# Megacities: Emissions, Impact on Air Quality and Climate, and Improved Tools for Mitigation Assessments (MEGAPOLI)

**EC 7FP project for:**

**ENV.2007.1.1.2.1. Megacities and regional hot-spots air quality and climate**

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**Vice-coordinators:** M. Lawrence (MPIC)

S. Pandis (FRTHUP)


**MEGAPOLI –CityZen Meeting**

**EGU, Vienna, 21.04.2009**

DMSP: 27 Nov 2000; R. Simmon (N

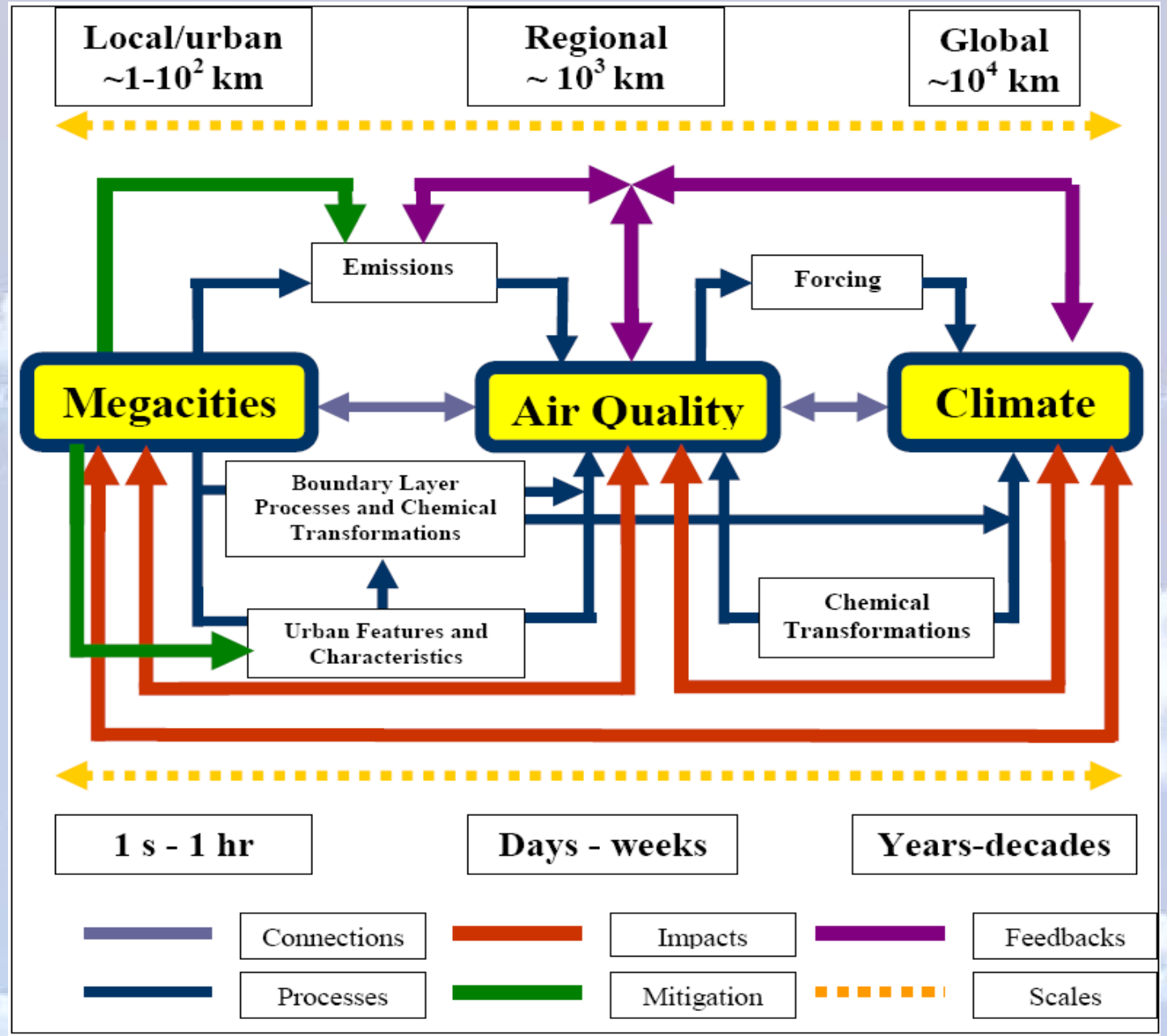
# *MEGAPOLI Partners:*

| Nr | Beneficiary name | short name | Country |
|---|---|---|---|
| 1 | **Danish Meteorological Institute** | **DMI** | Denmark |
| 2 | **Foundation for Research and Technology, Hellas, University of Patras** | **FORTH** | Greece |
| 3 | **Max Planck Institute for Chemistry** | **MPIC** | Germany |
| 4 | **ARIANET Consulting (SME)** | **ARIANET** | Italy |
| 5 | **Aristotle University Thessaloniki** | **AUTH** | Greece |
| 6 | **Centre National de Recherche Scientifique (incl. LISA, LAMP, LSCE, GAME, LGGE)** | **CNRS** | France |
| 7 | **Finnish Meteorological Institute** | **FMI** | Finland |
| 8 | **Joint Research Center, Ispra** | **JRC** | Italy |
| 9 | **International Centre for Theoretical Physics** | **ICTP** | Italy |
| 10 | **King's College London** | **KCL** | UK |
| 11 | **Nansen Environmental and Remote Sensing Center** | **NERSC** | Norway |
| 12 | **Norwegian Institute for Air Research** | **NILU** | Norway |
| 13 | **Paul Scherrer Institute** | **PSI** | Switzerland |
| 14 | **TNO-Built Environment and Geosciences** | **TNO** | The Netherlands |
| 15 | **UK MetOffice** | **MetO** | UK |
| 16 | **University of Hamburg** | **UHam** | Germany |
