

AREP
GAW



AQ forecasting examples

G. Calori, ARIANET

WMO
OMM

AREP
GAW



***The Rome air
quality
forecast system***

WMO
OMM



ARPALAZIO



arianet

Purpose & context

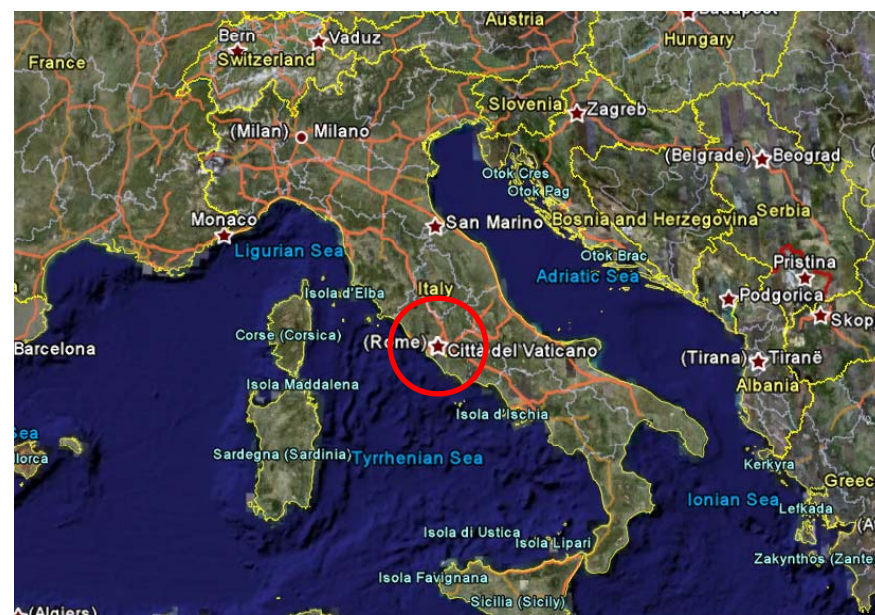
Provide daily information (48 hrs ahead) on air quality in Rome metropolitan area and in the surrounding region

Managed by Regional EPA (ARPA-Lazio), with ARIANET support

Support ARPA-Lazio in its institutional duties

Information to the public

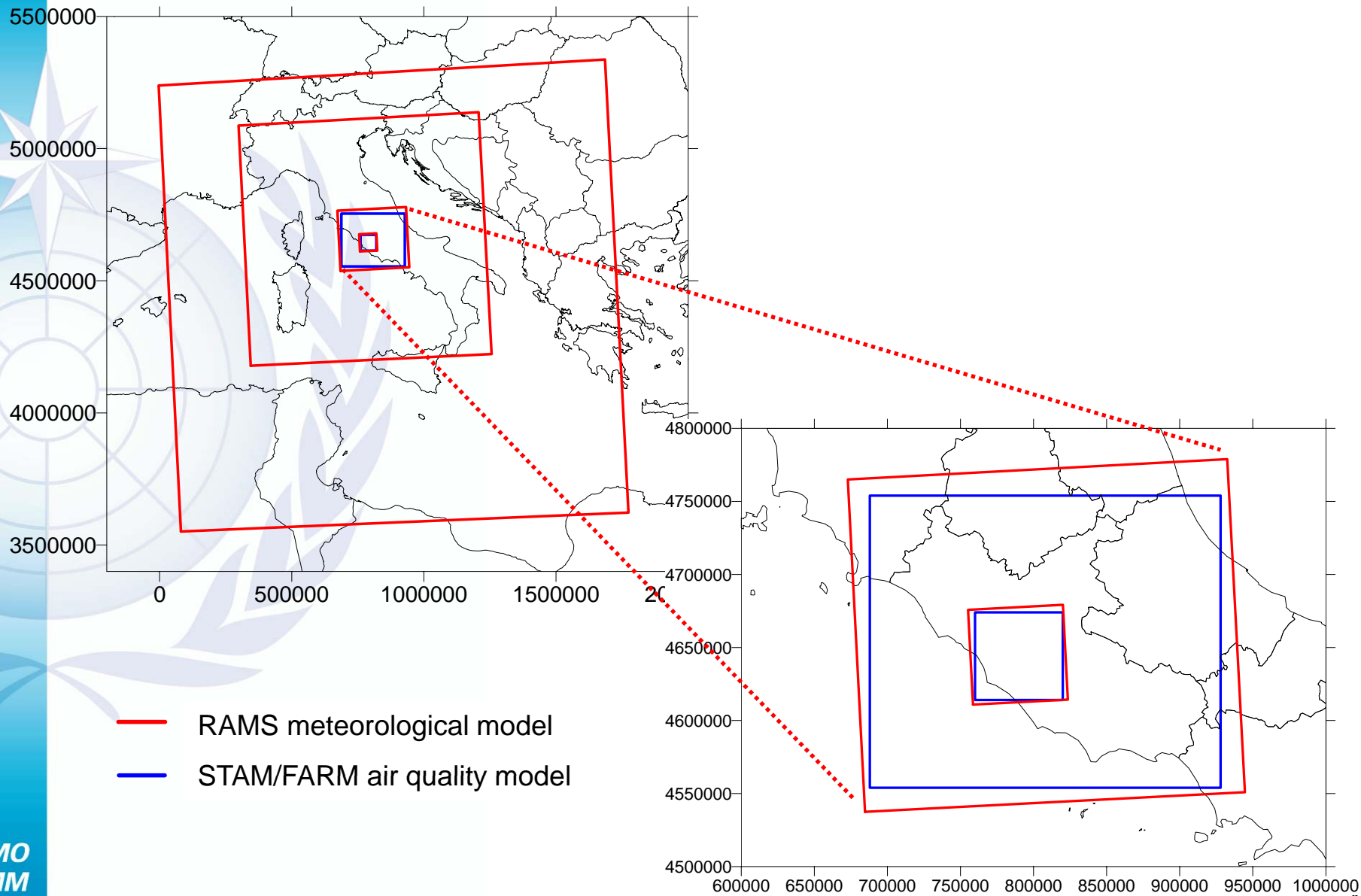
Currently being put on-line



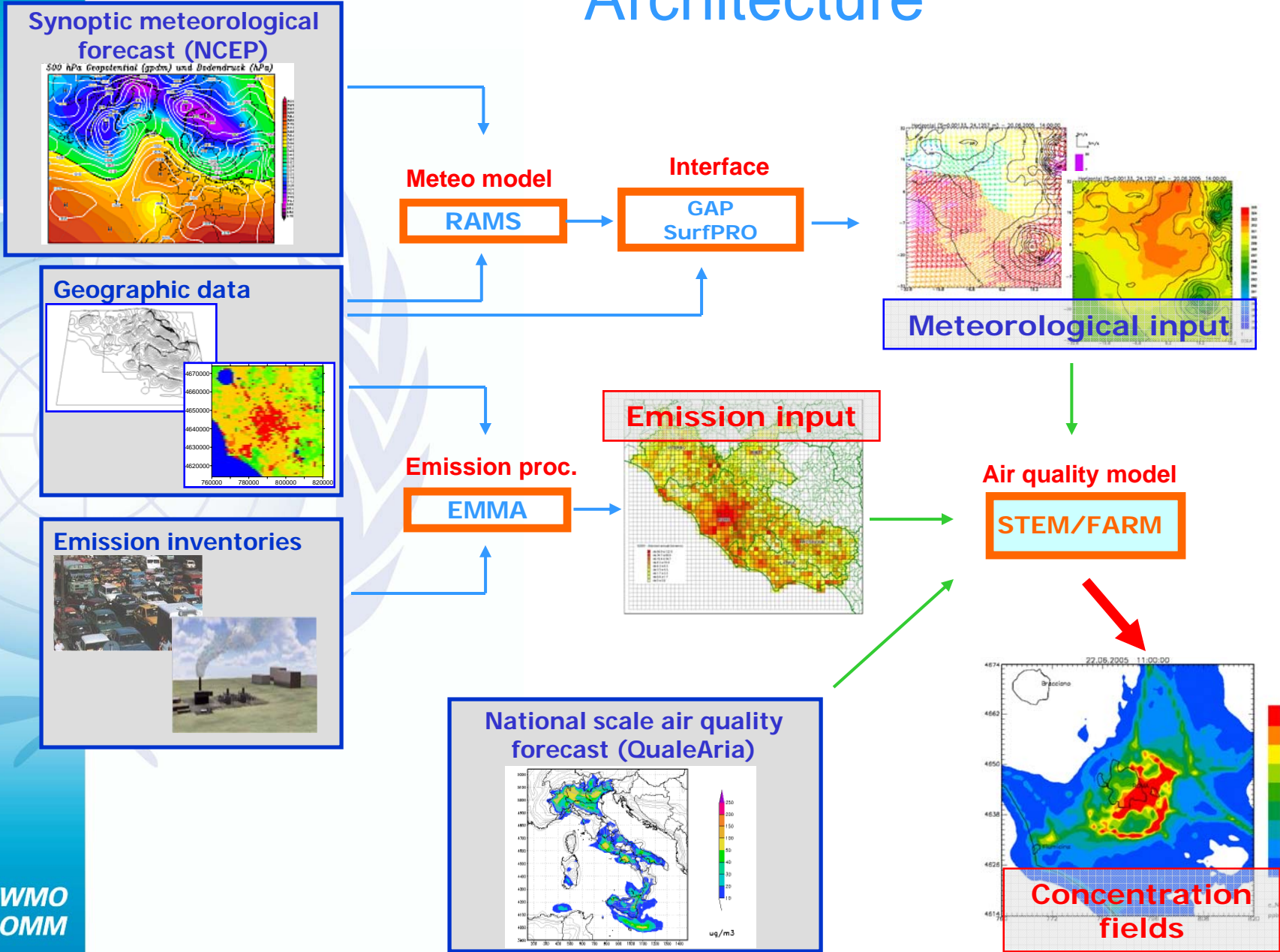
FUMAPEX

Integrated Systems for Forecasting Urban Meteorology, Air Pollution and Population Exposure

