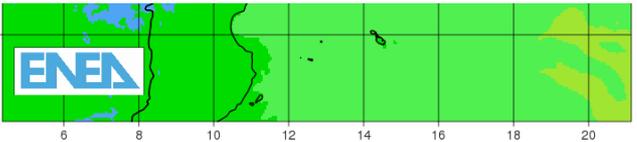
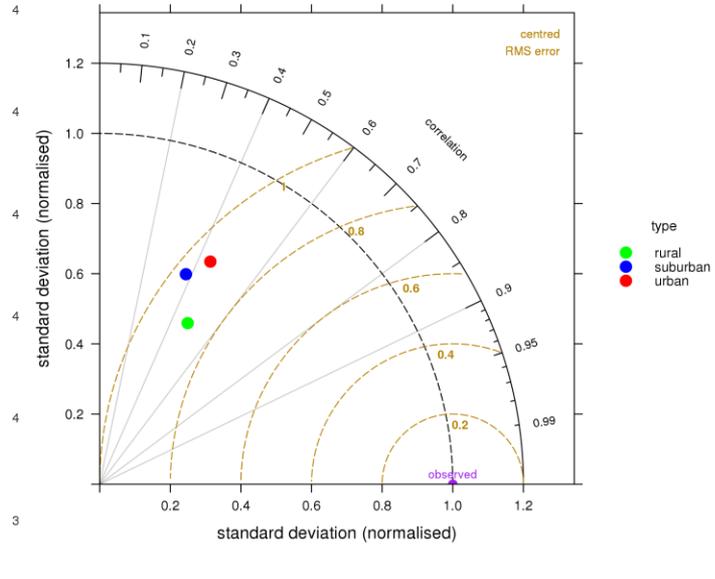
FORAIR-IT