| 17 | **University of Helsinki** | **UHel** | Finland |
| 18 | **University of Hertfordshire – Centre for Atmospheric and Instrum. Research** | **UH-CAIR** | UK |
| 19 | **University of Stuttgart** | **USTUTT** | Germany |
| 20 | **World Meteorological Organization** | **WMO** | Switzerland (Int.) |
| 21 | **Charles University, Prague** | **CUNI** | Czech Republic |
| 22 | **Institute of Tropospheric Research** | **IfT** | Germany |
| 23 | **Centre for Atmospheric Science, University of Cambridge** | **UCam** | UK |

# Connections between megacities, air quality and climate:

## main feedbacks, ecosystem, health and weather impact pathways, and mitigation routes

- Our hypothesis is that megacities around the world have an impact on air quality not only locally, but also regionally and globally and can influence the climate.
- Some of the links shown have already been considered by previous studies and are reasonably well-understood.
- However, a complete quantitative picture of these interactions is clearly missing.
- Understanding and quantifying these missing links will be the focus of MEGAPOLI.



# Main objectives of MEGAPOLI:

Objective 1: to assess impacts of megacities and large air-pollution “hot-spots” on local, regional, and global air quality and climate;
Objective 2: to quantify feedbacks between megacity emissions, air quality, local and regional climate, and global climate change;
Objective 3: to develop and implement improved, integrated tools to assess the impacts of air pollution from megacities on regional and global air quality and climate and to evaluate the effectiveness of mitigation option