Computational domains

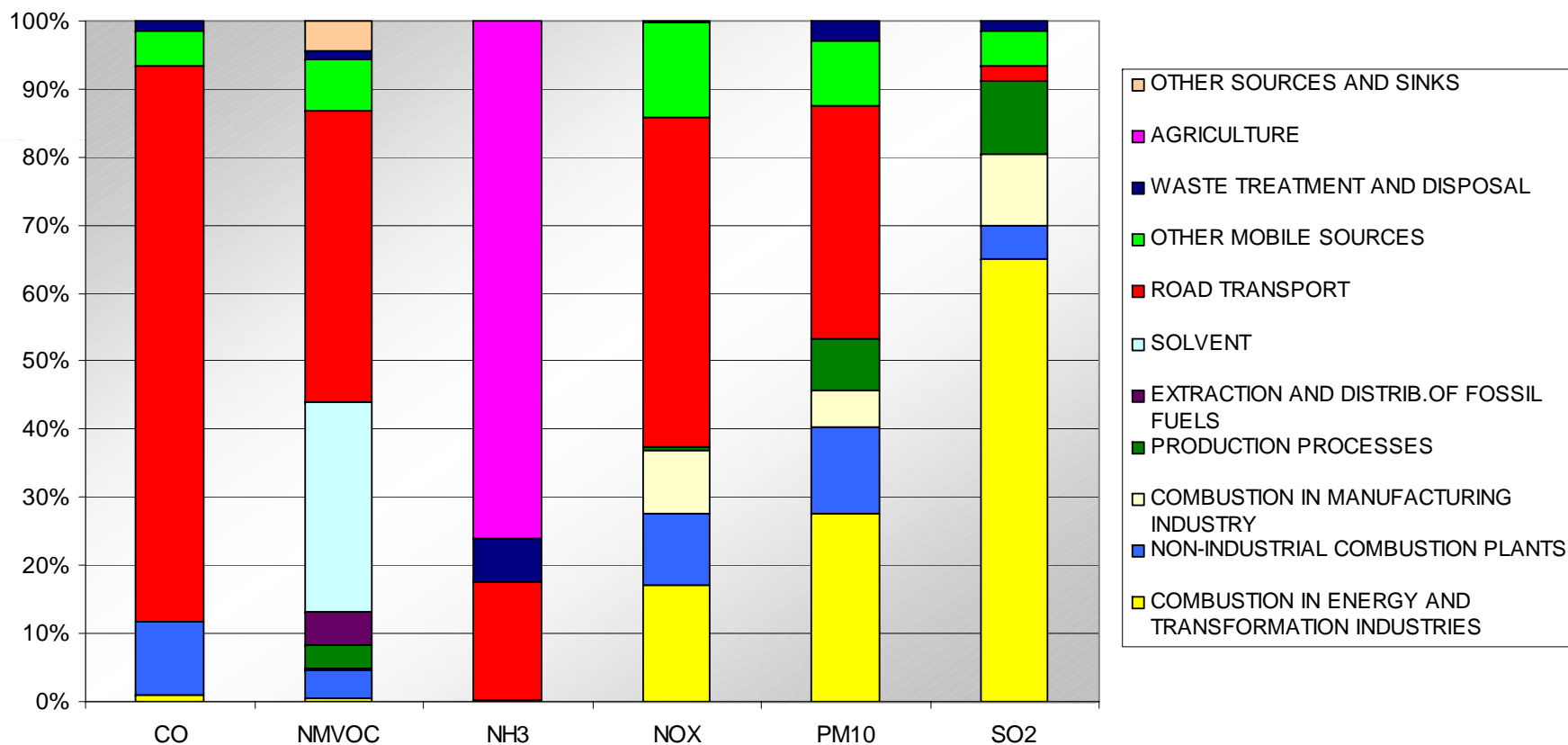


The Rome AQFS Architecture

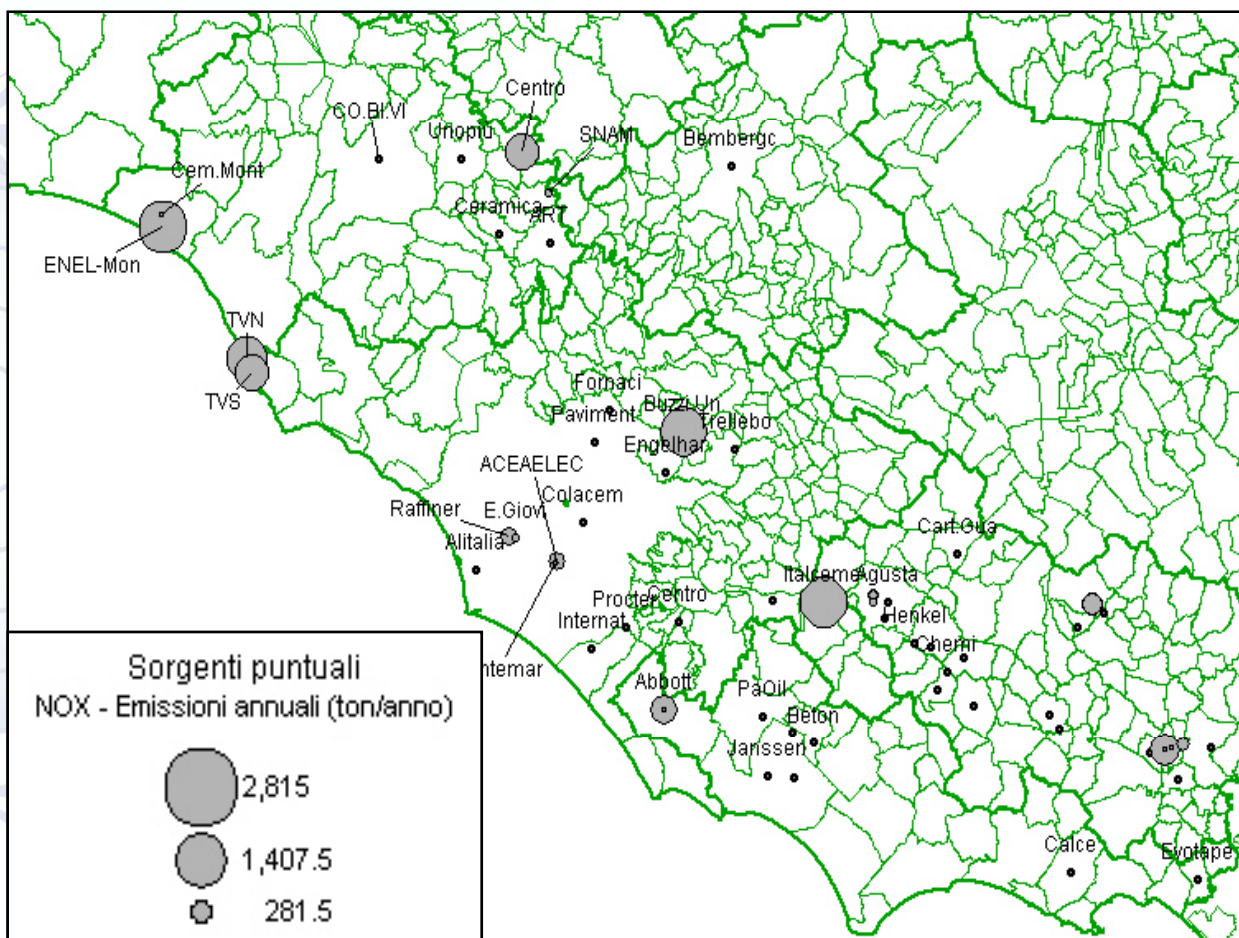


Emission inventory: sectors distribution

Province of Rome totals



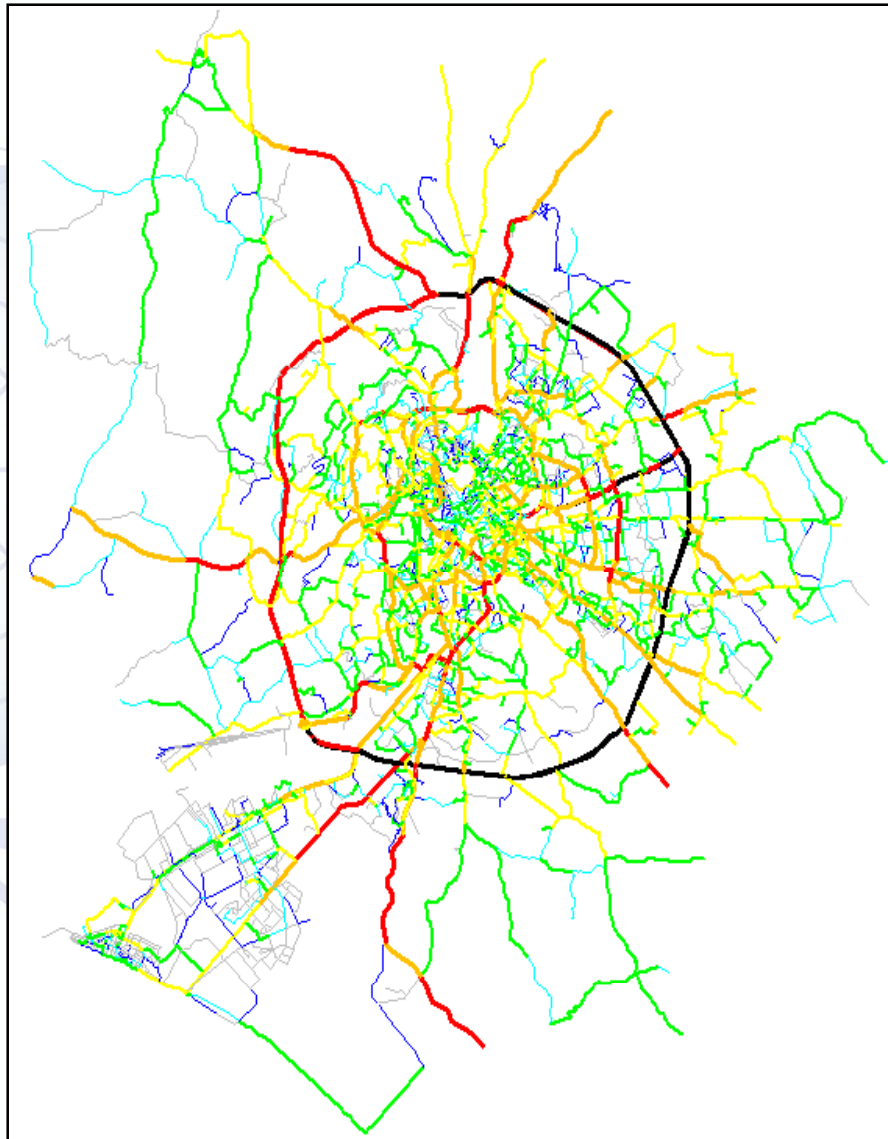
Emissions: point sources inventory



For each stack:

- location
- height
- diameter
- exit speed & temperature
- pollutants emission rates

Emissions: line sources



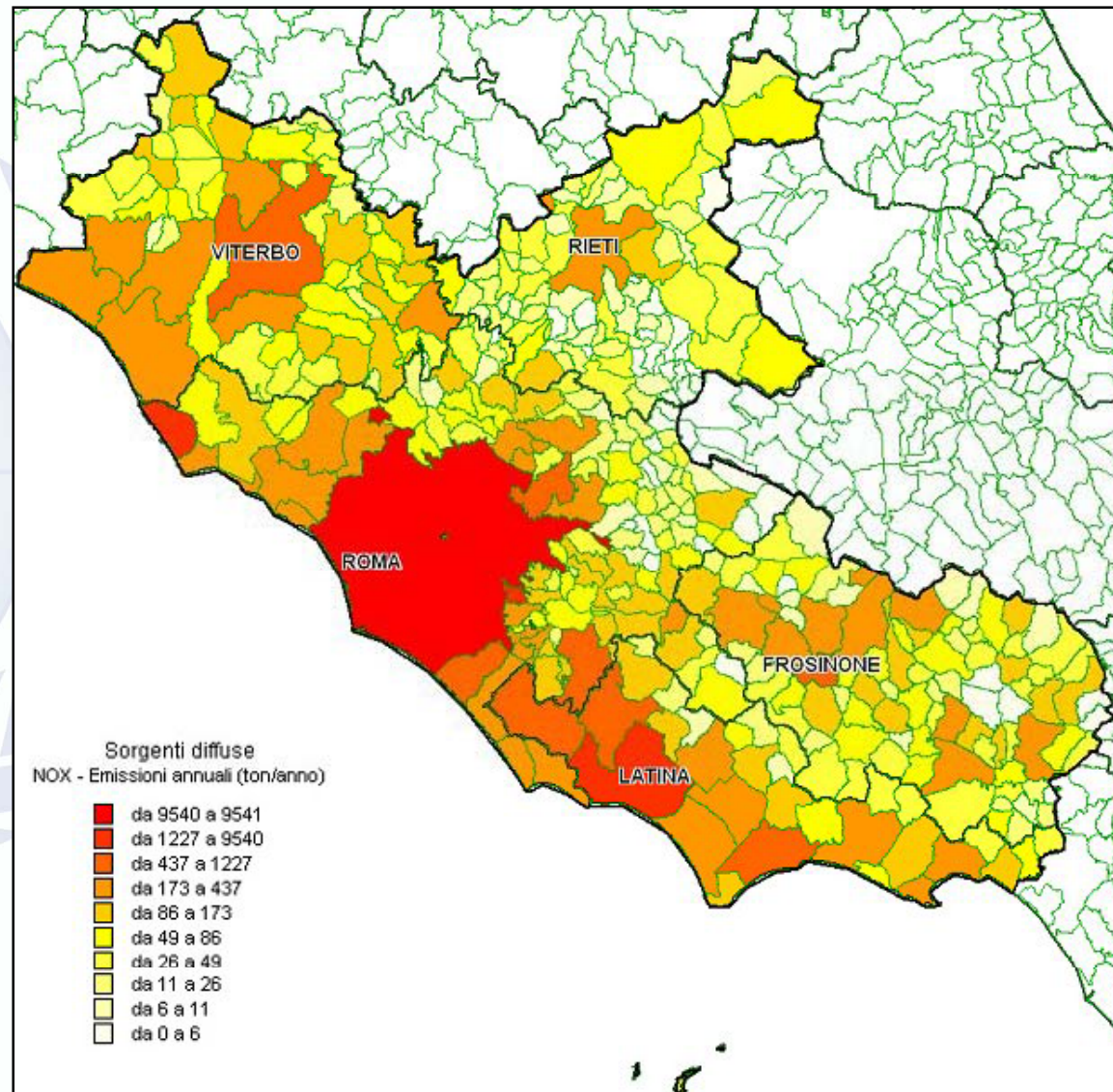
Metropolitan area road network

- ~ 9000 links
- traffic assignment model
+
- emissions module

On each link:

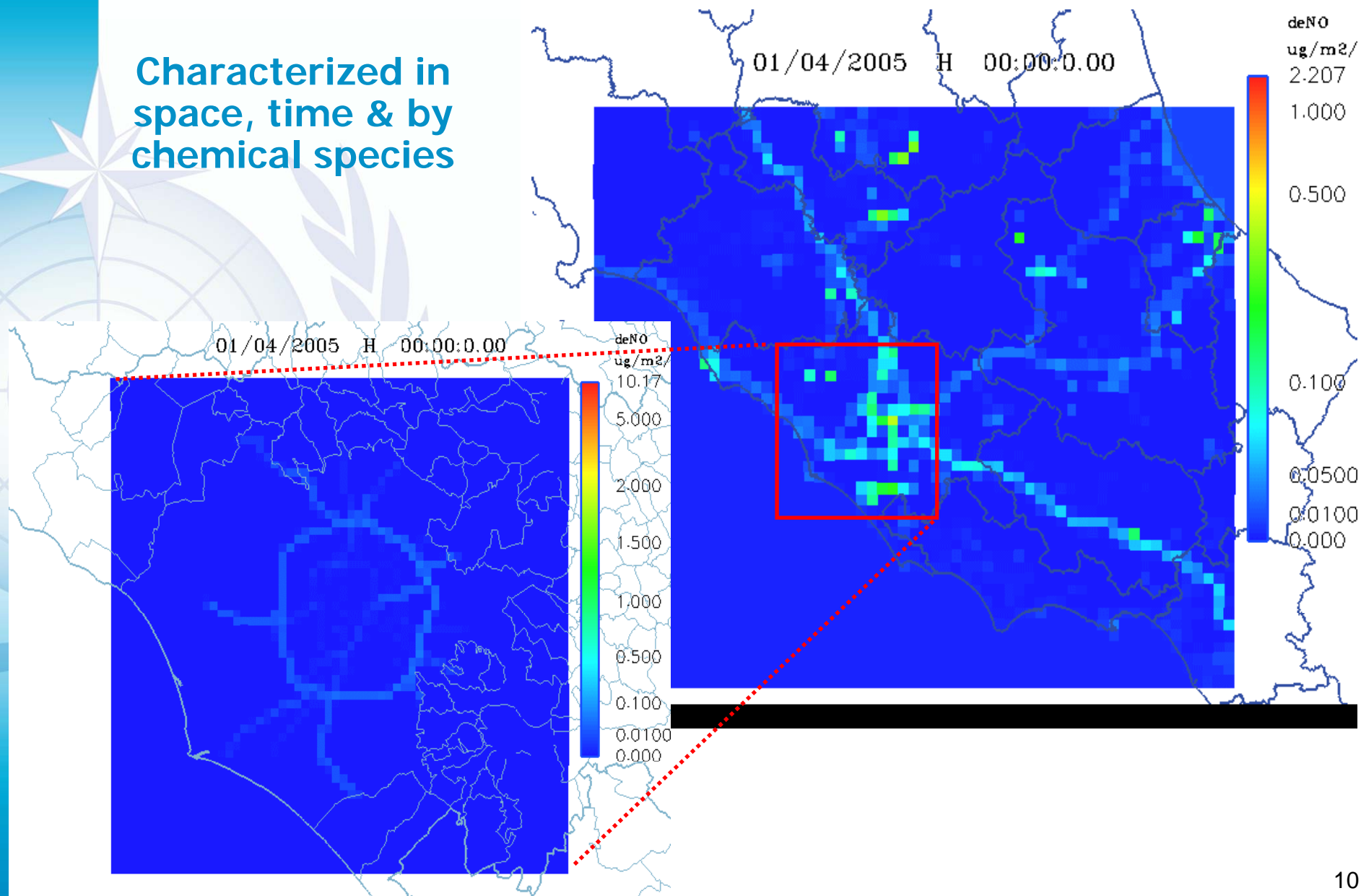
- vehicles flow & speed
- hourly emission rates by vehicle category