Date: 2024-04-09 Hourly data
 Number of valid background stations for O₃: 151



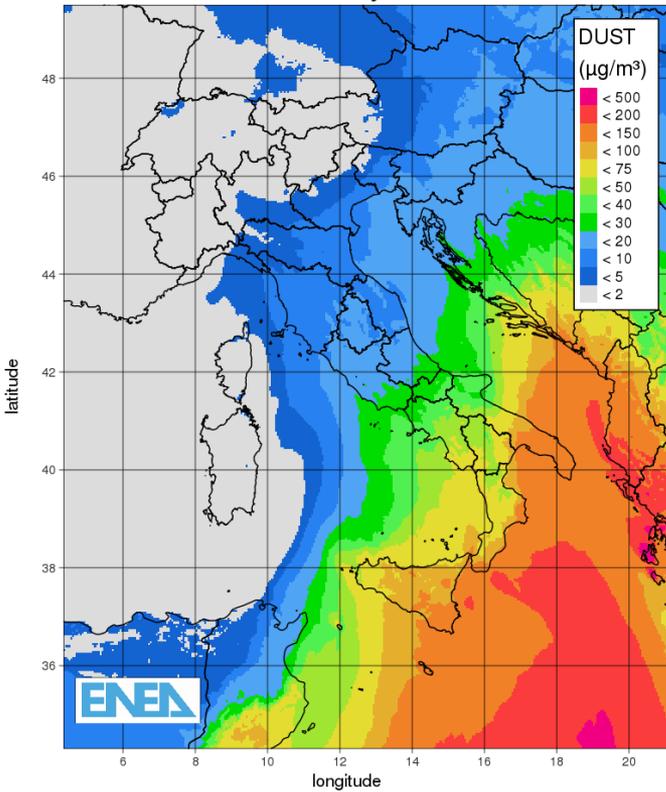
FORAIR-IT CAMS NCP

Date: 2024-04-09 Hourly data
 Number of valid background stations for O₃: 151

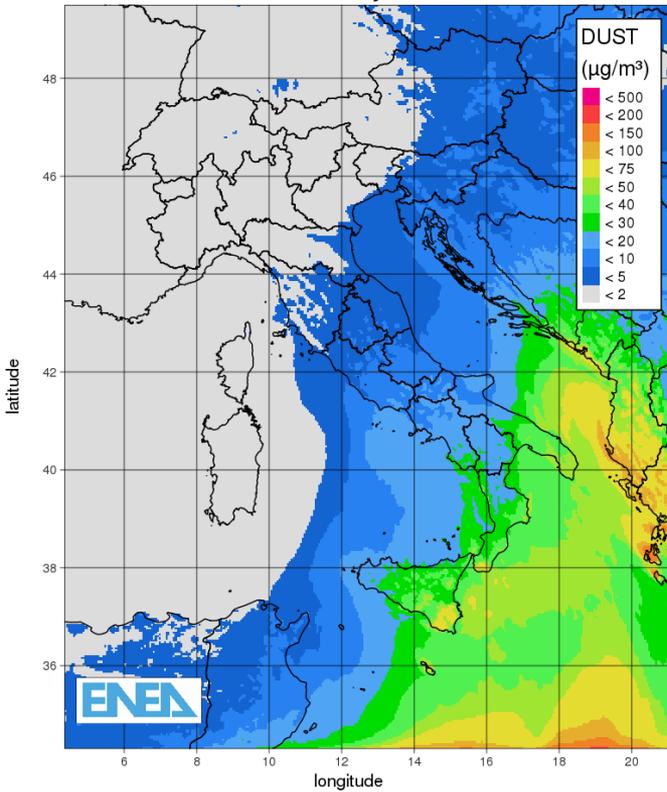


FORAIR-IT: le due versioni a confronto (DUST)

FORAIR-IT
2024-03-27 DUST Daily Mean



FORAIR-IT CAMS NCP
2024-03-27 DUST Daily Mean



FORAIR-IT: le due versioni a confronto (DUST)

FORAIR-IT

2024-03-27 DUST Daily Mean



CRESCO6 – Portici



- **1.4 PFLOPS**
- **424 nodi -> 20352 cores**
- **48 cores/nodo**
- **RAM: 192 GB/nodo**



Grazie
per
l'attenzione

massimo.disidoro@enea.it



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Con un doveroso ringraziamento alle colleghe e ai colleghi coinvolti nelle attività nel corso di questi anni.

In particolare per la parte tecnica nel seguire l'operatività:

 **Andrea Bolignano, Gino Briganti, Guido Guarnieri** (e Mario Adani)

FORAIR-IT: Problema speciazione (VOCs e PM totali)

```
aeromap=[("c_AS0IL", (0.999,"dust_cams")),\  
         ("c_AS0ILJ", (0.001,"dust_cams")),\  
         ("c_AORG", (1,"pm25_om")),\  
         ("c_ASEAS", (0.001,"pm10_ss_conc")),\  
         ("c_ASEASJ", (0.999,"pm10_ss_conc")),\  
         ("c_ACORS", (0.001,"pm10_meno_dust_meno_sale")),\  
         ("c_A25J", (1,"quel_che_resta")),\  
         ("c_AS04I", (0.001*0.5,"sia_cams")),\  
         ("c_AS04J", (0.999*0.5,"sia_cams")),\  
         ("c_ANH4I", (0.001*0.25,"sia_cams")),\  
         ("c_ANH4J", (0.999*0.25,"sia_cams")),\  
         ("c_AN03I", (0.001*0.25,"sia_cams")),\  
         ("c_AN03J", (0.999*0.25,"sia_cams")),\  
         ("c_AORPAI", (0.001*0.25,"pm25_meno_sia_meno_ectot")),\  
         ("c_AORPAJ", (0.999*0.25,"pm25_meno_sia_meno_ectot")),\  
         ("c_AECI", (0.001,"ectot_cams")),\  
         ("c_AECJ", (0.999,"ectot_cams"))]
```

```
a25j=pm10_meno_dust_meno_sale-sia-pm25_meno_sia_meno_ectot-ectot
```