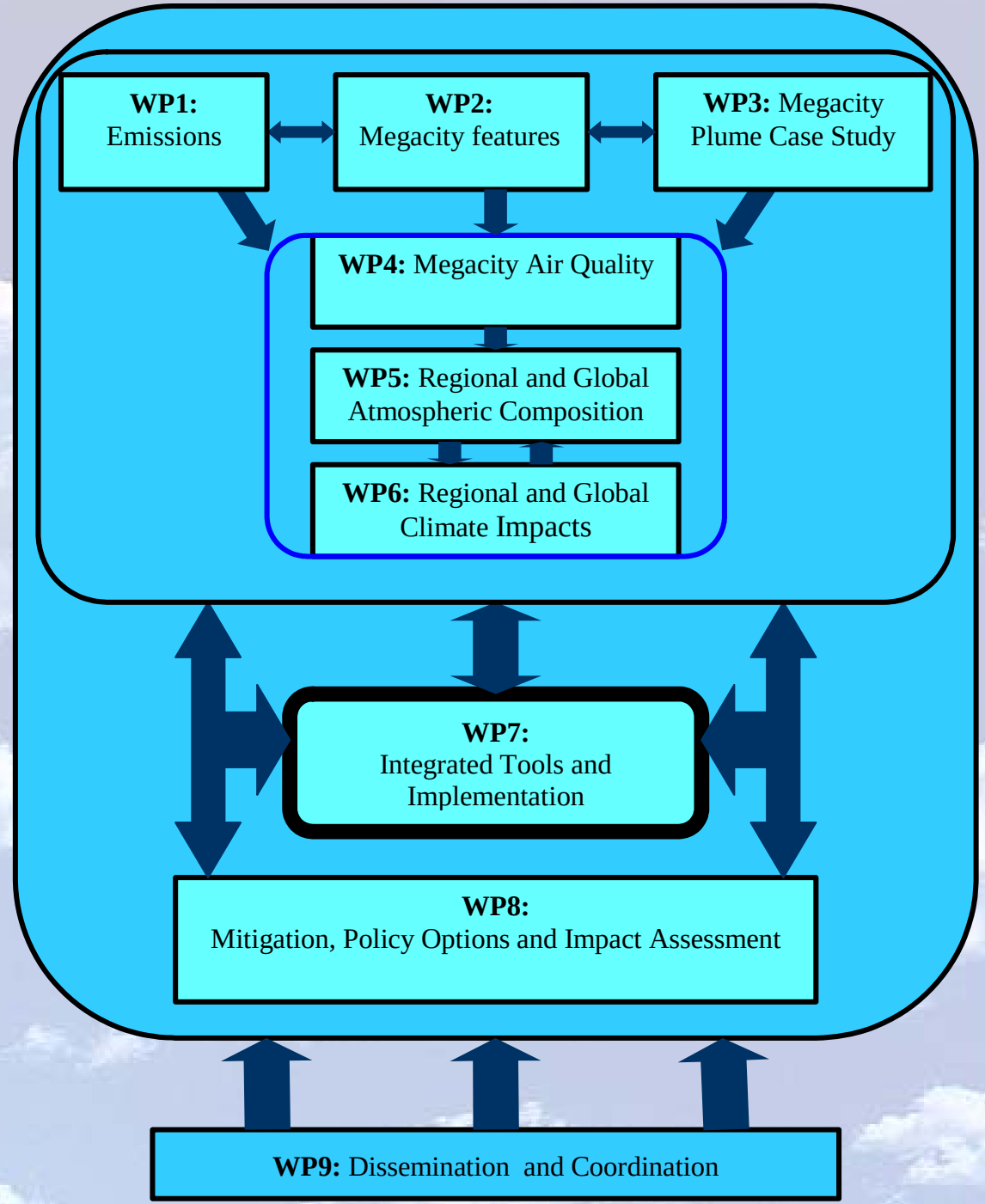
MEGAPOLI will include both basic and applied research, and will bridge the spatial and temporal scales that connect local emissions, air quality and weather conditions with global atmospheric chemistry and climate.