Emissions: area sources inventory



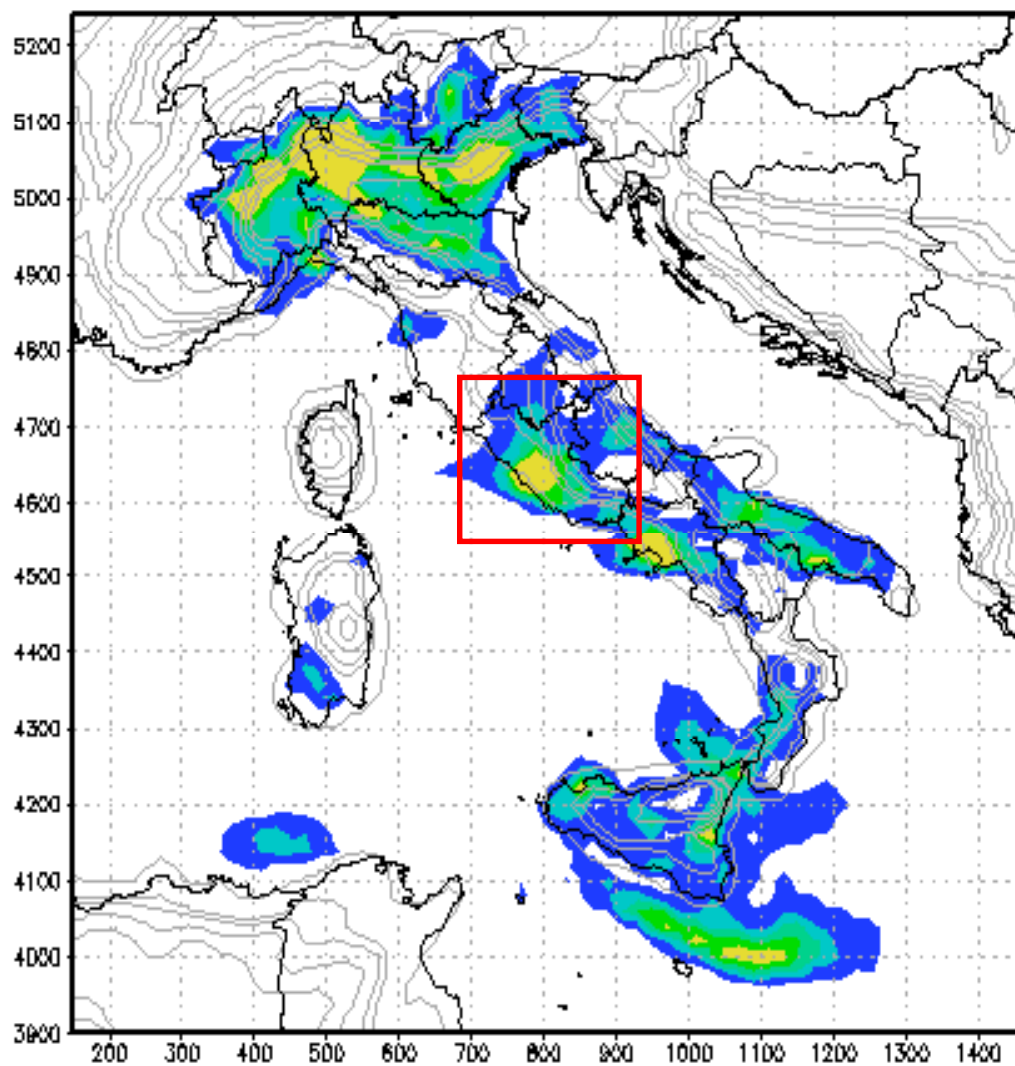
Modeled emissions input

Characterized in
space, time & by
chemical species



Chemical boundary conditions

NO_2 - 15 Nov 2008 hr 20



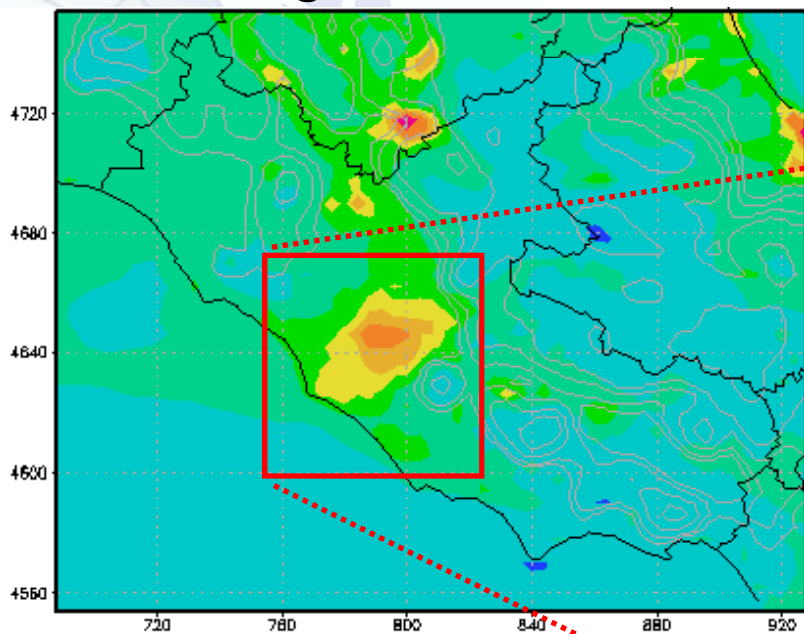
$\mu g/m^3$

QualeAria
national system

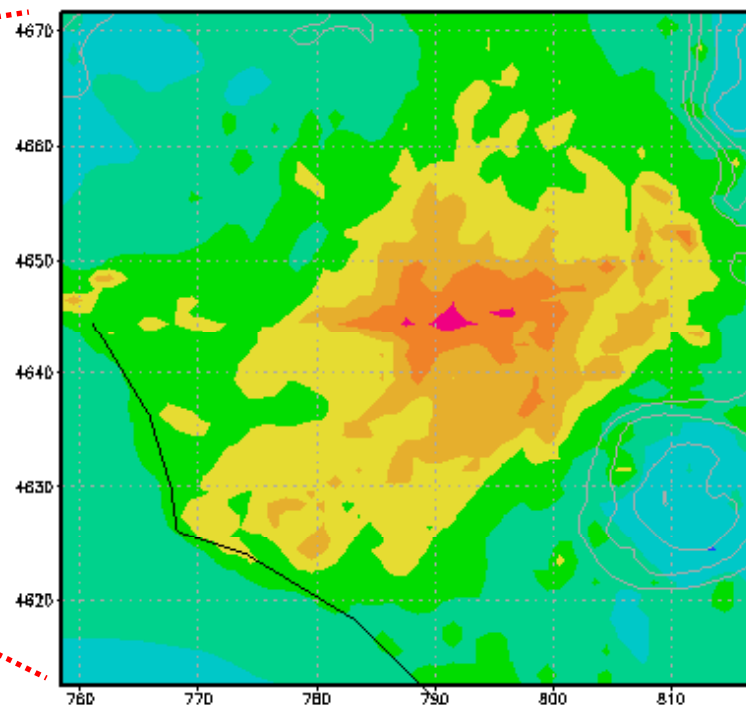
Hourly concentration maps

- STEM/FARM 3D Eulerian model
- 48 hrs ahead
- PM₁₀, O₃, NO₂, CO, SO₂, benzene, ...
- estimation of indicators according to legislation + exceedance

Regional domain



Rome metropolitan area



Maps distribution: 1 - web site

UrbanAria - Previsione della qualità dell'aria di Roma - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.aria-net.eu/ROMA/index_en.html

ARPALAZIO **UrbanAria**
Integrated Modelling System for air pollution forecast over Lazio Region and Rome metropolitan area

arianet

[Modelling system description](#)

Air Quality Forecast



[Lazio Region](#)

[Roma](#)

Visualise maps in Google Earth

[Lazio Region](#)

[Roma](#)

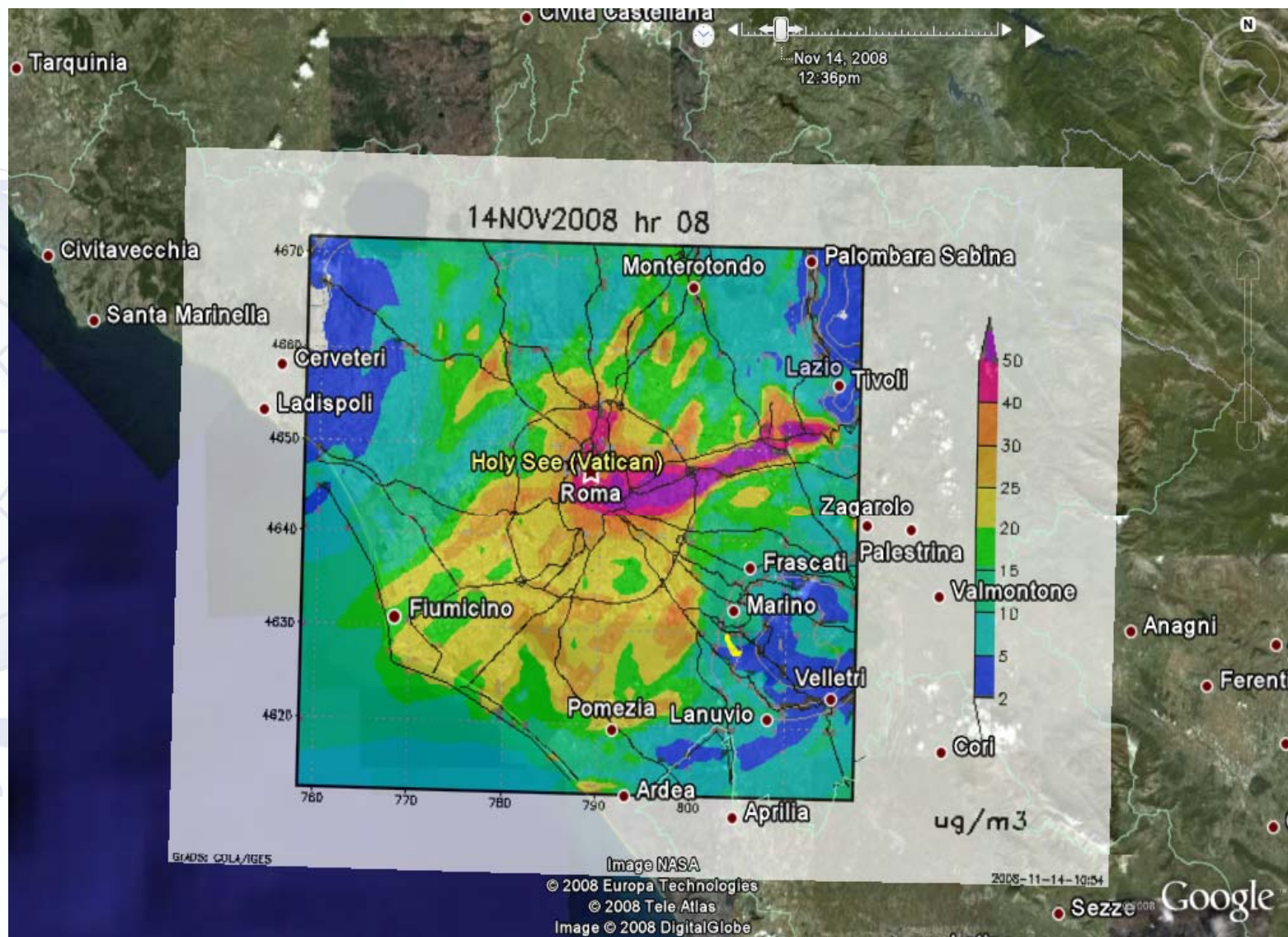
 

UNDER CONSTRUCTION

Done

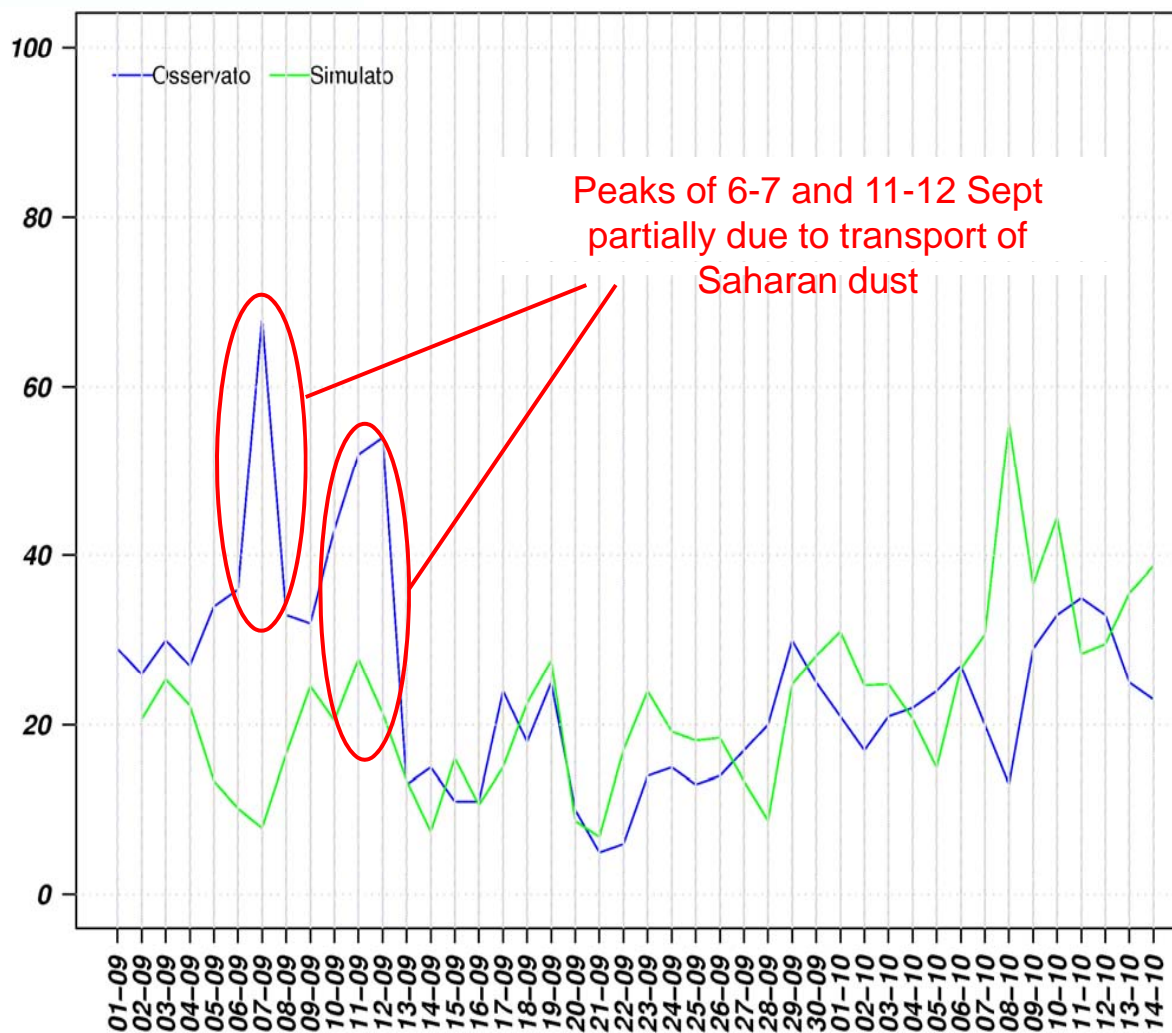
http://www.aria-net.eu/ROMA/index.html

Maps distribution: 2 – Google Earth



Improvement work (1)