# Scientific questions to be addressed:

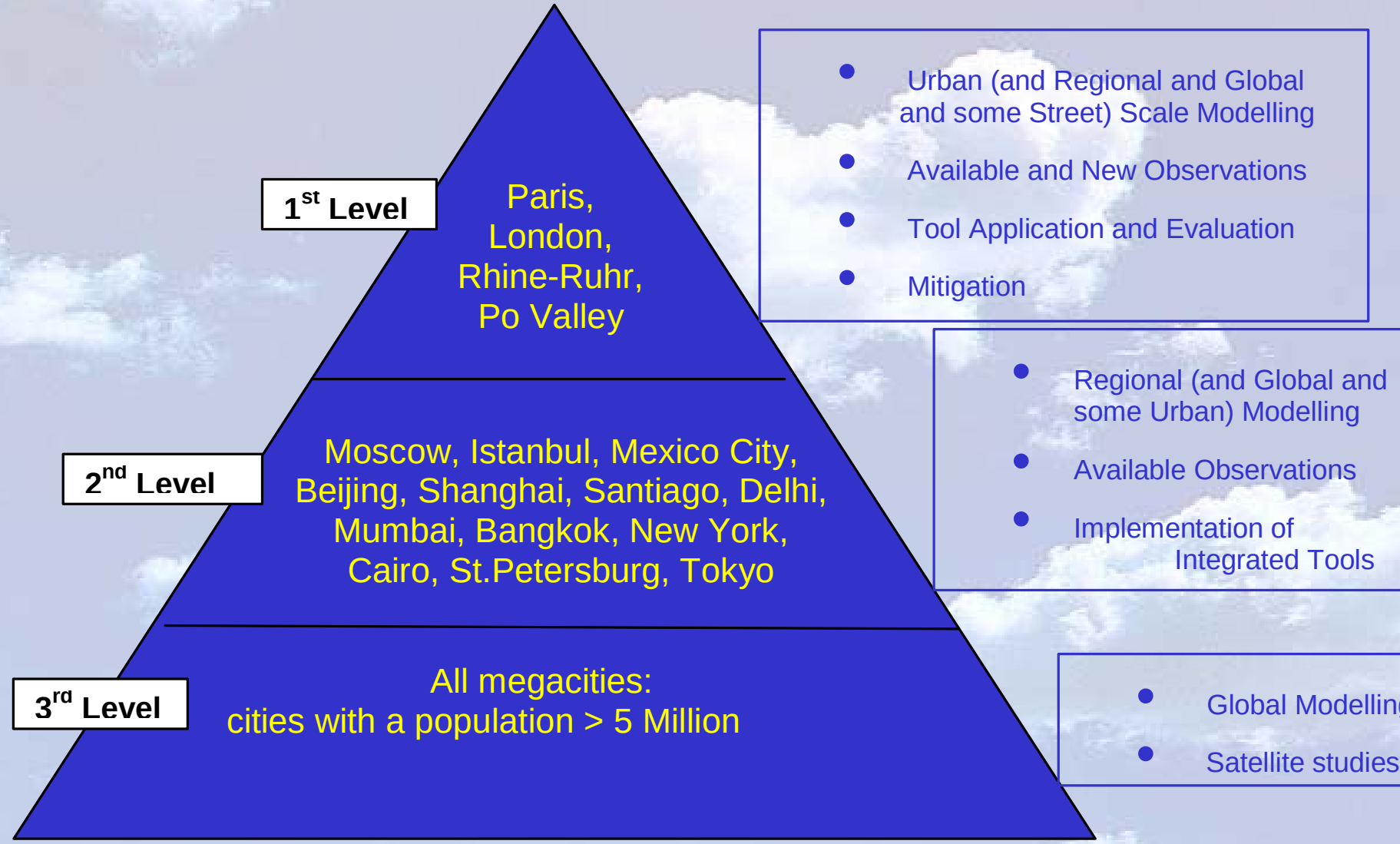
- Q1: What is the change of exposure of the overall population to the major air pollutants as people move into megacities? What are the health impacts of this exposure?
- Q2: How do megacities affect air quality on regional and global scales? What is the range of influence for major air pollutants (ozone, particulate matter, etc.)?
- Q3: What are the major physical and chemical transformations of air pollutants as they are moving away from megacities? What happens to the organic particulate matter, volatile organic compounds, etc?
- Q4: How accurate are the current emission inventories for megacities in Europe and around the world? What are the major gaps?
- Q5: How large is the current impact of megacities on regional and global climate?
- Q6: How will the growth of megacities affect future climate at global and regional scales?
- Q7: What is the impact of large-scale dynamic processes on air pollution from megacities?
- Q8: What are the key feedbacks between air quality, local climate and global climate change relevant to megacities? For example, how will climate change affect air quality in megacities?
- Q9: How should megacities (emissions, processing inside megacities, meteorology) be parameterised in regional and global models?
- Q10: What type of modelling tools should be used for the simulation of multi-scale megacity air quality - climate interactions?
- Q11: Which policy options are available to influence the emissions of air pollutants and greenhouse gases in megacities and how can these options be assessed?

# Work Packages (WPs) structure & integration

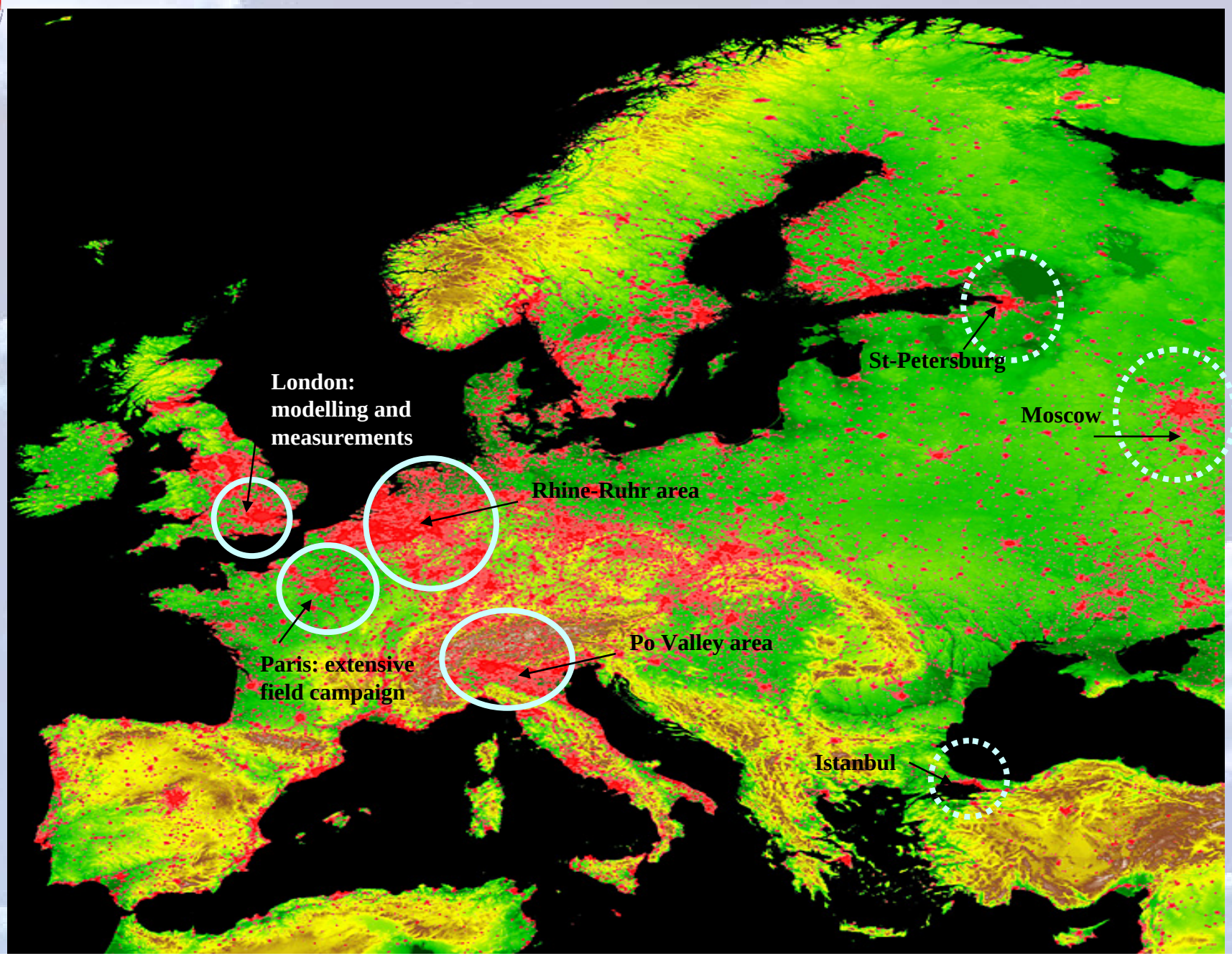
| WP No. | Title | Lead Participant(s) |
|---|---|---|
| 1 | Emissions | P. Builtjes<br>H. Denier van der Gon |
| 2 | Megacity Environments: Features, Processes and Effects | S. Grimmond<br>I. Esau |
| 3 | Megacity Plume Case Study | M. Beekmann<br>U. Baltensperger |
| 4 | Megacity Air Quality | N. Moussiopoulos |
| 5 | Regional and Global Atmospheric Composition | J. Kukkonen<br>A. Stohl |
| 6 | Regional and Global Climate Effects | W. Collins<br>F. Giorgii |
| 7 | Integrated Tools and Implementation | R. Sokhi<br>H. Schlünzen |
| 8 | Mitigation, Policy Options and Impact Assessment | R. Friedrich<br>D. van den Hout |
| 9 | Dissemination and Coordination | A. Baklanov<br>S. Pandis<br>M. Lawrence |