PM10 Ada
September-October 2008



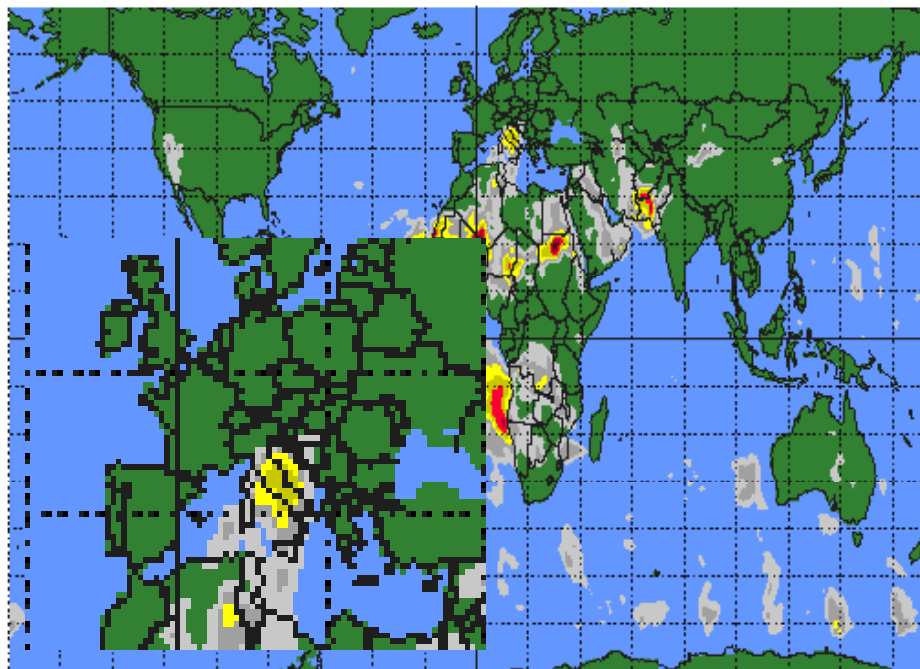
Improvement work (2)

Saharan dust events TOMS satellite data

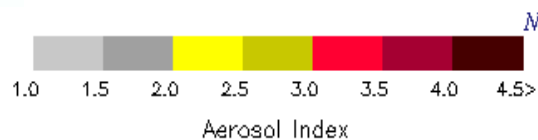
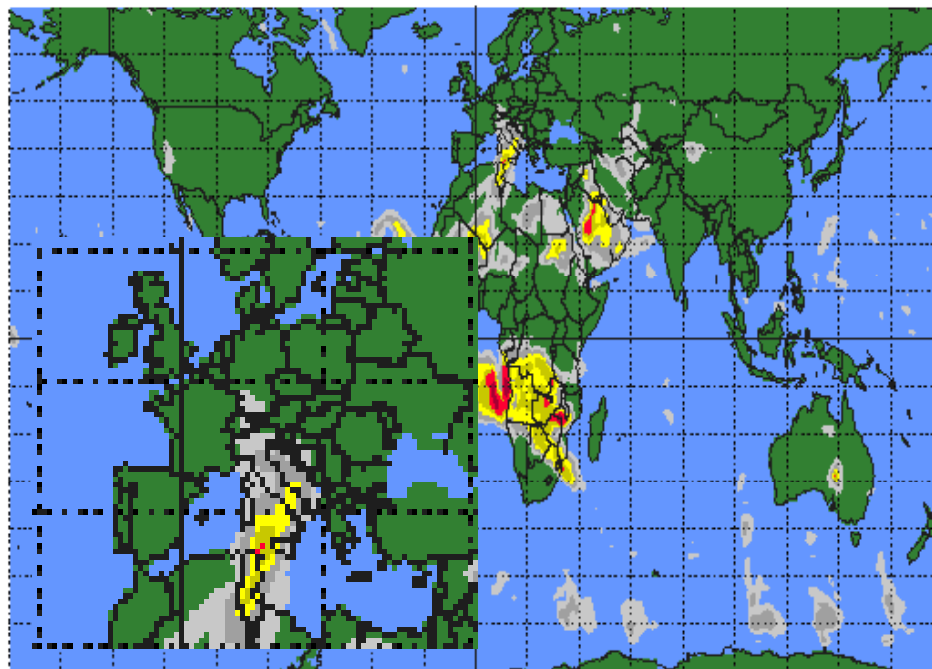
I picchi di PM10 dei giorni 6-7 hanno luogo in condizioni perturbate, in corrispondenza di valori bassi osservati per NO2 e PM2.5 e sono attribuibili prevalentemente al trasporto di polveri sahariane.

Nei giorni 11-12 settembre si osservano invece valori elevati di NO2 e rialzi di PM2.5 dovuti alla fase finale di un lungo periodo di alta pressione persistente. Si ha quindi sovrapposizione di contributo long range e di accumulo degli inquinanti emessi localmente.

OMI Aerosol Index
on September 06, 2008



OMI Aerosol Index
on September 11, 2008

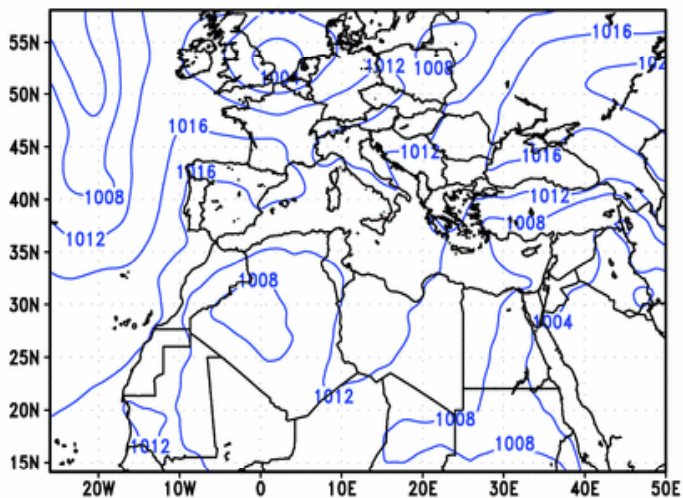


Improvement work (3)

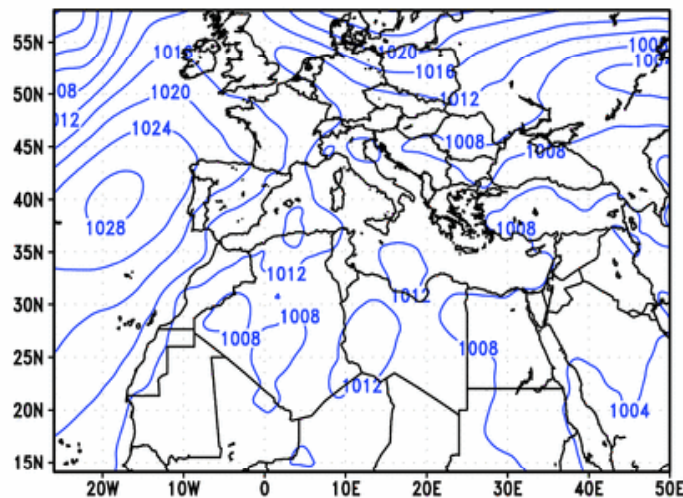
Saharan dust events

DREAM modelled data

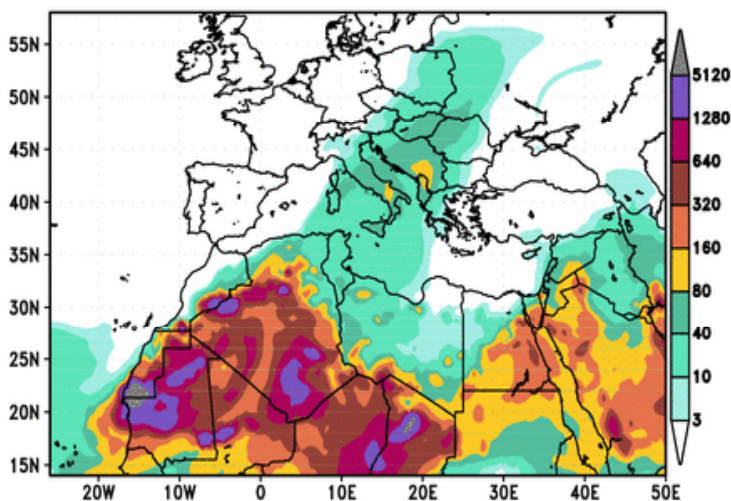
BSC/DREAM 12h acc. Precipitation and MSL Pressure
0h forecast for 12z 07 SEP 08



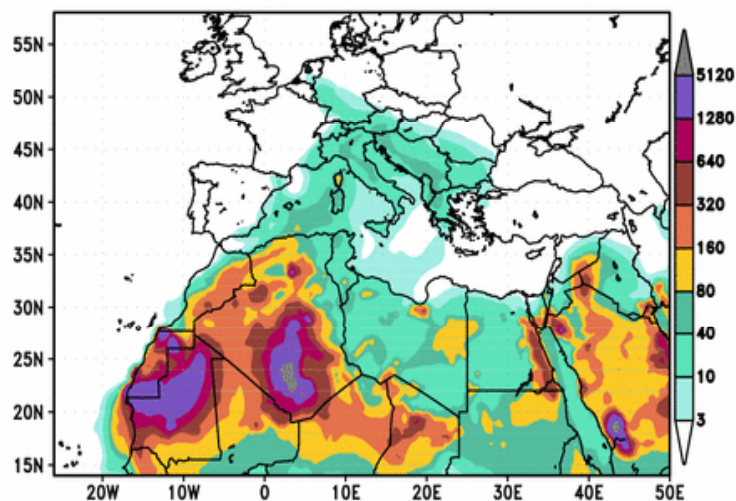
BSC/DREAM 12h acc. Precipitation and MSL Pressure
0h forecast for 12z 12 SEP 08




BSC/DREAM Lowest Model Level Dust Conc. ($\mu\text{g}/\text{m}^3$)
0h forecast for 12z 07 SEP 08



BSC/DREAM Lowest Model Level Dust Conc. ($\mu\text{g}/\text{m}^3$)
0h forecast for 12z 12 SEP 08



AREP
GAW



The Turin air quality forecast system

WMO
OMM

PIEMONTE
Arpa
Agenzia Regionale
per la Protezione Ambientale

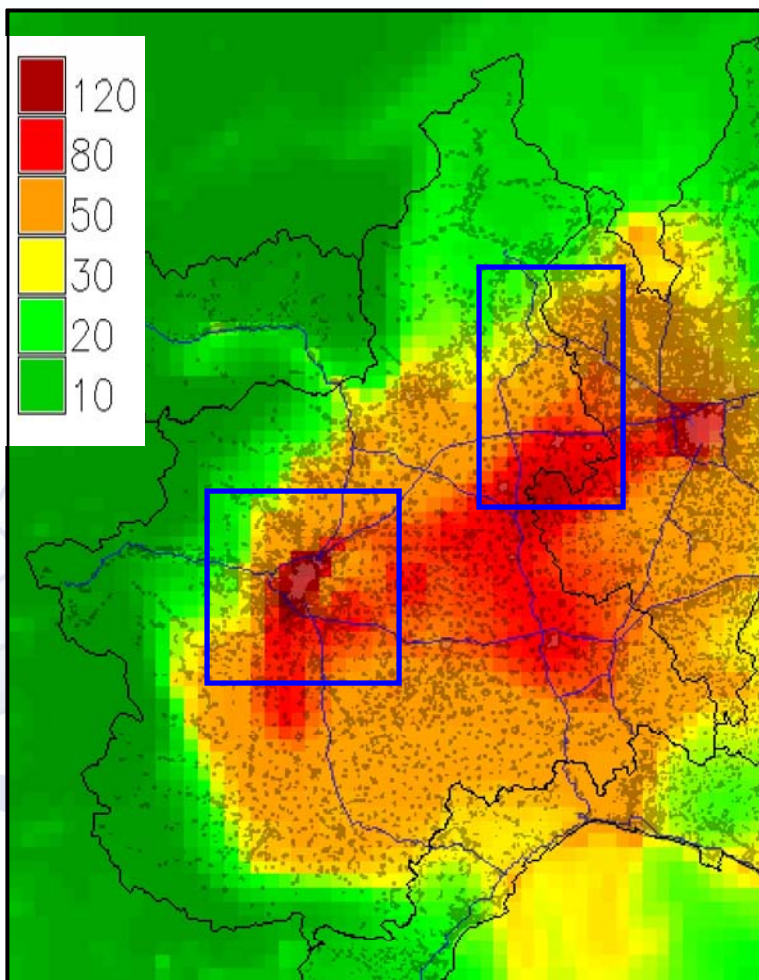

arianet

The Turin & Piemonte AQFS

- Operated since 2006
- Multiple years of historical data record
- Growing experience & understanding
- Confidence in performance
- Off-line counterpart for planning & emissions reduction programs

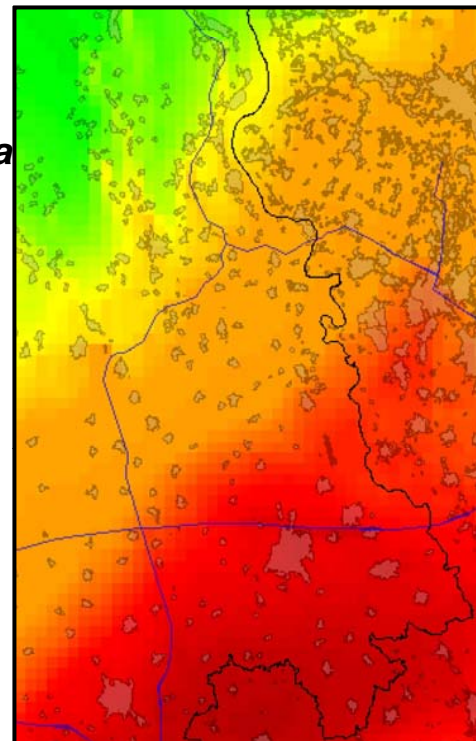
The Piemonte & Turin AQFS

g1 Piemonte

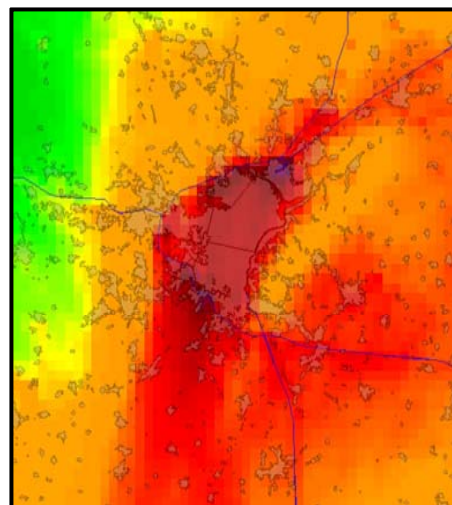


24/02/2007- PM_{10} daily mean [$\mu g/m^3$]
(run 23/02/2007)

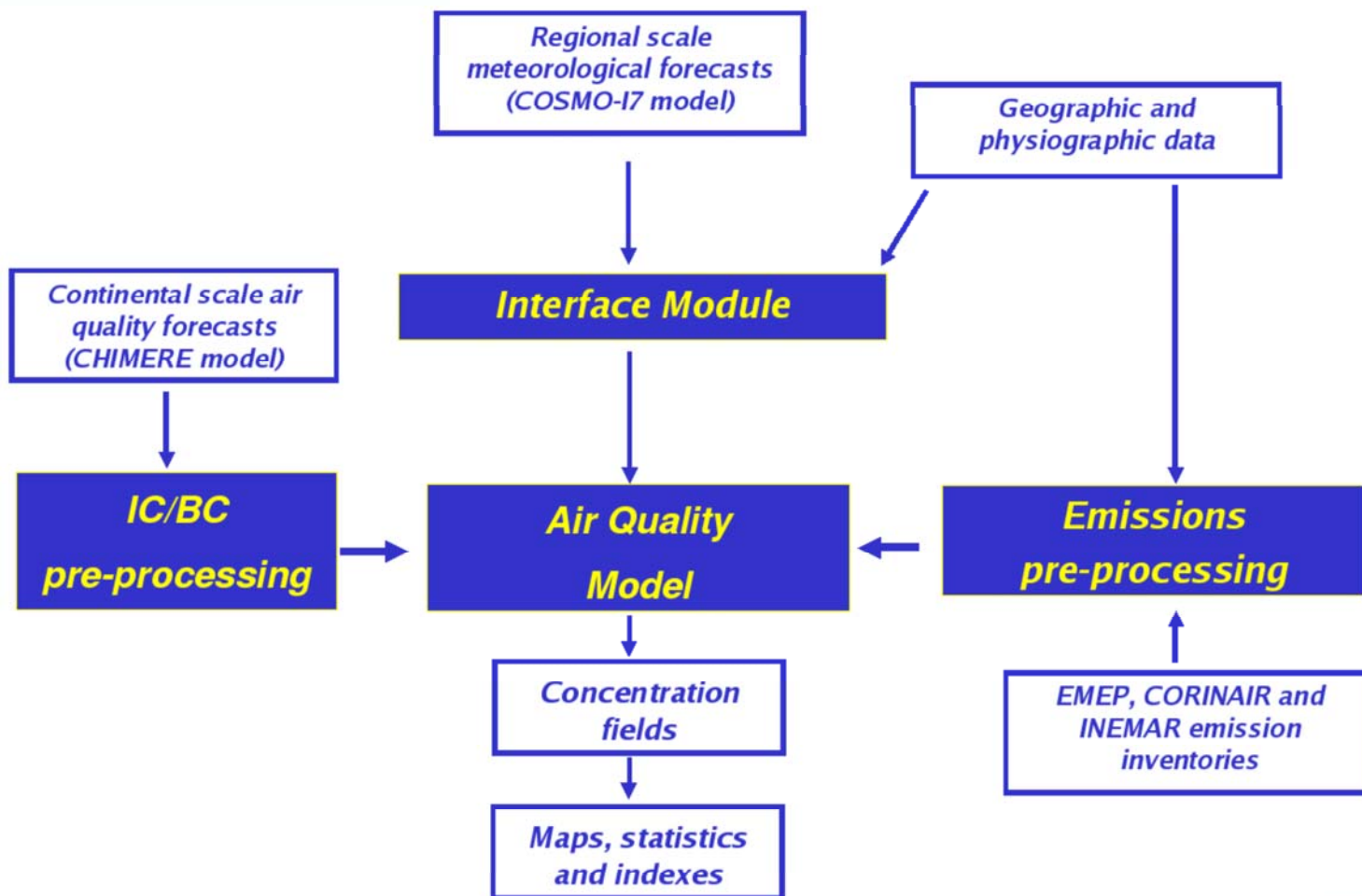
g2 Novara



g2 Turin

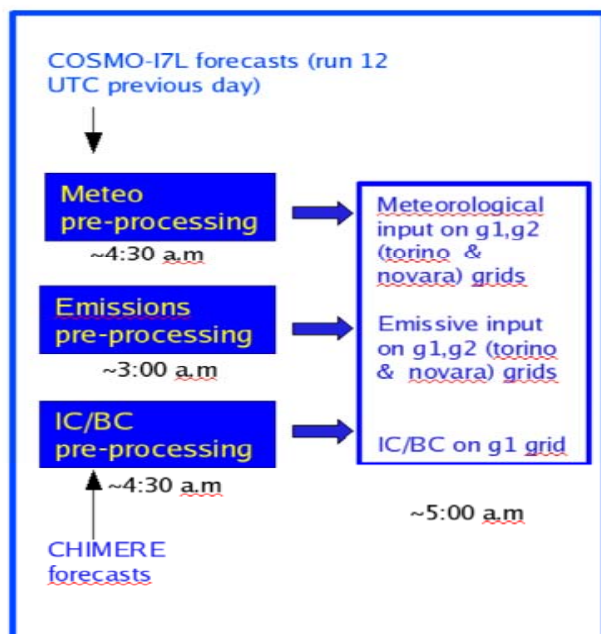


The Piemonte & Turin AQFS Architecture

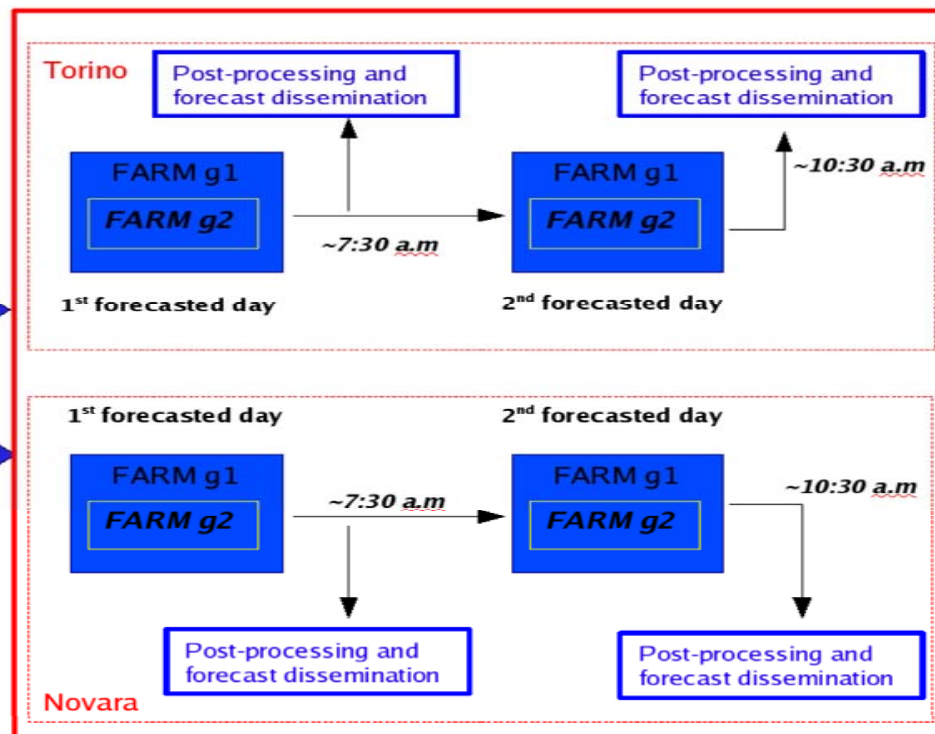


The Piemonte & Turin AQFS Scheduling

Step1
Input data processing



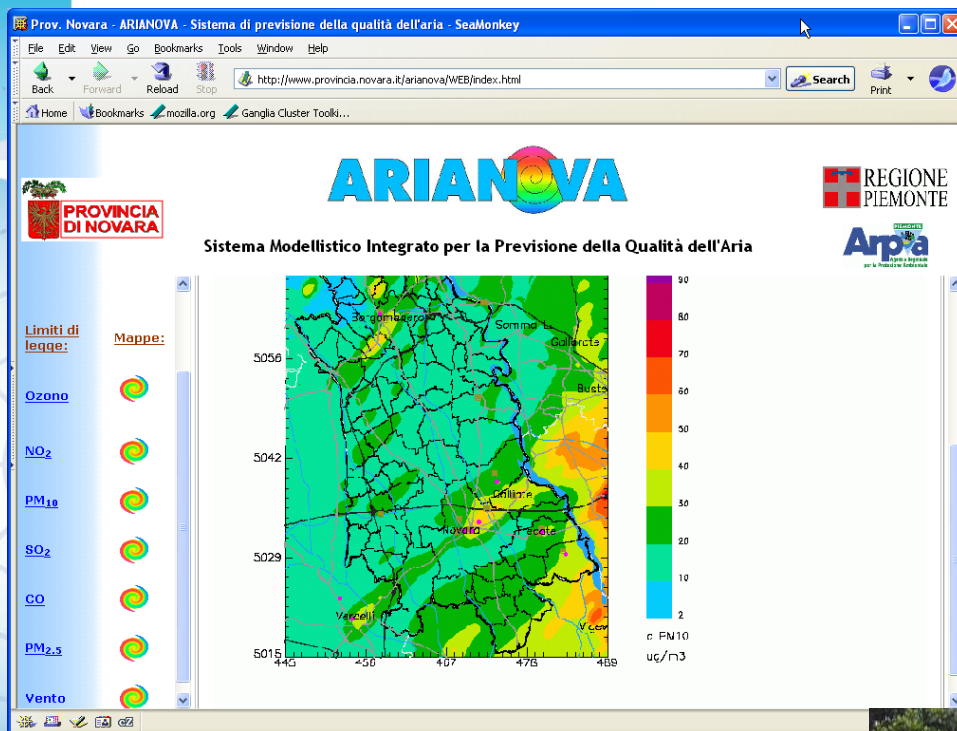
Step2
Air quality simulation



- **Forecast time:** 48 hours (2 days forecasts, starting from today 01:00 a.m)
- **Pollutants:** SO₂, NO_x, NO₂, CO, PM₁₀, PM_{2.5}, O₃ and C₆H₆
- **Time resolution:** 1 hour;
- **Post-processing:** maps, air quality indicators and Torino metropolitan area Air Quality Index (IQA)
- **Forecast dissemination:** forecast products are delivered to Torino and Novara Provinces, where they can be browsed and redistributed to end users and public through the web (e.g. <http://www.provincia.novara.it/arianova/WEB/index.html>)

Novara Province

Maps on web site



<http://www.provincia.novara.it/arianova/WEB/index.html>

Air Quality Index

Indice della qualità dell'aria nell'area metropolitana torinese			
La scala di riferimento per la qualità dell'aria	Valore dell'indice della qualità dell'aria relativo agli ultimi 7 giorni (°)	Previsione per Giovedì 20/09/2007	Previsione per Venerdì 21/09/2007
7 ↑ 6 5 4 3 2 1	<p>Mercoledì 19/09/2007</p> <p>2</p> <p>Buona</p>	↔ ☀	↔ ☀
6	18/09/2007	2	Non vi sono variazioni significative delle condizioni meteorologiche.
5	17/09/2007	3	
4	16/09/2007	3	
3	15/09/2007	5	
2	14/09/2007	4	
1	13/09/2007	3	

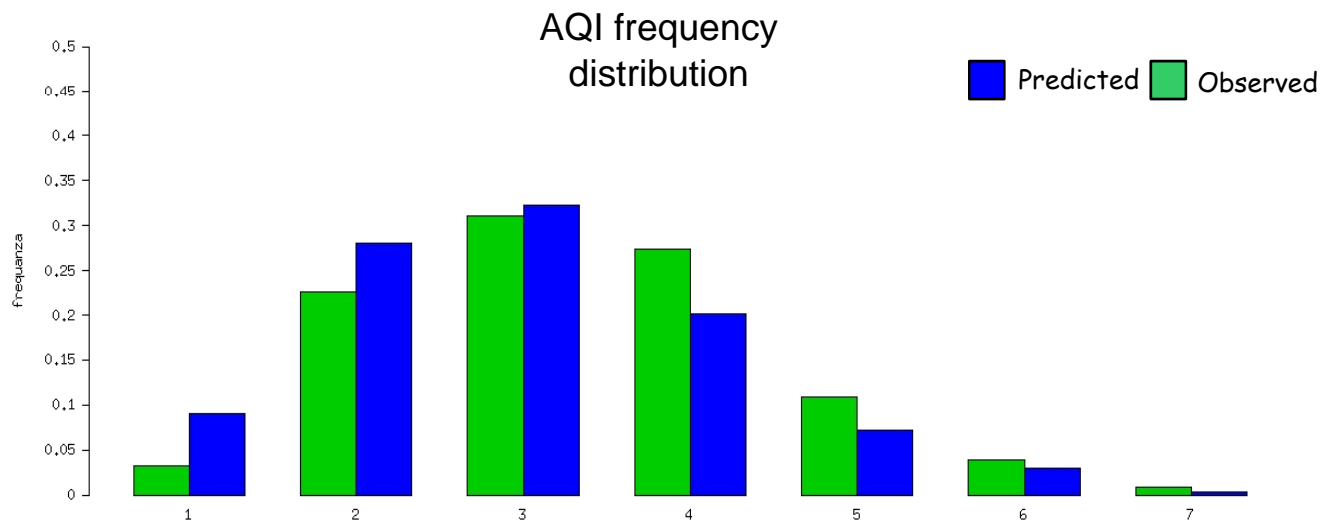
Road panels



Verification against measurements (1)