# The Pyramid of Megacities in Focus

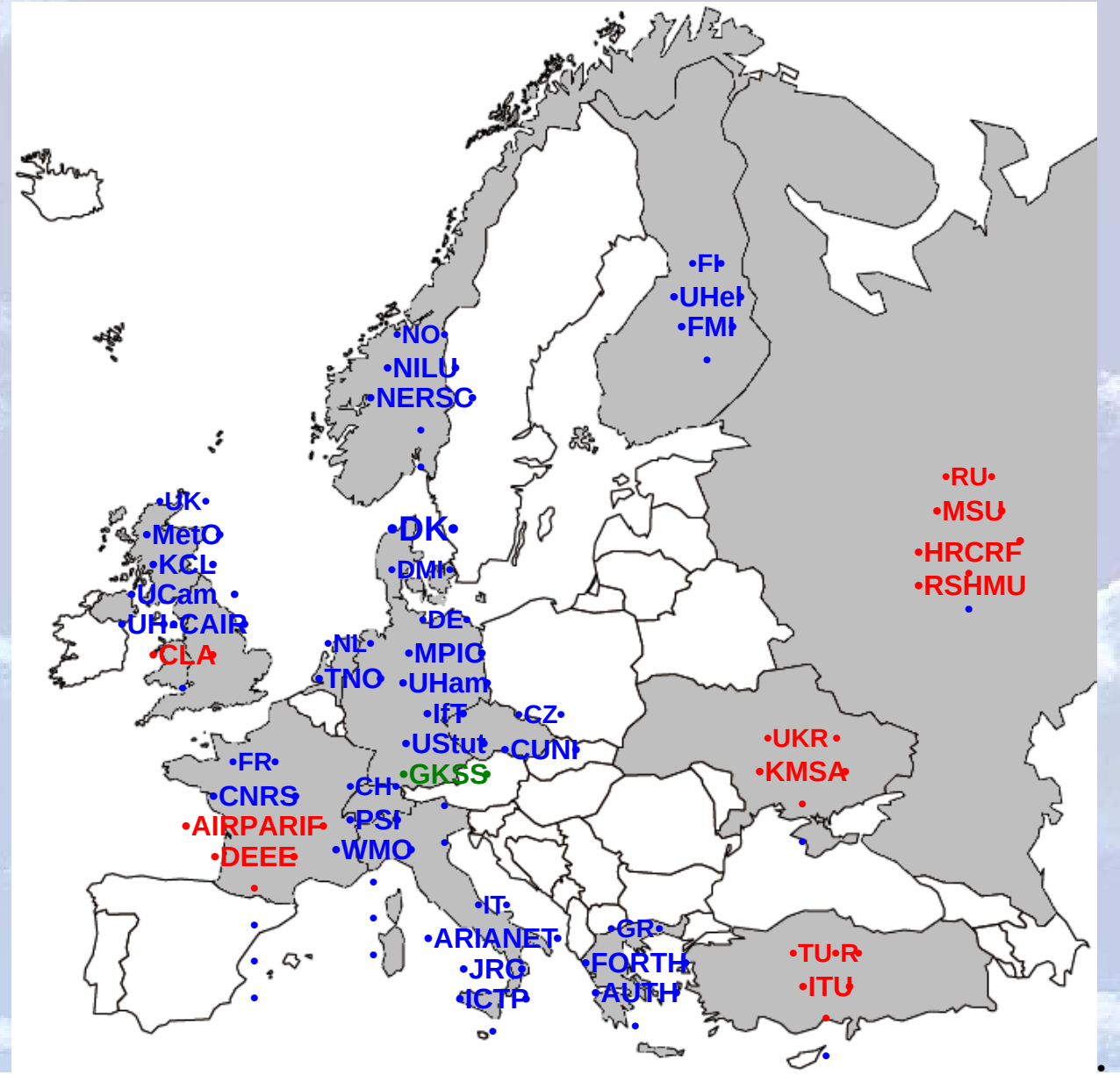


# European population distribution and megacities in focus

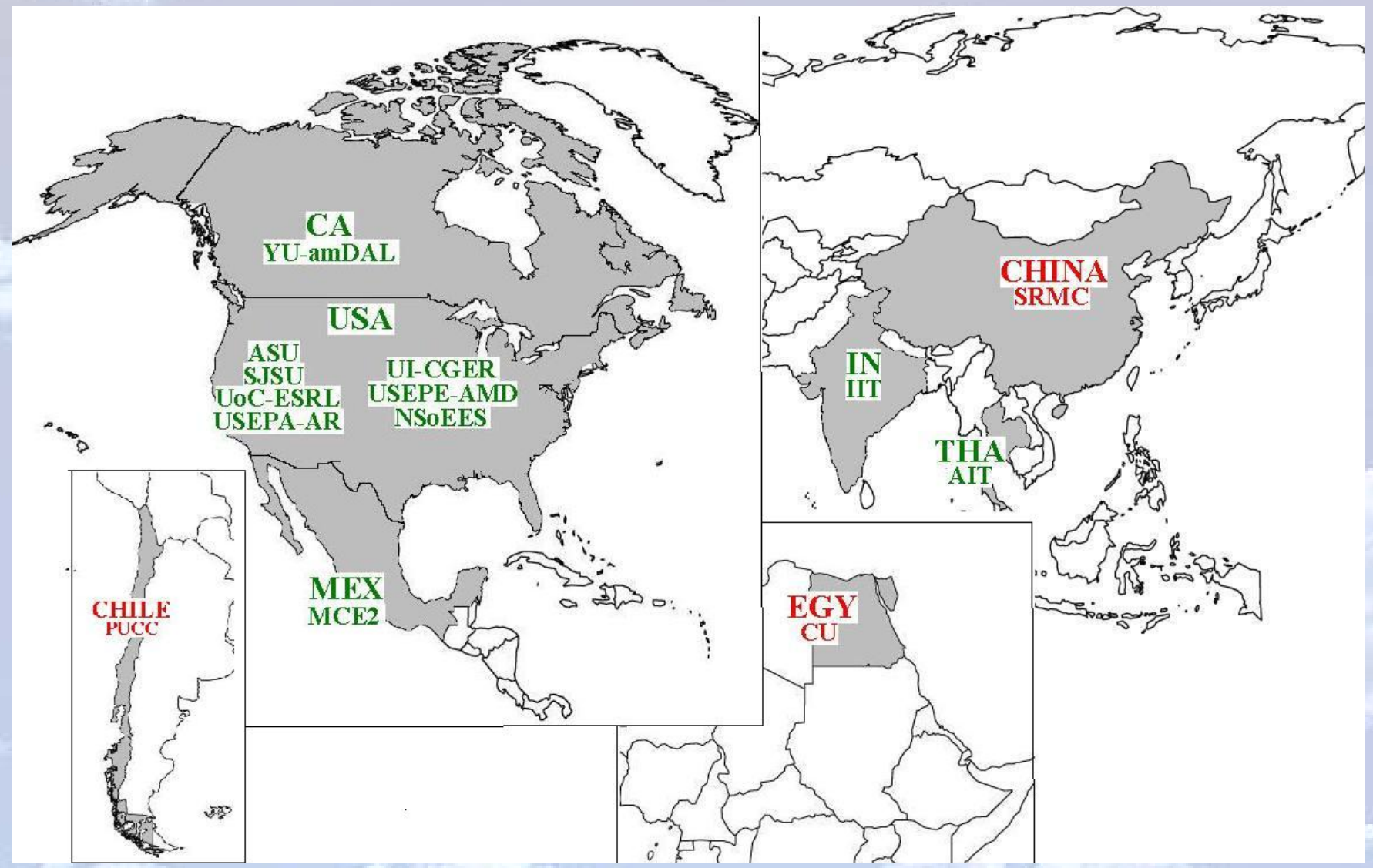


# MEGAPOLI European main partners

## (blue – funded, green – non-funded) and end-users/stakeholders (red)



# MEGAPOLI international partners (green) and end-users/stakeholders (red)



## *Telephone Conference with our sister CityZen Project*

- Identification of collaboration between CityZen and MEGAPOLI projects - differences and overlaps;
- Collaboration on the International Global Atmospheric Chemistry (IGAC) "Assessment on Impacts of Mega-cities on Air Quality and Climate";
- Establish links to each other's projects web sites;
  - *http://wiki.met.no/cityzen/ and http://www.megapoli.info*
- Emission inventories - future emission scenarios and present day emissions;
- Coordinated model studies;
- Exchange of measurement data;
- Common data base;
- Exchange and use of each other's mailing lists;
- Future conferences, where MEGAPOLI and CityZen should meet:
  - *Air Quality, Istanbul, Turkey, 24-27 March, 2009;*
  - *European Geosciences Union (EGU), Vienna, Austria, 19-24 April 2009;*
  - *European Meteorological Society (EMS), Toulouse, France, 28 Sep - 02 Oct 2009;*
  - *European Geosciences Union, Austria, April 2010;*
  - *IGAC + Commission for Atmospheric Chemistry and Global Pollution (CACGP) Joint Conference, Canada, July 2010;*
  - *European Geosciences Union, Austria, April 2011.*
- Action items;
- Research questions of MEGAPOLI and CityZen projects.