Jul 2006 - Jul 2007

Forecasted Air Quality Index for Torino urban area



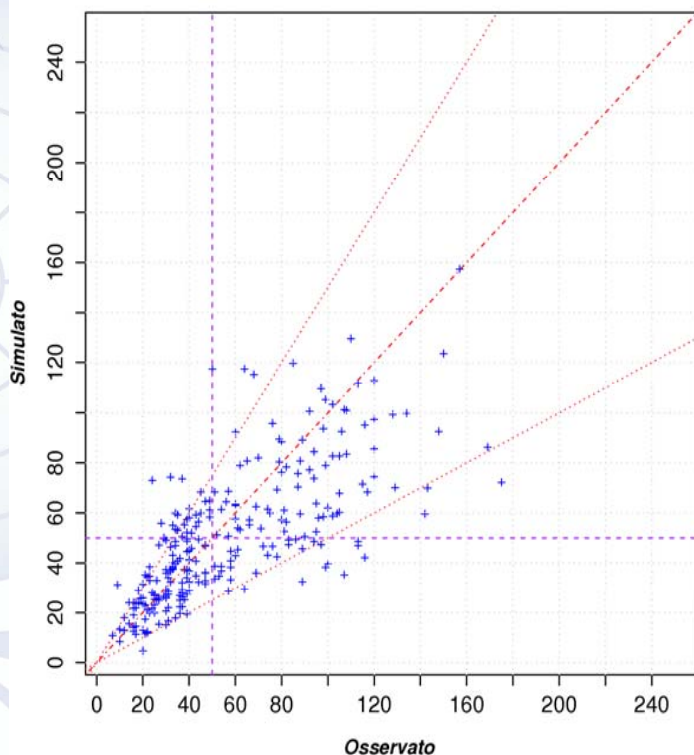
- Satisfactory agreement
- Underestimation of IQA in higher observed values (mainly due to PM_{10} underestimation during winter season)

Verification against measurements (2)

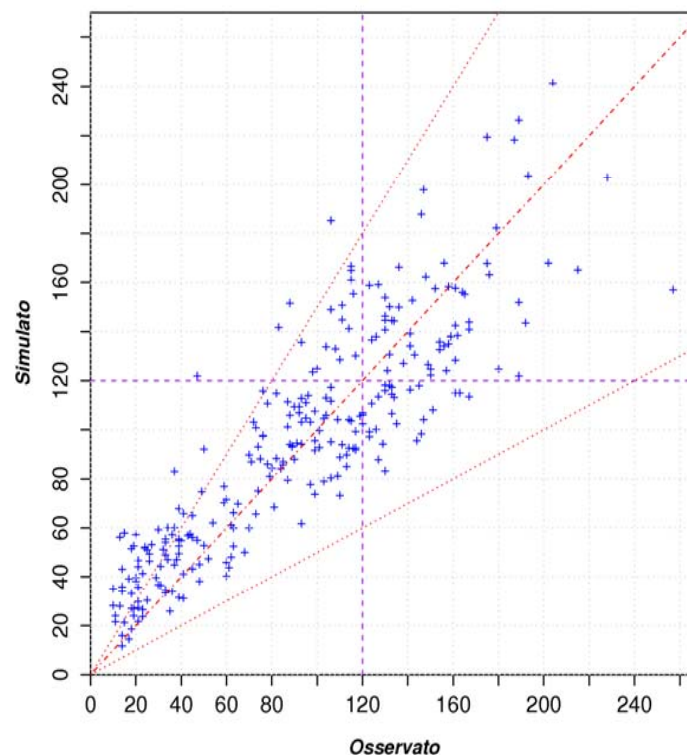
Jul 2006 - Jul 2007

(+48 forecast, g2 grid)

PM₁₀
TO Consolata

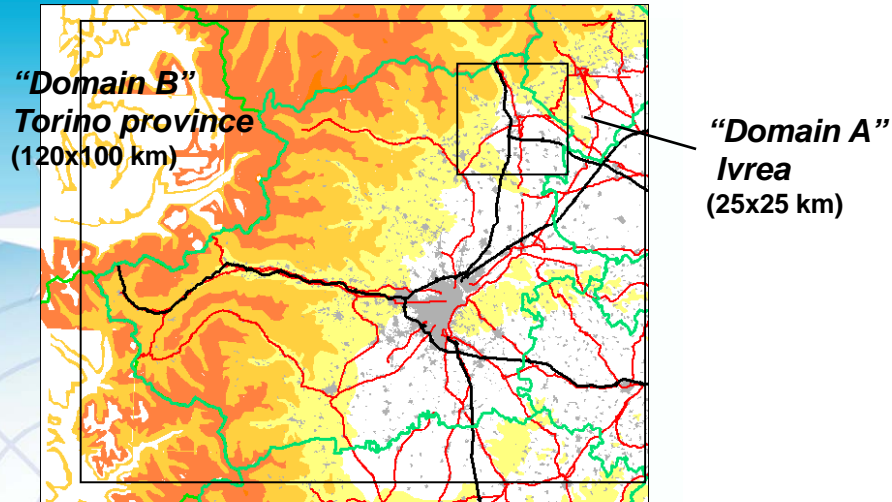


O₃ daily maximum 8-hour running average
Druento – La Mandria



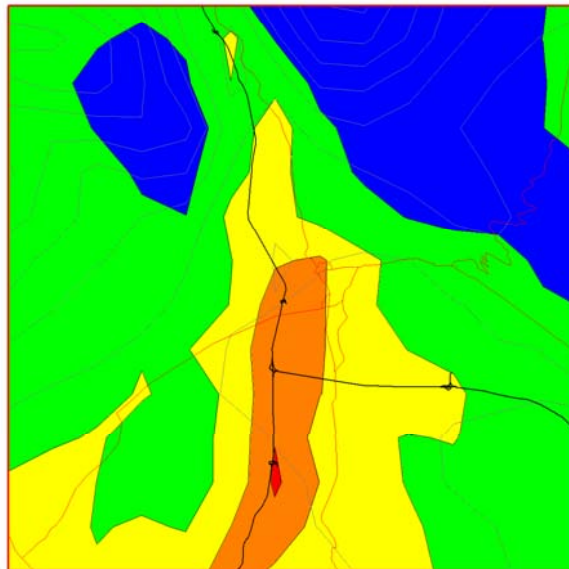
- forecasted PM₁₀ daily averages within the accuracy required by EU and Italian legislations (dotted red lines) at almost station locations
- greater underestimation for stations located outside the Torino metropolitan area

Resolution & comparison against measurements

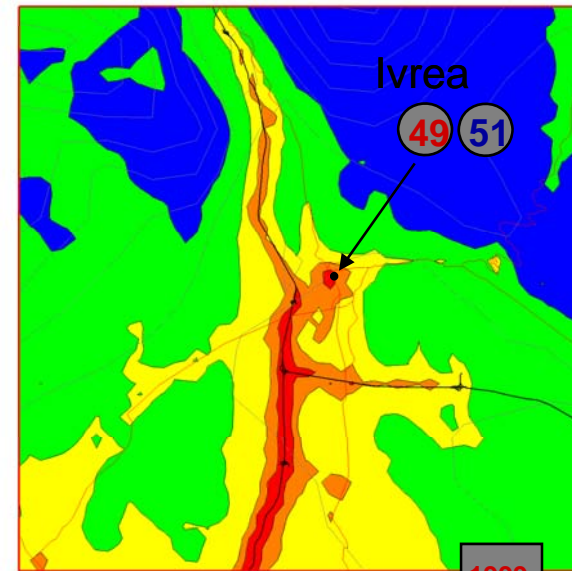


As seen from domain B

NO₂
Yearly
averages

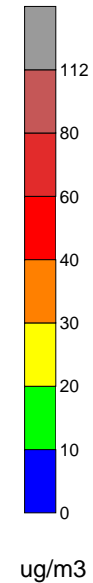


Domain A



Year of measured values:

1999
2000



Multiple AQFS





***Examples of
Air Quality
Forecast Systems***

Beijing AQFS

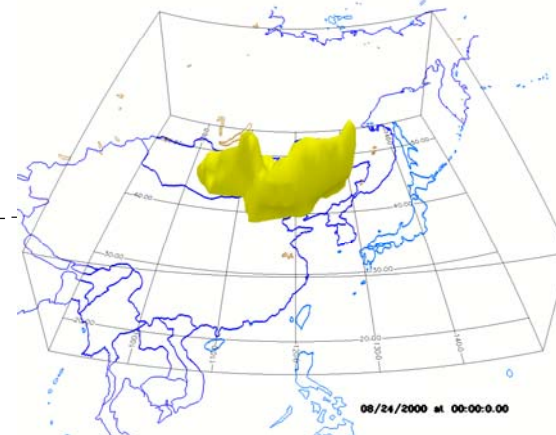
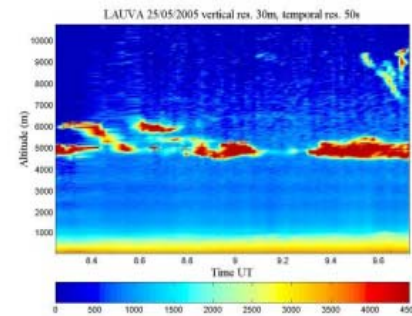
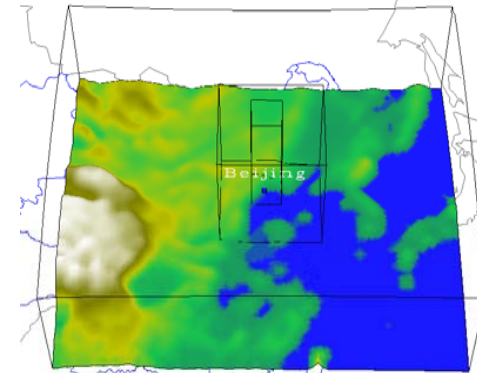
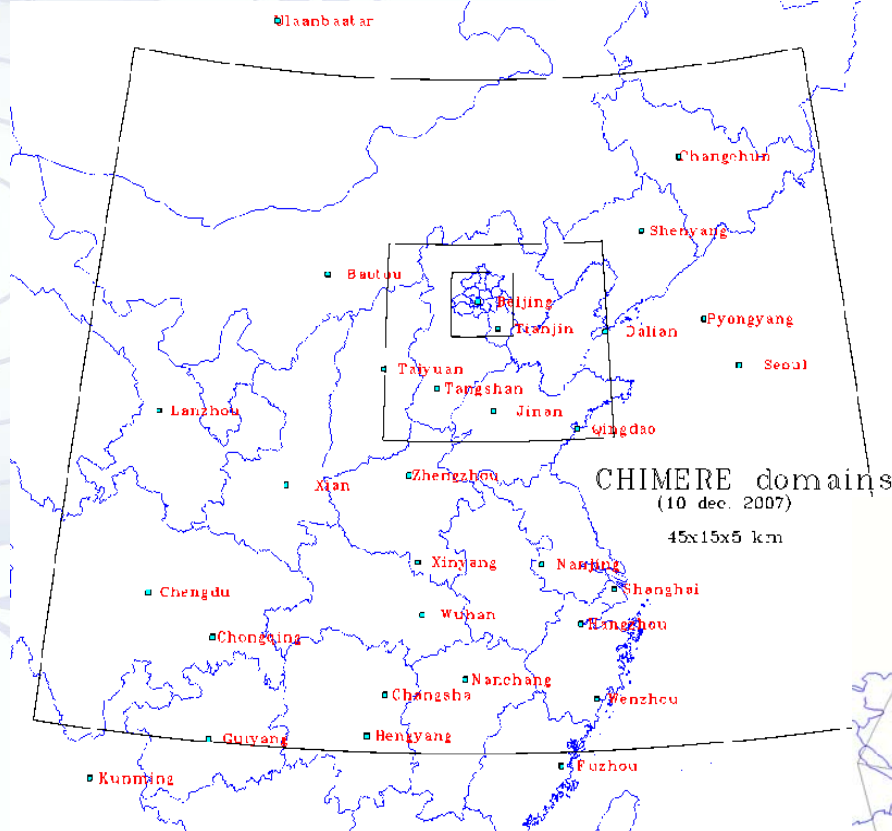
Beijing 2008

Partner: BMEMC

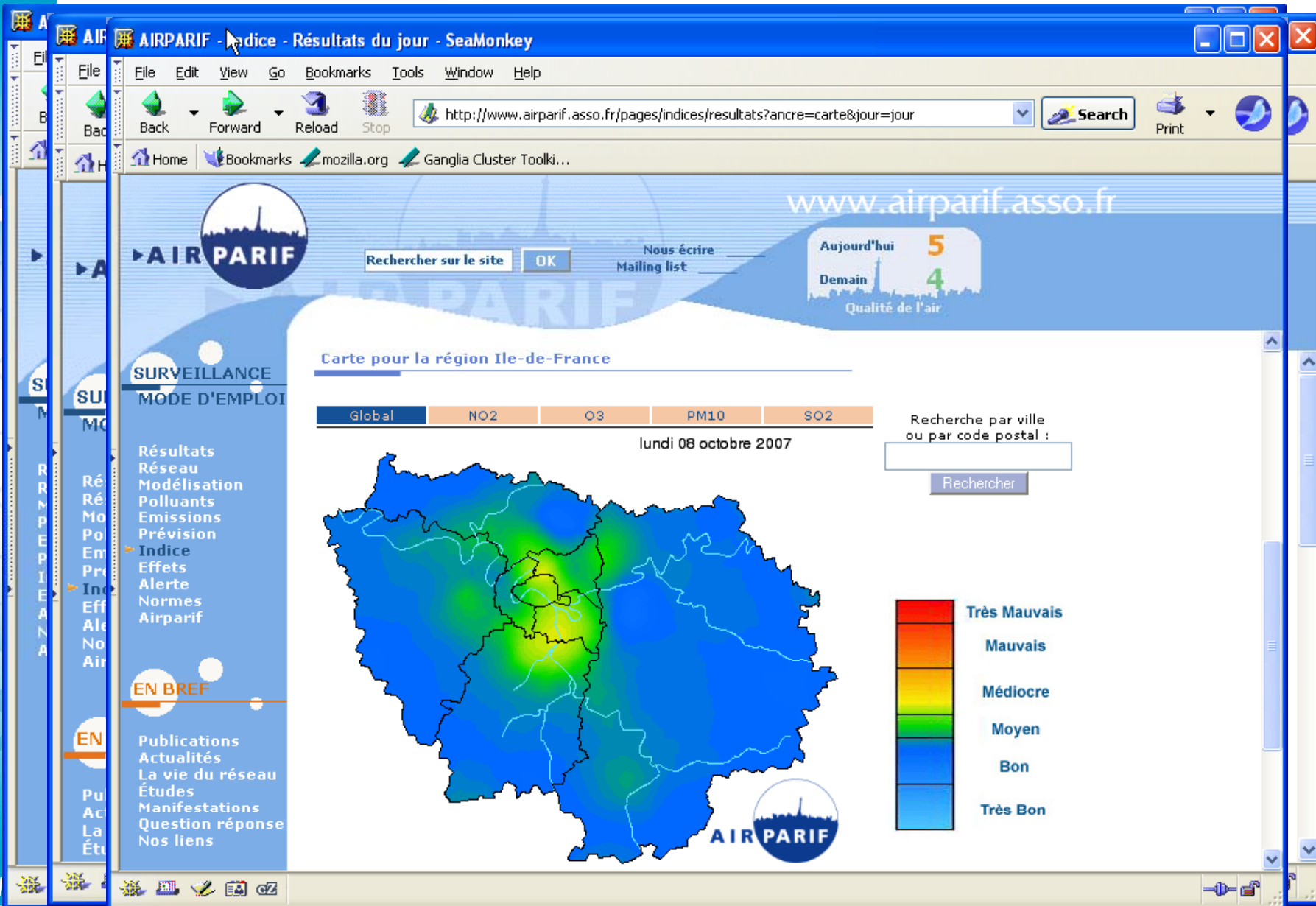
Target area: Beijing & Tianjin

3 domains zooming: 45 → 15 → 5 km

MM5 + CHIMERE



Paris



AIRPARIF - Indice - Résultats du jour - SeaMonkey

http://www.airparif.asso.fr/pages/indices/resultats?ancre=carte&jour=jour

www.airparif.asso.fr

Rechercher sur le site OK

Nous écrire Mailing list

Aujourd'hui **5**
Demain **4**
Qualité de l'air

SURVEILLANCE
MODE D'EMPLOI

Global NO2 O3 PM10 SO2

lundi 08 octobre 2007

Recherche par ville ou par code postal :

Rechercher

Très Mauvais
Mauvais
Médiocre
Moyen
Bon
Très Bon

EN BREF

Publications
Actualités
La vie du réseau
Études
Manifestations
Question réponse
Nos liens

Helsevirkninger knyttet til luftforurensning

For alle fem komponenter er det fastsatt varslingsklasser i forhold til konsentrasjonene av stoffene i luften. Tabellen under viser varslingsklasser for de ulike komponentene og helsevirkninger knyttet til varslingsklassene.

I tabellen nedenfor oppgis komponentenes konsentrasjon som tim og med benevnningen i mikrogram per kubikkmeter ($\mu\text{g}/\text{m}^3$). (En kubikkmeter luft veier ca 1 kg.)

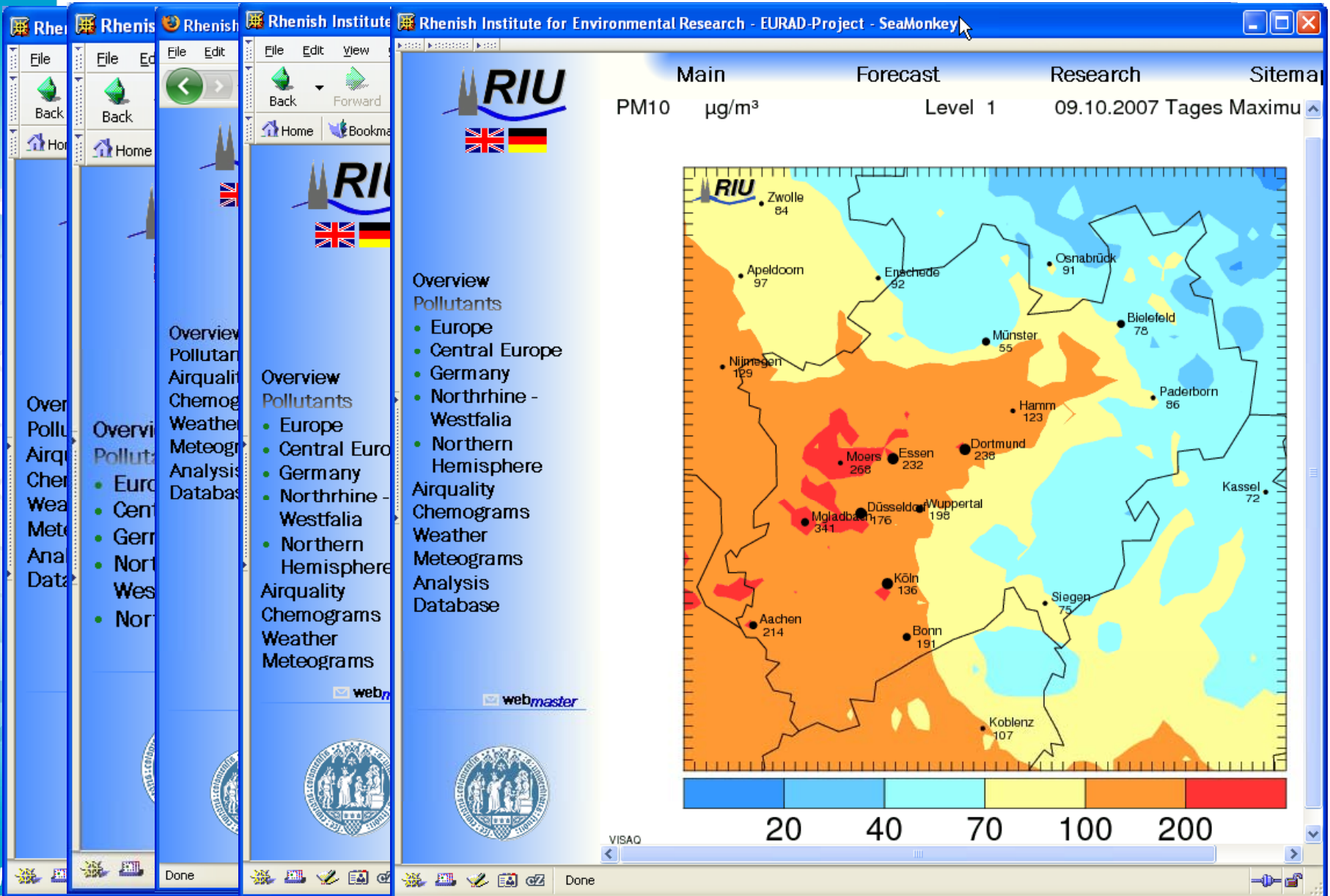
Nivå	Helsevirkninger knyttet til luftforurensning	PM10	PM2,5	NO2	SO2
		i $\mu\text{g}/\text{m}^3$			
Svært bra	Liten eller ingen helsesisiko.	<50	<25	<100	<150
Bra	Helseeffekter kan forekomme hos astmatikere.	50-100	25-50	100-150	50-100
Dårlig	Allergikere og personer med alvorlige hjerte- eller luftveislidelser bør unngå opphold utendørs i mye forurensete områder.	100-150	50-100	150-200	50-100
Svært dårlig	Allergikere og personer med alvorlige hjerte- eller luftveislidelser bør ikke oppholde seg i svært forurensete områder. Forbigående slimetassjoner og ubehag kan forekomme hos friske personer.	>150	>100	>200	>150

Helseeffekter
Les om hvordan luftforurensning påvirker din helse. [More...](#)

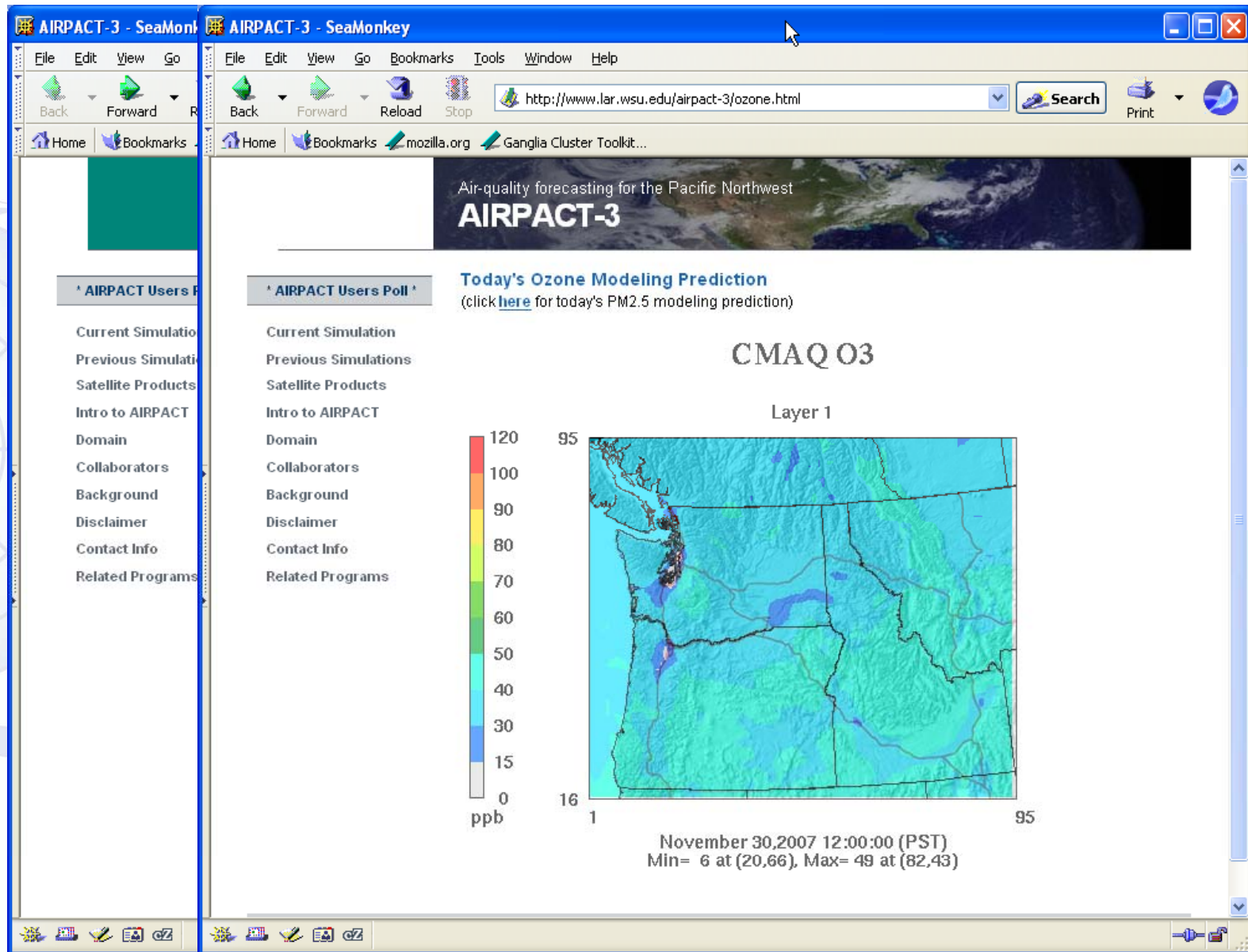
Relevant lenker

- [Folkehelseinstituttet](#)
- [World Health Organisation](#)