See more details at: https://wiki.met.no/cityzen/meetings -
in section "1st MEGAPOLI/CityZen phone conference, January 7, 2009"




## *Sister Project: CITYZEN – megaCITY – Zoom for the ENvironment*

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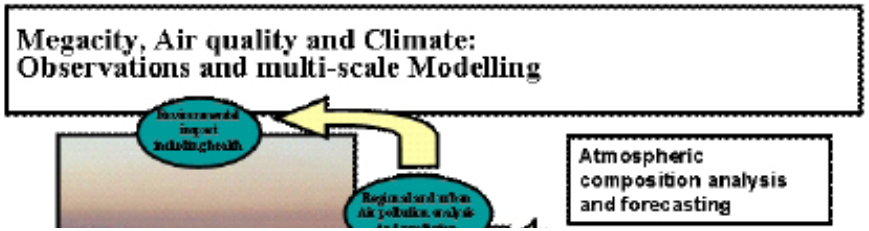
*Norwegian Meteorological Institute, Research and Development Department*

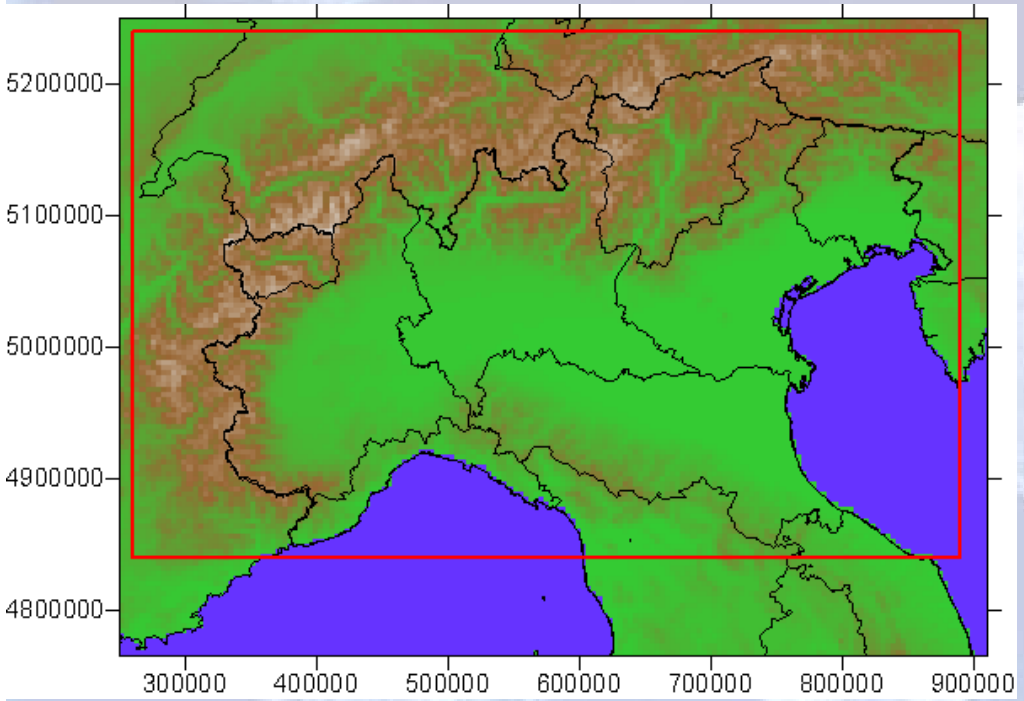
*http://met.no*

The project will provide a lasting semi-operational structure of nested models and methods applicable for the underpinning of policy development for hotspots/megacities and extending to the regional and global spatial scales.



# Po valley domains for MEGAPOLI and CityZen simulations

- **Joint meeting of the Po valley teams**




**MEGAPOLI domain**

**CityZen domains**