Northrhine-Westfalia



Pacific Northwest



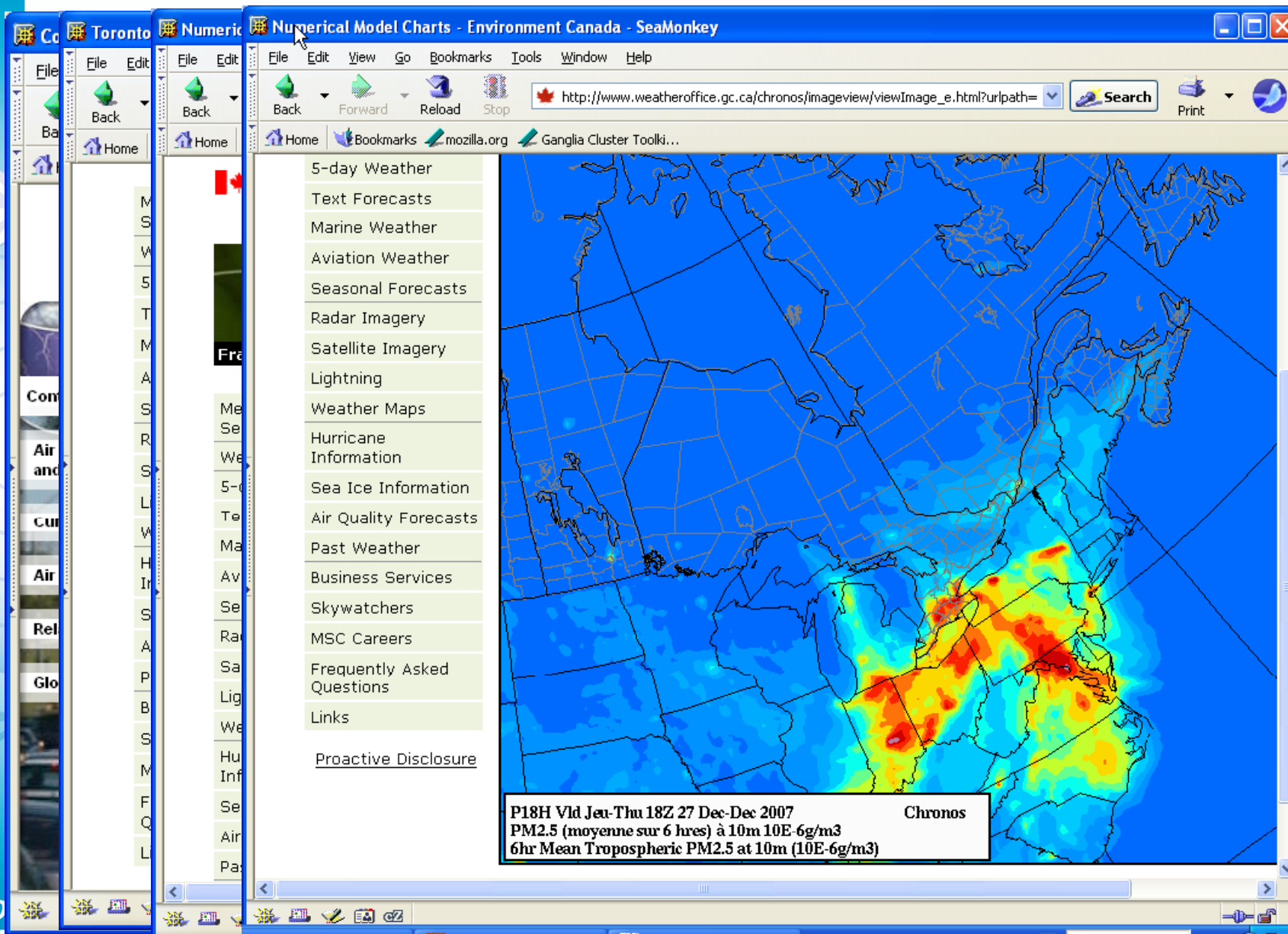
Sussex AQFS

The screenshot shows a web browser window titled "Sussex Air: Air Quality Near Me: Forecasts - SeaMonkey". The address bar shows the URL http://www.sussex-air.net/air_quality_forecasts.html. The website header features the "SUSSEX AIR" logo and the tagline "Promoting better air quality in Sussex". A navigation menu includes links for Home, About Us, Air Quality Near Me, airALERT, News & Events, Local Air Quality Management, Learn More, and Contact. A sidebar on the left lists "In this section:" with links to airALERT, Monitoring Data, Forecasts, Ozone Data, and Air Quality Events. Below this, "Related links:" includes Environmental Research Group, King's College London, National Air Quality Forecasts, and Weather Forecasts. The main content area displays a map of Sussex with various locations marked, including Brighton and Hove, which are highlighted in orange. An alert window is overlaid on the map, titled "http://www.erg.kcl.ac.uk - Air Quality Air Alert - SeaMonkey". The alert text reads: "Air pollution levels in all parts of Brighton and Hove are expected to be 'low'." It also includes a link: "An explanation of the possible health effects of 'moderate', 'high' and 'very high' pollution can be seen [here](#)". A "close" button is visible at the bottom of the alert window. The footer of the website contains the copyright notice: "© 2003 Sussex Air Quality Steering Group, Lewes D.C., Planning & Environment".

Haifa

The screenshot shows a web browser window titled "Air Quality in Haifa - SeaMonkey". The address bar shows "http://www.aironline.info/haifa/". The main content area features the title "Air Quality" and the organization name "Haifa District Municipal Association for the Environment" in Hebrew. A sidebar on the left contains navigation menus for "Stations", "Information", and "Links". A "MESSAGE BOARD" section on the right contains text in Hebrew. Below the main text, there are buttons for "View AQI map" and a table of pollutant selection buttons: PM₁₀, SO₂, NO_x, NO₂, and O₃. A "View map of 24-hour average" section contains a PM₁₀ button. At the bottom right, a red-bordered box contains the text "Link al sito web".

Toronto



Portugal

The screenshot shows a Microsoft Internet Explorer browser window displaying the website of the Instituto do Ambiente (IA) for air quality prediction. The browser's address bar shows the URL: http://www2.dao.ua.pt/gemac/previsao_qar/siaq.htm. The page content includes the IA logo, navigation links, and a table of air quality indices.

Instituto do Ambiente
MINISTÉRIO DO AMBIENTE, DO ORDENAMENTO DO TERRITÓRIO E DO DESENVOLVIMENTO REGIONAL

Links institucionais

HomePage

Detalhes

- Previsão por poluente
- Consulta histórico

Informações

- Índice Qualidade do Ar
- Eventos naturais
- Efeitos na saúde

Projecto

- Objectivos
- Modelos
- Validação
- Equipa
- Publicações

Links

- Parceiros
- Institucionais
- Investigação

Contactos

O Índice de Qualidade do Ar previsto baseia-se na seguinte Tabela, proposta para o ano 2006, em termos do valor máximo horário diário de Ozono (O₃) e da média diária de partículas inaláveis (PM₁₀).

Índice	O ₃		PM ₁₀	
	Mínimo	Máximo	Mínimo	Máximo
MUITO BOM	0.0	59.4	0.0	19.4
BOM				
MÉDIO	119.5	179.4	34.5	49.4
FRACO	179.5	239.4	49.5	119.4
MAU	239.5	>239.5	119.5	>119.5

Independentemente de quaisquer factores de sinergia entre os diferentes poluentes, o grau de degradação da qualidade do ar estará mais dependente da pior classificação verificada entre os dois poluentes considerados, pelo que o IQar é definido a partir daquele que apresentar pior classificação.

Para mais informações, consultar a página relativa ao [Índice de Qualidade do Ar](#).

Public awareness



Communication

Media:

- internet (web site, Google Earth ...)
- TV, newspapers
- text/SMS, fax, voice mail, e-mail ...
- road panels
- others ...

Which quantity?

- concentration values (max, 24 hrs avg., ...)
- synthetic indexes (AQI categories)

Information types:

- messages, bulletins
- time series at selected locations
- maps

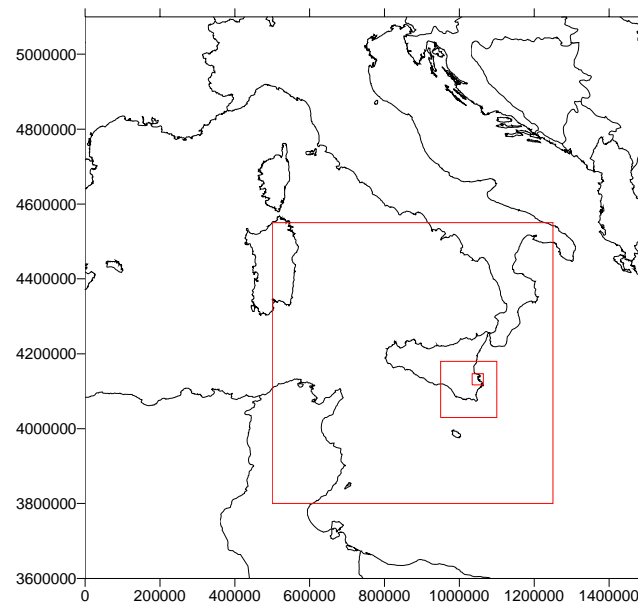
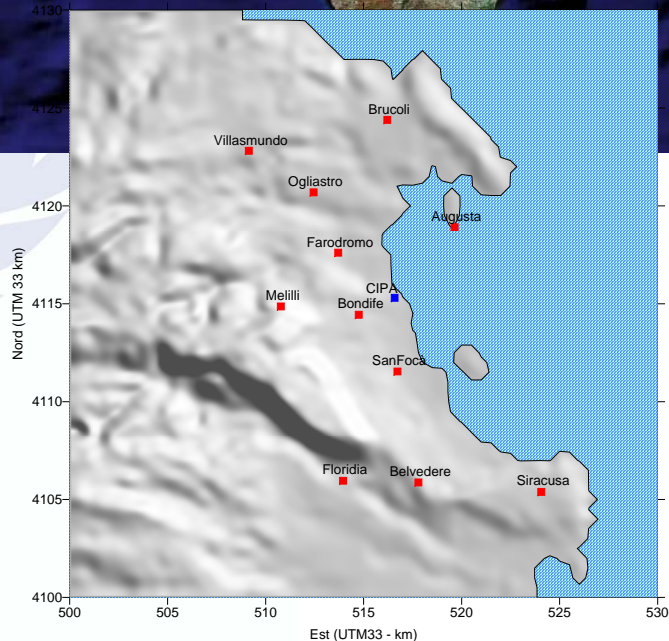
... depending on the audience & purpose

Forecast purposes

- Public health notification
- Episodic control programs
- Specialized monitoring programs
- Knowledge base for planning & emissions reduction programs

Forecast for industrial sites

The PRIOLO industrial complex



The PRIOLO industrial complex

SARO – user interface

The image displays three sequential screenshots of the SARO software interface, illustrating the workflow from data input to result visualization.

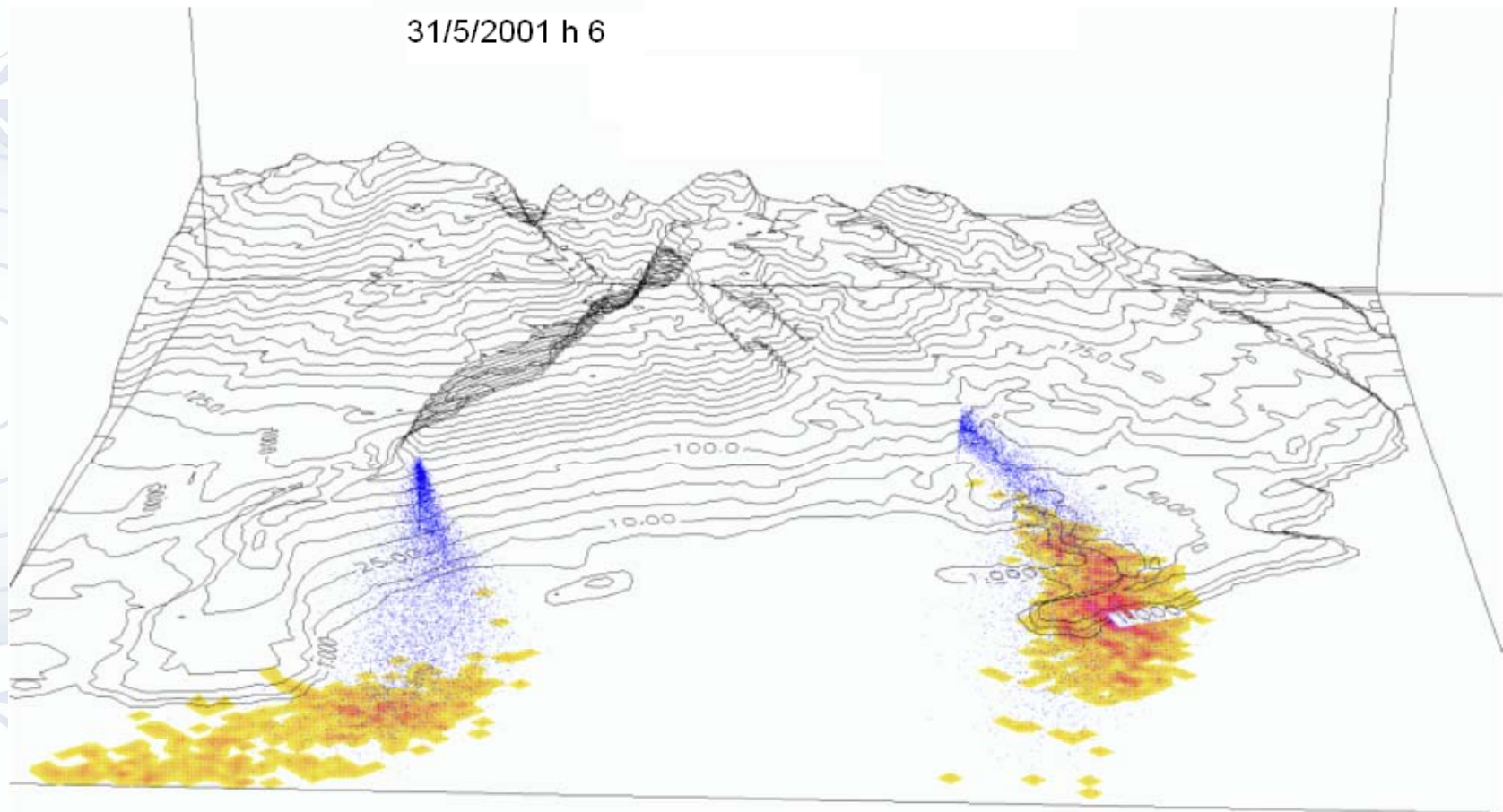
Left Screenshot: Shows the 'IN CORSO' (In Progress) status. The interface includes a menu bar (File, Routine, Storico, Scenario, Strumenti), a toolbar (Principale, Routine, Storico, Scenario), and a central map area. A list of data sources is visible on the right, including Suolo_Csv, Sodar_Uwyo, Rass_Uwyo, Creadoncsv, Adcons, Tim2Par, Spradsg, Cutmin, Minerve, Surfpro, Spray, Slicer-Meteo, Slicer-Conc, and Avisu. A status bar at the bottom indicates 'Stato: ...IN CORSO... ELABORATION FROM 05/11/04 TIME 00'.

Middle Screenshot: Shows the 'TERMINAZIONE CORRETTA' (Correct Termination) status. The status bar now reads 'Stato: TERMINAZIONE CORRETTA 20/10/2005 14:27'. The central area displays a log of the simulation steps, including 'START of C:\User...', 'Step 0 * Elaboration FROM 1 DATE : 05/11/04 2 DATE : 06/11/04', and subsequent steps for SUOLO_CSV, SODAR_UWYO, RASS_UWYO, and CREADONCSV.

Right Screenshot: Shows the final visualization of pollutant concentrations. The status bar indicates 'Stato: TERMINAZIONE CORRETTA 20/10/2005 14:27'. The main area displays a contour plot titled 'Horizontal (S=0,002, 4 m) - 20.10.05 14:00:00'. The plot shows concentration contours for SO2, NOx, WIND, and TEMP. A color scale on the right ranges from 0 to 500 MCG/M3. The plot includes a coordinate system with X-axis values from 500 to 530 and Y-axis values from 4108 to 4130.

- Check modelling system computing status
- Verify results of every step of the computational chain
- Visualise pollutant concentrations

Continuous plumes following



The PRIOLO industrial complex
Accidental events



30 April 2006 Accident

Credits

Many thanks to colleagues from ...

- ARPA Lazio
- ARPA Piemonte
- CIPA
- ENEA
- ARIA Technologies
- ARIANET

COST ESo602, Chemical Weather

Action ES0602: Towards a European Network on Chemical Weather
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